### Sunday, May 10, 2015

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<tr>
<th>Time</th>
<th>Session or Event Info</th>
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<tr>
<td>8:30 AM - 11:30 AM</td>
<td>Short Course 1 (none), <strong>SC424. Optical Terahertz Science and Technology</strong>&lt;br&gt;(Separate Registration Fee Required), Short Course</td>
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<tr>
<td>8:30 AM - 12:30 PM</td>
<td>Short Course 2 (none), <strong>SC361. Coherent MidInfrared Sources and Applications</strong>, Short Course</td>
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<tr>
<td>8:30 AM - 12:30 PM</td>
<td>Short Course 3 (none), <strong>SC149. Foundations of Nonlinear Optics</strong>, Short Course</td>
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<tr>
<td>8:30 AM - 12:30 PM</td>
<td>Short Course 4 (none), <strong>SC221. Nano Photonics: Physics and Techniques</strong>, Short Course</td>
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<tr>
<td>1:30 PM - 5:30 PM</td>
<td>Short Course 1 (none), <strong>SC361. Frontiers of Guided Wave Nonlinear Optics</strong>, Short Course</td>
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<tr>
<td>1:30 PM - 5:30 PM</td>
<td>Short Course 2 (none), <strong>SC378. Introduction to Ultrafast Optics</strong>, Short Course</td>
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<tr>
<td>1:30 PM - 5:30 PM</td>
<td>Short Course 3 (none), <strong>SC157. Laser Beam Analysis, Propagation, and Shaping Techniques</strong>, Short Course</td>
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<tr>
<td>2:00 PM - 5:00 PM</td>
<td>Short Course 4 (none), <strong>SC403. NanoCavity Quantum Electrodynamics and Applications</strong>, Short Course</td>
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### Monday, May 11, 2015

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<th>Time</th>
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<tr>
<td>8:00 AM - 10:00 AM</td>
<td>Executive Ballroom 210A (Convention Center), <strong>FM1A. Quantum Metrology and Measurement</strong>, FS Oral, <strong>QELS 2: Quantum Science, Engineering and Technology</strong>, Presider: Nicholas Peters, <a href="mailto:peters.na@gmail.com">peters.na@gmail.com</a>, Oak Ridge National Laboratory</td>
</tr>
<tr>
<td>8:00-9:00 AM</td>
<td><strong>FM1A.1. Quantum Measurement Techniques: Modern Approaches and Trends</strong> A.M. Steinberg</td>
</tr>
<tr>
<td>9:00-9:15 AM</td>
<td><strong>FM1A.2. Experimentally Quantifying the Advantages of Weak-Values-Based Metrology</strong> G. Viza; J. Martinez; G. Alves; A.N. Jordan; J. Howell</td>
</tr>
<tr>
<td>9:15-9:30 AM</td>
<td><strong>FM1A.3. Particle vs. Mode Entanglement in Optical Quantum Metrology</strong> N. Quesada; J. Sahota</td>
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<td>9:30-9:45 AM</td>
<td>FM1A.4</td>
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<tr>
<td>9:45-10:00 AM</td>
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<td>FM1B.2</td>
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<td>8:30-8:45 AM</td>
<td>FM1B.3</td>
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<td>8:45-9:00 AM</td>
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<td>9:00-9:15 AM</td>
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<td>9:45-10:00 AM</td>
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<td>8:00 AM-10:00 AM</td>
<td>FM1C</td>
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<tr>
<td>8:00-9:00 AM</td>
<td>FM1C.1</td>
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FS Oral, QELS 4: Optical Excitations and Ultrafast Phenomena in Condensed Matter
FS Oral, QELS 3: Metamaterials and Complex Media
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<tbody>
<tr>
<td>9:00-9:15 AM</td>
<td>FM1C.2</td>
<td>Third-Harmonic Generation from Silicon Oligomers and Metasurfaces</td>
<td>M.R. Shcherbakov; D.N. Neshev; B. Hopkins; A.S. Shorokhov; I. Staude; E.V. Melik-Gaykazyan; A. Miroshnichenko; I. Brener; A.A. Fedyanin; Y.S. Kivshar</td>
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<tr>
<td>9:15-9:30 AM</td>
<td>FM1C.3</td>
<td>Multipolar analysis of linear and nonlinear unidirectional response from plasmonic dimers</td>
<td>E. Poutrina; A. Urbas</td>
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<tr>
<td>9:30-9:45 AM</td>
<td>FM1C.4</td>
<td>Enhanced Magnetic Second-Harmonic Generation from Resonant Metasurfaces</td>
<td>S.S. Kruk; M. Weismann; A. Bykov; E. Mamonov; I. Kolmychek; T. Murzina; N. Panoiu; D.N. Neshev; Y.S. Kivshar</td>
</tr>
<tr>
<td>9:45-10:00 AM</td>
<td>FM1C.5</td>
<td>A new type of optical activity in a toroidal metamaterial</td>
<td>T. Raybould; V. Fedotov; N. Papsimakis; I. Youngs; W. Chen; D. Tsai; N. Zheludev</td>
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<tr>
<td>8:00 AM-10:00 AM</td>
<td>FM1D.1</td>
<td>Laser Guided Curved Electric Discharges</td>
<td>M. Clerici; Y. Hu; C. Miliân; A. Couairon; D.N. Christodoulides; Z. Chen; L. Razzari; F. Vidal; F. Légaré; D. Faccio; R. Morandotti</td>
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<td>8:15-8:30 AM</td>
<td>FM1D.2</td>
<td>Improving Electron Microscopy by Shaping the Electron Beam Wavefunction</td>
<td>M. Mutzafi; I. Kaminer; G. Harari; M. Segev</td>
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<tr>
<td>8:30-8:45 AM</td>
<td>FM1D.3</td>
<td>Prolonging the Lifetime of Relativistic Particles by Self-Accelerating Dirac Wavepackets</td>
<td>I. Kaminer; M. Rechtsman; R. Bekenstein; J. Nemirovsky; M. Segev</td>
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<td>8:45-9:00 AM</td>
<td>FM1D.4</td>
<td>Accelerating Self-Imaging: the Airy-Talbot Effect</td>
<td>Y. Lumer; L. Drori; Y. Hazan; M. Segev</td>
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<tr>
<td>9:00-9:15 AM</td>
<td>FM1D.5</td>
<td>Optical Wavepackets Overcoming Gravitational Effects</td>
<td>R. Bekenstein; R. Schley; M. Mutzafi; C. Rotschild; M. Segev</td>
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<tr>
<td>9:15-9:30 AM</td>
<td>FM1D.6</td>
<td>Three-Dimensional Abruptly Autofocusing Optical Wave Packet</td>
<td>Q. Cao; C. Wan; X. Huang; A. Chong</td>
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<td>9:30-9:45 AM</td>
<td>FM1D.7</td>
<td>Beam Shaping and Production of Vortex Beams in Coherent Raman Generation</td>
<td>M. Zhi; K. Wang; H. Xia; A. Zhdanova; M. Shutova; A. Sokolov</td>
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<td>9:45-10:00 AM</td>
<td>FM1D.8</td>
<td>Visualizing fast molecular dynamics by coherent feedback in an optical oscillator</td>
<td>A. Pe'er; I. Aharonobich</td>
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8:00 AM-10:00 AM, Executive Ballroom 210D (Convention Center), FM1D. Accelerating Beams & Beamshaping Application, FS Oral, QELS 5: Nonlinear Optics and Novel Phenomena, President: Demetrios Christodoulides, demetri@creol.ucf.edu, University of Central Florida

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<th>Authors</th>
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<tr>
<td>8:00 AM-10:00 AM</td>
<td>FM1E.</td>
<td>Symposium - Single-photon Nonlinear Optics I, Special Symposium, Symposium - Single-photon Nonlinear Optics</td>
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<td>Time</td>
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<td>8:00-8:30 AM</td>
<td>FM1E.1</td>
<td>Demonstration of Deterministic Photon-Photon Interactions with a Single Atom</td>
<td>S. Rosenblum; I. Shomroni; Y. Lovsky; O. Bechler; G. Guendelman; B. Dayan</td>
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<tr>
<td>8:30-8:45 AM</td>
<td>FM1E.2</td>
<td>Observation of the Nonlinear Phase Shift Due to Single Post-Selected Photons</td>
<td>A. Feizpour; M. Hallaji; G. Dmochowski; A.M. Steinberg</td>
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<tr>
<td>8:45-9:00 AM</td>
<td>FM1E.3</td>
<td>How a Single Photon Can Act Like Many Photons</td>
<td>M. Hallaji; A. Feizpour; G. Dmochowski; J. Sinclair; A.M. Steinberg</td>
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<tr>
<td>9:00-9:30 AM</td>
<td>FM1E.4</td>
<td>Few-photon Nonlinear Optics Using Interacting Rydberg Atoms</td>
<td>S. Hofferberth</td>
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<td>9:30-10:00 AM</td>
<td>FM1E.5</td>
<td>The Birth, Care, and Feeding of Cat States in Circuit QED:</td>
<td>R. Schoelkopf</td>
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<td>8:00 AM-10:00 AM</td>
<td>SM1F</td>
<td>Semiconductor Laser Physics, S&amp;I Oral, CLEO S&amp;I 3: Semiconductor Lasers</td>
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<td>8:00-8:30 AM</td>
<td>SM1F.1</td>
<td>Quantum Coherent Interactions in Room Temperature InAs/InP Quantum Dot Amplifiers</td>
<td>G. Eisenstein</td>
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<td>8:30-8:45 AM</td>
<td>SM1F.2</td>
<td>Crossed Exciton States in Complex Semiconductor Nanostructures</td>
<td>N. Owschimikow; M. Kolarczik; Y. Kaptan; N.B. Grosse; U.K. Woggon</td>
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<td>8:45-9:00 AM</td>
<td>SM1F.3</td>
<td>High-Speed Electrical Modulation of Polariton Lasers</td>
<td>M. Baten; T. Frost; S. Deshpande; P.K. Bhattacharya</td>
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<td>9:00-9:15 AM</td>
<td>SM1F.4</td>
<td>Lasers With Distributed Loss Have Sublinear Power Output</td>
<td>T. Mansuripur; G. de Naurois; A. Belyanin; F. Capasso</td>
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<td>9:15-9:30 AM</td>
<td>SM1F.5</td>
<td>Measuring a Radiative Recombination Current in an Optically Pumped Gain Medium</td>
<td>R. Thomas; P.M. Smowton; P. Blood</td>
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<td>9:30-9:45 AM</td>
<td>SM1F.6</td>
<td>Suppressed Relaxation-Oscillation Dynamics in a DFB laser Monolithically Integrated with Weak Optical Feedback</td>
<td>D. Lenstra; D. D'Agostino; H. Ambrosius; M. Smit</td>
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<td>9:45-10:00 AM</td>
<td>SM1F.7</td>
<td>Electrically pumped random lasing based on Au-ZnO nanowire Schottky junction</td>
<td>F. Gao; M. Morshed; S. Bashar; Y. Zheng; S. Yi; J. Liu</td>
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<td>8:00 AM-10:00 AM</td>
<td>SM1G</td>
<td>Nanostructures, S&amp;I Oral, CLEO S&amp;I 6: Optical Materials, Fabrication &amp; Characterization, Presider: Harald Giessen</td>
<td><a href="mailto:giessen@physik.uni-stuttgart.de">giessen@physik.uni-stuttgart.de</a>, UniversitÄt Stuttgart</td>
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<td>8:00-8:15 AM</td>
<td>SM1G.1</td>
<td>Germanium Nanowires as Spectrally-selective Photodetectors in the Visible-to-Infrared</td>
<td>A. Solanki; K.B. Crozier</td>
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<td>8:15-8:30 AM</td>
<td>SM1G.2</td>
<td>Ultrafine ferroelectric nanostructure in layered Mg:LiNbO₃ thin film</td>
<td>T. Okada; M. Shimizu; S. Horikawa; T. Utsugida; K. Fujii; S. Kurimura; H. Nakajima</td>
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<td>8:30-9:00 AM</td>
<td>SM1G.3</td>
<td>Tunable Coloration with Flexible High-Contrast Metastructures</td>
<td>L. Zhu; J. Kapraun; J. Ferrara; C.J. Chang-Hansnain</td>
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<td>9:00-9:15 AM</td>
<td>SM1G.4</td>
<td>Hybrid Diamond-Silicon Carbide Structures Incorporating Silicon Vacancies in Diamond as Quantum Emitters</td>
<td>J. Zhang; H. Ishiwata; M. Radulaski; T.M. Babinec; K. Muller; K.G. Lagoudakis; R. Edgington; K. Alassaad; G. Ferro; N. Melosh; Z. Shen; J. Vuckovic</td>
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<td>9:15-9:30 AM</td>
<td>SM1G.5</td>
<td>Experimental Demonstration of CMOS-Compatible Long-Range Dielectric-Loaded Surface Plasmon-Polariton Waveguides (LR-DLSPPWs)</td>
<td>R.T. Zektzer; B. Desiatov; N. Mazurski; S. bozhevolnyi; U. Levy</td>
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<td>9:30-9:45 AM</td>
<td>SM1G.6</td>
<td>Flat metallic surface with sub-10-nm gaps using modified atomic-layer lithography</td>
<td>D. Ji; B. Chen; X. Zeng; T. Moein; H. Song; Q. Gan; A. Cartwright</td>
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<td>9:45-10:00 AM</td>
<td>SM1G.7</td>
<td>Investigation of the reflection and transmission of nanoscale gold films</td>
<td>H. Qian; Y. Xiao; D. Lepage; Z. Liu</td>
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<td>8:00 AM-10:00 AM</td>
<td>SM1H.</td>
<td>THz Quantum Cascade Lasers, S&amp;I Oral, CLEO S&amp;I 5: Terahertz Technologies and Applications, Presider: David Burghoff, <a href="mailto:burghoff@mit.edu">burghoff@mit.edu</a>, Massachusetts Institute of Technology</td>
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<tr>
<td>8:00-8:15 AM</td>
<td>SM1H.1</td>
<td>Selection of Longitudinal Modes in a Terahertz Quantum Cascade Laser via Narrow-band Injection Seeding</td>
<td>H. Nong; S. Pal; S. Markmann; N. Hekmat; P. Dean; R.A. Mohandas; L. Lianhe; E. Linfield; G. Davies; A.D. Wieck; N. Jukam</td>
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<td>8:15-8:30 AM</td>
<td>SM1H.2</td>
<td>kW-Peak-Power Terahertz-Wave Parametric Generation and 70 dB-Dynamic-Range Detection Based on Efficient Surface-Coupling Configuration</td>
<td>Y. Takida; T. Notake; K. Nawata; Y. Tokizane; S. Hayashi; H. Minamide</td>
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<td>8:30-8:45 AM</td>
<td>SM1H.3</td>
<td>Broadly-Tunable Room-Temperature Monolithic Terahertz Quantum Cascade Laser Sources</td>
<td>A. Jiang; S. Jung; Y. Jiang; K. Vijayraghavan; J. Kim; M.A. Belkin</td>
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<td>8:45-9:00 AM</td>
<td>SM1H.4</td>
<td>QCL-based Metrological-grade THz Spectroscopy Tools</td>
<td>L. Consolino; M. Siciliani de Cumis; D. Mazzotti; A. Campa; M. Ravaro; M.S. Vitiello; S. Bartalini; P. Cancio Pastor; P. De Natale</td>
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<td>9:00-9:30 AM</td>
<td>SM1H.5</td>
<td>Coherent absorption control in polaritonic systems</td>
<td>A. Tredicucci</td>
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<td>9:30-9:45 AM</td>
<td>SM1H.6</td>
<td>Amplification of broadband terahertz pulses in a quantum cascade heterostructure</td>
<td>J. Darmo; D. Bachmann; M. Roesch; N. Leder; G. Scalari; M. Beck; H. Arthaber; J. Faist; K. Unterrainer</td>
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<tr>
<td>9:45-10:00 AM</td>
<td>SM1H.7. A Hybrid Plasmonic Waveguide Terahertz Quantum Cascade Laser</td>
<td>R. Degl'Innocenti; Y. Shah; R. Wallis; A. Klimont; Y. Ren; D. Jessop; H. Beere; D. Ritchie</td>
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<td>8:00 AM-10:00 AM</td>
<td>Meeting Room 211 B/D (Convention Center), SM1I. Silicon Photonics</td>
<td>S&amp;I Oral, CLEO S&amp;I 7: Micro- and Nano-Photonic Devices, Presider: Bahram Jalali, <a href="mailto:jalali@ucla.edu">jalali@ucla.edu</a>, University of California Los Angeles</td>
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<td>8:00-8:15 AM</td>
<td>SM1I.1. Plasmonic-organic hybrid (POH) modulators for OOK and BPSK signaling at 40 Gbit/s</td>
<td>A. Melikyan; K. Köhnle; M. Lauermann; R. Palmer; S.R. Koeber; S. Muehlbrandt; P. Schindler; D. Elder; S. Wolf; W. Heni; C. Haffner; Y. Fedoryshyn; D. Hillerkuss; M. Sommer; L. Dalton; D. VanThourhout; W. Freude; M. Kohl; J. Leuthold; C. Koos</td>
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<td>8:15-8:30 AM</td>
<td>SM1I.2. Ultra-Compact Hybrid Silicon-VO₂ Electroabsorption Optical Switch</td>
<td>A. Joushaghani; J. Jeong; S. Paradis; D. Alain; J. Aitchison; J.K. Poon</td>
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<td>8:30-8:45 AM</td>
<td>SM1I.3. Hybrid Silicon Ring Laser with Unidirectional Emission</td>
<td>W.D. Sacher; M. Davenport; M.J. Heck; J. Mikkelsen; J.K. Poon; J. Bowers</td>
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<td>8:45-9:00 AM</td>
<td>SM1I.4. Integrated on-chip C-band optical spectrum analyzer using dual-ring resonators</td>
<td>Y. Li; Q. Li; Y. Liu; T. Baehr-Jones; M. Hochberg; K. Bergman</td>
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<td>9:00-9:15 AM</td>
<td>SM1I.5. Effective carrier sweepout in a silicon waveguide by a metal-semiconductor-metal structure</td>
<td>Y. Ding; H. Hu; H. Ou; L.K. Oxenløwe; K. Yvind</td>
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<td>9:15-9:30 AM</td>
<td>SM1I.6. Apodized Focusing Fully Etched Sub-wavelength Grating Couplers With Ultra-low Reflections</td>
<td>Y. Wang; H. Yun; Z. Lu; R. Bojko; F. Zhang; M. Caverley; N.A. Jaeger; L. Chrostowski</td>
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<td>9:30-9:45 AM</td>
<td>SM1I.7. Sinusoidal Anti-coupling SOI Strip Waveguides</td>
<td>F. Zhang; H. Yun; V. Donzella; Z. Lu; Y. Wang; Z. Chen; L. Chrostowski; N.A. Jaeger</td>
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<td>9:45-10:00 AM</td>
<td>SM1I.8. Asymmetric-waveguide-assisted 3-dB Broadband Directional Couplerbed height=&quot;0&quot; id=&quot;xunlei_com_thunder_helper_plugin_d462f475-c18e-46be-bd10-327458d045bd&quot; type=&quot;application/thunder_download_plugin&quot; width=&quot;0&quot; /&gt; Z. Lu; H. Yun; Y. Wang; Z. Chen; F. Zhang; N.A. Jaeger; L. Chrostowski</td>
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<tr>
<td>8:00 AM-10:00 AM</td>
<td>Meeting Room 212 A/C (Convention Center), AM1J. Light Source and Devices for Biomedical Imaging I, A&amp;T Oral, CLEO A&amp;T 1: Biomedical Applications, Presider: Ilya Bezel, <a href="mailto:ilya.bezel@kla-tencor.com">ilya.bezel@kla-tencor.com</a>, KLA-Tencor Corp.</td>
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<tr>
<td>8:00-8:30 AM</td>
<td>AM1J.1. The Cell Laser</td>
<td>S.A. Yun</td>
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<td>Time</td>
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<td>Presenter(s)</td>
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<tr>
<td>8:30-8:45 AM</td>
<td>AM1J.2. Analysis of Optical Properties of Cell Lasers and Their Use as Biological Sensors</td>
<td>M. Humar; S.A. Yun</td>
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<tr>
<td>8:45-9:00 AM</td>
<td>AM1J.3. Sensitive and Selective Detection of Prostate Specific Antigen beyond ELISA Using Photonic Crystal Nanolaser</td>
<td>S. Hachuda; T. Watanabe; D. Takahashi; T. Baba</td>
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<td>9:00-9:15 AM</td>
<td>AM1J.4. 4.4 nJ, 114 fs Nd-doped Fiber Laser Pulses at 920nm for in Vivo Two-photon Microscopic Imaging</td>
<td>B. Chen; T. Jiang; W. Zong; F. Niu; L. Chen; Z. Zhang; Y. Song; A. wang</td>
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<tr>
<td>9:15-9:30 AM</td>
<td>AM1J.5. Highly Compact, Low-Noise All-Solid-State Laser System for Stimulated Raman Scattering Microscopy</td>
<td>T. Steinle; V. Kumar; A. Steinmann; M. Marangoni; G. Cerullo; H.W. Giessen</td>
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<tr>
<td>9:30-9:45 AM</td>
<td>AM1J.6. High Power 780 nm Femtosecond Fiber Laser</td>
<td>Z. Liu; W. Zong; Y. Liu; L. Zuo; C. Wen; T. Jiang; J. Zhang; Y. Ma; Z. Zhang; L. Chen; A. wang</td>
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<tr>
<td>9:45-10:00 AM</td>
<td>AM1J.7. A Six-Color Four Laser Mobile Platform for Multi-Spectral Fluorescence Imaging Endoscopy</td>
<td>J.F. Black; T. Tate; M. Keenan; E. Swan; U. Utzinger; J. Barton</td>
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<td>8:00 AM-10:00 AM</td>
<td>Meeting Room 212 B/D (Convention Center), AM1K. Microprocessing Ultra-Fast Processing of Dielectrics, A&amp;T Oral, CLEO A&amp;T 2: Industrial Applications, Presider: Yves Bellouard, <a href="mailto:yves@bellouard.eu">yves@bellouard.eu</a>, Ecole Polytechnique Federale de Lausanne</td>
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<td>8:00-8:30 AM</td>
<td>AM1K.1. Ultrashort Pulse Lasers for Precise Processing: Results of a Recent German Research Initiative</td>
<td>S. Nolte</td>
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<tr>
<td>8:30-8:45 AM</td>
<td>AM1K.2. High Density Data Storage In Transparent Plastics Using Femtosecond Laser Microstructuring</td>
<td>D.L. Kallepalli</td>
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<td>8:45-9:00 AM</td>
<td>AM1K.3. Femtosecond laser cutting of glass by controlled fracture propagation</td>
<td>C. Hoenninger; K. Mishchik; C. Javaux; O. Dematteo-Caulier; S. Skupin; B. Chimier; G. Duchateau; A. Bourgeade; R. Kling; A. Letan; E. Mottay; J. Lopez</td>
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<td>9:00-9:30 AM</td>
<td>AM1K.4. Microfabrication of Ion Trap Platforms with Integrated Optics and Three-dimensional Electrodes</td>
<td>M. Dugan; C. Schenck; A. Said</td>
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<td>9:30-10:00 AM</td>
<td>AM1K.5. Laser Processing of Optofluidic Devices for Lab-on-a-chip and Lab-in-fiber</td>
<td>P.R. Herman</td>
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<td>8:00 AM-10:00 AM</td>
<td>Salon I-II (Marriott), SM1L. Fiber Sensing and Measurement, S&amp;I Oral, CLEO S&amp;I 11: Fibers Photonic, Presider: Axel Schulzgen, <a href="mailto:axel@creol.ucf.edu">axel@creol.ucf.edu</a>, University of Central Florida</td>
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<td>8:00-8:30 AM</td>
<td>SM1L.1. Novel Technologies for High Precision Characterization of Fibers</td>
<td>A.D. Yablon</td>
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<td>8:30-8:45 AM</td>
<td>SM1L.2</td>
<td>Design and Fabrication of Side-channel Photonic Crystal Fiber for Surface Enhanced Raman Scattering Applications</td>
<td>N. Zhang; G. Humbert; T. Gong; P. Shum; J. Auguste; Z. Wu; M. Olivo; Q.X. Dinh; L. Wei</td>
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<td>8:45-9:00 AM</td>
<td>SM1L.3</td>
<td>Distributed Temperature and Strain Discrimination Using a Few-Mode Fiber</td>
<td>A. Li; Y. Wang; J. Fang; W. Shieh</td>
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<td>9:00-9:15 AM</td>
<td>SM1L.4</td>
<td>Simultaneous Measurement of Strain and Temperature using High Sensitivity Multicore Fiber Sensors</td>
<td>A. Van Newkirk; E. Antonio-Lopez; G. Salceda-Delgado; M. Piracha; R. Amezcu-Correa; A. Schulzgen</td>
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<td>9:15-9:30 AM</td>
<td>SM1L.5</td>
<td>Fiber Optic Sensors Based on Orbital Angular Momentum</td>
<td>R. Niederriter; M.E. Siemens; J. Gopinath</td>
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<td>9:30-9:45 AM</td>
<td>SM1L.6</td>
<td>Optical manipulation of microparticles using graded-index fiber taper and its microfluidic sensing application</td>
<td>Y. Gong; C. Zhang; Y. Rao</td>
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<td>9:45-10:00 AM</td>
<td>SM1L.7</td>
<td>Elongated abruptly tapered micro fiber interferometer for nanoparticles attraction and analyses</td>
<td>N. Chen; Z. Chen; K. Lou; W. Cheng; C. Lin</td>
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<td>8:00 AM-9:45 AM</td>
<td>SM1M.1</td>
<td>Optical and Hybrid Signal Processing</td>
<td>S. Radic</td>
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<td>9:00-9:15 AM</td>
<td>SM1M.2</td>
<td>Optical phase lock loop circuit for Non-degenerate optical parametric phase sensitive amplifiers with wide signal-idler optical frequency spacing</td>
<td>Y. Okamura; K. Higashiyama; M. Koga; A. Takada</td>
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<td>9:30-9:45 AM</td>
<td>SM1M.4</td>
<td>Broadband Counter-Phase Dithering of Multi-Terabit/s DP-QPSK Signals for Low Noise FWM with a Single CW Pump</td>
<td>M.D. Pelusi; K. Solis-Trapala; H. Nguyen Tan; T. Inoue; S. Namiki</td>
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<td>8:00 AM-9:45 AM</td>
<td>SM1N.1</td>
<td>Remote Backward-Propagating Lasing of Nitrogen and Oxygen in Air</td>
<td>A. Dogariu; R. Miles</td>
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<td>8:00-8:30 AM</td>
<td>SM1N.2</td>
<td>Experiments on Deep-UV Two-photon Pumping of Fluorescence and Stimulated Emission in Oxygen and Nitrogen Atoms in Flames</td>
<td>J. Bood; M. Aldén</td>
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<td>9:00-9:30 AM</td>
<td>SM1N.3</td>
<td>How Do Basic Nonlinear Optical Processes Lead to Atmospheric Lasing?</td>
<td>R.W. Boyd</td>
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<td>9:30-9:45 AM</td>
<td>SM1N.4</td>
<td>Low-threshold bidirectional air lasing</td>
<td>A. Laurain; M. Scheller; P.G. Polynkin</td>
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<td>8:00 AM-10:00 AM</td>
<td>SM1O.</td>
<td>Advanced Spectroscopic Techniques, S&amp;I Oral, CLEO S&amp;I 13: Active Optical Sensing</td>
<td>Presider: Scott Howard, <a href="mailto:showard@nd.edu">showard@nd.edu</a>, University of Notre Dame</td>
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<td>8:00-8:15 AM</td>
<td>SM1O.1</td>
<td>Analysis of Trace Gas Mixtures Using an External Cavity Quantum Cascade Laser Sensor</td>
<td>M.C. Phillips; M.S. Taubman; B. Brumfield; J. Kriesel</td>
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<td>8:15-8:30 AM</td>
<td>SM1O.2</td>
<td>Fundamental Limits in Chirped Laser Dispersion Spectroscopy</td>
<td>G. Plant; A. Hangauer; G. Wysocki</td>
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<td>8:30-9:00 AM</td>
<td>SM1O.3</td>
<td>Mid-IR Quantum Cascade Lasers as an Enabling Technology for Analytical Chemistry</td>
<td>C. Kristament; M. Brandstetter; A. Schwaighofer; M. Alcaraz; B. Lendl</td>
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<td>9:00-9:15 AM</td>
<td>SM1O.4</td>
<td>Background-Free Heterodyne Photoexpansion Infrared Nanospectroscopy</td>
<td>F. Lu; M. Jin; M.A. Belkin</td>
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<td>9:15-9:30 AM</td>
<td>SM1O.5</td>
<td>Large Amplitude Wavelength Modulation Spectroscopy for Sensitive Measurements of Broad Absorbers</td>
<td>T. Hayden; P. Schroeder; G.B. Rieker</td>
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<td>9:45-10:00 AM</td>
<td>SM1O.7</td>
<td>Photo-thermal Effects in Gases as a Method For Concentration Measurements</td>
<td>K. Krzempek; M.P. Nikodem; K.M. Abramski</td>
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<td>8:00 AM-10:00 AM</td>
<td>SM1P.</td>
<td>Few-cycle Infrared Sources, S&amp;I Oral, CLEO S&amp;I 8: Ultrafast Optics, Optoelectronics &amp; Applications</td>
<td>Presider: Hiroyuki Ishii, <a href="mailto:ishii.hiroyuki@lab.ntt.co.jp">ishii.hiroyuki@lab.ntt.co.jp</a>, NTT corporation</td>
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<td>8:00-8:15 AM</td>
<td>SM1P.1</td>
<td>A Compact Single Cycle Driver for Strong Field Applications based on a Self-compression in a Kagome Fiber</td>
<td>G. Fan; T. Balciunas; S. Hässler; C. Fourcade Dutin; T. Witting; A. Voronin; A. Zheltikov; F. Gérôme; G. Paulus; A. Baltuska; F. Benabid</td>
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<td>8:15-8:30 AM</td>
<td>SM1P.2</td>
<td>Mid-IR 0.4TW Pulses Achieved Through Hollow-Core Fiber Compression</td>
<td>V. Cardin; N. Thiré; V. Wanie; S. Beaulieu; F. Légaré; B.E. Schmidt</td>
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<td>8:30-8:45 AM</td>
<td>SM1P.3</td>
<td>Broadband ZGP OPA Pumped by Femtosecond Ho:YAG Chirped Pulse Amplifier</td>
<td>P. Malevich; T. Kanai; G. Gitzinger; R. Maksimenka; N. Forget; A. Baltuska; A. Pugzlys</td>
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<td>8:45-9:00 AM</td>
<td>SM1P.4. Millijoule 1-ps Pulses from a kHz Ho:YAG Regenerative Amplifier Seeded with a Tm, Ho-Fiber Laser P. Malevich; T. Kanai; H. Hoogland; R. Holzwarth; A. Baltuska; A. Pugzlys</td>
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<td>9:00-9:15 AM</td>
<td>SM1P.5. Ultrastable and High-Power Yb:Fiber Amplifier for Nonlinear Frequency Conversion at High Repetition Rate P. Storz; M. Wunram; D. Brida; A. Leitenstorfer</td>
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<td>9:15-9:30 AM</td>
<td>SM1P.6. Coherent Mid-IR Supercontinuum Generation in a Hydrogenated Amorphous Silicon Waveguide H. Sun; K. Wang; R. Salem; P. Fendel; A.C. Foster</td>
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<td>9:30-9:45 AM</td>
<td>SM1P.7. 220-fs 110-mJ Yb:CaF$_2$ Cryogenic Multipass Amplifier G. Andriukaitis; E. Kaksis; G. Polonyi; J. Flöp; A. Baltuska; A. Pugzlys</td>
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<td>9:45-10:00 AM</td>
<td>SM1P.8. An Approach for Intense Subcycle Pulse Generation in Air Y. Kida; T. Imasaka</td>
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<td>10:30 AM-12:30 PM</td>
<td>Executive Ballroom 210A (Convention Center), FM2A. Single Photon Sources, FS Oral, QELS 2: Quantum Science, Engineering and Technology, Presider: Aephraim Steinberg, <a href="mailto:steinberg@physics.utoronto.ca">steinberg@physics.utoronto.ca</a>, University of Toronto</td>
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<td>10:30-10:45 AM</td>
<td>FM2A.1. Ultra-pure single-mode photon generation in high-Q silicon microdisks X. Lu; W. Jiang; J. Zhang; Q. Lin</td>
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<td>10:45-11:00 AM</td>
<td>FM2A.2. Efficient Single Photon Generation using a Fiber-integrated Diamond Micro-Waveguide R. Patel; T. Schroder; N. Wan; L. Li; S. Mouradian; E. Chen; D. . Englund</td>
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<td>11:00-11:15 AM</td>
<td>FM2A.3. Enhancing the heralded single photon rate from a silicon photonic chip by pump pulse interleaving J. He; X. Zhang; I. Jizan; A. Clark; D. Choi; C. Chae; B.J. Eggleton; C. Xiong</td>
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<td>11:30-11:45 AM</td>
<td>FM2A.5. Temporal Multiplexing toward Periodic and Deterministic Single-Photon Sources F. Kaneda; B. Christensen; J. Wong; H. Park; K. McCusker; P. kwiat</td>
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<td>11:45-12:00 PM</td>
<td>FM2A.6. Thermal light cannot be represented as a statistical mixture of pulses A. Chenu; A. Branczyk; J.E. Sipe</td>
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<td>12:15-12:30 PM</td>
<td>FM2A.8. Ultra-fast heralded single photon source based on telecom technology and non-linear optics L. Ngah; O. Alibart; L. Labonté; V. D’Auria; S. Tanzilli</td>
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<td>10:30-10:45 AM</td>
<td>FM2B.1</td>
<td>Femtosecond coherent nano-spectroscopy of coupled molecular dynamics</td>
<td>J.M. Atkin; P. Sass; H. Yang; P. Teichen; J. Eaves; M.B. Raschke</td>
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<td>10:45-11:00 AM</td>
<td>FM2B.2</td>
<td>Nanoscale Transport of Excitons at the Interface Between ZnO and a Molecular Monolayer</td>
<td>s. friede; S. Kuehn; S. Sadofev; S. Blumstengel; F. Henneberger; T. Elsaesser</td>
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<tr>
<td>11:00-11:15 AM</td>
<td>FM2B.3</td>
<td>Single Molecular Vibrational Relaxation Dynamics and Adsorbate Fluctuation</td>
<td>K. Park; V. Kravtsov; P. Sass; J.M. Atkin; E.A. Muller; M.B. Raschke</td>
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<td>11:15-11:30 AM</td>
<td>FM2B.4</td>
<td>Probing Coherent Ultrafast Exciton Dissociation in a Polymer: Fullerene Photovoltaic Absorber</td>
<td>A. De Sio; E. Sommer; M. Maiuri; J. Rehault; C. Rozzi; E. Molinari; G. Cerullo; C. Lienau</td>
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<tr>
<td>11:30-11:45 AM</td>
<td>FM2B.5</td>
<td>Decoupling Bulk and Surface Contributions in Water-Splitting Photocatalysts by In Situ Ultrafast Spectroscopy</td>
<td>K. Appavoo</td>
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<td>11:45-12:00 PM</td>
<td>FM2B.6</td>
<td>Fast High-Fidelity Hole Spin Initialisation in a Single Quantum Dot at Zero Magnetic Field</td>
<td>A. Brash; L.M. Martins; F. Liu; J.H. Quilter; M.S. Skolnick; A. Fox</td>
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<td>12:00-12:15 PM</td>
<td>FM2B.7</td>
<td>Femtosecond Hole Relaxation and Biexcitonic Transient Absorption in Single CdSe/ZnSe Quantum Dots</td>
<td>C. Hinz; C. Traum; J. Haase; B. Bauer; A. Leitenstorfer; D. Seletskiy</td>
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<td>12:15-12:30 PM</td>
<td>FM2B.8</td>
<td>Charged Exciton Linewidth Narrowing via Nuclear Spin Screening in an InAs QD Ensemble</td>
<td>G. Moody; M. Feng; C. McDonald; R.P. Mirin; K. Silverman</td>
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<td>10:30-12:30 PM</td>
<td>FM2C.1</td>
<td>Mid-infrared Hyperbolic Metamaterial Based on Graphene-dielectric Multilayers</td>
<td>Y. Chang; C. Liu; C. Liu; Z. Zhong; T.B. Norris</td>
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<td>10:45-11:00 AM</td>
<td>FM2C.2</td>
<td>Thermal Radiation of Hyperbolic Metamaterials and Metallic Surfaces</td>
<td>M.A. Noginov; A. Mozafari; T. Tumkur; J. Kitur; E. Narimanov</td>
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<td>11:00-11:15 AM</td>
<td>FM2C.3</td>
<td>Optical Imaging with Photonic Hypercrystals</td>
<td>Z. Huang; E. Narimanov</td>
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<td>11:15-11:30 AM</td>
<td>FM2C.4</td>
<td>Light Emission in Nonlocal Plasmonic Nanowire Metamaterials</td>
<td>B. Wells; P. Ginzburg; A.V. Zayats; V.A. Podolskiy</td>
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<td>11:30-11:45 AM</td>
<td>FM2C.5. Simultaneous enhancement of decay rate and light extraction from active hyperbolic metamaterial</td>
<td>T. Galfsky; H. Krishnamoorthy; W. Newman; E. Narimanov; Z. Jacob; V.M. Menon</td>
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<td>11:45-12:00 PM</td>
<td>FM2C.6. Non-Resonant Hyperlens in the Visible Range</td>
<td>J. Sun; M. Shalaev; N.M. Litchinitser</td>
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<td>12:00-12:15 PM</td>
<td>FM2C.7. Multilayer Cladding with Hyperbolic Dispersion for Plasmonic Waveguides</td>
<td>V. Babicheva; M.Y. Shalaginov; S. Ishii; A. Boltasseva; A.V. Kildishev</td>
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<td>12:15-12:30 PM</td>
<td>FM2C.8. Effect of a hyperbolic metamaterial on radiation patterns of a single-photon source</td>
<td>M.Y. Shalaginov; A. Lagutchev; V.M. Shalaev; A.V. Kildishev</td>
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**10:30 AM-12:30 PM, Executive Ballroom 210D (Convention Center), FM2D. Novel Optical Phenomena, FS Oral, QELS 5: Nonlinear Optics and Novel Phenomena, Presider: Roberto Morandotti, morandotti@emt.inrs.ca, INRS-Energie Mat & Tele Site Varennes**

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<tr>
<td>10:30-10:45 AM</td>
<td>FM2D.1. Nonlinear Transmission of Light Through Biological Suspensions</td>
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<td>10:45-11:00 AM</td>
<td>FM2D.2. Rapid Manipulation of the Spatial Coherence</td>
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<td>11:00-11:15 AM</td>
<td>FM2D.3. Total Internal Reflection in Gain Media</td>
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<td>11:15-11:30 AM</td>
<td>FM2D.4. CW Laser Light Condensation</td>
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<td>11:45-12:00 PM</td>
<td>FM2D.6. Photoluminescence Upconversion Study of GaN Nanowires: Potential for Optical Refrigeration</td>
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<td>12:00-12:15 PM</td>
<td>FM2D.7. Guide-wave Photonic Pulling Force Using One-way Photonic Chiral Edge States</td>
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<td>12:15-12:30 PM</td>
<td>FM2D.8. Experimental Detection of Forces in an Optical Analog of Aharonov-Bohm Effect</td>
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<tr>
<td>10:30-11:00 AM</td>
<td>FM2E.1</td>
<td>Nonlinear Optics via Hybrid Quantum Systems</td>
<td>X. Xu; H. Xu; M. Gullans; C. Stambaugh; U. Kemiktarak; J. Lawall; J. Taylor</td>
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<tr>
<td>11:00-11:15 AM</td>
<td>FM2E.2</td>
<td>Fluorescent Nanodiamonds from Molecular Diamond Seed</td>
<td>H. Ishiwata; J. Zhang; R. Edgington; T.M. Babinec; K. Muller; K.G. Lagoudakis; N. Melosh; Z. Shen; J. Vuckovic</td>
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<td>11:15-11:30 AM</td>
<td>FM2E.3</td>
<td>On-Chip generation of photon-triplet states in integrated waveguide structures</td>
<td>S. Krapick; B. Brecht; V. Quiring; R. Ricken; H. Herrmann; C. Silberhorn</td>
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<td>11:30-12:00 PM</td>
<td>FM2E.4</td>
<td>Nonlinear Interactions in Optical Lattice Systems</td>
<td>D.N. Christodoulides</td>
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<tr>
<td>12:00-12:15 PM</td>
<td>FM2E.5</td>
<td>Complete conversion of one to two photons in dispersion-engineered nonlinear waveguides</td>
<td>A.S. Solntsev; A.A. Sukhorukov</td>
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<td>10:30 AM-12:30 PM</td>
<td>SM2F.1</td>
<td>Room-temperature lasing in GaAs nanowires embedding multi-stacked InGaAs/GaAs quantum dots</td>
<td>J. Tatebayashi; S. Kako; J. Ho; Y. Ota; S. Iwamoto; Y. Arakawa</td>
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<td>11:00-11:15 AM</td>
<td>SM2F.2</td>
<td>Nonpolar InGaN/GaN multi-quantum-well core-shell nanowire lasers</td>
<td>C. Li; J.B. Wright; S. Liu; P. Lu; J. Figiel; B. Leung; T.S. Luk; I. Brener; D. Feezell; S. Brueck; G. Wang</td>
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<td>11:15-11:30 AM</td>
<td>SM2F.3</td>
<td>A novel, highly-strained structure with an integrated optical cavity for a low threshold germanium laser</td>
<td>S. Gupta; D. Nam; J. Petykiewicz; D. Sukhdeo; J. Vuckovic; K. Saraswat</td>
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<td>11:30-11:45 AM</td>
<td>SM2F.4</td>
<td>Long Wave, Room Temperature, II-VI - Based Quantum Cascade Emitters</td>
<td>A. Ravikumar; T.A. Garcia; J. De Jesus; M.C. Tamargo; C.F. Gmachl</td>
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<td>11:45-12:00 PM</td>
<td>SM2F.5</td>
<td>Fe:ZnSe Channel Waveguide Laser Operating at 4122 nm</td>
<td>A. Lancaster; G. Cook; S. McDaniel; J. Evans; P. Berry; J. Shephard; A. Kar</td>
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<td>12:00-12:15 PM</td>
<td>SM2F.6</td>
<td>Optically Pumped Distributed Feedback Laser from Organo-Lead Iodide Perovskite Thin Films</td>
<td>S. Chen; W. Chong; J. Lee; K. Roh; E. Sari; N. Mathews; T. Sum; A. Nurmikko</td>
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<td>12:15-12:30 PM</td>
<td>SM2F.7</td>
<td>Monolayer Tungsten Disulfide Laser</td>
<td>Y. Ye; Z. Wong; X. Lu; H. Zhu; Y. Wang; X. Chen; X. Zhang</td>
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<td>10:30-10:45 AM</td>
<td>SM2G.1</td>
<td>Improvement for characterizing micro-ring resonator by low coherence interferometry measurement</td>
<td>W. Liu; C. Chen; C. Wei; Y. Chen</td>
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<td>10:45-11:00 AM</td>
<td>SM2G.2</td>
<td>Efficient Coefficient Extraction from Doublet Resonances in Microphotonic Resonator Transmission Functions</td>
<td>A. Jones; A.L. Lentine; C.T. DeRose; S.L. Andrew; P. Andrew; R. Norwood</td>
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<td>11:00-11:15 AM</td>
<td>SM2G.3</td>
<td>Verdet Constant and Magnetic Permeability in Microstructured FePt Nanoparticles in PS-P2VP Copolymer Composite Films</td>
<td>A. Miles; P. Gangopadhyay; Y. Gai; X. wang; J. Watkins; R. Norwood</td>
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<td>11:15-11:30 AM</td>
<td>SM2G.4</td>
<td>Diffusion Characterization Using Electron Beam Induced Current and Time-Resolved Photoluminescence of InAs/InAsSb Type-II Superlattices</td>
<td>D. Zuo; R. Liu; D. Wasserman; J. Mabon; Z. He; S. Liu; Y. Zhang; E.A. Kadlec; B.V. Olson; E.A. Shaner</td>
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<td>11:30-11:45 AM</td>
<td>SM2G.5</td>
<td>Broadband (3.9 – 9.6 μm) Photocurrent in Quantum Cascade Detector with Diagonal Transitions</td>
<td>G. Maioli Penello; B. Merkel; C.F. Gmachl; D.L. Sivco</td>
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<td>11:45-12:00 PM</td>
<td>SM2G.6</td>
<td>Spectral Dependence of Third-Order Nonlinear Optical Properties in InN</td>
<td>H. Ahn; M. Lee</td>
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<td>12:00-12:15 PM</td>
<td>SM2G.7</td>
<td>Characterization of Graphene Photothermoelectric Detector via Two-wave Mixing Technique</td>
<td>M. Jadidi; R.J. Suess; X. Cai; A.B. Sushkov; M. Mittendorff; M. Fuhrer; H. Drew; T.E. Murphy</td>
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<td>12:15-12:30 PM</td>
<td>SM2G.8</td>
<td>Tricycloquinazoline-Based Organometallic Compounds for Optical Switching</td>
<td>W. Shensky; J. Shi; M.J. Ferry; T. Pritchett</td>
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10:30 AM-12:30 PM, Executive Ballroom 210H (Convention Center), SM2H. Strong-Field THz Science and Technology, S&I Oral, CLEO S&I 5: Terahertz Technologies and Applications, Presider: Koichiro Tanaka, kochan@scphys.kyoto-u.ac.jp, Kyoto University

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<td>10:30-11:30 AM</td>
<td>SM2H.1</td>
<td>Nonlinear THz Optics and Control in Complex Solids</td>
<td>A. Cavalleri</td>
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<td>11:30-11:45 AM</td>
<td>SM2H.2</td>
<td>Generation of mJ THz pulses in organic crystal pumped by a Cr:Mg$_2$SiO$_4$ laser</td>
<td>C. Vicario; A. Ovchinnikov; S. Ashitkov; S. Agranat; V.E. Fortov; C.P. Hauri</td>
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<td>11:45-12:00 PM</td>
<td>SM2H.3</td>
<td>On Extracting the Maximum Terahertz Conversion Efficiency from Optical Rectification in Lithium Niobate</td>
<td>S. Carbajo; P. Alcorta; A. Calendron; H. Cankaya; X. Wu; K. Ravi; F. Ahr; W. Huang; F.X. KAERTNER</td>
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<td>12:00-12:15 PM</td>
<td>SM2H.4</td>
<td>Generation of Elliptically Polarized Half-Cycle Terahertz Pulses Generated by 6H-SiC Large Aperture Photoconductive Antenna</td>
<td>x. ropagnol; m. bouvier; C. Côté; M. Reid; M. Gauthier; T. Ozaki</td>
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<td>12:15-12:30 PM</td>
<td>SM2H.5. <strong>Extreme Terahertz brightness by focusing to a lambda-cubic volume</strong> C.P. Hauri; M. Shalaby</td>
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<td>10:30-11:00 AM</td>
<td>SM2I.1. <strong>Integrated Hardware-Software Implementation of Silicon Photonic Interconnected Computing System</strong> K. Bergman</td>
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<td>11:00-11:15 AM</td>
<td>SM2I.2. <strong>Active Resonance Wavelength Stabilization for Silicon Microring Resonators Using Slope-Detection with an In-resonator Defect-state-absorption-based Photodetector</strong> Y. Li; A.W. Poon</td>
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<td>11:15-11:30 AM</td>
<td>SM2I.3. <strong>Photoresistive Microring Heater with Resonance Control Loop</strong> C.V. Poulton; P. Dong; Y. Chen</td>
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<td>11:30-11:45 AM</td>
<td>SM2I.4. <strong>Demonstration of Reconfigurable Electro-Optical Directed-Logic Circuit by Carrier Depletion Micro-ring Resonators</strong> C. Qiu; W. Gao; R. Soref; J. Robinson; Q. Xu</td>
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<td>11:45-12:00 PM</td>
<td>SM2I.5. <strong>Integrated Mode-Locked Lasers in a CMOS-Compatible Silicon Photonic Platform</strong> C.M. Sorace-Agaskar; P.T. Callahan; K. Shtyrkova; A. Baldycheva; M. Moresco; J. Bradley; M.Y. Peng; N. Li; E. Magden; P. Purnawirman; M.Y. Sander; G. Leake; D.D. Coolbaugh; M.R. Watts; F.X. KAERTNER</td>
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<td>12:00-12:15 PM</td>
<td>SM2I.6. <strong>Noise and fluctuations in silicon photonics caused by free carrier and two-photon absorption</strong> D. Dimitropoulos; B. Jalali</td>
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<td>12:15-12:30 PM</td>
<td>SM2I.7. <strong>High contrast and power-efficient thermally-controlled optical switch on Silicon-on-Insulator</strong> Z. Han; G. Moille; X. Checoury; J. Bourderionnet; G. Lehoucq; P. Boucaud; A. De Rossi; S. Combrin</td>
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<td>10:30 AM-12:30 PM</td>
<td><strong>AM2J. Light Sources and Devices for Biomedical Imaging II</strong>, A&amp;T Oral, CLEO A&amp;T 1: <strong>Biomedical Applications</strong>, Presider: Seok-Hyun Yun, <a href="mailto:syun@hms.harvard.edu">syun@hms.harvard.edu</a>, Harvard Medical School</td>
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<td>10:30-10:45 AM</td>
<td>AM2J.1. <strong>A Full-Field Tomographic Imaging Camera Based on a Linearly Swept Frequency DFB at 1064 nm</strong> M. Harfouche; N. Satyan; G. Rakuljic; A. Yariv</td>
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<td>10:45-11:00 AM</td>
<td>AM2J.2. <strong>A Joint Richardson-Lucy Deconvolution Algorithm for the Reconstruction of Multifocal Structured Illumination Microscopy Data</strong> F. Stroehl; C.F. Kaminski</td>
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<td>11:00-11:15 AM</td>
<td>AM2J.3. <strong>Electron-injection Detectors for Swept Source Optical Coherence Tomography</strong> V. Fathipour; H. Mohseni</td>
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<td>11:15-11:30 AM</td>
<td>AM2J.4. <strong>Concentric Si Annular Photodiode Arrays for Spatially Resolved Diffuse Reflectance Spectroscopy</strong> O. Senlik; N.M. Jokerst</td>
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<td>11:30-11:45 AM</td>
<td>AM2J.5. Two-photon excited ReaChR by a three-stage femtosecond optical parametric amplifier C. Tsai; P. Hsiao; M. Chen; S. Yang; Y. Lin; A. Chiang</td>
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<td>11:45-12:00 PM</td>
<td>AM2J.6. End-Fire Silicon Waveguide Array as a Platform for High Power Beam Shaping and Steering M. Kossey; C. Rizk; A.C. Foster</td>
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<td>12:00-12:15 PM</td>
<td>AM2J.7. Tunable Dual Color Source For Multiphoton Imaging K. Charan; D. Heberle; C. Xu</td>
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<td>12:15-12:30 PM</td>
<td>AM2J.8. Tether-less Implantable Upconverting Microscale Light Bulbs for Deep Brain Neural Stimulation and Imaging M. Chamanzar; D. Garfield; j. iafrati; V. Sohal; B. Cohen; P. Schuck; M. Maharbiz</td>
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<td>10:30 AM-12:30 PM, Meeting Room 212 B/D (Convention Center), AM2K. Microprocessing Laser Processing of Silicon and Other Materials, A&amp;T Oral, CLEO A&amp;T 2: Industrial Applications, Presider: Peter Herman, <a href="mailto:p.herman@utoronto.ca">p.herman@utoronto.ca</a>, University of Toronto</td>
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<td>10:30-11:00 AM</td>
<td>AM2K.1. Industrial Processing of Various Materials using Ultrashort Pulsed Laser Sources D. Walter</td>
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<td>11:15-11:30 AM</td>
<td>AM2K.3. Radially Polarized Optical Vortex Micro-Converters Imprinted by Femtosecond Laser Nanostructuring in Amorphous Silicon R. Drevinskas; M. Beresna; M. Gecevičius; a.g. kazanskii; o.i. konkov; Y.P. Svirko; P. Kazansky</td>
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<td>11:30-12:00 PM</td>
<td>AM2K.4. Excimer Laser Annealing for LTPS on Large Substrates R. Paetzel</td>
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<td>12:00-12:15 PM</td>
<td>AM2K.5. Random Surface Texturing of mc-Silicon for Solar Cells with Picosecond Lasers; a Comparison between 1064 nm, 532 nm and 355 nm Laser Emission Wavelengths s. pellegrino; l. longoni; d. scorticati; s. binetti; A. Le Donne; A. Rolli; E. Grilli; C. Busto; B. Neuenschwander; B. Jaeggi</td>
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<td>12:15-12:30 PM</td>
<td>AM2K.6. Elucidating the Mechanism of Nanocone and Nanohole Formation on Si by Optical Trap Assisted Nanopatterning T. Chen; Y. Tsai; R. Fardel; C.B. Arnold</td>
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<td>10:30 AM-12:30 PM, Salon I-II (Marriott), SM2L. Modes in Fiber, S&amp;I Oral, CLEO S&amp;I 11: Fibers Photonic, Presider: Ayman Abouraddy, <a href="mailto:raddy@creol.ucf.edu">raddy@creol.ucf.edu</a>, University of Central Florida, CREOL</td>
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<td>10:30-10:45 AM</td>
<td>SM2L.1. Multiple-Cladding-Resonance All-Solid Photonic Bandgap Fibers with Large Mode Area G. Gu; F. Kong; T.W. Hawkins; M. Jones; L. Dong</td>
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<td>10:45-11:00 AM</td>
<td>SM2L.2. Scaling the mode area of Rare-Earth doped step index fiber under current state of the art MCVD technology D. Jain; Y. Jung; P. Barua; S. Alam; J. Sahu</td>
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| 11:00-11:15 AM     | SM2L.3. Experimental Observation of Non-Linear Mode Conversion in Few-Mode Fiber  
J. Xu; G.S. Gordon; T. Wilkinson; C. Peucheret                                |
| 11:15-11:30 AM     | SM2L.4. Reconstructing Core-to-Core Variations of Propagation Constant in Coupled Multicore Fiber for Quantum Walks  
P.J. Mosley; I. Gris-Sanchez; J. Stone; R. Francis-Jones; R.A. Hoggart; D.J. Ashton; T.A. Birks |
| 11:30-11:45 AM     | SM2L.5. Comparing Inter-Core Skew Fluctuations in Multi-Core and Single-Core Fibers  
R.S. Luis; B. Puttnam; J.M. Mendinueta; W. Klaus; Y. Awaji; N. Wada                      |
| 11:45-12:00 PM     | SM2L.6. Spatiotemporal Nonlinear Optics in Multimode Fibers  
L. Wright; D.N. Christodoulides; F.W. Wise                                         |
| 12:00-12:15 PM     | SM2L.7. Complete Spatiotemporal Measurement of Ultrashort Pulses Emerging from Multi-mode Optical Fiber  
Z. Guang; R. Trebino                                                              |
| 12:15-12:30 PM     | SM2L.8. Transmission of Focused Picosecond Light Pulse through a Multimode Fiber  
Y. Cen; Y. Chen                                                                   |
| 10:30 AM-12:30 PM, Salon IV (Marriott), SM2N. Symposium - Remote Atmospheric Lasing II, Special Symposium, Symposium - Remote Atmospheric Lasing, Presider: Ya Cheng, ya.cheng@siom.ac.cn, Shanghai Inst of Optics and Fine Mech |
| 10:30-11:00 AM     | SM2N.1. From Single Photon Superradiance to Coherence-Brightened Lasers in the Sky  
M.O. Scully                                                                        |
| 11:00-11:30 AM     | SM2N.2. Lasing from Plasma Filaments in Air  
Y. Liu; S. Mitryukovskiy; P. Ding; A. Houard; A. Mysyrowicz                         |
| 11:30-12:00 PM     | SM2N.3. Standoff Sources of Coherent Radiation Initiated by Femtosecond Filaments  
D. Kartashov; S. Alisauskas; G. Andriukaitis; A. Pugzlys; S. Haessler; A. Baltuska; M. Sheinder; B. Landgraf; A. Hoffmann; C. Spielmann; P.G. Polynkin; A. Mitrofanov; D. Sidorkov-Birukov; A. Zheltikov; J. Möhring; D. Starukhin; M. Motzkus; M. Ivanov; M. Richter; F. Morales  |
| 12:00-12:15 PM     | SM2N.4. Lasing actions in a flame filament  
H. Xu; Y. Cheng                                                                    |
| 12:15-12:30 PM     | SM2N.5. Characterization of Forward ASE Pulses Generated in Nitrogen with a Circularly Polarized Femtosecond Laser  
Y. Cheng; B. Zeng; Z. Li; J. Yao; H. Xie; G. Li; W. Chu; C. Jing; J. Ni               |
| 10:30 AM-12:00 PM, Salon III (Marriott), SM2M. Nonlinear Signal Processing, S&I Oral, CLEO S&I 12: Lightwave Communications and Optical Networks, Presider: Michael Vasilyev, vasilyev@uta.edu, University of Texas at Arlington |
| 10:30-10:45 AM     | SM2M.1. Investigation into the Role of Pump to Signal Power Ratio in FWM-based Phase Preserving Amplitude Regeneration  
K. Bottrill; G. Hesketh; F. Parmigiani; d. Richardson; P. Petropoulos               |
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<td>10:45-11:00 AM</td>
<td>SM2M.2</td>
<td>Investigation of 3-Channel All-Optical Regeneration in a Group-Delay-Managed Nonlinear Medium</td>
<td>L. Li; M. Vasilyev; T.I. Lakoba</td>
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<td>11:00-11:15 AM</td>
<td>SM2M.3</td>
<td>Spectrally Efficient Comb Source with Coupled Microresonators</td>
<td>Y. Okawachi; S. Miller; S. Ramelow; K. Luke; A. Farsi; M. Lipson; A.L. Gaeta</td>
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<td>11:15-11:30 AM</td>
<td>SM2M.4</td>
<td>Broadband Uniform Wavelength Conversion and Time Compression of WDM Channels</td>
<td>M. Shoai; A. Vedadi; C. Brès</td>
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<td>11:30-11:45 AM</td>
<td>SM2M.5</td>
<td>Nonlinear Compensation with Modified Adaptive Digital Backpropagation in Flexgrid Networks</td>
<td>E. Porto da Silva; R. Asif; K.J. Larsen; D. Zibar</td>
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<td>11:45-12:00 PM</td>
<td>SM2M.6</td>
<td>Low Complexity and Adaptive Nonlinearity Compensation</td>
<td>Z. Chen; L. Yan; A. Yi; L. Jiang; Y. Pan; W. Pan; B. Luo</td>
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<td>SM2O.1</td>
<td>Gas Sensing Fiber Network with Simultaneous Multi-node Detection using Range-resolved Chirped Laser Dispersion Spectroscopy</td>
<td>G. Plant; A. Hangauer; M. Huang; T. Wang; G. Wysocki</td>
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<td>10:45-11:00 AM</td>
<td>SM2O.2</td>
<td>Fiberoptic Evanescent Wave Spectroscopy in Water at ppm Sensitivity with a tunable Quantum Cascade Laser</td>
<td>G. De Naurois; I. Gaby; F. Capasso; A. Katzir</td>
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<td>11:00-11:15 AM</td>
<td>SM2O.3</td>
<td>Characterization of Temperature and Strain Sensitivity of Low Cost Few-mode Fiber Based Interferometer Sensor</td>
<td>Y. Wang; A. Li; X. Chen; W. Shieh</td>
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<td>11:30-11:45 AM</td>
<td>SM2O.5</td>
<td>Distributed Temperature and Strain Sensing using Spontaneous Brillouin Scattering in Optical Few-Mode Fibers</td>
<td>Y. Weng; E. Ip; Z. Pan; T. Wang</td>
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<td>11:45-12:00 PM</td>
<td>SM2O.6</td>
<td>Simultaneous Measurement of Temperature and Refractive Index Using a Photonic Crystal Cavity on a Fiber Tip</td>
<td>M. Boerkamp; Y. Lu; J. Mink; Z. Zobenica; R.W. van der Heijden</td>
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<td>12:00-12:15 PM</td>
<td>SM2O.7</td>
<td>Distance Measurement Using Second Harmonic Signal Component of Two-Photon Absorption Photocurrent from Si-APD</td>
<td>Y. Tanaka; Y. Yamada; T. Kurokawa</td>
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<td>12:15-12:30 PM</td>
<td>SM2O.8</td>
<td>Multipoint Hollow Core Photonic Crystal Fiber Sensor Network Based on Intracavity Absorption Spectroscopy</td>
<td>H. Zhang; Y. Lu; W. Shi; L. Duan; Z. Zhao; j. yao</td>
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<td>10:30-10:45 AM</td>
<td>SM2P.1</td>
<td>Coherent Pulse Stacking Amplification using Cascaded and Multiplexed Gires-Tournois Interferometers</td>
<td>T. Zhou; J. Ruppe; C. Zhu; I. Hu; J. Nees; R. Wilcox; W. Leemans; A. Galvanauskas</td>
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<td>10:45-11:00 AM</td>
<td>SM2P.2</td>
<td>Stabilizing the relative carrier-envelop phase of hybridly synchronized ultrafast Yb and Er fiber laser systems by the feed-forward scheme</td>
<td>W. Hsiang; B. Fong; W. Lin; S. Wu; J. Peng; Y. Lai</td>
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<td>11:00-11:15 AM</td>
<td>SM2P.3</td>
<td>Passive coherent combining of CEP-stable few-cycles pulses from a temporally divided hollow fiber compressor</td>
<td>H. Jacqmin; A. Jullien; B. Mercier; M. Hanna; F. Druon; D. Papadopoulos; R. Lopez-Martens</td>
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<td>11:15-11:30 AM</td>
<td>SM2P.4</td>
<td>Arbitrary-detuning asynchronous optical sampling with amplified laser systems</td>
<td>L. Antonucci; A. Bonvalet; X. Solinas; L. Daniault; M. Joffre</td>
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<td>11:30-11:45 AM</td>
<td>SM2P.5</td>
<td>Optimized Ancillae Generation for Ultra-Broadband Two-Dimensional Spectral Shearing Interferometry</td>
<td>C. Manzoni; R. Borrego Varillas; G. Cerullo; A. Oriana; F. Branchi</td>
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<td>11:45-12:00 AM</td>
<td>SM2P.6</td>
<td>Generation of Parabolic Pulses with Optimized Duration &amp; Energy by Use of Dispersive Frequency-to-time Mapping</td>
<td>J. Huh; D. Duchesne; J. Azaña</td>
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<td>12:00-12:15 PM</td>
<td>SM2P.7</td>
<td>Multiwavelength Ultrafast LiNbO₃ Raman Laser With Cascaded Terahertz-wave Generation</td>
<td>A.M. Warrier; J. Lin; H.M. Pask; A.J. Lee; D.J. Spence</td>
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<td>12:15-12:30 PM</td>
<td>SM2P.8</td>
<td>Injection-Locked VCSEL Arrays for Line-by-Line Pulse-Shaping with Update Times of Less Than 1 ns</td>
<td>S. Bhooplapur; A. Klee; P.J. Delfyett</td>
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12:00 PM-4:00 PM, Short Course 1 (none), **SC270. High Power Fiber Lasers and Amplifiers**, Short Course

12:00 PM-4:00 PM, Short Course 2 (none), **SC301. Quantum Cascade Lasers**, Short Course

1:00 PM-4:00 PM, Short Course 3 (none), **SC376. Plasmonics**, Short Course

1:00 PM-4:00 PM, Short Course 4 (none), **SC271. Quantum Information-Technologies and Applications**, Short Course

1:30 PM-3:30 PM, Executive Ballroom 210A (Convention Center), **FM3A. Frequency Conversion**, FS Oral, **QELS 2: Quantum Science, Engineering and Technology**, Presider: Xiao Li, xli321@umd.edu, Joint Quantum Institute
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<th>Time</th>
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<th>Authors</th>
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<tr>
<td>1:30-1:45 PM</td>
<td>FM3A.1</td>
<td>Demonstration of background-free, phase-preserving parametric up-conversion at the single-photon level</td>
<td>Y. Cheng; T.O. Thomay; G.S. Solomon; A.L. Migdall; S.V. Polyakov</td>
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<td>1:45-2:00 PM</td>
<td>FM3A.2</td>
<td>Ultrafast Time-to-Frequency Demultiplexing of Polarization-Entangled Photons</td>
<td>J.M. Donohue; J. Lavoie; K.J. Resch</td>
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<td>2:00-2:15 PM</td>
<td>FM3A.3</td>
<td>Low noise single photon frequency upconversion using Ti-indiffused periodically-poled lithium niobate waveguides with efficient narrowband filtering</td>
<td>Z. Xie; K. Luo; H. Herrmann; C. Silberhorn; C. Wong</td>
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<tr>
<td>2:15-2:30 PM</td>
<td>FM3A.4</td>
<td>Low-Noisy Quantum Frequency Translation of Single Photons</td>
<td>A. Farsi; S. Clemmen; S. Ramelow; A.L. Gaeta</td>
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<tr>
<td>2:30-2:45 PM</td>
<td>FM3A.5</td>
<td>Background-free Quantum Frequency Downconversion for Two-photon Interference of Heterogeneous Photon Sources</td>
<td>L. Yu; C.M. Natarajan; T. Horikiri; C. Langrock; J. Pelc; M.G. Tanner; E. Abe; S. Maier; S. Höffling; C. Schneider; M. Kamp; R.H. Hadfield; M.M. Fejer; Y. Yamamoto</td>
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<td>2:45-3:00 PM</td>
<td>FM3A.6</td>
<td>Ramsey Interferometry for Manipulation of Single Photons</td>
<td>A. Farsi; S. Clemmen; S. Ramelow; A.L. Gaeta</td>
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<td>3:00-3:15 PM</td>
<td>FM3A.7</td>
<td>Upconversion of Microwave to Optical Photons using Erbium Impurities in a Solid</td>
<td>X. Fernandez-Gonzalvo; L.A. Williamson; Y. Chen; C. Yin; S. Rogge; J.J. Longdell</td>
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<td>3:15-3:30 PM</td>
<td>FM3A.8</td>
<td>Progress towards quantum state transfer between microwave and optical light using an electro-optomechanical resonator</td>
<td>R. Peterson; P.S. Burns; R. Andrews; T.P. Purdy; K. Cicak; R.W. Simmonds; C.A. Regal; K.W. Lehnert</td>
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1:30 PM-3:30 PM, Executive Ballroom 210B (Convention Center), **FM3B. Light-matter Interactions in 2D Nanostructures**, FS Oral, **QELS 4: Optical Excitations and Ultrafast Phenomena in Condensed Matter**, Presider: Rohit Prasankumar, rpprasankumar@lanl.gov, Los Alamos National Laboratory

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<tr>
<td>1:30-1:45 PM</td>
<td>FM3B.1</td>
<td>Ultrafast Coulomb Intervally Interaction in Monolayer WS₂</td>
<td>R. Schmidt; G. Berghäuser; E. Malic; A. Knorr; R. Schneider; P. Tonndorf; S. Michaelis de Vasconcellos; R. Bratschitsch</td>
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<td>1:45-2:00 PM</td>
<td>FM3B.2</td>
<td>Ultrafast mid-infrared intraexcitonic spectroscopy of monolayer MoS₂₂</td>
<td>S. Cha; J. Sung; J. Kim; S. Sim; M. Jo; H. Choi</td>
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<tr>
<td>2:00-2:30 PM</td>
<td>FM3B.3</td>
<td>Manipulating the Valley Pseudospin in MoS₂ Transistors</td>
<td>K.F. Mak</td>
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<td>2:30-2:45 PM</td>
<td>FM3B.4</td>
<td>Single Photon Emission from Localized Excitons in Monolayer WSe₂</td>
<td>P. Tonndorf; R. Schmidt; J. Kern; M. Buscema; G. Steele; A. Castellanos-Gomez; H. van der Zant; S. Michaelis de Vasconcellos; R. Bratschitsch</td>
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<td>2:45-3:00 PM</td>
<td>FM3B.5. Emergent photophenomena in three dimensional van der Waals heterostructures</td>
<td>B. Mariserla; M. Man; S. Vinod; C. Chin; T. Harada; J. Taha-Tijerina; C. Tiwary; P. Nguyen; P. Chang; T. Narayanan; A. Rubio; P. Ajayan; S. Talapatra; K.M. Dani</td>
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<td>3:00-3:15 PM</td>
<td>FM3B.6. Topologically tunable Fano resonance in (Bi_{1-x}In_x)\textsubscript{2}Se\textsubscript{3}</td>
<td>S. Sangwan; N. Koirala; M. Brahlek; J. Park; S. Cha; S. Oh; H. Choi</td>
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<td>3:15-3:30 PM</td>
<td>FM3B.7. Quantum Interference Control of Photocurrents in Topological Insulator Films</td>
<td>D.A. Bas; K. Vargas-Valez; S. Babakiray; T.A. Johnson; D. Lederman; T. Stanescu; A.D. Bristow</td>
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<td>1:30 PM-3:30 PM</td>
<td>Executive Ballroom 210C (Convention Center)</td>
<td><strong>FM3C. Hyperbolic Metamaterial Waveguides</strong>, FS Oral, <strong>QELS 3: Metamaterials and Complex Media</strong>, Presider: Ekaterina Poutrina, <a href="mailto:ekaterina.poutrina.ctr@wpafb.af.mil">ekaterina.poutrina.ctr@wpafb.af.mil</a>, AFRL</td>
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<td>1:30-1:45 PM</td>
<td>FM3C.1. Super-Coulombic Energy Transfer: Engineering Dipole-Dipole Interactions with Metamaterials</td>
<td>W.D. Newman; C.L. Cortes; D. Purschke; A. Afshar; Z. Chen; G. De los Reyes; F. Hegmann; K. Cadien; R. Fedosejevs; Z. Jacob</td>
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<td>1:45-2:00 PM</td>
<td>FM3C.2. On-chip Super-robust All-dielectric Zero-Index Material</td>
<td>S. Kita; Y. Li; P. Muñoz; O. Reshef; D. Vulis; B. Day; E. Mazur; C. Lieber; M. Loncar</td>
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<td>2:00-2:15 PM</td>
<td>FM3C.3. Transparent subdiffraction optics: nanoscale light confinement without metal</td>
<td>S. Jahani; Z. Jacob</td>
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<td>2:15-2:30 PM</td>
<td>FM3C.4. Light Guiding by Gauge Field for Photons</td>
<td>Q. Lin; S. Fan</td>
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<td>2:30-2:45 PM</td>
<td>FM3C.5. General Conditions for Lossless Propagation in Near-Infrared Hyperbolic Metamaterial Waveguides</td>
<td>J.S. Smalley; F. Vallini; B. Kante; Y. Fainman</td>
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<td>2:45-3:00 PM</td>
<td>FM3C.6. Dispersion Control of High-k Waves in Tapered Hyperbolic Waveguides</td>
<td>N. Kinsey; P. West; M. Ferrera; A.V. Kildishev; V.M. Shalaev; A. Boltasseva</td>
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<td>3:00-3:15 PM</td>
<td>FM3C.7. Singular Evanescent Wave Resonances</td>
<td>Y. Guo; Z. Jacob</td>
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<td>3:15-3:30 PM</td>
<td>FM3C.8. Mode selection filter using THz metamaterials surfaced on LiNbO\textsubscript{3} sub-wavelength slab waveguide</td>
<td>B. Zhang; C. Pan; Y. Pan; S. Wang; Q. Wu; J. Xu</td>
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<td>1:30 PM-3:30 PM</td>
<td>Executive Ballroom 210D (Convention Center)</td>
<td><strong>FM3D. Frequency Conversion and its Application</strong>, FS Oral, <strong>QELS 5: Nonlinear Optics and Novel Phenomena</strong></td>
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<td>1:30-1:45 PM</td>
<td>FM3D.1. Nonlinear Frequency Mixing in a Surface Nanoscale Axial Photonics Resonator</td>
<td>M. Kues; C. Reimer; T. Hamidfar; R. Morandotti; P. Bianucci</td>
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<td>1:45-2:00 PM</td>
<td>FM3D.2. Second-harmonic Generation in a Phase-Matched Nonlinear 2D Crystal</td>
<td>M. Zhao; Z. Ye; Y. Ye; H. Zhu; Y. Wang; Y. Iwasa; X. Zhang</td>
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<td>2:00-2:15 PM</td>
<td>FM3D.3. Efficient Generation of Twin Photons at Telecom Wavelengths with 10 GHz Repetition-Rate-Tunable Comb Laser</td>
<td>R. Jin; R. Shimizu; I. Morohashi; K. Wakui; M. Takeoka; S. Izumi; T. Sakamoto; M. Fujiwara; T. Yamashita; S. Miki; H. Terai; Z. Wang; M. Sasaki</td>
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<td>2:30-3:00 PM</td>
<td>FM3D.5. Single-Pulse Two-dimensional Raman Spectroscopy</td>
<td>H. Frostig; T. Bayer; N. Dudovich; Y.C. Eldar; Y. Silberberg</td>
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<td>3:00-3:15 PM</td>
<td>FM3D.6. Raman oscillation, frequency upconversion, and Raman amplification at phonon-polariton resonance</td>
<td>Y.J. Ding</td>
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<td>3:15-3:30 PM</td>
<td>FM3D.7. Enhanced stimulated Brillouin scattering via saturable phonon losses</td>
<td>R. Behunin; W.H. Renninger; H. Shin; P. Kharel; E. Kittlaus; F. Carter; P.T. Rakich</td>
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<td>1:30 PM-3:30 PM</td>
<td>Executive Ballroom 210E (Convention Center), FM3E. Nonlinear Plasmonics, FS Oral, QELS 6: Nano-Optics and Plasmonics</td>
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<td>1:30-1:45 PM</td>
<td>FM3E.1. Giant nonlinear response of polaritonic metasurfaces coupled to intersubband transition</td>
<td>J. LEE; N. Nookala; M. Tymchenko; J. Gomez-Diaz; F. Demmerle; G. Boehm; M. Amann; A. Alu; M.A. Belkin</td>
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<td>1:45-2:00 PM</td>
<td>FM3E.2. Highly efficient SHG in NLO polymer-coated Au nanoparticles by doubly resonant excitations</td>
<td>A. Sugita; T. Hirabayashi; S. Niihashi; A. Ono; Y. Kawata</td>
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<td>2:00-2:15 PM</td>
<td>FM3E.3. Tip-enhanced Upconversion of Er$^{3+}$/Yb$^{3+}$:NaYF$_4$ Nanoparticles</td>
<td>G. Chen; E. Wu; C. Ding; B. Wu; X. Ci; Y. Liu; Y. Rong; Y. Xue; H. Zeng</td>
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<td>2:15-2:30 PM</td>
<td>FM3E.4. Large and Ultrafast Nonlinear Absorption of an Air/Gold Plasmonic Waveguide</td>
<td>A. Baron; T. Hoang; C. Fang; M. Mikkelsen; D. Smith</td>
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<td>2:30-2:45 PM</td>
<td>FM3E.5. Tailoring the Shape of Metallic Nanocavities for Enhanced Four-Wave Mixing</td>
<td>E.C. Almeida; Y. Prior</td>
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<td>2:45-3:00 PM</td>
<td>FM3E.6. All-Optical Electric-Field-Induced Second-Harmonic Generation</td>
<td>R. Davidson; A. Yanchenkon; J. Ziegler; S. Avanesyan; R.F. Haglund</td>
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<td>3:00-3:15 PM</td>
<td>FM3E.7. Scaling of the Nonlinear Response of Metal/Dielectric Plasmonic Waveguides</td>
<td>A. Baron; S. Larouche; D. Gauthier; D. Smith</td>
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<td>3:15-3:30 PM</td>
<td>SM3E.8</td>
<td>Suppression and Subsistence of Fano EIT Transmission Windows in Plasmonic-Vapor System</td>
<td>L. Stern; M.Y. Grajower; U. Levy</td>
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<td>1:30 PM-3:30 PM, Executive Ballroom 210F (Convention Center), SM3F. Ultrafast, High Speed and High Power Semiconductor Lasers, S&amp;I Oral, CLEO S&amp;I 3: Semiconductor Lasers, Presider: Leif Johansson, <a href="mailto:leif@freedomphotons.com">leif@freedomphotons.com</a>, Freedom Photonics, LLC</td>
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<td>1:30-1:45 PM</td>
<td>SM3F.1</td>
<td>Intracavity Loss and Dispersion Managed Mode-Locked Diode Laser</td>
<td>J.C. Balzer; B. Döpke; R.H. Pilny; C. Brenner; A. Klehr; G. Erbert; G. Tränkle; M.R. Hofmann</td>
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<td>1:45-2:00 PM</td>
<td>SM3F.2</td>
<td>Sub-300-femtosecond Semiconductor Disk Lasers</td>
<td>D. Waldburger; M. Mangold; S.M. Link; M. Golling; E. Gini; B.W. Tilma; U. Keller</td>
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<td>2:00-2:15 PM</td>
<td>SM3F.3</td>
<td>Synthesis of coherent optical pulses using a field-programmable gate array (FPGA)-based gradient descent phase-locking algorithm with three semiconductor lasers</td>
<td>K.J. Underwood; A.M. Jones; J. Gopinath</td>
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<td>2:15-2:30 PM</td>
<td>SM3F.4</td>
<td>A High Power and Ultrahigh Frequency Mode-Locked Laser Monolithically Integrated with an SOA</td>
<td>L. Hou; J.H. Marsh</td>
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<td>2:30-2:45 PM</td>
<td>SM3F.5</td>
<td>Tracking the Ultrafast Light-Matter Interaction in Population-Inverted Quantum Dots via Quantum State Tomography</td>
<td>N.B. Grosse; N. Owshimikow; A. Koltchanov; M. Kolarczik; U.K. Woggon; R. Aust; B. Lingnau; K. Lüdge</td>
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<td>2:45-3:00 PM</td>
<td>SM3F.6</td>
<td>Application of Strong Slow-Light Feedback to Boost the Modulation Bandwidth of VCSELs Beyond 70 GHz</td>
<td>M. Ahmed; A. Bakry; H. Dalir; F. Koyama</td>
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<td>3:00-3:15 PM</td>
<td>SM3F.7</td>
<td>DBR-free semiconductor disk lasers</td>
<td>Z. Yang; A.R. Albrecht; J.G. Cederberg; M. Sheik-Bahae</td>
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<td>3:15-3:30 PM</td>
<td>SM3F.8</td>
<td>Low-temperature Optimized 940 nm Diode Laser Bars with 1.98 kW Peak Power at 203 K</td>
<td>C. Frevert; P. Crump; F. Bugge; S. Knigge; A. Ginolas; G. Erbert</td>
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<td>1:30 PM-3:30 PM, Executive Ballroom 210G (Convention Center), SM3G. Group IV Photonics, S&amp;I Oral, CLEO S&amp;I 6: Optical Materials, Fabrication &amp; Characterization, Presider: Michael Menard, <a href="mailto:michael.menard@mail.mcgill.ca">michael.menard@mail.mcgill.ca</a>, McGill University</td>
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<td>1:30-2:00 PM</td>
<td>SM3G.1</td>
<td>Optical Interconnects based on Ge/SiGe Multiple Quantum Well Structures</td>
<td>D. Marris-Morini; P. Chaisakul; J. Frigerio; D. Chrastina; V. Vakarin; S. Cecchi; G. Isella; L. Vivien</td>
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<td>2:00-2:15 PM</td>
<td>SM3G.2</td>
<td>Relaxation Dynamics of Optically Generated Carriers in Graphene-on-Silicon Nitride Waveguide Devices</td>
<td>J. Wang; Z. Cheng; Q. Xie; C. Shu; H. Tsang</td>
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<td>2:15-2:30 PM</td>
<td>SM3G.3. A Black Phosphorus FET Integrated on a Silicon Waveguide for High Speed, Low Dark Current Photodetection</td>
<td>N. Youngblood; C. Chen; S.J. Koester; M. Li</td>
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<td>2:30-2:45 PM</td>
<td>SM3G.4. Germanium Photonic Crystal Nanobeam Cavity with $Q &gt; 1,300$</td>
<td>M. Kuroki; S. Kako; S. Ishida; K. Oda; T. Ido; S. Iwamoto; Y. Arakawa</td>
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<td>2:45-3:00 PM</td>
<td>SM3G.5. A Direct Band Gap GeSn Laser on Si</td>
<td>R. Geiger; S. Wirths; N. von den Driesch; Z. Ikonic; J. Hartmann; J. Faist; S. Maitl; D. Grützmacher; D. Buca; H. Sigg</td>
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<td>3:00-3:30 PM</td>
<td>SM3G.6. Monolithically Grown Superluminescent Diodes on Germanium and Silicon substrates</td>
<td>Q. Jiang; S. Chen; M. Tang; J. Wu; A. Seeds; H. Liu</td>
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<td>1:30 PM-3:15 PM, Executive Ballroom 210H (Convention Center)</td>
<td>SM3H. THz Materials Science, S&amp;I Oral, CLEO S&amp;I 5: Terahertz Technologies and Applications, Presider: David Cooke, <a href="mailto:cooke@physics.mcgill.ca">cooke@physics.mcgill.ca</a>, McGill University</td>
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<td>1:30-1:45 PM</td>
<td>SM3H.1. Extended-Drude Response of Photocarriers in InSb Revealed with Ultrabroadband Infrared Time-Domain Spectroscopy</td>
<td>E. Matsubara; T. Morimoto; M. Nagai; M. Ashida</td>
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<td>1:45-2:00 PM</td>
<td>SM3H.2. Photovoltaic Polymer-Fullerene Blends: Terahertz Carrier Dynamics and Device Performance</td>
<td>Z. Jin; D. Gehrig; C. Dyer-Smith; E. Heilweil; F. Laquai; M. Bonn; D. Turchinovich</td>
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<td>2:00-2:30 PM</td>
<td>SM3H.3. Probing Superconducting Gap Dynamics with THz Pulses</td>
<td>M. Beck; M. Klammer; I. Rousseau; G. Gol'tsman; I. Diamant; Y. Dagan; J. Demsar</td>
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<td>2:30-2:45 PM</td>
<td>SM3H.4. Enhancement of THz emission from GaN surface by Ga vacancy-related defects</td>
<td>Y. Sakai; I. Kawayama; H. nakanishi; M. Tonouchi</td>
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<td>2:45-3:00 PM</td>
<td>SM3H.5. Ultrabroadband, Lightweight, Flexible, and Polarization Sensitive Photodetector Based on Carbon Nanotube Fibers</td>
<td>A. Zubair; D. Tsentalovich; C.C. Young; N. Fujimura; X. Wang; X. He; W. Gao; Y. Kawano; M. Pasquali; J. Kono</td>
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<td>3:00-3:15 PM</td>
<td>SM3H.6. Ultrafast Carrier Transport in Silicon Nanocrystal Superlattices</td>
<td>H. Nemec; P. Kuzel; P. Maly; S. Gutsch; D. Hiller; M. Zacharias</td>
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<td>1:30 PM-3:30 PM, Meeting Room 211 B/D (Convention Center), SM3I. WDMs and Filters, S&amp;I Oral, CLEO S&amp;I 7: Micro- and Nano-Photonic Devices, Presider: Jessie Rosenberg, <a href="mailto:jcrosenb@us.ibm.com">jcrosenb@us.ibm.com</a>, International Business Machines Corp</td>
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<td>1:30-1:45 PM</td>
<td>SM3I.1. Design of a Polarization-Insensitive WDM Demultiplexing Lattice Filter in SOI</td>
<td>A. Bois; A. D. Simard; W. Shi; S. LaRochelle</td>
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<td>1:45-2:00 PM</td>
<td>SM3I.2</td>
<td>Inverse Design and Implementation of a Wavelength Demultiplexing Grating Coupler</td>
<td>A.Y. Piggott; J. Lu; T.M. Babinic; K. Lagoudakis; J. Petykiewicz; J. Vuckovic</td>
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<td>2:00-2:15 PM</td>
<td>SM3I.3</td>
<td>All-Optically Controlled Fabry-Perot Cavity-Assisted Add-Drop Microring Resonator on a Silicon Chip</td>
<td>W. Zhang; J. Yao</td>
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<td>2:15-2:30 PM</td>
<td>SM3I.4</td>
<td>Multichannel Optical Filters in Nanoscale Silicon Waveguides</td>
<td>M.W. Puckett; F. Vallini; A. Grieco; S. Fainman</td>
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<td>2:30-2:45 PM</td>
<td>SM3I.5</td>
<td>Narrowband Waveguide Bragg Gratings with Fully-etched Side Corrugations and Large Fabrication Tolerance</td>
<td>K. Lin; Y. Hung; C. Wu; C. Wang; Y. Chen</td>
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<tr>
<td>2:45-3:00 PM</td>
<td>SM3I.6</td>
<td>High-Quality Bragg Gratings Operating in Reflection without Circulators in SOI</td>
<td>A. D. Simard; S. LaRochelle</td>
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<td>3:00-3:15 PM</td>
<td>SM3I.7</td>
<td>Bragg Grating Spiral Strip Waveguide Filters for TM Modes</td>
<td>Z. Chen; J. Flueckiger; X. Wang; H. Yun; Y. Wang; Z. Lu; F. Zhang; N.A. Jaeger; L. Chrostowski</td>
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<td>3:15-3:30 PM</td>
<td>SM3I.8</td>
<td>Plasmonic Fano Nanoantenna for On-chip Wavelength Demultiplexing</td>
<td>R. Guo; M. Decker; F. Setzpfandt; I. Staude; D.N. Neshev; Y.S. Kivshar</td>
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2:00 PM-3:30 PM, Meeting Room 212 A/C (Convention Center), AM3J. Neurophotonics and Optogenetics, A&T Oral, CLEO A&T 1: Biomedical Applications, Presider: Do-Hyun Kim, DoHyun.Kim@fda.hhs.gov, Food and Drug Administration

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<tr>
<td>2:00-2:30 PM</td>
<td>AM3J.2</td>
<td>Visualizing Mammalian Brain Area Interactions by Dual-axis Two-photon Calcium Imaging</td>
<td>M. Schnitzer</td>
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<td>2:30-3:00 PM</td>
<td>AM3J.3</td>
<td>Engineering the Next Generation of Optogenetic Reporters to Illuminate Neuronal Activity</td>
<td>R.E. Campbell</td>
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<td>3:00-3:15 PM</td>
<td>AM3J.4</td>
<td>Label-Free Imaging of Single Neuron Activities by Stimulated Raman Scattering</td>
<td>D. Zhang; H. Lee; P. Shih; R. Drenan; J. Cheng</td>
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<td>3:15-3:30 PM</td>
<td>AM3J.5</td>
<td>Multifunctional Transparent Optoelectrode Array for in-vivo Optogenetic Studies</td>
<td>J. Lee; I. Ozden; Y. Song; A. Nurmikko</td>
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1:30 PM-3:30 PM, Meeting Room 212 B/D (Convention Center), AM3K. Components and Enabling Technologies, A&T Oral, CLEO A&T 2: Industrial Applications, Presider: Wilhelm Kaenders, wilhelm.kaenders@toptica.com, Toptica Photonics AG

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<td>1:30-1:45 PM</td>
<td>AM3K.1</td>
<td>High Speed Surface Micromachined MEMS Tunable VCSEL for Telecom Wavelengths</td>
<td>S. Paul; C. Gierl; J. Cesar; Q. Trung Le; M. Malekizandi; F. Kueppers; B. Koegel; J. Roskopf; C. Greus; M. Gorblich; Y. Xu; C. Neumeyr; M. Ortsiefer</td>
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<td>1:45-2:00 PM</td>
<td>AM3K.2</td>
<td>New Generation of VBGs for Efficient Spectral Beam Combination of Semiconductor Lasers</td>
<td>V.I. Smirnov</td>
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<td>2:00-2:15 PM</td>
<td>AM3K.3. Efficient Chirped Bragg Gratings for Stretching and Compression of High Energy Ultrashort Laser Pulses at 800 nm Spectral Region V.I. Smirnov</td>
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<td>2:30-2:45 PM</td>
<td>AM3K.5. Generation of continuous-wave and pulsed vortex beams in an a-cut Nd:YVO$_4$ laser with annular end-pumping A. Hu; P. Chen; Y. Wang; S. Li</td>
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<td>2:45-3:00 PM</td>
<td>AM3K.6. Development of YCOB Crystals for Large Aperture SHG, THG and OPA Applications Y. Zheng</td>
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<td>3:00-3:15 PM</td>
<td>AM3K.7. Development, Fabrication, and Real-World Applications of Polymeric Nanolayer Gradient Index Optical Components H. Fein; M. Ponting</td>
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<td>3:15-3:30 PM</td>
<td>AM3K.8. Fabrication of dielectric Bragg reflectors composed of CaF$_2$ and ZnS for delicate lasing materials A. Palatnik; M. Muallem; G.D. Nessim; Y. Tischler</td>
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<td>1:30-2:30 PM</td>
<td>SM3M.1. High Power Diode Lasers for Pumping High Energy Solid State Lasers P. Crump; C. Frevert; G. Erbert; G. Tränkle</td>
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<td>2:30-2:45 PM</td>
<td>SM3M.2. A Solid State 100 mJ Diode Pumped Temporally and Spatially Shaped Front End System for Seeding a 10 Hz 100 J Laser System W. Shaikh; T. Butcher; S. Banerjee; P. Mason; K. Ertel; J. Phillips; J. Smith; M. Divoky; M. De Vido; O. Cheklov; J. Greenhalgh; S. Tomlinson; I. Musgrave; C. Hernandez-Gomez; J.L. Collier</td>
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<td>2:45-3:00 PM</td>
<td>SM3M.3. High energy pump laser for Multi-Petawatt laser O. Casagrande; C. Derycke; A. Soujaeff; P. Ramos; L. Boudjemaa; C. Simon-Boisson; S. Laux; F. Lureau</td>
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<td>3:00-3:15 PM</td>
<td>SM3M.4. Recent Advances on the J-KAREN laser upgrad H. Kiriyama; M. Mori; A. Pirozhkov; K. Ogura; M. Nishiuchi; M. Kando; H. Sakaki; A. Kon; M. Kanasaki; H. Tanaka; Y. Fukuda; J. Koga; A. Sagisaka; T. Esirkepov; Y. Hayashi; H. Kotaki; S. Bulanov; K. Kondo; P. Bolton; Y. Mashiba; M. Asakawa; O. Slezak; M. Sawicka-Chyla; V. Jambunathan; A. Lucianetti; T. Mocek</td>
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<td>3:15-3:30 PM</td>
<td>SM3M.5. Apparatus and Techniques for Measuring Laser Damage Resistance of Large-Area, Multilayer Dielectric Mirrors for Use with High Energy, Picosecond Lasers R.A. Negres; I. Bass; K.A. Stanion; G. Guss; D.A. Cross; D.A. Alessi; C. Stolz; C.W. Carr</td>
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<td>1:30 PM-3:30 PM, Salon V &amp; VI (Marriott), SM3O. Nano and Micro-Optical Sensors, S&amp;I Oral, CLEO S&amp;I 13: Active Optical Sensing, Presider: Gerard Wysocki, <a href="mailto:gwysocki@princeton.edu">gwysocki@princeton.edu</a>, Princeton University</td>
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<td>SM3O.7.</td>
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<td>1:30 PM-4:00 PM, Willow Glen I - III (Marriott), SM3P. Mode Locked Lasers, S&amp;I Oral, CLEO S&amp;I 8: Ultrafast Optics, Optoelectronics &amp; Applications, Presider: F Omer Ilday, <a href="mailto:illday@bilkent.edu.tr">illday@bilkent.edu.tr</a>, Bilkent University</td>
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<td>1:30-1:45 PM</td>
<td>SM3P.1.</td>
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<td>1:45-2:00 PM</td>
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<td>2:00-2:15 PM</td>
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<td>2:30-2:45 PM</td>
<td>SM3P.5. Few-Femtosecond Synchronization Between a Few-MHz Ti:Sapphire Laser and a Multi-GHz Microwave Signal J. Kim; M. Walbran; A. Gliserin; K. Jung; P. Baum</td>
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<td>2:45-3:00 PM</td>
<td>SM3P.6. Low Phase Noise Hybrid Silicon Mode Locked Laser Using On-Chip Coherent Photon Seeding s. srinivasan; E. Norberg; T. Komljenovic; M. Davenport; G. Fish; J. Bowers</td>
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<td>3:00-3:15 PM</td>
<td>SM3P.7. Broadband, Low Noise Modelocked Semiconductor Laser with Intracavity Programmable Dispersion Control A. Klee; K. Bagnell; P.J. Delfyett</td>
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<td>3:15-3:30 PM</td>
<td>SM3P.8. All-optical Q-switching limiter for a 5-GHz SESAM-modelocked laser with record-high peak power A. Klenner; U. Keller</td>
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<td>4:30 PM-6:30 PM</td>
<td>Grand Ballroom (Convention Center), JM4A. Plenary I, Plenary Session</td>
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<td>4:30-5:00 PM</td>
<td>JM4A.1. Microscopy 2.0 S. Chu</td>
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<td>5:00-5:30 PM</td>
<td>JM4A.2. Nanoscopy with Focused Light S.W. Hell</td>
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<td>5:30-6:00 PM</td>
<td>JM4A.3. Light Paves the Way to Single-Molecule Detection and Photocontrol, Foundations of Super-Resolution Microscopy W. Moerner</td>
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<td>6:00-6:30 PM</td>
<td>JM4A.4. Imaging life at High Spatiotemporal Resolution E. Betzig</td>
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<td>8:00 AM-10:00 AM</td>
<td>Executive Ballroom 210A (Convention Center), FTu1A. Quantum Entanglement I, FS Oral, QELS 2: Quantum Science, Engineering and Technology, Presider: James Dailey, <a href="mailto:jdailey@appcomsci.com">jdailey@appcomsci.com</a>, Applied Communication Sciences</td>
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<td>8:00-8:15 AM</td>
<td>FTu1A.1. Generation of Hybrid Entanglement of Light Between Wave-like and Particle-like Qubits H. LE JEANNIC; O. Morin; K. HUANG; J. Liu; C. Fabre; J. Ruaudel; Y. Jeong; J. Laurat</td>
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<td>8:15-8:30 AM</td>
<td>FTu1A.2. Witness of Macroscopic Entanglement in Classical Statistical Optical Fields X. Qian; b. little; J. Howell; J.H. Eberly</td>
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<td>8:30-8:45 AM</td>
<td>FTu1A.3. Generation of multipartite spin entanglement from multimode squeezed states N. Sridhar; O. Pfister</td>
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<td>8:45-9:00 AM</td>
<td>FTu1A.4. Measurement of Quantum Two-Mode Squeezing Inspired by Classical Radio-Frequency Analogy Y. Shaked; T. Geller; A. Pe'er</td>
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<td>FTu1B.7</td>
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8:00 AM-10:00 AM, Executive Ballroom 210C (Convention Center), FTu1C. Optics of Metasurfaces, FS Oral, QELS 3: Metamaterials and Complex Media, Presider: Viktor Podolskiy, Viktor_Podolskiy@uml.edu, University of Massachusetts Lowell
| Time: 8:00-8:15 AM | FTu1C.1. Ohmic Loss Produces Chiral Dichroism in Plasmonic Metasurfaces: First Experimental Demonstration | G. Shvets; N. Arju; M.A. Belkin; R. Hillenbrand; F. Lu; M. Schnell; J. LEE; A.B. Khanikaev |
| Time: 8:15-8:30 AM | FTu1C.2. Dynamic Beam Steering in Micro-fluidic-meta-surface | L. Yan; P. Wu; Q. Song; W. Zhu; Z. Wu; D. Tsai; F. Capasso; A. LIU |
| Time: 8:30-8:45 AM | FTu1C.3. Diffraction Interface Theory: A nonlocal approach to metasurfaces | C. Roberts; S. Inampudi; V.A. Podolskiy |
| Time: 8:45-9:00 AM | FTu1C.4. Liquid Crystal Tuning of All-dielectric Metasurfaces | J. Sautter; I. Staude; M. Decker; E. Rusak; I. Brener; D.N. Neshev; Y.S. Kivshar |
| Time: 9:00-9:15 AM | FTu1C.5. Surface plasmon polariton control with Metasurfaces | P. Genevet; D. Wintz; A. Ambrosio; A. She; F. Capasso |
| Time: 9:30-9:45 AM | FTu1C.7. Plasmonic Metasurface for Color Hologram | Y. Huang; W. Chen; W. Tsai; P. Wu; C. Wang; G. Sun; D. Tsai |
| Time: 9:45-10:00 AM | FTu1C.8. Achromatic metasurfaces enable multi-wavelength flat optical components: demonstration of a dispersion-less beam deflector | F. Aieta; m. kats; p. genevet; r. Khorasaniejad; F. Capasso |

8:00 AM-10:00 AM, Executive Ballroom 210D (Convention Center), JTu1D. Symposium - Advanced Optical Microscopy for Brain Imaging I, Special Symposium, Symposium - Advanced Optical Microscopy for Brain Imaging, Presider: Na Ji, jin@janelia.hhmi.org, Howard Hughes Medical Inst.

| Time: 8:00-8:30 AM | JTu1D.1. Multi-photon Microscopy to Image Neuronal and Vascular Function in the Mammalian Brain | D. Kleinfeld |
| Time: 8:30-9:00 AM | JTu1D.2. Reconstructing Nervous System Development and Function with Light-Sheet Microscopy | P. Keller |
| Time: 9:00-9:30 AM | JTu1D.3. Integrated Neurophotonics: Toward Massively-Parallel Mapping of Brain Activity | M.L. Roukes |
| Time: 9:30-10:00 AM | JTu1D.4. Photoacoustic Tomography: Ultrasonically Beating Optical Diffusion and Diffraction | L.V. Wang |

8:00 AM-10:00 AM, Executive Ballroom 210E (Convention Center), FTu1E. 2D Materials for Nanoplasmonics and Nanophotonics, FS Oral, QELS 6: Nano-Optics and Plasmonics

<p>| Time: 8:00-8:30 AM | FTu1E.1. Nano-photonic Phenomena in van der Waals heterostructures | D.N. Basov |</p>
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<td>8:30-8:45 AM</td>
<td>FTu1E.2. Generation of Graphene Surface Plasmons and Their Applications in Beam Steering</td>
<td>M. Farhat; P. Chen; S. Guenneau; H. Bagci</td>
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<td>8:45-9:00 AM</td>
<td>FTu1E.3. Plasmon Resonance in Single- and Double-layer CVD Graphene Nanoribbons</td>
<td>D. Wang; N.K. Emani; T. Chung; L. Prokopeva; A.V. Kildishev; V.M. Shalaev; Y.P. Chen; A. Boltasseva</td>
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<td>9:00-9:15 AM</td>
<td>FTu1E.4. Nanoantenna-enhanced light-matter interaction in atomically thin WS2</td>
<td>J. Kern; A. Trügler; I. Niehaus; J. Ewering; R. Schmidt; R. Schneider; S. Najmaei; A. George; J. Zhang; J. Lou; U. Hohenester; S. Michaelis de Vasconcellos; R. Bratschitsch</td>
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<td>9:15-9:30 AM</td>
<td>FTu1E.5. Enhanced Spontaneous Emission from an Optical Antenna Coupled WSe₂ Monolayer</td>
<td>M. Eggleston; S. Desai; K. Messer; S. Madhavapathy; J. Xiao; X. Zhang; E. Yablonovitch; A. Javey; M.C. Wu</td>
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<td>9:45-10:00 AM</td>
<td>FTu1E.7. Pseudospin Selective Microcavity Polariton Emission From Two-dimensional Atomic Crystal</td>
<td>Z. Sun; X. Liu; H. Huang; Y. Tseng; Y. Lee; S. Cohen; V.M. Menon</td>
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<td>8:00 AM-10:00 AM</td>
<td>STu1F. Optical Integration on Chip, S&amp;I Oral, CLEO S&amp;I 9: Components, Integration, Interconnects and Signal Processing</td>
<td>Presider: Weidong Zhou, <a href="mailto:wzhou@uta.edu">wzhou@uta.edu</a>, University of Texas at Arlington</td>
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<td>8:00-8:15 AM</td>
<td>STu1F.1. Multicast 4x20 Silicon Photonic MEMS Switches</td>
<td>S. Han; T. Seok; C. Kim; R.S. Muller; M.C. Wu</td>
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<td>8:15-8:30 AM</td>
<td>STu1F.2. All-optical programmable integrated signal processor</td>
<td>H. Yu; M. Chen; H. Chen; S. Yang; S. Xie</td>
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<td>8:30-9:00 AM</td>
<td>STu1F.3. Nonlinear integrated optoelectronics</td>
<td>S. Mookherjea</td>
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<td>9:00-9:15 AM</td>
<td>STu1F.4. Unidirectional Coupling with Two Matched Dielectric and Metal Long-Period Gratings along a Polymer Waveguide</td>
<td>K.S. Chiang; B. Zou</td>
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<td>9:15-9:30 AM</td>
<td>STu1F.5. An Opto-Electro-Mechanical Phase Shifter</td>
<td>M.W. Pruessner; D. Park; T.H. Stievater; D.A. Kozak; W.S. Rabinovich</td>
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<td>9:30-9:45 AM</td>
<td>STu1F.6. Optofluidic Double-layer Fano Resonance Photonic Crystal Slab Liquid Sensors</td>
<td>S. Wang; Y. Liu; D. Zhao; Y. Shuai; H. Yang; W. Zhou; Y.A. Sun</td>
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<td>9:45-10:00 AM</td>
<td>STu1F.7. All-Fiber Polarization-Maintaining Electrooptic Pulse-Picker</td>
<td>M. Malmström; S. Boivinet; O. Tarasenko; J. Lecourt; Y. Hernandez; W. Margulis; F. Laurell</td>
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<td>8:00-8:15 AM</td>
<td><strong>STu1G.1. Evaluating the temporal profile of quantum cascade laser frequency combs</strong> D.P. Burghoff; Y. Yang; D. Hayton; J. Gao; J. Reno; Q. Hu</td>
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<td>8:15-8:30 AM</td>
<td><strong>STu1G.2. Injection Seeding and Modelocking of Metal-metal Terahertz Quantum Cascade Lasers</strong> F. WANG; a. Brewer; J. Freeman; J. Maysonneuve; S. Moumdji; R. Colombelli; I. Kundu; L. Lianhe; E. Linfield; G. Davies; H. Beere; D. Ritchie; S. Dhillon; J. Tignon</td>
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<td>8:30-8:45 AM</td>
<td><strong>STu1G.3. Investigation of Time-resolved Gain Dynamics in an Injection Seeded Terahertz Quantum Cascade Laser</strong> S. Markmann; H. Nong; S. Pal; N. Hekmat; P. Dean; R.A. Mohandas; L.H. Lianhe; E. Linfield; G. Davies; A.D. Wieck; N. Jukam</td>
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<td>8:45-9:00 AM</td>
<td><strong>STu1G.4. Scanning Voltage Microscopy Study of Lasing and Non-lasing Terahertz Quantum Cascade Lasers</strong> R. Dhar; G. Razavipour; E. Dupont; Z. Wasilewski; D. Ban</td>
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<td>9:00-9:15 AM</td>
<td><strong>STu1G.5. Two-Dimensional Pump Frequency Study of THz Generation in Mid-Infrared Quantum Cascade Lasers</strong> Y. Jiang; K. Vijayaraghavan; F. Demmerle; G. Boehm; M. Amann; M.A. Belkin</td>
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<td>9:30-9:45 AM</td>
<td><strong>STu1G.7. Optical Sideband Generation up to Room Temperature with Mid-Infrared Quantum Cascade Lasers</strong> S. Houver; A. Lebreton; P. Cavalié; M. Renaudat Saint-Jean; M. Amanti; C. Sirtori; L. Lianhe; E. Linfield; G. Davies; T. Pereira; J. Tignon; S. Dhillon</td>
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<td>9:45-10:00 AM</td>
<td><strong>STu1G.8. Long-Infrared InAs-based quantum cascade lasers</strong> D. Chastanet; A. Bousseksou; R. Colombelli; G. Lollia; M. Bahriz; A. Baranov; r. Teissier</td>
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8:00 AM-10:00 AM, Executive Ballroom 210H (Convention Center), **STu1H. Terahertz Photonics**, S&I Oral, **CLEO S&I 5: Terahertz Technologies and Applications**, Presider: Marco Rahm, marco.rahm@eit.uni-kl.de, Technische Universität Kaiserslautern

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<td><strong>STu1H.1. Investigation of Extraordinary Optical Transmission Inside a Terahertz Parallel-Plate Waveguide</strong> K.S. Reichel; P.Y. Lu; R. Mendis; D. Mittleman</td>
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<td><strong>STu1H.2. Dynamic light-induced THz resonators in a waveguide</strong> L. Gingras; M. Georgin; D.G. Cooke</td>
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<td><strong>STu1H.3. THz Artificial Dielectric Lens</strong> R. Mendis; M. Nagai; Y. Wang; N. Karl; D. Mittleman</td>
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8:00 AM-10:00 AM, Meeting Room 211 B/D (Convention Center), STuI Nonlinear Optics, S&I Oral, CLEO S&I 7 Micro- and Nano-Photonic Devices, Presider: Qiang Lin, qiang.lin@rochester.edu, University of Rochester
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<td>Low-Noise Stimulated Brillouin Lasing in a Microrod Resonator</td>
<td>W. Loh; J. Becker; F.N. Baynes; A. Green; D.C. Cole; F. Quinlan; H. Lee; K. Vahala; S.B. Papp; S. Diddams</td>
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<td>8:00 AM-10:00 AM</td>
<td>ATu1J.</td>
<td>Applications for Energy and Environment, A&amp;T Oral, CLEO A&amp;T 4: Laser &amp; Photonics Applications for Energy &amp; Environment, Presider: David Bomse, <a href="mailto:dbomse@mesaphotonics.com">dbomse@mesaphotonics.com</a>, Mesa Photonics</td>
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<td>8:00-8:15 AM</td>
<td>ATu1J.1</td>
<td>A Bistatic, Open-Path, Quantum Cascade Laser Array-Based Sensor for Methane and Nitrous Oxide Measurements</td>
<td>A.P. Michel; J. Kapit; M.F. Witinski; R. Blanchard; A. Gokoglu</td>
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<td>UAV-based laser spectrometer to quantify methane from agricultural and petrochemical activities</td>
<td>L. Tao; D. Pan; L. Golston; K. Sun; S. Saripalli; M.A. Zondlo</td>
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<td>ATu1J.3</td>
<td>Modeling the dependence of fork geometry on the performance of quartz enhanced photoacoustic spectroscopic sensors</td>
<td>S. Firebaugh; A. Sampaolo; P. Patimisco; V. Spagnolo; F.K. Tittel</td>
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<td>ATu1J.4</td>
<td>Ultralow-Noise Infrared Spectroscopy at Single-Photon Level Based on Frequency Upconversion System</td>
<td>W. Wu; R. Tang; X. Li; H. Pan; E. Wu; H. Zeng</td>
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<td>Thermal Emission of GaAs Nanowire Solar Cells</td>
<td>S. Wu; M. Povinelli</td>
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<td>Temperature-dependent Characterization of Ga_{0.94}Sn_{0.06} Light-Emitting Diode Grown on Si via CVD</td>
<td>S. Ghetmiri; W. Du; Y. Zhou; J. Margetis; T. Pham; A. Mosleh; B. Conley; A. Nazzal; G. Sun; R. Soref; J. Tolle; H. Naseem; B. Li; S. Yu</td>
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<td>Advanced Laser Lift Off in the Manufacturing of LEDs</td>
<td>M. Mendes; C. Porneala; X. Song; M. Hannon; R. Sarrafi; J. Schoenly; D. Sercel; S. Dennigan; R. VanGemert; H. Chaplin; J. Bickley; J. Sercel</td>
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<td>9:45-10:00 AM</td>
<td>ATu1J.8</td>
<td>Enhancement of quantum dot luminescence by using plasmonic resonance scheme of stacking asymmetric split-ring metamaterials</td>
<td>T. Shen; T. Kao; H. Kuo</td>
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<td>Integrated Optofluidics: Sensing, Guiding and Tailored Fabrication, S&amp;I Oral, CLEO S&amp;I 10: Biophotonics and Optofluidics, Presider: Timo Mappes, <a href="mailto:timo.mappes@zeiss.com">timo.mappes@zeiss.com</a>, Carl Zeiss AG</td>
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<td>8:00-8:15 AM</td>
<td>STu1K.1</td>
<td>Field-portable optofluidic plasmonic biosensor for wide-field and label-free monitoring of molecular interactions</td>
<td>A.F. Coskun; A. Cetin; B. Galarreta; D.A. Alvarez; H. Altug; A. Ozcan</td>
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<td>8:15-8:30 AM</td>
<td>STu1K.2</td>
<td>Spectrally Reconfigurable Multi-Spot Trap on Optofluidic ARROW Chip</td>
<td>K.D. Leake; M. Olson; D. Ozcelik; A. Hawkins; H. Schmidt</td>
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<td>STu1K.3</td>
<td>Physical insight into optical coupling between photoreceptor cell nuclei</td>
<td>H.T. Xuan</td>
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<td>Optofluidic Polarization Beam Splitter</td>
<td>Y. Liu; L. Shi; X. Fan; X. Zhang</td>
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<td>STu1K.5</td>
<td>Optical Waveguides from a Lithographically-Defined Wetting of a High-Index Liquid</td>
<td>C.C. Evans; E. Hsu; M. Ji; C. Liu; J. Suntivich</td>
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<td>Density Assisted Optofluidic Fabrication of 3D Shaped Particles</td>
<td>K. Paulsen; A. Chung</td>
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<td>STu1K.7</td>
<td>Tailoring Light Flow in Microfluidics</td>
<td>H. Zhao; L. Chin; W. Zhu; E. Yap; W. Ser; A. LIU</td>
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<td>STu1K.8</td>
<td>Ultra-broadband SERS substrates for &quot;all&quot; excitation wavelengths</td>
<td>N. Zhang; K. Liu; H. Song; X. Zeng; D. Ji; Q. Gan</td>
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<td>ATu1M</td>
<td>Process Control and Metrology Applications</td>
<td>A&amp;T Oral, CLEO A&amp;T 2: Industrial Applications, Presider: Jana Jágerská, <a href="mailto:jana.jagerska@uit.no">jana.jagerska@uit.no</a>, UiT Norges Arktiske Universitet</td>
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<td>8:00-8:30 AM</td>
<td>ATu1M.1</td>
<td>Advanced optical distance measurements using femtosecond laser pulses.</td>
<td>S. Kim; Y. Kim; B. Chun; K. Lee; S. Han; Y. Jang; H. Kang</td>
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<td>ATu1M.2</td>
<td>High speed two-dimensional temporal compressive sampling microscopic camera</td>
<td>Q. Guo; H. Chen; M. Chen; Z. Weng; Y. Liang; F. Xing; S. Xie</td>
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<td>Design Challenges of a High Speed Tunable Laser Interrogator for Future Spacecraft Health Monitoring</td>
<td>S. Ibrahim; J. O'Dowd; R. McCue; A. Honniball; M. Farnan</td>
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<td>Safety Monitoring of Long Distance Power Transmission Cables and Oil Pipelines with OTDR Technology</td>
<td>H. Wu; Y. Qian; H. Li; S. Xiao; Z. Fu; Y. Rao</td>
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<td>Curvature Sensor Based on Long-Period Grating in Dual Concentric Core Fiber</td>
<td>Z. Wu; N. Zhang; P. Shum; X. Shao; H. Zhang; T. Huang; G. Humbert; J. Auguste; F. Gérôme; J. Blondy; Q.X. Dinh</td>
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<td>Highly Sensitive Liquid Level Sensor using a Polymer Optical Bragg Grating for Industrial Applications</td>
<td>C. Marques; G. Peng; D.J. Webb</td>
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<td>ATu1M.7.</td>
<td>Integrated Fabry-Perot/Fiber Bragg Grating Sensor for Simultaneous Measurement</td>
<td>P. Lu; F. M. Abdulhussein</td>
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<td>Symposium - Breaking Limits with Unconventional Optical Fields</td>
<td>Presider: Qiwen Zhan, <a href="mailto:qzhan1@udayton.edu">qzhan1@udayton.edu</a>, University of Dayton</td>
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<td>8:00-8:30 AM</td>
<td>STu1L.1.</td>
<td>Tailoring Light at the Source: Structured Light from Laser Resonators</td>
<td>A. Forbes</td>
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<td>High-Topological Charge Vortex Tweezers with Continuous Control of Orbital Angular Momentum</td>
<td>R. Drevinskas; M. Gecevičius; M. Beresna; P. Kazansky</td>
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<td>Optical Coherency Matrix Tomography of Unconventional Beams</td>
<td>K. Kagalwala; H. Kondacki; A.F. Abouraddy; B.E. Saleh</td>
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<td>Study of Turbulence Induced Orbital Angular Momentum Channel Crosstalk in a 1.6 km Free-Space Optical Link</td>
<td>M.P. Lavery; B. Heim; C. Peuntinger; E. Karimi; O.S. Magaña-Loaiza; T. Bauer; C. Marquardt; a. willner; R.W. Boyd; M. Padgett; G. Leuchs</td>
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<td>Single-aperture STED illumination using a q-plate and fiber</td>
<td>L. Yan; E. Karimi; P. Gregg; R.W. Boyd; S. Ramachandran</td>
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<td>Increasing the Quantum Number, Dimensionality and Complexity of Entanglement</td>
<td>R. Fickler; M. Krenn; R. Lapkiewicz; M. Huber; W.N. Plick; S. Ramelow; A. Zeilinger</td>
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<td>8:00 AM-10:00 AM</td>
<td>STu1N.</td>
<td>Fiber Components &amp; Devices, S&amp;I Oral, CLEO S&amp;I 11: Fibers Photonic</td>
<td>Presider: Juliet Gopinath, <a href="mailto:Juliet.Gopinath@colorado.edu">Juliet.Gopinath@colorado.edu</a>, University of Colorado at Boulder</td>
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<td>8:00-8:15 AM</td>
<td>STu1N.1.</td>
<td>Splicing Tapered Inhibited-coupling Hypocycloid-core Kagome Fiber to SMF Fibers</td>
<td>Z. XIMENG; B. Debord; M. Alharbi; L. Vincetti; F. Gérôme; F. Benabid</td>
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<td>High Power WDM with Narrow Wavelength Separations</td>
<td>B. Pati; w. Tian; A. Van Newkirk; A. Schulzgen</td>
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<td>Towards a Plasma-Core PCF for Tunable UV-DUV Radiation</td>
<td>B. Debord; F. Gérôme; D. Passerieux; P. Coche; L. Alves; F. Benabid</td>
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<td>Hollow Core Silicon-Silica Bragg Fiber</td>
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<td>Inspection of Defect-Induced Mode Coupling in Hollow-Core Photonic Bandgap Fibers Using Time-of-Flight</td>
<td>N.H. Wong; S. Sandoghchi; Y. Jung; T. Bradley; N.V. Wheeler; N. Baddela; J.R. Hayes; F. Poletti; M. Petrovich; S. Alam; P. Petropoulos; d. Richardson</td>
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<td>9:30-9:45 AM</td>
<td>STu1N.7</td>
<td>Kagome-type HC-PCF pulse compression: high average power (&gt;100 W), high efficiency and very low noise performance</td>
<td>F. Emaury; A. Diebold; B. Debord; F. Gérôme; C.J. Saraceno; T. Sudmeyer; F. Benabid; U. Keller</td>
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<td>Scaling Laws in Tube Lattice Fibers</td>
<td>M. Masruri; A. Cucinotta; L. Vincetti</td>
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<td>STu1O.1</td>
<td>Laser Technologies and Challenges for XFEL Beamlines</td>
<td>A. Fry</td>
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<td>Sub-300 fs, 0.5 mJ Pulse at 1kHz from Ho:YLF Amplifier and Kagome Pulse Compression</td>
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<td>Ultrafast Diode-Pumped Ti:Sapphire Laser Generating 200-mW Average Power in 68-fs Pulses</td>
<td>K. Gurel; M. Hoffmann; C.J. Saraceno; V.J. Wittwer; S. Hakobyan; B. Resan; A. Rohrbacher; K. Weingarten; S. Schilt; T. Sudmeyer</td>
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<td>CPA-free ultrafast fiber laser source based on pre-chirp managed nonlinear amplification</td>
<td>D.N. Schimpf; W. Liu; T. Eidam; J. Limpert; A. Tünnermann; F. Kaertner; G. Chang</td>
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<td>Optimized SESAMs for Kilowatt Ultrafast Lasers</td>
<td>A. Diebold; T. Zengerle; M. Mangold; C. Schriber; F. Emaury; M. Hoffmann; C.J. Saraceno; M. Golling; D. Follman; G. Cole; M. Aspelmeyer; T. Sudmeyer; U. Keller</td>
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<td>STu1O.6</td>
<td>Multi-Terawatt CO\textsubscript{2} Laser with Chirped-Pulse Amplification</td>
<td>M.N. Polyanskiy; M. Babzien; I. Pogorelsky</td>
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<td>Generation of 33-fs laser pulses from a Kerr-lens modelocked Yb:Ca\textsubscript{3}Al\textsubscript{2}O\textsubscript{4} Laser</td>
<td>Z. Gao; J. Zhu; J. Wang; Z. Wei; L. Zheng; L. Su; J. Xu</td>
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<td>SC362. Cavity Optomechanics: Fundamentals and Applications of Controlling and Measuring Nano- and Micro-mechanical Oscillators with Laser Light, Short Course</td>
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<td>Finite Element Modeling Methods for Photonics and Optics, Short Course</td>
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<td>9:00 AM-12:00 PM, Short Course 3 (none), SC352.</td>
<td>Introduction to ultrafast pulse shaping--principles and applications, Short Course</td>
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<td>10:30 AM-12:30 PM, Executive Ballroom 210A (Convention Center)</td>
<td>FTu2A. Quantum Entanglement II, FS Oral, QELS 2: Quantum Science, Engineering and Technology, Presider: Todd Pittman, <a href="mailto:todd.pittman@umbc.edu">todd.pittman@umbc.edu</a>, University of Maryland Baltimore County</td>
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<td>10:30-10:45 AM</td>
<td><strong>FTu2A.1. Chip-to-chip quantum entanglement distribution</strong> J. Wang; M. Villa; D. Bonneau; R. Santagati; J.W. Silverstone; C. Erven; S. Miki; T. Yamashita; M. Fujiwara; M. Sasaki; H. Terai; M.G. Tanner; R.H. Hadfield; J. O'Brien; M.G. Thompson</td>
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<td>10:45-11:00 AM</td>
<td><strong>FTu2A.2. Realization of Sub-picosecond Clock Synchronization based on Second-Order Quantum Coherence</strong> R. Quan; R. Dong; Y. Zhai; M. Wang; S. Wang; F. Hou; T. Liu; S. Zhang</td>
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<td>11:00-11:15 AM</td>
<td><strong>FTu2A.3. Controlling frequency distinguishability of photons using cross phase modulation</strong> N. Matsuda</td>
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<td>11:15-11:30 AM</td>
<td><strong>FTu2A.4. Bell State Free Dense Coding with Linear Optics</strong> P. Lougovski; D. Uskov</td>
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<td>11:30-11:45 AM</td>
<td><strong>FTu2A.5. Experimental Reconstruction of Time-Bin-Entangled Qutrit States using Polarization Projective Measurements</strong> S. Nowierski; N.N. Oza; P. Kumar; G.S. Kanter</td>
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<td>11:45-12:00 PM</td>
<td><strong>FTu2A.6. Distributing Energy-Time Entangled Photon Pairs in Demultiplexed Channels over 110 km</strong> D. Aktas; B. Fedrici; F. Kaiser; L. Labonté; S. Tanzilli</td>
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<td>12:00-12:15 PM</td>
<td><strong>FTu2A.7. Multi-photon Generation and Interference in an Interferometric Optical Fiber Gyroscope</strong> T. Niu; S. Dong; W. Zhang; J. Wu; W. Zhang; L. You; Y. Huang; Z. Wang</td>
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<td>12:15-12:30 PM</td>
<td><strong>FTu2A.8. Experimental Tests of Nonlocality with Entangled Photons</strong> B. Christensen; N. Gisin; N. Brunner; Y. Liang; P. Kwiat</td>
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<td>10:30 AM-12:30 PM, Executive Ballroom 210B (Convention Center), FTu2B. Quantum Optics in Semiconductor Microcavities, FS Oral, QELS 4: Optical Excitations and Ultrafast Phenomena in Condensed Matter, Presider: Keshav Dani, <a href="mailto:keshav.dani@gmail.com">keshav.dani@gmail.com</a>, Okinawa Inst of Science &amp; Technology</td>
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<td>10:30-11:30 AM</td>
<td><strong>FTu2B.1. Manipulating Quantum Fluids of Light in Microstructured Semiconductor Cavities</strong> J. Bloch</td>
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<tr>
<td>11:30-11:45 AM</td>
<td><strong>FTu2B.2. Quantum Optics for Studying Ultrafast Processes in Condensed Matter</strong> M. Esposito; F. Randi; F. Giusti; D. Boschettu; F. Parmigiani; D. Fausti</td>
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<td>11:45-12:00 PM</td>
<td>FTu2B.3</td>
<td>A Spin-controlled Microcavity Laser</td>
<td>F. Hsu; W. Xie; Y. Lee; S. Lin; C. Lai</td>
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<td>12:00-12:15 PM</td>
<td>FTu2B.4</td>
<td>Polariton Condensates in Complex Potential Landscapes</td>
<td>C. Schneider; K. Winkler; A. Schade; R. Dall; M. Amthor; E. Ostrovskaya; M. Kamp; S. Hoefling</td>
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<td>12:15-12:30 PM</td>
<td>FTu2B.5</td>
<td>Soliton-Soliton interaction and Logic Gates in Cavity Polariton Circuits</td>
<td>E. Cancellieri</td>
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10:30 AM-12:15 PM, Executive Ballroom 210C (Convention Center), **FTu2C. Topological Photonics I**, FS Oral, **QELS 3: Metamaterials and Complex Media**, Presider: Stefano Lupi, stefano.lupi@roma1.infn.it, Dip. di Fisica

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<tr>
<td>10:30-10:45 AM</td>
<td>FTu2C.1</td>
<td>Optical Access to Topological-Insulator Surface States with Plasmonic Rotating Fields</td>
<td>G. Spektor; A. David; G. Bartal; M. Orenstein; A. Hayat</td>
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<td>10:45-11:00 AM</td>
<td>FTu2C.2</td>
<td>Reflections-Free Wave Propagation at the Interface of Photonic Topological Insulators: Theory and Experiment</td>
<td>T. Ma; K. Lai; G. Shvets</td>
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<td>11:00-11:15 AM</td>
<td>FTu2C.3</td>
<td>Large Chern number one-way waveguides</td>
<td>S. Skirlo; Y. Igarashi; L. Lu; M. Soljacic</td>
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<td>11:15-11:30 AM</td>
<td>FTu2C.4</td>
<td>Topological Control of Bloch Oscillations of Edge Modes in Photonic Lattices</td>
<td>Y. Plotnik; M.A. Bandres; Y. Lumer; M. Rechtsman; M. Segev</td>
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<td>11:30-11:45 AM</td>
<td>FTu2C.5</td>
<td>Single-Sided Diffraction by PT-Symmetric Metasurfaces</td>
<td>N.S. Nye; M. Miri; D.N. Christodoulides</td>
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<td>11:45-12:00 PM</td>
<td>FTu2C.6</td>
<td>PT-symmetric cavities with simultaneous unidirectional lasing and reflectionless modes</td>
<td>H. Ramezani; H. Li; Y. Wang; X. Zhang</td>
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<td>12:00-12:15 PM</td>
<td>FTu2C.7</td>
<td>Parity-time (PT) symmetric topological interface states</td>
<td>S. Weimann; M. Rechtsman; Y. Plotnik; Y. Lumer; K. Makris; M. Segev; A. Szameit</td>
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10:30 AM-12:30 PM, Executive Ballroom 210D (Convention Center), **JTu2D. Symposium - Advanced Optical Microscopy for Brain Imaging II**, Special Symposium, **Symposium - Advanced Optical Microscopy for Brain Imaging**, Presider: Chris Xu, cx10@cornell.edu, Cornell University

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<tr>
<td>10:30-11:00 AM</td>
<td>JTu2D.1</td>
<td>Adaptive Optics to Study the Structure and Function of the Human Visual System</td>
<td>A.J. Roorda</td>
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<td>11:00-11:30 AM</td>
<td>JTu2D.2</td>
<td>Wave Front Shaping and Optogenetics</td>
<td>V. Emiliani</td>
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<tr>
<td>11:30-12:00 PM</td>
<td>JTu2D.3</td>
<td>Rapid Adaptive Optical Recovery of Diffraction-Limited Resolution Over Large Multicellular Volumes</td>
<td>E. Betzig</td>
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<td>Time</td>
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<td>10:30-12:30 PM</td>
<td>JTu2D.4. Ultrafast Fluorescent Probes for Brain Activity Imaging</td>
<td>M. Lin</td>
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<td>10:30 AM-12:30 PM, Executive Ballroom 210E (Convention Center), <strong>FTu2E</strong>: Plasmonic Nanoantennas and Nanocavities, FS Oral, QELS 6: Nano-Optics and Plasmonics, Presider: Rashid Zia, <a href="mailto:Rashid_Zia@brown.edu">Rashid_Zia@brown.edu</a>, Brown University</td>
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<td>10:30-10:45 AM</td>
<td><strong>FTu2E.1</strong>: Filter Design Method for Construction of 3D Plasmonic Directional Light Sensors</td>
<td>M. Davis; J.K. Lee; A. Agrawal; H.J. Lezec</td>
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<td>10:45-11:00 AM</td>
<td><strong>FTu2E.2</strong>: Hybrid Metal-Dielectric Nanoantennas for Directional Emission Enhancement</td>
<td>E. Rusak; R. Guo; I. Staude; M. Decker; J. Sautter; A. Miroshnichenko; D.A. Powell; D.N. Neshev; Y.S. Kivshar</td>
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<td>11:00-11:15 AM</td>
<td><strong>FTu2E.3</strong>: Slanted 3D Plasmonic Antenna Arrays</td>
<td>P. Zilio; M. Malerba; A. Toma; F. De Angelis</td>
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<td>11:15-11:30 AM</td>
<td><strong>FTu2E.4</strong>: Parity-time symmetry breaking and amplifier-absorber transitions in plasmonic nanoparticles</td>
<td>N. Mohammadi Estakhri; A. Alu</td>
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<td>11:30-11:45 AM</td>
<td><strong>FTu2E.5</strong>: Coil-type Fano Resonances: a Plasmonic Approach to Magnetic Sub-diffraction Confinement</td>
<td>S. Panaro; A. Nazir; R. Zaccaria; C. Liberale; F. De Angelis; A. Toma</td>
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<td>11:45-12:00 PM</td>
<td><strong>FTu2E.6</strong>: Coupling Nano-Antennas to Microcavities: Radiative Interactions Cause Strong and Tunable Frequency Shifts</td>
<td>F. Ruesink; H.M. Doeleman; R. Hendrikx; F. Koenderink; E. Verhagen</td>
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<td>12:00-12:15 PM</td>
<td><strong>FTu2E.7</strong>: Localized Surface Phonon Polariton Resonators in GaN</td>
<td>K. Feng; W. Streyer; S. Islam; J. Verma; D. Jena; D. Wasserman; A. Hoffman</td>
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<td>12:15-12:30 PM</td>
<td><strong>FTu2E.8</strong>: Plasmonic whispering-gallery modes in a semiconductor-insulator-metal hybrid structure</td>
<td>C. Lee; H. Yeh; Y. Chen; C. Wang; S. Gwo; J. Huang; W. Chang</td>
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<td>10:30 AM-12:30 PM, Executive Ballroom 210F (Convention Center), <strong>STu2F</strong>: Optical Interconnect on Chip, S&amp;l Oral, CLEO S&amp;l 9: Components, Integration, Interconnects and Signal Processing, Presider: Weidong Zhou, <a href="mailto:wzhou@uta.edu">wzhou@uta.edu</a>, University of Texas at Arlington</td>
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<td>10:30-10:45 AM</td>
<td><strong>STu2F.1</strong>: Hybrid 3D Photonic Integrated Circuit for Optical Phased Array Beam Steering</td>
<td>B. Guan; C. Qin; R.P. Scott; B. Ercan; N.K. Fontaine; T. Su; S. Yoo</td>
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<td>10:45-11:00 AM</td>
<td><strong>STu2F.2</strong>: Multi-Chip Integration of Lasers and Silicon Photonics by Photonic Wire Bonding</td>
<td>M. Billah; T. Hoose; T. Onanuga; N. Lindenmann; P. Dietrich; T. Wingert; M. Goedcke; A. Hofmann; U. Troppenz; A. Sigmund; M. Möhrle; W. Freude; C. Koos</td>
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<td>11:00-11:30 AM</td>
<td>STu2F.3. High-Speed and Stable Operation of Highly Unidirectional III-V/Silicon Microring Lasers for On-chip Optical Interconnects</td>
<td>K. Ohira; H. Uemira; N. Iizuka; H. Yoshida; H. Uemura; Y. Kurita; H. Furuyama; M. Ezaki</td>
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<td>11:30-11:45 AM</td>
<td>STu2F.4. Heterogeneous Microring and Mach-Zehnder Lithium Niobate Electro-Optical Modulators on Silicon</td>
<td>A. Rao; A. Patil; J. Chiles; M. Malinowski; S. Novak; K. Richardson; P. Rabiei; S. Fathpour</td>
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<td>11:45-12:00 PM</td>
<td>STu2F.5. Hybrid Silicon and Lithium Niobate Racetrack Modulator with Large Spurious Free Dynamic Range</td>
<td>L. Chen; J. Chen; J.T. Nagy; R.M. Reano</td>
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<td>12:00-12:15 PM</td>
<td>STu2F.6. Si₃N₄ Multilayer Platform for Photonic Integrated Circuits</td>
<td>K. Shang; S. Pathak; B. Guan; G. Liu; C. Qin; R.P. Scott; S. Yoo</td>
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<td>12:15-12:30 PM</td>
<td>STu2F.7. Crystalline Silicon on Silicon Nitride Hybrid Platform for Integrated Photonic Applications</td>
<td>A. Hosseinnia; A.H. Atabaki; Q. Li; H. Moradinejad; M. Sodagar; F. Ghasemi; A. Eftekhar; A. Adibi</td>
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10:30 AM-12:30 PM, Executive Ballroom 210G (Convention Center), **STu2G. Cascade Lasers II**, S&I Oral, **CLEO S&I 3: Semiconductor Lasers**, Presider: Raffaele Colombelli, raffaele.colombelli@ief.u-psud.fr, Universite Paris Sud and CNRS

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<td>10:30-11:30 AM</td>
<td>STu2G.1. High-Brightness Interband Cascade Lasers</td>
<td>J.R. Meyer; C.L. Canedy; C.S. Kim; M. Kim; W.W. Bewley; C. Merritt; I. Vurgaftman</td>
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<td>11:30-11:45 AM</td>
<td>STu2G.2. Double-Ridge Interband Cascade Lasers for High-Power Spectroscopy in the Mid-Infrared</td>
<td>C. Borgentun; S. Forouhar; C. Frez; R. Briggs; M. Bagheri; M. Fradet</td>
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<td>11:45-12:00 PM</td>
<td>STu2G.3. Type-I Interband Cascade Lasers Near 3.2μm</td>
<td>J. Gupta; G. Aers; E. Dupont; J. Baribeau; X. Wu; Y. Jiang; L. Li; R. Yang; M. Johnson</td>
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<td>12:00-12:15 PM</td>
<td>STu2G.4. Ultra-Broadband (3.3-12.5 μm) Single Stack Quantum Cascade Gain Medium</td>
<td>L. Le; X. Wang; J. Fan; M. Troccoli; D.L. Sivco; C.F. Gmachl</td>
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10:30 AM-12:15 PM, Executive Ballroom 210H (Convention Center), **STu2H. THz Spectroscopy of Graphene and Magnetic Materials**, S&I Oral, **CLEO S&I 5: Terahertz Technologies and Applications**, Presider: Dmitry Turchinovich, turchino@mpip-mainz.mpg.de, Max Planck Inst. for Polymer Research
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<td>10:30-11:00 AM</td>
<td>STu2H.1. Terahertz Nonlinear Magnetic Response in Antiferromagnets</td>
<td>K. Tanaka; Y. Mukai; H. Hirori; T. Yamamoto; H. Kageyama</td>
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<td>11:00-11:15 AM</td>
<td>STu2H.2. Nonlinear THz transmission of gated graphene</td>
<td>S. Razavipour; W. Yang; F. Blanchard; A. Guermoune; M. Hilke; D.G. Cooke</td>
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<td>11:15-11:30 AM</td>
<td>STu2H.3. Terahertz Emission in Double-Graphene-Layer Structure</td>
<td>D. Yadav; B.T. Stephane; T. Watanabe; V. Ryzhii; T. Otsuji</td>
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<td>11:30-11:45 AM</td>
<td>STu2H.4. Intense Terahertz Field-induced Carrier Dynamics in Gated Monolayer Graphene</td>
<td>H. Hafez Eid; P. Lévesque; I. Al-Naib; M.M. Dignam; X. Chai; D. Ferachou; R. Martel; T. Ozaki</td>
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<td>11:45-12:00 PM</td>
<td>STu2H.5. Graphene on nanoscale gratings for terahertz Smith-Purcell radiation</td>
<td>K. Tantiwanichapan; X. Wang; A. Swan; R. Paiella</td>
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<td>12:00-12:15 PM</td>
<td>STu2H.6. Polarization-Dependent Terahertz Spectroscopy of Macroscopically Aligned Carbon Nanotubes</td>
<td>W. Gao; A. Zubair; J. Robinson; X. He; C.C. Young; D. Tsentalovich; N. Alvarez; R. Hauge; M. Pasquali; J. Kono</td>
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10:30 AM-12:30 PM, Meeting Room 211 B/D (Convention Center), STu2I. **Nonlinear Optics in Microresonators and Nanostructures**, S&I Oral, CLEO S&I 4: **Nonlinear Optical Technologies**, Presider: Paulina Kuo, pkuo@nist.gov, National Inst of Standards & Technology

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<td>10:30-11:00 AM</td>
<td>STu2I.1. Nonlinear and Quantum Optics with Whispering Gallery Resonators</td>
<td>D.V. Strekalov</td>
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<td>11:00-11:15 AM</td>
<td>STu2I.2. Surface-normal Coupled Four-wave Mixing in a High Contrast Grating Resonator</td>
<td>T. Sun; C.J. Chang-Hansnain</td>
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<td>11:15-11:30 AM</td>
<td>STu2I.3. Cascaded Four-Wave Mixing in Silicon-on-Sapphire Microresonators at $\lambda=4.5 \mu m$</td>
<td>S. Kalchmair; R. Shankar; S. Kita; C. Mittag; I. Bulu; M. Loncar</td>
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<td>11:30-11:45 AM</td>
<td>STu2I.4. Second Harmonic Generation In a GaN Photonic Crystal Cavity on Silicon</td>
<td>P. Boucaud; Y. Zeng; I. Roland; X. Checoury; Z. Han; M. El Kurdi; S. Sauvage; B. Gayral; C. Brimont; T. Guillet; M. Mexis; F. Semond</td>
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<td>11:45-12:00 PM</td>
<td>STu2I.5. Resonant Wavelength Conversion in Gallium Phosphide Nanostructures</td>
<td>D. Lake; M. Mitchell; A. Hryciw; J. Jayakumar; P.E. Barclay</td>
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<td>12:00-12:15 PM</td>
<td>STu2I.6. Coherent Second Harmonic Generation in a Quantum Well-Metasurface Coupled System</td>
<td>o. wolf; S. Campione; A. Benz; A.P. Ravikumar; S. Liu; E.A. Kadlec; E. Shaner; J.F. Klem; M.B. Sinclair; I. Brener</td>
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<td>12:15-12:30 PM</td>
<td>STu2I.7. Low-Power Parametric Wavelength Conversion in 45nm Microelectronics CMOS Silicon-On-Insulator Technology C.M. Gentry; M.T. Wade; X. Zeng; F. Pavanello; M. Popovic</td>
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<td>10:30 AM-12:30 PM</td>
<td>ATu2J. Solar Optics and Cells, A&amp;T Oral, CLEO A&amp;T 4: Laser &amp; Photonics Applications for Energy &amp; Environment, Presider: Homan Yuen, <a href="mailto:homanbyuen@gmail.com">homanbyuen@gmail.com</a>,</td>
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<td>10:30-11:00 AM</td>
<td>ATu2J.1. Self-Tracking Concentrator for Photovoltaics P. Kozodoy; C. Gladden; M. Pavilonis; C. Rhodes; T. Wheeler; C. Casper</td>
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<td>11:00-11:15 AM</td>
<td>ATu2J.2. Microphotonic spectrum-splitting &amp; concentration for high-efficiency photovoltaic N. Mohammed; P. Wang; D. Friedman; K. Ramanathan; L. Mansfield; R. Menon</td>
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<td>11:45-12:00 PM</td>
<td>ATu2J.4. Microcavity-Integrated Colored Perovskite Solar Cells K. Lee; M. Fukuda; C. Ji; L. Guo</td>
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<td>12:00-12:30 PM</td>
<td>ATu2J.5. Wide-angle Nonimaging Optics for Concentration and Illumination; Principles and Applications R. Winston</td>
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<td>10:30 AM-12:30 PM</td>
<td>STu2K. Computational Bioimaging, S&amp;I Oral, CLEO S&amp;I 10: Biophotonics and Optofluidics, Presider: Kevin Tsia, <a href="mailto:tsia@hku.hk">tsia@hku.hk</a>, University of Hong Kong</td>
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<td>10:30-10:45 AM</td>
<td>STu2K.1. Low-Light Reflective Correlation Imaging M. Akhlaghi Bouzan; T. Kohlgraf-Owens; A. Dogariu</td>
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<td>10:45-11:00 AM</td>
<td>STu2K.2. Differential Interference Imaging via Radio-frequency Sideband Encoding A.M. Fard; A. Mahjoubfar; B. Jalali</td>
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<td>11:00-11:15 AM</td>
<td>STu2K.3. High-resolution On-chip Imaging using Synthetic Aperture W. Luo; A. Greenbaum; Y. Zhang; A. Ozcan</td>
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<td>11:15-11:30 AM</td>
<td>STu2K.4. Compressive 39.6-gigapixel/s continuous imaging using spectrally-structured ultrafast laser pulses B.T. Bosworth; J. Stroud; D. Tran; T. Tran; S. Chin; M.A. Foster</td>
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<td>11:30-11:45 AM</td>
<td>STu2K.5. Compressive Optical Imaging Using Wavelength Dependent Scattering J. Shin; M.A. Foster</td>
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<td>11:45-12:00 PM</td>
<td>STu2K.6. Field-Portable Nanoparticle and Virus Sizing Enabled by On-Chip Microscopy and Vapor-Condensed Nanolenses E. McLeod; T.U. Dincer; M. Veli; Y.N. Ertas; C. Nguyen; W. Luo; A. Greenbaum; A. Feizi; A. Ozcan</td>
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<td>12:00-12:15 PM</td>
<td>STu2K.7. A cannula-based computational fluorescence microscope for neuronal imaging G. Kim; N. Nagarajan; A. Meiri; S. Merrill; M. Capecchi; E. Jorgensen; R. Menon</td>
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<td>12:15-12:30 PM</td>
<td>STu2K.8. Adaptive Optics in Three-Photon Fluorescence Microscopy</td>
<td>D. Sinefeld; H.P. Paudel; D.G. Ouzounov; T.G. Bifano; C. Xu</td>
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<td>10:30 AM-12:30 PM, Salon III (Marriott), ATu2M. Process Controls, Monitoring &amp; Novel Sources, A&amp;T Oral, CLEO A&amp;T 2: Industrial Applications, Presider: Oliver Heckl, <a href="mailto:oliver.heckl@jila.colorado.edu">oliver.heckl@jila.colorado.edu</a>, University of Colorado at Boulder JILA</td>
<td>ATu2M.1. MIR Spectroscopy beyond Trace Levels - Environmental and Industrial Applications</td>
<td>L. Emmenegger</td>
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<td>10:30-11:00 AM</td>
<td>ATu2M.2. Application of a widely tunable Sampled Grating Distributed Bragg Quantum Cascade laser for multi-species spectroscopy</td>
<td>A. Diba; F. Xie; B. Gross; C. Zah; F. Moshary</td>
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<td>11:00-11:15 AM</td>
<td>ATu2M.3. Direct Calorimetric Measurement of Powder Absorptivity</td>
<td>A.M. Rubenchik; S.S. Wu; M.M. LeBlanc; S.C. Mitchell; N.L. Peterson; I.V. Golosker</td>
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<td>11:30-11:45 AM</td>
<td>ATu2M.5. Robust Non-Reciprocal Optical DC Phase Shift Measurement with Differential Modulation Phase Detection</td>
<td>X. Gu; S.V. Marchese; K. Bohnert</td>
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<td>12:00-12:15 PM</td>
<td>ATu2M.6. Demonstration of Soliton Self Shifting Employing Er^{3+} Doped VLM- and HOM-Fiber Amplifiers</td>
<td>A. Zach; W. Kaenders; J.W. Nicholson; J.M. Fini; A. DeSantolo</td>
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<td>12:15-12:30 PM</td>
<td>ATu2M.7. Difference-frequency Generation of Spectrally Bright, ~1 W Average-power Mid-IR Radiation Using a ns-pulse Fiber Laser</td>
<td>P. Belden; D. Chen; F. Di Teodoro</td>
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<td>10:30 AM-12:30 PM, Salon II (Marriott), STu2L. Symposium - Breaking Limits with Unconventional Optical Fields II, Special Symposium, Symposium - Breaking Limits with Unconventional Optical Fields, Presider: Uriel Levy, <a href="mailto:ulevy@mail.huji.ac.il">ulevy@mail.huji.ac.il</a>, The Hebrew University of Jerusalem</td>
<td>STu2L.1. Relativistic Few-cycle Cylindrical Vector Beams for Novel Table-top Particle Accelerators</td>
<td>S. Carbajo; E.A. Nanni; L. Wong; R. Miller; F.X. KAERTNER</td>
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<td>STu2L.2. Topological Nature of Optical Bound States in the Continuum and its Application in Generating High-order Vector beams</td>
<td>B. Zhen; C. Hsu; L. Lu; A. Stone; M. Soljacic</td>
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<td>STu2L.3. Multiple Wavefront Shaping by a Single Gradient Metasurface</td>
<td>N. Shitrit; D. Veksler; E. Maguid; D. Ozeri; V. Kleiner; E. Hasman</td>
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<td>STu2L.5. Smaller Spot Formation by Vector Beam for Higher Resolution Microscopy</td>
<td>S. Sato; Y. Kozawa</td>
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<td>10:30 AM-12:30 PM</td>
<td>STu2N. Control &amp; Diagnostics, S&amp;I Oral, CLEO S&amp;I 2: Advanced Science and Technology for Laser Systems and Facilities</td>
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<td>STu2N.1. Optical differentiation wavefront sensor based on binary pixelated transmission filters</td>
<td>J. Qiao; A. Travinsky; C. Dorrer</td>
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<td>STu2N.2. Design and performance of an integrated phase and amplitude diversity sensor</td>
<td>N. Védrenne; F. Cassaing; L. Mugnier; V. Michau; G. Iaquaniello; L. Blanco; G. Chériaux</td>
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<td>11:00-11:15 AM</td>
<td>STu2N.3. High-Contrast, Closed-Loop Control of Laser Beam Profiles</td>
<td>L.E. McIntire; M. Divoky; W.H. Knox; S. Bahk; J.D. Zuegel</td>
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<td>11:30-11:45 AM</td>
<td>STu2N.5. High-throughput Lensfree Ion-Track Analysis for Laser-Driven Accelerators</td>
<td>W. Luo; F. Shabbir; C. Gong; C. Gulec; J. Pigeon; J. Shaw; A. Greenbaum; T. Su; A.F. Coskun; S. . Tochitsky; C. Joshi; A. Ozcan</td>
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<td>11:45-12:00 PM</td>
<td>STu2N.6. A Time-Multiplexed Pulse-Shaping System for Generating Multiple High-Bandwidth, Low-Jitter Optical Waveforms</td>
<td>C. Dorrer; W. Bittle; R. Cuffney; E. Hill; J. Kelly; T. Kosc; J.D. Zuegel</td>
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<td>STu2N.7. Sub-Femtosecond Free-Electron Laser Pulses</td>
<td>W. Helml; A. Maier; W. Schweinberger; I. Grguras; P. Radcliffe; G. Doumy; C. Roedig; J. Gagnon; M. Messerschmidt; S. Schorb; C. Bostedt; F. Grüner; L. DiMauro; D. Cubaynes; J. Bozek; T. Tschentscher; J. Costello; M. Meyer; R. Coffee; S. Düsterer; A.L. Cavalieri; R. Kienberger</td>
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<td>12:15-12:30 PM</td>
<td>STu2N.8. Remote two-color optical-to-optical synchronization between two passively mode-locked lasers</td>
<td>H. Li; L. Chen; H. Cheng; J. May; S. Smith; K. Muehlig; A. Uttamadoss; J. Frisch; A. Fry; F. Kaernter; P. Bucksbaum</td>
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<td>1:30 PM-2:30 PM</td>
<td>JTu3A. Plenary Session II, Plenary</td>
<td>T. Heinz</td>
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<td>1:30-2:00 PM</td>
<td>JTu3A.1. Electrons in Atomically Thin Two-Dimensional Crystals</td>
<td>T. Heinz</td>
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<td>2:00-2:30 PM</td>
<td>JTu3A.2. Current and Future of Solid State Lighting</td>
<td>H. Amano</td>
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<td>4:00 PM-6:00 PM</td>
<td>FTu4A. Fundamental Quantum Optics, FS Oral, QELS 2: Quantum Science, Engineering and Technology, NTT Basic Research Laboratories</td>
<td>Presider: William Munro, <a href="mailto:bill.munro@me.com">bill.munro@me.com</a>, NTT Basic Research Laboratories</td>
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<td>FTu4A.1</td>
<td>Direct measurement of the Wigner function by photon-number-resolving detection</td>
<td>N. Sridhar; R. Shahrokhhshahi; A. Miller; T. Gerrits; A. Lita; S. Nam; O. Pfister</td>
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<td>4:15-4:30 PM</td>
<td>FTu4A.2</td>
<td>Direct measurement of the quantum density matrix in the basis of azimuthal angle</td>
<td>M. Mirhosseini; O.S. Magaña-Loaiza; S. Hashemi Rafsanjani; C. Chen; E. Karimi; R.W. Boyd</td>
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<td>4:30-4:45 PM</td>
<td>FTu4A.3</td>
<td>Quantum Process Estimation with Unknown Measurements</td>
<td>B.J. Smith; M. Cooper; M. Karpinski</td>
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<td>FTu4A.4</td>
<td>Reducing the Free-Space Group Velocity of Single Photons by Transverse Structuring</td>
<td>D. Giovannini; J. Romero; V. Potocek; G. Ferenczi; F. Speirits; S. Barnett; D. Faccio; M. Padgett</td>
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<td>5:00-5:15 PM</td>
<td>FTu4A.5</td>
<td>Hong-Ou-Mandel Interference between Transverse Spatial Waveguide Modes</td>
<td>A. Mohanty; M. Zhang; S. Ramelow; P. Nussenzveig; M. Lipson</td>
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<td>FTu4A.6</td>
<td>Quantum Walk Coherences on a Dynamical Percolation Graph</td>
<td>F. Elster; S. Barkhofen; T. Nitsche; J. Novotný; A. Gábris; I. Jex; C. Silberhorn</td>
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<td>5:30-5:45 PM</td>
<td>FTu4A.7</td>
<td>Efficient Boson Sampling Schemes using Dispersion and Pulse Shaping</td>
<td>M. Pant; D. Englund</td>
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<td>5:45-6:00 PM</td>
<td>FTu4A.8</td>
<td>Repeat-Until-Success Cubic Phase Gate</td>
<td>K.A. Marshall; R. Pooser; G. Siopses; C. Weedbrook</td>
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<td>4:00 PM-6:00 PM, Executive Ballroom 210B (Convention Center), FTu4B</td>
<td>Light-matter Interaction in Graphene and other Carbon-based Materials, FS Oral, QELS 4: Optical Excitations and Ultrafast Phenomena in Condensed Matter, Presider: Jigang Wang, <a href="mailto:jgwang@iastate.edu">jgwang@iastate.edu</a></td>
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<td>4:00-4:15 PM</td>
<td>FTu4B.1</td>
<td>Ultrafast electron diffraction can visualize strong-field phenomena in graphene</td>
<td>V.S. Yakovlev; F. Krausz; M. Stockman; P. Baum</td>
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<td>FTu4B.2</td>
<td>Ultrafast Pseudospin Dynamics in Graphene</td>
<td>A. Grupp; M. Trushin; G. Soavi; A. Budweg; D. De Fazio; A. Lombardo; A.C. Ferrari; W. Betzig; A. Leitenstorfer; D. Brida</td>
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<td>FTu4B.3</td>
<td>Lateral Photo-Dember Effect in Graphene</td>
<td>C. Liu; Y. Chang; S. Lee; Y. Zhang; Y. Zhang; T.B. Norris; Z. Zhong</td>
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<td>FTu4B.4</td>
<td>Terahertz Generation by Dynamical Photon Drag Effect in Graphene</td>
<td>J. Mangenev; J. Maysonnave; S. Huppert; F. WANG; s. Maero; C. Berger; W.A. de Heer; T.B. Norris; L. de Vaulchier; S. Dhillon; R. Ferreira; J. Tignon</td>
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<td>FTu4B.5. Microscopic Origins of the Terahertz Carrier Relaxation and Cooling Dynamics in Graphene</td>
<td>M.T. Mihnev; C.J. Divin; F. Kadi; T. Winzer; S. Lee; C. Liu; Z. Zhong; X. Wang; R.S. Ruoff; C. Berger; W.A. de Heer; E. Malic; A. Knorr; T.B. Norris</td>
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<td>FTu4B.6. Ultrabroadband THz Conductivity of Non-equilibrium Dirac Fermions in Graphene</td>
<td>G. Coslovich; R.P. Smith; S. Shi; J.H. Buss; J.T. Robinson; F. Wang; R.A. Kaindl</td>
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<td>FTu4B.7. Ultrafast Photo-Excitation Dynamics of Nitrogen-Vacancy Defects in Diamond</td>
<td>R. Ulbricht; S. Dong; J. Schwartz; H. Kim; Y. Tanimura; B. Mariseria; K.M. Dani; Z. Loh</td>
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<td>FTu4B.8. Controlling Carbon Nanotube Mechanics with Optical Microcavities</td>
<td>M. Zhang; A. Barnard; P. McEuen; M. Lipson</td>
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<td>4:00-6:00 PM</td>
<td>FTu4C. Topological Photonics II, FS Oral, QELS 3: Metamaterials and Complex Media</td>
<td>Presider: Natalia Litchinitser, <a href="mailto:natashal@buffalo.edu">natashal@buffalo.edu</a>, State University of New York at Buffalo</td>
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<td>4:00-4:15 PM</td>
<td>FTu4C.1. Optical Topological Transitions in Photonic Hypercrys</td>
<td>E.E. Narimanov</td>
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<td>FTu4C.2. Observing Light Dynamics in Micro-sized Schwarzschild Metric</td>
<td>R. Bekenstein; Y. kabessa; O. Tal; M.A. Bandres; A. Agranat; A. Segev</td>
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<td>FTu4C.3. Dirac Plasmons in Topological Insulators</td>
<td>S. Lupi</td>
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<td>FTu4C.4. One-Way Topological Transitions in Magnetoplasmonic Hyperbolic Metamaterials</td>
<td>B. Stein; A. Leviyev; T. Galfsky; H. Krishnamoorthy; I.L. Kuskovsky; V.M. Menon; A.B. Khanikaev</td>
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<td>FTu4C.5. Integrated impedance-matched photonic Dirac-cone metamaterials</td>
<td>Y. Li; S. Kita; P. Muñoz; O. Reshef; D. Vulis; M. Loncar; E. Mazur</td>
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<td>FTu4C.6. Probing the Ultrathin Limit of Hyperbolic Meta-material: Nonlocality Induced Topological Transitions</td>
<td>L. Chen; C. Zhang; J. Zhou; L. Guo</td>
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<td>FTu4C.7. Photonic Topological Edge Modes without an Edge</td>
<td>Y. Tenenbaum Katan; Y. Lumer; Y. Plotnik; M. Rechtsman; M. Segev</td>
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4:00 PM-6:00 PM, Executive Ballroom 210D (Convention Center), FTu4D. Optical Filamentation and Compression, FS Oral, QELS 5: Nonlinear Optics and Novel Phenomena, Presider: Steven Cundiff, cundiff@jila.colorado.edu, University of Colorado at Boulder JILA

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<td>4:00-4:15 PM</td>
<td>FTu4D.1. 250-GW Sub-Three-Cycle Multi-Millijoule Mid-IR Pulses Self-Compressed in a YAG plate</td>
<td>V. Shumakova; P. Malevich; S. Alisauskas; A. Voronin; A. Zheltikov; D. Faccio; D. Kartashov; R. Maksimenka; G. Gitzinger; N. Forget; A. Baltuska; A. Pugzlys</td>
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<td>Mid-IR Filamentation in Dielectrics: 3-octave-spanning Supercontinuum</td>
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<td>Generation and Sub-2-cycle Self-compression</td>
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<td>FTu4D.3.</td>
<td>White-light Generation Pumped by Sub-ps Pulse</td>
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<td>FTu4D.4.</td>
<td>Transition between linear and nonlinear focusing regimes during</td>
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<td>FTu4D.5.</td>
<td>Superfilamentation in water with tight focusing laser beams</td>
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<td>FTu4D.6.</td>
<td>Generation and Enhancement of XUV Pulse from UV Filament Interaction</td>
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<td>FTu4D.7.</td>
<td>Plasma density measurement along femtosecond laser filament via</td>
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<td>Spatial Dependence of the Interaction between a Single Aerosol and</td>
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<td>a Laser Filament on its Reformation</td>
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<td>FTu4E.</td>
<td>Plasmonic Nanoantennas for Sensing and Focusing</td>
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<td>FTu4E.1.</td>
<td>Infrared Vibrational Molecular Hybridization with a Single Optical</td>
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<td>High-Brilliance Mid-Infrared Femtosecond Light Source for Surface-</td>
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<td>Enhanced Infrared Spectroscopy</td>
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<td>Plasmonic Nanoantennas on Nanopedestals for Ultra-Sensitive Vibrational</td>
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<td>3D Plasmonic nanostar structures for recyclable SERS applications</td>
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<td>Plasmonics of Ultranarrow Gaps Shunted by Organic Conductive Junctions</td>
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<td>Subwavelength Sensing Elements from Film-Coupled Silver Nanocubes</td>
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<td>Efficient Integration of Sub-5-nm-gap Plasmonic Crystal Cavities with</td>
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<td>5:45-6:00 PM</td>
<td>FTu4E.8</td>
<td>Hybridisation of antenna and cavity modes in nanoparticle-on-mirror plasmonic nanocavities</td>
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<td>4:00 PM-6:00 PM, Executive Ballroom 210F (Convention Center), STu4F</td>
<td>STu4F. Components and Optical Interconnects, S&amp;I Oral, CLEO S&amp;I 9: Components, Integration, Interconnects and Signal Processing, Presider: Leif Johansson, <a href="mailto:leif@freedomphotronics.com">leif@freedomphotronics.com</a>, Freedom Photonics, LLC</td>
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<td>4:00-4:15 PM</td>
<td>STu4F.1</td>
<td>A Comb Laser-Driven DWDM Silicon Photonic Transmitter with Microring Modulator for Optical Interconnect</td>
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<td>4:15-4:30 PM</td>
<td>STu4F.2</td>
<td>5 x 20 Gb/s III-V on Silicon Electroabsorption Modulator Array Heterogeneously Integrated with a 1.6nm Channel-Spacing Silicon AWG</td>
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<td>4:30-5:00 PM</td>
<td>STu4F.3</td>
<td>Demonstration of Error Free Operation Up To 32 Gb/s From a CMOS Integrated Monolithic Nano-Photonic Transmitter</td>
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<td>5:00-5:15 PM</td>
<td>STu4F.4</td>
<td>Efficient III-V/Si Hybrid SOAs for Optical Interconnects</td>
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<td>5:15-5:30 PM</td>
<td>STu4F.5</td>
<td>56 Gb/s PAM-4 Data Transmission Over a 1 m Long Multimode Polymer Interconnect</td>
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<td>STu4F.6</td>
<td>56 Gb/s, PAM-4 Transmission Over 25 km, Using IQ Modulator and Unequally Spaced Levels</td>
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<td>5:45-6:00 PM</td>
<td>STu4F.7</td>
<td>6.25 Gb/s POF Link Using GaN µLED Arrays and Optically Generated Pulse Amplitude Modulation</td>
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<td>4:00-6:00 PM, Executive Ballroom 210G (Convention Center), STu4G</td>
<td>Cascade Lasers I, S&amp;I Oral, CLEO S&amp;I 3: Semiconductor Lasers, Presider: Jerry Meyer, <a href="mailto:jerry.meyer@nrl.navy.mil">jerry.meyer@nrl.navy.mil</a>, US Naval Research Laboratory</td>
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<td>4:00-4:15 PM</td>
<td>STu4G.1</td>
<td>Sampled Grating Quantum Cascade Lasers with High Tuning Stability</td>
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<td>4:15-4:30 PM</td>
<td>STu4G.2</td>
<td>Surface emitting, single-mode quantum cascade laser array</td>
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<td>4:30-4:45 PM</td>
<td><strong>STu4G.3. Coherent Beam-Combining of Quantum Cascade Amplifier Arrays</strong>  B.G. Saar; K. Creedon; L. Missaggia; C.A. Wang; M.K. Connors; J. Donnelly; G.W. Turner; A. Sanchez-Rubio; W. Herzog</td>
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<td>4:45-5:00 PM</td>
<td><strong>STu4G.4. Room Temperature Operation of a Photonic Crystal Quantum Cascade Laser</strong> R. Peretti; V. Liverini; J. Wolf; C. Bonzon; S. Lourdudoss ; W. Metaferia; M. Beck; J. Faist</td>
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<td>5:00-5:30 PM</td>
<td><strong>STu4G.5. Perspectives for intersubband polariton lasers and Bose-Einstein condensation of intersubband polaritons</strong> R. Colombelli; J. Manceau</td>
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<td>5:30-5:45 PM</td>
<td><strong>STu4G.6. Continuous Wave Room Temperature External Ring Cavity Quantum Cascade Laser</strong> M. Hemingway; D. Vaitiekus; J. Cockburn; N. Hempler; G. MAKER; G. MALCOLM; D.G. Revin</td>
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<td>5:45-6:00 PM</td>
<td><strong>STu4G.7. Monolithic Integration of Quantum Cascade Lasers and Passive Components</strong> J. Montoya; C.A. Wang; K. Creedon; A. Goyal; J. Daulton; J. Donnelly; L. Missaggia; A. Sanchez-Rubio; W. Herzog</td>
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<td>4:00 PM-6:00 PM, Executive Ballroom 210H (Convention Center), <strong>STu4H. THZ Spectroscopic Techniques</strong>, S&amp;I Oral, CLEO S&amp;I 5: Terahertz Technologies and Applications, Presider: Philip Taday, <a href="mailto:philip.taday@teraview.com">philip.taday@teraview.com</a>, TeraView Ltd</td>
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<td>4:00-4:15 PM</td>
<td><strong>STu4H.1. Self-referenced Transient THz Spectroscopy with ABCD Detection</strong>  F. D’Angelo; S. Parekh; M. Bonn; D. Turchinovich</td>
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<td>4:15-4:30 PM</td>
<td><strong>STu4H.2. Electron Dynamics in a Gold Thin Film Accelerated via an Intense Terahertz Field</strong> Y. Minami; T.D. Dao; T. Nagao; J. Takeda; M. Kitajima; I. Katayama</td>
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<td><strong>STu4H.3. Time-resolved THz Laser spectra using a Fibre-interfaced Optical Heterodyne system</strong> T. Folland; A. ramospulido; o. marshall; H. Beere; D. Ritchie; S. Chakraborty</td>
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<td>4:45-5:00 PM</td>
<td><strong>STu4H.4. Terahertz Response of Long-lived Photoexcited Electrons in Silicon Observed Using Single-shot Terahertz Spectroscopy</strong> I. Katayama; K. Masuda; K. Horiuchi; Y. Minami; J. Takeda</td>
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<td>5:00-5:15 PM</td>
<td><strong>STu4H.5. Real-Time Absolute Frequency Measurement of CW-THz Wave Based on a Free-Running THz Comb</strong> T. Ogura; K. Hayashi; H. Inaba; K. Minoshima; T. Yasui</td>
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<td>5:15-5:30 PM</td>
<td><strong>STu4H.6. Generation and Stabilization of THz-waves with Extraordinary Low Line Width and Phase Noise</strong> S. Preussler; T. Schneider; H. Al-Taify</td>
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<td>5:30-5:45 PM</td>
<td><strong>STu4H.7. Transition from Plasmon Coupling to Plasmon-Microcavity Hybridization</strong> Q. Song; P. Wu; W. Zhu; w. zhang; Z. shen; Q. liang; Z. Yang; Y. Jin; Y. Hao; T. Bourouina; Y. Leprince-Wang; A. LIU</td>
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<td>5:45-6:00 PM</td>
<td>STu4H.8. Single Nanowire Terahertz Detectors</td>
<td>K. Peng; P. Parkinson; L. Fu; Q. Gao; N. Jiang; Y. Guo; F. Wang; H. Joyce; J. Boland; M. Johnston; H. Tan; C. Jagadish</td>
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<td>4:00 PM-6:00 PM, Meeting Room 211 B/D (Convention Center), STu4I. Mid-IR Photonics, S&amp;I Oral, CLEO S&amp;I 7: Micro- and Nano-Photonic Devices</td>
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<td>4:00-4:15 PM</td>
<td>STu4I.1. Nano-Silicon-Photonic Fourier Transform Infrared (FTIR) Spectrometer-on-a-Chip</td>
<td>B. Dong; H. Cai; Y. Gu; Z. Yang; Y. Jin; Y. Hao; D. Kwong; A. LIU</td>
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<td>4:15-4:30 PM</td>
<td>STu4I.2. Monolithically Integrated Quantum Cascade Lasers, Detectors and Dielectric Waveguides at 9.5μm for Far-Infrared Lab-on-Chip Chemical Sensing</td>
<td>Y. Zou; K. Vijayraghavan; P. Wray; S. Chakravarty; M.A. Belkin; R.T. Chen</td>
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<td>4:30-4:45 PM</td>
<td>STu4I.3. Experimental Demonstration of Mid-Infrared Holey and Slotted Photonic Crystal Waveguides in Silicon on Sapphire</td>
<td>Y. Zou; P. Wray; S. Chakravarty; R.T. Chen</td>
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<td>4:45-5:00 PM</td>
<td>STu4I.4. Near Field Optical Measurements of Silicon Waveguide in Mid-IR Regime Using Scanning Thermal Microscopy</td>
<td>M.Y. Grajower; D. Sebbag; A. Naiman; B. Desiatov; U. Levy</td>
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<td>5:00-5:15 PM</td>
<td>STu4I.5. On-Chip Modulation in the Mid-Infrared with Silicon-on-Lithium-Niobate Photonics</td>
<td>J. Chiles; S. Fathpour</td>
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<td>5:15-5:30 PM</td>
<td>STu4I.6. Microscopic Analysis of Quantum-Confined Stark Effect of Group IV Quantum Wells for Mid-Infrared Si-Based Electroabsorption Modulators</td>
<td>T. Fujisawa; K. Saitoh</td>
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<td>5:30-5:45 PM</td>
<td>STu4I.7. All-optical Modulation in Germanium-on-silicon Waveguides in the Mid-infrared</td>
<td>L. Shen; N. Healy; C. Mitchell; J. Penades; M. Nedeljkovic; G. Mashanovich; A.C. Peacock</td>
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<td>5:45-6:00 PM</td>
<td>STu4I.8. Broadband Mid-Infrared Frequency Comb Generation in a Si$_3$N$_4$ Microresonator</td>
<td>K. Luke; Y. Okawachi; M. Lamont; A.L. Gaeta; M. Lipson</td>
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<td>4:00 PM-6:00 PM, Meeting Room 212 A/C (Convention Center), ATu4J. Environmental Sensing, A&amp;T Oral, CLEO A&amp;T 4: Laser &amp; Photonics Applications for Energy &amp; Environment, Presider: Mark Phillips, <a href="mailto:mark.phillips@pnnl.gov">mark.phillips@pnnl.gov</a>, Pacific Northwest National Laboratory</td>
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<td>4:00-4:30 PM</td>
<td>ATu4J.1. Nitrogen oxide radicals and organic nitrate photochemistry in Earth’s atmosphere</td>
<td>R. Cohen</td>
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<td>4:30-4:45 PM</td>
<td>ATu4J.2. Transportable Dual-Modulation Faraday Rotation Spectrometer for Time-Multiplexed Nitric Oxide Isotope Ratiometry</td>
<td>E.J. Zhang; S. Huang; M. Silvernagel; G. Wysocki</td>
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<td>4:45-5:00 PM</td>
<td>ATu4J.3. Quantifying Primary Reactive Nitrogen Emissions Using Open-Path, Quantum Cascade Laser-Based Sensors</td>
<td>K. Sun; L. Tao; D. Pan; L. Golston; Y. Tian; M. Huang; J. Hu; T. Wang; M.A. Zondlo</td>
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<td>5:00-5:15 PM</td>
<td>ATu4J.4</td>
<td>Airborne Multi-Gas Sensor</td>
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<td>ATu4J.5</td>
<td>CAMS - Compact Atmospheric Multi-Species Spectrometer</td>
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<td>ATu4J.6</td>
<td>Advancing a Deep Sea Near-Infrared Laser Spectrometer for Dual Isotope Measurements</td>
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<td>ATu4J.7</td>
<td>Advances in Diode Laser Based Lidar for Profiling Atmospheric Water Vapor</td>
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<td>STu4K</td>
<td>STu4K.1. Micro-Cavity based Force Sensors - A Novel and Simple Interferometric Tool for Cell-Mechanical Investigations</td>
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<td>Wide Dynamic Range Specific Detection of Therapeutic Drugs by Photonic Crystal Microcavity Arrays</td>
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<td>STu4K.3</td>
<td>Silicon Nitride Coupled-Resonator Optical-Waveguide-based Biosensors using Visible-Light-Scattering Pattern Recognition</td>
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<td>STu4K.4</td>
<td>Phospholipid-functionalized microgoblet lasers for biomolecular detection</td>
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<td>STu4K.5</td>
<td>193nm Lithography Fabricated High Sensitivity Photonic Crystal Microcavity Biosensors for Plasma Protein Detection in Patients with Pancreatic Cancer</td>
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<td>STu4K.6</td>
<td>High Contrast Grating Resonator for Label-Free Biosensor</td>
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<td>STu4K.7</td>
<td>On-chip Integrated Differential Optical Microring Biosensing Platform Based on a Dual Laminar Flow Scheme</td>
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<td>ATu4M</td>
<td>ATu4M.1. Lasers in the 2um SWIR spectral regime and their Applications</td>
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<td>ATu4M. Novel Sources for Industrial Applications, A&amp;T Oral</td>
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<td>ATu4M.3</td>
<td>ATu4M.4. Industrial Applications</td>
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<td>4:30-5:00 PM</td>
<td>ATu4M.2. High Power Laser-Sustained Plasma Lightsources for KLA-Tencor Broadband Inspection Tools I. Bezel; G. Delgado; M. Derstine; K. Gross; R. Solarz; A. Shchemelinin; D. Shortt</td>
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<td>5:00-5:15 PM</td>
<td>ATu4M.3. High-energy, 34 fs, fiber source via nonlinear compression in hypocycloid-core Kagome fiber A. Giree; F. Guichard; Y. Zaouter; M. Hanna; G. Machinet; B. Debord; F. Gérôme; P. Dupriez; C. Hoenninger; E. Mottay; F. Benabid; P. Georges</td>
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<td>5:15-5:30 PM</td>
<td>ATu4M.4. 1.75 kW CW Narrow Linewidth Yb-doped all-fiber Amplifiers for Beam Combining Application Y. Qi; M. Lei; C. Liu; B. He; J. Zhou</td>
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<td>5:30-6:00 PM</td>
<td>ATu4M.5. Status and Potential of Laser based EUV Sources A. Endo</td>
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4:00 PM-6:00 PM, Salon I-II (Marriott), STu4L. Higher-Order Modes & Mode Coupling in Fiber, S&I Oral, CLEO S&I 11: Fibers Photonic, Presider: Poul Kristensen, pkristensen@ofsoptics.com, OFS Fitel Denmark I/S

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<td>STu4L.1. Astrophotonics: The Future of Astronomical Instrumentation J. Bland-Hawthorn</td>
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<td>4:30-4:45 PM</td>
<td>STu4L.2. Input and Output Coupling in Higher Order Mode Fibers J. Demas; L. Rishoej; S. Ramachandran</td>
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<td>STu4L.3. Large Mode Area Guidance in a Simple Fiber Structure L. Rishoej; M. Jones; J. Demas; G. Prabhakar; L. Yan; T.W. Hawkins; J. Ballato; S. Ramachandran</td>
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<td>5:00-5:15 PM</td>
<td>STu4L.4. High Energy Pulse Amplification in a Higher-Order Mode Fiber Amplifier with Axicon for Output Mode Conversion J.W. Nicholson; J.M. Fini; A. DeSantolo; P.S. Westbrook; R. Windeler; T. Kremp; C. Headley; D. DiGiovanni</td>
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<td>5:15-5:30 PM</td>
<td>STu4L.5. Microstructured suspended core fiber for cylindrical vector beams propagation H. Ji; Y. Ruan; H. Ebendorff-Heidepriem; W. Zhang; S. Afshar; T. Monro</td>
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<td>STu4L.6. Fano Resonance in Inhibited Coupling Kagome Fiber A. Amsanpally; B. Debord; M. Alharbi; E. Ilinova; L. Vincetti; F. Gérôme; F. Benabid</td>
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<td>5:45-6:00 PM</td>
<td>STu4L.7. Triple-cup Hypocycloid-Core Inhibited-Coupling Kagome Hollow-Core Photonic Crystal Fiber L. Vincetti; B. Debord; M. Alharbi; F. Gérôme; F. Benabid</td>
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4:00 PM-6:00 PM, Salon IV (Marriott), STu4N. Ultrafast Imaging and Spectroscopy, S&I Oral, CLEO S&I 8: Ultrafast Optics, Optoelectronics & Applications, Presider: Cristian Manzoni, cristian.manzoni@polimi.it, IFN-CNR
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<td>4:00-4:15 PM</td>
<td>STu4N.1</td>
<td>Motion Picture Femtophotography with Sequentially Timed All-optical Mapping Photography</td>
<td>K. Nakagawa; A. Iwasaki; Y. Oishi; R. Horisaki; A. Tsukamoto; A. Nakamura; K. Hirosawa; H. Liao; T. Ushida; K. Goda; F. Kannari; I. Sakuma</td>
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<td>4:15-4:30 PM</td>
<td>STu4N.2</td>
<td>Ultrafast Imaging using Simultaneous Spatially and Temporally Resolved Wavelength-Multiplexed Photography (SSTWP)</td>
<td>T. Suzuki; F. Isa; L. Fujii; K. Hirosawa; F. Kannari</td>
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<td>STu4N.3</td>
<td>Imaging through permuted optical probes</td>
<td>B. Heshmat; I. Lee; H. Bedri; R. Raskar</td>
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<td>STu4N.4</td>
<td>Coherent Diffraction Imaging with Absorption Contrast using Broadband Tabletop Soft X-ray Sources</td>
<td>G. Cadenazzi; B.K. McFarland; N.r. Weisse-Bernstein; M.C. Tyson; G. Rodriguez; R.L. Sandberg</td>
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<td>STu4N.5</td>
<td>Probing Ultrafast Magnetization Dynamics using Bright Circularly Polarized High Harmonics</td>
<td>D. Zusin; R. Knut; P. Grychtol; O. Kfir; C. Gentry; H. Nembach; J. Shaw; T. Silva; A. Fleischer; O. Cohen; H.C. Kapteyn; M.M. Murnane</td>
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<td>5:15-5:30 PM</td>
<td>STu4N.6</td>
<td>Attenuated total reflectance infrared spectroscopy with chirped-pulse upconversion</td>
<td>T. Fuji; H. Shirai; C. Duchesne; Y. Furutani</td>
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<td>5:30-5:45 PM</td>
<td>STu4N.7</td>
<td>Real-Time Averaging of Repetitive Optical Waveforms by Non-Integer Factors based on Temporal Self-Imaging</td>
<td>L. Romero Cortés; R. Maram Qartavol; J. Azaña</td>
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<td>5:45-6:00 PM</td>
<td>STu4N.8</td>
<td>Extreme localization of light with femtosecond subwavelength rogue waves</td>
<td>C. Liu; v. Ruben; N. Rotenberg; K. Kuipers; T. Krauss; A. Di Falco; A. Fratalocchi</td>
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<td>4:00 PM-6:00 PM, Salon V &amp; VI (Marriott), STu4O.  OPCPA Systems &amp; Pump Lasers, S&amp;I Oral, CLEO S&amp;I 2: Advanced Science and Technology for Laser Systems and Facilities, Presider: Constantin Haefner, <a href="mailto:haefner2@llnl.gov">haefner2@llnl.gov</a>, Lawrence Livermore National Laboratory</td>
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<td>4:00-4:30 PM</td>
<td>STu4O.1</td>
<td>Scaling High Peak Powers to High Average Powers – Opportunities in Innovation and Technology</td>
<td>J.L. Collier</td>
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<td>4:30-5:00 PM</td>
<td>STu4O.2</td>
<td>220mJ Ultrafast Thin-Disk Regenerative Amplifier</td>
<td>S. Klingebiel; M. Schultz; C. Teisset; R. Bessing; M. Haefner; S. Prinz; M. Gorjan; D.H. Sutter; K. Michel; H.G. Barros; z. Major; F. Krausz; T. Metzger</td>
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<td>5:00-5:15 PM</td>
<td>STu4O.3</td>
<td>Picosecond, 115 mJ Energy, 200 Hz Repetition Rate Cryogenic Yb:YAG Bulk-amplifier</td>
<td>M. Hemmer; F. Reichert; K. Zapata; M. Smrz; A. Calendron; H. Cankaya; K. Hong; F. Kaernter; L.E. Zapata</td>
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| 5:15-5:30 PM     | **STu4O.4.** 100 mJ thin disk regenerative amplifier at 1 kHz as a pump for picosecond OPCPA
                      J. Novák; P. Bakule; J.T. Green; Z. Hubka; B. Rus |
| 5:30-5:45 PM     | **STu4O.5.** 145 W, 3 kHz Picosecond Amplifier for OPCPA Pumping
                      M. Bodnar; B. Webb; M. Chini; L. Shah; M. Richardson |
| 5:45-6:00 PM     | **STu4O.6.** High Contrast Broadband Seeder for Multi-PW Laser System
                      O. Chalus; A. Pellegrina; O. Casagrande; C. Derycke; L. Boudjemaa; C. Simon-Boisson; S. Laux; F. Lureau; D. Sanchez; J. Biegert; J. Ahrens; T. Binhammer; O. Prochnow; S. Rausch |

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| 6:00 PM-8:00 PM  | **JTu5A.** Enhanced optical limiting effects in multiphoton absorbers
                      using cylindrical vector beams
                      G. Bing; J. Wu; N. Sheng; D. Liu; Y. Cui |
| 6:00 PM-8:00 PM  | **JTu5A.2.** Multi-nonlinear Effects in a Two-crystal Optical Parametric
                      Oscillator
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| 6:00 PM-8:00 PM  | **JTu5A.5.** Femtosecond dynamics of a spaser and unidirectional
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                      A. Rogov; E. Narimanov |
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<td>6:00 PM-8:00 PM</td>
<td>JTu5A.106. Miniaturization Resonators in Mimicking Electromagnetically Induced Transparency D. Meng</td>
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<tr>
<td>6:00 PM-8:00 PM</td>
<td>JTu5A.107. Negative-index Polarization-independent Metamaterial M. Karami; C. Rosenbury; S. Kitchin; M.A. Fiddy</td>
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<tr>
<td>6:00 PM-8:00 PM</td>
<td>Exhibit Hall (Poster Session Area) (Convention Center), CLEO 2015: Conference Reception, Exhibit Hall Event</td>
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Wednesday, May 13, 2015

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<tr>
<th>Time</th>
<th>Session or Event Info</th>
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<tbody>
<tr>
<td>8:00 AM-10:00 AM</td>
<td>FW1A. Symposium - Cavity Quantum Electrodynamics I, Special Symposium, Symposium - Cavity Quantum Electrodynamics, Presider: Glenn Solomon, <a href="mailto:glenn.solomon@nist.gov">glenn.solomon@nist.gov</a>, Joint Quantum Institute</td>
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<tr>
<td>8:00-8:30 AM</td>
<td>FW1A.1. Quantum State Control with Atoms and Cavities J. Raimond; T. Rybarczyk; B. Peaudecerf; M. Penasa; S. Gerlich; S. Gleyzes; M. Brune; S. Haroche; I. Dotsenko</td>
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<tr>
<td>8:30-8:45 AM</td>
<td>FW1A.2. Cavity-Modified Collective Rayleigh Scattering of Exactly Two Atoms R. Reimann; W. Alt; T. Kampshulte; T. Macha; L. Ratschbacher; N. Thau; S. Yoon; D. Meschede</td>
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<td>FW1A.4</td>
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<td>9:30-10:00 AM</td>
<td>FW1A.5</td>
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<td>8:00 AM-10:00 AM, Executive Ballroom 210B (Convention Center), FW1B. Novel Sources for Attoscience, FS Oral, QELS 7: High-Field Physics and Attoscience, Presider: Oliver Muecke, <a href="mailto:oliver.muecke@cfel.de">oliver.muecke@cfel.de</a>, Deutsches Elektronen Synchrotron</td>
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<td>8:00-8:30 AM</td>
<td>FW1B.1</td>
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<td>9:45-10:00 AM</td>
<td>FW1B.7</td>
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<tr>
<td>8:00 AM-10:00 AM, Executive Ballroom 210C (Convention Center), FW1C. Optics of Complex Media I, FS Oral, QELS 3: Metamaterials and Complex Media, Presider: Alexey Yamilov, <a href="mailto:yamilov@mst.edu">yamilov@mst.edu</a>, Missouri Univ of Science &amp; Technology</td>
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<td>8:00-8:15 AM</td>
<td>FW1C.1</td>
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<td>8:15-8:30 AM</td>
<td>FW1C.2</td>
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<td>8:30-8:45 AM</td>
<td>FW1C.3</td>
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| 8:45-9:00 AM | **FW1C.4. Localization of Light at Vanishingly Small Disorder-Levels with Heavy Photons**
A. Baron; R. Faggiani; X. Zang; L. Lalouat; S. Schulz; K. Vynck; B. O'Regan; B. Cluzel; F. de Fornel; T. Krauss; P. Lalanne |
| 9:00-9:30 AM | **FW1C.5. Coherent Perfect Absorbers and Coherent Enhancement of Absorption**
A. Stone; H. Cao; Y. Chong; L. Ge; S. Popoff; A. Goetschy |
| 9:30-9:45 AM | **FW1C.6. Efficient Thermal-Light and Light-Thermal Conversion by a Selective Emitter/Absorber**
J. Zhou; X. Chen; L. Guo |
| 9:45-10:00 AM| **FW1C.7. Microcavity Laser Linewidth Theory**
A. Pick; A. Cerjan; D. Liu; A. Rodriguez; Y. Chong; A. Stone; S. Johnson |

8:00 AM-10:00 AM, Executive Ballroom 210D (Convention Center), **FW1D. Integrated Nonlinear Devices**, FS Oral, **QELS 5: Nonlinear Optics and Novel Phenomena**, Presider: Luca Razzari, razzari@emt.inrs.ca, INRS-Energie Materiaux et Telecom

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| 8:00-8:30 AM | **FW1D.1. Integrated Lithium Niobate Nonlinear Optical Devices**
C. Wang; M.J. Burek; z. lin; H.A. Atikian; V. Venkataraman; I. Huang; P. Stark; M. Loncar |
| 8:30-8:45 AM | **FW1D.2. A Nonlinear Polymer Waveguide Implemented Using an Augmented Low Index Guide**
M.Z. ALAM; X. Sun; M. Mojahedi; J. Aitchison |
| 8:45-9:00 AM | **FW1D.3. Pump-Degenerate Phase-Sensitive Amplification in Amorphous Si Waveguides**
H. Sun; K. Wang; A.C. Foster |
| 9:00-9:15 AM | **FW1D.4. Nonlinear Silicon Photonics and the Moment Method**
S. Lefrancois; C.A. Husko; A. Blanco-Redondo; B.J. Eggleton |
| 9:15-9:30 AM | **FW1D.5. Low Power All-Optical Switching in a Gallium Arsenide Photonic Molecule**
R. Bose; J. Pelc; C. Santori; R. Beausoleil |
| 9:30-9:45 AM | **FW1D.6. Single Mode Broad Area PT-Symmetric Microring Lasers**
W. Hayenga; M. Miri; H. Hodaie; A. Ulhassan; M. Heinrich; D.N. Christodoulides; M. Khajavikhan |
| 9:45-10:00 AM| **FW1D.7. Spontaneous mirror-symmetry breaking in two coupled nanolasers**
P. Hamel; S. Haddadi; f. raineri; P. Monnier; g. beaudoin; I. Sagnes; A. Levenson; A.M. Giacomotti |

8:00 AM-10:00 AM, Executive Ballroom 210E (Convention Center), **FW1E. Quantum Emission and Plasmonics**, FS Oral, **QELS 6: Nano-Optics and Plasmonics**

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| 8:00-8:15 AM | **FW1E.1. Propagation of quantum signal in plasmonic waveguides**
X. Ren; Y. Cai; M. Li; C. Zou; X. Xiong; H. Lei; B. Liu; G. Guo; G. Guo |
| 8:15-8:30 AM | **FW1E.2. Plasmonic Nanopatch Antennas for Large Purcell Enhancement**
G.M. Akselrod; C. Argyropoulos; T. Hoang; C. Ciraci; C. Fang; J. Huang; D.R. Smith; M. Mikkelsen |
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<tr>
<td>8:30-8:45 AM</td>
<td>FW1E.3</td>
<td>Enhanced Single Photon Emission from Quantum Dots Coupled to Localized Surface Plasmons</td>
<td>B. Demory; T. Hill; c. teng; L. Zhang; H. Deng; P. Ku</td>
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<td>8:45-9:00 AM</td>
<td>FW1E.4</td>
<td>Plasmonic Giant Semiconductor Nanocrystals with Enhanced Light Output and Suppressed Blinking for Biomedical Applications</td>
<td>s. sampat; N. karan; A. Keller; A. Piryatinski; O. Roslyak; C. Hanson; Y. Ghosh; h. htoon; j. hollingsworth; a. malko</td>
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<tr>
<td>9:00-9:15 AM</td>
<td>FW1E.5</td>
<td>Quantum Model of Plasmon-Quantum Emitter Interaction in the Strong-Coupling Regime</td>
<td>R. Davidson; P. Lougovski; B. Lawrie</td>
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<td>9:15-9:30 AM</td>
<td>FW1E.6</td>
<td>Efficient Fiber Collection of Nitrogen-Vacancy Center Emission from Diamond Nano Beams</td>
<td>H. Jayakumar; B. Khanalloo; P.E. Barclay</td>
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<td>9:30-9:45 AM</td>
<td>FW1E.7</td>
<td>Carrier Multiplication in a Single Semiconductor Nanocrystal</td>
<td>F. Hu; B. Lv; C. Zhang; X. Wang; M. Xiao</td>
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<td>9:45-10:00 AM</td>
<td>FW1E.8</td>
<td>Spin Control in Charged Quantum Dots by Twisted Light</td>
<td>G. Quinteiro; T. Kuhn</td>
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<tr>
<td>8:00 AM-10:00 AM, Executive Ballroom 210F (Convention Center), SW1F. Surface Emitting Semiconductors Lasers, S&amp;I Oral, CLEO S&amp;I 3: Semiconductor Lasers, Presider: Weidong Zhou, <a href="mailto:wzhou@uta.edu">wzhou@uta.edu</a>, University of Texas at Arlington</td>
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<td>8:00-8:15 AM</td>
<td>SW1F.1</td>
<td>Position-modulated Photonic-crystal Lasers and Control of Beam Direction and Polarization</td>
<td>T. Okino; K. Kitamura; D. Yasuda; Y. Liang; S. Noda</td>
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<tr>
<td>8:15-8:30 AM</td>
<td>SW1F.2</td>
<td>Compact Vortex Beam Emitter Laterally Integrated with VCSEL Array</td>
<td>K. Tanabe; X. GU; A. Matsutani; F. Koyama</td>
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<td>8:30-8:45 AM</td>
<td>SW1F.3</td>
<td>Resonance Tuning and Coherent Operation in Anti-Guided Vertical-Cavity Laser Arrays</td>
<td>S. Fryslie; M.P. Tan; M. Johnson; K.D. Choquette</td>
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<td>8:45-9:00 AM</td>
<td>SW1F.4</td>
<td>Effect of In-plane Mirror Dispersion on Vertical Cavities Based on High-Contrast Grating Mirrors</td>
<td>A. Taghizadeh; J. Mork; I. Chung</td>
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<td>9:00-9:15 AM</td>
<td>SW1F.5</td>
<td>Smooth lasing transition in high β buried multiple-quantum-well 2D photonic crystal lasers</td>
<td>M. Takiguchi; H. Taniyama; H. Sumikura; D.M. Birowosuto; E. . Kuramochi; A. Shinya; T. Sato; K.T. Takeda; S. Matsuo; M. Notomi</td>
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<td>9:15-9:30 AM</td>
<td>SW1F.6</td>
<td>Broadband Self-Swept High Contrast Grating VCSEL</td>
<td>S. Gerke; W. Yang; K. Ng; C. Chase; Y. Rao; C.J. Chang-Hansnain</td>
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<tr>
<td>9:30-9:45 AM</td>
<td>SW1F.7</td>
<td>Printed Photonic Crystal Bandedge Surface-emitting Lasers on Silicon</td>
<td>S. Liu; D. Zhao; H. Yang; Z. Ma; C. Reuterskiöld-Hedlund; M. Hammar; W. Zhou</td>
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<td>9:45-10:00 AM</td>
<td>SW1F.8. Electrically Tunable Organic Vertical Cavity Surface Emitting Laser W. Chang; A. Murarka; A. Wang; V. Bulovic; J.H. Lang</td>
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<td>8:00 AM-10:00 AM, Executive Ballroom 210G (Convention Center), SW1G. Optical Frequency Comb Spectroscopy, S&amp;I Oral, CLEO S&amp;I 13: Active Optical Sensing. Presider: Mark Phillips, <a href="mailto:mark.phillips@pnln.gov">mark.phillips@pnln.gov</a>, Pacific Northwest National Laboratory</td>
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<td>8:00-8:15 AM</td>
<td>SW1G.1. Mid-Infrared frequency comb for rapid detection of CH₄ and H₂O in open air L. Nugent-Glandorf; F.R. Giorgetta; S.A. Diddams</td>
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<td>8:15-8:30 AM</td>
<td>SW1G.2. Dual-Frequency Comb Measurements of Atmospheric Absorption: Comparison with HITRAN Database Parameters G.B. Rieker; F.R. Giorgetta; W.C. Swann; L.C. Sinclair; C.L. Cromer; E. Baumann; I.R. Coddington; N.R. Newbury</td>
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<td>8:30-8:45 AM</td>
<td>SW1G.3. Dual-Comb Spectroscopy based on Quantum Cascade Laser Frequency Combs G. Villares; F. Cappelli; A. Hugi; S. Blaser; J. Faist</td>
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<td>8:45-9:00 AM</td>
<td>SW1G.4. Noise properties in multi-heterodyne spectrometers based on quantum- and interband-cascade lasers A. Hangauer; J. Westberg; M. Soskind; E.J. Zhang; G. Wysocki</td>
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<td>9:00-9:15 AM</td>
<td>SW1G.5. Multiheterodyne Spectroscopy with Electro-Optic Frequency Combs D. Long; A.J. Fleisher; J.T. Hodges; D.F. Plusquellic</td>
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<td>9:30-9:45 AM</td>
<td>SW1G.7. Optical Frequency Combs of Multi-GHz Line-spacing for Real-time Multi-heterodyne Spectroscopy A. Ishizawa; T. Nishikawa; M. Yan; G. Millot; H. Gotoh; T. Hänsch; N. Picqué</td>
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<td>9:45-10:00 AM</td>
<td>SW1G.8. Mid-Infrared Optical Frequency Combs based on Difference Frequency Generation for Dual-Comb Spectroscopy F.C. Cruz; D.L. Maser; T. Johnson; G. Ycas; A. Klose; L.C. Sinclair; I. Coddington; N.R. Newbury; S. Diddams</td>
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<td>8:00 AM-10:00 AM, Executive Ballroom 210H (Convention Center), SW1H. Ultrashort Pulse Characterization, S&amp;I Oral, CLEO S&amp;I 8: Ultrafast Optics, Optoelectronics &amp; Applications. Presider: Takao Fuji, <a href="mailto:fuji@ims.ac.jp">fuji@ims.ac.jp</a>, National Institutes of Natural Sciences</td>
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<td>8:00-8:30 AM</td>
<td>SW1H.1. Solid State Light Field Sampling and Light Phase Detection T. Paasch-Colberg</td>
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<td>8:30-8:45 AM</td>
<td>SW1H.2. Electro-optic Sampling of Mid-to-Near-Infrared Waveforms S. Keiber; S. Sederberg; A. Schwarz; O. Razskazovskaya; M.K. Trubetskoy; V. Pervak; F. Krausz; N.E. Karpowicz</td>
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<td>8:45-9:00 AM</td>
<td>SW1H.3. Cross-Correlation Frequency-Resolved Optical Gating for Characterization of A Train of Monocyte Optical Pulses Y. Nakano; Y. Kida; K. Motoyoshi; T. Imasaka</td>
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<td>9:00-9:15 AM</td>
<td>SW1H.4. A Spectrally Resolved Lateral-Shearing Interferometer for Measurement of Relative Group Delay Using a Periodic Entrance Slit in a Spectrometer</td>
<td>S. Bahk; C. Dorrer; R. Roides; J. Bromage</td>
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<td>9:15-9:30 AM</td>
<td>SW1H.5. Pulse Characterization in Ultrafast Microscopy: a Comparison of FROG, MIIPS and G-MIIPS</td>
<td>A. Comin; M. Rhodes; R. Ciesielski; R. Trebino; A. Hartschuh</td>
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<td>9:30-9:45 AM</td>
<td>SW1H.6. Ultrafast Graphene Photodetector for On-chip Broadband Auto-correlator</td>
<td>R. Shiue; Y. Gao; J. Hone; D. Englund</td>
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<td>9:45-10:00 AM</td>
<td>SW1H.7. Quantitative Characterization of Polarization States of Axisymmetrically Polarized Pulses Generated by Coherent Beam Combining</td>
<td>M. Suzuki; K. Yamane; K. Oka; Y. Toda; R. Morita</td>
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<td>8:00 AM-10:00 AM</td>
<td>SW1. Micro &amp; Nanophotonics, S&amp;I Oral, CLEO S&amp;I 7: Micro- and Nano-Photonic Devices</td>
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<td>8:00-8:30 AM</td>
<td>SW1.1. Integrated Photonic Devices with Single Quantum Dots</td>
<td>A. Fox; E. Clarke; R. Coles; J. Dixon; I.J. Luxmoore; M. Hugues; M. Makhonin; J. O'Hara; N. Prtljaga; A. Ramsay; B. Royall; N. Wasley; M.S. Skolnick</td>
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<td>8:30-8:45 AM</td>
<td>SW1.2. Observation of Einstein's Rings and Optical Gravitational Collimation</td>
<td>C. Sheng; R. Bekenstein; H. Liu; S. Zhu; M. Segev</td>
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<td>8:45-9:00 AM</td>
<td>SW1.3. Theory and Practice of Resonant Antireflection</td>
<td>K. Wang; S. Fan</td>
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<td>SW1.4. Silicon Super-Resolution in the Visible</td>
<td>A. David; B. Gjonaj; G. Bartal</td>
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<td>9:15-9:30 AM</td>
<td>SW1.5. Design Rule of 2D High Contrast Gratings and Engineering of Orbital Angular Momentum of Light</td>
<td>P. Qiao; L. Zhu; C.J. Chang-Hansnain</td>
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<td>9:30-9:45 AM</td>
<td>SW1.6. Cloaking of Metal Contacts on Solar Cells</td>
<td>M.F. Schumann; S. Wiesendanger; J. Goldschmidt; K. Bittkau; U.W. Paetzold; A. Sprafke; R.B. Wehrspohn; C. Rockstuhl; M. Wegener</td>
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<td>9:45-10:00 AM</td>
<td>SW1.7. Photovoltaic performance improvement of Si HIT Solar Cell by Incorporating Flower-Like light trapping Structures</td>
<td>S. Tsai; M. Lee; V. Su; S. Lin; C. Hsu; Y. You; P. Chen; Y. Chen; Z. Hung; C. Kuan</td>
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<td>8:00 AM-10:00 AM</td>
<td>AW1J. Biomedical Imaging and Sensing I, A&amp;T Oral, CLEO A&amp;T 1: Biomedical Applications, Presider: Xuan Liu, <a href="mailto:xliu@njit.edu">xliu@njit.edu</a>, New Jersey Institute of Technology</td>
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<td>AW1J.1. Multipurpose Information Encoding using interleaved Optical Coherence Tomography</td>
<td>A. Ellerbee</td>
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<td>8:30-9:00 AM</td>
<td>AW1J.2. Quantitative Imaging of Tissue Polarization Property by Jones Matrix Optical Coherence Tomography</td>
<td>Y. Yasuno</td>
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<td>9:00-9:30 AM</td>
<td>AW1J.3. The Ultimate Road to Real Time 3D Optical Coherence Imaging  T. Huo; X. Zhang; C. Wang; T. Chen; W. Liao; W. Zhang; S. Ai; J. Hsieh; P. Xue</td>
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<td>9:30-9:45 AM</td>
<td>AW1J.4. Differential Mueller-matrix formalism for polarization sensitive optical coherence tomography  M. Villiger; N. Lippok; B. Bouma</td>
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<td>9:45-10:00 AM</td>
<td>AW1J.5. Effects of Wavelength and Side Lobes on Airy Beam for Optical Coherence Tomography  M. Zhang; P. Yu; Z. Ren</td>
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8:00 AM-10:00 AM, Meeting Room 212 B/D (Convention Center), **SW1K. Laser-Induced Structuring in Bulk Material, S&I Oral, CLEO S&I 1: Light-Matter Interactions and Materials Processing**, Presider: Richard Haglund, richard.haglund@vanderbilt.edu, Vanderbilt University

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<td>8:00-8:15 AM</td>
<td>SW1K.1. Fabrication of complex three-dimensional metallic microstructures based on femtosecond laser micromachining  F. Chen; Q. Yang; C. Shan</td>
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<td>8:15-8:30 AM</td>
<td>SW1K.2. Fs-laser Induced Optical Changes in Zinc Aluminum Phosphate Glasses  J. Hernandez Rueda; C. Smith; R. Brow; D. Krol</td>
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<td>8:30-9:00 AM</td>
<td>SW1K.3. Optical Aspect of Ultrafast Laser Ablation on Transparent Dielectrics: Ciliary White Light  Y. Liu; Y. Brelet; Z. He; L. Yu; Y. Zhong; Z. Zeng; R. Li; A. Houard; A. Couairon; A. Mysyrowicz</td>
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<td>9:00-9:15 AM</td>
<td>SW1K.4. Formation of nanogratings in porous glass initiated by excitation of plasma waves at interfaces  Y. Liao; J. Ni; L. Qiao; M. Huang; Y. Cheng</td>
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<td>9:15-9:30 AM</td>
<td>SW1K.5. Board-Level Optical Interconnect Using Glass s. huang; Chen; M. Li</td>
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<td>9:30-9:45 AM</td>
<td>SW1K.6. Direct Laser Writing of 3D Gratings and Diffraction Optics  M. Moebius; K. Vora; S. Kang; P. Muñoz; G. Deng; E. Mazur</td>
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<td>9:45-10:00 AM</td>
<td>SW1K.7. Harnessing Polarization Spatio-Temporal Coupling: A New Degree of Freedom in Ultrafast Laser Material Processing  A. Patel; M. Beresna; P. Kazansky</td>
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8:00 AM-10:00 AM, Salon III (Marriott), **SW1M. Coherent Communications, S&I Oral, CLEO S&I 12: Lightwave Communications and Optical Networks**, Presider: Takashi Sugihara, Sugihara.Takashi@ak.MitsubishiElectric.co.jp, Mitsubishi Electric Corporation

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<td>SW1M.1. Phase Diversity Method for Optical Coherent Receiver  T.M. Hoang; M. Osman; M. Chagnon; Q. Zhuge; D. Patel; D. Plant</td>
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<td>SW1M.2. Multi-Gigabit Coherent Communications Using Low-Rate FEC to Approach the Shannon Capacity Limit  D.J. Geisler; V. Chandar; T.M. Yarnall; M.L. Stevens; S.A. Hamilton</td>
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8:00 AM-10:00 AM, Salon I-II (Marriott), SW1L. Mid-IR & Supercontinuum Fiber Sources, S&I Oral, CLEO S&I 11: Fibers Photonic, Presider: Fetah Benabid, f.benabid@xlim.fr, Xlim Research Institute
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<td><strong>SW1N. Applications of Optical Resonators</strong>, S&amp;I Oral, CLEO S&amp;I 9: Components, Integration, Interconnects and Signal Processing, Presider: Lin Zhu, <a href="mailto:zhu3@clemson.edu">zhu3@clemson.edu</a>, Clemson University</td>
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<td>B. Song; L. Zhuang; C. Zhu; B. Corcoran; A. Lowery</td>
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<td>JW2A.33. Optimized scalable circular grating with efficient photon extraction for Nitrogen Vacancy centers in a bulk diamond</td>
<td>J. Zheng; E. Chen; L. Li; F. Dolde; D. Englund</td>
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<td>JW2A.34. Laser and Optical Subsystem for NASA's Cold Atom Laboratory</td>
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<td>JW2A.35. A New Algorithm for Attosecond Pulse Characterization</td>
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<td>JW2A.36. Versatile Simulation Package for Ultrafast Pulse Propagation and High Harmonic Generation</td>
<td>G.J. Stein; C. Lai; P.D. Keathley; P.R. Krogen; H. Liang; C.L. Chang; K. Hong; G. Laurent; F.X. KAERTNER</td>
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<td>JW2A.37. Towards Observing Dynamical Localization within the Quantum Linear Rotor</td>
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<td>JW2A.38. Ultrafast Rotational Spectroscopy Based on a Free-space Nitrogen Ion Laser</td>
<td>H. Xie; B. Zeng; H. Zhang; G. Li; W. Chu; J. Yao; C. Jing; J. Ni; Y. Cheng</td>
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<td>JW2A.39. Highly Efficient High–order Harmonics with Large Cutoff from Carbon Molecules using Various Laser Wavelengths</td>
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<td>K. Serratto; F. Aymond; B. Simon; A.C. Bernstein; T. Ditmire</td>
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<td>JW2A.42. Density-chopped Far-infrared Transmission Spectroscopy to Probe Subband-Landau Splittings and Tune Intersubband Transitions</td>
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<td>JW2A.44. Control of Energy Relaxation Pathways in Graphene: Carrier-Carrier Scattering vs Phonon Emission</td>
<td>Z. Mics; S. Jensen; I. Ivanov; S. Varol; D. Turchinovich; F. Koppens; M. Bonn; K. Tielrooij</td>
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<td>JW2A.48. Exciton States in InGaN Nano-disks in GaN Nanowires Revealed Using Nonlinear Laser Spectroscopy</td>
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<td>J. Schulte; S. Carbajo; K. Ravi; D.N. Schimpf; F. Kaernter</td>
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<td>JW2A.67. Improved Multiple Pulse Reconstruction from SHG FROG Spectrograms</td>
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<td>JW2A.68. Twisted-Nematic Liquid Crystal Polarization Rotators for Broadband Laser Applications</td>
<td>P. Fiala; C. Dorrer; K. Marshall</td>
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<td>JW2A.69. Incoherent-light implementation of the photonic time stretch concept</td>
<td>B. Li; S. Lou; J. Azaña</td>
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<td>JW2A.70. Nonstoichiometric Si₁₋ₓGeₓ Based Tunable Saturable Absorber for Mode-Locked Erbium-doped Fiber Laser</td>
<td>C. Yang; Y. Lin; G. Lin</td>
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<td>JW2A.71. 16 W All-Normal-Dispersion Mode-Locked Yb-Doped Fiber Laser With Large Core Diameter</td>
<td>Z. Lv; H. Teng; L. Wang; Z. Wei</td>
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<td>JW2A.73. Single-Shot Measurement of High-Harmonic Generation Intensity Waveforms by Spatially Encoded Transmission Switching</td>
<td>H. Chu; C. Yang; L. Liu; J. Wang</td>
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<td>JW2A.74. Passively Mode-locked Fiber Laser based on CVD WS₂ R. Khazaeinezhad; S. Hosseinzadeh Kassani; H. Jeong; D. Yeom; K. Oh</td>
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<td>JW2A.75. Real-time and Ultrafast Phase Retrieval in Optical Time-stretch Using a Modified Gerchberg-Saxton Algorithm</td>
<td>Y. Xu; Z. Ren; K. Wong; K.K. Tsia</td>
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<td>JW2A.76. $\chi^{(2)}$-Lens Mode-Locking of a Nd:YVO$_4$ Laser with High Average Power and Repetition Rate up to 600 MHz</td>
<td>V.S. Aleksandrov; H. Iliev; I. Buchvarov</td>
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<td>JW2A.77. Deviations from Theory by Femtosecond Lasers due to Noise</td>
<td>G. Rasskazov; V. Lozovoy; M. Dantus</td>
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<td>JW2A.78. Vertically Stacked AllPolymer WhisperingGallery Mode Lasers for Biosensing Applications</td>
<td>S. Wondimu; T. Siegle; U. Bog; S. Kraemmer; H. Kalt; T. Mappes; S. Koeber; T. Wienhold; C. Koos</td>
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<td>JW2A.79. Fiber Optical Tweezers for Simultaneous Force Exertion and Measurements in a 3D Hydrogel Compartment</td>
<td>C. Ti; G.M. Thomas; Q. Wen; Y. Liu</td>
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<td>JW2A.80. Implementation of optical multiplicative spike-timing-dependent plasticity with adaptive current feedback of semiconductor optical amplifiers</td>
<td>Y. Zhang; Q. Ren; J. Zhao</td>
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<td>JW2A.81. Resonantly-Enhanced Sensing Using Surface Plasmon Polaritons in a Sagnac Interferometer</td>
<td>B. Hake; H. Grotewohl; M. Deutsch</td>
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<td>JW2A.82. 60-MHz wavelength-encoded tomography (WET)</td>
<td>B. Li; C. Zhang; S. Tan; X. Wei; Y. Xu; K.K. Tsia; K. Wong</td>
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<td>JW2A.83. Manipulation of Nanoparticles using Quadrangular Microlens</td>
<td>Y. Shi; L. Chin; J. Wu; T. Chen; A. LIU</td>
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<td>JW2A.84. Hologram Acquisition by Using Time Resolved Heterodyne Method in Optical Scanning Holography</td>
<td>M. Lee; G. Min; N. Kim; B. Lee</td>
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<td>JW2A.85. Hybrid Mid-IR OCT System for Imaging and Spectroscopy Using New High Power Low-Coherence Quantum Cascade Superluminescent Emitters</td>
<td>D. Varnell; M. Zheng; N.L. Aung; A. Musse; S. Lee; C.F. Gmachl</td>
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<td>JW2A.86. Ellipsometry-based opto-fluidic platform for characterizing 10,000 biomolecular reactions on solid supports in real time and for identifying inhibitors against specific protein-receptor interactions</td>
<td>X. Zhu</td>
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<td>JW2A.87. Optical Measurement on Cell Membrane Roughness Influenced by Paclitaxel and Gold Nanoparticles</td>
<td>C. Lee; L. Jang; H. Pan</td>
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<td>JW2A.88. Improvement in In-Plane Localization Precision of Nanoparticles Using Interference Analysis</td>
<td>A. Meiri; C. Ebeling; J. Martineau; N. Zalevsky; J. Gerton; R. Menon</td>
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<td>JW2A.89. Optofluidic Detection for Virus Infection Monitoring using Effective Refractive Index</td>
<td>P. Liu; L. Chin; W. Ser; T. Ayi; E. Yap; T. Bourouina; Y. Leprince-Wang</td>
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<td>JW2A.90. Virtual Acousto-optic Beam Paths for Steerable Deep-tissue Optical Stimulation and Imaging</td>
<td>M. Chamanzar; M. Huh; N. DO; M. Alam; M. Maharbiz</td>
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<td>JW2A.91. Ce-doped Fibers with High Axial Resolution for Optical Coherence Tomography Applications</td>
<td>L. Chun-Nien; Y. Huang; P. Huang; S. Huang; W. Cheng</td>
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<td>JW2A.92. Noninvasive flow cytometry by heterodyne self-mixing interferometry.</td>
<td>o. HUGON; M. INGLEBERT; O. JACQUIN; H. Guillet de Chatellus; E. LACOT; C. MISBAH; B. VAN DER SANDE</td>
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<td>JW2A.93. All-Fiber Tunable Ring Laser Based on an Acousto-Optic Tunable Coupler</td>
<td>L. Huang; W. Zhang; D. Mao; F. Gao; W. Peng; F. Bo; G. Zhang; J. Xu</td>
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<td>JW2A.94. Supercontinuum Generated by Noise-like Pulses for Spectral-domain Optical Coherence Tomography</td>
<td>Y. You; C. Wang; P. Xue; A. Zaytsev; C. Pan</td>
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<td>JW2A.95. Annular Cladding Erbium-Doped Multi-Core Fiber for SDM Amplification</td>
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<td>JW2A.96. Transition Profile Control for Broadband Visible Supercontinuum Generation in Tapered PCF</td>
<td>T. Jiang; A. wang; F. Niu; W. Zhang; Y. Chang; Z. Zhang</td>
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<td>JW2A.97. Design of Supermode Fiber for Orbital Angular Momentum (OAM) Multiplexing</td>
<td>S. Li; J. Wang</td>
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<td>JW2A.98. Widely tunable Raman laser in a tellurite fiber ring cavity</td>
<td>D. Deng; L. Liu; T. Cheng; X. Xue; L. Zhang; M. Yamada; T. Suzuki; Y. Ohishi</td>
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<td>JW2A.99. Small signal gain for Nd/Cr:YAG ceramics at high temperature</td>
<td>Y. Honda; S. Motokoshi; T. Jitsuno; N. Miyanaga; K. Fujioka; M. Nakatsuka; M. Yoshida</td>
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<td>JW2A.100. Simulated Tempering Markov Chain Monte Carlo for Full Waveform Analysis</td>
<td>W. He; W. Yin; F. Shi; G. Gu; Q. Chen</td>
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<td>JW2A.101. The design and performance of SGII upgrade laser facility third harmonic frequency convertor</td>
<td>L. Ji</td>
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<td>JW2A.102. Hybrid White Light-emitting Diodes by Organic-Inorganic materials</td>
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<td>JW2A.103. Flat-Plate Photovoltaics with Solar-Tracking Origami Micro-Concentrator Arrays C. Chien; K. Lee; M. Shlian; S. Forrest; M. Shtein; P. Ku</td>
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<td>JW2A.104. Application of Fractional Fourier Transform for Interferometry M. Lu; F. Zhang; R. Tao; G. Ni; T. Bai</td>
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<td>FW3A. Symposium - Cavity Quantum Electrodynamics II, Special Symposium, Symposium - Cavity Quantum Electrodynamics, Presider: Pascale Senellart, <a href="mailto:pascale.senellart@lp.cnrs.fr">pascale.senellart@lp.cnrs.fr</a>, CNRS-Laboratoire de Photonique et Nanost</td>
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<td>FW3A.1. Cavity-QED with a Trapped Ion in an Optical Fiber Cavity M. Köhl</td>
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<td>FW3A.2. Fiber-Based Cavities for Ion-Trap Quantum Networks T. Northup; K. Schüppert; F. Ong; B. Casabone; K. Friebe; M. Lee; J. Reichel; R. Blatt</td>
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<td>FW3A.3. Nanophotonic Quantum Memory Based on Rare-Earth-Ions Coupled to an Optical Resonator T. Zhong; J. Kindem; E. Miyazono; A. Faraon</td>
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<td>FW3A.4. A Solid-State Spin-Photon Transistor S. Sun; H. Kim; G.S. Solomon; E. Waks</td>
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<td>FW3A.6. Exploring Cavity QED with Superconducting Circuits A. Wallraff</td>
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<td>FW3B. Novel Approach for Studying Condensed Matter, FS Oral, QELS 4: Optical Excitations and Ultrafast Phenomena in Condensed Matter, Presider: Robert Kaindl, <a href="mailto:Rakaindl@lbl.gov">Rakaindl@lbl.gov</a>, Lawrence Berkeley National Laboratory</td>
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<td>FW3B.1. Attosecond Sources for Time-Bandwidth Balanced Spectroscopy A. Simoncig; S. Schulz; I. Grguras; S. Bajt; A.L. Cavalieri</td>
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<td>FW3B.2. Experimental Distinction between Femtosecond Transient Demagnetization and Spin Current Dynamics in Metals Z. Jin; J. Arabski; G. Schmerber; E. Beaurepaire; M. Bonn; D. Tuchinovich</td>
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<td>FW3B.3. Ultrafast Pump-probe Spectroscopy in Gallium Arsenide at 25 Tesla J. Curtis; T. Tokumoto; N. Nolan; L. McClintock; J. Cherian; S. McGill; D.J. Hilton</td>
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<td>FW3B.4. Dynamical Driving and Probing of Quantum Phase Transitions on the Nanoscale S. Doenges; B.T. O’Callahan; J.M. Atkin; O. Khatib; M.B. Raschke</td>
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<td>Ultrafast Dynamics of the Skyrmion and Conical Phases in Cu$_2$OSeO$_3$</td>
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<td>Tailored Light-Matter Interaction through Epsilon-Near-Zero Modes</td>
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<td>Optics of Complex Media II, FS Oral, QELS 3: Metamaterials and Complex Media, Presider: Hui Cao, <a href="mailto:hui.cao@yale.edu">hui.cao@yale.edu</a>, Yale University</td>
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<td>Critical States Embedded in the Continuum</td>
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<td>FW3C.3</td>
<td>Quantitative test of the ab initio intrinsic laser linewidth theory</td>
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<td>FW3C.4</td>
<td>Opportunities for Imaging in Heavily Scattering Random Media with Spatial Intensity Correlations</td>
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<td>Optical Detection and Imaging in Complex Media: How the Memory Effect Can Help Overcome Multiple Scattering</td>
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<td>Correlation effects in Anderson localization and light transport in a 2D photonic disorder</td>
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<td>New Effects in Nanostructures and Semiconductors, FS Oral, QELS 5: Nonlinear Optics and Novel Phenomena, Presider: Dragomir Neshev, <a href="mailto:dnn124@physics.anu.edu.au">dnn124@physics.anu.edu.au</a>, Australian National University</td>
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<td>FW3D.2. Studying the Interplay of Electric and Magnetic Resonance-</td>
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<td>Enhanced Second Harmonic Generation: Theory and Experiments. R.</td>
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<td>Chandrasekar; N.K. Emani; A. Lagutchev; V.M. Shalaev; C. Ciraci;</td>
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<td>FW3D.3. Semiconductor-Superconductor Two-Photon Amplifier R. Marjieh;</td>
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<td>E. Sabag; A. Hayat</td>
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<td>Unstructured Solids A. Chakrabarty; A. Fisher; E.F. Dreyer; S.C. Rand</td>
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<td>Surface and Bulk Contributions C. Schmidt; S. Priyadarshi; M. Bieler</td>
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<td>FW3D.6. Analysis of soliton fission induced by free-carriers C.A. Husko;</td>
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<td>S. Lefrancois; M. Wulf; S. Combrie; A. De Rossi; L. Kuipers; B.J. Eggelet</td>
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<td>FW3D.7. Beam Deflection Measurements of Nondegenerate</td>
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<td>Nonlinear Refractive Indices in Direct-gap Semiconductors P. Zhao;</td>
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<td>M. Reichert; T. Ensley; D.J. Hagan; E.W. Van Stryland</td>
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1:00 PM-3:00 PM, Executive Ballroom 210E (Convention Center), FW3E. Active Plasmonics and Nanolasers, FS Oral, QELS 6: Nano-Optics and Plasmonics, Presider: Jie Yao, yaojie@berkeley.edu, Berkeley Univ.

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<td>FW3E.1. Quantum-Coherently Assisted Deep-UV Localization of Photonic States in Active Stopped-Light Plasmonic Heterostructures K. Tsakmakidis; P.K. Jha; Y. Wang; X. Zhang</td>
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<td>FW3E.2. Optical Switching of Mid-Infrared Plasmonic Nanoantennas Based on Germanium M. Fischer; C. Schmidt; J. Stock; E. Sakat; A. Samarelli; J. Frigerio; P. Biagioni; D.J. Paul; G. Isella; A. Leitenstorfer; D. Brida</td>
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<td>FW3E.3. Enhanced Near- and Far-Field Faraday Rotation with a Monolayer Array of Core-Shell Nanoparticles A. Davoyan; N. Engheta</td>
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<td>FW3E.4. Plasmon-mediated emission in the strong coupling regime T. Tumkur; G. Zhu; D. Courtwright; M.A. Noginov</td>
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<td>FW3E.5. Time-Domain Model of 4-Level Gain System Fitted to Nanohole Array Lasing Experiment J. Fang; J. Liu; Z. Wang; X. Meng; L. Prokopeva; V.M. Shalaev; A.V. Kildishev</td>
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<td>FW3E.6. Room Temperature Continuous Wave Blue Lasing in High Quality Factor III-Nitride Nanobeam Cavity on Silicon N. Vico Triviño; R. Butte; J. Carlin; N. Grandjean</td>
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<td>FW3E.7. Plasmonic Random Lasing in Strongly Scattering Regime with Slanted Silver Nanorod Array Z. Wang; X. Meng; S. Choi; Y. Kim; V.M. Shalaev; A. Boltasseva</td>
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**SW3G.4. Measuring Part-per-Billion Line Shifts and Frequencies with Direct-Frequency-Comb Vernier Spectroscopy**  
P. Cancio Pastor; M. Siciliani de Cumis; R. Eramo; P. De Natale; N. Coluccelli; M. Cassinerio; G. Galzerano; P. Laporta

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**SW3G.5. Dual-Comb Modelocked Lasers**  
S.M. Link; A. Klenner; M. Mangold; M. Golling; B.W. Tilma; U. Keller

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**SW3G.6. Discrete Fourier Transform Infrared Spectroscopy Using Precisely Periodic Pulse**  
Y. HSIEH; S. Okubo; H. Inaba; M. Hashimoto; T. Yasui

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**SW3G.7. A compact iodine-stabilized diode laser at 531 nm**  
T. Kobayashi; D. Akamatsu; K. Hosaka; H. Inaba; S. Okubo; T. Tanabe; M. Yasuda; A. Onae; F. Hong

1:00 PM-3:00 PM, Executive Ballroom 210H (Convention Center), **AW3H. A&T Topical Review - Advances in Molecular Imaging I**  
Presider: Melissa Skala, m.skala@vanderbilt.edu, Vanderbilt University

1:00-1:30 PM  
**AW3H.1. Label-Free Optical Molecular Imaging for Clinical Tissue Diagnostics**  
M. Mycek

1:30-2:00 PM  
**AW3H.2. Wide-Field Lifetime-Based Förster Resonance Energy Transfer in Live Animals**  
X. Intes

2:00-2:30 PM  
**AW3H.3. Molecular Imaging with Sum-frequency Generation Microscopy**  
Y. Han; j. hsu; N. Ge; E.O. Potma

2:30-3:00 PM  
**AW3H.4. Fluorescence lifetime imaging of cellular heterogeneity in cancer drug response**  
M. Skala

1:00 PM-3:00 PM, Meeting Room 211 B/D (Convention Center), **SW3I. Metamaterials & Metasurfaces**, S&I Oral, **CLEO S&I 7: Micro- and Nano-Photonic Devices**

1:00-2:00 PM  
**SW3I.1. Nanophotonics based on Metasurfaces**  
F. Capasso

2:00-2:15 PM  
**SW3I.2. Simultaneous and Complete Control of Light Polarization and Phase using High Contrast Transmitarrays**  
A. Arbabi; Y. Horie; M. Bagheri; A. Faraon

2:15-2:30 PM  
**SW3I.3. Liquid Crystal Tunable Plasmonic Color**  
D. Franklin; D. Chanda

2:30-3:00 PM  
**SW3I.4. Nanophotonic Metastructures: Functionality at the Extreme**  
N. Engheta

1:00 PM-3:00 PM, Meeting Room 212 A/C (Convention Center), **AW3J. Symposium - Photonics in Surgery I**, Special Symposium, **Symposium - Photonics in Surgery**, Presider: Nicusor Iftimia, iftimia@psicorp.com, Physical Sciences Inc.
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<td>AW3J.1. Molecular Guided Surgery - Quantitative Immunologic Guidance with Optical Imaging</td>
<td>B.W. Pogue</td>
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<td>1:30-2:00 PM</td>
<td>AW3J.2. Clinical Potential of Light-Activated Tissue Crosslinking</td>
<td>R. Redmond; I.E. Kochevar; M.C. McCormack; W.G. Austen</td>
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<td>2:00-2:30 PM</td>
<td>AW3J.3. Optical Surgical Navigation for Medulloblastoma</td>
<td>C. Contag</td>
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<td>2:30-3:00 PM</td>
<td>AW3J.4. Title to be Determined</td>
<td>V. Yang</td>
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<td>1:00 PM-3:00 PM</td>
<td>AW3K. Fluid Coupled Optomechanical Oscillators</td>
<td>H. Tang</td>
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<td>AW3K.1. Fluid Coupled Optomechanical Oscillators</td>
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<td>1:30-1:45 PM</td>
<td>AW3K.2. Surface Sensitive Microfluidic Optomechanical Ring Resonator Sensors</td>
<td>K. Kim; X. Fan</td>
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<td>AW3K.3. Single Molecule Detection with an Optomechanical Nanosensor</td>
<td>W. Yu; W. Jiang; Q. Lin; T. Lu</td>
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<td>AW3K.4. Real-time Size/Mass Spectrometry in Solution using Whispering Gallery Micro-Global Positioning</td>
<td>S. Arnold; D. Keng</td>
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<td>AW3K.5. Plasmon-Assisted Optoelectrofluidics</td>
<td>J.C. Ndukaife; A.V. Kildishev; A. Nnanna; s.T. Wereley; V.M. Shalaev; A. Boltasseva</td>
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<td>2:45-3:00 PM</td>
<td>AW3K.6. Spontaneous Light-driven Heat Cycles in Metallic Nanofluids with Nanobubbles</td>
<td>J. Dominguez; M. Moocarme; L. Vuong</td>
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<td>1:00 PM-3:00 PM</td>
<td>SW3M. Microwave Photonics Mixer based on Polarization Rotation in Semiconductor Optical Amplifier</td>
<td>Q. Zhou; M.P. Fok</td>
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<td>1:00-1:15 PM</td>
<td>SW3M.1. Microwave Photonics Mixer based on Polarization Rotation in Semiconductor Optical Amplifier</td>
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<td>1:30-1:45 PM</td>
<td>SW3M.3. Dispersion Compensation Scheme for Ultra-Wideband Coherent Matched Detection</td>
<td>T. Sakamoto</td>
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<td>1:45-2:00 PM</td>
<td>SW3M.4. Widely Tunable Optoelectronic Oscillator Utilizing an Optical Notch Filter Based on the Deamplification of Stimulated Brillouin Scattering</td>
<td>H. Peng; Y. Xu; C. Zhang; P. Guo; L. Zhu; W. Hu; Z. Chen</td>
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<td>2:00-2:30 PM</td>
<td>SW3M.5. Experimental Demonstration of Optical Switching of Tbit/s Data Packets for High Capacity Short-Range Networks</td>
<td>A. Medhin; V. Kamchevska; H. Hu; M. Galili; L.K. Oxenløwe</td>
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<td>SW3M.6</td>
<td>High speed and high resolution demodulation system for hybrid WDM/FDM based fiber microstructure sensor network by using Fabry-Perot filter</td>
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<td>SW3M.7</td>
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<td>Nonlinear Effects in Waveguides, S&amp;I Oral, CLEO S&amp;I 11: Fibers Photonic</td>
<td>Presider: Peter Dragic, <a href="mailto:p-dragic@illinois.edu">p-dragic@illinois.edu</a>, Univ of Illinois at Urbana-Champaign</td>
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<td>SW3L.1</td>
<td>New Directions for Chip-based Nonlinear Optics</td>
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<td>SW3L.3</td>
<td>Spectral Narrowing of CW Light in Optical Fibers with Normal Dispersion</td>
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<td>SW3L.4</td>
<td>Dual-peaked Laser Spectral Compression Generated in a Dispersion-increasing Fiber</td>
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<td>SW3L.5</td>
<td>Raman-Enhanced Phase-Sensitive Fiber Optical Parametric Amplifier</td>
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<td>1:00 PM-3:00 PM, Salon IV (Marriott), SW3N.</td>
<td>Integrated Optical Modulators, S&amp;I Oral, CLEO S&amp;I 9: Components, Integration, Interconnects and Signal Processing</td>
<td>Presider: Mark Foster, <a href="mailto:mark.foster@jhu.edu">mark.foster@jhu.edu</a>, Johns Hopkins University</td>
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<td>1:00-1:15 PM</td>
<td>SW3N.1</td>
<td>High-speed Energy-efficient Silicon-polymer Hybrid Integrated Slot Photonic Crystal Waveguide Modulator</td>
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<td>1:15-1:30 PM</td>
<td>SW3N.2</td>
<td>WDM Transmitter Using Si Photonic Crystal Optical Modulators</td>
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<td>1:30-1:45 PM</td>
<td>SW3N.3</td>
<td>A 41 GHz Slow-Wave Series Push-Pull Silicon Photonic Modulator</td>
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<td>SW3N.4</td>
<td>OOK and QPSK Operation with Wide Working Spectrum in 200-300 μm Si Photonic Crystal Slow Light Modulators</td>
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<td>2:00-2:15 PM</td>
<td>SW3N.5</td>
<td>Linear silicon PN junction phase modulator</td>
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<td>SW3N.6</td>
<td>Linearity Measurement of a Silicon Single-Drive Push-Pull Mach-Zehnder Modulator</td>
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<td>SW3N.7</td>
<td>64 Gb/s silicon QPSK modulator with single-drive push-pull traveling wave electrodes</td>
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<td>SW3N.8</td>
<td>Monolithically Integrated Quantum Dot Optical Modulator with Semiconductor Optical Amplifier for High-speed Optical Data Generation</td>
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<td>SW3O.1</td>
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<td>SW3O.2</td>
<td>Multi-Milliwatt, Continuous-Wave, Mid-Infrared Source for the 6.4-7.5 μm Spectral Range Based on Orientation-Patterned GaAs</td>
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<td>SW3O.5</td>
<td>Long-Wave Infrared Single-Frequency OP-GaAs OPO Pumped by a Pulsed Tm:YAP Microlaser</td>
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<td>2:30-2:45 PM</td>
<td>SW3O.7</td>
<td>Widely tunable 1μm optical vortex laser</td>
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<td>FW4A.1</td>
<td>Implementation of the Classical and Quantum Fourier Transform in Photonic Lattices</td>
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<td>3:30-3:45 PM</td>
<td>FW4A.2</td>
<td>Programmable Nanophotonic Processor for Arbitrary High Fidelity Optical Transformations</td>
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<td>4:00-4:30 PM</td>
<td>FW4A.3</td>
<td>A Fermionic Quantum Computer with Ultracold Atoms</td>
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<td>4:30-4:45 PM</td>
<td>FW4A.4</td>
<td>Topological Protection of Path Entanglement in Photonic Quantum Walks</td>
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<td>4:45-5:00 PM</td>
<td>FW4A.5</td>
<td>Quantum Random Walks in a Programmable Nanophotonic Processor</td>
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<td>FW4A.7</td>
<td>Hybridization: When two wrongs make a right</td>
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<td>FW4B.1</td>
<td>Enhanced Multi-Photon Emission from Single NV Center Coupled to Graphene by Laser-Shaping</td>
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<td>FW4B.2</td>
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<td>FW4B.3</td>
<td>Single NV Zero-Phonon Line Emission into Waveguide-Coupled GaP-on-Diamond Disk Resonators</td>
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<td>FW4B.4</td>
<td>Tunable Squeezing Using Coupled Ring Resonators on a Silicon Nitride Chip</td>
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<td>FW4B.5</td>
<td>Effect of Pure Dephasing and Phonon Scattering on the Coupling of Semiconductor Quantum Dots to Optical Cavities</td>
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<td>FW4B.6</td>
<td>Proposed Method of Optical Spin Read-out in a Quantum Dot using the AC Stark Effect</td>
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<td>Measurement of Nonlinear Polariton Dispersion Curves Reveals the Tavis-Cummings Quantum Ladder</td>
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3:30 PM-5:30 PM, Executive Ballroom 210B (Convention Center), FW4B. Integrated Structures for Quantum Optics, FS Oral, QELS 1: Quantum Optics of Atoms, Molecules and Solids, Presider: Glenn Solomon, glenn.solomon@nist.gov, Joint Quantum Institute

3:30 PM-5:30 PM, Executive Ballroom 210C (Convention Center), FW4C. Novel Optics, FS Oral, QELS 3: Metamaterials and Complex Media, Presider: Sebastian Knitter, sebastian.knitter@yale.edu, Yale University
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<td><strong>FW4C.1.</strong> Control of Coherent Backscattering in a Multimode Fiber Using Nonreciprocal Phase Modulation</td>
<td>Y. Bromberg; B. Redding; H. Cao</td>
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<td>3:45-4:00 PM</td>
<td><strong>FW4C.2.</strong> Casimir forces in inhomogeneous media: towards a workable regularization</td>
<td>U. Leonhardt; I. Griniasty</td>
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<td>4:00-4:15 PM</td>
<td><strong>FW4C.3.</strong> All-Solid-State Invisibility Cloak for Diffuse Light</td>
<td>R. Schittny; A. Niemeyer; M. Kadic; T. Bückmann; A. Naber; M. Wegener</td>
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<td>4:15-4:30 PM</td>
<td><strong>FW4C.4.</strong> Metasurface Optical Antireflection Coatings</td>
<td>H. Chen; B. Zhang; J. Guo; J. Hendrickson; N. Nader</td>
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<td><strong>FW4C.5.</strong> Analytic Modeling of Metmaterial Absorbers</td>
<td>P. Bowen; A. Baron; D.R. Smith</td>
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<td><strong>FW4C.6.</strong> Highly Efficient Modulation of THz Metamaterials Using Graphene Surface Plasmons</td>
<td>I.J. Luxmoore; P.Q. Liu; S.A. Mikhailov; N.A. Savostianova; F. Valmorra; J. Faist; G.R. Nash</td>
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<td>5:00-5:15 PM</td>
<td><strong>FW4C.7.</strong> Dielectric Metasurface Analogue of Electromagnetically Induced Transparency</td>
<td>Y. Yang; I.I. Kravchenko; D. Briggs; J. Valentine</td>
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<td><strong>FW4C.8.</strong> Plasmonic Metasurface for Efficient Laser-Driven Particle Acceleration</td>
<td>D. Bar-Lev; J. Scheuer</td>
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<td><strong>Executive Ballroom 210D (Convention Center)</strong>, <strong>FW4D.</strong> Nonlinear Fiber Effects, FS Oral, QELS 5: Nonlinear Optics and Novel Phenomena</td>
<td>Presider: Mark Foster, <a href="mailto:mark.foster@jhu.edu">mark.foster@jhu.edu</a>, Johns Hopkins University</td>
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<td><strong>FW4D.1.</strong> Spatiotemporal Dynamics of Multimode Optical Solitons</td>
<td>L. Wright; W.H. Renninger; D.N. Christodoulides; F.W. Wise</td>
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<td><strong>FW4D.2.</strong> Dynamics of Rogue Wave and Soliton Emergence in Spontaneous Modulation Instability</td>
<td>S. Toenger; T. Godin; C. Billet; F. Dias; M. Erkintalo; G. Gently; J. Dudley</td>
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<td>4:00-4:15 PM</td>
<td><strong>FW4D.3.</strong> Multiple Raman Soliton Generation in a Birefringence Tellurite Microstructured Optical Fiber</td>
<td>L. Zhang; T. Cheng; D. Deng; D. Sega; L. Liu; T. Suzuki; Y. Ohishi</td>
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<td>4:15-4:30 PM</td>
<td><strong>FW4D.4.</strong> Polarization dynamics of dissipative solitons in an erbium doped fiber laser passively mode locked by carbon nanotube polymer composite</td>
<td>C. Mou; S. Sergeyev; S. Kolpakov; R. Arif; A. Rozhin; M. Chernysheva; S. Turitsyn</td>
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<td><strong>FW4D.5.</strong> How Optical Spectrum of Random Fiber Laser is Formed</td>
<td>D.V. Churkin; I. Kolokolov; E.V. Podivilov; I. Vatnik; M. Nikulin; S. Vergeles; I. Terekhov; V. Lebedev; G. Falkovich; S.A. Babin; S. Turitsyn</td>
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<td>4:45-5:00 PM</td>
<td>FW4D.6. Graphene Coated Microfiber For Cascaded Four-Wave-Mixing Generating</td>
<td>B. Yao; Y. Wu; Q. Feng; Z. Wang; Y. Rao; Y. Chen; K.S. Chiang</td>
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<td>FW4D.7. Temporal cloaking enhancements for optical communication</td>
<td>J.M. Lukens; A.J. Metcalf; D.E. Leaird; A.M. Weiner</td>
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<td>3:30 PM-5:30 PM, Executive Ballroom 210E (Convention Center), FW4E. Plasmonic Metasurfaces and Metamaterials, FS Oral, QELS 6: Nano-Optics and Plasmonics, Presider: Nanfang Yu, <a href="mailto:ny2214@columbia.edu">ny2214@columbia.edu</a>, Columbia University</td>
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<td>3:30-4:00 PM</td>
<td>FW4E.1. Photon Spin Induced Collective Electron Motion on a Metasurface</td>
<td>X. Ni; J. Xiao; S. Yang; Y. Wang; X. Zhang</td>
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<td>FW4E.2. Active Epsilon-Near-Zero Infrared Metamaterials</td>
<td>N. Arju; T. Ma; S. Trendafilov; J. LEE; M.A. Belkin; G. Shvets</td>
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<td>FW4E.3. Negative refraction due to discrete plasmon diffraction</td>
<td>A. Kriesch; H.H. Lee; D. Ploss; S.P. Burgos; H. Pfeifer; J. Naeger; H. Atwater; U. Peschel</td>
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<td>4:30-4:45 PM</td>
<td>FW4E.4. Controlled steering of Cherenkov surface plasmon wakes with a one-dimensional metamaterial</td>
<td>P. Genevet; D. Wintz; A. Ambrosio; A. She; R. Blanchard; F. Capasso</td>
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<td>4:45-5:00 PM</td>
<td>FW4E.5. Three-Dimensional Metasurface Carpet Cloak</td>
<td>X. Ni; Z. Wong; Y. Wang; X. Zhang</td>
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<td>5:00-5:15 PM</td>
<td>FW4E.6. Metasurface Engaged with a Plasmonic Spiral Achieve Super Functional Lensing</td>
<td>G. Spektor; A. David; G. Bartal; M. Orenstein</td>
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<td>5:15-5:30 PM</td>
<td>FW4E.7. Creating Surface Plasmon Orbital Angular Momentum in a Gold Metasurface</td>
<td>C. Chen; C. Ku; M. Pan; P. Wei; C. Huang</td>
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<td>3:30 PM-5:30 PM, Executive Ballroom 210F (Convention Center), SW4F. Micro and Nano Lasers, S&amp;I Oral, CLEO S&amp;I 3: Semiconductor Lasers, Presider: Kent Choquette, <a href="mailto:choquett@illinois.edu">choquett@illinois.edu</a>, University of Illinois</td>
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<td>3:30-3:45 PM</td>
<td>SW4F.1. Opening up spectrum with InPAs quantum dot lasers</td>
<td>I. Karomi; S. Shutts; P.M. Smowton; A. Krysa</td>
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<td>3:45-4:00 PM</td>
<td>SW4F.2. Quantum cascade laser-based Kerr frequency comb generation</td>
<td>C. Lecaplain; C. Javerzac-Galy; E. Lucas; J.D. Jost; t. kippenberg</td>
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<td>SW4F.3. Very Small Lasers and Resonators</td>
<td>Y. Lee; H. Jang</td>
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<td>SW4F.4. Waveguide-integrated Unidirectional-Emission Microspiral Lasers for Optical Interconnects</td>
<td>Y. ZHANG; A.W. Poon</td>
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<td>Executive Ballroom 210G (Convention Center), <strong>SW4G. Comb Technology</strong>, S&amp;I Oral, CLEO S&amp;I 14: Optical Metrology</td>
<td>Presider: Brian Washburn, <a href="mailto:washburn@phys.ksu.edu">washburn@phys.ksu.edu</a>, Kansas State University</td>
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<td>3:30-3:45 PM</td>
<td>SW4G.1. Octave Spanning Frequency Comb Generation in a Dispersion-Controlled Short Silicon-Wire Waveguide with a Fiber Laser Oscillator</td>
<td>T. Goto; A. Ishizawa; R. Kou; T. Tsuchizawa; N. Matsuda; K. Hitachi; T. Nishikawa; K. Yamada; T. Sogawa; H. Gotoh</td>
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<td>3:45-4:00 PM</td>
<td>SW4G.2. A Hybrid III-V-Graphene Device for Modelocking and Noise Suppression in a Frequency Comb</td>
<td>C. Lee; K. Silverman; A. Feldman; T. Harvey; R.P. Mirin; T.R. Schibli</td>
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<td>4:00-4:15 PM</td>
<td>SW4G.3. A Robust 2f-to-3f Collinear Interferometer with a Dual-Pitch Periodically Poled Lithium Niobate Ridge Waveguide</td>
<td>K. Hitachi; A. Ishizawa; O. Tadanaga; H. Mashiko; T. Nishikawa; T. Sogawa; H. Gotoh</td>
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<td>4:15-4:30 PM</td>
<td>SW4G.4. Ultra low noise all polarization-maintaining fiber-based Er optical frequency combs</td>
<td>N. Kuse; C. Lee; J. Jiang; C. Mohr; T.R. Schibli; M.E. Fermann</td>
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<td>4:30-4:45 PM</td>
<td>SW4G.5. Thin-Disk Lasers for Multi-100-W Average Power Frequency Combs: Challenges and Analysis</td>
<td>A. Diebold; F. Emaury; A. Klenner; C.J. Saraceno; S. Schilt; T. Sudmeyer; U. Keller</td>
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<td>5:00-5:15 PM</td>
<td>SW4G.7. Spectrally Flattened, Broadband Astronomical Frequency Combs</td>
<td>R. Probst; Y. Wu; T. Steinmetz; S. Stark; T. Hänsch; T. Udem; R. Holzwarth</td>
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<td>5:15-5:30 PM</td>
<td>SW4G.8. A low-dispersion Fabry-Perot cavity for generation of a 30 GHz astrocomb spanning 140 nm</td>
<td>D. Hackett; G. Ycas; S. Diddams</td>
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3:30 PM-5:30 PM, Executive Ballroom 210H (Convention Center), **AW4H. A&T Topical Review - Advances in Molecular Imaging II.** A&T Topical Review, A&T Topical Review - Advances in Molecular Imaging, Presider: Brian Applegate, apple@tamu.edu, Texas A&M University

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<td><strong>AW4H.1. Molecular Contrast in Interferometric Imaging</strong> A. Wax</td>
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<td>4:00-4:30 PM</td>
<td><strong>AW4H.2. Multi-Scale Optical Molecular Imaging</strong> Y. Chen</td>
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<td>4:30-5:00 PM</td>
<td><strong>AW4H.3. Fiber-optic Endomicroscopy for Label-free Optical Histology</strong> X. Li</td>
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<td>5:00-5:30 PM</td>
<td><strong>AW4H.4. Ultra High-Resolution Photoacoustic Microscopy Using a Novel Transient Absorption Technique</strong> B.E. Applegate</td>
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3:30 PM-5:30 PM, Meeting Room 211 B/D (Convention Center), **SW4I. Novel Materials for On-chip Photonics.** S&I Oral, CLEO S&I 7: Micro- and Nano-Photonic Devices, Presider: Federico Capasso, capasso@seas.harvard.edu, Harvard University

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<td>3:30-3:45 PM</td>
<td><strong>SW4I.1. Microdisk Cavity-Coupled MoS$_2$ with Tunable Narrowband Emission</strong> J.C. Reed; A.Y. Zhu; H. Zhu; É. Cubukcu</td>
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<td>3:45-4:00 PM</td>
<td><strong>SW4I.2. Fabrication of 1D Photonic Crystal on a Single Erbium Chloride Silicate Nanowire and Microcavity Laser Design</strong> Z. Liu; H. Sun; Y. Li; J. Zhang; C. Ning</td>
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<td><strong>SW4I.3. Two-Dimensional Material Nanophotonics</strong> F. Xia</td>
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<td>4:30-4:45 PM</td>
<td><strong>SW4I.4. 30 GHz Zeno-based Graphene Electro-optic Modulator</strong> C.T. Phare; Y. Lee; J. Cardenas; M. Lipson</td>
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<td>4:45-5:00 PM</td>
<td><strong>SW4I.5. Small Footprint Barium Titanate Photonic Crystal Modulators for Photonic Integrated Circuits</strong> P. Girouard; P. Chen; Y. Tu; Y. Jeong; Z. Liu; S. Ho; B.W. Wessels</td>
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<td>5:00-5:15 PM</td>
<td><strong>SW4I.6. Electrically Controllable Extraordinary Optical Transmission in Metallic Surface Gratings on VO$_2$</strong> J. Jeong; A. Joushaghani; S. Paradis; D. Alain; J.K. Poon</td>
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<td>5:15-5:30 PM</td>
<td><strong>SW4I.7. Lithium Niobate on Insulator (LNOI) Grating Couplers</strong> M. Mahmoud; S. Ghosh; G. Piazza</td>
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3:30 PM-5:30 PM, Meeting Room 212 A/C (Convention Center), **AW4J. Symposium - Photonics in Surgery II.** Special Symposium, Symposium - Photonics in Surgery, Presider: Jin Kang, jkang@jhu.edu, Johns Hopkins University

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<td><strong>AW4J.1. Photosurgery for the skin: Younger, Healthier and Easier</strong> B.L. Goo</td>
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<td>4:00-4:15 PM</td>
<td><strong>AW4J.2. Delineation of Basal Cell Carcinoma Margins with Combined RCM/OCT Imaging</strong> N. Iftimia</td>
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<td>3:30-4:00 PM</td>
<td><strong>AW4K.1. Photonic Crystal Enhanced Microscopy</strong> B.T. Cunningham; w. chen; k.d. long; Y. Zhuo; J.S. Choi; B.A. Harley</td>
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<td>4:00-4:30 PM</td>
<td><strong>AW4K.2. Microfluidic Isolation and Fluorescence Microscopy in a Fully Automated Digital Diagnostic Instrument (SIMOA HD-1)</strong> W. McGuigan</td>
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<td>4:45-5:00 PM</td>
<td><strong>AW4K.4. Electrowetting-Based Variable Tuning Prism</strong> S. Terrab; A. Watson; K. Dease; J. Gopinath; V. Bright</td>
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<td>5:00-5:30 PM</td>
<td><strong>AW4K.5. What Is the Microfluidics Doing in Electrowetting Displays?</strong> T. He; m. jin; x. chen; g. zhou; L. Shui</td>
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<td>3:30 PM-5:15 PM, Salon III (Marriott), <strong>SW4M. SDM, OAM &amp; Free-Space Communications</strong>, S&amp;I Oral, CLEO S&amp;I 12: Lightwave Communications and Optical Networks, Presider: Christian Malouin, <a href="mailto:christianmalouin@gmail.com">christianmalouin@gmail.com</a>, Juniper Networks Inc.</td>
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<td>3:30-4:00 PM</td>
<td><strong>SW4M.1. Dense Space Division Multiplexed Transmission Technology</strong> T. Mizuno; H. Takara; A. Sano; Y. Miyamoto</td>
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<td>4:00-4:15 PM</td>
<td><strong>SW4M.2. Experimental Demonstration of N-Dimensional 1-to-1100 Multicasting (25 Wavelengths x 22 Orbital Angular Momentum Modes x 2 Polarizations) of OFDM-mQAM Signal</strong> J. Wang; S. Li; J. Liu; C. Li; L. Zhu; J. Du; M. Luo; Q. Yang; S. Yu</td>
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<td>4:15-4:30 PM</td>
<td><strong>SW4M.3. Q-plates for Switchable Excitation of Fiber OAM Modes</strong> P. Gregg; M. Mirhosseini; A. Rubano; L. Marrucci; E. Karimi; R.W. Boyd; S. Ramachandran</td>
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<td>3:30-5:30 PM, Salon I-II (Marriott)</td>
<td>SW4L. Nonlinear Fiber Optics, S&amp;I Oral, CLEO S&amp;I 11: Fibers Photonic, Presider: Sze Yun Set, <a href="mailto:set@alnair-labs.com">set@alnair-labs.com</a>, Alnair Labs Corporation</td>
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<td>3:30-4:00 PM</td>
<td>SW4L.1. Towards nonlinear optics with cold Rydberg atoms inside a hollow core fiber</td>
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<td>4:00-4:15 PM</td>
<td>SW4L.2. SBS Suppression in Nanosecond Fiber Amplifier with Controlled Frequency Chirp</td>
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<td>4:15-4:30 PM</td>
<td>SW4L.3. Stimulated Forward Brillouin Scattering in Hollow-core Photonic Crystal Fiber</td>
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<td>SW4L.5. Crosstalk Reduction by Backward Raman Pumping in Multi-Wavelength Fiber Optical Parametric Amplification</td>
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<td>SW4L.6. Addressing a cavity with patterns at ultra-wideband detune</td>
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<td>3:30-3:45 PM</td>
<td>SW4N.1. Scaling Zero-Change Photonics: An Active Photonics Platform in a 32 nm Microelectronics SOI CMOS Process</td>
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<td>3:45-4:00 PM</td>
<td>SW4N.2. III-V Nanopillar Phototransistor Directly Grown on Silicon</td>
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<td>4:00-4:15 PM</td>
<td>SW4N.3. Performance Evaluation of GaN/InGaN Heterojunction Phototransistors</td>
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<td>5:15-5:30 PM</td>
<td>SW4O.8. Quarter-harmonic generation of femtosecond pulses at 4.18 μm from a mode-locked Yb:fiber laser A. Marandi; K. Ingold; R.L. Byer</td>
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<td>4:30 PM-6:30 PM</td>
<td>Exhibit Hall (Poster Session Area) (Convention Center), <strong>Exhibit Happy Hour</strong>, Exhibit Hall Event</td>
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<td>6:30 PM-8:30 PM</td>
<td>Grand Ballroom (Convention Center), <strong>JW5A. Plenary Session III</strong>, Plenary Session</td>
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<td>6:30-7:00 PM</td>
<td><strong>JW5A.1. Light’s Twist</strong> M. Padgett</td>
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<td>7:00-7:30 PM</td>
<td><strong>JW5A.2. Energy savings by LED Lighting</strong> S. Nakamura</td>
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<td>8:00 AM-10:00 AM</td>
<td>Executive Ballroom 210A (Convention Center), <strong>FTh1A. Quantum Entanglement III</strong>, FS Oral, <strong>QELS 2: Quantum Science, Engineering and Technology</strong>, Presider: Antonio Acín, <a href="mailto:antonio.acin@icfo.es">antonio.acin@icfo.es</a>, ICFO -The Institute of Photonic Sciences</td>
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<td>8:00-8:15 AM</td>
<td>FTh1A.1. Noise Figure Improvement and Quantum Information Tapping in a Fiber Optical Parametric Amplifier with Correlated Quantum Fields X. Li; X. Guo; N. Liu; Y. Liu; Z. Ou</td>
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<td>8:15-8:30 AM</td>
<td>FTh1A.2. Propagation of Two-qubit States using Interference in a Distributed Phase Sensitive Amplifier A. Agarwal; J.M. Dailey; P. Toliver; N.A. Peters</td>
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<td>FTh1A.3. Effects of Distributed Amplifiers on Quantum Coherence J.D. Franson; B.T. Kirby</td>
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<td>FTh1A.4. Enhanced Photon-Pair Detection Using Phase-Sensitive Pre-amplification J.M. Dailey; A. Agarwal; P. Toliver; N.A. Peters</td>
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<td>9:00-9:15 AM</td>
<td>FTh1A.5. Engineering large-scale entanglement in the quantum optical frequency comb P. Wang; W. Fan; M. Chen; O. Pfister</td>
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<td>9:15-9:30 AM</td>
<td>FTh1A.6. Frequency-Resolved Reconstruction of the Biphoto Polarization State via Stimulated Emission Tomography B. Fang; M. Liscidini; J.E. Sipe; V. Lorenz</td>
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<td>FTh1A.7</td>
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<td>FTh1A.8</td>
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8:00 AM-10:00 AM, Executive Ballroom 210B (Convention Center), FTh1B. Quantum Control and Precision Measurements, FS Oral, QELS 1: Quantum Optics of Atoms, Molecules and Solids, Presider: Joshua Nunn, j.nunn1@physics.ox.ac.uk, University of Oxford

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<td>8:00-8:15 AM</td>
<td>FTh1B.1</td>
<td>Quantum Zeno Dynamics with Rydberg Atoms</td>
<td>A. FACON</td>
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<td>8:15-8:30 AM</td>
<td>FTh1B.2</td>
<td>Feedback Cooling of a Nanomechanical Oscillator to Near its Quantum Ground State</td>
<td>d. wilson; t. kippenberg; V. Sudhir; N. Piro; R. Schilling</td>
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<td>8:30-8:45 AM</td>
<td>FTh1B.3</td>
<td>Search For a Permanent Electric Dipole Moment (EDM) of 225Ra Atom</td>
<td>M. Kalita; M. Bishop; K. Bailey; m. Dietrich; J. Greene; R. Holt; W. Korsch; Z. Lu; N. Lemke; P. Mueller; T. O'Connor; R. Parker; J. Taggart Singh</td>
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<td>8:45-9:00 AM</td>
<td>FTh1B.4</td>
<td>Nonlinear optical magnetometry with accessible in situ optical squeezing</td>
<td>N. Otterstrom; R. Pooser; B. Lawrie</td>
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<td>9:00-10:00 AM</td>
<td>FTh1B.5</td>
<td>Making the World's Best Atomic Clock</td>
<td>J. Ye</td>
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8:00 AM-10:00 AM, Executive Ballroom 210C (Convention Center), FTh1C. High-field and XFEL Physics, FS Oral, QELS 7: High-Field Physics and Attoscience, Presider: Todd Ditmire, tditmire@physics.utexas.edu, Univ. of Texas Austin

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<td>FTh1C.1</td>
<td>Getting Beyond Unity Fusion Fuel Gain in an Inertially Confined Fusion Implosion</td>
<td>O. Hurricane</td>
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<td>8:30-8:45 AM</td>
<td>FTh1C.2</td>
<td>Laser Generation of Scaled Astrophysical Blast Waves in a Dynamically-Significant Magnetic Field</td>
<td>N. Riley; M. Wisher; S. Lewis; C. Wagner; V. Minello; R. Bengtson; T. Ditmire</td>
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<td>FTh1C.3</td>
<td>Laser Acceleration and Deflection of 96.3keV Electrons with a Silicon Dielectric Structure</td>
<td>K. Leedle; F. Pease; R.L. Byer; J.S. Harris</td>
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<td>9:00-9:15 AM</td>
<td>FTh1C.4</td>
<td>He Ion Acceleration in Near Critical Density Plasma</td>
<td>S. Tochitsky; C. Gong; J. Pigeon; F. Fiuza; C. Joshi</td>
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<td>FTh1C.5</td>
<td>Difference-Frequency Generation of Optical Radiation from Two-Color X-Ray Pulses</td>
<td>E. Shwartz; S. Shwartz</td>
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<td>9:30-9:45 AM</td>
<td>FTh1C.6.</td>
<td>Investigation of the Newly Proposed Carrier-Envelope-Phase Stable Attosecond Pulse Source</td>
<td>Z. Tibai; G. Tóth; Z. Nagy-Csiaha; J. Fülöp; G. Almási; J. Hebling</td>
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<td>9:45-10:00 AM</td>
<td>FTh1C.7.</td>
<td>Intense broadband THz pulse generation from relativistic laser-plasma interaction</td>
<td>S. Mondal</td>
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<td>8:00 AM-10:00 AM</td>
<td>FTh1D. Nonlinear Resonators and Optical Frequency Combs</td>
<td>FS Oral, QELS 5: Nonlinear Optics and Novel Phenomena, Presider: Marco Peccianti, <a href="mailto:m.peccianti@sussex.ac.uk">m.peccianti@sussex.ac.uk</a>, University of Sussex</td>
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<td>8:00-8:30 AM</td>
<td>FTh1D.1. Temporal Cavity Solitons: From Fiber Resonators to Microresonators</td>
<td>S. Coen; J.K. Jang; S.G. Murdoch; M. Erkintalo</td>
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<td>FTh1D.2.</td>
<td>Monolithic microresonator for simultaneous lasing feedback and intracavity hyperparametric oscillation</td>
<td>Z. Xie; W. Liang; A.A. Savchenkov; J. Mcmillan; j. Burkhart; V.S. Ilchenko; A.B. Matsko; L. Maleki; C. Wong</td>
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<td>8:45-9:00 AM</td>
<td>FTh1D.3. Silicon Carbide Microresonators with High Optical Q and Large Kerr Nonlinearity for Nonlinear Optical Effects</td>
<td>X. Lu; J.Y. Lee; S. Rogers; Q. Lin</td>
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<td>9:00-9:15 AM</td>
<td>FTh1D.4. Frequency Comb-enhanced Coupling in Silicon Nitride Microresonators</td>
<td>P. Wang; Y. Xuan; X. Xue; Y. Liu; J. Wang; D.E. Leaird; M. Qi; A.M. Weiner</td>
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<td>9:30-9:45 AM</td>
<td>FTh1D.6. Synchronization of multiple parametric frequency combs</td>
<td>Y.H. Wen; M.R. Lamont; A.L. Gaeta</td>
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<td>9:45-10:00 AM</td>
<td>FTh1D.7. A New Route for Fabricating On-Chip Chalcogenide Microcavity Resonators</td>
<td>O. Aktas; E. Huseyinoglu; M. Bayindir</td>
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<td>8:00 AM-10:00 AM</td>
<td>FTh1E. Electron and Ultrafast Probing of Plasmonic Nanostructures</td>
<td>FS Oral, QELS 6: Nano-Optics and Plasmonics, Presider: Christoph Lienau, <a href="mailto:christoph.lienau@uni-oldenburg.de">christoph.lienau@uni-oldenburg.de</a>, Carl V. Ossietzky Univ Oldenburg</td>
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<td>8:00-8:15 AM</td>
<td>FTh1E.1. Interferometric Plasmon Propagation and Lensing with Nanohole Arrays in Gold Films: Visualization by Nonlinear Photoemission Electron Microscopy</td>
<td>W. Hess</td>
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<td>8:15-8:30 AM</td>
<td>FTh1E.2. Advanced Disc-Ring Optical Nanoantennas Investigated by Photoelectron Emission Microscopy (PEEM)</td>
<td>T. Kaiser; M. Falkner; J. Qi; M. Steinert; C. Menzel; C. Rockstuhl; T. Pertsch</td>
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<td>8:30-9:00 AM</td>
<td>FTh1E.3. Electron-Light Interaction in Optical Near-Fields studied by Ultrafast Transmission Electron Microscopy</td>
<td>A. Feist; K.E. Echterkamp; J. Schauss; S.V. Yalunin; S. Schäfer; C. Ropers</td>
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| 9:00-9:15 AM | FTh1E.4. Ultrafast pump-probe photo-induced force microscopy at nanoscale  
                J. Jahng; J. Brocious; d. Fishman; E.O. Potma |
| 9:15-9:30 AM | FTh1E.5. Spatially-Resolved, Three-Dimensional Investigation of Surface Plasmon Resonances in Complex Nanostructures  
                J. Hachtel; D. Mayo; A. Mouti; C. Marvinney; R. Mu; R.F. Haglund; A. Lupini; M. Chisholm; S. Pantelides |
| 9:30-9:45 AM | FTh1E.6. Extremely confined gap surface-plasmon modes probed by electron energy-loss spectroscopy (EELS)  
                N. Stenger; S. Raza |
| 9:45-10:00 AM | FTh1E.7. Coherent Control in Single Plasmonic Nanostructures  
                A. Comin; R. Ciesielski; A. Bouhelier; A. Hartschuh |

8:00 AM-10:00 AM, Executive Ballroom 210F (Convention Center), STh1F. Mode Division Multiplexing, S&I Oral, CLEO S&I 9: Components, Integration, Interconnects and Signal Processing, Presider: Takahide Sakamoto, tsaka@nict.go.jp, NICT

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                Y. Ding; K. Yvind |
| 8:15-8:30 AM | STh1F.2. Integrated Switch for Mode-Division Multiplexing (MDM) and Wavelength-Division Multiplexing (WDM)  
                B. Stern; X. Zhu; C. Chen; L. Tzuang; J. Cardenas; K. Bergman; M. Lipson |
| 8:30-8:45 AM | STh1F.3. Mode division multiplexing using chip-scale silicon coupled vertical gratings  
                G.F. Chen; T. Wang; K.J. Ooi; A.K. Chee; L. Ang; D. Tan |
| 8:45-9:00 AM | STh1F.4. Mode Multiplexer Based on Integrated Horizontal and Vertical Polymer-Waveguide Directional Couplers  
                K.S. Chiang; J. Dong; W. Jin |
| 9:00-9:15 AM | STh1F.5. Photonics Integrated Circuit for WDM Mode Division Multiplexing with Phase to Intensity Demodulation  
                M. Ye; Y. Yu; G. Chen; Y. Luo; L. Shi; X. Zhang |
| 9:15-9:30 AM | STh1F.6. Demonstration of Distance Emulation for an Orbital-Angular-Momentum Beam  
                N. Ahmed; M.P. Lavery; p. liao; G. Xie; H. Huang; L. Li; Y. Ren; Y. Yan; Z. Zhao; Z. Wang; N. Ashrafi; S. Ashrafi; R. Linquist; M. Tur; a. williner |
| 9:30-9:45 AM | STh1F.7. Detecting orbital angular momentum of light with an arc slit  
                H. Zhou; J. Dong; P. Zhang; Y. Zhou; X. Zhang |
| 9:45-10:00 AM | STh1F.8. 2x2 Broadband Adiabatic 3-dB Couplers on SOI Strip Waveguides for TE and TM modes  
                H. Yun; Z. Lu; Y. Wang; W. Shi; L. Chrostowski; N.A. Jaeger |

8:00 AM-10:00 AM, Executive Ballroom 210G (Convention Center), STh1G. Glass and Rare Earth Doped Materials, S&I Oral, CLEO S&I 6: Optical Materials, Fabrication & Characterization
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<td>STh1G.1.</td>
<td>Properties of Gallium Lanthanum Sulphide Glass</td>
<td>P. Bastock; C. Craig; K. Khan; E. Weatherby; J. Yao; D.W. Hewak</td>
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<td>STh1G.2.</td>
<td>Fluorescence in Erbium Doped Gallium Lanthanum Sulphide: Potential for mid-IR Waveguide Laser</td>
<td>G. Demetriou; F. Thorburn; A. Lancaster; C. Craig; E. Weatherby; D.W. Hewak; A. Kar</td>
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<td>STh1G.3.</td>
<td>Photo-Induced Tuning of Chalcogenide-on-Silicon Photonic Integrated Circuits</td>
<td>R. Califa; H. Genish; D. Munk; Y. Kaganovskii; I. Bakish; M. Rosenbluh; A. Zadok</td>
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<td>Visible up-conversion luminescence in (ErSc)₂O₃ epitaxial thin films and its suppression by photonic band-gap</td>
<td>T. Tawara; T. McManus; Y. Kawakami; H. Omi; A. Najar; R. Kaji; S. Adachi; H. Gotoh</td>
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<td>STh1G.5.</td>
<td>Highly Yb-doped KGD(WO₄)₂ Thin-film Amplifier</td>
<td>Y. Yong; S. Aravazhi; S.A. Vázquez-Córdova; S.M. García-Blanco; M. Pollnau</td>
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<td>STh1G.6.</td>
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<td>J. Chiles; M. Malinowski; A. Rao; S. Novak; K. Richardson; S. Fathpour</td>
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<td>STh1G.8.</td>
<td>Solution processed Chalcogenide photonic crystal</td>
<td>T. Gu; C. Lu; T. Heinz; A. Rodriguez; C. Arnold</td>
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8:00 AM-10:00 AM, Executive Ballroom 210H (Convention Center), **STh1H. Nonlinear Optics for Advanced Measurements and Characterization, S&I Oral, CLEO S&I 4: Nonlinear Optical Technologies**, Presider: Derryck Reid, d.t.reid@hw.ac.uk, Heriot-Watt University

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<td>M. Bocoum; F. Bohle; B. beaurepaire; A. Vernier; A. Jullien; J. Faure; R.B. Lopez-Martens</td>
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<td>Ultrabroadband Mid-Infrared Pump-Probe Spectroscopy using Chirped-Pulse Upconversion</td>
<td>H. Shirai; T. Yeh; Y. Nomura; C. Luo; T. Fuji</td>
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<td>Relaxation dynamics of the OH stretching overtones in isolated HDO molecules observed by IR pump-repump-probe spectroscopy</td>
<td>D. Hutzler; J. Werhahn; R. Heider; M. Bradler; R. Kienberger; E. Riedle; H. Iglev</td>
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<td>Tunable All-Optical Modulation by Period Multiplication in a Synchronously-Pumped Optical Parametric Oscillator</td>
<td>T. Steinle; V. Kumar; A. Steinmann; M. Marangoni; G. Cerullo; H.W. Giessen</td>
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<td>STh1H.5. Two-crystal Optical Parametric Oscillator for Broadband Dual-comb Spectroscopy</td>
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<td>STh1H.6. Visualization of the Internal Structure of Orientation-Patterned III-V Semiconductors</td>
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<td>9:30-9:45 AM</td>
<td>STh1H.7. High-Resolution Sub-Surface Microscopy of CMOS Integrated Circuits Using Radially Polarized Light</td>
<td>M. Rutkauskas; C. Farrell; C. Dorrer; K. Marshall; T. Lundquist; P. Vedagarbha; D.T. Reid</td>
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<td>STh1H.8. 3-D Scanning Mid-IR Imaging of Buried Structures Using Extremely Nondegenerate Two-photon Absorption in a GaN Photodiode</td>
<td>H.S. Pattanaik; M. Reichert; D.J. Hagan; E.W. Van Stryland</td>
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<td>STh1I.1. Tandem Photodetectors Containing Silicon Nanowires with Selective Spectral Absorption</td>
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<td>STh1I.2. Waveguide-Coupled Superconducting Nanowire Single-Photon Detectors</td>
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<td>STh1I.3. Series-Nanowire Photon Number Resolving Detector Counting up to 24 Photons</td>
<td>F. Mattioli; Z. Zhou; A. Gaggero; R. Gaudio; R. Leoni; A. Fiore</td>
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<td>8:45-9:00 AM</td>
<td>STh1I.4. High Responsivity Silicon-Graphene Schottky Avalanche Photodetectors for Visible and Telecom Wavelengths</td>
<td>I. Goykhman; A. Eiden; D. De Fazio; U. Sassi; M. Barbone; A.C. Ferrari</td>
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<td>9:00-9:15 AM</td>
<td>STh1I.5. Graphene on Silicon-on-Sapphire Waveguide Photodetectors</td>
<td>Z. Cheng; J. Wang; K. Xu; H. Tsang; C. Shu</td>
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<td>STh1I.6. A CMOS-Compatible Plenoptic Sensor for Smart Lighting Applications</td>
<td>J. Ghasemi; A. Neumann; S. Nezhadbadeh; X. Nie; P. Zarkesh-Ha; S. Brueck</td>
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<td>9:30-9:45 AM</td>
<td>STh1I.7. Enhanced Responsivity up to 2.85 A/W of Si-based Ge\textsubscript{0.9}Sn\textsubscript{0.1} Photoconductors by Integration of Interdigitated Electrodes</td>
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<td>9:45-10:00 AM</td>
<td>STh1I.8. Dual-Drifting-Layer Uni-Traveling Carrier Photodiode for Wide Bandwidth and High Power Performance</td>
<td>L. Jin; X. Bing; S. Changzheng; Y. Luo</td>
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<td>8:00-8:15 AM</td>
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<td>Label-free imaging of biological tissues with nonlinear photothermal microscopy</td>
<td>J. He; J. Miyazaki; N. Wang; T. Kobayashi</td>
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<td>High-throughput Imaging of Self-luminous Objects through a Single Optical Fiber</td>
<td>R. Barankov; J. Mertz</td>
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<td>Advanced wideband cavity enhanced spectroscopy</td>
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8:00 AM-10:00 AM, Salon III (Marriott), STh1M. Beam Shaping for Optimized Laser-matter Interaction, S&I Oral, CLEO S&I 1: Light-Matter Interactions and Materials Processing, Presider: Ya Cheng, ya.cheng@siom.ac.cn, Shanghai Inst of Optics and Fine Mech

8:00-8:30 AM  STh1M.1. Materials Processing based on Unconventional Femtosecond Laser Beams C. Hnatovsky; V. Shvedov; W. Krollkowsi

8:30-8:45 AM  STh1M.2. Tuning into Tyndall windows B. Groever; B. Heshmat; R. Raskar

8:45-9:00 AM  STh1M.3. Generating Optical Tractor Beams of Improved Stability with Metasurfaces C. Pfeiffer; C. Zhang; L. Guo; A. Grbic

9:00-9:15 AM  STh1M.4. Laser Micromachining with Femtosecond Higher-order Bessel Beams W. Cheng; P.G. Polynkin

9:15-9:30 AM  STh1M.5. Light Localization in Axisymmetric Nano-Structured Plasmonic Gratings A. Lozano; M. shayegannia; A. Montazeri; Y. Fang; K. Moussakhani; N. Kherani

9:30-9:45 AM  STh1M.6. Ultra-broadband Tunable Polarization Converter for Micro-fluidic-meta-surfaces P. Wu; L. Yan; Q. Song; W. Zhu; Z. Wu; D. Tsai; F. Capasso; A. LIU

9:45-10:00 AM  STh1M.7. Unraveling the Effects of Radiation Forces in Water N.G. Astrath; L. Malacarne; M. Baesso; G. Lukasievicz; S. Bialkowski

8:00 AM-10:00 AM, Salon I-II (Marriott), STh1L. Mode-Locked Fiber Lasers, S&I Oral, CLEO S&I 11: Fibers Photonic, Presider: Andy Chong, achong1@udayton.edu, University of Dayton

8:00-8:30 AM  STh1L.1. Ultralow-Jitter Mode-Locked Fiber Lasers and Their Applications J. Kim

8:30-8:45 AM  STh1L.2. High power synchronously pumped femtosecond Raman fiber laser D. Churin; J. Olson; R. Norwood; N. Peyghambarian; K. Kieu

8:45-9:00 AM  STh1L.3. Fast Wavelength-Tunable Picosecond Pulses from Mode-Locked Er Fiber Laser using an Intracavity Filter with Repetition Rate Compensator Y. Ozeki; D. Tashiro

9:00-9:15 AM  STh1L.4. Passively Mode-locked Holmium-doped Fiber Oscillators Optimized for Ho:YLF Amplifier Seeding P. Li; A. Ruehl; C. Bransley; I. Hartl

9:15-9:30 AM  STh1L.5. Reducing Nonlinear Limitations of Ytterbium Mode-Locked Fibre Lasers with Hollow-Core Negative Curvature Fibre C. Harvey; F. Yu; J.C. Knight; W. Wadsworth; P. Almeida
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<td>STh1N.2</td>
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<td>K.F. Lee; C. Mohr; J. Jiang; P.G. Schunemann; M.E. Fermann</td>
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<td>Frequency Comb Spanning 2.5-7.5 µm from a Subharmonic GaAs OPO and its</td>
<td>V.O. Smolski; S.D. Gorelov; J. Zhao; J. Xu; P.G. Schunemann; K.L. Vodopyanov</td>
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<td>STh10.4. Experimental Demonstration of Tunable Homodyne Detection for Two Channels Simultaneously using Nonlinear Optical Signal Processing to Automatically Lock a Single &quot;Local&quot; Pump Laser to Two 20-Gbaud BPSK Data Signals a. almaiman; M. Ziyadi; A. Mohajerin Ariaei; y. cao; M. Chitgarha; p. liao; Y. akasaka; J. Yang; m. sekiya; j. touch; c. langrock; M.M. Fejer; m. tur; a. willner</td>
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<td>STh10.5. Experimental Demonstration of Tunable and Automatically-Locked Homodyne Detection for Dual-Polarization 20-32-Gbaud QPSK Channels using Nonlinear Mixing and Polarization Diversity M. Ziyadi; A. Mohajerin Ariaei; a. almaiman; y. cao; M. Chitgarha; p. liao; Y. akasaka; J. Yang; m. sekiya; j. touch; m. tur; c. langrock; M.M. Fejer; a. willner</td>
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<td>9:15-9:30 AM</td>
<td>STh10.6. Demonstration of Tunable and Automatic Frequency/Phase Locking for Multiple-Wavelength QPSK and 16-QAM Homodyne Receivers using a Single Nonlinear Element M. Ziyadi; A. Mohajerin Ariaei; M. Chitgarha; y. cao; a. almaiman; Y. akasaka; J. Yang; G. Xie; p. liao; m. sekiya; j. touch; m. tur; c. langrock; M.M. Fejer; a. willner</td>
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<td>9:30-9:45 AM</td>
<td>STh10.7. All-Optical Ultrafast Wavelength and Mode Converter Based on Inter-Modal Nonlinear Wave Mixing in Few-Mode Fibers Y. Weng; X. He; J. Wang; Z. Pan</td>
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<td>9:45-10:00 AM</td>
<td>STh10.8. Record Phase Sensitive Extinction Ratio in a Silicon Germanium Waveguide M.A. Ettabib; F. Parmigiani; A. Kapsalis; A. Bogris; M. Brun; P. Labeye; S. Nicoletti; K. Hammani; D. Syvridis; d. Richardson; P. Petropoulos</td>
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<td>11:30 AM-1:00 PM</td>
<td>JTh2A. Poster Session Thursday, A&amp;T, S&amp;I, FS Joint Poster, Joint Poster Session</td>
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<td>11:30 AM-1:00 PM</td>
<td>JTh2A.1. Generation of Broadband Chaos Signal by Self-injection Monolithic Integrated Mode-beating Amplified Feedback Laser B. Pan; D. Lu; L. Yu; l. zhang; L. Zhao</td>
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<td>11:30 AM-1:00 PM</td>
<td>JTh2A.2. Lithographic VCSEL Reliability Under Extreme Operating Conditions X. Yang; G. Zhao; M. Li; D. Deppe</td>
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<td>11:30 AM-1:00 PM</td>
<td>JTh2A.3. Improved Performance of Tunable Single Mode Laser Array Based on Non Uniformly Spaced Slots A. Abdullaev; Q.Y. Lu; W.H. Guo; M. Wallace; M. Nawrocka; J.O. Callaghan; J. Donegan</td>
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<td>11:30 AM-1:00 PM</td>
<td>JTh2A.4. Arrayed Waveguide Grating Based Monolithic Multi-wavelength Mode-locked Semiconductor Laser s. liu; Q. Ke; M. Sun; D. Lu; R. Zhang; C. Ji</td>
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<td>11:30 AM-1:00 PM</td>
<td>JTh2A.5. Fiber Pump-Delivery System for Spectral Narrowing and Wavelength Stabilization of Broad-Area Lasers</td>
<td>J.P. Leidner; J.R. Marciante</td>
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<td>11:30 AM-1:00 PM</td>
<td>JTh2A.6. Fabrication of Semiconductor Nanomembrane Lasers</td>
<td>J. Diaz; Z. Liu; K. Ding; G. Stracke; J. Schulze; D. Bimberg; C. Ning</td>
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<td>11:30 AM-1:00 PM</td>
<td>JTh2A.7. High performance 2150nm InAs/InGaAs/InP quantum well lasers grown by metalorganic vapor phase epitaxy</td>
<td>L. Shuai; J. Haiming; F. Gao; X. Yang; T. Yang</td>
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<td>11:30 AM-1:00 PM</td>
<td>JTh2A.8. GaSb-based Mid Infrared Photonic Crystal Surface Emitting Laser</td>
<td>C. Pan; C. Lin; T. Chang; T. Lu; C. Lee</td>
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<td>11:30 AM-1:00 PM</td>
<td>JTh2A.9. Modulation-Frequency Dependence of the Phase-Amplitude Coupling in Quantum Dot Lasers</td>
<td>C. Wang; M.A. Osinski; K. Schires; J. Even; F. Grillot</td>
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<td>11:30 AM-1:00 PM</td>
<td>JTh2A.10. Volume Holographic Grating Stabilized 780 nm Ridge Waveguide Laser With an Output Power of 380 mW</td>
<td>S. Rauch; J. Sacher</td>
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<td>11:30 AM-1:00 PM</td>
<td>JTh2A.11. Broadband quantum cascade laser at wavelength λ~10 mm based on continuum-to-continuum design</td>
<td>B. Meng; Y. Zeng; E. Rodriguez; Q. Wang</td>
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<td>11:30 AM-1:00 PM</td>
<td>JTh2A.12. Timing Jitter Reduction of a Passively Mode-Locked External-Cavity Semiconductor Laser Via Repetition Rate Transitions and Optical Feedback</td>
<td>S. Rauch; L. Drzewietzki; A. Klehr; J. Sacher; W. Elsässer; S. Breuer</td>
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<td>11:30 AM-1:00 PM</td>
<td>JTh2A.13. A Modulated Segmented Contact Method for the Measurement of Internal Optical Mode Loss</td>
<td>P. Rees; R. Pascoe; P.M. Smowton; P. Blood</td>
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<td>11:30 AM-1:00 PM</td>
<td>JTh2A.14. The Effect on Dot Gain Behaviour of Confining Layer Composition in InP/(Al)GaInP Quantum Dot Lasers</td>
<td>M. Smith; S. Elliott; M. Kasim; P.M. Smowton; A. Krysa</td>
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<td>11:30 AM-1:00 PM</td>
<td>JTh2A.15. External Cavity Quantum Cascade Laser Based on Fabry-Perot Reflecter</td>
<td>D. Vaitiekus; M. Hemingway; A. Krysa; J. Cockburn; D.G. Revin</td>
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<td>11:30 AM-1:00 PM</td>
<td>JTh2A.16. Femtosecond Laser Repairing of the effects in Glass Materials Induced by Ion Implantation</td>
<td>Q. Cao; J. Zhang</td>
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<td>11:30 AM-1:00 PM</td>
<td>JTh2A.17. Frequency Degenerate Two Beam Coupling In Organic Media Using a Single Nanosecond Pump</td>
<td>J. Slagle; J. Haus; S. Guha; D. McLean; D. Krein</td>
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<td>11:30 AM-1:00 PM</td>
<td>JTh2A.18. Stabilization of Premixed High Flow Speed Methane/air Flames Using a Nanosecond Laser Induced Plasma</td>
<td>X. Li; X. Yu; Y. Yu; R. Fan; D. Chen; R. Sun</td>
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<td>11:30 AM-1:00 PM</td>
<td>JTh2A.19. Photon-stimulated desorption surface spectroscopy by VUV emissions from a laser-produced plasma</td>
<td>M. Kaku; D. Kai; M. Katto; A. Yokotani; W. Sasaki; S. Kubodera</td>
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<td>11:30 AM-1:00 PM</td>
<td>JTh2A.20. Optical Scattering of Airy Beam and Gaussian Beam Through Turbid Medium</td>
<td>R. Hutchins; M. Zhang; L. Ma; P. Yu</td>
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<td>11:30 AM-1:00 PM</td>
<td>JTh2A.21. Generalizing and extending Kubelka-Munk theory</td>
<td>C. Sandoval; A.D. Kim</td>
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<td>11:30 AM-1:00 PM</td>
<td>JTh2A.22. Fano Resonance Structural Color in Patterned Dielectric Surfaces</td>
<td>E. Regan; Y. Shen; M. Soljacic</td>
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<td>11:30 AM-1:00 PM</td>
<td>JTh2A.23. Sm$^{3+}$ Ions Doped Phosphate Glasses for Multiband Visible Laser Applications</td>
<td>N. Jha; K. Linganna; C. Jayasankar; A. Kar</td>
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<td>11:30 AM-1:00 PM</td>
<td>JTh2A.24. GaN-based Ridge Waveguides with Very Smooth and Vertical Sidewalls by ICP Dry Etching and Chemical Etching</td>
<td>W. Li; Y. Luo; B. Xiong; S. Changzheng; W. Lai; J. Wang; H. Yanjun; J. Yan; T. Wei; H. Lu</td>
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<td>11:30 AM-1:00 PM</td>
<td>JTh2A.25. Inband-Pumped Ho:KLu(WO$_4$)$_2/2$ Microchip Laser Q-switched with a PbS-Quantum-Dot-Doped Glass</td>
<td>X. Mateos; P. Loiko; J. Serres; K. Yumashev; A. Malyarevich; A. Onushchenko; V. Petrov; U. Griebner; M. Aguiol; F. Diaz</td>
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<td>11:30 AM-1:00 PM</td>
<td>JTh2A.26. A new type of Yb$^{3+}$ doped fiber with an octagonal-shaped core</td>
<td>W. Yibo; N. zhao; L. Liao; N. Dai; J. Peng; H. Li; J. Li</td>
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<td>11:30 AM-1:00 PM</td>
<td>JTh2A.27. Structural optimization for modulation efficiency enhancement in a top-gated graphene optical modulator</td>
<td>K. Warabi; R. Kou; H. Nishi; S. Tanabe; Y. Kobayashi; T. Yamamoto; K. Yamada; H. Nakajima</td>
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<td>11:30 AM-1:00 PM</td>
<td>JTh2A.28. Growth and Electroluminescent Property of Multi-Facet InGaN/GaN Multiple Quantum Well Light Emitting Device</td>
<td>Y. Li; S. Chang; Y. Cheng; H. Kuo; C. Chang</td>
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<td>11:30 AM-1:00 PM</td>
<td>JTh2A.29. Silicate Spin-on-Glass as an Overcoat Layer for SiO$_2$ Ridge Waveguides</td>
<td>M. Stott; T. Wall; D. Ozcelik; J. Parks; G.G. Meena; E. Hamilton; R. Chu; H. Schmidt; A. Hawkins</td>
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<td>11:30 AM-1:00 PM</td>
<td>JTh2A.30. Fabrication and Characterization of Fiber Waveguides from Single-Crystal Er$^{3+}$-Doped YAG</td>
<td>E.F. Dreyer; L. Stagg; S. Trembath-Reichert; C. Hoef; C.D. Nie; J.A. Harrington; S.C. Rand</td>
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<td>11:30 AM-1:00 PM</td>
<td>JTh2A.31. Strain Relaxation in InGaN/GaN Multiple-Quantum Wells by Nano-Patterned Sapphire Substrates with Smaller Period</td>
<td>P. Chen; V. Su; M. Lee; Y. You; Y. Chen; Z. Hung; T. Hsu; Y. Lin; R. Lin; C. Kuan</td>
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<td>11:30 AM</td>
<td>JTh2A.32</td>
<td>Extraordinary Optical Properties of Atomic-Layer Doped Transparent</td>
<td>D. Lee; J. Kim; G.E. Fernandes; J. Kim; C. Bledt; K. Kim; J. Xu</td>
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<td>Conductive Oxide Superlattice</td>
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<td>11:30 AM</td>
<td>JTh2A.33</td>
<td>Numerical Study of a 10 GHz Optical Flip-Flop Based on a Short</td>
<td>a. abbasi; G. Roelkens; G. Morthier</td>
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<td>Asymmetric DFB Laser</td>
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<td>11:30 AM</td>
<td>JTh2A.34</td>
<td>Dispersion Engineering Employing Curved Space Mapping and Chromo-</td>
<td>H. Park; M. Asghari; B. Jalali</td>
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<td>Modal Excitation</td>
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<td>11:30 AM</td>
<td>JTh2A.35</td>
<td>Integrated Photonic Reservoir Computing based on Hierarchical</td>
<td>H. Zhang; X. Feng; B. Li; Y. Wang; K. Cui; F. Liu; W. Dou; Y. Huang</td>
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<td>Time-multiplexing Structure</td>
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<td>11:30 AM</td>
<td>JTh2A.36</td>
<td>Stable, Tuneable, All-optical Pulse Generation with 1 Hz Phase</td>
<td>A.S. Helmy; F. Li</td>
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<td>Noise</td>
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<td>11:30 AM</td>
<td>JTh2A.37</td>
<td>Metamaterial Electric-LC Resonators on Electro-Optic Modulator for</td>
<td>Y. Wijayanto; A. Kanno; T. Kawanishi</td>
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<td>Wireless THz-Lightwave Signal Conversion</td>
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<td>11:30 AM</td>
<td>JTh2A.38</td>
<td>Robust Large-Port-Count Hybrid Switches with Relaxed Control</td>
<td>Q. Cheng; A. Wonfor; R.V. Penty; I.H. White</td>
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<td>Tolerances</td>
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<td>11:30 AM</td>
<td>JTh2A.39</td>
<td>A Multi-frequency Optoelectronic Oscillator based on a Single</td>
<td>P. Zhou; F. Zhang; S. Pan</td>
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<td>Phase-Modulator</td>
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<td>11:30 AM</td>
<td>JTh2A.40</td>
<td>Pure Single-Sideband Modulation Using High Extinction-Ratio Parallel</td>
<td>Y. Yamaguchi; A. Kanno; T. Kawanishi; M. Izutsu; H. Nakajima</td>
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<td>Mach-Zehnder Modulator with Third-Order Harmonics Superposition</td>
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<td>11:30 AM</td>
<td>JTh2A.41</td>
<td>High-Speed Data Transmission Through Silicon Contra-Directional</td>
<td>M. Caverley; R. Boeck; L. Chrostowski; N.A. Jaeger</td>
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<td>Grating Coupler Optical Add-Drop Multiplexers</td>
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<td>11:30 AM</td>
<td>JTh2A.42</td>
<td>Suppressed XMD in Multi-carrier, RF-amplified RF Photonic Link by</td>
<td>X. Liang; F. Yin; Y. Dai; J. Li; K. Xu</td>
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<td>Cascaded MZMs</td>
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<td>11:30 AM</td>
<td>JTh2A.43</td>
<td>Optical Leaky Wave Antenna Experiment Demonstration and Electronic</td>
<td>Q. Zhao; Y. Huang; C. Guclu; F. Capolino; O. Boyraz</td>
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<td>Modulation Investigation</td>
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<td>JTh2A.44</td>
<td>A Time-to-frequency Converter Utilizing a Modified Time Lens</td>
<td>D. Wang; L. Huo; Y. Xing; C. Lou</td>
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<td>11:30 AM</td>
<td>JTh2A.45</td>
<td>Wide-spectrum-range Power-efficient Compact Thermooptic Switch based</td>
<td>X. Zhang; S. Chakravarty; C. Chung; Z. Pan; R.T. Chen</td>
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<td>on Coupled Photonic Crystal Microcavities</td>
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<td>11:30 AM</td>
<td>JTh2A.46</td>
<td>Permanent Trimming of Silicon Ring Resonator Filters by Thermal</td>
<td>S. Spector; J.M. Knecht; P.W. Juodawlkis</td>
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<td>11:30 AM-1:00 PM</td>
<td>JTh2A.47</td>
<td>High-speed Directly Modulated Laterally-coupled Twin Stripe Lasers for Optical Interconnects</td>
<td>H. Taniguchi; H. Dalir; F. Koyama</td>
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<td>11:30 AM-1:00 PM</td>
<td>JTh2A.48</td>
<td>Photonically-Enabled Microwave Function Generation Via Tailored Distortion</td>
<td>A. Bhatia; H. Ting; M.A. Foster</td>
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<td>11:30 AM-1:00 PM</td>
<td>JTh2A.49</td>
<td>Fiber Nonlinearity Tolerance of Traceback Equalization for Non-Uniformly Distorted QAM Signals</td>
<td>T. Sakamoto; G. Lu; T. Kawanishi</td>
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<td>11:30 AM-1:00 PM</td>
<td>JTh2A.50</td>
<td>Real-time heterodyne-based measurements of fiber laser spectral dynamics</td>
<td>S. Sugavanam; S. Fabbri; T.L. Son; I. Lobach; S.I. Kablukov; S. Khorev; D.V. Churkin</td>
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<td>11:30 AM-1:00 PM</td>
<td>JTh2A.51</td>
<td>Analytical Step-Size Selection Rule for Simulation of Signal Propagation in Vector Optical Fiber Channel</td>
<td>Q. Zhang; L. Xing; H. Min; M. Hayee</td>
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<td>11:30 AM-1:00 PM</td>
<td>JTh2A.52</td>
<td>Novel Unipolar Sign Encoded OFDM for Next Generation PONs</td>
<td>M. Mohammed; Z.A. El-Sahn</td>
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<td>11:30 AM-1:00 PM</td>
<td>JTh2A.53</td>
<td>Evaluation of Nonlinear Interference in Few-Mode Fiber Using the Gaussian Noise Model</td>
<td>A.E. El-Fiqi; A.A. I Ali; Z.A. El-Sahn; H.M. Shalaby; R.K. Pokharel</td>
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<td>JTh2A.54</td>
<td>Fiber-Optic Distribution of Arbitrary Radio-Frequency Waveforms with Stabilized Group Delay</td>
<td>A. Ben Amram; Y. Stern; A. Zadok</td>
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<td>11:30 AM-1:00 PM</td>
<td>JTh2A.55</td>
<td>Symbol Rate Identification Using Asynchronous Delayed Sampling</td>
<td>J. Shang; S. Cui; C. Ke; Z. Xia; S. Fu; D. Liu</td>
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<td>11:30 AM-1:00 PM</td>
<td>JTh2A.56</td>
<td>Frequency Transfer and Time Synchronization Via Urban Fiber</td>
<td>N. Cheng; W. Chen; Q. Liu; D. Xu; F. Yang; Y. Gui; H. Cai</td>
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<td>11:30 AM-1:00 PM</td>
<td>JTh2A.57</td>
<td>Tunable, narrow line-width silicon micro-ring laser source for coherent optical communications</td>
<td>Y. Qiu</td>
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<td>11:30 AM-1:00 PM</td>
<td>JTh2A.58</td>
<td>Frequency Chirp Reducing of a Colorless Laser Diode for 40-Gbit/s 256-QAM OFDM Transmission</td>
<td>C. Tsai; Y. Chi; G. Lin</td>
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<td>11:30 AM-1:00 PM</td>
<td>JTh2A.59</td>
<td>LDPC-Coded 16-Dimensional Modulation Based on the Nordstrom-Robinson Nonlinear Block Code</td>
<td>T. Koike-Akino; D.S. Millar; K. Kojima; K. Parsons; K. Sugihara; Y. Miyata; T. Yoshida</td>
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<td>11:30 AM-1:00 PM</td>
<td>JTh2A.60</td>
<td>Routing Algorithm to Optimize Loss and IPDR for Rearrangeably Non-Blocking Integrated Optical Switches</td>
<td>M. Ding; Q. Cheng; A. Wonfor; R.V. Penty; I.H. White</td>
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<td>11:30 AM-1:00 PM</td>
<td><strong>JTh2A.61. SNR Equalized Optical Direct-Detected OFDM Transmission with CAZAC Equalization</strong> Z. Feng; M. Tang; R. Lin; R. Wang; Q. Wu; L. Zhang; L. Xu; X. Wang; C. Zhou; J. Wu; S. Zhou; L. Deng; S. Fu; D. Liu; P. Shum</td>
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<td>11:30 AM-1:00 PM</td>
<td><strong>JTh2A.62. Performance Metrics for a Free-space Communication Link Based on Multiplexing of Multiple Orbital Angular Momentum Beams with Higher Order Radial Indice</strong> G. Xie; L. Li; Y. Yan; Y. Ren; Z. Zhao; p. liao; N. Ahmed; Z. Wang; N. Ashrafi; S. Ashrafi; R. Linquist; m. tur; a. willner</td>
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<td>11:30 AM-1:00 PM</td>
<td><strong>JTh2A.63. Experimental Demonstration of Using Multi-Layer-Overlay Technique for Increasing Spectral Efficiency to 1.18 bits/s/Hz in a 3 Gbit/s Signal over 4-km Multimode Fiber</strong> G. Xie; C. Bao; Y. Ren; Y. Yan; a. almainan; L. Li; p. liao; Z. Zhao; N. Ahmed; Z. Wang; y. cao; H. Huang; N. Ashrafi; S. Ashrafi; R. Linquist; m. tur; a. willner</td>
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<td><strong>JTh2A.64. Low-Cost In-Band OSNR Monitoring based on Coherent Hybrid in CO-OFDM System</strong> L. Zhang; Z. Feng; R. Wang; R. Lin; L. Xu; X. Wang; C. Zhou; J. Wu; S. Zhou; L. Deng; S. Fu; M. Tang; D. Liu</td>
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<td><strong>JTh2A.65. Sub-Harmonic Injection-Locking of Quantum Dash Laser Through Spectral Enrichment for All-Optical Clock Recovery</strong> M. Srivastava; P.M. Anandarajah; B. Srinivasan; S. O Duill; D. Venkitesh; P. Landais</td>
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<td><strong>JTh2A.66. 56 Gb/s WDM transmitter module based on silicon microrings using comb lasers</strong> H. Füser; A. Giesecke; A. Prinzen; S. Suckow; C. Porschatis; D. Schall; H. Lerch; M.M. Tarar; J. Bolten; T. Wahlbrink; H. Kurz</td>
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<td><strong>JTh2A.67. Experimental Demonstration of Free-Space Optical Communications Using Orbital Angular Momentum (OAM) Array Encoding/Decoding</strong> S. Li; Z. Xu; J. Liu; N. Zhou; Y. Zhao; L. Zhu; F. Xia; J. Wang</td>
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<td><strong>JTh2A.68. Arrays of WSi Superconducting Nanowire Single Photon Detectors for Deep Space Optical Communications</strong> M. Shaw; F. Marsili; A. Beyer; J. Stern; G. Resta; P. Ravindran; S. Chang; J. Bardin; F. Patawaran; V. Verma; R.P. Mirin; S. Nam; W. Farr</td>
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<td><strong>JTh2A.69. A Colorless ONU Scheme for WDM-OFDM-PON with Symmetric Bitrate and Low-cost Direct-detection Receivers</strong> C. Lei; M. Chen; H. Chen; S. Yang; S. Xie</td>
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<td><strong>JTh2A.70. Experimental Demonstration of Bandwidth Reduction using Nyquist Shaped PSK for Flexible udWDM</strong> J. Altabas; J. Lazaro; F. Sotelo; I. Garces</td>
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<td><strong>JTh2A.71. Dynamic Adaptation of Bandwidth Granularity for Multipath Routing in Elastic Optical OFDM Networks</strong> L. Altarawneh; S. Taebi</td>
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<td>JTh2A.72</td>
<td>Study of Methane Saturated Dispersion Resonances Amplitude near 2.36 μm over the Temperature Range 77-300 K</td>
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<td>JTh2A.73</td>
<td>Phase Noise Measurement of Microwave Signal Sources based on Microwave Photonic Technologies</td>
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<td>JTh2A.74</td>
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<td>P. Luo; J. Hu; Y. Feng; L. Wang; J. Shy</td>
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<td>Ultra-Narrow Linewidth, Micro-Integrated Semiconductor External Cavity Diode Laser Module for Quantum Optical Sensors in Space</td>
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<td>L. Huang; W. Peng; W. Zhang; F. Gao; F. Bo; G. Zhang; J. Xu</td>
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<td>JTh2A.84. Dual-parameters sensing based on multimode microfiber with Fresnel reflection</td>
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<td>JTh2A.85. Analysis of signal amplitude in Chirped Laser Dispersion Spectroscopy</td>
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<td>JTh2A.86. Cylindrical multipass reflection cells for optical trace gas sensing</td>
<td>M. Mangold; L. Emmenegger; B. Tuzson; H. Looser</td>
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<td>JTh2A.88. Stand-off Detection of Liquid Thin Films using Active Mid-Infrared Hyperspectral Imaging</td>
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<td>JTh2A.89. Filaments for Raman Spectroscopy</td>
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<td>JTh2A.91. Electronics-assisted ultra-narrow optical filtering and its application in low phase noise lasing</td>
<td>Y. Dai; Z. Zhang; F. Yin; Y. Zhou; J. Li; K. Xu</td>
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<td>JTh2A.92. A New Method of Longitudinal Mode Selection in Q-switched Lasers</td>
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<td>JTh2A.94. Nonlinear Polarization Switching and Preservation Effects in 55 µm Core Polygonal-CCC Fibers</td>
<td>I. Hu; C. Zhu; M. Haines; T. McComb; G. Fanning; R. Farrow; A. Galvanauskas</td>
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<td>JTh2A.95. Novel Design of Simple and Compact Tunable Fiber Laser</td>
<td>Y. Fujimoto; O. Ishii; M. Yamazaki</td>
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<td>JTh2A.96. Spatially-resolved Pulse-front-tilt and Pulse-width Distributions of Q-switched Pulses from an Unstable Nd:YAG Resonator</td>
<td>C. Feng; X. Xu; J. Diels</td>
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<td>JTh2A.97. Single Frequency 310ps, 1.67J Laser Pulses Generation with Nonfocusing-pumped Stimulated Brillouin Scattering</td>
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<td>JTh2A.98. Widely-tunable high-power narrow-linewidth thulium-doped all-fiber superfluorescent source</td>
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<td>JTh2A.99. UV Laser Beam Stabilization System for the European XFEL Electron Injector Laser Beamline F. Kaiser; S. Köhler; F. Peters; L. Winkelmann; I. Hartl</td>
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<td>JTh2A.100. Spectroscopic characterization of Pr^{3+}:ZnSe crystals fabricated via post growth thermal diffusion A. Martinez; O. Gafarov; D. Martyshkin; V.V. Fedorov; S.B. Mirov</td>
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<td>JTh2A.102. Power Scaling of Femtosecond Ti:sapphire Laser Double -Side-Pumped by High-Power Green InGaN Diode Lasers R. Sawada; H. Tanaka; R. Kariyama; K. Hirosawa; F. Kannari</td>
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<td>JTh2A.103. Developed objective system for measuring the visibility of the display with metal mesh as a capacitive touch sensor K.T. Young</td>
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<td>JTh2A.104. Fabrication of Gratings with Low Spacing Error by the Dual-Beam Exposure System with Spherical Lenses S. Wang; L. Zeng</td>
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12:30 PM-2:00 PM, Exhibit Hall (Poster Session Area) (Convention Center), Pizza Lunch at the CLEO: Expo, Exhibit Hall Event

2:00 PM-4:00 PM, Executive Ballroom 210A (Convention Center), ATh3A. Symposium - Science and Technology of Laser Three Dimensional Printing I, Special Symposium, Symposium - Science and Technology of Laser Three Dimensional Printing

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<td>ATh3A.2. Laser Written 3D Lightwave Circuits and Applications S. Gross; N. Riesen; J. Love; M.J. Withford</td>
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<td>ATh3A.3. 3D Printing Sets New Standards in Microfabrication M. Hermatschweiler</td>
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<td>ATh3A.4. Achromatic polarization rotator imprinted in glass by ultrafast laser nanostructuring R. Desmarchelier; M. Lancry; M. Gecevivius; M. Beresna; P. Kazansky; B. Poumellec</td>
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<td>3:45-4:00 PM</td>
<td>ATh3A.5. Characterization of melt-flow dynamics in selective laser melting (SLM) processes M.J. Matthews; S. Rubenchik; G. Guss; n. norman</td>
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2:00 PM-4:00 PM, Executive Ballroom 210B (Convention Center), FTh3B. NV - Centers for Metrology and Photonics, FS Oral, QELS 1: Quantum Optics of Atoms, Molecules and Solids, Presider: Dirk Englund, englund@mit.edu, Massachusetts Institute of Technology

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<td>FTh3B.1. Deterministic High-yield Creation of Nitrogen Vacancy Centers in Diamond Photonic Crystal Cavities and Photonic Elements T. Schroder; L. Li; E. Chen; M. Walsh; M.E. Trusheim; I. Bayn; J. Zheng; S. Mouradian; H. Bakhru; O. Gaathon; D. . Englund</td>
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<td>FTh3B.2. Direct laser writing aligned with nano-diamonds containing NV-centers as single-photon emitters Q. Shi; J. Fischer; P. Rath; B. Sontheimer; A. Schell; W. Pernice; O. Benson; A. Naber; M. Wegener</td>
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<td>FTh3B.3. Efficient collection from a nitrogen-vacancy qubit in a circular grating L. Li; E. Chen; J. Zheng; S. Mouradian; F. Dolde; T. Schroder; S. Karaveli; M. Markham; D. Twitchen; D. . Englund</td>
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<td>FTh3B.4. Strain coupling of diamond nitrogen vacancy centers to nanomechanical resonators S. Meesala; Y. Sohn; H.A. Atikian; M.J. Burek; S. Kim; J. Choy; M. Loncar</td>
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<td>FTh3B.5. Atom–Photon Coupling from Nitrogen-vacancy Centers Embedded in Tellurite Microspheres Y. Ruan; B.C. Gibson; D.W. Lau; A. Greentree; H. Ji; H. Ebendorff-Heidepriem; B.C. Johnson; T. Ohshima; T. Monro</td>
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<td>FTh3B.6. Electrochemical potential control of charge state and fluorescence of nitrogen vacancy centers in nanodiamonds S. Karaveli; O. Gaathon; A. Wolcott; R. Sakakibara; D. Peterka; J.S. Owen; R. Yuste; D. . Englund</td>
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<td>FTh3B.7. Nanoscale Magnetic Imaging using Quantum Defects in Diamond R. Walsworth</td>
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2:00 PM-4:00 PM, Executive Ballroom 210C (Convention Center), FTh3C. Attosecond Spectroscopy, FS Oral, QELS 7: High-Field Physics and Attoscience, Presider: Martin Schultze, martin.schultze@mpq.mpg.de, Max Planck Institut fuer Quantenoptik

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<td>FTh3C.2. Fano Resonances in the Time Domain A. Kaldun; C. Ott; A. Blättermann; T. Ding; A. Fischer; P. Raith; K. Meyer; M. Laux; J. Evers; C.H. Keitel; T. Pfeifer; C.H. Greene</td>
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<td>FTh3C.3. Quantum Beats in Attosecond Transient Absorption of Krypton Autoionizing States Y. Cheng; M. Chini; X. Tong; A. Chew; J. Biedermann; Y. Wu; E. Cunningham ; Z. Chang</td>
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<td>FTh3C.4. Excitation Energy Dependent Attosecond Photoemission Timing in Tungsten M. Jobst; S. Neppl; J. Riemsberger; M. Ossiander; M. Schäffer; E. Bothschafter; M. Gerl; A. Kim; J. Barth; F. Krausz; P. Feulner; R. Kienberger</td>
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<td>FTh3C.5. Attosecond Transient Absorption Explores Coupling Mechanisms of Autoionizing States B. Bernhardt; X. Li; A. Beck; E.R. Warrick; D.J. Haxton; C.W. McCurdy; D.M. Neumark; S.R. Leone</td>
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2:00 PM-4:00 PM, Executive Ballroom 210D (Convention Center), FTh3D. Synthetic Lattices & Topological Phenomena, FS Oral, QELS 5: Nonlinear Optics and Novel Phenomena, Presider: Alexander Szameit, alexander.szameit@uni-jena.de, Friedrich-Schiller-Universität Jena
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<td>Supersymmetric Laser Arrays</td>
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2:00 PM-4:00 PM, Executive Ballroom 210E (Convention Center), **FTh3E. Light Harvesting and Electroplasmonics**, FS Oral, **QELS 6: Nano-Optics and Plasmonics**

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<td>FTh3E.6</td>
<td>Integrated On-Chip Silicon Plasmonic Four Quadrant Detector in the</td>
<td>M.Y. Grajower; N. Mazurski; B. Desiatov; U. Levy</td>
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<td>3:45-4:00 PM</td>
<td>FTh3E.7. Controlling Plasmon Drag with Illumination and Surface Geometry</td>
<td>N. Noginova; V. Rono; A. Jackson; M. Durach</td>
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<td>2:00 PM-4:00 PM, Executive Ballroom 210F (Convention Center), STh3F. Microwave Photonic Devices, S&amp;I Oral, CLEO S&amp;I 9: Components, Integration, Interconnects and Signal Processing, Presider: Mark Foster, <a href="mailto:mark.foster@jhu.edu">mark.foster@jhu.edu</a>, Johns Hopkins University</td>
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<td>2:00-2:15 PM</td>
<td>STh3F.1. Linearized Intensity-Modulation Link by a Direct-Detection Intermodulation-Compensation Receiver</td>
<td>D. Tu; F. Yin; X. Liang; Y. Dai; J. Li; K. Xu</td>
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<td>2:15-2:30 PM</td>
<td>STh3F.2. Frequency Band Selectable Microwave Photonic Multiband Bandpass Filter based on Lyot filter</td>
<td>J. Ge; M.P. Fok</td>
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<td>2:30-3:00 PM</td>
<td>STh3F.3. Silicon-photonics-based Signal Processing for Microwave Photonic Frontends</td>
<td>M. Chen; H. Yu; J. Wang; H. Chen; S. Yang; S. Xie</td>
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<td>3:00-3:15 PM</td>
<td>STh3F.4. Tunable Microwave Photonic Phase Shifter Using On-Chip Stimulated Brillouin Scattering</td>
<td>M. Pagani; D. Marpaung; D. Choi; S. Madden; B. Luther-Davies; B.J. Eggleton</td>
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<td>3:15-3:30 PM</td>
<td>STh3F.5. Photonic Generation of High-Power Pulsed Microwave Signals with Peak Powers up to 14.2 Watt</td>
<td>X. Xie; K. Li; Q. Li; A. Beling; J.C. Campbell</td>
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<td>3:30-3:45 PM</td>
<td>STh3F.6. Impact of the Coulomb Interaction on the Franz-Keldysh Effect in a High-Current Photodetector</td>
<td>Y. Hu; C.R. Menyuk; M. Hutchinson; V.J. Urick; K.J. Williams</td>
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<td>3:45-4:00 PM</td>
<td>STh3F.7. Improved Carrier-to-Sideband Ratio for Free Space Millimeter Wave-Coupled Electro-Optic Polymer High Speed Phase Modulators</td>
<td>D. Park; V.R. Pagán; T.E. Murphy; J. Luo; A.K. Jen; W.N. Herman</td>
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<td>2:00 PM-4:00 PM, Executive Ballroom 210G (Convention Center), STh3G. Fabrication Techniques I, S&amp;I Oral, CLEO S&amp;I 6: Optical Materials, Fabrication &amp; Characterization, Presider: Amy Foster, <a href="mailto:amy.foster@jhu.edu">amy.foster@jhu.edu</a>, Johns Hopkins University</td>
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<td>2:00-3:00 PM</td>
<td>STh3G.1. Heterogeneous 2D and 3D Photonic Integration for Future Chip-Scale Microsystems</td>
<td>S. Yoo</td>
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<td>3:00-3:15 PM</td>
<td>STh3G.2. Fabrication of Gray-Scale Semiconductor Structures with Dynamic Digital Projection Photochemical Etching</td>
<td>K. Wang; C. Edwards; S.N. Srivastava; L.L. Goddard</td>
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<td>3:15-3:30 PM</td>
<td>STh3G.3. Ultra-High Q Silicon Resonators In Planarized LOCOS</td>
<td>A. Naiman; B. Desiatov; L. Stern; N. Mazurski; J. Shapir; U. Levy</td>
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<td>3:30-3:45 PM</td>
<td>STh3G.4. Improvement of Silicon Dioxide Ridge Waveguides Using Low Temperature Thermal Annealing</td>
<td>J. Parks; H. Cai; T. Wall; M. Stott; R. Chu; E. Hamilton; A. Hawkins; H. Schmidt</td>
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<td>3:45-4:00 PM</td>
<td>STh3G.5. Photonic Damascence Process for high-Q SiN Microresonator Fabrication for Nonlinear Photonics M. Pfeiffer; A. Kordts; V. Brasch; C. Lecaplain; J.D. Jost; M. Geiselmann; t. kippenberg</td>
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<td>2:00 PM-4:00 PM, Executive Ballroom 210H (Convention Center), STh3H. Materials and Devices for Nonlinear Frequency Upconversion, S&amp;I Oral, CLEO S&amp;I 4: Nonlinear Optical Technologies, Presider: Antoine Godard, <a href="mailto:antoine.godard@onera.fr">antoine.godard@onera.fr</a>, ONERA - The French Aerospace Lab</td>
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<td>2:00-2:30 PM</td>
<td>STh3H.1. Nonlinear Optical Processes and DUV Generation in Random Domain Structures of SBO A.S. Aleksandrovsky</td>
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<td>2:30-2:45 PM</td>
<td>STh3H.2. Generation of Coherent Vacuum UV Radiation in Randomly Quasi-Phase-Matched Strontium Tetraborate P. Trabs; F. Noack; A.S. Aleksandrovsky; A. Zaitsev; V. Petrov</td>
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<td>2:45-3:00 PM</td>
<td>STh3H.3. Frequency Conversion in Periodically Oriented Gallium Nitride S.R. Bowman; C.G. Brown; J. Hite; F.J. Kub; C. Eddy; I. Vurgaftman; J.R. Meyer; J.H. Leach; K. Udwary</td>
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<td>3:00-3:15 PM</td>
<td>STh3H.4. Violet second harmonic generation in adhered slab waveguide based on periodically poled lithium tantalate H. LIM; S. Kurimura; K. Fujii; M. Okano; S. Takeuchi</td>
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<td>3:15-3:30 PM</td>
<td>STh3H.5. PP-LBGO device with 2nd-order QPM structure for 266nm generation J. Hirohashi; T. Taniuchi; K. Imai; Y. Furukawa</td>
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<td>3:30-3:45 PM</td>
<td>STh3H.6. Tunable Second Harmonic Generation of a Continuous-wave Carbon Dioxide Laser Using 3 mm Thick Orientation Patterned GaAs Crystals in Fan-out and Single-grating-period Configurations S. Guha; J. Barnes; L.P. Gonzalez; P.G. Schunemann</td>
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<td>3:45-4:00 PM</td>
<td>STh3H.7. Third harmonic generation in ultrathin epsilon-near-zero media T. Luk; D. de Ceglia; G. Keeler; R.P. Prasankumar; M.A. Vincenti; S. Liu; M. Scalora; M.B. Sinclair; S. Campione</td>
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<td>2:00 PM-4:00 PM, Meeting Room 211 B/D (Convention Center), STh3I. Optomechanics I, S&amp;I Oral, CLEO S&amp;I 7: Micro- and Nano-Photonic Devices</td>
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<td>2:00-2:15 PM</td>
<td>STh3I.1. Diamond Electro-optomechanical Devices with Resonance Frequencies above 100 MHz P. Rath; S. Ummethala; S. Diewald; G. Lewes-Malandrakis; D. Brink; N. Heidrich; C. Nebel; W. Pernice</td>
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<td>2:15-2:30 PM</td>
<td>STh3I.2. GaAs nanobeam piezo-optomechanical crystals K.C. Balram; M.I. Davanco; J. Lim; J. Song; K. Srinivasan</td>
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<td>2:30-2:45 PM</td>
<td>STh3I.3. Diamond Nanobeam Waveguide Optomechanics B. Khanaliloo; H. Jayakumar; D. Lake; P.E. Barclay</td>
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<td>2:45-3:00 PM</td>
<td>STh3I.4. Enhanced Coupling in Si$_3$N$_4$ Slot-Mode Optomechanical Crystals via Stress Tuning K. Grutter; M.I. Davanco; K. Srinivasan</td>
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| 3:00-3:15 PM | STh3I.5. Subharmonics radio-frequency division in chip-scale optomechanical oscillators  
J. Wu; Y. Huang; M. Yu; D. Kwong; C. Wong |
| 3:15-3:30 PM | STh3I.6. Synchronization and Phase Noise Reduction in Arrays of Optomechanical Oscillators  
M. Zhang; M. Lipson |
| 3:30-3:45 PM | STh3I.7. Frequency instability and phase noise characterization of an integrated chip-scale optomechanical oscillator  
Y. Huang; J. Wu; X. Luan; S. Huang; M. Yu; G. Lo; D. Kwong; G. Wen; C. Wong |
| 3:45-4:00 PM | STh3I.8. Multi-stable Synchronization of Delay-Coupled Optomechanical Oscillators  
S.Y. Shah; M. Zhang; M. Lipson |

2:00 PM-4:00 PM, Meeting Room 212 A/C (Convention Center), ATh3J. Clinical Technologies and Systems I, A&T Oral, CLEO A&T 1: Biomedical Applications, Presider: Jin Kang, jkang@jhu.edu, Johns Hopkins University

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| 2:00-2:30 PM | ATh3J.1. Finding Bugs in your Ear: Clinical Imaging of Middle-Ear Infections and Biofilms using OCT  
S.A. Boppart |
| 2:30-3:00 PM | ATh3J.2. Integrative Advances for OCT-Guided Ophthalmic Surgery and Intraoperative OCT  
Y.K. Tao; M. El-Haddad; S. Srivastava; D. Feiler; A. Noonan; A. Rollins; J. Ehlers |
| 3:00-3:15 PM | ATh3J.3. Deuterated Cholesterol Uptake Revealed With Stimulated Raman Microscopy  
A. Alfonso Garcia; S. Pfisterer; H. Riezman; E. Ikonen; E.O. Potma |
| 3:15-3:30 PM | ATh3J.4. Dynamic vocal fold imaging by integrating optical coherence tomography with laryngeal high-speed video endoscopy  
G. Maguluri; N. Iftimia |
| 3:30-3:45 PM | ATh3J.5. Imaging Patient Derived Breast Cancer Xenografts in an Orthotopic Mammary Window Chamber Model  
H.M. Leung; R. Schafer; A.F. Gmitro |
| 3:45-4:00 PM | ATh3J.6. Highly Selective VOC Breath Analysis Using a 3.3 μm Broadly-Tunable VECSEL  
J. Jágerská; H. Looser; B. Tuzson; F. Felder; L. Tappy; L. Emmenegger |

2:00 PM-4:00 PM, Meeting Room 212 B/D (Convention Center), STh3K. Novel Microscopy Techniques and OCT, S&I Oral, CLEO S&I 10: Biophotonics and Optofluidics, Presider: Chulmin Joo, cjoo@yonsei.ac.kr, Yonsei University; Chulmin Joo, cjoo@yonsei.ac.kr, Yonsei University

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| 2:00-2:30 PM | STh3K.1. Brillouin microscopy for tissue and cell biomechanics  
G. Scarcelli |
| 2:30-2:45 PM | STh3K.2. Enhanced Detection of Longitudinal Field of a Radially Polarized Beam in Confocal Laser Microscopy  
Y. Kozawa; S. Sato |
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<td>2:45-3:00 PM</td>
<td>STh3K.3</td>
<td>Towards Automated Detection of Basal Cell Carcinoma from Polarization Sensitive Optical Coherence Tomography Images of Human Skin</td>
<td>T. Marvdashti; L. Duan; K. Ransohoff; S. Aasi; J. Tang; A. Ellerbee</td>
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<td>3:00-3:15 PM</td>
<td>STh3K.4</td>
<td>Phase-inverted sidelobe-annihilated optical coherence tomography to break through the temporal diffraction limit</td>
<td>C. Zhang; K. Wong</td>
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<td>3:15-3:30 PM</td>
<td>STh3K.5</td>
<td>Ultrafast spectral-domain optical coherence tomography realized by parametric spectro-temporal analyzer</td>
<td>C. Zhang; X. Wei; Y. Xu; J. Xu; L. Yu; B. Li; S. Tan; A. Lau; X. Wang; X. Xu; K.K. Tsia; K. Wong</td>
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<td>3:30-3:45 PM</td>
<td>STh3K.6</td>
<td>Photothermal detection of single nanoparticle by using single element interferometer</td>
<td>Y. Nagata; Y. Mizutani; T. Iwata; Y. Otani</td>
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<td>3:45-4:00 PM</td>
<td>STh3K.7</td>
<td>Dynamic Label-free Imaging of Live-cell Adhesion Using Photonic Crystal Enhanced Microscopy (PCEM)</td>
<td>Y. Zhuo; J.S. Choi; H. Yu; B.A. Harley; B.T. Cunningham</td>
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2:00 PM-4:00 PM, Salon III (Marriott), STh3M. Fundamental Light-material Interaction I, S&I Oral, CLEO S&I 1: Light-Matter Interactions and Materials Processing, Presider: Emmanuel Haro-Poniatowski, haro@xanum.uam.mx, Physics Department, UAM-Iztapalapa

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<td>2:00-2:15 PM</td>
<td>STh3M.1</td>
<td>Rapid and highly-sensitive detection using Fano resonances in ultrathin plasmonic nanogratings</td>
<td>B. Zeng</td>
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<td>2:15-2:30 PM</td>
<td>STh3M.2</td>
<td>Far-field Scattering Measurement of a Single Gold Nanorod Using Total-Internal-Reflection Illumination</td>
<td>D. Kim; K. Jeong; H. Ee; H. Park; M. Seo</td>
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<td>2:30-2:45 PM</td>
<td>STh3M.3</td>
<td>Fabrication of high-Q lithium niobate microresonators using femtosecond laser micromachining for second harmonic generation</td>
<td>J. Lin; Y. Xu; Z. Fang; M. Wang; J. Song; N. Wang; L. Qiao; W. Fang; Y. Cheng</td>
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<td>2:45-3:00 PM</td>
<td>STh3M.4</td>
<td>Cavity-Enhanced Mid-IR Optical Frequency Comb Spectroscopy: Enhanced Time and Spectral Resolution</td>
<td>O.H. Heckl; B. Spaun; P.B. Changala; B. Bjork; D. Patterson; J.M. Doyle; J. Ye</td>
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<td>3:00-3:15 PM</td>
<td>STh3M.5</td>
<td>3D Laser Ablation of Biocompatible Silk Fibroin Hydrogels for Biomedical Applications</td>
<td>M. Applegate; B.P. Partlow; J. Coburn; J. Moreau; B. Marelli; D. Kaplan; F. Omenetto</td>
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<td>3:15-3:30 PM</td>
<td>STh3M.6</td>
<td>Super-resolution Optical Nanolithography: Beyond the far-field diffraction limit</td>
<td>A. Majumder; F. Masid; B. Pollock; T. Andrew; R. Menon</td>
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<td>3:30-3:45 PM</td>
<td>STh3M.7</td>
<td>The optical absorption in zincblende and wurtzite GaP nanowire polytypes</td>
<td>M. Aghaeipour; N. Anttu; G. Nylund; L. Samuelson; S. Lehmann; M. Pistol</td>
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<td>3:45-4:00 PM</td>
<td>STh3M.8</td>
<td>Strong exciton-photon coupling in monolayer heterostructures in tunable microcavities</td>
<td>S. Schwarz; S. Dufferwiel; F. Withers; A. Trichet; F. Li; C. Clark; K. Novoselov; J.M. Smith; M.S. Skolnick; D.N. Krizhanovskii; A. Tartakovskii</td>
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2:00 PM-4:00 PM, Salon I-II (Marriott), STh3L. Ultrafast Fiber Lasers, S&I Oral, CLEO S&I 8: Ultrafast Optics, Optoelectronics & Applications, Presider: Peter Fendel, pfendel@thorlabs.com, Thorlabs Inc

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<td>2:00-2:15 PM</td>
<td>STh3L.1</td>
<td>All-fiber bidirectional optical parametric oscillator for precision rotation sensing</td>
<td>R. Gowda; N. Nguyen; J. diels; R. Norwood; N. Peyghambarian; K.Q. Kieu</td>
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<td>2:15-2:30 PM</td>
<td>STh3L.2</td>
<td>Pulse-to-pulse spectral evolution of breathing bound solitons in a mode-locked fiber laser</td>
<td>S. Sugavanam; C. Mou; J. Peng; D.V. Churkin</td>
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<td>2:30-2:45 PM</td>
<td>STh3L.3</td>
<td>Dissipative soliton thulium fiber laser with pulse energy above 10 nJ</td>
<td>Y. Tang; F.W. Wise</td>
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<td>STh3L.4</td>
<td>Observing the spectral dynamics of a mode-locked laser with ultrafast parametric spectro-temporal analyzer</td>
<td>X. Wei; C. Zhang; B. Li; K. Wong</td>
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<td>STh3L.5</td>
<td>Nonlinearity Engineering of Ultrafast Lasers and Laser-Material Interactions</td>
<td>F. Ilday</td>
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2:00 PM-4:00 PM, Salon IV (Marriott), STh3N. Time and Frequency Transfer, S&I Oral, CLEO S&I 14: Optical Metrology, Presider: Jungwon Kim, jungwon.kim@kaist.ac.kr, Korea Advanced Inst of Science & Tech

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<td>STh3N.1</td>
<td>Ultra-low Jitter Timing Transfer over a Multi-km Fiber Network with 10^-21 Relative Stability</td>
<td>K. Shafak; M. Xin; M.Y. Peng; F.X. KAERTNER</td>
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<td>2:15-2:30 PM</td>
<td>STh3N.2</td>
<td>Simultaneous Time and Frequency Transfer over a 158-km Long Fiber Network Using a Mode-Locked Laser</td>
<td>M. Lessing; H.S. Margolis; C. Brown; G. Marra</td>
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<td>2:30-2:45 PM</td>
<td>STh3N.3</td>
<td>Ultrastable Frequency Dissemination Based on Feed-forward Digital Phase Compensation Technology</td>
<td>X. Chen; J. Zhang; J. Lu; Y. Cui; X. Lu; Z. Lv; X. Tian; C. Ci; B. Liu; H. Wu; T. Tang; K. Shi; Z. Zhang</td>
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<td>STh3N.4</td>
<td>Phase Stabilized Radio Frequency Signal Transmission via Optical Fiber Link</td>
<td>A. Zhang; F. Yin; Y. Dai; J. Li; K. Xu</td>
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<td>STh3N.5</td>
<td>Frequency and Timing Distribution using Optical Methods</td>
<td>N.R. Newbury</td>
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<td>2:00 PM-4:00 PM</td>
<td>salon V &amp; VI (Marriott), STh3O. Remote and Standoff Optical Detection, S&amp;I Oral, CLEO S&amp;I 13: Active Optical Sensing</td>
<td>Presider: Michael Wojcik, <a href="mailto:michael.wojcik@sl.usu.edu">michael.wojcik@sl.usu.edu</a>, Space Dynamics Laboratory</td>
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<td>2:00-2:15 PM</td>
<td>STh3O.1. Monostatic All-Fiber Rangefinder System</td>
<td>J. Leach; S.R. Chinn; L. Goldberg</td>
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<td>2:15-2:30 PM</td>
<td>STh3O.2. Continuous-Wave Laser Range Finder Based on Incoherent Compression of Periodic Sequences</td>
<td>N. Arbel; L. Hirschbrand; S. Weiss; N. Levanon; A. Zadok</td>
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<td>2:45-3:00 PM</td>
<td>STh3O.4. Rapid Swept-Wavelength External Cavity Quantum Cascade Laser for Open Path Sensing</td>
<td>B. Brumfield; M.C. Phillips</td>
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<td>3:00-3:15 PM</td>
<td>STh3O.5. Low Power Integrated Path Differential Absorption Lidar Detection of CO₂, CH₄, and H₂O over a 5.5 km Path using a Waveform Driven EO Sideband Spectrometer</td>
<td>D.F. Plusquellic; G. Wagner; S. Maxwell; K. Douglass; D. Long; J.T. Hodges; A.J. Fleisher</td>
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<td>3:15-3:30 PM</td>
<td>STh3O.6. Progress toward a high-resolution single-photon camera based on superconducting single photon detector arrays and compressive sensing</td>
<td>T. Gerrits; S. Allman; D. Lum; V. Verma; J. Howell; R.P. Mirin; S. Nam</td>
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<td>3:30-3:45 PM</td>
<td>STh3O.7. Computational Optical Density-Density Correlation Sensing</td>
<td>M. Akhlaghi Bouzan; A. Dogariu</td>
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<td>3:45-4:00 PM</td>
<td>STh3O.8. Standoff Detection of Buried Landmines Using Genetically Engineered Fluorescent Bacterial Sensors</td>
<td>Y. Kabessa; O. Eyal; O. Bar-On; S. Yagur-Kroll; S. Belkin; A. Agranat</td>
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<td>4:30 PM-6:30 PM</td>
<td>Executive Ballroom 210A (Convention Center), ATh4A. Symposium - Science and Technology of Laser Three Dimensional Printing II, Special Symposium, Symposium - Science and Technology of Laser Three Dimensional Printing</td>
<td>Presider: Yves Bellouard, <a href="mailto:yves@bellouard.eu">yves@bellouard.eu</a>, Ecole Polytechnique Federale de Lausanne</td>
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<tr>
<td>4:30-5:00 PM</td>
<td>ATh4A.1. Strategies for Nanofabrication based on Optothermal Manipulation of Plasmonic Nanoparticles</td>
<td>T. Lohmüller</td>
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<td>5:00-5:30 PM</td>
<td>ATh4A.2. Multiphoton Processing Technologies for Applications in Biology and Tissue Engineering</td>
<td>J. Tørgersen; A. Ovsianikov; R. Liska; J. StampfI</td>
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<td>5:30-6:00 PM</td>
<td>ATh4A.3. Hybrid Subtractive and Additive Micromanufacturing using Femtosecond Laser for Fabrication of True 3D Biochips</td>
<td>K. Sugioka; D. Wu; J. Xu; F. Sima; K. Midorikawa</td>
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<td>4:30 PM-6:30 PM</td>
<td>Executive Ballroom 210B (Convention Center), FTh4B. Quantum Memories, FS Oral, QELS 1: Quantum Optics of Atoms, Molecules and Solids, Presider: Irina Novikova, <a href="mailto:inovikova@physics.wm.edu">inovikova@physics.wm.edu</a>, College of William &amp; Mary</td>
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<td>4:30-4:45 PM</td>
<td>FTh4B.1</td>
<td>Bad Cavities for Good Memories: Storing Broadband Photons with Low Noise</td>
<td>J. Nunn; T.F. Champion; J. Munns; C. Qiu; D. Saunders; I.A. Walmsley</td>
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<td>4:45-5:00 PM</td>
<td>FTh4B.2</td>
<td>Complete Control of Frequency-Time Correlation of Narrow-Band Biphotos</td>
<td>Y. Cho; K. Park; J. Lee; Y. Kim</td>
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<td>5:00-5:15 PM</td>
<td>FTh4B.3</td>
<td>Optical Nanofibers as Light-Matter Interfaces for Quantum Networks</td>
<td>B. Gouraud; D. Maxein; A. Nicolas; O. Morin; J. Laurat</td>
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<td>5:15-5:30 PM</td>
<td>FTh4B.4</td>
<td>THz-bandwidth molecular memories for light</td>
<td>P.J. Bustard; J. Erskine; D. England; R. Lausten; B. Sussman</td>
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<td>5:30-5:45 PM</td>
<td>FTh4B.5</td>
<td>Storage and retrieval of ultrafast single photons using a room-temperature diamond quantum memory</td>
<td>K. Fisher; D. England; J. Maclean; P. Bustard; R. Lausten; K.J. Resch; B. Sussman</td>
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<td>5:45-6:00 PM</td>
<td>FTh4B.6</td>
<td>Scalable Integration of Solid State Quantum Memories into a Photonic Network</td>
<td>S.L. Mouradian; T. Schroder; C.B. Poitras; L. Li; J. Goldstein; E. Chen; J. Zheng; I. Bay; J. Mower; N.C. Harris; A. Dane; K.K. Berggren; M. Lipson; D. . Englund</td>
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<td>6:00-6:15 PM</td>
<td>FTh4B.7</td>
<td>Towards Detection of Single Rare-Earth-Ions in a Nanophotonic Resonator</td>
<td>T. Zhong; J. Kindem; E. Miyazono; A. Faraon</td>
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<td>6:15-6:30 PM</td>
<td>FTh4B.8</td>
<td>Coupling an erbium spin ensemble to a 3D superconducting cavity at zero magnetic field</td>
<td>Y. Chen; X. Fernandez-Gonzalvo; J. Longdell</td>
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<td>4:30-6:30 PM</td>
<td>FTh4C</td>
<td>Attosecond Dynamics and Strong-field Interactions</td>
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<td>4:30-4:45 PM</td>
<td>FTh4C.1</td>
<td>Attosecond Spectroscopy of Band-gap Dynamics</td>
<td>M. Schultze; K. Ramasesha; A. Sommer; D. Pemmaraju; S. Sato; D. Whitmore; A. Gandman; J.S. Prell; L.J. Borja; D. Prendergast; D.M. Neumark; S.R. Leone; F. Krausz; E. Bothschafter; K. Yabana</td>
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<td>4:45-5:00 PM</td>
<td>FTh4C.2</td>
<td>Using Attosecond Transient Absorption to Study Non-Adiabatic Molecular Dynamics</td>
<td>C. Liao; X. Li; D.J. Haxton; C.W. McCurdy; A. Sandhu</td>
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<td>5:00-5:15 PM</td>
<td>FTh4C.3</td>
<td>Photoionization Time Delay Dynamics in Noble Gas</td>
<td>S. Heuser; M. Sabbar; R. Boge; M. Lucchini; L. Gallmann; C. Cirelli; U. Keller</td>
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<td>5:15-5:30 PM</td>
<td>FTh4C.4</td>
<td>Structure Tomography of Argon Trimer with Laser-Driven Coulomb Explosion Imaging</td>
<td>C. Wu; X. Xie; Q. Gong</td>
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<td>5:30-5:45 PM</td>
<td><strong>FTh4C.5. Explosion Dynamics of Methane Clusters Irradiated by 38 nm XUV Laser Pulses</strong> A.M. Helal; S. Bruce; H.J. Quevedo; A.C. Bernstein; J. Keto; T. Ditmire</td>
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<td>5:45-6:00 PM</td>
<td><strong>FTh4C.6. Direct Observation of Rescattering from Strong Field Ionization by Two-Color Circularly Polarized Laser Fields</strong> C.A. Mancuso; D. Hickstein; P. Grychtol; R. Knut; O. Kfir; X. Tong; F. Dollar; D. Zuszin; M. Gopalakrishnan; C. Gentry; E. Turgut; J. Ellis; M. Chen; A. Fleischer; O. Cohen; H.C. Kapteyn; M.M. Murnane</td>
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<td>6:00-6:15 PM</td>
<td><strong>FTh4C.7. Sub-Ångström Scale Imaging of Aligned Acetylene</strong> B. Wolter; M.G. Pullen; A. Le; M. Baudisch; M. Sclafani; H. Pires; M. Hemmer; A. Senftleben; C. Schröter; J. Ullrich; R. Moshammer; C. Lin; J. Biegert</td>
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<td>6:15-6:30 PM</td>
<td><strong>FTh4C.8. Observation of High-Lying Rydberg States Survived from Strong Field Interaction</strong> S. Larimian; S. Erattupuzha; R. Maurer; C. Lemell; S. Nagele; S. Yoshida; J. Burgdörfer; A. Baltuska; M. Kitzler; X. Xie</td>
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<td>4:30 PM-6:30 PM</td>
<td><strong>Executive Ballroom 210D (Convention Center), FTh4D. Quantum and Fundamental Phenomena, FS Oral, QELS 5: Nonlinear Optics and Novel Phenomena,</strong> Presider: Zhigang Chen, <a href="mailto:zhigang@sfsu.edu">zhigang@sfsu.edu</a>, San Francisco State University</td>
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<td>4:30-5:30 PM</td>
<td><strong>FTh4D.1. Probing and Controlling Quantum Matter in Crystals of Light</strong> I. Bloch</td>
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<td>5:30-5:45 PM</td>
<td><strong>FTh4D.2. Bloch Oscillations of Einstein-Podolsky-Rosen States</strong> M. Lebugle; M. Gräfe; R. Heilmann; A. Perez-Leija; S. Nolte; A. Szameit</td>
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<td>5:45-6:00 PM</td>
<td><strong>FTh4D.3. Optically tunable entangled photon state generation in a nonlinear directional coupler</strong> F. Setzpfandt; A.S. Solntsev; J. Titchener; C.W. Wu; C. Xiong; T. Pertsch; R. Schiek; D.N. Neshev; A.A. Sukhorukov</td>
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<td>6:00-6:15 PM</td>
<td><strong>FTh4D.4. Nondegenerate Two-Photon Gain in GaAs</strong> M. Reichert; D.J. Hagan; E.W. Van Stryland</td>
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<td>6:15-6:30 PM</td>
<td><strong>FTh4D.5. Optical Bistability in Electrically Driven Polariton Condensates</strong> M. Amthor; T. Liew; C. Metzger; S. Brodbeck; L. Worschech; M. Kamp; I. Shelykh; A. Kavokin; C. Schneider; S. Höfling</td>
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<td>4:30 PM-6:30 PM</td>
<td><strong>Executive Ballroom 210E (Convention Center), FTh4E. Nanophotonics for Thermal Transfer and Waveguiding, FS Oral, QELS 6: Nano-Optics and Plasmonics,</strong></td>
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<td>4:30-5:00 PM</td>
<td><strong>FTh4E.1. Near-Field Radiative Heat Transfer between Integrated Nanostructures using Silicon Carbide</strong> R. St-Gelais; L. Zhu; B. Guha; S. Fan; M. Lipson</td>
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<td>5:00-5:15 PM</td>
<td>FTh4E.2</td>
<td>The analog of superradiant emission in quantum emitters leads to the well-known superradiant</td>
<td>M. Zhou; S. Yi; T. Luk; Q. Gan; Z. Yu</td>
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<td>5:15-5:30 PM</td>
<td>FTh4E.3</td>
<td>Near complete violation of detailed balance in thermal radiation</td>
<td>L. Zhu; S. Fan</td>
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<td>5:30-5:45 PM</td>
<td>FTh4E.4</td>
<td>Controlling Guided Waves In Telecom Waveguides Using One Dimensional Phased Antenna Arrays</td>
<td>Z. Li; M. Kim; N. Yu</td>
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<td>5:45-6:00 PM</td>
<td>FTh4E.5</td>
<td>Epsilon-near zero wave diffraction in the optical domain</td>
<td>D. Ploss; A. Kriesch; J. Naeger; U. Peschel</td>
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<td>6:00-6:15 PM</td>
<td>FTh4E.6</td>
<td>Coupling Control Based on Adiabatic Elimination in Densely Integrated Nano-Photonics</td>
<td>M. Mrejen; H. Suchowski; T. Hatakeyama; C. Wu; L. Feng; K. O'Brien; Y. Wang; X. Zhang</td>
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<td>6:15-6:30 PM</td>
<td>FTh4E.7</td>
<td>Plasmonic Waveguide Array: Simulating Topological Photonic States and Massless Dirac Fermion</td>
<td>Q. Cheng; T. Li</td>
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<td>4:30 PM-6:30 PM</td>
<td>STh4F</td>
<td>Photonic, Microwave Signal Processing, S&amp;I Oral, CLEO S&amp;I 9: Components, Integration, Interconnects and Signal Processing, Presider: Takahide Sakamoto, <a href="mailto:tsaka@nict.go.jp">tsaka@nict.go.jp</a>, NICT</td>
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<td>4:30-4:45 PM</td>
<td>STh4F.1</td>
<td>DPSK Demodulation Using Coherent Perfect Absorption</td>
<td>R.R. Grote; J.M. Rothenberg; J.B. Driscoll; R.M. Osgood</td>
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<td>4:45-5:00 PM</td>
<td>STh4F.2</td>
<td>Continuous 119.2-GSample/s Photonic Compressed Sensing of Sparse Microwave Signals</td>
<td>J. Stroud; B. Bosworth; D. Tran; T. McKenna; T. Clark; T. Tran; S. Chin; M.A. Foster</td>
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<td>5:00-5:15 PM</td>
<td>STh4F.3</td>
<td>Experimental Demonstration of Arbitrary Waveform Generation Using Anamorphic Stretch Transform</td>
<td>G. hongbiao; M. Asghari; B. Jalali</td>
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<td>5:15-5:30 PM</td>
<td>STh4F.4</td>
<td>Novel Photonic Radio-frequency Arbitrary Waveform Generation based on Photonic Digital-to-Analog Conversion with Pulse Carving</td>
<td>J. Liao; B. Chen; S. Li; X. Yang; X. Zheng; H. Zhang; B. Zhou</td>
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<td>5:30-5:45 PM</td>
<td>STh4F.5</td>
<td>All-Optical Optomechanical Modulation Enabling Real-Time Signal Tracking</td>
<td>J. Huang; B. Dong; H. Cai; J. Wu; T. Chen; Y. Gu; A. LIU</td>
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<td>5:45-6:00 PM</td>
<td>STh4F.6</td>
<td>Towards Highly Linear Intensity Modulator for High Resolution Photonic ADCs Using a Three-Section Mode-Locked Laser</td>
<td>E. Sarailou; P.J. Delfyett</td>
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<td>6:00-6:15 PM</td>
<td>STh4F.7</td>
<td>On-Chip Instantaneous Microwave Frequency Measurement System based on a Waveguide Bragg Grating on Silicon</td>
<td>M. Burla; X. Wang; M. Li; L. Chrostowski; J. Azaña</td>
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<td>4:30 PM-6:30 PM</td>
<td>STh4G. Fabrication Techniques II, S&amp;I Oral, CLEO S&amp;I 6: Optical Materials, Fabrication &amp; Characterization, Presider: Zhaowei Liu, <a href="mailto:zhaowei@ucsd.edu">zhaowei@ucsd.edu</a>, University of California, San Diego</td>
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<td>4:30-4:45 PM</td>
<td>STh4G.1. Metamaterials Assembled by Light</td>
<td>S. Yang; X. Ni; X. Yin; B. KANTE; Y. Wang; X. Zhang</td>
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<td>4:45-5:00 PM</td>
<td>STh4G.2. Self-assembled Micro-reflectors for Signal Enhancement in Fluorescence Microscopy</td>
<td>Z. Göröcs; E. McLeod; S. Acharya; A. Ozcan</td>
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<td>5:00-5:15 PM</td>
<td>STh4G.3. Electrospun dye-doped fiber networks: Lasing emission from randomly distributed cavities</td>
<td>S. Kraemmer; C. Vannahme; C.L. Smith; T. Grossmann; M. Jenne; S. Schierle; L. Jørgensen; M. Tran; A. Kristensen; I. Chronakis; H. Kalt</td>
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<td>5:45-6:00 PM</td>
<td>STh4G.6. Etch-Free Patterning of PEDOT:PSS for Optoelectronics</td>
<td>S.A. Rutledge; A.S. Helmy</td>
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<td>6:00-6:15 PM</td>
<td>STh4G.7. Microfluidic Reconfigurable Metasurface: A Demonstration of Tunable Focusing from Near Field to Far Field</td>
<td>W. Zhu</td>
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<td>6:15-6:30 PM</td>
<td>STh4G.8. On-Demand Fabrication of Micro-Wired Rods and Nano-Coupling Control for 3D Polymeric Optical System</td>
<td>H. Yoshioka; N. Hirakawa; M. Nakano; Y. Oki</td>
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<td>4:30 PM-6:30 PM</td>
<td>STh4H. Novel Applications and Phenomena of Nonlinear Optics, S&amp;I Oral, CLEO S&amp;I 4: Nonlinear Optical Technologies, Presider: Valentin Petrov, <a href="mailto:valentin.petrov@mbi-berlin.de">valentin.petrov@mbi-berlin.de</a>, Max Born Institute</td>
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<td>4:30-4:45 PM</td>
<td>STh4H.1. Highly Efficient Backward Stimulated Polariton Scattering in Periodically Poled KTiOPO$_4$</td>
<td>H. Jang; A. Zukauskas; C. Canalias; V. Pasiskevicius</td>
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<td>4:45-5:00 PM</td>
<td>STh4H.2. Laser Induced Damage Thresholds of KTiOPO$_4$ and Rb:KTiOPO$_4$ at 1 µm and 2 µm</td>
<td>R. Coetzee; N. Thilmann; A. Zukauskas; C. Canalias; V. Pasiskevicius</td>
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<td>5:00-5:15 PM</td>
<td>STh4H.3. Enhanced Spontaneous Raman Signal Collected Evanescently by Silicon Nitride Slot Waveguides</td>
<td>A. Dhakal; F. Peyskens; A. Subramanian; N. Le Thomas; R. Baets</td>
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<td>5:15-5:30 PM</td>
<td>STh4H.4. Inhibiting Stimulated Brillouin Scattering in a Highly Nonlinear Waveguide M. Merklein; I. Kabakova; T. Buettner; D. Choi; S. Madden; B. Luther-Davies; B.J. Eggleton</td>
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<td>5:30-5:45 PM</td>
<td>STh4H.5. Broadband Fourier-transform Stimulated Raman Scattering J. Rehault; F. Crisafi; V. Kumar; M. Marangoni; G. Cerullo; D. Polli</td>
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<td>5:45-6:00 PM</td>
<td>STh4H.6. Handedness Control Of Mid-infrared (9-12μm) Vortex Laser M. Horikawa; A. Ogawa; K. Furuki; K. Miyamoto; T. Omatsu</td>
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<td>6:00-6:15 PM</td>
<td>STh4H.7. Electrically Controllable Saturable Absorption in Hybrid Graphene-Silicon Waveguides K. Alexander; Y. Hu; M. Pantouvaki; S. Brems; I. Asselberghs; S. Gorza; C. Huyghebaert; J. Van Campenhout; B. Kuyken; D. Van Thourhout</td>
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<td>6:15-6:30 PM</td>
<td>STh4H.8. Ultra-low power passive mode-locking using an integrated nonlinear microring resonator C. Reimer; M. Kues; B. Wetzel; P. Roztocki; B.E. Little; S.T. Chu; D. Moss; R. Morandotti</td>
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<td>4:30 PM-6:30 PM</td>
<td>Meeting Room 211 B/D (Convention Center), <strong>STh4I. Optomechanics II</strong>, S&amp;I Oral, CLEO S&amp;I 7: Micro- and Nano-Photonic Devices, Presider: Peter Rakich, <a href="mailto:peter.rakich@yale.edu">peter.rakich@yale.edu</a>, Yale University</td>
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<td>4:30-4:45 PM</td>
<td><strong>STh4I.1. Chip-based Silica Microspheres for Cavity Optomechanics</strong> X. Jiang; M. Kuzyk; T. Oo; H. Wang</td>
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<td>4:45-5:00 PM</td>
<td><strong>STh4I.2. An Optomechanical Induced Short Pulse Raman Laser</strong> W. Yu; W. Jiang; Q. Lin; T. Lu</td>
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<td>5:00-5:15 PM</td>
<td><strong>STh4I.3. Strong Mechanical Nonlinearity of Optomechanically Driven Suspended Photonic Crystal Membrane</strong> P. Hui; A. Rodriguez; D. Woolf; E. Iwase; M. Khan; F. Capasso; M. Loncar</td>
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<td>5:15-5:30 PM</td>
<td><strong>STh4I.4. Unifying Brillouin scattering and cavity optomechanics in silicon photonic wires</strong> R. Van Laer; B. Kuyken; R. Baets; D. Van Thourhout</td>
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<td>5:30-6:00 PM</td>
<td><strong>STh4I.5. Optomechanical Nonlinearities in Microstructured Optical Fibers</strong> P.S. Russell; A. Butsch; J. Koehler; R.E. Noskov; M. Pang</td>
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<td>6:00-6:15 PM</td>
<td><strong>STh4I.6. Microwave Frequency Traveling Surface Acoustic Wave Induced Transparency</strong> H. Li; S.A. Tadesse; Q. Liu; M. Li</td>
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<td>6:15-6:30 PM</td>
<td><strong>STh4I.7. Surface Acoustic Wave Modulation of Optical Cavities on a Suspended Membrane</strong> S. Tadesse; H. Li; Q. Liu; M. Li</td>
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<td>4:30 PM-6:30 PM</td>
<td>Meeting Room 212 A/C (Convention Center), <strong>ATH4J. Clinical Technologies and Systems II</strong>, A&amp;T Oral, CLEO A&amp;T 1: Biomedical Applications, Presider: Yuankai Tao, <a href="mailto:taoy@ccf.org">taoy@ccf.org</a>, Cole Eye Institute Cleveland Clinic</td>
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<td>4:30-5:00 PM</td>
<td><strong>ATH4J.1. Blood Coagulation Sensing at the Point of Care</strong> S.K. Nadkarni</td>
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<td>5:00-5:30 PM</td>
<td>ATh4J.2. Multi-spectral Imaging for Determining End-point of Photothermal Damage on Tissue D. Kim</td>
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<td>5:30-5:45 PM</td>
<td>ATh4J.3. Design and Implementation of a Volume Holographic Imaging Endoscope I.D. Howlett; M. Gordon; G. Orsinger; J. Brownlee; M. Romanowski; J. Barton; R.K. Kostuk</td>
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<td>5:45-6:00 PM</td>
<td>ATh4J.4. <em>In vivo</em> longitudinal cellular imaging of small intestine by side-view confocal endomicroscopy J. Ahn; K. Choe; T. Wang; Y. Hwang; K. Kim; P. Kim</td>
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<td>ATh4J.5. <em>In Vivo</em> Real-time Observation of ICG Pharmacokinetics by NIR Laser-scanning Confocal Microscopy Y. Hwang; H. Yoon; K. Choe; J. Park; P. Kim</td>
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<td>6:15-6:30 PM</td>
<td>ATh4J.6. Field-Portable Smartphone Microscopy Platform for Wide-field Imaging and Sizing of Single DNA molecules Q. Wei; W. Luo; S. Chiang; T. Kappel; C. Mejia; D. Tseng; R. Chan; E. Yan; H. Qi; F. Shabbir; H. Ozkan; S. Feng; A. Ozcan</td>
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<td>4:30 PM-6:30 PM</td>
<td>STh4K. Super-resolution Imaging, S&amp;I Oral, CLEO S&amp;I 10: Biophotonics and Optofluidics, Presider: Dmitry Dylov, <a href="mailto:dylov@ge.com">dylov@ge.com</a>, GE Global Research</td>
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<td>4:30-5:30 PM</td>
<td>STh4K.1. Accelerating Localisation Microscopy S. Cox</td>
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<td>5:45-6:00 PM</td>
<td>STh4K.3. Maximally Informative Point Spread Functions for 3D Super-Resolution Imaging Y. Shechtman; S.J. Sahl; A.S. Backer; W. Moerner</td>
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<td>STh4K.4. Adaptive optics for single molecule switching nanoscopy M.J. Booth</td>
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<td>STh4M. Fundamental Light-material Interaction II, S&amp;I Oral, CLEO S&amp;I 1: Light-Matter Interactions and Materials Processing, Presider: Tsing-Hua Her, <a href="mailto:ther@uncc.edu">ther@uncc.edu</a>, Univ of North Carolina at Charlotte</td>
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<td>4:30-4:45 PM</td>
<td>STh4M.1. First-principles calculations for ultrafast laser-induced damage in dielectrics S. Sato; K. Yabana; Y. Shinohara; T. Otobe; K. Lee; G.F. Bertsch</td>
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<td>STh4M.2. Doping-controlled Coherent Electron-Phonon Coupling in Vanadium Dioxide K. Appavoo</td>
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<td>5:00-5:15 PM</td>
<td>STh4M.3</td>
<td>Unusual Conductivity Increase Related to UV-light Assisted Domain Inversion in Mg-doped Lithium Niobate Crystals</td>
<td>X. Wang; F. Bo; S. Chen; J. Chen; Y. Kong; J. Xu; G. Zhang</td>
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<td>5:15-5:30 PM</td>
<td>STh4M.4</td>
<td>Non-thermal ablation and deposition of graphite induced by ultrashort pulsed laser radiation</td>
<td>C. Kalupka</td>
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<td>STh4M.5</td>
<td>Single photon sources using diamond colour centres in novel open access microcavities</td>
<td>P. Dolan; S. Johnson; A. Trichet; L. Flatten; L. Weng; J.M. Smith</td>
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<td>STh4M.6</td>
<td>Electrical Valley Excitation by Spin Injection in Monolayer TMDC</td>
<td>Y. Ye; X. Yin; H. Wang; Z. Ye; H. Zhu; Y. Wang; J. Zhao; X. Zhang</td>
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<td>6:00-6:15 PM</td>
<td>STh4M.7</td>
<td>Multi-shots ablation of polymethylmethacrylate by two-color femtosecond synthesized waveform</td>
<td>C. Lin; C. Yang; A. Zaytsev; C. Pan</td>
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<td>STh4M.8</td>
<td>Control of Absorption in Femtosecond Laser-Dielectric Interaction with the Polarization of a Seeding Pulse</td>
<td>M. Green; T. Her; C. Lin; C. Pan</td>
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4:30 PM-6:30 PM, Salon I-II (Marriott), **STh4L. Fiber Lasers**, S&I Oral, **CLEO S&I 11: Fibers Photonic**, Presider: Ming-lie Hu, hueminglie@tju.edu.cn, Tianjin University

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<td>Cladding-pumped Yb-doped Fiber Laser with Vortex Output Beam</td>
<td>D. Lin; W.A. Clarkson</td>
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<td>All-fiber passively Q-switched fiber laser based on the multimode interference effect</td>
<td>S. Fu; Q. Sheng; X. Zhu; W. Shi; J. Yao; R. Norwood; N. Peyghambarian</td>
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<td>STh4L.3</td>
<td>Enhancement of OCT Imaging Depth by Pulse-modulated Dispersion-tuned Swept Fiber Laser</td>
<td>Y. Takubo; S. Yamashita</td>
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<td>STh4L.4</td>
<td>Pulse Coherence in Self-sweeping Fiber Laser</td>
<td>I.A. Lobach; S.I. Kablukov; E.V. Podivilov; A.A. Fotiadi; S.A. Babin</td>
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<td>STh4L.5</td>
<td>Rogue Waves in a Normal-Dispersion Fiber Laser</td>
<td>Z. Liu; S. Zhang; F.W. Wise</td>
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<td>High Peak Power Single-Frequency Efficient Erbium-Ytterbium Doped LMA Fiber</td>
<td>W. Renard; T. Robin; B. Cadier; J. Le Gouët; L. Lombard; A. Durécu; P. Bourdon; G. Canat</td>
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<td>STh4L.7</td>
<td>2.6 mJ Energy and 81 GW Peak Power Femtosecond Laser -Pulse Delivery and Spectral Broadening in Inhibited Coupling Kagome Fiber</td>
<td>B. Debord; F. Gérôme; P. Paul; A. Husakou; F. Benabd</td>
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<td>STh4L.8</td>
<td>High-power, high-efficiency random fiber lasing with a low reflectivity mirror</td>
<td>Z. Wang; H. Wu; M. Fan; L. Zhang; W. Zhang; Y. Rao</td>
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<td>STh4N.</td>
<td>Micro and GHz Combs, S&amp;I Oral, CLEO S&amp;I 14: Optical Metrology, Presider: Franklyn Quinlan, <a href="mailto:fquinlan@boulder.nist.gov">fquinlan@boulder.nist.gov</a>, National Inst of Standards &amp; Technology</td>
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<td>4:30-5:00 PM</td>
<td>STh4N.1</td>
<td>Photonic Chip Based Optical Frequency Comb Using Soliton Induced Cherenkov Radiation</td>
<td>V. Brasch; M. Geiselmann; T. Herr; G. Lihachev; M. Pfeiffer; M. Gorodetsky; t. kippenberg</td>
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<td>5:00-5:15 PM</td>
<td>STh4N.2</td>
<td>Parametric soliton formation in narrow-band laser-gain driven microresonators</td>
<td>Y.H. Wen; M. Lamont; A.L. Gaeta</td>
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<td>STh4N.3</td>
<td>Spectral broadening of Kerr Frequency Combs Generated from a Normal Dispersion Silicon Nitride Microresonator</td>
<td>Y. Liu; A.J. Metcalf; Y. Xuan; X. Xue; P. Wang; M. Qi; A.M. Weiner</td>
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<td>STh4N.4</td>
<td>Microwave to Optical Link Using an Optical Microresonator</td>
<td>J.D. Jost; T. Herr; C. Lecaplain; E. Lucas; V. Brasch; M. Pfeiffer; t. kippenberg</td>
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<td>STh4N.5</td>
<td>Self-referencing a 10 GHz Electro-optic Comb</td>
<td>D.C. Cole; K. Beha; F.N. Baynes; P. Del'Haye; A. Rolland; T.M. Fortier; F. Quinlan; S. Diddams; S.B. Papp</td>
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<td>STh4N.6</td>
<td>Low-Phase-Noise Millimeter-Wave Signal Generator assisted with Frequency Comb based on Electro-Optics-Modulators</td>
<td>A. Ishizawa; T. Nishikawa; T. Goto; K. Hitachi; T. sogawa; H. Gotoh</td>
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<td>6:15-6:30 PM</td>
<td>STh4N.7</td>
<td>Low Phase-noise Tunable Optoelectronic Comb Generator</td>
<td>A.J. Metcalf; F. Quinlan; T.M. Fortier; S. Diddams; A.M. Weiner</td>
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<td>STh4O.</td>
<td>Optical Sensing Techniques for Combustion and Energy Research, S&amp;I Oral, CLEO S&amp;I 13: Active Optical Sensing, Presider: Gerard Wysocki, <a href="mailto:gwysocki@princeton.edu">gwysocki@princeton.edu</a>, Princeton University</td>
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<td>4:30-5:30 PM</td>
<td>STh4O.1</td>
<td>Advances in Tunable Diode Laser Absorption Spectroscopy (TDLAS) for Measurements of Gas Properties in Combustion Systems</td>
<td>R.K. Hanson</td>
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<td>STh4O.2</td>
<td>Cavity-Enhanced Optical Frequency Comb Spectroscopy of High-Temperature Water in a Flame</td>
<td>A. Khodabakhsh; Z. Qu; C. Abd Alrahman; A. Johansson; L. Rutkowski; F.M. Schmidt; A. Foltynowicz-Matyba</td>
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<td>Fiber Optical Chemical Sensors Rated for 800°C Operation</td>
<td>A. Yan; R. Chen; Z.L. Poole; P.R. Ohodnicki; T. Elsmann; T. Habisreuther; M. Rothhardt; H. Bartelt; K.P. Chen</td>
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<td>R. Chen; A. Yan; M. Zaghoul; G. Lu; A.P. Bunger; G.A. Miller; G. Cranch; K.P. Chen</td>
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<td>STh4O.5. Demonstration of a Differential Absorption Lidar for Emissions Measurement</td>
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<td>of a Coal-Fired Power Plant M. Wojcik; B. Crowther; R. Lemon; P. Valupadas; L. Fu;</td>
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<td>B. Leung; Z. Yang; Q. Huda; A. Chambers</td>
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<td>FF1A. Quantum Key Distribution, FS Oral, QELS 2: Quantum Science, Engineering and</td>
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<td>Technology, Presider: Ping Lam, <a href="mailto:Ping.Lam@anu.edu.au">Ping.Lam@anu.edu.au</a>, Australian National University</td>
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<td>FF1A.1. Device-Independent Quantum Key Distribution A. Acin</td>
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<td>FF1A.2. Practical High-Dimensional Quantum Key Distribution with Decoy States D.</td>
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<td>Bunandar; Z. Zhang; J. Shapiro; D. . Englund</td>
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<td>FF1A.3. Multi-Photon Quantum Key Distribution Based on Double-Lock Encryption K.C.</td>
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<td>Chan; M. El Rifai; P. Verma; S. Kak; Y. Chen</td>
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<td>FF1A.4. Quantum Teleportation over 100 km of Fiber using MoSi Superconducting</td>
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<td>Nanowire Single-Photon Detectors H. Takesue; S.D. Dyer; M.J. Stevens; V. Verma; R.P.</td>
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<td>Mirin; S. Nam</td>
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<td>FF1A.5. Polarization Insensitive 100 MHz Clock Subcarrier Quantum Key Distribution</td>
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<td>over a 45 dB Loss Optical Fiber Channel A.V. Gleim; V. Egorov; Y.V. Nazarov; S.V.</td>
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<td>Smirnov; V.V. Chistyakov; O.I. Bannik; A.A. Anisimov; S.M. Kynev; R.J. Collins; S.A.</td>
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<td>FF1A.6. Integrated Photonic Devices for Quantum Key Distribution P. Sibson; M.</td>
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<td>Godfrey; C. Erven; S. Miki; T. Yamashita; M. Fujiwara; M. Sasaki; H. Terai; M.G.</td>
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<td>Tanner; C.M. Natarajan; R.H. Hadfield; J. O’Brien; M.G. Thompson</td>
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<td>FF1A.7. Quantum hacking of continuous-variable quantum key distribution systems:</td>
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<td>realtime Trojan-horse attacks B. Stiller; I. Khan; N. Jain; P. Jouguet; S. Kunz-</td>
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<td>Jacques; E. Diamanti; C. Marquardt; G. Leuchs</td>
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<td>FF1B. Quantum Optics with Quantum Dots, FS Oral, QELS 1: Quantum Optics of Atoms,</td>
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<td>Molecules and Solids, Presider: Sergey Polyakov, <a href="mailto:sergey.polyakov@nist.gov">sergey.polyakov@nist.gov</a>, National</td>
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<td>FF1B.2. Screening Nuclear Field Fluctuations in Quantum Dots for Indistinguishable Photon Generation</td>
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<td>FF1B.3. Phonon-Assisted Population Inversion of a Single Quantum Dot</td>
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<td>FF1B.4. Coherent Writing of the Dark Exciton State Using One Picosecond Long Optical Pulse</td>
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<td>FF1B.6. Two-Photon Spectrum of the Light Scattered by a Quantum Dot</td>
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<td>FF1B.7. Nuclear Spin Narrowing in an InAs Quantum Dot Molecule: Extension of Two-Electron Spin Decoherence Time</td>
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<td>FF1B.8. Optical Spin State Preparation of Two Electrons Confined in an InAs Quantum Dot Molecule</td>
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8:00 AM-10:00 AM, Executive Ballroom 210C (Convention Center), **FF1C. Nanophotonics and Photonic Crystals, FS Oral, QELS 6: Nano-Optics and Plasmonics**

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<td>M. Soljačić</td>
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<td>FF1C.2. Circularly Polarized Light Emission of Quantum Dots at the Band Edge of Three-Dimensional Chiral Photonic Crystals</td>
<td>S. Takahashi; T. Tajiri; Y. Ota; J. Tatebayashi; S. Iwamoto; Y. Arakawa</td>
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<td>FF1C.3. Enhanced Transverse Photo-Induced Voltage by Slow Light</td>
<td>N. Proscia; I. Ketzschmar; R. Koder; V.M. Menon; L.T. Vuong</td>
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<td>FF1C.4. Region Specific Enhancement of Quantum Dot Emission Using Interleaved Two-dimensional Photonic Crystals</td>
<td>G.G. See; L. Xu; M. Naughton; T. Tang; Y. Bonita; J. Joo; P. Trefonas; K. Deshpande; P. Kenis; R.G. Nuzzo; B.T. Cunningham</td>
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<td>FF1C.5. GaN L3 Photonic Crystal Cavities With an Average Quality Factor in Excess of 16000 in the Near Infrared</td>
<td>N. Vico Triviño; M. Minkov; G. Urbinati; M. Galli; J. Carlin; R. Butte; V. Savona; N. Grandjean</td>
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### SF1D: Nonlinear Optics Frequency Conversion with Integrated Optical Devices
- **Time:** 8:00 AM - 10:00 AM
- **Location:** Executive Ballroom 210D (Convention Center)
- **Presider:** Michal Lipson, michal.lipson@cornell.edu, Cornell University

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<td>SF1D.2. Exact Solutions and Scaling Laws for Kerr Frequency Combs</td>
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<td>8:45-9:00 AM</td>
<td>SF1D.3. Generation of Mid-IR Radiation by Four-Wave Mixing in Metal Coated Waveguides</td>
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<td>SF1D.4. Signal Gain from Four-Wave Mixing in Anomalous AlGaAs nanowaveguides</td>
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<td>SF1D.5. Low-Noise Silicon Mid-Infrared Frequency Comb</td>
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<td>9:45-10:00 AM</td>
<td>SF1D.7. Parametric Frequency Conversion in Silicon Carbide Waveguides</td>
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### AF1E: A&T Topical Review - High Performance Optics I
- **Time:** 8:00 AM - 10:00 AM
- **Location:** Executive Ballroom 210E (Convention Center)
- **Presider:** Vladimir Pervak, vladimir.pervak@lmu.de, Ludwig-Maximillians-Universität Munchen

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<td>AF1E.2. Dispersive Mirror Compressors for Few-Cycle Laser Pulses</td>
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<td>AF1E.3. Ultra-broadband Spectral Beam Combiner</td>
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<td>AF1E.5. Selective Lasing and Nonlinear Relaxation of Confined Exciton-Polaritons</td>
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<td>9:45-10:00 AM</td>
<td>AF1E.6. All-Optical Tunable Multilevel Amplitude Regeneration Based on Coherent Polarization Mixing</td>
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8:00 AM-10:00 AM, Executive Ballroom 210G (Convention Center), SF1G. Novel Devices, S&I Oral, CLEO S&I 6: Optical Materials, Fabrication & Characterization

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<td>All-carbon photodetectors</td>
<td>F. Wang; Y. Liu; X. Wang; E. Flahaut; Y. Li; x. wang; X. Wang; Y. Xu; Y. Shi; R. Zhang</td>
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<td>8:30-8:45 AM</td>
<td>SF1G.2</td>
<td>Highly Efficient Hybrid Quantum Dot Light Emitting Diodes with Prolonged Lifetime</td>
<td>S. Hsu; Y. Chen; Z. Tu; H. Han; S. Lin; T. Chen; H. Kuo; C. Lin</td>
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<td>SF1G.3</td>
<td>Inhibited Coupling Kagome Fibers with Ultra-large Hollow-core Size for High Energy Ultrafast Laser Applications</td>
<td>B. Debord; A. Amsanpally; M. Alharbi; L. Vincetti; J. Blondy; F. Gérôme; F. Benabid</td>
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<td>Electro-optic effect in silicon nitride</td>
<td>S. Miller; Y. Lee; J. Cardenas; A.L. Gaeta; M. Lipson</td>
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<td>Y. Kabessa; A. Agranat</td>
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<td>9:30-9:45 AM</td>
<td>SF1G.6</td>
<td>Graphene-Based Saturable Absorber for Passive Q-switching of Tm:KLu(WO4)2 Microchip Laser</td>
<td>X. Mateos; J. Serres; P. Loiko; K. Yumashev; V. Petrov; U. Griebner; M. Aguilo; F. Diaz</td>
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<td>9:45-10:00 AM</td>
<td>SF1G.7</td>
<td>A ZnO/InN/GaN Heterojunction Photodetector with Extended Infrared Response</td>
<td>L. Hsu; S. Hsu; H. Lee; Y. Tsai; D. Lin; H. Kuo; Y. Hwang; Y. Chen; J. He; Y. Cheng; S. Lin; C. Lin</td>
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<td>8:00 AM-10:00 AM</td>
<td>SF1H</td>
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<td>M. Radulaski; T.M. Babinec; K. Muller; K.G. Lagoudakis; J.L. Zhang; S.M. Buckley; K. Alassaad; G. Ferro; J. Vuckovic</td>
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<td>Silicon Carbide Nanobeam Cavities with High Q/V</td>
<td>J. Lee; X. Lu; Q. Lin</td>
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<td>M. Mitchell; B. Khanaliloo; A. Hryciw; P.E. Barclay</td>
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<td>Optical Microresonators as Single-Molecule Spectrometers</td>
<td>K.H. Heyltman; K. Knapper; E.H. Horak; R.H. Goldsmith</td>
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<td>Photocurrent-induced Peak-dragging in a Nanobeam Photonic Crystal Cavity</td>
<td>M. Sodagar; M. Miri; A. Eftekhar; A. Adibi</td>
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<td>SF1H.6</td>
<td>Free-Space Read-Out of WGM Lasers Using Circular Micromirrors</td>
<td>T. Wienhold; S. Kraemmer; A. Bacher; H. Kalt; C. Koos; S. Koeber; T. Mappes</td>
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<td>S. Bakhtiari Gorajoobi; G. Senthil Murugar; M. Zervas</td>
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<td>Demonstration of the first monolithically integrated self-rolled-up tube based vertical photonic coupler</td>
<td>X. Yu; E. Arbabi; X. Li; L.L. Goddard; X. Chen</td>
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<td>Presider: John Marsh, <a href="mailto:john.marsh@Glasgow.ac.uk">john.marsh@Glasgow.ac.uk</a>, University of Glasgow</td>
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<td>Tunable Parity-Time-Symmetric Microring Lasers</td>
<td>H. Hodaei; W. Hayenga; M. Miri; A. Ulhassan; D.N. Christodoulides; M. Khajavikhan</td>
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<td>Widely-tunable narrow-linewidth lasers with monolithically integrated external cavity</td>
<td>T. Komljenovic; S. Srinivasan; M. Davenport; E. Norberg; G. Fish; J. Bowers</td>
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<td>SF1I.3</td>
<td>Continuously Tunable Laser Based on Multiple-Section DFB Laser Technology for 1.25 Gbps WDM-PON Applications</td>
<td>D. McIntosh-Dorsey, R. Bikky, H. Zhang, K. Anselm, J. Lii, H. Wang, H. Liao, I. Ho, H. Xie, L. Bo, P. Lorenzo, Y. Wang, J. Zheng</td>
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<td>All-Optical Carrier Recovery Using a Single Injection Locked Semiconductor Laser Stabilized by an Incoherent Optical-Feedback</td>
<td>A. Albores-Mejia, T. Kaneko, E. Banno, K. Uesaka, H. Shoji, H. Kuwatsuka</td>
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<td>Double Half-Wave-Coupled Rectangular Ring-FP Semiconductor Laser with 19-nm Quasi-Continuous Tuning Range</td>
<td>M. Sun, L. Wu, X. Xiong, X. Liao, J. He</td>
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<td>Effect of microcavity size to the RIN and 40 Gb/s data transmission performance of high speed VCSELs</td>
<td>F. Tan, M. Wu, C. Wang, M. Liu, M. Feng, N. Holonyak</td>
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<td>Millimeter-wave Modulation of 850 nm VCSELs for Radio over Fiber Applications</td>
<td>H. Dalir, F. Koyama</td>
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<td>Microwave Signal Generation Using a 1550 nm VCSEL Subject to Dual-Beam Orthogonal Optical Injection</td>
<td>P. Pérez, A. Quirce, A. Valle, L. Pesquera, A. Consoli, I. Esquivias</td>
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<td>Measurement of Process Parameters, A&amp;T Oral, CLEO A&amp;T 3: Ph. Instrumentation &amp; Techniques for Metrology &amp; Industrial Process</td>
<td>Presider: Robert Hickernell, <a href="mailto:bobhick@nist.gov">bobhick@nist.gov</a>, National Inst of Standards &amp; Technology</td>
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<td>8:00-8:30 AM</td>
<td>AF1J.1</td>
<td>Diode Laser Spectroscopy based Monitoring of Pharmaceutical Freeze Drying: Linking Measurements to Critical Process Parameters</td>
<td>W.J. Kessler</td>
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<td>Real-time Full Characterization of Colloidal Dynamics</td>
<td>J. R. Guzman-Sepulveda, A. Dogariu</td>
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<td>AF1J.3</td>
<td>Indentation hardness and scratch tests for thin layers manufactured by sol-gel process</td>
<td>H. PIOMBINI, C. Ambard, F. Compoint, K. Valle, P. Belleville, C. Sanchez</td>
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<td>Fiber-optic SERS detection enabled by light-induced gold nano-particle aggregation</td>
<td>H. Liu, J. Liu, L. Chen, H. Zhou, Z. Zheng</td>
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<td>Frequency comparisons of Sr, Yb, and Hg based optical lattice clocks and their applications</td>
<td>H. Katori</td>
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<td>SF1L.2.</td>
<td>Broadband Phase Noise Limit in the Direct Detection of Ultralow Jitter Optical Pulses</td>
<td>F. Quinlan; W. Sun; T.M. Fortier; J. Deschenes; Y. Fu; J.C. Campbell; S. Diddams</td>
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<td>SF1L.3.</td>
<td>Electro-optical frequency division and stable microwave synthesis</td>
<td>X. Yi; J. Li; H. Lee; S. Diddams; K. Vahala</td>
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<td>SF1L.6.</td>
<td>Fiber-based portable optical frequency standard for telecommunication</td>
<td>M. Triches; A. Brusch; J. Hald; J. Lægsgaard; O. Bang</td>
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<td>Compact and robust laser system for precision atom interferometry based on a frequency doubled telecom fiber bench</td>
<td>F. THERON; N. Zahzam; Y. Bidel; M. Cadoret; A. Bresson</td>
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<td>SF1K.1.</td>
<td>High Speed and Flexible Optical Transport Network</td>
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<td>Experimental Demonstration of 3D Elastic Optical Networking in Space, Time and Frequency</td>
<td>C. Qin; B. Guan; R.P. Scott; R. Proietti; N.K. Fontaine; S. Yoo</td>
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<td>SF1K.3.</td>
<td>Wavelength Conflict Resolution by Spectral Overlap of Two Nyquist-WDM Signals</td>
<td>L. Huang; S. Gao; C. Chan</td>
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<td>SF1M.1.</td>
<td>High Energy and Power Optical Waveform Synthesizers</td>
<td>F.X. KAERTNER</td>
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<td>SF1M.2.</td>
<td>Third-generation femtosecond technology</td>
<td>H. Fattahi; N.E. Karpowicz; T. Metzger; z. Major; F. Krausz</td>
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<td>9:00-9:15 AM</td>
<td>SF1M.3. Sub-Two-Cycle Millijoule Optical Pulses at 1600 nm from a BiB₃O₆ Optical Parametric Chirped-Pulse Amplifier N. Ishii; K. Kaneshima; T. Kanai; S. Watanabe; J. Itatani</td>
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<td>SF1M.5. Improved Characteristics of High Repetition Rate Non-Collinear Optical Parametric Amplifiers for Electron-Ion Coincidence Spectroscopy F.J. Furch; A. Anderson; S. Birkner; Y. Wang; A. Giree; C. Schulz; M. Vrakking</td>
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<td>SF1M.6. High-Power 300-kHz OPCA System Generating CEP-Stable Few-Cycle Pulses M. Schultze; S. Prinz; M. Haefner; C. Teisset; R. Bessing; K. Michel; T. Metzger</td>
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<td>10:30 AM-12:30 PM</td>
<td>10:30 AM-12:30 PM, Executive Ballroom 210A (Convention Center), FF2A. Single Photon Detectors, FS Oral, QELS 2: Quantum Science, Engineering and Technology, Presider: Jevon Longdell, <a href="mailto:jevon@physics.otago.ac.nz">jevon@physics.otago.ac.nz</a>, University of Otago</td>
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<td>FF2A.1. Low-jitter single-photon detector arrays integrated with silicon and aluminum nitride photonic chips F. Najafi; J. Mower; N.C. Harris; F. Bellei; A. Dane; C. Lee; X. Hu; S. Mouradian; T. Schroder; P. Kharel; F. Marsili; S. Assefa; K.K. Berggren; D. . Englund</td>
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<td>FF2A.2. Probing Number-Correlated States of up to 50 Photons G. Harder; T.J. Bartley; A. Lita; S. Nam; T. Gerrits; C. Silberhorn</td>
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<td>FF2A.3. Saturated Photon Detection Efficiency in NbN Superconducting Photon Detectors R. Murphy; M. Grein; T. Gudmundsen; A. McCaughan; F. Najafi; K.K. Berggren; F. Marsili; E. Dauler</td>
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<td>FF2A.4. Polarization-Insensitive Superconducting Nanowire Single-Photon Detectors S.D. Dyer; H. Takesue; V. Verma; R. Horansky; R.P. Mirin; S. Nam</td>
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<td>FF2A.5. Superconducting Nanowire Detectors Based on MgB₂ F. Marsili; D.P. Cunnane; R. Briggs; M.D. Shaw; B.S. Karasik; M. Wolak; N. Acharya ; X. Xi</td>
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<td>FF2A.6. A Robust Optical Coupler for Alignment of Superconducting Nanowire Detector Array R.H. Shepard; A. Guzman; M. Grein; E. Dauler; D. Rosenberg; T. Gudmundsen; R. Murphy</td>
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<td>FF2A.7. Using Double Compressive Sensing in Simultaneous Imaging of Spatial Entanglement S.H. Knarr; G. Howland; J. Schneeloch; D. Lum; J. Howell</td>
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<td>FF2A.8. Classical Imaging with Undetected Photons J.H. Shapiro; D. Venkatraman; F.N. Wong</td>
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<td>Giant Polarization Rotation Induced by a Single Spin: a Cavity-Based Spin-Photon Interface</td>
<td>J. Demory; C. Arnold; V. Loo; A. Lemaître; I. Sagnes; M. Glazov; O. Krebs; P. Voisin; P. Senellart; L. Lanco</td>
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<td>FF2B.2</td>
<td>Macroscopic Kerr Rotation from a Bright Negatively Charged Quantum Dot in a Low-Q Micropillar Cavity</td>
<td>P. Androvitsaneas; A. Young; C. Schneider; S. Höfling; M. Kamp; E. Harbord; J. Rarity; R. Oulton</td>
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<td>Optical Pumping of Individual Spins in Self-Assembled and Site-Controlled Quantum Dots</td>
<td>K. Lagoudakis; P.L. McMahon; K. Fischer; K. Muller; T. Sarmiento; S. Puri; D. Dalacu; P. Poole; M. Reimer; V. Zwiller; Y. Yamamoto; J. Vuckovic</td>
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<td>FF2B.4</td>
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<td>B. Gmeiner; A. Maser; T. Utikal; S. Götzinger; V. Sandoghdar</td>
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<td>FF2B.5</td>
<td>Xenon-based Nonlinear Fabry-Perot Interferometer for Quantum Information Applications</td>
<td>G. Hickman; T.B. Pittman; J.D. Franson</td>
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<td>FF2B.6</td>
<td>Experimental Generation of Quadruple Quantum Correlated Beams from Cascaded Four-Wave Mixing Processes in Hot Rubidium Vapors</td>
<td>J. Jing</td>
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<td>FF2B.7</td>
<td>Continuous Generation of Rubidium Vapor in a Hollow Core Photonic Band-Gap Fiber</td>
<td>P. Donvalkar; S. Ramelow; S. Clemmen; A.L. Gaeta</td>
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10:30 AM-12:30 PM, Executive Ballroom 210C (Convention Center), **FF2C. Near-field Imaging, Spectroscopy and Optomechanics**, FS Oral, **QELS 6: Nano-Optics and Plasmonics**

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<td>W. Zhu; T. Xu; A. Agrawal; H.J. Lezec</td>
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<td>FF2C.2</td>
<td>Gap Mode Formation in Metallic, Nanofocusing SNOM Tapers for High Spatial Resolution Broadband Spectroscopy</td>
<td>M. Esmann; S. Becker; K. Yoo; H. Kollmann; P. Gross; R. Vogelgesang; N. Park; C. Lienau</td>
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<td>Holographic 3D Superlocalization of Brownian Scattering Particles for Stochastic Optical Mapping</td>
<td>A. Martínez-Marrades; J. Rupprecht; M. Gross; G. Tessier</td>
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<td>FRET-based Scanning Probe Microscopy with a Donor Dye Coated AFM Tip</td>
<td>B. Kalanoor</td>
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|                 | I. Huang; R. Jensen; O. Chen; J. Choy; T. Bischof; M. Bawendi; M. Loncar |
| 11:45-12:00 PM  | FF2C.6. Nonreciprocal Optical Interaction of Dissimilar Particles  
|                 | S. Sukhov; A. Shalin; D. Haefner; A. Dogariu |
| 12:00-12:15 PM  | FF2C.7. Optical manipulation of Janus nanoparticles  
|                 | O. Ilic; I. Kaminer; Y. Lahini; H. Buljan; M. Soljacic |
| 12:15-12:30 PM  | FF2C.8. Simultaneous Transport of Multiple Nanoparticles Across a Patterned Plasmonic Substrate  
|                 | J. Ryan; Y. Zheng; P. Hansen; T. Huang; L. Hesselink |

10:30 AM-12:30 PM, Executive Ballroom 210D (Convention Center), **SF2D. Supercontinuum Generation: Fundamentals Issues and New Technologies**, S&I Oral, **CLEO S&I 4: Nonlinear Optical Technologies**, Presider: Jaime Cardenas, jc922@cornell.edu, Cornell University

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| 10:30-10:45 AM  | SF2D.1. Coherent Supercontinuum from a Silicon Nitride Waveguide  
|                 | A.R. Johnson; A. Mayer; A. Klenner; K. Luke; E.S. Stranford; M. Lamont; Y. Okawachi; F.W. Wise; M. Lipson; U. Keller; A.L. Gaeta |
| 10:45-11:00 AM  | SF2D.2. Blue-enhanced supercontinuum generation pumped by a giant-chirped SESAM mode-locked fiber laser  
|                 | S. Gao; R. Sun; D. Jin; P. Wang |
| 11:00-11:15 AM  | SF2D.3. Silicon-on-Sapphire Nanowire for Mid-IR Supercontinuum Generation  
|                 | N. Singh; D. Hudson; Y. Yu; C. Grillet; A. Read; P. Atanackovic; S. Duval; S. Madden; D. Moss; B. Luther-Davies; B.J. Eggleton |
|                 | G. Zhou; M. Xin; F. Kaernter; G. Chang |
| 11:30-11:45 AM  | SF2D.5. Enhanced Supercontinuum Generation by Polarization Control of Filamentation in Molecular Gases  
|                 | S. Rostami; M. Chini; K. Lim; M. Durand; M. Baudelet; M. Richardson; J. Diels; L. Arissian |
| 11:45-12:00 PM  | SF2D.6. Visible-to-near-Infrared Octave Spanning Supercontinuum Generation in a Partially Underetched Silicon Nitride Waveguide  
|                 | H. Zhao; B. Kuyken; F. Leo; S. Clemmen; E. Brainis; G. Roelkens; R. Baets |
| 12:00-12:30 PM  | SF2D.7. Mid-Infrared Supercontinuum Generation Spanning More Than 11 μm in a Chalcogenide Step-Index Fiber  
|                 | C.R. Petersen; U. Møller; I. Kubat; B. Zhou; S. Dupont; J. Ramsay; T. Benson; S. Sujecki; N. Abdel-Moneim; Z. Tang; D. Furniss; A. Seddon; O. Bang |

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<td>10:30-11:00 AM</td>
<td><strong>AF2E.1.</strong> Laser-Induced Ionization and Damage of High-Performance Optics by Ultrashort Pulses V. Gruzdev</td>
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<td>11:00-11:30 AM</td>
<td><strong>AF2E.2.</strong> Laser-induced damage of nodular defects in dielectric multilayer coatings Z. Wang; X. Cheng; J. Zhang; T. Ding; H. Jiao; B. Ma</td>
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<td>11:30-11:45 AM</td>
<td><strong>AF2E.3.</strong> Generating Structural Colors from Dielectric Surface Resonances Y. Shen; V. Rinnerbauer; M. Soljacic; J.D. Joannopoulos; i. wang</td>
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<td>11:45-12:00 PM</td>
<td><strong>AF2E.4.</strong> Laser Damage of Interference Coatings at $\lambda=1.6,\mu\text{m}$ with an Optical Parametric Chirped Pulse Amplifier D. Schiltz; D. Patel; C. Baumgarten; B. Reagan; J.J. Rocca; C.S. Menoni</td>
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<td>12:00-12:15 PM</td>
<td>Abstract Withdrawn</td>
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<td>12:15-12:30 PM</td>
<td><strong>AF2E.6.</strong> Full-range Gate-controlled Terahertz Phase Modulation with Graphene Metasurfaces Z. Miao; Q. Wu; X. Li; Q. He; K. Ding; Z. An; Y. Zhang; L. Zhou</td>
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<td>10:30-10:45 AM</td>
<td><strong>SF2F.1.</strong> Novel Diode Pumped Sulfur Oxide Laser: DPSOL W.F. Krupke</td>
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<td>10:45-11:00 AM</td>
<td><strong>SF2F.2.</strong> Diode Pumped Sodium Molecular Laser W. Luhs; B. Wellegehausen</td>
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<td>11:00-11:15 AM</td>
<td><strong>SF2F.3.</strong> Doubly-Resonant Fabry-Perot Cavity for Power Enhancement of Burst-Mode Picosecond Ultraviolet Pulses A. Rakham</td>
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<td>11:15-11:30 AM</td>
<td><strong>SF2F.4.</strong> Double Pass Gain in Helium-Xenon Discharges in Hollow Optical Fibres at 3.5$\mu\text{m}$ A. Love; S. Bateman; W. Belardi; C. Webb; W. Wadsworth</td>
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<td>11:30-11:45 AM</td>
<td><strong>SF2F.5.</strong> The Physical Origin of Kramers-Kronig Self-Phasing in Coherent Laser Beam Combination J.R. Leger; H. Chiang; J. Hanson</td>
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<td>11:45-12:00 PM</td>
<td><strong>SF2F.6.</strong> Phase Locking of Many Lasers by Combined Talbot Cavity and Fourier Filtering C. Tradonsky; V. Pal; R. Chriki; A.A. Friesem; N. Davidson</td>
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**AF2E.1.** Laser-Induced Ionization and Damage of High-Performance Optics by Ultrashort Pulses V. Gruzdev

**AF2E.2.** Laser-induced damage of nodular defects in dielectric multilayer coatings Z. Wang; X. Cheng; J. Zhang; T. Ding; H. Jiao; B. Ma

**AF2E.3.** Generating Structural Colors from Dielectric Surface Resonances Y. Shen; V. Rinnerbauer; M. Soljacic; J.D. Joannopoulos; i. wang

**AF2E.4.** Laser Damage of Interference Coatings at $\lambda=1.6\,\mu\text{m}$ with an Optical Parametric Chirped Pulse Amplifier D. Schiltz; D. Patel; C. Baumgarten; B. Reagan; J.J. Rocca; C.S. Menoni

**AF2F.1.** Novel Diode Pumped Sulfur Oxide Laser: DPSOL W.F. Krupke

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**AF2F.3.** Doubly-Resonant Fabry-Perot Cavity for Power Enhancement of Burst-Mode Picosecond Ultraviolet Pulses A. Rakham

**AF2F.4.** Double Pass Gain in Helium-Xenon Discharges in Hollow Optical Fibres at 3.5$\mu\text{m}$ A. Love; S. Bateman; W. Belardi; C. Webb; W. Wadsworth

**AF2F.5.** The Physical Origin of Kramers-Kronig Self-Phasing in Coherent Laser Beam Combination J.R. Leger; H. Chiang; J. Hanson

**AF2F.6.** Phase Locking of Many Lasers by Combined Talbot Cavity and Fourier Filtering C. Tradonsky; V. Pal; R. Chriki; A.A. Friesem; N. Davidson
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<td>12:00-12:15 PM</td>
<td>SF2F.7</td>
<td>Transverse mode competition in index-antiguided planar waveguide lasers with large mode area</td>
<td>Y. Liu; T. Her; C. Lee</td>
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<td>Executive Ballroom 210G (Convention Center), SF2G. III-V Photonics, S&amp;I Oral, CLEO S&amp;I 6: Optical Materials, Fabrication &amp; Characterization, Presider: Uriel Levy, <a href="mailto:ulevy@mail.huji.ac.il">ulevy@mail.huji.ac.il</a>, The Hebrew University of Jerusalem</td>
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<tr>
<td>10:30-10:45 AM</td>
<td>SF2G.1</td>
<td>Realization of A SOI-Like III-V Platform Based On the Integration of GaAs With Silicon</td>
<td>R. Sharma; H. Lin; M.W. Puckett; Y. Fainman</td>
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<td>10:45-11:00 AM</td>
<td>SF2G.2</td>
<td>Recovery Time Control in a Nanophotonic Nonlinear Gate Using Atomic Layer Deposition</td>
<td>G. Moille; S. Combrin; G. Lehoucq; L. Morgenroth; F. Neuilly; D. Decoster; A. De Rossi</td>
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<td>11:00-11:15 AM</td>
<td>SF2G.3</td>
<td>1.5μm High Density Quantum Dots Waveguide Photodetector with Avalanche Effect</td>
<td>T. Umezawa; K. Akahane; N. Yamamoto; A. Kanno; T. Kawanishi</td>
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<td>11:15-11:30 AM</td>
<td>SF2G.4</td>
<td>Monolithically Integrated Multi-Color (Blue and Green) Light-Emitting Diode Chips</td>
<td>C. Teng; L. Zhang; Y. Tsai; C. Lin; H. Kuo; H. Deng; P. Ku</td>
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<td>SF2G.5</td>
<td>GaInAs/InP MQW light-emitting diode fabricated on wafer bonded InP/Quartz substrate</td>
<td>K. Matsumoto; M. Takasu; Y. Kanaya; J. Kishikawa; K. Shimomura</td>
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<td>11:45-12:00 PM</td>
<td>SF2G.6</td>
<td>Phosphor-free Monolithic High-Efficiency White Light-Emitting-Diodes on Ternary InGaN Substrates</td>
<td>Y. Ooi; J. Zhang</td>
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<td>10:30 AM-12:30 PM</td>
<td>Meeting Room 211 B/D (Convention Center), SF2H. Photonic Crystals, S&amp;I Oral, CLEO S&amp;I 7: Micro- and Nano-Photonic Devices, Presider: Paul Barclay, <a href="mailto:pbarclay@ucalgary.ca">pbarclay@ucalgary.ca</a>, University of Calgary</td>
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<td>10:30-10:45 AM</td>
<td>SF2H.1</td>
<td>Over-1mm-long Wideband on-Chip Slowlight Waveguides Realized by 1,000 Coupled L3 Nanocavities</td>
<td>E. Kuramochi; N. Matsuda; K. Nozaki; H. Takesue; M. Notomi</td>
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<td>10:45-11:00 AM</td>
<td>SF2H.2</td>
<td>Systematic tuning of ultrahigh-Q no-missing-hole (H0) nanocavity</td>
<td>E. Kuramochi; H. Duprez; H. Taniyama; H. Sumikura; K. Nozaki; A. Shinya; M. Notomi</td>
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<td>11:00-11:15 AM</td>
<td>SF2H.3</td>
<td>Bending Behavior of Flexible Crystalline Silicon Nanomembrane Photonic Crystal Microcavities</td>
<td>X. Xu; H. subbaram; S. Chakravarty; R.T. Chen</td>
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<td>SF2H.4</td>
<td>Femtojoule Optical Switching in Hydrogenated Amorphous Silicon Photonic Crystal Nanocavities</td>
<td>J. Pel; R. Bose; C. Santor; T. Tran; R. Beausoleil</td>
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<td>SF2H.5</td>
<td>Experimental demonstration of non-reciprocal transmission in a nonlinear photonic-crystal Fano structure</td>
<td>Y. Yu; Y. Chen; H. Hu; W. Xue; K. Yvind; J. Mork</td>
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| 11:45-12:00 PM | SF2H.6. Low-loss Mode Converter for Silicon-Polymer Hybrid Slot Photonic Crystal Waveguide  
X. Zhang; H. Subbaraman; Z. Pan; C. Chung; A. Hosseini; R.T. Chen |
| 12:00-12:15 PM | SF2H.7. Flat-top Drop Filter based on a Single Topology Optimized Photonic Crystal Cavity  
L.H. Frandsen; Y. Elesin; X. Guan; O. Sigmund; K. Yvind |
| 12:15-12:30 PM | SF2H.8. Photonic Surfaces for Designable Nonlinear Power Shaping  
R. Biswas; M. Povinelli |
| 10:30 AM-12:30 PM | SF2I. Laser Surface Nano-structuring, S&I Oral, CLEO S&I 1: Light-Matter Interactions and Materials Processing, 
Presider: Emmanuel Haro-Poniatowski, haro@xanum.uam.mx, Physics Department, UAM-Iztapalapa |
| 10:30-11:30 AM | SF2I.1. Nano-Ablation by Femtosecond Laser-Matter Interactions  
S. Sakabe; M. Hashida |
| 11:30-11:45 AM | SF2I.2. Deep and Near Sub wavelength Ripples on Natural MoS\textsubscript{2}  
Induced by Femtosecond Laser with Threshold Dependence  
Y. Pan; Y. Li; J. Yao; Q. Wu; J. Xu |
| 11:45-12:00 PM | SF2I.3. Laser fluence dependence of periodic structures on metals produced by femtosecond double pulse laser  
M. Hashida; L. Gemini; T. Nishii; Y. Miyasaka; H. Sakagami; S. Inoue; J. Limpouch; T. Mocek; S. Sakabe |
| 12:00-12:15 PM | SF2I.4. Polarization Sensitive Printing by Ultrafast Laser Nanostructuring in Amorphous Silicon  
R. Drevinskas; M. Beresna; M. Gecevičius; m. khenkin; a.g. kazanskii; o.i. konkov; P. Kazansky |
| 12:15-12:30 PM | SF2I.5. Influence of Self-scattering on the Fabrication of Surface Nanostructures in Zinc Phosphate Glass Using Fs-laser Pulses  
J. Clarijs; J. Hernandez Rueda; M. Scholten; H. Zhang; D. Krol; D. van Oosten |
| 10:30 AM-12:30 PM | AF2J. Chemical and Gas Sensing, A&T Oral, CLEO A&T 3: Ph. Instrumentation & Techniques for Metrology & Industrial Process, 
Presider: Ekaterina Golovchenko, kgolovchenko@te.com, TE Connectivity |
| 10:30-10:45 AM | AF2J.1. Silicon on Sapphire Chip Based Photonic Crystal Waveguides for Detection of Chemical Warfare Simulants And Volatile Organic Compound  
Y. Zou; P. Wray; S. Chakravarty; R.T. Chen |
| 10:45-11:00 AM | AF2J.2. Highly Sensitive Chemical Gas Sensor Based on Graphene Deposited D-shaped-fiber  
Y. Wu; B. Yao; X. Cao; Z. Wang; Y. Rao; Y. Chen; K.S. Chiang |
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<td>11:00-11:15 AM</td>
<td>AF2J.3. Mid-infrared detection of atmospheric CH4, N2O and H2O based on a single continuous wave quantum cascade laser Y. Cao; N.P. Sanchez; R. Griffin; F.K. Tittel</td>
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<td>12:15-12:30 PM</td>
<td>AF2J.5. An Interband Cascade Laser based Sulfur Dioxide Sensor for Emission Monitoring Applications P. Geiser; O. Bjørøy; P. Kaspersen; L. Nähle; J. Scheuermann; M. von Edlinger; J. Koeth</td>
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<td>10:30 AM-11:45 AM</td>
<td>SF2K. Short Reach &amp; PON Communication, S&amp;I Oral, CLEO S&amp;I 12: Lightwave Communications and Optical Networks, Presider: Neda Cvijetic, <a href="mailto:neda@nec-labs.com">neda@nec-labs.com</a>, NEC Laboratories America Inc</td>
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<td>10:30-10:45 AM</td>
<td>SF2K.1. 100Gb/s WDM-SSB-DD-OFDM using a Gain Switched Monolithically Integrated Passive Feedback Comb Source P.M. Anandarajah; T. Shao; R. Zhou; D. Gutierrez Pascual; L. P. Barry</td>
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<td>10:45-11:00 AM</td>
<td>SF2K.2. Up to 16 Gb/s CAP16 Modulation over 100 km IM/DD Dispersion Uncompensated Transmission using Dual-EML M. Chaibi; C. Kazmierski; D. Erasme</td>
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<td>11:00-11:15 AM</td>
<td>SF2K.3. Design of 100G PDM-QPSK Unrepeatered Transmission Systems with EDFA Only Amplification X. He; B. Zhang; D. Pudvay; R. Lofland; M. Salsi; Q. Wang; J. O'neil; Y. Yue; J. Anderson; Z. Pan</td>
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<td>11:30-11:45 AM</td>
<td>SF2K.5. 8-User PAM-ECDMA PON with 25.6 Gb/s Aggregate Data Rate X. Guo; X. Li; A. Wonfor; L. Zhou; L. Fang; R.V. Penty; I.H. White</td>
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<td>10:30 AM-12:30 PM</td>
<td>SF2L. Ranging and Metrology, S&amp;I Oral, CLEO S&amp;I 14: Optical Metrology, Presider: Mark Notcutt, <a href="mailto:mnotcutt@gmail.com">mnotcutt@gmail.com</a>, Stable Laser Systems</td>
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<td>10:30-10:45 AM</td>
<td>SF2L.1. Fiber-based optical frequency comb interferometer with nm-stability and meters-wide scanning range Y. Nakajima; K. Minoshima</td>
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<td>10:45-11:00 AM</td>
<td>SF2L.2. Attosecond-Resolution Time-of-Flight Stabilization of Optical Pulse Train in 76-m Indoor Atmospheric Link J. Kang; J. Shin; C. Kim; K. Jung; J. Kim</td>
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<td>SF2L.3. Dual-comb absolute ranging using balanced optical cross-correlator as time-of-flight detector H. Shi; Y. Song; F. Liang; L. Xu; M. Hu; C. Wang</td>
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<td>SF2L.4. Dual-comb Reciprocal Temporal Scanning for Absolute Distance Measurement H. Zhang; X. Wu; H. Wei; Y. Li</td>
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10:30 AM-12:30 PM, Salon IV (Marriott), SF2M. Symposium - OPA/OPCPA - Next Generation of Ultra-Short Pulse Laser Technology II, Special Symposium, Symposium - OPA/OPCPA - Next Generation of Ultra-Short Pulse Laser Technology
Quantum Measurement Techniques: Modern Approaches and Trends

A. M. Steinberg; 1, 2;
1. Dept. of Physics & CQIQC, University of Toronto, Toronto, ON, Canada.
2. Canadian Institute for Advanced Research, Toronto, ON, Canada.

Abstract (35 Word Limit): While quantum measurement has long been seen as a deep philosophical conundrum, technological progress and new potential applications such as quantum information processing have turned it into a respectable experimental discipline as well. I will introduce a modern perspective on real-world quantum measurement, including the new paradigm of "weak measurement" and its (controversial) potential for addressing fundamental issues as well as for improving the precision of practical measurement.
Experimentally Quantifying the Advantages of Weak-Values-Based Metrology
G. Viza; J. Martinez; G. Alves; A. N. Jordan; J. Howell;
1. Department of Physics and Astronomy, University of Rochester, Rochester, NY, United States.
2. The Center for Coherence and Quantum Optics, University of Rochester, Rochester, NY, United States.
3. Instituto de Fisica, Universidade Federal do Rio de Janeiro, Rio de Janeiro, Brazil.

Abstract (35 Word Limit): We measure optical beam deflections both using a weak-values technique and by focusing. By introducing controlled modulations, the WVT outperforms focusing. Post-selecting on 1% of the photons, we obtain 99% of the available Fisher information.
Particle vs. Mode Entanglement in Optical Quantum Metrology

N. Quesada; J. Sahota;
1. University of Toronto, Toronto, ON, Canada.

Abstract (35 Word Limit): We present a constructive proof of the fact that mode entanglement is not necessary for optical quantum enhanced metrology (QEM) but particle entanglement is. We provide a particle entanglement witness that detects all path symmetric states useful for QEM in a Mach-Zender interferometer.
Quantum Refractometer

L. A. Krivitsky; 1; A. Paterova; 1; D. Kalashnikov; 1; S. Kulik; 2;
1. Data Storage Institute, Singapore, Singapore.
2. Department of Physics, Lomonosov Moscow State University, Moscow, Russian Federation.

Abstract (35 Word Limit): We exploit interference of two Parametric Down Conversion (PDC) sources to observe infrared resonances of CO2. Frequency correlations of PDC enable determination of the refractive index at IR wavelengths with visible range optics and photodetectors.
Experimental Demonstration of Quantum Sensing in the Presence of Quantum Decoherence

Z. Zhang; 1; S. Mouradian; 1; F. N. Wong; 1; J. Shapiro; 1;
1. Massachusetts Institute of Technology, Somerville, MA, United States.

Abstract (35 Word Limit):
We report the first experimental demonstration of an entanglement-enhanced sensing system that is resilient to environmental loss and noise.
Ultrafast Terahertz Probes of Interacting Dark Excitons in Chirality-specific Single-walled Carbon Nanotubes

L. Luo; 1, 2; I. Chatzakis; 1, 2; A. Patz; 1, 2; J. Wang; 1, 2;
1. Physics and Astronomy, Iowa State University, Ames, IA, United States.

Abstract (35 Word Limit): Ultrafast terahertz intra-excitonic transition ~6 meV reveals stable quasi-1D many-exciton states that evolve uniquely from a predominant dark exciton population to complex phase-space filling of both dark and bright pair states in (6,5) SWNTs.
Control of Coherent Intersubband Excitations by a Nonresonant THz Pulse
M. Woerner; C. Somma; D. Morrill; G. Folpini; K. Reimann; T. Elsaesser; K. Biermann;
1. Max Born Institute, Berlin, Germany.
2. Paul Drude Institute, Berlin, Germany.

Abstract (35 Word Limit): Using fully phase-resolved two-dimensional terahertz spectroscopy we study coherent intersubband Rabi oscillations in GaAs quantum wells. A strong terahertz field modifies particularly the phase of the nonlinearly emitted field during the Rabi oscillation.
Measurement of Transversal Polarization Forces on Excitons in GaAs Quantum Wells

E. Martin,1,3; M. Borsch;2; M. Kira;2; S. Cundiff,1,3;
1. JILA, University of Colorado & NIST, Boulder, CO, United States.
2. Philipps-University Marburg, Marburg, Germany.

Abstract (35 Word Limit): We observe resonant optical tweezing of quantum-well excitons created by an excitation pulse. The ultrafast dynamics of a small excitation spot show that the tweezing is due to the first-order polarization induced by the pump.
Ultrafast Modulation of Strong Light-Matter Coupling

A. Hayat; C. Lange; C. Cancellieri; L. A. Rozema; R. Chang; S. Potnis; A. M. Steinberg; M. Steger; D. W. Snoke; L. N. Pfeiffer; K. W. West;
1. Universität Regensburg, Regensburg, Germany.
2. University of Sheffield, Sheffield, United Kingdom.
3. Department of Physics, Centre for Quantum Information and Quantum Control, and Institute for Optical Sciences, University of Toronto, Toronto, ON, Canada.
4. Department of Physics and Astronomy, University of Pittsburgh, Pittsburgh, PA, United States.

Abstract (35 Word Limit): We modulate strong coupling in a GaAs/AlGaAs microcavity by transiently decoupling exciton and cavity through the optical Stark effect induced by intense, red-detuned laser pulses. Pulses longer (1500 fs) and shorter (225 fs) than the Rabi cycle time of 500 fs yield distinctly different line shapes.
Coherent Control of Correlation Transport between Semiconductor Quantum Wells

O. Vänskä; ¹, ²; I. Tittonen; ²; S. Koch; ¹; M. Kira; ¹;

1. Philipps-Universität Marburg, Marburg, Germany.
2. Aalto University, Espoo, Finland.

Abstract (35 Word Limit): Terahertz control of semiconductor excitations is analyzed theoretically in a double-quantum-well by theoretical modeling. The results demonstrate that selective transport of electrons, excitons and even pure correlations is realizable in present-day experiments.
Quantum Optics with Droplets

M. Mootz; M. Kira; S. Koch; A. Almand-Hunter; K. Wang; S. Cundiff;
1. Department of Physics, Philipps-University Marburg, Marburg, Germany.
2. JILA, University of Colorado and National Institute of Standards and Technology, Boulder, CO, United States.
3. Department of Physics, University of Colorado, Boulder, CO, United States.

Abstract (35 Word Limit): Droplets are highly correlated quasiparticles, recently found in GaAs quantum wells. We demonstrate that they can be controlled by adjusting light source's quantum fluctuations and that their size grows with increasing temperature.
Terahertz Magneto-spectroscopy of Quantum Wells: Stability of High-Density Excitons in High Magnetic Fields

Q. Zhang; 1; W. Gao; 1; J. Watson; 2; M. Manfra; 2; J. Kono; 1

1. Rice University, Houston, TX, United States.
2. Purdue University, West Lafayette, IN, United States.

Abstract (35 Word Limit): We study the dynamics of excitons in GaAs quantum wells via optical-pump/terahertz-probe spectroscopy in magnetic fields. We found that the 1s-2p intra-excitonic transition is robust at high magnetic fields even under high excitation fluences, indicating magnetically enhanced stability of excitons.
Terahertz magneto-optical spectroscopy of two-dimensional hole and electron systems

K. Natarajan; 1; W. Pan; 3; U. Ekenberg; 2; D. Gvozdić; 4; S. Boubanga-Tombet; 6, 5; P. C Upadhyya; 1, 6; J. Reno; 3; A. J. Taylor; 1; R. P. Prasankumar; 1;

1. Center for Integrated nanotechnologies, Los Alamos National Laborotary, Los Alamos, NM, United States.
3. Sandia National Laboratory, Albuquerque, NM, United States.
4. School of Electrical Engineering, University of Belgrade, Belgrade, Serbia.
5. Research Institute of Electrical Communication, Tohoku University, Katahira, Japan.

Abstract (35 Word Limit): Terahertz magneto-optical spectroscopy on a two-dimensional hole gas reveal a nonlinear dependence on the applied magnetic field. This is due to its complex non-parabolic valence band structure, as verified by multiband Landau level theoretical calculations.
Recent Progress in Optical Metamaterials

X. Zhang;

1. University of California Berkeley, Berkeley, CA, United States.

Abstract (35 Word Limit): I will discuss progress in metamaterials including symmetry breaking related phenomena. I will also discuss non-Hermitian optics and parity-time symmetry and PT lasers of single mode.
Third-Harmonic Generation from Silicon Oligomers and Metasurfaces

M. R. Shcherbakov; D. N. Neshev; B. Hopkins; A. S. Shorokhov; I. Staude; E. V. Melik-Gaykazyan; A. Miroshnichenko; I. Brener; A. A. Fedyanin; Y. S. Kivshar;

1. Nonlinear Physics Centre, Research School of Physics and Engineering, The Australian National University, Canberra, ACT, Australia.
2. Center for Integrated Nanotechnologies, Sandia National Laboratory, Albuquerque, NM, United States.
3. Faculty of Physics, Lomonosov Moscow State University, Moscow, Russian Federation.

Abstract (35 Word Limit): Third-harmonic generation spectroscopy of silicon oligomers and metasurfaces reveals the nonlinear spectra reshaping with electric and magnetic dipolar Mie-type resonances and up-conversion increase by two orders of magnitude as compared to the bulk silicon.
Multipoles analysis of linear and nonlinear unidirectional response from plasmonic dimers

E. Poutrina; ², ¹; A. Urbas; ²;
1. UES, Inc., Xenia, OH, United States.
2. Air Force Research Laboratory, Dayton, OH, United States.

Abstract (35 Word Limit): We develop the retrieval procedure for linear and nonlinear polarizabilities of plasmonic nanodimers and present examples of unidirectional scattering and nonlinear unidirectional generation from such geometries. Related effective parameters of periodic dimer arrangements are discussed.
Abstract (35 Word Limit): We demonstrate enhancement of second-harmonic generation efficiency in resonant nanostructures supporting optically induced magnetic response. This is achieved through simultaneous excitation of electric and magnetic multipoles at the second-harmonic wavelength and their constructive interference.
A new type of optical activity in a toroidal metamaterial

T. Raybould; 1; V. Fedotov; 1; N. Papsimakis; 1; I. Youngs; 2; W. Chen; 3; D. Tsai; 3; N. Zheludev; 1;
1. University of Southampton, Southampton, United Kingdom.
2. DSTL, Salisbury, United Kingdom.
3. National Taiwan University, Taipei, Taiwan.

Abstract (35 Word Limit): We demonstrate experimentally and numerically the first ever observation of optical activity in a chiral metamaterial that is underpinned by the exotic resonant combination of an electric quadrupole and the elusive toroidal dipole.
Laser Guided Curved Electric Discharges

R. Morandotti; 2; M. Clerici; 1, 2; Y. Hu; 2; C. Milián; 3; A. Couairon; 3; D. N. Christodoulides; 4; Z. Chen; 5; L. Razzari; 2; F. Vidal; 2; F. Légaré; 2; D. Faccio; 1;

1. Heriot-Watt University, Varennes, United Kingdom.
2. INRS-EMT, Varennes, QC, Canada.
3. Centre de Physique Theorique, Ecole Polytechnique, Palaiseau, France.
4. College of Optics, University of Central Florida, Orlando, FL, United States.
5. Department of Physics and Astronomy, San Francisco State University, San Francisco, CA, United States.

Abstract (35 Word Limit): We report laser-guided electric discharges along curved trajectories, and hence around obstacles in line of sight between electrodes. Furthermore, beam self-healing enables direct discharge on target even when the laser beam directly hits the obstacle.
Improving Electron Microscopy by Shaping the Electron Beam Wavefunction

M. Mutzafi; ¹; I. Kaminer; ², ¹; G. Harari; ¹; M. Segev; ¹;

1. Physics, Technion Israel Institute of Technology, Haifa, Israel.
2. Physics, Massachusetts Institute of Technology, Cambridge, MA, United States.

Abstract (35 Word Limit): We show a novel technique to enhance resolution and SNR in electron microscopes – by shaping the quantum wavefunction of electrons. Our technique overcomes fundamental limits that currently set the resolution and SNR in electron microscopy.
Prolonging the Lifetime of Relativistic Particles by Self-Accelerating Dirac Wavepackets

I. Kaminer; 1, 2; M. Rechtsman; 1; R. Bekenstein; 1; J. Nemirovsky; 1; M. Segev; 1;
1. Technion Israel Institute of Technology, Haifa, Israel.
2. Department of Physics, Massachusetts Institute of Technology, Cambridge, MA, United States.

Abstract (35 Word Limit): We show that shaping the wavepackets of Dirac particles can alter fundamental relativistic effects such as length contraction and time dilation. For example, shaping decaying particles as self-accelerating Dirac wavepackets extends their lifetime.
Accelerating Self-Imaging: the Airy-Talbot Effect

Y. Lumer; L. Drori; Y. Hazan; M. Segev;

1. Physics Department, Technion Israel Institute of Technology, Haifa, Israel.

Abstract (35 Word Limit): We present self-imaging of optical waves along curved trajectories, theoretically and experimentally. Unlike the Talbot effect, the field wave need not be periodic. Paraxially, self-imaging persists indefinitely, while non-paraxially is limited by overall bending angle.
Optical Wavepackets Overcoming Gravitational Effects

R. Bekenstein; 1; R. Schley; 1; M. Mutzafi; 1; C. Rotschild; 1; M. Segev; 1;
1. Technion Israel Institute of Technology, Haifa, Israel.

Abstract (35 Word Limit): We find specific wavepackets that overcome analogue gravitational phenomena due to the complex interplay between interference effects and various optical gravitational effects, and demonstrate them in experiments with nonlocal nonlinear interactions.
Three-Dimensional Abruptly Autofocusing Optical Wave Packet

Q. Cao; ², ³; C. Wan; ²; X. Huang; ²; A. Chong; ², ⁴;
1. DESY, Hamburg, Germany.
2. Electro-Optics Program, University of Dayton, Dayton, OH, United States.
4. Physics, University of Dayton, Dayton, OH, United States.

Abstract (35 Word Limit): We generate a three-dimensional (3D) autofocusing wave packet by combining counter-propagating Airy pulses and an Airy ring beam. A 3D profile measurement reveals unique 3D autofocusing of such wave packet in a linear medium.
Beam Shaping and Production of Vortex Beams in Coherent Raman Generation

A. Zhdanova; M. Zhi; K. Wang; H. Xia; M. Shutova; A. Sokolov;
1. Texas A&M University, College Station, TX, United States.
2. Biosystems and Biomaterials Division, National Institute of Standards and Technology, Gaithersburg, MD, United States.
3. Department of Physics and JILA, University of Colorado, Boulder, CO, United States.

Abstract (35 Word Limit): We explore the role of spatial shaping in nonlinear interactions of ultrafast laser beams. We investigate the coherent transfer of orbital angular momentum in PbWO$_4$ crystal by using two time-delayed linearly chirped infrared pulses.
Visualizing fast molecular dynamics by coherent feedback in an optical oscillator

A. Pe’er; I. Aharonovich;

1. Bar-Ilan University, Ramat Gan, Israel.

Abstract (35 Word Limit): We exploit the inherent mode competition in a laser resonator to solve in real time the major coherent control problem – how to shape a pulse that will dump a general wave-packet into a single target state.
Demonstration of Deterministic Photon-Photon Interactions with a Single Atom

B. Dayan; 1; S. Rosenblum; 1; I. Shomroni; 1; Y. Lovsky; 1; O. Bechler; 1; G. Guendelman; 1;

1. Weizmann Institute of Science, Rehovot, Israel.

Abstract (35 Word Limit): We demonstrate all-optical deterministic photon-atom and photon-photon interactions with a single Rb atom coupled to high-Q fiber-coupled microresonator. This scheme enables all-optical photon routing, passive quantum memory and quantum gates activated solely by single photons.
Abstract (35 Word Limit): We implement a strong optical nonlinearity using electromagnetically-induced transparency in cold atoms, and measure the resulting nonlinear phase shift for postselected photons.

We believe that this represents the first direct measurement of the cross-phase shift due to individual photons.
How a Single Photon Can Act Like Many Photons

M. Hallaji; 1; A. Feizpour; 1; G. Dmochowski; 1; J. Sinclair; 1; A. M. Steinberg; 1;
1. Physics, University of Toronto, Toronto, ON, Canada.

Abstract (35 Word Limit): The weak nonlinear effect of a single photon on a probe beam is amplified by postselecting on a rare final state ("WVA" effect). The resulting cross-phase shift is up to five times greater than the usual single-photon phase shift.
Few-photon Nonlinear Optics Using Interacting Rydberg Atoms
S. Hofferberth.1
1. Harvard University, Cambridge, MA, United States.

Abstract (35 Word Limit): Mapping the interaction between Rydberg excitations onto photons enables the realization of optical nonlinearities on the single-photon level. We present a single-photon transistor, where one gate photon controls the transmission of many source photons.
The Birth, Care, and Feeding of Cat States in Circuit QED: Quantum Jumps of Photon Parity
R. Schoelkopf
1
1. Yale University, New Haven, CT, United States.

Abstract (35 Word Limit): I will describe recent experiments where we store quantum information in Schrodinger cat states of a microwave cavity, and perform the first continuous observation of a quantum error syndrome, based on the photon number parity.
Quantum Coherent Interactions in Room Temperature InAs/InP Quantum Dot Amplifiers

G. Eisenstein;
1. Technion Israel Institute of Technology, Haifa, Israel.

Abstract (35 Word Limit): We survey the latest advances in initiation and observation of quantum coherent interactions in room temperature quantum dot amplifiers operating at 1550 nm. Single and double pulse FROG measurements accompanied by detailed modeling are described.
Crossed Exciton States in Complex Semiconductor Nanostructures

N. Owschimikow; M. Kolarczik; Y. Kaptan; N. B. Grosse; U. K. Woggon;

1. Technische Universität Berlin, Berlin, Germany.

Abstract (35 Word Limit): Based on gain excitation spectra derived from two-color pump-probe experiments, we identify crossed exciton states formed in semiconductor nanostructures of mixed dimensionality and investigate their influence on the carrier dynamics.
High-Speed Electrical Modulation of Polariton Lasers

M. Baten; 1, T. Frost; 1, S. Deshpande; 1, P. K. Bhattacharya; 1

1. University of Michigan, Ann Arbor, United States.

Abstract (35 Word Limit): Room temperature electrical modulation response of a bulk GaN-based electrically injected polariton laser is reported. The frequency response is derived from the measured time-resolved electroluminescence and a maximum -3dB bandwidth of 0.65 GHz is obtained.
Lasers With Distributed Loss Have Sublinear Power Output

T. Mansuripur; 3; G. de Naurois; 1; A. Belyanin; 2; F. Capasso; 1;
1. School of Engineering and Applied Sciences, Harvard University, Cambridge, MA, United States.
2. Department of Physics, Texas A&M University, College Station, TX, United States.
3. Department of Physics, Harvard University, Cambridge, MA, United States.

Abstract (35 Word Limit): We provide a simple explanation for why laser media with distributed loss should have a sublinear output power characteristic. This understanding clarifies the role of long-range spatial hole burning in reducing the efficiency of semiconductor lasers, and is essential for optimizing power output.
Measuring a Radiative Recombination Current in an Optically Pumped Gain Medium

R. Thomas; ¹; P. M. Smowton; ¹; P. Blood; ¹;
1. Cardiff University, Cardiff, United Kingdom.

Abstract (35 Word Limit): An analytical technique for determining the radiative current in optically pumped gain media is presented. A means of separately identifying the effects of gain compression and pump non-uniformities in amplified spontaneous emission spectra is introduced.
Suppressed Relaxation-Oscillation Dynamics in a DFB laser Monolithically Integrated with Weak Optical Feedback

D. D'Agostino; D. Lenstra; H. Ambrosius; M. Smit;

Abstract (35 Word Limit): We experimentally demonstrate a laser which operates under weak optical feedback, showing two broad regions of operation without relaxation-oscillation induced instabilities and where high side-mode suppression above 40 dB is maintained, irrespective of the feedback phase.
Electrically pumped random lasing based on Au-ZnO nanowire Schottky junction

J. Liu; F. Gao; M. Morshed; S. Bashar; Y. Zheng; S. Yi;

1. Electrical and Computer Engineering, University of California, Riverside, CA, United States.
2. Nanjing University, Nanjing, China.
3. University of California, Riverside, CA, United States.
4. University of California, Riverside, CA, United States.

Abstract (35 Word Limit): Electrically pumped random lasing based on Au-ZnO nanowire Schottky junction diode is demonstrated. Good lasing behavior is achieved and excitonic recombination is responsible for lasing generation. It provides an alternative approach towards semiconductor random lasers.
Germanium Nanowires as Spectrally-selective Photodetectors in the Visible-to-Infrared
A. Solanki; K. B. Crozier;
1. Harvard University, Cambridge, MA, United States.
2. School of Physics, University of Melbourne, Melbourne, VIC, Australia.
3. Department of Electrical and Electronic Engineering, University of Melbourne, Melbourne, VIC, Australia.

Abstract (35 Word Limit): We experimentally demonstrate arrays of vertical Ge nanowires as spectrally-selective photodetectors at visible to infrared wavelengths. Measurements reveal that the external quantum efficiency spectra of fabricated devices vary with the radius of the constituent nanowires.
Ultrafine ferroelectric nanostructure in layered Mg:LiNbO$_3$ thin film

T. Okada$^{1,2}$; M. Shimizu$^{1,2}$; S. Horikawa$^{1,2}$; T. Utsugida$^{1,2}$; K. Fujii$^1$; S. Kurimura$^{1,2}$; H. Nakajima$^2$

1. National Institute for Materials Science, Tsukuba, Ibaraki, Japan.
2. Waseda University, Shinjuku, Tokyo, Japan.

Abstract (35 Word Limit): We reported a fabrication of ultrafine ferroelectric domain structure with 540 nm period into layered Mg-doped/insulator/non-doped LiNbO$_3$.
Tunable Coloration with Flexible High-Contrast Metastructures

L. Zhu; J. Kapraun; J. Ferrara; C. J. Chang-Hansnain;
1. University of California Berkeley, Berkeley, CA, United States.

Abstract (35 Word Limit): Actively controlling the perceived color of objects is highly desirable for a variety of applications. We report a new flexible high contrast metastructure (HCM) with color being varied by stretching the elastomeric membrane.
Abstract (35 Word Limit): We demonstrate a novel technique for generating several hybrid solid state nano- and micro-photonic devices. Our approach combines the growth of nanodiamonds on silicon carbide substrate from molecular diamond with the use of these particles as hard mask for pattern transfer into the substrate.
Experimental Demonstration of CMOS-Compatible Long-Range Dielectric-Loaded Surface Plasmon-Polariton Waveguides (LR-DLSPPWs)

R. T. Zektzer; 1; B. Desiatov; 1; N. Mazurski; 1; S. bozhevolnyi; 2; U. Levy; 1;

1. The hebrew university of Jerusalem, Jerusalem, Israel.
2. Technology and Innovation, University of Southern Denmark, Odense, Denmark.

Abstract (35 Word Limit): We demonstrate the design, fabrication and experimental characterization of longrange dielectric-loaded SPP waveguides (LR-DLSPPWs) that are compatible with CMOS technology. The demonstrated waveguides feature good mode confinement together with long propagation at telecom wavelengths.
Flat metallic surface with sub-10-nm gaps using modified atomic-layer lithography

H. Song; 1; D. Ji; 1; B. Chen; 1; X. Zeng; 1; T. Moein; 1; Q. Gan; 1; A. Cartwright; 1;
1. State University of New York at Buffalo, East Amherst, NY, United States.

Abstract (35 Word Limit): We developed a novel atomic layer lithography procedure to fabricate large area flat metallic surfaces with sub-10-nm features, which is particularly useful for fabrication of nanostructures with strongly localized field enhancement.
Investigation of the reflection and transmission of nano-scale gold films

H. Qian; 1; Y. Xiao; 1; D. Lepage; 1; Z. Liu; 1, 2;

1. Department of Electrical and Computer Engineering, UC San Diego, La Jolla, CA, United States.
2. Materials Science and Engineering, UC San Diego, La Jolla, CA, United States.

Abstract (35 Word Limit): The reflection and transmission of thin gold films with thickness varying from 2.5 nm to 30 nm are experimentally investigated. A theory is proposed and explains all experimental data.
Selection of Longitudinal Modes in a Terahertz Quantum Cascade Laser via Narrow-band Injection Seeding

S. Pal; 1; H. Nong; 1; S. Markmann; 1; N. Hekmat; 1; P. Dean; 2; R. A. Mohandas; 2; L. Lianhe; 2; E. Linfield; 2
; G. Davies; 2; A. D. Wieck; 1; N. Jukam; 1;
1. Ruhr-Universität Bochum, Bochum, Germany.
2. University of Leeds, Leeds, United Kingdom.

Abstract (35 Word Limit): A terahertz quantum cascade laser is injection seeded with narrowband seed pulses generated from a periodically poled lithium niobate crystal. The spectral emission of the quantum cascade laser is controlled by the seed spectra.
kW-Peak-Power Terahertz-Wave Parametric Generation and 70 dB-Dynamic-Range Detection Based on Efficient Surface-Coupling Configuration

Y. Takida; 1; T. Notake; 1; K. Nawata; 1; Y. Tokizane; 1; S. Hayashi; 1; H. Minamide; 1;
1. RIKEN, Sendai, Miyagi, Japan.

Abstract (35 Word Limit): We have demonstrated kW-peak-power terahertz (THz)-wave parametric generation and 70 dB-dynamic-range detection by using efficient surface-coupling configuration. The system is capable of producing and detecting monochromatic THz-wave pulses in the wide frequency range from 0.8 to 2.8 THz.
Abstract (35 Word Limit): We report a monolithic terahertz source made of an array of 10 electrically-tunable mid-infrared quantum cascade lasers with intra-cavity terahertz difference-frequency generation. Continuous tunability between 2 and 4 THz is demonstrated at room temperature.
Abstract (35 Word Limit): We present the latest results on high-resolution QCL-based THz spectroscopy: the possibility to perform saturated absorption or cavity-enhanced spectroscopy on THz molecular transitions, strengthened by the realization of a new generation THz FCS.
Coherent absorption control in polaritonic systems

A. Tredicucci; 2, 1;
1. NEST, Istituto Nanoscienze-CNR, Pisa, PI, Italy.
2. Dipartimento di Fisica "E. Fermi", Università di Pisa, Pisa, Italy.

Abstract (35 Word Limit): Coherent Perfect Absorption is discussed in the context of strongly-coupled polariton systems. It occurs when the cavity loss rate matches the material one, as demonstrated for intersubband transitions in a photonic crystal resonator.
Amplification of broadband terahertz pulses in a quantum cascade heterostructure

J. Darmo; D. Bachmann; M. Roesch; N. Leder; G. Scalari; M. Beck; H. Arthaber; J. Faist; K. Unterrainer;
1. Technische Universität Wien, Vienna, Austria.
2. ETH Zürich, Zürich, Switzerland.

Abstract (35 Word Limit): We demonstrate an amplification of broadband terahertz pulses in the bandwidth of 500 GHz centered at 2.5 THz. The amplification is based on gain switched quantum cascade structure width the heterogeneous active region.
A Hybrid Plasmonic Waveguide Terahertz Quantum Cascade Laser

Y. Shah; 1; R. Degl’Innocenti; 1; R. Wallis; 1; A. Klimont; 1; Y. Ren; 1; D. Jessop; 1; H. Beere; 1; D. Ritchie; 1; 1. University of Cambridge, Cambridge, United Kingdom.

Abstract (35 Word Limit): We present a quantum cascade laser emitting around 2.9 THz, based on a new hybrid plasmonic waveguide design. The resultant optical mode provides a performance commensurate with a metal-metal waveguide, while improving the far-field pattern.
Plasmonic-organic hybrid (POH) modulators for OOK and BPSK signaling at 40 Gbit/s

A. Melikyan; 1 K. Köhnle; 1 M. Lauermann; 1 R. Palmer; 1 S. R. Koeber; 1 S. Muehlbrandt; 1 P. Schindler; 1 D. Elder; 2 S. Wolf; 1 W. Heni; 3 C. Haffner; 3 Y. Fedoryshyn; 3 D. Hillerkuss; 3 M. Sommer; 1 L. Dalton; 2 D. VanThourhout; 4 W. Freude; 1 M. Kohl; 1 J. Leuthold; 3 C. Koos; 1

1. Karlsruher Institut für Technologie, Karlsruhe, Germany.
2. Department of Chemistry, University of Washington, Seattle, WA, United States.
3. ETH Zürich, Zürich, Switzerland.
4. Ghent University - IMEC, Gent, Belgium.

Abstract (35 Word Limit): We report on plasmonic-organic hybrid (POH) phase modulator generating error free (BER<10^{-10}) BPSK signals at 40Gbit/s. In addition, generation and direct detection of 40Gbit/s OOK signals are discussed using POH Mach-Zehnder modulators on the transmitter side.
Ultra-Compact Hybrid Silicon-VO₂ Electroabsorption Optical Switch

J. Jeong; A. Joushaghani; S. Paradis; D. Alain; J. Aitchison; J. K. Poon;

1. Electrical and Computer Engineering, University of Toronto, Toronto, ON, Canada.
2. Defence Research and Development Canada - Valcartier, Quebec, QC, Canada.

Abstract (35 Word Limit): A 1 μm-long hybrid Si-VO₂ electroabsorption switch with integrated electrical contacts is demonstrated. A record extinction ratio of ~12 dB/μm is achieved over a bandwidth of ~100 nm with a power dissipation of 2.55 mW.
Hybrid Silicon Ring Laser with Unidirectional Emission

W. D. Sacher; ¹; M. Davenport; ²; M. J. Heck; ²; J. Mikkelsen; ¹; J. K. Poon; ¹; J. Bowers, ²

1. Department of Electrical and Computer Engineering, University of Toronto, Toronto, ON, Canada.
2. Department of Electrical and Computer Engineering, University of California at Santa Barbara, Santa Barbara, CA, United States.

Abstract (35 Word Limit): A hybrid silicon ring laser in which the counter-clockwise circulating power is coupled into the clockwise mode is demonstrated. Unidirectional clockwise laser output is achieved with a suppression ratio of 19 dB over the counter-clockwise mode.
Abstract (35 Word Limit): We demonstrate an on-chip optical spectrum analyzer (OSA) using two cascade optical ring resonators. The OSA’s span is wider than 50nm and resolution is ~0.1nm. A germanium photodetector and a p-i-n modulator are integrated on the chip and used for detection.
Effective carrier sweepout in a silicon waveguide by a metal-semiconductor-metal structure

Y. Ding; 1; H. Hu; 1; H. Ou; 1; L. K. Oxenløwe; 1; K. Yvind; 1;
1. DTU Fotonik, Department of Photonics Engineering, Technical University of Denmark, Kgs. Lyngby, Denmark.

Abstract (35 Word Limit): We demonstrate effective carrier depletion by metal-semiconductor-metal junctions for a silicon waveguide. Photo-generated carriers are efficiently swept out by applying bias voltages, and a shortest carrier lifetime of only 55 ps is demonstrated.
Apodized Focusing Fully Etched Sub-wavelength Grating Couplers With Ultra-low Reflections

Y. Wang; 1; H. Yun; 1; Z. Lu; 1; R. Bojko; 2; F. Zhang; 1; M. Caverley; 1; N. A. Jaeger; 1; L. Chrostowski; 1;
2. University of Washington, Seattle, WA, United States.

Abstract (35 Word Limit): We experimentally demonstrated apodized focusing fully etched sub-wavelength grating couplers for the transverse electric (TE) mode. An insertion loss of 4.2 dB, 1-dB bandwidth of 36 nm, and back reflection of -24 dB have been obtained.
Sinusoidal Anti-coupling SOI Strip Waveguides

F. Zhang; 1; H. Yun; 1; V. Donzella; 1; Z. Lu; 1; Y. Wang; 1; Z. Chen; 1; L. Chrostowski; 1; N. A. Jaeger; 1;

Abstract (35 Word Limit): We experimentally demonstrate sinusoidal anti-coupling silicon-on-insulator strip
waveguides, separated by 200 nm, that have a minimum inter-waveguide crosstalk suppression of 26.8 dB within the
C-band for the fundamental transverse electric mode.
Abstract (35 Word Limit): We demonstrate 3-dB broadband directional couplers that use asymmetric-waveguide-based phase compensation. Average coupling ratios of 46.57% and 48.28% were obtained from 1500 nm to 1600 nm for transverse electric and transverse magnetic modes, respectively.
The Cell Laser

S. A. Yun, 1, 2

1. Harvard Medical School, Cambridge, MA, United States.
2. Massachusetts General Hospital, Boston, MA, United States.

Abstract (35 Word Limit): The first demonstration of a cell laser in 2011 opened new avenues for generating coherent light from living matters. Here we show progress in this new class of light sources and demonstrate their applications for sensing.
Analysis of Optical Properties of Cell Lasers and Their Use as Biological Sensors
M. Humar; 2, 1; S. A. Yun; 2,
1. Condensed Matter Department, J. Stefan Institute, Ljubljana, Slovenia.
2. Wellman Center for Photomedicine, Department of Dermatology, Harvard Medical School and Massachusetts General Hospital, Cambridge, MA, United States.

Abstract (35 Word Limit): We analyzed single-cell lasers made from different cell types and fluorescent dyes. Two mirrors enclose the cells forming a laser cavity. The different transversal cell laser modes are dependent on cell shape, refractive index and gain distribution enabling single cell characterization and sensing.
Sensitive and Selective Detection of Prostate Specific Antigen beyond ELISA Using Photonic Crystal Nanolaser

S. Hachuda; 1; T. Watanabe; 1; D. Takahashi; 1; T. . Baba; 1;
1. Electrical and computer engineering, Yokohama National University, Yokohama, Kanagawa, Japan.

Abstract (35 Word Limit): We sensitively detected prostate specific antigen (PSA) using photonic crystal nanolaser sensors. In pure water and impure sample including 1 μM BSA, we detected <100 fM PSA, which is lower than the limit of ELISA.
4.4 nJ, 114 fs Nd-doped Fiber Laser Pulses at 920nm for in Vivo Two-photon Microscopic Imaging

B. Chen; T. Jiang; W. Zong; F. Niu; L. Chen; Z. Zhang; Y. Song; A. Wang;
1. Peking University, United States.
2. China Department of Cognitive Sciences, Institute of Basic Medical Sciences, Beijing, Beijing, China.
3. Beijing University of Technology, School of Applied Science, Beijing, China.

Abstract (35 Word Limit): We optimized pre-chirp in an Nd-doped fiber amplifier to achieve high-quality femtosecond 920 nm pulses. The in vivo zebrafish imaging proves the laser amplifier an ideal source in two-photon microscopic imaging.
Highly Compact, Low-Noise All-Solid-State Laser System for Stimulated Raman Scattering Microscopy

T. Steinle; V. Kumar; A. Steinmann; M. Marangoni; G. Cerullo; H. W. Giessen;
1. 4th Physics Institute, University of Stuttgart, Stuttgart, Germany.
2. IFN-CNR, Dipartimento di Fisica, Politecnico di Milano, Milano, Italy.

Abstract (35 Word Limit): We present a simple, compact and very robust laser source for low-noise stimulated Raman scattering microscopy using a single-stage optical parametric amplifier seeded with tunable cw radiation from an external-cavity diode laser.
High Power 780 nm Femtosecond Fiber Laser

Z. Liu; 1 W. Zong; 2, 3 Y. Liu; 1 L. Zuo; 1 C. Wen; 1 T. Jiang; 1 J. Zhang; 1 Y. Ma; 1 Z. Zhang; 1 L. Chen; 1 A. Wang; 1
1. Peking University, Beijing, Beijing, China.
2. The State Key Laboratory of Biomembrane and Membrane Biotechnology, Institute of Molecular Medicine, Beijing, China.
3. China Department of Cognitive Sciences, Institute of Basic Medical Sciences, Beijing, China.

Abstract (35 Word Limit): We demonstrate an 880 mW 780 nm femtosecond laser based on a high-order dispersion compensated Er-doped fiber laser and frequency doubling. It has been used on a two-photon three-axis digital scanned light-sheet microscopy.
A Six-Color Four Laser Mobile Platform for Multi-Spectral Fluorescence Imaging Endoscopy

J. F. Black; 1; T. Tate; 2; M. Keenan; 3; E. Swan; 2; U. Utzinger; 3; J. Barton; 3;
2. College of Optical Sciences, University of Arizona, Tucson, AZ, United States.
3. Biomedical Engineering, University of Arizona, Tucson, AZ, United States.

Abstract (35 Word Limit): A Q-switched alexandrite laser is frequency doubled and tripled to the ultraviolet, combined with 3 visible wavelengths, and fiber coupled to form the illumination source for a micro-endoscope designed for minimally invasive ovarian cancer screening.
Ultrashort Pulse Lasers for Precise Processing: Results of a Recent German Research Initiative

S. Nolte; 1
1. Friedrich-Schiller-Universität Jena, Jena, Germany.

Abstract (35 Word Limit): We review results of 10 joint research projects on ultrashort pulse technology. Topics include novel laser sources, reliable components and specialized applications from eye surgery to processing of semiconductors, carbon fiber reinforced plastics and metals.
Abstract (35 Word Limit): We report high data storage ~ 66 GB/cm$^3$ in Poly (methylmethacrylate) by utilizing locally confined fluorescent data bits fabricated by a femtosecond (fs) laser.
Femtosecond laser cutting of glass by controlled fracture propagation

E. Mottay; 1; C. Hoenninger; 1; K. Mishchik; 2; C. Javaux; 3; O. Dematteo-Caulier; 2; S. Skupin; 2; B. Chimier; 2; G. Duchateau; 2; A. Bourgeade; 4; R. Kling; 3; A. Letan; 1; J. Lopez; 2;
1. Amplitude Systemes, Pessac, France.
2. Université Bordeaux, CNRS, CEA, CELIA UMR5107, Talence, France.
3. Alphanov, Talence, France.
4. CEA, Le Barpe, France.

Abstract (35 Word Limit): We present the use of a compact femtosecond laser with 300-fs pulse duration and pulse energy on the order of 10s of µJ for the cutting of glass by controlled fracture propagation.
Microfabrication of Ion Trap Platforms with Integrated Optics and Three-dimensional Electrodes

M. Dugan; 1 C. Schenck; 1 A. Said; 1
1. Translume Inc., Ann Arbor, MI, United States.

Abstract (35 Word Limit): We discuss a laser-based process to fabricate three-dimensional electromagnetic microtraps on silica platforms. Design flexibility for extended electrode geometries with a high degree of optical access and component integration is supported by this fabrication process.
Laser Processing of Optofluidic Devices for Lab-on-a-chip and Lab-in-fiber

P. R. Herman;  
1. University of Toronto, Toronto, ON, Canada.

Abstract (35 Word Limit): TBD
Novel Technologies for High Precision Characterization of Fibers

A. D. Yablon; 1
1. Interfiber Analysis, LLC, Sharon, MA, United States.

Abstract (35 Word Limit): Optical fiber gain profiling, spectrogram modal analysis, and interferometric refractive index and residual stress measurement are reviewed. These novel characterization technologies are important for designing, assembling and optimizing fiber-based lasers and amplifiers.
Final ID: SM1L.2

Design and Fabrication of Side-channel Photonic Crystal Fiber for Surface Enhanced Raman Scattering Applications
N. Zhang; 1, 2; G. Humbert; 3; T. Gong; 1, 4; P. Shum; 1, 2; J. Auguste; 3; Z. Wu; 1, 2; M. Olivo; 4, 5; Q. X. Dinh; 2, 6; L. Wei; 1;
1. School of Electrical and Electronic Engineering, Nanyang Technological University, Singapore, Singapore.
2. CINTRA CNRS/NTU/THALES, UMI3288, Singapore, Singapore.
3. Xlim - UMR 6172 University of Limoges/CNRS, Limoges, France.
5. School of Physics, National University of Ireland, Galway, Ireland.
6. R&T Department, Thales Solutions Asia Pte Ltd, Singapore, Singapore.

Abstract (35 Word Limit): We demonstrate a side-channel photonic crystal fiber for surface enhanced Raman scattering applications. A low detection concentration of 5 pM 4-aminothiophenol solution and an accumulative effect of Raman signal along the fiber length are achieved.
Distributed Temperature and Strain Discrimination Using a Few-Mode Fiber
A. Li; ¹; Y. Wang; ¹, ²; J. Fang; ¹; W. Shieh; ¹;
1. University of Melbourne, Parkville, Melbourne, VIC, Australia.
2. National ICT Australia, Melbourne, VIC, Australia.

Abstract (35 Word Limit): We propose a novel method for distributed measurement of temperature and strain using a few-mode fiber (FMF). High discrimination accuracies of 0.115 °C and 0.283 µε are achieved, under a spatial resolution of 2.5 m.
Simultaneous Measurement of Strain and Temperature using High Sensitivity Multicore Fiber Sensors

A. Van Newkirk; 1
E. Antonio-Lopez; 1
G. Salceda-Delgado; 1, 2
M. Piracha; 3
R. Amezcu-Correa; 1
A. Schulzgen; 1

1. University of Central Florida, Orlando, FL, United States.
2. CIO, Centro de Investigaciones en Optica, Leon, Guanajuato, Mexico.
3. FAZ Technology Inc., Orlando, FL, United States.

Abstract (35 Word Limit): We demonstrate strain sensors consisting of multicore fiber spliced between two single mode fibers, with increased sensitivity to a factor of 12x a standard FBG. Simultaneous decoupling of strain and temperature measurements are also demonstrated.
Fiber Optic Sensors Based on Orbital Angular Momentum

R. Niederriter; 1 M. E. Siemens; 2 J. Gopinath; 3
1. Department of Physics, University of Colorado, Boulder, CO, United States.
2. Department of Physics and Astronomy, University of Denver, Denver, CO, United States.

Abstract (35 Word Limit): Fiber optic sensors based on orbital angular momentum (OAM) have unexplored potential. We propose a design for an OAM-based fiber sensor and analyze its ability to measure changes in strain and temperature.
Optical manipulation of microparticles using graded-index fiber taper and its microfluidic sensing application

Y. Gong; C. Zhang; Y. Rao;

1. Univ of Electronic Science & Tech China, Chengdu, Sichuan, China.

Abstract (35 Word Limit): Contactless optical manipulation of microparticles is demonstrated based on graded-index multimode fiber taper, which is further applied for microfluidic flow rate sensing. The manipulation length can be as long as 177.0 μm.
Elongated abruptly tapered micro fiber interferometer for nanoparticles attraction and analyses

K. Lou;¹; N. Chen;¹; Z. Chen;¹; W. Cheng;²; C. Lin;³;
1. National United University, Miaoli, Taiwan.
2. National Chung Hsing University, Taichung, Taiwan.
3. Bell Labs and Bellcore, Union, NJ, United States.

Abstract (35 Word Limit): The nanoparticle analyses based on elongated-abruptly-tapered microfiber interferometer. The charged nanoparticles generating from incomplete combustion of carboncontaining compounds are stringently attached onto micro interferometer at equal distance separation to analyze nanoparticle sizes.
Optical and Hybrid Signal Processing

S. Radic¹;

1. University of California, San Diego, La Jolla, CA, United States.

Abstract (35 Word Limit): Physics and implementation of optical signal processing in communication and sensing links is introduced. Hybrid processing schemes capable of interfacing with high-rate network traffic and electronic backplane are described and illustrated using application examples.
Optical phase lock loop circuit for Non-degenerate optical parametric phase sensitive amplifiers with wide signal-idler optical frequency spacing

Y. Okamura; K. Higashiyama; M. Koga; A. Takada;
1. The University of Tokushima, Tokushima, Japan.
2. Oita University, Oita, Japan.

Abstract (35 Word Limit): Optical phase lock loop circuit for non-degenerate parametric phase sensitive amplifiers with wide signal-idler light frequency spacing is proposed. The proof-of-principle experiment is successfully demonstrated for 40-GHz spaced signal-idler lights using 5-GHz beat signals.
Multichannel Wavelength Multicasting for QAM Signals Free of Pump-Phase-Noise using Flexible Coherent Multi-Carrier Pump

G. Lu; 2, 1; T. Sakamoto; 1; T. Kawanishi; 1;
2. Tokai University, Kanagawa, Japan.

Abstract (35 Word Limit): We propose and demonstrate pump-phase-noise-free 2-to-7 multichannel wavelength multicasting for QAM signals using flexible coherent multi-carrier pump. <0.4dB penalty is obtained after multicasting with the proposed scheme even using 3-MHz-linewidth DFB laser as pump source.
Broadband Counter-Phase Dithering of Multi-Terabit/s DP-QPSK Signals for Low Noise FWM with a Single CW Pump

M. D. Pelusi; K. Solis-Trapala; H. Nguyen Tan; T. Inoue; S. Namiki;
1. School of Physics, University of Sydney, Camperdown, NSW, Australia.
2. National Institute of Advanced Industrial Science and Technology (AIST), Tsukuba, Ibaraki, Japan.

Abstract (35 Word Limit): Counter-phase modulation of WDM 24×100Gb/s DP-QPSK channels in a polarization-insensitive fiber-loop is demonstrated for low noise degenerate four-wave mixing with a CW pump. The OSNR is boosted by 9dB enabling an average 4dB $Q^2$-factor improvement.
Remote Backward-Propagating Lasing of Nitrogen and Oxygen in Air

A. Dogariu; R. Miles;
1. Princeton University, Princeton, NJ, United States.

Abstract (35 Word Limit): We present the latest developments in remote atmospheric air lasing. Stimulated emission induced by two-photon atomic excitation following molecular dissociation creates robust coherent emission in the backwards direction.
Experiments on Deep-UV Two-photon Pumping of Fluorescence and Stimulated Emission in Oxygen and Nitrogen Atoms in Flames

J. Bood; 1, M. Aldén; 1;
1. Lund University, Lund, Sweden.

Abstract (35 Word Limit): Flame experiments using stimulated emission in oxygen and nitrogen atoms induced by 2-photon excitation are reviewed and discussed in terms of today’s development of remote sensing concepts based on backward lasing in air.
How Do Basic Nonlinear Optical Processes Lead to Atmospheric Lasing?

R. W. Boyd; 1, 2
1. Department of Physics, University of Ottawa, Ottawa, ON, Canada.
2. Institute of Optics, University of Rochester, Rochester, NY, United States.

Abstract (35 Word Limit): We review some of the experimental observations of atmospheric lasing and describe how basic nonlinear optical processes such as self focusing, beam filamentation, amplified spontaneous emission and superradiance could lead to some of this behavior.
Low-threshold bidirectional air lasing
A. Laurain; M. Scheller; P. G. Polynkin;
1. University Of Arizona, Tucson, AZ, United States.

Abstract (35 Word Limit): We demonstrate directional forward and backward emission from atmospheric oxygen and nitrogen pumped by a tunable deep-UV laser source. Significant emission enhancement is achieved, in both cases, through pre-dissociation by an additional IR laser pulse
Abstract (35 Word Limit): We measure and analyze mixtures of trace gases at ppb-ppm levels using an external cavity quantum cascade laser sensor with a 1-second response time. Accurate spectral fits are obtained in the presence of overlapping spectra.
Fundamental Limits in Chirped Laser Dispersion Spectroscopy

G. Plant; A. Hangauer; G. Wysocki;

1. Princeton University, Princeton, NJ, United States.

Abstract (35 Word Limit): We present performance analysis of chirped laser dispersion spectroscopy (CLaDS) under shot noise limited conditions. A comparison to direct laser absorption spectroscopy (DLAS) is also provided.
Abstract (35 Word Limit): An overview on the state of the art on the analysis of liquids by QCLs is given with special focus on the determination of secondary structure elements in aqueous protein solutions using an EC-QCL system.
Background-Free Heterodyne Photoexpansion Infrared Nanospectroscopy

F. Lu; M. Jin; M. A. Belkin;
1. University of Texas at Austin, Austin, TX, United States.

Abstract (35 Word Limit): The unwanted photoacoustic pressure force in photoexpansion spectroscopy, which comes from light absorption of the sample not below the AFM tip, was suppressed at the heterodyne frequency of laser pulses and piezo-driven cantilever oscillation.
Large Amplitude Wavelength Modulation Spectroscopy for Sensitive Measurements of Broad Absorbers

T. Hayden; 1; P. Schroeder; 1; G. B. Rieker; 1;

Abstract (35 Word Limit): We demonstrate wavelength modulation spectroscopy of CO$_2$ at >30 atm using a fast-scanning MEMS laser. The technique shows promise for sensitive measurements of species with broadband absorption features, such as high-pressure gases and large molecules.
Fourier-Transform-Based Noise-Immune Cavity-Enhanced Optical Frequency Comb Spectroscopy

A. Khodabakhsh; A. Johansson; L. Rutkowski; A. Foltynowicz-Matyba;

1. Department of Physics, Umeå University, Umeå, Sweden.

Abstract (35 Word Limit): We achieve absorption sensitivity of $6.4 \times 10^{-11} \text{ cm}^{-1} \text{ Hz}^{-1/2}$ per spectral element with near-infrared Fourier-transform-based noise-immune cavity-enhanced optical frequency comb spectroscopy (NICE-OFCS), which allows detection of CO$_2$ at ppb concentration levels.
Photo-thermal Effects in Gases as a Method For Concentration Measurements

M. P. Nikodem; K. Krzempek; K. M. Abramski;

1. Laser&Fiber Electronics Group Wroclaw University of Technology, Wroclaw, Poland.
2. Wroclaw Research Center EIT+, Wroclaw, Poland.

Abstract (35 Word Limit): We present preliminary results on using photo-thermal effects for gas composition analysis. Proof-of-concept experiments will be discussed and several unique detection schemes will be presented.
Abstract (35 Word Limit): We report on Kagome fiber based self-compression of 100 µJ IR pulses to single cycle duration and demonstrate HHG in an integrated scheme which allows a compact isolated attosecond XUV source implementation above 50 eV.
Mid-IR 0.4TW Pulses Achieved Through Hollow-Core Fiber Compression
V. Cardin; 1; N. Thiré; 1; V. Wanie; 1; S. Beaulieu; 1; F. Légaré; 1; B. E. Schmidt; 1;
1. INRS-EMT, Varennes, QC, Canada.

Abstract (35 Word Limit): By employing hollow-core fiber compression using a stretched flexible fiber, we achieved 2-cycles pulses centered on 1.8µm with more than 5mJ energy per pulse.
Broadband ZGP OPA Pumped by Femtosecond Ho:YAG Chirped Pulse Amplifier

P. Malevich; T. Kanai; G. Gitzinger; R. Maksimenka; N. Forget; A. Baltuska; A. Pugzlys;
1. Fastlite, Valbonne, France.
2. Vienna University of Technology, Vienna, Austria.
3. Center for Physical Sciences & Technology, Vilnius, Lithuania.

Abstract (35 Word Limit): We demonstrate a broadband parametric amplifier at 6 µm driven by a femtosecond 2.1-µm Ho:YAG chirped-pulse amplifier. The scheme offers an all-in-one solution for seeding, pumping and phase stabilization of few-cycle pulses in ZnGeP₂ and similar mid-IR crystals.
Millijoule 1-ps Pulses from a kHz Ho:YAG Regenerative Amplifier Seeded with a Tm,Ho-Fiber Laser

P. Malevich; 1; T. Kanai; 1; H. Hoogland; 3, 4; R. Holzwarth; 3, 5; A. Baltuska; 1, 2; A. Pugzlys; 1, 2;
1. Vienna University of Technology, Vienna, Austria.
2. Center for Physical Sciences & Technology, Vilnius, Lithuania.
4. Department of Physics, University of Erlangen-Nuremberg, Erlangen, Germany.
5. Max-Planck-Institute of Quantum Optics, Garching, Germany.

Abstract (35 Word Limit): We demonstrate a 2090-nm 1-ps MOPA based on a Tm,Ho-fiber laser seeder and a Ho:YAG regenerative amplifier delivering 1.25-mJ pulses at a repetition rate of 1-kHz as a prospective driver laser for mid-IR frequency conversion
Ultrastable and High-Power Yb:Fiber Amplifier for Nonlinear Frequency Conversion at High Repetition Rate

P. Storz; M. Wunram; D. Brida; A. Leitenstorfer;
1. Department of Physics, University of Konstanz, Konstanz, Baden-Württemberg, Germany.

Abstract (35 Word Limit): We demonstrate an ultrastable Yb:fiber amplifier delivering 145 fs pulses with 6 µJ energy at 10 MHz repetition rate. The Er:fiber seed laser provides inherently synchronized broadband continua whose power is boosted via optical parametric amplification.
Coherent Mid-IR Supercontinuum Generation in a Hydrogenated Amorphous Silicon Waveguide

H. Sun;¹; K. Wang;¹; R. Salem;²; P. Fendel;²; A. C. Foster;¹;
1. Johns Hopkins University, Baltimore, MD, United States.
2. Thorlabs Inc., Newton, NJ, United States.

Abstract (35 Word Limit): A 790-nm wide Mid-IR supercontinuum generation, spanning from 1.63 μm to 2.42 μm, is demonstrated in a hydrogenated amorphous silicon waveguide. The pump source is a 160-fs Thulium doped fiber laser centered at 1910 nm.
Abstract (35 Word Limit): We report on the design and performance of a Yb:CaF$_2$ booster with a pass-by-pass compensated spatial gain narrowing. A 5-concave-mirror design affords a flexible number of passes as well as 4f-image relay and progressive beam magnification onto the laser crystal.
An Approach for Intense Subcycle Pulse Generation in Air

Y. Kida; T. Imasaka;
1. Kyushu University, Fukuoka, Fukuoka, Japan.

Abstract (35 Word Limit): Four-wave mixing in air is employed for the generation of energetic multicolor femtosecond pulses. After the subsequent propagation in air, the multicolor emissions are phase locked to each other to form intense subcycle laser pulses.
Ultra-pure single-mode photon generation in high-Q silicon microdisks

X. Lu; 1; W. Jiang; 1; J. Zhang; 1; Q. Lin; 1;
1. University of Rochester, Rochester, NY, United States.

Abstract (35 Word Limit): We report ultra-pure single-mode photon generation through four-wave mixing in high-Q silicon microdisks. The cross correlation of photon pairs peaks over 25,000 and the self correlations of both photon modes peak around 1.8.
Efficient Single Photon Generation using a Fiber-integrated Diamond Micro-Waveguide

R. Patel; T. Schroder; N. Wan; L. Li; S. Mouradian; E. Chen; D. Englund;
1. Stanford, Stanford, CA, United States.
2. MIT, Cambridge, MA, United States.

Abstract (35 Word Limit): We demonstrate the efficient coupling of a diamond micro-waveguide containing a single nitrogen-vacancy center to a single mode optical fiber. Strong photon anti-bunching is observed with a raw single-photon count rate exceeding 712,000 Hz.
Enhancing the heralded single photon rate from a silicon photonic chip by pump pulse interleaving

J. He; 1; X. Zhang; 1; I. Jizan; 1; A. Clark; 1; D. Choi; 2; C. Chae; 3; B. J. Eggleton; 1; C. Xiong; 1;
1. School of Physics, University of Sydney, Sydney, NSW, Australia.
2. Laser Physics Centre, Australian National University, Canberra, ACT, Australia.
3. Advanced Photonics Research Institute, Gwangju Institute of Science and Technology, Gwangju, Korea (the Republic of).

Abstract (35 Word Limit): We demonstrate heralded single photon source on a silicon photonic chip by a pump interleaving technique. We have achieved 90±5% enhancement to single photon rate with only 14±2% reduction in quantum signal to noise ratio.
Abstract (35 Word Limit): We show an order-of-magnitude increase in the spectral purity of heralded single photons by engineering the joint spectrum of downconverted photon-pairs. We do this by customizing the crystal poling configuration using simulated annealing.
Final ID: FM2A.5

Temporal Multiplexing toward Periodic and Deterministic Single-Photon Sources
F. Kaneda; 1; B. Christensen; 1; J. Wong; 1; H. Park; 2; K. McCusker; 1, 3; P. Kwiat; 1;
1. University of Illinois at Urbana-Champaign, Urbana, IL, United States.
2. Korea Research Institute of Standards and Science, Daejeon, Korea (the Republic of).
3. Northwestern University, Evanston, IL, United States.

Abstract (35 Word Limit): Utilizing time multiplexing of a heralded single-photon source based on spontaneous parametric downconversion pumped by periodic laser pulses, we observed large enhancements in the single-photon probability.
Thermal light cannot be represented as a statistical mixture of pulses

A. Chenu; A. Branczyk; J. E. Sipe;
1. Perimeter Institute for Theoretical Physics, Waterloo, ON, Canada.
2. University of Toronto, Toronto, ON, Canada.

Abstract (35 Word Limit): Can thermal light be represented by a mixture of single pulses? It cannot; only a modified mixture can yield the correct first-order correlation function at equal space-points. Still, this fails to reproduce higher orders.
Monolithic Source of Tunable Narrowband Photons for Future Quantum Networks

S. Ramelow; 1, 2; A. Farsi; 1; S. Clemmen; 1; K. Luke; 3; M. Lipson; 3, 4; A. L. Gaeta; 1, 4;

1. School of Applied and Engineering Physics, Cornell University, Ithaca, NY, United States.
2. Faculty of Physics, University of Vienna, Vienna, Austria.
3. School of Electrical and Computer Engineering, Cornell University, Ithaca, NY, United States.

Abstract (35 Word Limit): Using high-Q Si₃N₄ microresonators, we generate the narrowest bandwidth (40 MHz) photon pairs, yet achieved for a chip-based source. Its high intrinsic stability and broad tunability are highly promising for interfacing to quantum memory networks.
Ultra-fast heralded single photon source based on telecom technology and non-linear optics

L. Ngah; 1; O. Alibart; 1; L. Labonté; 1; V. D'Auria; 1; S. Tanzilli; 1;
1. Lab.de Physique de la Matière Condensée, Nice cedex 2, France.

Abstract (35 Word Limit): We realize an ultra-fast source of telecom single photons heralded at MHz-rates by combining a 10-GHz repetition-rate laser with off-the-shelf fiber components and waveguide non-linear stages. Measured 2nd-order autocorrelation functions are the lowest reported to date.
Femtosecond coherent nano-spectroscopy of coupled molecular dynamics

J. M. Atkin; 1; P. Sass; 1; H. Yang; 1; P. Teichen; 2; J. Eaves; 2; M. B. Raschke; 1, 2;

1. Physics, University of Colorado, Boulder, CO, United States.
2. Chemistry, University of Colorado, Boulder, CO, United States.

Abstract (35 Word Limit): We isolate the vibrational free-induction decay of a homogeneous molecular sub-ensemble using ultrafast infrared scattering-scanning near-field microscopy. The observed long lifetimes, intramolecular coherence transfer, and spatial variations in vibrational modes indicate non-ergodic behavior.
Nanoscale Transport of Excitons at the Interface Between ZnO and a Molecular Monolayer

S. friede; 1 S. Kuehn; 1 S. Sadofev; 2 S. Blumstengel; 2 F. Henneberger; 2 T. Elsaesser; 1
1. Max-Born-Institute, Berlin, Germany.
2. Institut für Physik, Humboldt-Universität zu Berlin, Berlin, Germany.

Abstract (35 Word Limit): Time-resolved near-field optical microscopy maps exciton transport in a hybrid system. Within the 100 ps photoluminescence lifetime, an equilibrium distribution of surface and bound excitons displays lateral diffusion on a 50 nm length scale.
Single Molecular Vibrational Relaxation Dynamics and Adsorbate Fluctionality

K. Park; V. Kravtsov; P. Sass; J. M. Atkin; E. A. Muller; M. B. Raschke; 1
1. University of Colorado Boulder, United States.

Abstract (35 Word Limit): Tip-enhanced Raman spectroscopy at cryogenic temperatures probes the intrinsic linewidths of vibrational modes. Temperature dependence in small ensembles reveals ultrafast vibrational relaxation dynamics, conformational heterogeneity, and single molecule fluctionality on the seconds time scale.
Probing Coherent Ultrafast Exciton Dissociation in a Polymer: Fullerene Photovoltaic Absorber

A. De Sio; 1 E. Sommer; 1 M. Maiuri; 2 J. Rehault; 2 C. Rozzi; 3 E. Molinari; 3 G. Cerullo; 2 C. Lienau; 1
1. Institut für Physik, Universität Oldenburg, Oldenburg, Germany.
2. Politecnico di Milano, Milano, Italy.
3. CNR Centro S3, Modena, Italy.

Abstract (35 Word Limit): Combining high-time resolution optical spectroscopy and time-dependent density functional theory calculations, we provide strong evidence for the role of vibronic coupling in driving the initial steps of the current photogeneration in an organic photovoltaic system.
Decoupling Bulk and Surface Contributions in Water-Splitting Photocatalysts by \textit{In Situ} Ultrafast Spectroscopy

K. Appavoo; 1

1. Center for Functional Nanomaterials, Brookhaven National Laboratory, Upton, NY, United States.

Abstract (35 Word Limit): By performing ultrafast emissionspectroscopy in an operating, bias-controlled photoelectrochemical cell, we distinguish between bulk and surface recombination processes in a nanostructured photocatalyst and correlate its electronic properties directly with its incident-photon-to-current efficiency.
Fast High-Fidelity Hole Spin Initialisation in a Single Quantum Dot at Zero Magnetic Field
A. Brash; 1 L. M. Martins; 1 F. Liu; 1 J. H. Quilter; 1, 2 M. S. Skolnick; 1 A. Fox; 1
1. Department of Physics and Astronomy, University of Sheffield, Sheffield, United Kingdom.
2. Department of Physics, Royal Holloway, London, United Kingdom.

Abstract (35 Word Limit): Fast (~50 ps) initialisation of a long-lived hole spin qubit in a single InGaAs quantum dot is achieved by exciton ionisation. A QD exhibiting no fine structure yields fidelities exceeding 98% at zero external field thus forming a key building block for high fidelity quantum information processing.
Femtosecond Hole Relaxation and Biexcitonic Transient Absorption in Single CdSe/ZnSe Quantum Dots

C. Hinz, C. Traum, J. Haase, B. Bauer, A. Leitenstorfer, D. Seletskiy

1. Physics, University of Konstanz, Konstanz, Germany.

Abstract (35 Word Limit): Femtosecond few-fermion dynamics in single CdSe/ZnSe quantum dots is studied by two-color pump-probe measurements. We observe sub-picosecond hole relaxation and induced absorption into biexciton states when pumping p-p and d-s transitions.
Charged Exciton Linewidth Narrowing via Nuclear Spin Screening in an InAs QD Ensemble

G. Moody; 1; M. Feng; 1; C. McDonald; 1; R. P. Mirin; 1; K. Silverman; 1;
1. National Institute of Standards and Technology, Boulder, CO, United States.

Abstract (35 Word Limit): Differential transmission spectroscopy of InAs QDs reveals that the positively charged exciton homogeneous linewidth is broadened by the electron hyperfine interaction. Application of a Faraday magnetic field screens the interaction, narrowing the linewidth by 25%.
Mid-infrared Hyperbolic Metamaterial Based on Graphene-dielectric Multilayers

Y. Chang; 1 C. Liu; 1 C. Liu; 1 Z. Zhong; 1 T. B. Norris; 1
1. University of Michigan, Ann Arbor, MI, United States.

Abstract (35 Word Limit): We have designed and fabricated a mid-infrared hyperbolic metamaterial composed of alternating Al₂O₃ and chemical-vapor-deposited graphene. Infrared ellipsometry shows a topological transition from elliptical to hyperbolic dispersion at the wavelength of 7.4 μm.
Thermal Radiation of Hyperbolic Metamaterials and Metallic Surfaces

M. A. Noginov; 1; A. Mozafari; 1; T. Tumkur; 1; J. Kitur; 1; E. Narimanov; 2;
1. Norfolk State University, Norfolk, VA, United States.
2. Purdue University, West Lafayette, IN, United States.

Abstract (35 Word Limit): We have studied angular distribution and spectra of thermal radiation of lamellar metal/dielectric metamaterials with hyperbolic dispersion and have found them to be reasonably close to the corresponding properties of simple metallic films.
Optical Imaging with Photonic Hypercrystals

Z. Huang; 1, 2; E. Narimanov; 1, 2;

1. School of Electrical and Computer Engineering, Purdue University, West Lafayette, IN, United States.
2. Birck Nanotechnology Center, Purdue University, West Lafayette, IN, United States.

Abstract (35 Word Limit): We present an optical imaging system based on photonic hypercrystal, an artificial optical medium combining the properties of hyperbolic materials and photonic crystals. This system functions as a negative refraction lens with substantially reduced image aberrations.
Light Emission in Nonlocal Plasmonic Nanowire Metamaterials

B. Wells; P. Ginzburg; A. V. Zayats; V. A. Podolskiy;
1. Univ Massachusetts Lowell, United States.
2. Physics, King's College, London, United Kingdom.

Abstract (35 Word Limit): We analyze, analytically and computationally, light emission in nonlocal plasmonic nanowire metamaterials and analyze the contribution of longitudinal wave to the density of optical states in the system.
Simultaneous enhancement of decay rate and light extraction from active hyperbolic metamaterial
T. Galfsky; 1, 2; H. Krishnamoorthy; 1, 2; W. Newman; 3; E. Narimanov; 4; Z. Jacob; 3; V. M. Menon; 1, 2;
1. Physics, Graduate Center of the City University of New York, New York, NY, United States.
2. Physics, City College of the City University of New York, New York, NY, United States.
3. Department of Electrical and Computer Engineering, University of Alberta, Edmonton, AB, Canada.
4. Birck Nanotechnology Center, School of Computer and Electrical Engineering, Purdue University, West Lafayette, IN, United States.

Abstract (35 Word Limit): We demonstrate simultaneous enhancement in spontaneous emission rate and light extraction from hyperbolic metamaterials embedded with quantum dots using a high contrast grating. Enhancements of twenty-fold in extraction and thirteen-fold in emission rate are observed.
Non-Resonant Hyperlens in the Visible Range

J. Sun; ¹; M. Shalaev; ¹; N. M. Litchinitser; ¹;
1. State University of New York at Buffalo, Buffalo, NY, United States.

Abstract (35 Word Limit): A non-resonant hyperlens operating in the visible wavelength range is demonstrated experimentally. Non-resonant indefinite properties, enabling low-loss, broadband sub-wavelength imaging, were realized using a fan-like structure made using a combination of top-down and bottom-up techniques.
Multilayer Cladding with Hyperbolic Dispersion for Plasmonic Waveguides

V. Babicheva; 1, 2; M. Y. Shalaginov; 2; S. Ishii; 2, 3; A. Boltasseva; 2, 4; A. V. Kildishev; 2;

1. ITMO University, St. Petersburg, Russian Federation.
2. Purdue University, West Lafayette, IN, United States.
3. International Center for Materials Nanoarchitectonics (MANA), National Institute for Materials Science (NIMS), Tsukuba, Ibaraki 305-0044, Japan.
4. DTU Fotonik, Technical University of Denmark, Kgs. Lyngby, Denmark.

Abstract (35 Word Limit): We study the properties of plasmonic waveguides with a dielectric core and multilayer metal-dielectric claddings that possess hyperbolic dispersion. The waveguides hyperbolic multilayer claddings show better performance in comparison to conventional plasmonic waveguides.
Effect of a hyperbolic metamaterial on radiation patterns of a single-photon source

M. Y. Shalaginov; 1; A. Lagutchev; 1; V. M. Shalaev; 1; A. V. Kildishev; 1;
1. Purdue University, West Lafayette, IN, United States.

Abstract (35 Word Limit): We explore the effect of a planar hyperbolic metamaterial (a superlattice of TiN and Al_{0.7}Sc_{0.3}N on MgO substrate) on the far-field radiation patterns of a single-photon source (a nitrogen-vacancy center in a nanodiamond).
Nonlinear Transmission of Light Through Biological Suspensions

A. Bezryadina; 1; G. Siggins; 1; A. Kalmbach; 2; E. Carpenter; 2; Z. Chen; 1, 3;

1. Physics and Astronomy, San Francisco State University, San Francisco, CA, United States.
2. Romberg Tiburon Center for Environmental Studies, San Francisco State University, San Francisco, CA, United States.
3. TEDA Applied Physics Institute and School of Physics, Nankai University, Tianjin, China.

Abstract (35 Word Limit): We study nonlinear light propagation through suspensions of *Synechococcus* cells. Such cyanobacteria in aqueous solution enable self-focusing or self-defocusing of a light beam, leading to controlled transmission despite extremely low absorption and weak polarizability.
Rapid Manipulation of the Spatial Coherence

C. Tradonsky; 1 R. Chriki; 1 M. Nixon; 1 V. Pal; 1 G. Barach; 1 A. A. Friesem; 1 N. Davidson; 1

Abstract (35 Word Limit): Efficient method for manipulating the spatial coherence of a laser is presented. Different mutual intensity coherence functions, such as cosine or Bessel functions, are obtained, and number of modes is controlled in 1D and 2D.
Total Internal Reflection in Gain Media

H. Herzig Sheinfux; 1, B. Zhen; 1, 2, I. Kaminer; 1, 2, M. Segev; 1;
1. Technion Israel Institute of Technology, Haifa, Israel.
2. MIT, Cambridge, MA, United States.

Abstract (35 Word Limit): We resolve the controversy around total internal reflection from gain media, propose new effects of (extremely) amplified reflection from a single interface, and show sensitivity to subwavelength features.
CW Laser Light Condensation

M. Zhurahov; A. Bekker; B. Levit; R. Weill; B. Fischer;

1. Technion Israel Institute of Technology, Haifa, Israel.

Abstract (35 Word Limit): We present a first experimental demonstration of classical CW laser condensation in the frequency (mode) domain. It also sheds light on the general question of photon-BEC (Bose-Einstein condensation) in laser cavities.
Resonant Phase Matching of Josephson Junction Traveling Wave Parametric Amplifiers

K. O'Brien; 1; C. Macklin; 2; I. Siddiqi; 2; X. Zhang; 1;
1. University of California at Berkeley, Berkeley, CA, United States.
2. QNL, University of California at Berkeley, Berkeley, CA, United States.

Abstract (35 Word Limit): We propose a technique to phase-match Josephson-junction traveling wave parametric amplifiers to achieve high gain over a broad bandwidth for applications such as the multiplexed readout of quantum coherent circuits.
Photoluminescence Upconversion Study of GaN Nanowires: Potential for Optical Refrigeration
R. Chen; 1; G. Sun; 1; Y. J. Ding; 1; H. Nguyen; 2; Z. Mi; 2;
1. Electrical and Computer Engineering, Lehigh University, Bethlehem, PA, United States.
2. Electrical and Computer Engineering, McGill University, Montreal, QC, Canada.

Abstract (35 Word Limit): Up-converted photoluminescence of GaN nanowires is observed at the temperature above 375 K. At 475 K, the mechanism of the photoluminescence was identified as phonon-assisted bandtail emission. Such a phenomenon contributes to optical refrigeration.
Guide-wave Photonic Pulling Force Using One-way Photonic Chiral Edge States

D. Wang; 1, C. Qiu; 3; P. T. Rakich; 2; Z. Wang; 4;

1. Department of Physics, The University Of Texas at Austin, Austin, TX, United States.
2. Department of Applied Physics, Yale University, New Haven, CT, United States.
3. Department of Electrical and Computer Engineering, National University of Singapore, Singapore, Singapore.
4. Department of Electrical and Computer Engineering, The University Of Texas at Austin, Austin, TX, United States.

Abstract (35 Word Limit): We provide a new scheme of photonic pulling force in one-way waveguides. Objects of arbitrary shape and dielectric properties can be pulled all the way to the light source, regardless of waveguide geometry.
Experimental Detection of Forces in an Optical Analog of Aharonov-Bohm Effect

S. Sukhov; V. Kajorndejnukul; J. Broky; A. Dogariu

1. University of Central Florida, CREOL, Orlando, FL, United States.

Abstract (35 Word Limit): Wavefront dislocations in scattering create an Aharonov-Bohm setting where nonconservative reaction forces can be detected experimentally. Observing the dynamics of microscopic particles clarifies the role the finite wave-packets on the transfer of wave’s canonical momentum.
Abstract (35 Word Limit): Realization of a quantum optical nonlinearity at the single-photon level remains an outstanding challenge. Here we consider optomechanical and microwave-domain approaches for such nonlinearities, and develop applications in quantum sensing and simulation.
Fluorescent Nanodiamonds from Molecular Diamond Seed

H. Ishiwata; J. Zhang; R. Edgington; T. M. Babinec; K. Muller; K. G. Lagoudakis; N. Melosh; Z. Shen; J. Vuckovic;

1. Stanford University, Mountain View, CA, United States.

Abstract (35 Word Limit): We present a new materials growth technique using diamondoid molecular diamonds as a seed for chemical vapor deposition growth. We show that both nanoscopic high quality diamond crystals with silicon vacancy color centers can be grown from self-assembled monolayers of pentamantane (C_{26}H_{32}).
On-Chip generation of photon-triplet states in integrated waveguide structures

S. Krapick; 1 B. Brecht; 1 V. Quiring; 1 R. Ricken; 1 H. Herrmann; 1 C. Silberhorn; 1
1. Physics Department, University of Paderborn, 33098 Paderborn, Germany.

Abstract (35 Word Limit): We present a miniaturized integrated waveguide source providing $11.3 \pm 0.7$ photon-triplet states per hour, measured with off-the-shelf components. By double-stage heralding and integration times of 83 hours, we achieve statistical significance of more than $27 \sigma$. 
Nonlinear Interactions in Optical Lattice Systems

D. N. Christodoulides; 1

1. University of Central Florida, Orlando, FL, United States.

Abstract (35 Word Limit): Photonic lattices provide a versatile classical platform for observing a host of nonlinear processes. In this talk we provide an overview of recent activities in such arrangements with a special emphasis on quantum-inspired systems.
Complete conversion of one to two photons in dispersion-engineered nonlinear waveguides

A. A. Sukhorukov; A. S. Solntsev;

1. Nonlinear Physics Centre, Research School of Physics and Engineering, Australian National University, Canberra, ACT, Australia.

Abstract (35 Word Limit): We predict that complete deterministic conversion of one to two photons can be achieved at a finite propagation distance in specially engineered nonlinear waveguides, by designing quantum frequency mixing across a broad range of frequencies.
Phase-Noise Limitations on Nonlinear-Optical Quantum Computing

J. Dove; C. Chudzicki; J. H. Shapiro; 2

2. Research Laboratory of Electronics, Massachusetts Institute of Technology, Cambridge, MA, United States.

Abstract (35 Word Limit): We establish a framework for evaluating CPHASE gates that use single-photon Kerr nonlinearities in which one pulse overtakes another. We show that causality-induced phase noise precludes the possibility of high-fidelity π-radian conditional phase shifts.
Abstract (35 Word Limit): We report the demonstration of room-temperature lasing in a single GaAs nanowire embedding 50-stacked In$_{0.22}$Ga$_{0.78}$As/GaAs quantum dots at a lasing emission energy of 1.37 eV with a threshold pump pulse fluence of 138 μJ/cm$^2$. 

Room-temperature lasing in GaAs nanowires embedding multi-stacked InGaAs/GaAs quantum dots

J. Tatebayashi; 2; S. Kako; 2; J. Ho; 2; Y. Ota; 2; S. Iwamoto; 2, 1; Y. Arakawa; 2, 1;

1. IIS, the University of Tokyo, Meguro, Japan.
2. NanoQUINE, the University of Tokyo, Meguro, Japan.
Nonpolar InGaN/GaN multi-quantum-well core-shell nanowire lasers

C. Li; J. B. Wright; S. Liu; P. Lu; J. Figiel; B. Leung; T. S. Luk; I. Brener; D. Feezell; S. Brueck; G. Wang;

1. Center for High Technology Materials, University of New Mexico, Albuquerque, NM, United States.
2. Sandia National Laboratories, Albuquerque, NM, United States.
3. Center for Integrated Nanotechnology, Sandia National Laboratories, Albuquerque, NM, United States.

Abstract (35 Word Limit): Lasing is demonstrated from nonpolar III-nitride core-shell multi-quantum-well nanowires. The nanowire lasers were fabricated by coupling a top-down and bottom-up methodology and achieved lasing at wavelengths below the GaN bandedge.
A novel, highly-strained structure with an integrated optical cavity for a low threshold germanium laser
S. Gupta; 1; D. Nam; 1; J. Petykiewicz; 1; D. Sukhdeo; 1; J. Vuckovic; 1; K. Saraswat; 1;
1. Stanford University, Stanford, CA, United States.

Abstract (35 Word Limit): We propose a novel low threshold, CMOS-compatible laser structure with a strained
germanium gain medium and a photonic crystal cavity. We demonstrate 1.70% uniaxial tensile strain through
experiments and design a high quality factor (>11,000) optical cavity around the gain medium.
Abstract (35 Word Limit): We demonstrate the first long-wave, room temperature II-VI materials based Quantum Cascade emitter around 7.2 µm. At 80 K, a device differential resistance of 2.6 Ω and a narrow electroluminescent width of 16% was obtained.
Fe:ZnSe Channel Waveguide Laser Operating at 4122 nm
A. Lancaster; 1; G. Cook; 2; S. McDaniel; 3; J. Evans; 2; P. Berry; 2; J. Shephard; 1; A. Kar; 1;
1. Heriot-Watt University, Dundee, United Kingdom.
2. Sensors Directorate, Air Force Research Laboratory, Dayton, OH, United States.
3. Leidos Inc, Dayton, OH, United States.

Abstract (35 Word Limit): The first demonstration of a waveguide laser in Fe:ZnSe is presented. The waveguide laser produces 49 mW of output power at 4122 nm with a spectral bandwidth of 6 nm FWHM.
Optically Pumped Distributed Feedback Laser from Organo-Lead Iodide Perovskite Thin Films

S. Chen; 1; W. Chong; 2, 3; J. Lee; 1; K. Roh; 1; E. Sari; 1; N. Mathews; 4; T. Sum; 2; A. Nurmikko; 1;
1. School of Engineering and Department of Physics, Brown University, Providence, RI, United States.
2. School of Physics & Mathematical Sciences, Nanyang Technological University, Singapore, Singapore.
3. Energy Research Institute @NTU, Interdisciplinary Graduate School, Nanyang Technological University, Singapore, Singapore.
4. School of Materials Science and Engineering, Nanyang Technological University, Singapore, Singapore.

Abstract (35 Word Limit): Perovskite (CH$_3$NH$_3$PbI$_3$) films possessing optical quality were prepared by solution-based spin-casting at room temperature. We report near infrared lasing with well-defined spatially coherent output from second-order surface-emitting distributed feedback grating structure with perovskite active media.
Monolayer Tungsten Disulfide Laser
Y. Ye; Z. Wong; X. Lu; H. Zhu; Y. Wang; X. Chen; X. Zhang
1. UC Berkeley, Berkeley, CA, United States.
2. Hefei National Laboratory for Physics Science at Microscale and Department of Physics, University of Science and Technology of China, Beijing, China.
3. Lawrence Berkeley National Laboratory, Materials Sciences Division, Berkeley, CA, United States.

Abstract (35 Word Limit): We demonstrate the first realization of monolayer tungsten disulfide laser embedded in a microdisk resonator.
Improvement for characterizing micro-ring resonator by low coherence interferometry measurement

W. Liu; 1; C. Chen; 1; C. Wei; 1; Y. Chen; 1;
1. National Sun-Yat-sen University, Kaohsiung, Taiwan.

Abstract (35 Word Limit): We demonstrate an effective technique which allows one to characterize a small radius micro-ring resonator via low coherence interferometric measurement beyond light source bandwidth limitation. The experimental results show significant improvements in the extracted parameters.
Efficient Coefficient Extraction from Doublet Resonances in Microphotonic Resonator Transmission Functions

A. Jones; 1, 2; A. L. Lentine; 1; C. T. DeRose; 1; S. L. Andrew; 1; P. Andrew; 1; R. Norwood; 2;
1. Sandia National Laboratories, , United States.
2. Optical Sciences, University of Arizona, Tucson, AZ, United States.

Abstract (35 Word Limit): We develop a computationally efficient and robust algorithm to automatically extract the coefficients of doublet resonances and apply this technique to 418 resonances in ring resonator transmission data with a mean RMS deviation of $7.28 \times 10^{-4}$. 
Abstract (35 Word Limit): Complex Faraday effect and magnetic permeability measurements on iron-platinum (FePt) nanoparticles embedded in a polystyrene–poly(2-vinyl)pyridine (PS-P2VP) copolymer matrix are reported. Possible applications include high performance biomagnetic field sensors and optical isolators.
Abstract (35 Word Limit): We present the characterization of minority carrier diffusion length and surface recombination velocity, as well as vertical diffusivity and mobility by performing an electron beam induced current measurement in addition to an optical lifetime measurement.
Broadband (3.9 – 9.6 μm) Photocurrent in Quantum Cascade Detector with Diagonal Transitions
G. Maioli Penello; 1; B. Merkel; 1, 2; C. F. Gmachl; 1; D. L. Sivco; 1;
1. Princeton University, Princeton, NJ, United States.
2. Department of Physics, University of Duisburg-Essen, Duisburg, Germany.

Abstract (35 Word Limit): By carefully designing diagonal transitions in the active region, we present a broadband mid-infrared quantum cascade detector with photocurrent ranging from 3.9 to 9.6 mm, more than 2 times broader than stacked designs.
Spectral Dependence of Third-Order Nonlinear Optical Properties in InN

H. Ahn; M. Lee;
1. National Chiao Tung University, Hsinchu, Taiwan.

Abstract (35 Word Limit): Spectral dependence of nonlinear optical absorption cross-section (s) near and below the bandgap ($E_g$) is measured for InN by using Z-scan technique. A drastic increase of s near $E_g$ can be understood by the band-filling model.
Characterization of Graphene Photothermoelectric Detector via Two-wave Mixing Technique

M. Jadidi; R. J. Suess; X. Cai; A. B. Sushkov; M. Mittendorff; M. Fuhrer; H. Drew; T. E. Murphy;

1. Institute for Research in Electronics and Applied Physics, University of Maryland, College Park, MD, United States.
2. Center for Nanophysics and Advanced Materials, University of Maryland, College Park, MD, United States.

Abstract (35 Word Limit): We study the response of a graphene photothermoelectric-based detector illuminated by two continuous-wave optical beams. The power and frequency dependence of the photoresponse are used to probe the graphene hot-electron cooling rates and mechanisms.
Tricycloquinazoline-Based Organometallic Compounds for Optical Switching

W. Shensky; J. Shi; M. J. Ferry; T. Pritchett;

1. US Army Research Laboratory, Adelphi, MD, United States.

Abstract (35 Word Limit): The nonlinear absorption was studied for compounds linking tricycloquinazoline to a number of iridium groups. It was determined that the excited-state cross section was highest for the compound with a single iridium group.
Nonlinear THz Optics and Control in Complex Solids

A. Cavalleri, 1, 2
1. Max Planck Institute for the Structure and Dynamics of Matter, Hamburg, Germany.
2. Department of Physics, University of Oxford, Oxford, United Kingdom.

Abstract (35 Word Limit): I will discuss nonlinear interaction between THz light and matter. Especially, I will discuss the nonlinear response of infrared active phonons and superconducting plasmons in High Tc cuprates.
Generation of mJ THz pulses in organic crystal pumped by a Cr:Mg2SiO4 laser

C. Vicario; 1 A. Ovchinnikov; 2 S. Ashitkov; 2 S. Agranat; 2 V. E. Fortov; 2 C. P. Hauri; 1, 3
1. Paul Scherrer Institute, Villigen, AG, Switzerland.
2. Joint Institute for High Temperatures of RAS, Moscow, Russian Federation.
3. Ecole Polytechnique Federale de Lausanne, Lausanne, Switzerland.

Abstract (35 Word Limit): We demonstrated 0.9 mJ terahertz pulses by optical rectification of a high-energy Cr:Mg2SiO4 laser in large organic crystal. The emitted spectrum covers 0.1- 5 THz and the peak fields exceed 42 MV/cm and 14 Tesla.
On Extracting the Maximum Terahertz Conversion Efficiency from Optical Rectification in Lithium Niobate

S. Carbajo; 2, 3; P. Alcorta; 2; A. Calendron; 2, 3; H. Cankaya; 2; X. Wu; 2; K. Ravi; 1; F. Ahr; 2, 3; W. Huang; 1; F. X. KAERTNER; 1, 2,

1. Massachusetts Institute of Technology, Cambridge, MA, United States.
3. Physics Department, University of Hamburg, Hamburg, Germany.

Abstract (35 Word Limit): We report on a record 2% extracted optical-to-terahertz conversion efficiency in the mm-wavelength range through optical rectification in cryogenically-cooled lithium niobate by exploiting spatial and temporal shaping of the optical pump beam.
Generation of Elliptically Polarized Half-Cycle Terahertz Pulses Generated by 6H-SiC Large Aperture Photoconductive Antenna

x. ropagnol; 1; m. bouvier; 2; C. Côté; 2; M. Reid; 3; M. Gauthier; 1; T. Ozaki; 1;
1. INRS-EMT, Varennes, QC, Canada.
2. Axis photonique INC, Varennes, QC, Canada.
3. UNBC, Prince George, BC, Canada.

Abstract (35 Word Limit): We demonstrated the generation of elliptically half-cycle terahertz pulses with 167 nJ energy generated by a 6H-SiC large aperture photoconductive antenna covered by a phase mask. By optimizing the design of the antenna and the mask, we could generate circularly polarized half-cycle THz pulses.
Extreme Terahertz brightness by focusing to a lambda-cubic volume

C. P. Hauri; 1, 2; M. Shalaby; 1;
1. Paul Scherrer Institut, Villigen PSI, AG, Switzerland.
2. Ecole Polytechnique Federale de Lausanne, Lausanne, Switzerland.

Abstract (35 Word Limit): We demonstrate bright low-frequency terahertz (<5 THz) radiation confined to a diffraction-limited spot size by wavefront manipulation. Focusing to a lambda-cubic volume provides bright THz radiation at the PW/m² level.
Integrated Hardware-Software Implementation of Silicon Photonic Interconnected Computing System

K. Bergman; 1
1. Columbia University, New York, NY, United States.

Abstract (35 Word Limit): Silicon photonics interconnect technology can potentially deliver computing systems energy efficient data movement with extreme bandwidth densities. We discuss the first complete experimental silicon photonic interconnected hardware-software implementation that demonstrates the system-level performance benefits.
Active Resonance Wavelength Stabilization for Silicon Microring Resonators Using Slope-Detection with an In-resonator Defect-state-absorption-based Photodetector

Y. Li; 1; A. W. Poon; 1;
1. Photonic Device Laboratory, Department of Electronic and Computer Engineering, The Hong Kong University of Science and Technology, Hong Kong, China.

Abstract (35 Word Limit): We demonstrate active resonance wavelength stabilization for silicon microrings with an in-resonator BF$_2$-implanted photodetector using a slope-detection method. Our experiment reveals active resonance wavelength stabilization with ~1dB transmission intensity variations upon a 7°C 10mHz modulation.
Photoresistive Microring Heater with Resonance Control Loop

P. Dong; C. V. Poulton; Y. Chen;

Abstract (35 Word Limit): We demonstrate a germanium photoresistive microring heater that acts as a single device to sense and tune the resonant wavelength of the ring. A control loop to lock the resonance to a laser is shown.
Demonstration of Reconfigurable Electro-Optical Directed-Logic Circuit by Carrier Depletion Micro-ring Resonators

C. Qiu, 1, 2; W. Gao, 2; R. Soref, 3; J. Robinson, 2; Q. Xu, 2;
1. Shanghai Jiao Tong University, Shanghai, China.
2. Rice University, Houston, TX, United States.
3. University of Massachusetts, Boston, MA, United States.

Abstract (35 Word Limit): Here we demonstrate a reconfigurable electro-optical directed-logic circuit based on a 4-fold array of switches. We showed that this circuit can be reconfigured to perform arbitrary two-input logic functions with speed up to 3 Gb/s.
Abstract (35 Word Limit): Integrated components necessary for a mode-locked laser are demonstrated on a platform that allows for monolithic integration with active silicon photonics and CMOS circuitry. CW lasing and Q-switched mode-locking are observed in the full structures.
Noise and fluctuations in silicon photonics caused by free carrier and two-photon absorption

B. Jalali; 2
D. Dimitropoulos; 1
1. -, Athens, Greece.
2. Electrical Engineering, UCLA, Los Angeles, CA, United States.

Abstract (35 Word Limit): Non-linear optical losses result from convergence of wafer scale economics and information theory in silicon nanophotonics. We discuss new sources of noise and fluctuations that arise from two-photon and free carrier plasma effects.
High contrast and power-efficient thermally-controlled optical switch on Silicon-on-Insulator

S. Combrié; Z. Han; G. Moille; X. Checoury; J. Bourderionnet; G. Lehoucq; P. Boucaud; A. De Rossi;
1. Thales Research & Technology, Palaiseau, France.
2. Univ. Paris-Sud, CNRS UMR 8622, Institut d’Electronique Fondamentale, Orsay, France.

Abstract (35 Word Limit): A low-loss and fast optical switch is demonstrated on Silicon-on-Insulator. Low insertion losses (6dB), a large dynamic contrast (30dB) and a wide tuning range (6nm) are achieved with an operating electric power consumption in the milliwatt range.
A Full-Field Tomographic Imaging Camera Based on a Linearly Swept Frequency DFB at 1064 nm

M. Harfouche; ¹; N. Satyan; ²; G. Rakuljic; ²; A. Yariv; ³;
1. Electrical Engineering, California Institute of Technology, Pasadena, CA, United States.
2. Telaris Inc., Santa Monica, CA, United States.

Abstract (35 Word Limit): High resolution, full-field tomograms are acquired in four exposures of a CCD camera using a swept laser. The imaged depth is selected by modulating the swept laser output power enabling volumetric imaging with no moving parts.
A Joint Richardson-Lucy Deconvolution Algorithm for the Reconstruction of Multifocal Structured Illumination Microscopy Data

C. F. Kaminski; 1; F. Stroehl; 1;

Abstract (35 Word Limit): We demonstrate the reconstruction of multifocal structured illumination microscopy images using a joint Richardson-Lucy deconvolution algorithm, which is based on an underlying widefield image-formation model and particularly well suited for noise corrupted data.
Electron-injection Detectors for Swept Source Optical Coherence Tomography
V. Fathipour; 1; H. Mohseni; 1;
1. Northwestern University, Evanston, IL, United States.

Abstract (35 Word Limit): Electron-injection detectors are used in an OCT system for the first time. Compared to a commercial p-i-n detector, electron-injection detectors show ~20 dB higher SNR. This could lead to OCT systems without the need for balanced-detection.
Concentric Si Annular Photodiode Arrays for Spatially Resolved Diffuse Reflectance Spectroscopy

O. Senlik; 1; N. M. Jokerst; 1;
1. Electrical and Computer Engineering, Duke University, Durham, NC, United States.

Abstract (35 Word Limit): This paper describes the design, fabrication, and test of a custom concentric PD array for spatially resolved diffuse reflectance (SRDR) measurements. To the best of our knowledge, this is the first reported compact, densely packed semiconductor SRDR probe.
Two-photon excited ReaChR by a three-stage femtosecond optical parametric amplifier

C. Tsai; P. Hsiao; M. Chen; S. Yang; Y. Lin; A. Chiang;
1. Natl Tsing Hua Univ, Hsinchu, Taiwan.
2. Academia Sinica, Taipei, Taiwan.

Abstract (35 Word Limit): A three-stage optical parametric amplifier is built to produce 1 kHz, 31 fs, ~200 μJ signal pulses with tunable wavelengths. Red-activatable channelrhodopsin in fruit fly is optimally two-photon excited to copulation behavior at 1250 nm.
End-Fire Silicon Waveguide Array as a Platform for High Power Beam Shaping and Steering
M. Kossey; C. Rizk; A. C. Foster; 1
1. Johns Hopkins University, Baltimore, MD, United States.
2. Johns Hopkins Applied Physics Laboratory, Laurel, MD, United States.

Abstract (35 Word Limit): We demonstrate a scalable array of end-firing silicon waveguides as a platform for high-speed, high-power operation beam-steering applications. We fabricate devices, culminating in 16×1 arrays with a measured central lobe FWHM of 7°±0.6°.
Tunable Dual Color Source For Multiphoton Imaging

D. Heberle; 1; K. Charan; 1; C. Xu; 1;
1. Cornell University, Ithaca, NY, United States.

Abstract (35 Word Limit): We present a tunable-wavelength, multi-color source for imaging several fluorophores simultaneously. The source is based on amplitude modulation of the seed in a chirped-pulse amplification system, followed by soliton self-frequency shift in a large-mode-area fiber.
Tether-less Implantable Upconverting Microscale Light Bulbs for Deep Brain Neural Stimulation and Imaging

M. Chamanzar; 1; D. Garfield; 2; j. iafrati; 3; V. Sohal; 3; B. Cohen; 2; P. Schuck; 2; M. Maharbiz; 1;

1. University of California Berkeley, Berkeley, CA, United States.
2. Lawrence Berkeley National Lab, Berkeley, CA, United States.
3. UCSF, San Francisco, CA, United States.

Abstract (35 Word Limit): We demonstrate the design and fabrication of implantable micro-scale light “bulbs” comprising of parylene-encapsulated upconverting lanthanide-doped nanocrystals (absorbing near-infrared and emitting blue light) for non-invasive targeted optogenetic stimulation of local neuronal ensembles.
Industrial Processing of Various Materials using Ultrashort Pulsed Laser Sources

D. Walter;  
1. MANZ, Reutlingen, Germany.

Abstract (35 Word Limit): Micro machining using ultra short laser pulses renders high ablation quality along with superb precision. Due to a very short interaction time in combination with high power densities various applications such as cutting, patterning, marking etc. may be carried out on a wide range of materials from brittle to ductile. Implementing suitable laser sources along and its periphery in high-throughput industrial machinery is a key for efficient production facilities.
Nonlinear Laser Lithography for Enhanced Tribological Properties

I. Gnilitskyi; 1
1. UNIMORE, Reggio Emilia, RE, Italy.

Abstract (35 Word Limit): This paper investigates a new field for application of femtosecond laser-induced periodic surface structures (LIPSS). We designed an innovative solution to reduce coefficient of friction of mechanical parts by using the nonlinear laser lithography technique (NLL).
Radially Polarized Optical Vortex Micro-Converters Imprinted by Femtosecond Laser Nanostructuring in Amorphous Silicon

R. Drevinskas; M. Beresna; M. Gecevičius; a. g. kazanskii; o. i. konkov; Y. P. Svirko; P. Kazansky.
1. University of Southampton, Southampton, United Kingdom.
2. M.V. Lomonosov Moscow State University, Moscow, Russian Federation.
3. A.F. Ioffe Physicotechnical Institute, St. Petersburg, Russian Federation.
4. University of Eastern Finland, Joensuu, Finland.

Abstract (35 Word Limit): We demonstrate space variant polarization and phase converters imprinted by femtosecond laser nanostructuring in hydrogenated amorphous silicon thin film. Giant birefringence of imprinted structures allows fabrication of microoptic element arrays.
Excimer Laser Annealing for LTPS on Large Substrates

R. Paetzel; 1
1. Coherent GmbH, Goettingen, Germany.

Abstract (35 Word Limit): Low-Temperature Polycrystalline Silicon (LTPS) is the enabling backplane technology for AMOLED displays and small to medium sized high-resolution AMLCDs. Progress on Excimer Laser Annealing towards large-scale production of LTPS is described.
Random Surface Texturing of mc-Silicon for Solar Cells with Picosecond Lasers; a Comparison between 1064 nm, 532 nm and 355 nm Laser Emission Wavelengths

s. pellegrino; 4; l. longoni; 4; d. scorticati; 4; s. binetti; 1; A. Le Donne; 1; A. Rolfi; 1; E. Grilli; 1; C. Busto; 2; B. Neuenschwander; 3; B. Jaeggi; 3;
1. Università Milano Bicocca, Milano, Italy.
2. ENI, Novara, Italy.
3. Bern University of Applied Sciences, Bern, Switzerland.
4. Laserpoint, Vimodrone, Italy.

Abstract (35 Word Limit): Multicrystalline Silicon was textured with picosecond laser. Different laser wavelengths (λ = 1064, 532, 355 nm) where compared regarding laser-induced damage. We found that λ = 355 nm picosecond radiation resulted in shallower defect-reach region
Elucidating the Mechanism of Nanocone and Nanohole Formation on Si by Optical Trap Assisted Nanopatterning

T. Chen; Y. Tsai; R. Fardel; C. B. Arnold;

1. Princeton University, Princeton, NJ, United States.

Abstract (35 Word Limit): Using optical trap-assisted nanopatterning (OTAN), we are able to control the formation of nanocones and nanoholes in Silicon. The effects are described by integrating FDTD and heat transfer modeling to account for the nanoscale features.
Multiple-Cladding-Resonance All-Solid Photonic Bandgap Fibers with Large Mode Area

G. Gu; F. Kong; T. W. Hawkins; M. Jones; L. Dong;
1. Clemson University, Anderson, SC, United States.

Abstract (35 Word Limit): We demonstrated both theoretically and experimentally robust single-mode operation in all-solid photonic bandgap fibers with record effective mode areas of ~2650µm² by introducing multiple strongly coupled smaller cores in the cladding.
Abstract (35 Word Limit): We demonstrate an ultra-low-NA (~0.038) Yb-doped step-index-fiber fabricated using conventional MCVD and solution-doping process. The fiber ensures ~700μm² Aeff for effective-single-mode operation and 81% laser efficiency with M² ~1.1 at a bend diameter of 32cm.
Experimental Observation of Non-Linear Mode Conversion in Few-Mode Fiber

J. Xu; 1 G. S. Gordon; 2 T. Wilkinson; 2 C. Peucheret; 3
1. Huazhong University of Sci. and Tech., Wuhan, Hubei, China.
2. Engineering Department, Electrical Engineering Division, Cambridge, United Kingdom.
3. CNRS UMR 6082, Foton Laboratory, Rennes, France.

Abstract (35 Word Limit): We show for the first time directly experimentally observed nonlinear spatial mode coupling in a 10 km long graded-index few-mode fiber.
Reconstructing Core-to-Core Variations of Propagation Constant in Coupled Multicore Fiber for Quantum Walks

P. J. Mosley; 1 I. Gris-Sanchez; 1; J. Stone; 1 R. Francis-Jones; 1 R. A. Hoggarth; 1 D. J. Ashton; 2 T. A. Birks; 1

1. Centre for Photonics and Photonic Materials, University of Bath, Bath, United Kingdom.
2. Department of Physics, University of Bath, Bath, United Kingdom.

Abstract (35 Word Limit): We present a novel method of determining differences in propagation constant between coupled cores in multicore fiber by a Markov chain Monte Carlo reconstruction and discuss its implications for quantum walks of photons.
Comparing Inter-Core Skew Fluctuations in Multi-Core and Single-Core Fibers

Y. Awaji; R. S. Luis; B. Puttnam; J. M. Mendinueta; W. Klaus; N. Wada;


Abstract (35 Word Limit): We measure the dynamic skew fluctuations between cores in a multicore fiber and show that they are more than one order of magnitude smaller than those of parallel single-core fibers over a 24 hour period.
Spatiotemporal Nonlinear Optics in Multimode Fibers

L. Wright; 1  D. N. Christodoulides; 2  F. W. Wise; 1
1. Cornell University, Ithaca, NY, United States.
2. College of Optics and Photonics, CREOL, University of Central Florida, Orlando, FL, United States.

Abstract (35 Word Limit): We study nonlinear pulse propagation of high-energy ultrashort pulses in graded-index multimode fibers. By adjusting initial conditions, we observe and control a wide range of nonlinear effects including spatiotemporal effects resembling self-focusing and multiple filamentation.
Complete Spatiotemporal Measurement of Ultrashort Pulses Emerging from Multi-mode Optical Fiber

Z. Guang; 1
R. Trebino; 1
1. Georgia Institute of Technology, Atlanta, GA, United States.

Abstract (35 Word Limit): Using a newly developed technique, we measure the complete spatiotemporal field of ultrashort pulses emerging from dual-mode optical fibers, finding spatiotemporal complexity, introduced by the different spatial modes, having different group velocities and modal dispersions.
Transmission of Focused Picosecond Light Pulse through a Multimode Fiber

Y. Cen; 2, 1; Y. Chen; 2, 1;

1. Department of Physics, City University of New York Graduate Center, New York, NY, United States.
2. Department of Physics and Astronomy, Hunter College, New York, NY, United States.

Abstract (35 Word Limit): We report the experimental demonstration and numerical simulation for delivery of spatially focused temporally compressed picosecond laser pulse through a 10-meter-long step-index multimode fiber by shaping the wavefront of incident light using a deformable mirror.
From Single Photon Superradiance to Coherence-Brightened Lasers in the Sky

M. O. Scully; 1, 2;
1. TEXAS A&M UNIVERSITY, College Station, TX, United States.
2. BAYLOR UNIVERSITY, Waco, TX, United States.

Abstract (35 Word Limit): A single photon stored in a large cloud of atoms provides new insights into the radiation physics of single-photon superradiance. In further work, we have developed a detailed theoretical study of a recent experiment [PNAS, 109, 15185 (2012)] in which a laser-like source is created in air by pumping with a nanosecond pulse. Our analysis indicates that the emission is largely governed by quantum coherence via cooperation between atoms of an ensemble.
Lasing from Plasma Filaments in Air

A. Mysyrowicz; 1 ; Y. Liu; 1 ; S. Mitryukovskiy; 1 ; P. Ding; 1 ; A. Houard; 1 ;
1. Laboratoire d’Optique Appliquée, Versailles, France.

Abstract (35 Word Limit): The stimulated emission obtained from the filamentation of a femtosecond laser pulse is discussed. The crucial role of pump laser polarization is emphasized.
Final ID: SM2N.3

Standoff Sources of Coherent Radiation Initiated by Femtosecond Filaments

D. Kartashov; 1; S. Alisauskas; 2; G. Andriukaitis; 2; A. Pugzlys; 2; S. Haessler; 2; A. Baltuska; 2; M. Shneider; 3; B. Landgraf; 1; A. Hoffmann; 1; C. Spielmann; 1; P. G. Polynkin; 4; A. Mitrofanov; 5, 6; D. Sidorov-Biryukov; 5, 6; A. Zheltikov; 5, 7; J. Möhring; 8; D. Starukhin; 8; M. Motzkus; 8; M. Ivanov; 9; M. Richter; 9; F. Morales; 9;

1. Institute for Optics and Quantum Electronics, Friedrich-Schiller-University Jena, Jena, Germany.
2. Photonics Institute, Vienna University of Technology, Vienna, Austria.
3. Department of Mechanical and Aerospace Engineering, Princeton University, Princeton, NJ, United States.
5. International Laser Center, Lomonosov Moscow State University, Moscow, Russian Federation.
6. Russian Quantum Center, Skolkovo, Moscow Region, Russian Federation.
7. Department of Physics and Astronomy, Texas A&M University, College Station, TX, United States.
8. Physikalisch-Chemisches Institut, Heidelberg University, Heidelberg, Germany.
9. Max-Born Institute, Berlin, Germany.

Abstract (35 Word Limit): we present the results of experimental and theoretical investigations for remote initiation of lasing in nitrogen and air by femtosecond filaments generated by laser pulses with different wavelengths, polarization and applying adaptive control methods.
Lasing actions in a flame filament

H. Xu; 1; Y. Cheng; 2;
1. Jilin University, Changchun, Jilin, China.
2. SIOM, Shanghai, China.

Abstract (35 Word Limit): We demonstrate lasing in a femtosecond filament with the combustion intermediate of CN as the gain target by femtosecond laser excitation. The lasing action is ascribed to amplified spontaneous emission.
Characterization of Forward ASE Pulses Generated in Nitrogen with a Circularly Polarized Femtosecond Laser
B. Zeng; 1; Y. Cheng; 1; Z. Li; 1; J. Yao; 1; H. Xie; 1; G. Li; 1; W. Chu; 1; C. Jing; 1; J. Ni; 1;
1. Shanghai Inst of Optics and Fine Mech, Jiading, Shanghai, China.

Abstract (35 Word Limit): We report on generation of forward amplified spontaneous emission (ASE) pulses in nitrogen with a circularly polarized femtosecond pump laser as well as characterization of polarization and temporal properties of the ASE pulses.
Investigation into the Role of Pump to Signal Power Ratio in FWM-based Phase Preserving Amplitude Regeneration

K. Bottrill;1 G. Hesketh;1 F. Parmigiani;1 d. Richardson;1 P. Petropoulos;1

1. University of Southampton, Southampton, United Kingdom.

Abstract (35 Word Limit): We carry out a detailed experimental characterization of a four-wave mixing based amplitude limiter in highly nonlinear fiber based on the Bessel-like power transfer characteristics and highlight trade-offs for phase preserving capabilities.
Abstract (35 Word Limit): We investigate three-channel performance of a stand-alone Mamyshev 2R regenerator based on Raman-assisted group-delay-managed medium. Our results indicate, for the first time to our knowledge, the feasibility of simultaneous regeneration of 100-GHz-spaced WDM channels.
Spectrally Efficient Comb Source with Coupled Microresonators

Y. Okawachi; 1 S. Miller; 2 S. Ramelow; 1 K. Luke; 2 A. Farsi; 1 M. Lipson; 2, 3 A. L. Gaeta; 1, 3

1. School of Applied and Engineering Physics, Cornell University, Ithaca, NY, United States.
2. School of Electrical and Computer Engineering, Cornell University, Ithaca, NY, United States.

Abstract (35 Word Limit): We demonstrate a spectrally efficient parametric comb source for WDM applications using a Si$_3$N$_4$ dual-coupled microring resonator. This geometry allows for operating wavelength flexibility and avoidance of mode crossings for stable comb generation.
Broadband Uniform Wavelength Conversion and Time Compression of WDM Channels

M. Shoaie; A. Vedadi; C. Brès;
1. École polytechnique fédérale de Lausanne, Lausanne, VD, Switzerland.

Abstract (35 Word Limit): A scheme based on 2-pump OPA is proposed for uniform wavelength conversion and optimized compression. We show 4.7-fold compression over 32 nm range resulting in Gaussian pulses from sinusoidal modulation and enabling simultaneous compression of WDM channels for granularity adaptation.
Nonlinear Compensation with Modified Adaptive Digital Backpropagation in Flexigrid Networks

E. Porto da Silva; 1; R. Asif; 1; K. J. Larsen; 1; D. Zibar; 1;
1. DTU Fotonik, Technical University of Denmark, Kongens Lyngby, Denmark.

Abstract (35 Word Limit): We present a modified version of adaptive digital backpropagation based on EVM metric, and numerically access its performance in a flexigrid WDM scenario.
Low Complexity and Adaptive Nonlinearity Compensation

Z. Chen; L. Yan; A. Yi; L. Jiang; Y. Pan; W. Pan; B. Luo;
1. Ctr Info Photonics & Communications, Chengdu, SiChuan, China.

Abstract (35 Word Limit): A low complexity adaptive nonlinearity compensation algorithm is experimentally demonstrated based on variance of intensity noise and low-pass filter. Digital-back propagation efficiency is improved about four times in 40-Gb/s DP-QPSK transmission over 720-km SMF.
Gas Sensing Fiber Network with Simultaneous Multi-node Detection using Range-resolved Chirped Laser Dispersion Spectroscopy

G. Plant; 1; A. Hangauer; 1; M. Huang; 2; T. Wang; 2; G. Wysocki; 1;

1. Princeton University, Princeton, NJ, United States.
2. NEC Laboratories America, Princeton, NJ, United States.

Abstract (35 Word Limit): We present a laser-spectroscopic method for continuous and simultaneous interrogation of multiple passive gas sensor nodes in a fiber based sensor network. Enabled by chirped laser dispersion spectroscopy, methane leak detection is demonstrated as an example application.
Fiberoptic Evanescent Wave Spectroscopy in Water at ppm Sensitivity with a tunable Quantum Cascade Laser

G. De Naurois; I. Gaby; F. Capasso; A. Katzir;
1. Harvard University, Cambridge, MA, United States.
2. School of Physics and Astronomy, Sackler Faculty of Exact Sciences, Tel Aviv University, Tel Aviv, Israel.

Abstract (35 Word Limit): We present in water chemical spectroscopy by the use of a AgClBr fiber and a tunable mid-IR Quantum Cascade Laser source (QCL. We show detection of ppm concentration of ethanol in water.
Characterization of Temperature and Strain Sensitivity of Low Cost Few-mode Fiber Based Interferometer Sensor

Y. Wang; 2, 1; A. Li; 1; X. Chen; 1; W. Shieh; 1;

1. The University of Melbourne, Melbourne, VIC, Australia.
2. Victoria research laboratory, NICTA Ltd., Melbourne, VIC, Australia.

Abstract (35 Word Limit): We experimentally characterize a two-mode fiber (TMF) based intermodal interferometer sensor for temperature and strain. A wavelength-temperature coefficient of - 43 pm/°C and wavelength-strain coefficient of - 2.3 pm/µε have been characterized.
Near-Infrared Absorption Gas Sensors using Metal-Organic Framework-Coated Optical Fibers

A. X. Wang; 1
1. Oregon State University, Corvallis, OR, United States.

Abstract (35 Word Limit): We report a near-infrared fiber-optic CO₂ sensor with only 8-centimeter sensing length coated with nanoporous metal-organic framework materials. We achieved 500ppm detection limit with an overall response time of 40 seconds in a gas cell.
Distributed Temperature and Strain Sensing using Spontaneous Brillouin Scattering in Optical Few-Mode Fibers

Y. Weng; 1, 2; E. Ip; 1; Z. Pan; 2; T. Wang; 1;
1. NEC Laboratories America, Inc., Princeton, NJ, United States.
2. Department of Electrical & Computer Engineering, University of Louisiana at Lafayette, Lafayette, LA, United States.

Abstract (35 Word Limit): A novel approach to achieve simultaneous distributed temperature and strain sensing based on spontaneous Brillouin scattering in few-mode optical fibers is proposed and experimentally investigated, with high sensitivity using heterodyne detection and optical time-domain reflectometry.
Simultaneous Measurement of Temperature and Refractive Index Using a Photonic Crystal Cavity on a Fiber Tip

R. W. van der Heijden; 1; M. Boerkamp; 2; Y. Lu; 2; J. Mink; 2; Z. Zobenica; 1;


Abstract (35 Word Limit): The operation of a luminescent semiconductor photonic crystal cavity on an optical fiber tip is demonstrated for simultaneous measurement of temperature and refractive index by measuring the wavelength-shifts of two different cavity modes.
Distance Measurement Using Second Harmonic Signal Component of Two-Photon Absorption Photocurrent from Si-APD

Y. Tanaka; 1, Y. Yamada; 1, T. Kurokawa; 1

1. Tokyo Univ. of Agriculture and Technology, Tokyo, Japan.

Abstract (35 Word Limit): We propose a laser distance measurement using second harmonic signal component of two-photon absorption photocurrent from a Si-APD. The proof-of-concept experiment demonstrates the accurate measurement with short data acquisition time of several tens of seconds.
Multipoint Hollow Core Photonic Crystal Fiber Sensor Network Based on Intracavity Absorption Spectroscopy

H. Zhang; 1, 2; Y. Lu; 1, 2; W. Shi; 1, 2; L. Duan; 1, 2; Z. Zhao; 1, 2; J. Yao; 1, 2

1. School of Precision Instrument and Opto-electronics Engineering, Institute of Laser and Opto-electronics, Tianjin University, Tianjin, China.
2. Key Laboratory of Opto-electronics Information Technology (Tianjin University), Ministry of Education, Tianjin, China.

Abstract (35 Word Limit): We firstly demonstrate an automatic intracavity absorption multipoint acetylene sensor network via dense wavelength division multiplexing filters by applying voltage gradient to the F-P tunable filter. The sensitivity is up to 100ppmV at 1536.71nm.
Coherent Pulse Stacking Amplification using Cascaded and Multiplexed Gires-Tournois Interferometers

T. Zhou; J. Ruppe; C. Zhu; I. Hu; J. Nees; R. Wilcox; W. Leemans; A. Galvanauskas;

1. University of Michigan, Ann Arbor, MI, United States.
2. Lawrence Berkeley National Laboratory, Berkeley, CA, United States.

Abstract (35 Word Limit): We show stacking of multiple equal-amplitude pulses into a single pulse using properly configured sequences of Gires-Tournois interferometers, which in conjunction of chirped pulse amplification in fibers can enable large increase in extractable pulse energies.
Stabilizing the relative carrier-envelope phase of hybridly synchronized ultrafast Yb and Er fiber laser systems by the feed-forward scheme

W. Hsiang; 1; B. Fong; 1; W. Lin; 1; S. Wu; 2; J. Peng; 3; Y. Lai; 2, 4;
1. Dep. of Physics, Fu Jen Catholic Univ., Taipei County, Taiwan.
2. Department of Photonics & Institute of Electro-Optical Engineering, National Chiao-Tung University, Hsinchu, Taiwan.
3. Center for Measurement Standards, Industrial Technology Research Institute, Hsinchu, Taiwan.
4. Research Center for Applied Sciences, Academia Sinica, Taipei, Taiwan.

Abstract (35 Word Limit): Stabilization of the relative carrier-envelope (CE) phase for hybridly synchronized two-color fs Yb and Er fiber laser systems is demonstrated for the first time by utilizing the feed-forward scheme based on an acousto-optic frequency shifter.
Passive coherent combining of CEP-stable few-cycles pulses from a temporally divided hollow fiber compressor

H. Jacqmin,1 A. Jullien,1 B. Mercier,4 M. Hanna,2 F. Druon,2 D. Papadopoulos,3 R. Lopez-Martens,4

1. Thales Optronique SA, Elancourt, France.
2. Institut d’Optique, Palaiseau, France.
3. LULI, Palaiseau, France.
4. Laboratoire d’Optique Appliquee, Palaiseau, France.

Abstract (35 Word Limit): We demonstrate a robust passive coherent combining technique for post-compression of mJ energy CEP-stable laser pulses down to few-cycle duration in a gas-filled hollow fiber. High combining efficiency is achieved using carefully oriented calcite plates.
Arbitrary-detuning asynchronous optical sampling with amplified laser systems
L. Antonucci; A. Bonvalet; X. Solinas; L. Daniault; M. Joffre;
1. Ecole Polytechnique, Palaiseau, France.

Abstract (35 Word Limit): We demonstrate a new method for pump-probe spectroscopy by applying arbitrary detuning asynchronous optical sampling (AD-ASOPS) to two independent amplified laser systems. The resulting time dynamics ranges from 400 fs up to 1 ms.
Abstract (35 Word Limit): We introduce a scheme to overcome the challenges of ancillae preparation in traditional spectrally-sheared interferometry techniques for pulse characterization. The approach, applied to two-dimensional spectral shearing interferometry, reliably characterizes few-optical-cycle pulses from UV to IR.
Generation of Parabolic Pulses with Optimized Duration & Energy by Use of Dispersive Frequency-to-time Mapping

J. Huh; 1  D. Duchesne; 1  J. Azaña; 1

1. Institut National de la Recherche Scientifique—Énergie, Matériaux et Télécommunications, Montreal, QC, Canada.

Abstract (35 Word Limit): Parabolic pulses with durations ranging from the picosecond to the sub-nanosecond range (100-ps reported here) were generated through frequency-to-time mapping. A virtual time-lens was applied in the spectral shaping stage in order to relax the constraints imposed by the far-field condition.
Multiwavelength Ultrafast LiNbO$_3$ Raman Laser With Cascaded Terahertz-wave Generation

A. M. Warrier; 1; J. Lin; 1; H. M. Pask; 1; A. J. Lee; 1; D. J. Spence; 1;
1. Macquarie University, North Ryde, NSW, Australia.

Abstract (35 Word Limit): We demonstrate an ultrafast Raman laser to extend the wavelength versatility of mode-locked lasers. Polariton scattering in LiNbO$_3$ is used to make a tunable ultrafast laser with potential for terahertz generation.
Injection-Locked VCSEL Arrays for Line-by-Line Pulse-Shaping with Update Times of Less Than 1 ns

S. Bhooplapur; 1; A. Klee; 1; P. J. Delfyett; 1;
1. University of Central Florida, Orlando, FL, United States.

Abstract (35 Word Limit): Dynamic and static optical pulse shaping with line-by-line control is shown, using a 12-channel injection-locked VCSEL linear array. With channel modulation frequencies up to 3.125 GHz, pulse shape changes within 1 ns are conclusively demonstrated.
Final ID: FM3A.1

Demonstration of background-free, phase-preserving parametric up-conversion at the single-photon level
Y. Cheng; 2, 1; T. O. Thomay; 2, 1; G. S. Solomon; 2, 1; A. L. Migdall; 2, 1; S. V. Polyakov; 1

1. National Institute of Standards and Technology, Gaithersburg, MD, United States.
2. Joint Quantum Institute, National Institute of Standards and Technology, University of Maryland, College Park, MD, United States.

Abstract (35 Word Limit): We demonstrate single-photon-level phase preservation in an up-converting interferometer. The up-conversion process is background-free to within experimental uncertainty, allowing high fringe contrast even at low photon levels. This enables faithful up-conversion of entangled photon pairs.
Ultrafast Time-to-Frequency Demultiplexing of Polarization-Entangled Photons

J. M. Donohue; J. Lavoie; K. J. Resch;

1. Institute for Quantum Computing and Department of Physics & Astronomy, University of Waterloo, Waterloo, ON, Canada.
2. Group of Applied Physics, University of Geneva, Geneva, Switzerland.

Abstract (35 Word Limit): Using shaped pulses and nonlinear optics, we have experimentally demonstrated the demultiplexing of a train of polarization-encoded single photons through time-to-frequency conversion. We have shown this technique to preserve polarization entanglement with a partner photon.
Low noise single photon frequency upconversion using Ti-indiffused periodically-poled lithium niobate waveguides with efficient narrowband filtering

Z. Xie; K. Luo; H. Herrmann; C. Silberhorn; C. Wong;

1. Columbia University, New York, NY, United States.
2. University of California, Los Angeles, Los Angeles, CA, United States.
3. University of California, Los Angeles, Los Angeles, CA, United States.
4. Paderborn University, Paderborn, Germany.

Abstract (35 Word Limit): We demonstrate single-photon frequency-upconversion using a titanium-infused periodically-poled lithium niobate waveguide by L-band erbium-doped fiber amplifier pump. Internal efficiencies up to 84.4% and dark-count rate of 44kHz are achieved with narrowband filtering down to 3.5GHz.
Low-Noise Quantum Frequency Translation of Single Photons

A. Farsi; ¹; S. Clemmen; ¹; S. Ramelow; ¹; A. L. Gaeta; ¹;
1. Cornell University, Ithaca, NY, United States.

Abstract (35 Word Limit): We demonstrate quantum frequency translation of single photons via four-wave-mixing Bragg scattering using a liquid nitrogen cooled dispersion-shifted fiber. We achieve 80% photon conversion efficiency with less than 0.001 noise photons per 5ns gate.
Background-free Quantum Frequency Downconversion for Two-photon Interference of Heterogeneous Photon Sources

L. Yu; 1; C. M. Natarajan; 2, 1; T. Horikiri; 3, 1; C. Langrock; 1; J. Pelc; 4; M. G. Tanner; 5; E. Abe; 3; S. Maier; 6
S. Höfling; 7, 6; C. Schneider; 6; M. Kamp; 6; R. H. Hadfield; 2; M. M. Fejer; 1; Y. Yamamoto; 1, 3;
1. Stanford University, Stanford, CA, United States.
2. University of Glasgow, Glasgow, United Kingdom.
3. National Institute of Informatics, Tokyo, Japan.
5. Heriot-Watt University, Edinburgh, United Kingdom.
6. University of Wurzburg, Wurzburg, Germany.
7. University of St Andrews, Fife, United Kingdom.

Abstract (35 Word Limit): We report background-free, near-infrared-to-telecom quantum frequency downconversion, mediating two-photon interference with a mean wavepacket overlap larger than 0.89, regardless of the original separation between photon sources in wavelength (900- and 911-nm), wavepacket, and distance (2 km).
Ramsey Interferometry for Manipulation of Single Photons

A. Farsi; S. Clemmen; S. Ramelow; A. L. Gaeta;
1. Cornell University, Ithaca, NY, United States.

Abstract (35 Word Limit): We demonstrate a Ramsey interferometer for single photons via consecutive quantum frequency conversions where the phase depends on the propagation between the two interaction regions. Such an interferometer offers control over frequency encoded quantum states.
Upconversion of Microwave to Optical Photons using Erbium Impurities in a Solid

J. J. Longdell; 1; X. Fernandez-Gonzalvo; 1; L. A. Williamson; 1; Y. Chen; 1; C. Yin; 2; S. Rogge; 2;
1. University of Otago, Dunedin, New Zealand.
2. Physics, University of New South Wales, Sydney, NSW, Australia.

Abstract (35 Word Limit): We present a proposal for the efficient, quiet conversion of quantum states encoded as microwave photons into telecommunications photons using erbium dopants in solids. We also present initial results showing low efficiency conversion.
Progress towards quantum state transfer between microwave and optical light using an electro-optomechanical resonator

R. Peterson; P. S. Burns; R. Andrews; T. P. Purdy; K. Cicak; R. W. Simmonds; C. A. Regal; K. W. Lehnert

1. JILA, Boulder, CO, United States.
2. NIST, Boulder, CO, United States.

Abstract (35 Word Limit): We have constructed a bidirectional and efficient converter between microwave and optical light using a mechanically compliant membrane coupled via the optomechanical interaction. Ongoing work towards quantum state transfer is discussed.
Ultrafast Coulomb Intervalley Interaction in Monolayer WS₂

R. Schmidt, 1 G. Berghäuser, 2 E. Malic, 2 A. Knorr, 2 R. Schneider, 1 P. Tonndorf, 1 S. Michaelis de Vasconcellos, 1 R. Bratschitsch, 1

1. Institute of Physics and Center for Nanotechnology, University of Münster, Münster, Germany.
2. Department for Theoretical Physics, Technical University Berlin, Berlin, Germany.

Abstract (35 Word Limit): We reveal the ultrafast intervalley dynamics in monolayer WS₂ with a spectrally-resolved ultrafast pump-probe experiment and a microscopic theory. We find strong intervalley Coulomb coupling in the atomically thin semiconductor.
Ultrafast mid-infrared intraexcitonic spectroscopy of monolayer MoS$_2$

S. Cha; J. Sung; J. Kim; S. Sim; M. Jo; H. Choi

1. School of Electrical and Electronic Engineering, Yonsei University, Seoul, Korea (the Republic of).
2. Center for Artificial Low Dimensional Electronic Systems, Institute for Basic Science, Division of Advanced Materials Science, Pohang University of Science and Technology (POSTECH), Pohang, Korea (the Republic of).

Abstract (35 Word Limit): We report the first ultrafast mid-infrared (IR) spectroscopy in monolayer MoS$_2$. The observed mid-IR dynamics show multiple, yet broadened absorption, indicating the predominant intraexcitonic transition from the ground to the higher-lying excitonic states.
Manipulating the Valley Pseudospin in MoS2 Transistors

K. F. Mak$^2,1$;
1. Columbia University, New York, NY, United States.
2. Penn State University, University Park, PA, United States.

Abstract (35 Word Limit): Monolayer MoS2 possess a new valley-pseudospin degree of freedom besides electronic charge and spin. In this talk I will talk about our recent results on optical generation of valley polarization, based on which a novel Hall effect associated with the new degree of freedom is demonstrated. The mechanisms responsible for driving the new valley Hall effect will be discussed.
Single Photon Emission from Localized Excitons in Monolayer WSe$_2$

P. Tonndorf; $^1$; R. Schmidt; $^1$; J. Kern; $^1$; M. Buscema; $^2$; G. Steele; $^2$; A. Castellanos-Gomez; $^2$; H. van der Zant; $^2$; S. Michaelis de Vasconcellos; $^1$; R. Bratschitsch; $^1$

1. Institute of Physics and Center for Nanotechnology, University of Münster, Münster, Germany.
2. Kavli Institute of Nanoscience, Delft University of Technology, Delf, Netherlands.

Abstract (35 Word Limit): We observe stable and narrowband single photon emission from localized quantum emitters in a WSe$_2$ monolayer. Photoluminescence excitation spectroscopy reveals that the emission originates from single excitons trapped in a local potential well.
Emergent photophenomena in three dimensional van der Waals heterostructures

B. Mariserla; 1; M. Man; 1; S. Vinod; 2; C. Chin; 1; T. Harada; 1; J. Taha-Tijerina; 2; C. Tiwary; 3; P. Nguyen; 2; P. Chang; 4; T. Narayanan; 5; A. Rubio; 6, 7; P. Ajayan; 2; S. Talapatra; 1, 8; K. M. Dani; 1;

2. Department of Materials Science and Nanoengineering, Rice University, Texas, TX, United States.
3. Materials Engineering, Indian Institute of Science, Bangalore, India.
4. Department of Chemistry, Rice University , Texas, TX, United States.
5. TIFR Center for Interdisciplinary Sciences (TCIS), Tata Institute of Fundamental Research, Hyderabad, India.
6: Max Planck Institute for the Structure and Dynamics of Matter, Hamburg, Germany.
8. Department of Physics, Southern Illinois University, Carbondale, IL, United States.

Abstract (35 Word Limit): We report on the fabrication and observation of emergent opto-electronic phenomena in three dimensional, micron-sized van der Waals heterostructures self-assembled from atomic layers of graphene and hexagonal boron nitride in varying ratios.
Topologically tunable Fano resonance in (Bi$_{1-x}$In$_x$)$_2$Se$_3$

S. Sangwan; 1 N. Koirala; 2 M. Brahlek; 2 J. Park; 1 S. Cha; 1 S. Oh; 2 H. Choi; 1
1. Yonsei University, Seoul, Korea (the Republic of).
2. Rutgers University, New Jersey, NJ, United States.

Abstract (35 Word Limit): We report new tunable Fano interference phenomena depending on topological phase in (Bi$_{1-x}$In$_x$)$_2$Se$_3$. The controlled spatial overlap of topological surface wavefunction with bulk phonon is responsible for the ultrafast tunability of the Fano resonance.
Quantum Interference Control of Photocurrents in Topological Insulator Films
A. D. Bristow; 1; D. A. Bas; 1; K. Vargas-Valez; 1; S. Babakiray; 1; T. A. Johnson; 1; D. Lederman; 1; T. Stanescu; 1

1. West Virginia University, Morgantown, WV, United States.

Abstract (35 Word Limit): Charge currents in thin films of Bi$_2$Se$_3$ are controlled using a two-color scheme that exploits quantum interference of single- and two-photon absorption pathways. Injection and shift currents are observed and linked to surface state excitations.
Super-Coulombic Energy Transfer: Engineering Dipole-Dipole Interactions with Metamaterials

W. D. Newman; 1; C. L. Cortes; 1; D. Purschke; 3; A. Afshar; 2; Z. Chen; 1; G. De los Reyes; 3; F. Hegmann; 3; K. Cadien; 2; R. Fedosejevs; 1; Z. Jacob; 1; 1. Electrical and Computer Engineering, University of Alberta, Edmonton, AB, Canada. 2. Department of Chemical and Materials Engineering, University of Alberta, Edmonton, AB, Canada. 3. Department of Physics, University of Alberta, Edmonton, AB, Canada.

Abstract (35 Word Limit):
We demonstrate experimentally that hyperbolic metamaterials fundamentally alter dipole-dipole interactions conventionally limited to the near-field. The effect is captured in long-range energy transfer and lifetime reduction of donor emitters due to acceptors placed 100 nm away.
On-chip Super-robust All-dielectric Zero-Index Material

S. Kita; 1; Y. Li; 1; P. Muñoz; 1; O. Reshef; 1; D. Vulis; 1; B. Day; 1; E. Mazur; 1; C. Lieber; 1; M. Loncar; 1;
1. Harvard University, Cambridge, MA, United States.

Abstract (35 Word Limit): The robustness of the modal degeneracy for photonic Dirac-cone can be engineered by designing all-dielectric pillar arrays giving on-chip platform of zero index material for any wavelength regime. We demonstrate this concept for telecom regime.
Final ID: FM3C.3

Transparent subdiffraction optics: nanoscale light confinement without metal

S. Jahani; 1; Z. Jacob; 1;
1. University of Alberta, Edmonton, AB, Canada.

Abstract (35 Word Limit): We introduce a paradigm shift in light confinement strategy and show that light can be confined below the diffraction limit using completely transparent artificial media (metamaterials with $\varepsilon_{ij}>1$ and $\mu_{ij}=1$).
Light Guiding by Gauge Field for Photons
Q. Lin; S. Fan;
1. Stanford University, Stanford, CA, United States.

Abstract (35 Word Limit): We propose a waveguiding mechanism based on the effective gauge field for photons, where the core and cladding are subject to different gauge potentials. This can be realized in a modulated resonator lattice, and provides a dynamically reconfigurable mechanism for generating a one-way waveguide.
General Conditions for Lossless Propagation in Near-Infrared Hyperbolic Metamaterial Waveguides

J. S. Smalley; 1; F. Vallini; 1; B. Kante; 1; Y. Fainman; 1;

1. University of California at San Diego, San Diego, CA, United States.

Abstract (35 Word Limit): We present general conditions for lossless propagation in near-infrared hyperbolic metamaterial (HMM) waveguides with lateral confinement. We conclude that HMMs based on noble metals, rather than transparent conducting oxides, offer greatest promise for low-loss propagation.
Dispersion Control of High-k Waves in Tapered Hyperbolic Waveguides

N. Kinsey;², P. West;²; M. Ferrera;²,¹; A. V. Kildishev;²; V. M. Shalaev;²; A. Boltasseva;²;
1. Engineering and Physical Sciences, Heriot-Watt, Edinburgh, EH14 4AS, United Kingdom.
2. Electrical and Computer Engineering, Purdue University, West Lafayette, IN, United States.

Abstract (35 Word Limit): The fundamental problem of efficiently outcoupling high-k waves from hyperbolic metamaterials is approached with an in-plane configuration, and enhanced with adiabatic tapering. This strategy may allow for better efficiency of Purcell enhanced quantum sources.
Singular Evanescent Wave Resonances
Y. Guo; 1; Z. Jacob; 1;
1. University of Alberta, Edmonton, AB, Canada.

Abstract (35 Word Limit):
We report on the discovery of a unique resonance in moving media, impossible in a stationary system. It leads to giant non-contact fluctuational drag force between moving bodies (giant quantum friction).
Mode selection filter using THz metamaterials surfaced on LiNbO$_3$ sub-wavelength slab waveguide

Q. Wu; B. Zhang; C. Pan; Y. Pan; S. Wang; J. Xu;
1. Nankai University, Tianjin, Tianjin, China.

Abstract (35 Word Limit): We implemented periodic bar arrays metamaterials to separate waveguide modes of terahertz waves propagating in a LiNbO$_3$ sub-wavelength waveguide. The spatial and temporal electric field profiles were recorded using a time-resolved phase contrast imaging system.
Nonlinear Frequency Mixing in a Surface Nanoscale Axial Photonics Resonator

P. Bianucci, 1 M. Kues, 2 C. Reimer, 2 T. Hamidfar, 1 R. Morandotti, 2
1. Department of Physics, Concordia University, Montreal, QC, Canada.
2. INRS-EMT, Varennes, QC, Canada.

Abstract (35 Word Limit): We report on four-wave mixing in a simple-to-fabricate surface nanoscale axial photonics resonator (SNAPR) obtained by pumping with two spectral modes while exploiting a self-locked pump scheme.
Second-harmonic Generation in a Phase-Matched Nonlinear 2D Crystal

M. Zhao; Z. Ye; Y. Ye; H. Zhu; Y. Wang; Y. Iwasa; X. Zhang;
1. University of California, Berkeley, CA, United States.
2. Applied Physics, University of Tokyo, Tokyo, Japan.

Abstract (35 Word Limit): We studied the phase-matched SHG from thin crystals of 3R-MoS$_2$. Due to the noncentrosymmetric nature of the crystal, the typically observed intensity oscillation in 2H-MoS$_2$ is replaced with constructive interference of the second harmonic light.
Efficient Generation of Twin Photons at Telecom Wavelengths with 10 GHz Repetition-Rate-Tunable Comb Laser

R. Jin; 1; R. Shimizu; 2; I. Morohashi; 1; K. Wakui; 1; M. Takeoka; 1; S. Izumi; 1, 3; T. Sakamoto; 1; M. Fujiwara; 1; T. Yamashita; 1; S. Miki; 1; H. Terai; 1; Z. Wang; 1; M. Sasaki; 1;
1. NICT, Tokyo, Japan.
2. University of Electro-Communications, Tokyo, Japan.
3. Sophia University, Tokyo, Japan.

Abstract (35 Word Limit): We demonstrate a down-conversion-based twin photon source pumped by a 10 GHz repetition-rate-tunable comb laser at 1553 nm wavelength. We show high Hong-Ou-Mandel interference visibilities, which are free from the pump-power induced degradation.
 Significant Enhancement of Third- and Fifth-Harmonic Generation in Air via Two-Color, Time-Resolved Methods
B. Shim; 1; D. Weerawarne; 1; R. Grynko; 1; H. J. Meyer; 1;
1. SUNY Binghamton, Binghamton, NY, United States.

Abstract (35 Word Limit): We report two orders of magnitude enhancement of third- and fifth-harmonic generation in air via time-resolved methods using two-color, femtosecond beams. We attribute the significant enhancement to cross-phase modulation and/or plasma assisted phase matching effects.
Abstract (35 Word Limit): We present a single-pulse two-dimensional Raman spectroscopy scheme. Our scheme offers not only a major simplification of the conventional setup but also an inherent favoring of the direct fifth-order signal over the cascaded signal, the latter being a signal that carries no coupling information.
Raman oscillation, frequency upconversion, and Raman amplification at phonon-polariton resonance

Y. J. Ding; 1
1. Lehigh University, Bethlehem, PA, United States.

Abstract (35 Word Limit): We have shown that Raman oscillation, frequency upconversion, and Raman amplification can be achieved in a second-order nonlinear medium at the phonon-polariton resonance.
Enhanced stimulated Brillouin scattering via saturable phonon losses
R. Behunin; W. H. Renninger; H. Shin; P. Kharel; E. Kittlaus; F. Carter; P. T. Rakich;
1. Yale University, New Haven, CT, United States.

Abstract (35 Word Limit):
Using stimulated Brillouin spectroscopy we demonstrate that nonlinear phonon dynamics emerging at cryogenic temperatures can be effectively harnessed to enhance Brillouin gain and extend phonon lifetimes in fiber.
Giant nonlinear response of polaritonic metasurfaces coupled to intersubband transition

J. LEE; 1; N. Nookala; 1; M. Tymchenko; 1; J. Gomez-Diaz; 1; F. Demmerle; 2; G. Boehm; 2; M. Amann; 2; A. Alu; 1; M. A. Belkin; 1;

1. Electrical and Computer Engineering, University of Texas at Austin, Austin, TX, United States.
2. Walter Schottky Institut, Technische Universität München, Garching, Germany.

Abstract (35 Word Limit): We report highly-nonlinear metasurfaces based on combining electromagnetically-engineered plasmonic nanoresonators with quantum-engineered intersubband nonlinearities. Experimentally, effective nonlinear susceptibility over 480 nm/V was measured for second-harmonic generation at normal incidence.
Highly efficient SHG in NLO polymer-coated Au nanoparticles by doubly resonant excitations

A. Sugita; 1; T. Hirabayashi; 1; S. Nihashi; 1; A. Ono; 1; Y. Kawata; 1;
1. Shizuoka University, Hamamatsu, Shizuoka, Japan.

Abstract (35 Word Limit): We present localized SP-assisted SHG in NLO polymer-coated Au nanoparticles. More than threefold enhancement in the SHG conversion efficiencies was recorded by tuning the transition frequency of the NLO polymers to the excitation light frequency.
Tip-enhanced Upconversion of Er$^{3+}$/Yb$^{3+}$:NaYF$_4$ Nanoparticles

G. Chen; 1; E. Wu; 1; C. Ding; 1; B. Wu; 1; X. Ci; 1; Y. Liu; 1; Y. Rong; 1; Y. Xue; 1; H. Zeng; 1;
1. State Key Laboratory of Precision Spectroscopy, East China Normal University, Shanghai, Shanghai, China.

Abstract (35 Word Limit): We demonstrated tip-enhanced upconversion luminescence from a single Er$^{3+}$/Yb$^{3+}$:NaYF$_4$ nanoparticle due to plasmonic effect. The gold-coated tip enabled improved reception and transmission of incident electromagnetic fields, which increased both absorption and emission processes.
Large and Ultrafast Nonlinear Absorption of an Air/Gold Plasmonic Waveguide

A. Baron; 1; T. Hoang; 1; C. Fang; 1; M. Mikkelsen; 1; D. Smith; 1;
1. Duke University, Durham, NC, United States.

Abstract (35 Word Limit): We investigate theoretically and experimentally the nonlinear propagation of surface plasmons on an air/gold interface which reveals large and ultrafast (≈100 fs) self-induced absorption. The experiment enables a direct measurement of the third-order nonlinear susceptibility.
Tailoring the Shape of Metallic Nanocavities for Enhanced Four-Wave Mixing

E. C. Almeida; ¹; Y. Prior; ¹;
1. Weizmann Institute of Science, Rehovot, Israel.

Abstract (35 Word Limit): Efficient four-wave mixing, with nonlinear response equivalent to BBO of the same thickness, is demonstrated for arrays of nanocavities milled in a free-standing gold film when their shape is properly designed.
All-Optical Electric-Field-Induced Second-Harmonic Generation

R. Davidson; 1, 2; A. Yanchenko; 3; J. Ziegler; 1; S. Avanesyan; 1; R. F. Haglund; 1.

1. Physics, Vanderbilt University, Nashville, TN, United States.
2. Quantum Information Sciences, Oak Ridge National Laboratory, Oak Ridge, TN, United States.
3. Physics, University of Virginia, Charlottesville, VA, United States.

Abstract (35 Word Limit): Interferometric pump-probe spectroscopy is used to demonstrate all-optical second-harmonic generation from a polymer dielectric in a serrated nanogap structure. Strong optical frequency electric-fields from surface plasmons create ultrafast controllable nonlinear light pulses.
Scaling of the Nonlinear Response of Metal/Dielectric Plasmonic Waveguides

A. Baron; S. Larouche; D. Gauthier; D. Smith;
1. Duke University, Durham, NC, United States.

Abstract (35 Word Limit): The scaling of the nonlinear response of a single-interface plasmonic waveguide is studied, where both the metal and dielectric display nonlinearity. We introduce a figure-of-merit that guides metal/dielectric nanophotonic device design for specific applications.
Suppression and Subsistence of Fano EIT Transmission Windows in Plasmonic-Vapor System

L. Stern; M. Y. Grajower; U. Levy;
1. Applied Physics, Hebrew University of Jerusalem, Jerusalem, Israel.

Abstract (35 Word Limit): We report on the sub Doppler transmission characteristics of a pump-probe V-type surface plasmon and atomic system. Suppression and subsistence of EIT windows is demonstrated due to the unique character of the plasmonic-atomic hybrid system.
Intracavity Loss and Dispersion Managed Mode-Locked Diode Laser

J. C. Balzer; 1; B. Döpke; 1; R. H. Pilny; 1; C. Brenner; 1; A. Klehr; 2; G. Erbert; 2; G. Tränkle; 2; M. R. Hofmann; 1;

1. Ruhr Universität Bochum, Bochum, Germany.
2. Ferdinand-Braun-Institut, Leibniz Institut für Höchstfrequenztechnik im Forschungsverbund Berlin e.V., Berlin, Germany.

Abstract (35 Word Limit): We present a self-optimizing diode laser, which generates 216 fs Fourier-limited pulses after external pulse compression. This is achieved by a closed-loop learning concept that optimizes the intracavity spectral phase and amplitude.
Sub-300-femtosecond Semiconductor Disk Lasers

D. Waldburger; 1; M. Mangold; 1; S. M. Link; 1; M. Golling; 1; E. Gini; 2; B. W. Tilma; 1; U. Keller; 1
1. ETH Zurich, Zurich, ZH, Switzerland.
2. FIRST Center for Micro- and Nanosience, Zurich, Switzerland.

Abstract (35 Word Limit): We present the first sub-150-fs SESAM-modelocked vertical external-cavity surface-emitting laser (VECSEL) in the 100-mW average output power regime and the first sub-300-fs modelocked integrated external-cavity surface-emitting laser (MIXSEL) with 180 mW of average output power.
Synthesis of coherent optical pulses using a field-programmable gate array (FPGA)-based gradient descent phase-locking algorithm with three semiconductor lasers

K. J. Underwood; 1; A. M. Jones; 1; J. Gopinath; 1;


Abstract (35 Word Limit): We demonstrate optical pulse synthesis through coherent combination of AOM-separated light by phase-locking feedback from an FPGA. An order of magnitude improvement in phase stability is shown, limited by the noise of the AOM driver.
A High Power and Ultrahigh Frequency Mode-Locked Laser Monolithically Integrated with an SOA

J. H. Marsh; 1; L. Hou; 1;
1. School of Engineering, University of Glasgow, Glasgow, United Kingdom.

Abstract (35 Word Limit): We report 628 GHz and 1.20 THz pulse repetition frequencies with 142 mW peak powers from a passively mode-locked side-wall SGDBR laser integrated with an SOA, demonstrating high reproducibility, controllability and a wide operation range.
Tracking the Ultrafast Light-Matter Interaction in Population-Inverted Quantum Dots via Quantum State Tomography

U. K. Woggon; 1; N. B. Grosse; 1; N. Owschimikow; 1; A. Koltchanov; 1; M. Kolarczik; 1; R. Aust; 2; B. Lingnau; 2; K. Lüdge; 2;

1. IOAP, Technische Universität Berlin, Berlin, Germany.
2. ITP, Technische Universität Berlin, Berlin, Germany.

Abstract (35 Word Limit): Based on the full characterization of a pulse transmitted through a semiconductor optical amplifier by quantum state tomography, we determine the degree of population inversion and the momentary signal-to-noise ratio at sub-picosecond times and RT.
Application of Strong Slow-Light Feedback to Boost the Modulation Bandwidth of VCSELs Beyond 70 GHz

M. Ahmed; 1, 2; A. Bakry; 1; H. Dalir; 3; F. Koyama; 3, 1;

1. King Abdulaziz University, Jeddah, Saudi Arabia.
2. Physics, Minia University, Minia, Egypt.
3. Tokyo Institute of Technology, Tokyo, Japan.

Abstract (35 Word Limit): We present modeling of strong slow-light feedback in VCSEL coupled with a transverse cavity. We show boosting of the modulation bandwidth to frequencies reaching 70 GHz as well as resonance modulation around 90 GHz.
Abstract (35 Word Limit): We demonstrate a novel DBR-free semiconductor disk laser, where multiple quantum well active region is fusion bonded directly onto a diamond heat spreader. CW output powers of 2.5 W have been demonstrated at 1150 nm.
Low-temperature Optimized 940 nm Diode Laser Bars with 1.98 kW Peak Power at 203 K
C. Frevert; 1; P. Crump; 1; F. Bugge; 1; S. Knigge; 1; A. Ginolas; 1; G. Erbert; 1;
1. Ferdinand-Braun-Institut, Leibniz-Institut für Höchstfrequenztechnik, Berlin, Germany.

Abstract (35 Word Limit): Passively cooled 1-cm wide QCW diode laser bars with low-temperature optimized vertical designs reach output powers of 1.98 kW at 203 K, with conversion efficiency of 64% at 1 kW and 57% at 1.9 kW.
Optical Interconnects based on Ge/SiGe Multiple Quantum Well Structures

D. Marris-Morini;1 P. Chaisakul;1, 2 J. Frigerio;3 D. Chrastina;3 V. Vakarin;1 S. Cecchi;3 G. Isella;3 L. Vivien;4

1. Institut d'Electronique Fondamentale, Université Paris Sud, Orsay cedex, France.
2. Department of Materials Engineering, The University of Tokyo, Tokyo, Japan.
3. Politecnico Di Milano, L-NESS, Como, Italy.
4. CNRS, Institut d'Electronique Fondamentale, ORsay, France.

Abstract (35 Word Limit): Silicon photonics devices based on Ge/SiGe structures are promising. However their integration with silicon on insulator waveguides is a challenging point. We present an innovative approach to monolithically integrate low-voltage, broadband photonic interconnection on silicon.
Relaxation Dynamics of Optically Generated Carriers in Graphene-on-Silicon Nitride Waveguide Devices

J. Wang; 1; Z. Cheng; 1; Q. Xie; 1; C. Shu; 1; H. Tsang; 1;
1. The Chinese University of Hong Kong, Hong Kong, Hong Kong.

Abstract (35 Word Limit): We studied the carrier relaxation dynamics in graphene-on-silicon nitride waveguides. Optically generated carriers from a quasi-continuous wave pump laser show a microsecond response time while those generated from mode-locked laser pulses exhibit accelerated relaxation dynamics.
A Black Phosphorus FET Integrated on a Silicon Waveguide for High Speed, Low Dark Current Photodetection
N. Youngblood; C. Chen; S. J. Koester; M. Li;
1. UMN, Minneapolis, MN, United States.

Abstract (35 Word Limit): A waveguide-integrated black phosphorus photodetector with high responsivity and low dark current is demonstrated for telecom wavelengths with an RC-limited bandwidth of 3 GHz. Electrostatic doping and frequency dependent photoresponse are used to identify photocurrent generation mechanisms.
Germanium Photonic Crystal Nanobeam Cavity with Q > 1,300

S. Iwamoto; 1 M. Kuroki; 1 S. Kako; 1 S. Ishida; 1 K. Oda; 2 T. Ido; 2 Y. Arakawa; 1

1. Institute of Industrial Science and Institute for Nano Quantum Information Electronics, University of Tokyo, Meguro-ku, Tokyo, Japan.
2. Hitachi Ltd., Kokubunji, Tokyo, Japan.

Abstract (35 Word Limit): We fabricate germanium-based photonic crystal nanobeam cavities and observe a large enhancement (≈170 times) of room-temperature photoluminescence signal at a cavity resonance of ≈1,700 nm. A cavity quality factor as high as 1,350 is achieved.
A Direct Band Gap GeSn Laser on Si
R. Geiger; 1, 2; S. Wirths; 3; N. von den Driesch; 3; Z. Ikonic; 4; J. Hartmann; 5; J. Faist; 2; S. Mantl; 3; D. Grützmacher; 3; D. Buca; 3; H. Sigg; 1;

1. Laboratory for Micro- and Nanotechnology, Paul Scherrer Institute, Villigen, Switzerland.
2. Institute for Quantum Electronics, ETH Zürich, Zürich, Switzerland.
3. Peter Grünberg Institute 9, Forschungszentrum Jülich, Jülich, Germany.
4. Institute of Microwaves and Photonics, University of Leeds, Leeds, United Kingdom.
5. CEA, LETI, Grenoble, France.

Abstract (35 Word Limit): Temperature-dependent photoluminescence spectroscopy reveals that partially strain-relaxed Ge$_{0.87}$Sn$_{0.13}$ exhibits a fundamental direct band gap. For such an alloy, we show lasing at ≈ 2.3 μm emission wavelength under optical pumping up to 90 K.
Monolithically Grown Superluminescent Diodes on Germanium and Silicon substrates
Q. Jiang; S. Chen; M. Tang; J. Wu; A. Seeds; H. Liu;
1. UCL, Rickmansworth, United Kingdom.

Abstract (35 Word Limit): We demonstrate the first InAs/GaAs quantum-dot (QD) superluminescent diode (SLD) monolithically grown on both Ge and Si substrates by molecular beam epitaxy.
Extended-Drude Response of Photocarriers in InSb Revealed with Ultrabroadband Infrared Time-Domain Spectroscopy

E. Matsubara; 1, 2; T. Morimoto; 2; M. Nagai; 2; M. Ashida; 2;
1. Department of Physics, Osaka Dental University, Hirakata, Japan.
2. Graduate School of Engineering Science, Osaka University, Toyonaka, Osaka, Japan.

Abstract (35 Word Limit): We visualized the extension of Drude response of photoexcited carriers by energy-dependent scattering time and effective mass of electrons in InSb, making full use of the advantage of air plasma based ultrabroadband infrared time-resolved spectroscopy.
Abstract (35 Word Limit): Ultrafast THz spectroscopy of photovoltaic polymer-fullerene blends PTB7:PC$_{70}$BM and P3HT:PC$_{70}$BM reveals differences in conductivity lifetimes and quantum yields, well correlated with different power conversion efficiencies of photovoltaic devices utilizing these compounds.
Probing Superconducting Gap Dynamics with THz Pulses

J. Demsar; 1, 2; M. Beck; 2; M. Klammer; 2; I. Rousseau; 2; G. Gol'tsman; 3; I. Diamant; 4; Y. Dagan; 4;
1. Johannes Gutenberg Universitat Mainz, Mainz, Germany.
2. Physics Department, University of Konstanz, Konstanz, Germany.
3. Moscow State Pedagogical University, Moscow, Russian Federation.
4. Raymond and Beverly Sackler School of Physics and Astronomy, Tel Aviv University, Tel Aviv, Israel.

Abstract (35 Word Limit): We studied superconducting gap dynamics in a BCS superconductor NbN and electron doped cuprate superconductor PCCO following excitation with near-infrared (NIR) and narrow band THz pulses. Systematic studies on PCCO imply very selective electron-phonon coupling.
Enhancement of THz emission from GaN surface by Ga vacancy-related defects

Y. Sakai; 1; I. Kawayama; 1; H. nakanishi; 2; M. Tonouchi; 1;
1. Osaka University, Suita, Osaka, Japan.
2. SCREEN Holdings Co., Ltd., Kyoto, Japan.

Abstract (35 Word Limit): The enhancement of terahertz emission from a GaN wafer induced by Ga vacancy-related defects was observed. This phenomena can be explained by the change of the band bending at these defects.
Ultrabroadband, Lightweight, Flexible, and Polarization Sensitive Photodetector Based on Carbon Nanotube Fibers

A. Zubair; 1 D. Tsentalovich; 2 C. C. Young; 2 N. Fujimura; 3 X. Wang; 1 X. He; 1 W. Gao; 1 Y. Kawano; 3 M. Pasquali; 2 4 J. Kono; 1 5

1. Electrical and Computer Engineering, Rice University, Houston, TX, United States.
2. Chemical and Biomolecular Engineering, Rice University, Houston, TX, United States.
3. Physical Electronics, Tokyo Institute of Technology, Houston, TX, United States.
4. Chemistry, Rice University, Houston, TX, United States.
5. Physics and Astronomy, Rice University, Houston, TX, United States.

Abstract (35 Word Limit): We present a flexible ultrabroadband (visible to terahertz), polarization-sensitive carbon nanotube fiber photodetector. This photothermoelectric-effect-based room-temperature photodetector fabricated using a unique technique has high responsivities, up to 2.2 mA/W in the terahertz regime.
Ultrafast Carrier Transport in Silicon Nanocrystal Superlattices

H. Nemec; 1; P. Kuzel; 1; P. Maly; 2; S. Gutsch; 3; D. Hiller; 3; M. Zacharias; 3;
1. Institute of Physics AS CR, v.v.i, Prague, Czech Republic.
2. Charles University, Prague, Czech Republic.
3. Albert-Ludwigs-University of Freiburg, Freiburg, Germany.

Abstract (35 Word Limit): Time-resolved terahertz spectroscopy is employed to study silicon nanocrystals prepared by thermal decomposition of silicon-rich SiO_x layers. We observe that higher silicon content favors formation of larger silicon clusters with short-range percolation.
Design of a Polarization-Insensitive WDM Demultiplexing Lattice Filter in SOI
A. Bois; 1; A. D. Simard; 1; W. Shi; 1; S. LaRochelle; 1;
1. Université Laval, Lévis, QC, Canada.

Abstract (35 Word Limit): We propose a novel design method for polarization-insensitive optical lattice filters. The technique takes advantage of the spectral periodicity of the Mach-Zehnder building blocks and optimizes the coupler and interferometer lengths to minimize cost functions.
Inverse Design and Implementation of a Wavelength Demultiplexing Grating Coupler

A. Y. Piggott; 1; J. Lu; 1; T. M. Babinec; 1; K. Lagoudakis; 1; J. Petykiewicz; 1; J. Vuckovic; 1;

1. Stanford University, Stanford, CA, United States.

Abstract (35 Word Limit): We have developed a general inverse design algorithm for designing micro- and nano-photonic devices, where the user only specifies the desired device performance. We experimentally demonstrate a vertical-incidence wavelength demultiplexing grating designed by this algorithm.
All-Optically Controlled Fabry-Perot Cavity-Assisted Add-Drop Microring Resonator on a Silicon Chip

J. Yao; 1; W. Zhang; 1;
1. University of Ottawa, Ottawa, ON, Canada.

Abstract (35 Word Limit): An all-optically controlled Fabry-Perot cavity-assisted add-drop microring resonator (MRR) on a silicon chip, in which one bus waveguide is replaced by a sidewall Bragg grating Fabry-Perot cavity, is proposed and experimentally demonstrated.
Multichannel Optical Filters in Nanoscale Silicon Waveguides

M. W. Puckett; F. Vallini; A. Grieco; S. Fainman; 1

1. University of California, San Diego, La Jolla, CA, United States.

Abstract (35 Word Limit): We design and characterize asymmetric Bragg gratings in waveguides which possess multiple reflected wavelengths. We experimentally demonstrate devices with two independent stopbands, then use finite-difference time domain software to characterize more complex grating designs.
Narrowband Waveguide Bragg Gratings with Fully-etched Side Corrugations and Large Fabrication Tolerance

K. Lin; 1; Y. Hung; 1; C. Wu; 1; C. Wang; 1; Y. Chen; 1;
1. National Sun Yat-sen University, Taipei, Taiwan.

Abstract (35 Word Limit): Fully-etched cladding-modulated grating allows not only flexible control of the reflection response but also large fabrication tolerance. A reflection bandwidth of < 0.6 nm and a Bragg wavelength variation of within 1 nm is experimentally demonstrated.
High-Quality Bragg Gratings Operating in Reflection without Circulators in SOI

A. D. Simard; 1; S. LaRochelle; 1;
1. Universite Laval, Quebec, QC, Canada.

Abstract (35 Word Limit): We demonstrate that apodized Bragg gratings placed in the two arms of a Mach-Zehnder structure in SOI can provide high-quality filtering functions overcoming phase noise distortions. As examples, we present narrowband, phase-shifted and dispersion-less filters.


Bragg Grating Spiral Strip Waveguide Filters for TM Modes

Z. Chen; 1 J. Flueckiger; 1 X. Wang; 1 H. Yun; 1; Y. Wang; 1 Z. Lu; 1 F. Zhang; 1 N. A. Jaeger; 1; L. Chrostowski; 1

1. University of British Columbia, , United States.

Abstract (35 Word Limit): We demonstrate a 1 cm long Bragg grating filter, on a compact spiral SOI waveguide, for the fundamental transverse magnetic mode, that has a 0.5 nm bandwidth, 40 dB extinction ratio, and 1 dB/cm loss.
Plasmonic Fano Nanoantenna for On-chip Wavelength Demultiplexing

R. Guo; 1; M. Decker; 1; F. Setzpfandt; 1; I. Staude; 1; D. N. Neshev; 1; Y. S. Kivshar; 1;
1. Australian National University, Canberra, ACT, Australia.

Abstract (35 Word Limit): We demonstrate a single-element Fano nanoantenna allowing for strong directional coupling of light to a silicon waveguide depending on the operational wavelength. This antenna can spatially separate wavelength-encoded optical signals, realizing an ultra-compact plasmonic demultiplexer.
Visualizing Mammalian Brain Area Interactions by Dual-axis Two-photon Calcium Imaging

M. Schnitzer; 1

1. Departments of Biology and Applied Physics, Stanford University, Stanford, CA, United States.

Abstract (35 Word Limit): Fluorescence Ca2+ imaging enables large-scale recordings of neural activity, but collective dynamics across mammalian brain regions are generally inaccessible within single fields of view. Here we introduce a two-photon microscope possessing two articulated arms that can simultaneously image two brain areas (~0.38 mm2 each), either nearby or distal, using microendoscopes, in awake behaving rodents.
Engineering the Next Generation of Optogenetic Reporters to Illuminate Neuronal Activity

R. E. Campbell; 1

1. University of Alberta, Edmonton, AB, Canada.

Abstract (35 Word Limit): The Campbell group uses protein engineering to develop fluorescent protein-based reporters for cell imaging. I will describe our most recent efforts to engineer an improved generation of reporters for calcium ion, membrane potential, and neurotransmitters.
Label-Free Imaging of Single Neuron Activities by Stimulated Raman Scattering

D. Zhang; H. Lee; P. Shih; R. Drenan; J. Cheng;
1. Purdue University, west Lafayette, IN, United States.

Abstract (35 Word Limit): We report the observation of single neuron activities by spectral focusing stimulated Raman scattering (SRS) microscopy. Changes in SRS signal intensity in live neurons correlate to action potentials indicated by fluorescent calcium indicator.
**Multifunctional Transparent Optoelectrode Array for in-vivo Optogenetic Studies**

J. Lee; 1; I. Ozden; 1; Y. Song; 2, 3; A. Nurmikko; 1;

1. Brown University, Providence, RI, United States.
2. Seoul National University, Seoul, Korea (the Republic of).
3. Advanced Institutes of Convergence Technology, Suwon, Korea (the Republic of).

**Abstract (35 Word Limit):** We developed fully transparent 2-dimensional intracortical neural probe microarrays based on ZnO single crystal. The unique material and device design enabled efficient multifunctional, multi-site patterned optical stimulation and simultaneous electrical recording in rodents.
Abstract (35 Word Limit): We report direct modulation of a widely tunable surface micromachined MEMS VCSEL. The MEMS is electro-thermally actuated for tuning the emission wavelength over 60 nm with a center wavelength of 1554 nm. Error-free transmission is achieved at 10 Gbit/s for 47 nm tuning range.
New Generation of VBGs for Efficient Spectral Beam Combination of Semiconductor Lasers

V. I. Smirnov; 1
1. OptiGrate Corp, Oviedo, FL, United States.

Abstract (35 Word Limit): Novel types of volume Bragg gratings with enhanced parameters were recorded in PTR glass. They were used for efficient spectral beam combination of high power multimode semiconductor lasers with high spectral density of 1 nm/channel.
Efficient Chirped Bragg Gratings for Stretching and Compression of High Energy Ultrashort Laser Pulses at 800 nm Spectral Region

V. I. Smirnov; 1
1. OptiGrate Corp, Oviedo, FL, United States.

Abstract (35 Word Limit): This paper reports on new generation of recorded in PTR glass chirped gratings with enhanced beam quality and efficiency for stretching and compression of ultrashort laser pulses in 800 nm spectral region.
Abstract (35 Word Limit): The potpourri of aspheric surfaces offers many possibilities in optical design, even the chance for flexible beam shaping setups. Since these are refractive optical elements the beam shaping is robust with respect to wavelength changes.
Generation of continuous-wave and pulsed vortex beams in an a-cut Nd:YVO\(_4\) laser with annular end-pumping

A. Hu; 1; P. Chen; 1; Y. Wang; 1; S. Li; 1;

1. Huazhong Univ of Science & Technology, Wuhan, Hubei, China.

Abstract (35 Word Limit): We directly produced continuous-wave (CW) and pulsed first order Laguerre-Gaussian vortex beams from an annular end-pumped Nd:YVO\(_4\) laser with a general fiber coupled LD source (core diameter, 800 \(\mu\)m).
Development of YCOB Crystals for Large Aperture SHG, THG and OPA Applications

Y. Zheng; 1

1. Shanghai Institute of Ceramics, CAS, , United States.

Abstract (35 Word Limit): Large clear aperture elements bigger than 30 mm x 30 mm are difficult to growth and are of high cost for BBO, LBO crystals. YCOB grown by Czochralski method was shown a good choice of large aperture applications.
Development, Fabrication, and Real-World Applications of Polymeric Nanolayer Gradient Index Optical Components
H. Fein; 1; M. Ponting; 1;
1. PolymerPlus LLC, Valley View, OH, United States.

Abstract (35 Word Limit): Specially formulated Gradient-Index polymeric optical materials offer capabilities not possible in present GRIN optics. A novel technology that enables large scale processing of nanolayered polymer films into real, performance-enhancing lenses for military Night-Vision-Goggle eyepieces is discussed.
Fabrication of dielectric Bragg reflectors composed of CaF$_2$ and ZnS for delicate lasing materials

A. Palatnik; 1; M. Muallem; 1; G. D. Nessim; 1; Y. Tischler; 1;

1. Chemistry, Bar Ilan University, Ramat Gan, Israel.

Abstract (35 Word Limit): We describe the fabrication and characterization of highly reflecting distributed Bragg reflectors (DBR) composed of thermally evaporated thin films of CaF$_2$ and ZnS without substrate heating. Proposed technique enables DBR deposition on delicate lasing materials.
High Power Diode Lasers for Pumping High Energy Solid State Lasers

P. Crump; C. Frevert; G. Erbert; G. Tränkle;
1. Ferdinand-Braun Institut, Berlin, Germany.

Abstract (35 Word Limit): The optical energy used in high-energy-class solid state laser facilities is generated by high power diode lasers. This tutorial reviews and summarizes progress in ongoing efforts world-wide to improve the performance of these critical components.
A Solid State 100 mJ Diode Pumped Temporally and Spatially Shaped Front End System for Seeding a 10 Hz 100 J Laser System

W. Shaikh; 1; T. Butcher; 1; S. Banerjee; 1; P. Mason; 1; K. Ertel; 1; J. Phillips; 1; J. Smith; 1; M. Divoky; 2; M. De Vido; 1; O. Cheklov; 1; J. Greenhalgh; 1; S. Tomlinson; 1; I. Musgrave; 1; C. Hernandez-Gomez; 1; J. L. Collier; 1;

1. CLF, STFC, Oxford, United Kingdom.
2. Laser, HiLase Project, Prague, Na Slovance, Czech Republic.

Abstract (35 Word Limit): We describe a 100 mJ three component ytterbium based laser system operating at 1030 nm. Capabilities of both temporal pulse shaping and efficient active/passive spatial shaping for amplification in a 100 J system are incorporated.
High energy pump laser for Multi-Petawatt laser

O. Casagrande; 1; C. Derycke; 1; A. Soujaeff; 1; P. Ramos; 1; L. Boudjemaa; 1; C. Simon-Boisson; 1; S. Laux; 1

F. Lureau; 1;

1. Laser Solutions Unit, Thales Optronique, Elancourt, France.

Abstract (35 Word Limit): ATLAS 100, a compact high energy laser delivering more than 100 joules at the repetition rate of 1 shot per minute has been developed for the two 10 PetaWatt beamlines of ELI NP infrastructure.
Recent Advances on the J-KAREN laser upgrade

H. Kiriyama; M. Mori; A. Pirozhkov; K. Ogura; M. Nishiuchi; M. Kando; H. Sakaki; A. Kon; M. Kanasaki; H. Tanaka; Y. Fukuda; J. Koga; A. Sagisaka; T. Esirkepov; Y. Hayashi; H. Kotaki; S. Bulanov; K. Kondo; P. Bolton; Y. Mashiba; M. Asakawa; O. Slezak; M. Sawicka-Chyla; V. Jambunathan; A. Lucianetti; T. Mocek;

2. Faculty of Science and Engineering, Kansai University, Suita, Osaka, Japan.
3. Interdisciplinary Graduate School of Engineering Sciences, Kyushu University, Kasuga, Japan.
4. HiLASE, Prague, Czech Republic.

Abstract (35 Word Limit): We report recent progress on the J-KAREN laser upgrade to realize $10^{22}$ W/cm² intensity at 0.1 Hz. Our current high-spatiotemporal-quality broadband pulses of over 20 J will be further amplified in the final amplifier.
Apparatus and Techniques for Measuring Laser Damage Resistance of Large-Area, Multilayer Dielectric Mirrors for Use with High Energy, Picosecond Lasers

R. A. Negres; 1  I. Bass; 1  K. A. Stanion; 1  G. Guss; 1  D. A. Cross; 1  D. A. Alessi; 1  C. Stolz; 1  C. W. Carr; 1
1. Lawrence Livermore National Laboratory, Livermore, CA, United States.

Abstract (35 Word Limit): We present techniques for measuring the damage performance of a variety of optical components with ps laser pulses, introduce a novel beam diagnostic technique, and explore the sensitivity of damage resistance to laser spot size for the case of high-reflectivity, multilayer dielectric (MLD) mirrors.
Glass-clad Ti:sapphire crystal fiber laser

S. Wang; 1; C. Hsu; 1; D. Jheng; 1; T. Ho; 1; T. Yang; 1; Y. Xu; 1; S. Huang; 1;

1. National Taiwan University, Taipei, Taiwan.

Abstract (35 Word Limit): Glass-clad Ti:sapphire crystal fibers were grown using the co-drawing laser-heated pedestal growth method. A laser threshold of less than 100 mW was achieved at room temperature with an a-cut-core diameter as small as 18 μm.
Abstract (35 Word Limit): We experimentally demonstrate a Type I grating effect in a lanthanum-aluminum silicate fiber for the first time, to the best of our knowledge. This grating shows a temperature sensitivity $\sim 8.71 \text{ pm}^\circ\text{C}$, which is lower than that of FBG in standard single-mode fiber.
Mid-infrared Raman sources with highly GeO$_2$ doped silica optical fibers

X. Dong; $^1$, $^2$; L. Wang; $^1$, $^4$; X. Li; $^4$; P. Shum; $^4$, $^2$; H. Su; $^3$, $^2$; Q. Wang; $^4$.

1. China Jiliang University, Hangzhou, Zhejiang, China.
2. CINTRA, Research Techno Plaza, 50 Nanyang Drive, Singapore, Singapore.
3. Nanyang Technological University, School of Materials Science and Engineering, Singapore, Singapore.
4. Nanyang Technological University, School of Electrical & Electronic Engineering, Singapore, Singapore.

Abstract (35 Word Limit): Mid-infrared Raman sources based on highly GeO$_2$-doped silica fibers pumped at $\sim$2.0 μm pulsed/cw lasers are studied. Supercontinuum generation up to 3.0 μm and cascaded Raman scattering up to 2.53 μm are achieved, respectively.
Low-Loss Tellurite Fibers With Embedded Nanodiamonds

H. Ebendorff-Heidepriem; Y. Ruan; H. Ji; B. Johnson; T. Ohshima; A. Greentree; B. C. Gibson; T. Monro

2. University of Melbourne, Melbourne, VIC, Australia.
3. RMIT, Melbourne, VIC, Australia.

Abstract (35 Word Limit): We report the development of nanodiamond-doped tellurite fibers with both preserved single photon emission properties of the nanodiamonds embedded in the glass and fiber loss reduced to levels suitable for practical applications.
Graphene-deposited Microfiber for Ultrafast Optical Modulation

S. Yu; L. Tong;

1. State Key Laboratory of Modern Optical Instrumentation, Department of Optical Engineering, Zhejiang University, Hangzhou, Zhejiang, China.

Abstract (35 Word Limit): With a convenient and controllable evanescent-field-induced transfer method, graphene flakes were deposited on the surface of a 1-μm-diameter microfiber, which can be used for ultrafast optical modulation based on its distinct saturable absorption.
Multiwavelength Thulium-doped Fiber Laser Based on Four-wave Mixing in Highly Germania-doped Fiber

T. Huang; 1; X. Li; 1; P. Shum; 1; Q. Wang; 1; X. Shao; 1; L. Wang; 1; H. Li; 1; Z. Wu; 1; X. Dong; 1;
1. Nanyang Technological University, Singapore, Singapore.

Abstract (35 Word Limit): An all-fiber multiwavelength Tm-doped laser based on four-wave mixing in highly-germania-doped-highly-nonlinear-fiber (HG-HNLF) has been demonstrated. By using 50-m HG-HNLF to provide intensity-depended gain, 36 lasing lines with wavelength spacing of 0.86 nm within 30-dB bandwidth is obtained.
Thermo-optic Degradation of Single-Modedness in Active LMA fibers and Simple Compensation Mechanisms

V. Supradeepa; J. M. Fini;
1. Indian Institute of Science, Bangalore, KA, India.
2. OFS Laboratories, Somerset, NJ, United States.

Abstract (35 Word Limit): We demonstrate significant thermo-optic degradation of single-modedness in active large mode area fibers due to heat generation in the fiber. We propose and demonstrate through simulations, simple compensation mechanisms using custom length dependent fiber coiling.
Influence of Al/Ge ratio on radiation-induced attenuation in nanostructured erbium-doped fibers preforms

M. Lancry; 1; M. Leon-Pichel; 1; N. Ollier; 2; L. Bigot; 3; H. El Hamzaoui; 3; I. Savelii; 3; A. Pastouret; 4; E. Burov; 4; B. Poumellec; 1; M. Bouazaoui; 3;

1. Université de Paris Sud, Orsay, France.
2. IRAMIS/DSM/CNRS/Ecole polytechnique, Palaiseau, France.
3. PhLAM/IRCICA, Villeneuve d’Ascq, France.
4. Draka Comteq France, Marcoussis, France.

Abstract (35 Word Limit): We studied the radiation resistance of Er$^{3+}$-doped fiber preforms manufactured with different technologies: Si and Al nanoparticles and sol-gel fibers. They have been irradiated with gamma rays and then studied using absorption and EPR spectroscopies.
Filament-Based Impulsive Raman Excitation of Vibrational and Rotational Modes of Polyatomic Molecules

R. J. Levis; 1
1. Temple University, Philadelphia, PA, United States.

Abstract (35 Word Limit): Femtosecond laser filamentation serves as a source well-suited for detection using impulsive excitation of vibrational and rotational modes of molecules. The resulting coherent motion serves a route to remote detection through single shot Raman scattering.
Picosecond Ionization Dynamics in Femtosecond Filaments at High Pressures

X. Gao; 1; G. Patwardhan; 1; S. Schrauth; 1; D. Zhu; 1; A. L. Gaeta; 1;
1. School of Applied and Engineering Physics, Cornell University, Ithaca, NY, United States.

Abstract (35 Word Limit): We observe a 3-fold increase in the electron density within 30 picoseconds after the filamentary propagation of femtosecond pulses in 60-bar argon gases. This suggests that electron-impact ionization dominates on this time scale.
On the Role of Freeman Resonances in Pump-Probe Measurements of the Nonlinear Refractive Index

M. Hofmann; C. Bree;

1. Weierstrass-Institute, Berlin, Germany.

Abstract (35 Word Limit): We demonstrate the dramatic impact of Freeman resonances on the cross-induced transient refractive index. Its nonperturbative character must be carefully considered in pump-probe based measurements of the all-optical Kerr effect.
Abstract (35 Word Limit): We theoretically investigate the role of group velocity matching in high-order harmonic generation. We introduce the associated walk-off length, and present its scaling with wavelength and pulse duration.
Final ID: SM3N.5

Laser Acceleration of Non-relativistic Electrons at Dielectric Structures: Status and Outlook

P. Hommelhoff; 1, 2; J. McNeur; 1; A. Li; 1; N. Schönenberger; 1; A. Tafel; 1;
1. Department of Physics, University of Erlangen-Nuremberg, Erlangen, Germany.
2. Max Planck Institute for Quantum Optics, Garching, Germany.

Abstract (35 Word Limit): Dielectric laser acceleration of electrons is the optical counterpart of phase-synchronous RF-acceleration of electrons in classical accelerators, demonstrated by us and at Stanford/SLAC recently. We discuss concept, experiments and detail highlights of this high-gradient scheme.
Final ID: SM30.1

Single Nucleic Acid Interactions Monitored with Optical Microcavity Biosensors

F. Vollmer; 1

1. Max-Planck-Inst Physik des Lichts, Erlangen, Germany.

Abstract (35 Word Limit): We have developed a label-free biosensing platform that is capable of monitoring single DNA molecules and their interaction kinetics, hence achieving an unprecedented sensitivity in the optical domain.
Differentiating surface and bulk interactions in nanoplasmic interferometric sensor arrays

B. Zeng; 1; F. Bartoli; 1;
1. Lehigh University, Bethlehem, PA, United States.

Abstract (35 Word Limit): We present a nanoplasmic interferometric sensor platform that can differentiate the adsorption of a thin protein layer on the sensor surface from bulk refractive index changes, exploiting the different penetration depths of multiple SPPs.
Universal Enhancement of Raman Scattering Sensing by Plasmonic Nanotubes Coupled with Photonic Crystal Slab

Z. Wang; 1, 2; C. Liu; 1, 3; S. Chakravarty; 4; D. Fan; 1, 3; A. X. Wang; 5; R. T. Chen; 1, 2

1. Materials Science and Engineering Program, Texas Materials Institute, The University of Texas at Austin, Austin, TX, United States.
2. Department of Electrical and Computer Engineering, The University of Texas at Austin, Austin, TX, United States.
3. Department of Mechanical Engineering, The University of Texas at Austin, Austin, TX, United States.
4. Omega Optics, Inc., Austin, TX, United States.
5. School of Electrical Engineering and Computer Science, Oregon State University, Corvallis, OR, United States.

Abstract (35 Word Limit): We experimentally demonstrate 2-D photonic crystal slab-coupled plasmonic nanocapsules for surface enhanced Raman spectroscopy (SERS). A strong Raman signal enhancement can be unambiguously detected even with a low concentration 10 nM dye molecules.
Low-Loss Titanium Dioxide Waveguides for Integrated Evanescent Raman Spectroscopy

C. C. Evans; 1; C. Liu; 1; J. Suntivich; 1;
1. Cornell University, Ithaca, NY, United States.

Abstract (35 Word Limit): We propose an integrated-optical device consisting of a channel waveguide, capable of exciting and collecting Raman-scattered light of surrounding chemicals via the evanescent field, as a new chemical sensing platform.
Monolithical Absorption Sensor Based on Bi-functional Quantum Cascade Structures

W. Schrenk; 1; D. Ristanic; 1; B. Schwarz; 1; P. Reininger; 1; H. Detz; 1; A. M. Andrews; 1; D. C. MacFarland; 1; T. Zederbauer; 1; G. Strasser; 1;
1. Technische Universität Wien, Vienna, Austria.

Abstract (35 Word Limit): An integrated mid-infrared sensor consisting of an array of DFB lasers and detectors built from a bi-functional quantum cascade structure is demonstrated. The different frequencies enable the identification of the chemicals in a liquid mixture.
Frequency locked cascaded micro ring resonators enabling real time and highly precise long and short time sensing

L. Stern; 1 G. Keinan; 1 A. Naiman; 1 N. Mazurski; 1 U. Levy; 1

1. Applied Physics, Hebrew University of Jerusalem, Jerusalem, Israel.

Abstract (35 Word Limit): We demonstrate an ultrasensitive differential sensing apparatus, based on a frequency locked cascaded micro-resonator scheme. By measuring the lasers beat frequency a highly sensitive sensor both in short (seconds) and long (hours) times is demonstrated.
Whispering gallery mode-based magnetometer

T. D. Vo; 1, E. Magi; 2, B. J. Eggleton; 2, B. Ferguson; 1

2. CUDOS, the University of Sydney, Sydney, NSW, Australia.

Abstract (35 Word Limit): We demonstrate a compact all-optical magnetic sensor based on whispering gallery modes in a photonic crystal fiber infiltrated with ferrofluid. We achieve a sensitivity of $\sim 0.18 \text{ pm/}\mu\text{T}$ and a resolution of $\sim 222 \text{ nT}$. 
Abstract (35 Word Limit): We report on our recent experiments of a 50.5 nJ, 750 fs ultra-stable dissipative soliton fiber laser in the presence of Raman scattering in a long ring cavity. We demonstrated that a transition from noise-like soliton to stable dissipate soliton took place at sufficiently high pulse energy.
A Harmonically Mode-locked Femtosecond Fiber Laser using Bulk-structured Bi$_2$Te$_3$ Topological Insulator

J. Lee; J. Koo; C. Chi; J. Lee;

Abstract (35 Word Limit): We experimentally demonstrate femtosecond harmonic mode-locking of a fiber laser using a bulk-structured Bi$_2$Te$_3$ topological insulator (TI)-deposited side-polished fiber.
Tm/Ho Co-doped Mode-locked Fiber Laser based on Graphene Transferred on Side-polished Fiber

X. Li; X. Yu; Z. Yan; Q. Wang; X. Yu; Y. Zhang;
1. Nanyang Technological University, Singapore, Singapore.
2. Centre for Disruptive Photonic Technologies, Nanyang Technological University, Singapore, Singapore.

Abstract (35 Word Limit): All-fiber Tm/Ho co-doped mode-locked fiber laser based on a side polished fiber with atom-layered graphene manufactured by chemical-vapor-deposition (CVD) method as platform has been investigated, which can operate from fundamental to thirteenth harmonic mode locking.
Mid-infrared Two-color Optical Parametric Oscillator across a 30 THz Spectral Range

Y. Jin; 1; S. M. Cristescu; 1; F. J. Harren; 1; J. Mandon; 1;
1. Department of Molecular and Laser Physics, Radboud Universiteit Nijmegen, Nijmegen, Netherlands.

Abstract (35 Word Limit): We present a broadband tunable two-color optical parametric oscillator. The single cavity is capable of generating two idlers that are separated up to 30 THz. Fourier transform spectroscopy with this source has been demonstrated for multi-gas detection.
Abstract (35 Word Limit): We show 3.7-fs (rms) synchronization between a 5-MHz, 0.5-μJ Ti:sapphire laser and a 6.2-GHz microwave signal [integration bandwidth: 1 Hz - 2.5 MHz]. This result may help advancing pump-probe imaging in free-electron lasers or ultrafast electron diffraction.
Low Phase Noise Hybrid Silicon Mode-Locked Laser Using On-Chip Coherent Photon Seeding

Srinivasan; Norberg; Komljenovic; Davenport; Fish; Bowers

1. UCSB, Goleta, CA, United States.

Abstract (35 Word Limit): We demonstrate 6dB improvement in phase noise of a mode-locked semiconductor laser using coherent photon seeding, achieving a record linewidth of 29kHz. The complete photonic-circuit including the feedback cavity is integrated on a single chip.
Broadband, Low Noise Modelocked Semiconductor Laser with Intracavity Programmable Dispersion Control

A. Klee; K. Bagnell; P. J. Delfyett;
1. University of Central Florida, CREOL, Orlando, FL, United States.

Abstract (35 Word Limit): An intracavity pulseshaper is used to broaden the spectrum of a 10 GHz semiconductor frequency comb to greater than 28 nm. Timing jitter is measured to be 15.4 fs integrated from 1 kHz to 100 MHz offset.
All-optical Q-switching limiter for a 5-GHz SESAM-modelocked laser with record-high peak power

U. Keller; A. Klenner;
1. Eidgenossische Tech Hochschule Zurich, Zurich, ZH, Switzerland.

Abstract (35 Word Limit): We use a Kerr-lens induced all-optical limiter to reduce Q-switching instabilities in a high-power diode-pumped 5-GHz SESAM-modelocked Yb:CALGO laser. This supports cw modelocking with 4.1-W average output power and 96-fs pulses, leading 7.5-kW peak power.
Abstract (35 Word Limit): Although the genomes of many animals, from worms to humans, have been sequenced, much of the detailed molecular understanding of the biology of these genes and their proteins is unknown. One of the major problems is that we cannot currently see what a protein does, where it is, and how it moves. Thus, most functional conclusions about a protein are necessarily indirect. The visualization of the structure of DNA by Watson and Crick led a true understanding of the concept of genes, transcription, and translation. In recent years, the invention of new imaging technologies is having a profound impact on biological sciences. I will discuss how a revolution in optical and electron microscopy will provide the tools that can have a profound impact on biology, biomedicine and bioengineering.
Nanoscopy with Focused Light

S. W. Hell;

1. Max Planck Institute for Biophysical Chemistry, Goettingen, Germany.

Abstract (35 Word Limit): For more than a century, it has been widely accepted that diffraction of light precludes any lens-based optical microscope from discerning details smaller than about half of the wavelength of light (~200 nm). However, in the 1990’s we discovered that basic state transitions in a fluorophore can be exploited to eliminate the resolution-limiting role of diffraction. Since then, fluorescence microscopes have been developed that are now able to resolve on the nanometer scale. We discuss the basic principles of these nanoscopy (superresolution) concepts with particular emphasis on the first viable far-field ‘nanoscopy’ method, STED microscopy. We show their scope of applications in the life sciences and beyond.
Abstract (35 Word Limit): More than 25 years ago, low temperature experiments aimed at establishing the ultimate limits to optical storage in solids led to the first optical detection and spectroscopy of a single molecule in the condensed phase. At this unexplored ultimate limit, many surprises occurred where single molecules showed both spontaneous changes (blinking) and light-driven control of emission, properties that were also observed in 1997 at room temperature with single green fluorescent protein variants. These observations form foundations for super-resolution microscopy beyond the diffraction limit with single molecules, and tracking of single molecules in cells continues to yield surprises.
Imaging life at High Spatiotemporal Resolution

E. Betzig;

1. Howard Hughes Medical Institute, Ashburn, VA, United States.

Abstract (35 Word Limit): Three different technologies that balance the inevitable tradeoffs of spatial resolution, speed, and non-invasiveness in fluorescence microscopy will be described: 3D localization microscopy of cellular ultrastructure; nonlinear structured illumination microscopy of live cell dynamics in the sub-100 nm regime; and lattice light sheet microscopy of rapid 3D dynamic processes in vivo.
Generation of Hybrid Entanglement of Light Between Wave-like and Particle-like Qubits

H. LE JEANNIC; 1; O. Morin; 1; K. HUANG; 1, 2; J. Liu; 1; C. Fabre; 1; J. Ruaudel; 1; Y. Jeong; 1; J. Laurat; 1;
1. Laboratoire Kastler Brossel, UPMC-Sorbonne Universites, CNRS, ENS-PSL Research University, College de France, Paris, France.
2. State Key Laboratory of Precision Spectroscopy, East China Normal University, Shanghai 200062, China.

Abstract (35 Word Limit): The wave-particle duality of light has led to two different encodings for optical quantum information processing. We report here the remote generation of entanglement between particle-like discrete-variable qubits and wave-like continuous-variable qubits.
Witness of Macroscopic Entanglement in Classical Statistical Optical Fields

X. Qian; b. little; J. Howell; J. H. Eberly;
1. University of Rochester, Rochester, NY, United States.

Abstract (35 Word Limit): We examine correlations between polarization and amplitude degrees of freedom for classical statistical optical fields with Bell-analysis experiments. Strong violations of the Clauser-Horne-Shimony-Holt inequality are observed. These constitute a new witness of classical macroscopic entanglement.
Abstract (35 Word Limit): We investigate the use of the Schwinger representation for casting multimode squeezed states into multipartite spin entangled states. While the generalization is not straightforward, we can still find highly entangled multipartite states.
Measurement of Quantum Two-Mode Squeezing Inspired by Classical Radio-Frequency Analogy

Y. Shaked; T. Geller; A. Pe'er;
1. Bar-Ilan University, Ramat Gan, Israel.

Abstract (35 Word Limit): From analogy to RF theory and applications, we devise general measurement schemes for two-mode squeezing using nonlinear optical mixing as the physical detector. We provide complete quantum and classical theory, with RF and optical demonstrations.
Varying the Entanglement of 1.55 μm Photon Pairs Generated by a Silicon Nanophotonic Chip

R. Kumar; 1 M. Savanier; 1 Ong; 1 S. Mookherjea; 1
1. University of California San Diego, La Jolla, CA, United States.

Abstract (35 Word Limit): We characterize the strength of entanglement corresponding to different Joint Spectral Intensities of telecommunications-wavelength photon pairs generated using spontaneous four-wave mixing in a diode-pumped compact CMOS-compatible silicon chip.
Twin Photon Pairs in a High-Q Silicon Microresonator

S. Rogers; 1; X. Lu; 1; W. Jiang; 2; Q. Lin; 3, 2;
1. Department of Physics and Astronomy, University of Rochester, Rochester, NY, United States.
2. Institute of Optics, University of Rochester, Rochester, NY, United States.
3. Department of Electrical and Computer Engineering, University of Rochester, Rochester, NY, United States.

Abstract (35 Word Limit): We report the generation of twin photon pairs in a high-Q silicon microdisk resonator. The device is able to produce pairs at a flux of $5.31 \times 10^5$ pairs/s within a bandwidth of 0.73 GHz, and a coincidence-to-accidental ratio as large as 155, the highest value reported to date for twin photon pairs.
Abstract (35 Word Limit): Standard methods of analyzing Bell's inequalities are fundamentally flawed when it comes to ruling out local realism. Here we present a powerful analysis technique that can falsify local realism in a certifiable manner.
Quantum Entanglement Distillation Using an Optical Metamaterial

M. Béchu; 1 M. Asano; 2 M. Tame; 3, 4 S. K. Ozdemir; 5 R. Ikuta; 2 T. Yamamoto; 2 D. Guney; 6 L. Yang; 5 M. Wegener; 1, 7 N. Imoto; 2

1. Institute of Applied Physics, Karlsruhe Institute of Technology, Karlsruhe, Baden-Württemberg, Germany.
2. Department of Material Engineering Science, Osaka University, Toyonaka, Osaka, Japan.
3. School of Chemistry and Physics, University of KwaZulu Natal, Durban, KwaZulu-Natal, South Africa.
4. National Institute for Theoretical Physics, University of KwaZulu Natal, Durban, KwaZulu-Natal, South Africa.
5. Department of Electrical and Systems Engineering, Washington University, St. Louis, MO, United States.
6. Department of Electrical and Computer Engineering, Michigan Technological University, Houghton, MI, United States.
7. Institute of Nanotechnology, Karlsruhe Institute of Technology, Karlsruhe, Baden-Württemberg, Germany.

Abstract (35 Word Limit): We perform an entanglement distillation protocol on pure and mixed states using optical metamaterials composed of gold nano-antennas and measure the density matrices by quantum-state tomography. The fidelity is improved from 0.85 to 0.97.
Mott behavior in K$_{x}$Fe$_{2-y}$Se$_{2}$ superconductors revealed by pump-probe spectroscopy

C. Zhang$^{1}$; W. Li$^{1}$; M. Xiao$^{2}$;

1. Nanjing University, Nanjing, Jiangsu, China.
2. Department of Physics, University of Arkansas, Fayetteville, AR, United States.

Abstract (35 Word Limit): Pump-probe spectroscopic data on K$_{x}$Fe$_{2-y}$Se$_{2}$ superconductors exhibit signatures of orbital-selective Mott transition with a significant enhancement of a slow decay component alongside a decrease in oscillatory coherent-phonon signals upon raising temperature to 160 K.
Critical Speeding-Up of Non-Equilibrium Electronic Relaxation Near Ising-Nematic Transition in Unstrained $\text{Ba(Fe}_{1-x}\text{Co}_x\text{As}_2}_2$ 

X. Yang; 1, A. Patz; 1, 2, T. Li; 1, 2, S. Ran; 1, 2, S. Bud’ko; 1, 2, P. Canfield; 1, 2, J. Wang; 1, 2, 
1. Physics, Iowa State University, Ames, IA, United States. 
2. Ames Lab -USDOE, Ames, IA, United States.

Abstract (35 Word Limit): We observe a critical speeding up in the electronic relaxation time that implies that nematic fluctuations govern the electronic thermalization/cooling dynamics and that magnetic fluctuations dominate the nonlinear signals that arise from the Ising-nematicity.
Ultrafast dissection of excitonic and structural orders in a persisting charge density wave

M. Porer; 1; U. Leierseder; 1; J. Ménard; 1; H. Dachraoui; 2; L. Mouchliadis; 3; I. E. Perakis; 3; U. Heinzmann; 2; J. Demsar; 4; K. Rossnagel; 5; R. Huber; 1;
1. Department of Physics, University of Regensburg, Regensburg, Germany.
2. Molecular and Surface Physics, University of Bielefeld, Bielefeld, Germany.
3. Department of Physics, University of Crete & FORTH/IESL, Heraklion, Greece.
4. Institute of Physics, Ilmenau University of Technology, Ilmenau, Germany.
5. Institute of Experimental and Applied Physics, University of Kiel, Kiel, Germany.

Abstract (35 Word Limit): We monitor the terahertz fingerprints of electronic and structural orders of the charge density wave in 1T-TiSe₂ on the femtosecond scale. NIR photoexcitation selectively melts electronic ordering while the structural distortion persists in a coherently excited state.
Probing Short- and Long-range Stripe Correlations in a Nickelate via Multi-THz Spectroscopy

G. Coslovich; W. Lee; H. Bechtel; M. M. Martin; T. Sasagawa; Z. Shen; R. A. Kaindl;
1. Materials Sciences Division, Lawrence Berkeley National Laboratory, Berkeley, CA, United States.
2. Advanced Light Source, Lawrence Berkeley National Laboratory, Berkeley, CA, United States.
3. SIMES, SLAC National Accelerator Laboratory and Stanford University, Menlo Park, CA, United States.
4. Materials and Structures Laboratory, Tokyo Institute of Technology, Kanagawa, Japan.

Abstract (35 Word Limit): We report optical-pump THz-probe reflectivity studies around the resonance frequency (=11 THz) of the in-plane bending mode of a stripe-ordered nickelate. The experiments reveal signatures of both short and long-range nanoscale charge order dynamics.
Ultrafast Dynamics of Multiferroic $h$-LuFeO$_3$

J. Bhowan; 1; X. Xu; 2; K. Sinha; 2; S. Trugman; 1; A. J. Taylor; 1; R. P. Prasankumar; 1; D. Yarotski; 1;
1. Los Alamos National Laboratory, Los Alamos, NM, United States.
2. Physics and Astronomy, University of Nebraska, Lincoln, Lincoln, NE, United States.

Abstract (35 Word Limit): Hexagonal LuFeO$_3$ is a multiferroic showing ferroelectricity and antiferromagnetism at room temperature. Below $T_R = 130$ K, it becomes ferrimagnetic. Ultrafast optical pump-probe measurements reveal that the dynamics are correlated with the structural changes responsible for ferrimagnetism.
Abstract (35 Word Limit): We measure dynamics of the helical ordering in the Lanthanide metal Dy resulting from transient changes in the conduction electron Fermi surface and subsequent scattering events that transfer the excitation to the core spin.
Direct Observation of Magnon Dynamics in Multiferroic HoMnO₃

P. R. Bowlan;¹; D. Yarotski;¹; N. Hur;²; A. J. Taylor;¹; R. P. Prasankumar;¹;
1. Center for Integrated Nanotechnologies, Los Alamos National Laboratory, Los Alamos, NM, United States.
2. Department of Physics, Inha University, Icheon, Korea (the Democratic People's Republic of).

Abstract (35 Word Limit): We directly resolve energy transfer pathways from electrons to magnons in multiferroic HoMnO₃ using ultrafast optical/terahertz spectroscopy. This reveals that energy is initially transferred from electrons to phonons and subsequently to magnons through spin-lattice relaxation.
Ohmic Loss Produces Chiral Dichroism in Plasmonic Metasurfaces: First Experimental Demonstration

G. Shvets; 1; N. Arju; 1; M. A. Belkin; 1; R. Hillenbrand; 2; F. Lu; 1; M. Schnell; 2; J. LEE; 1; A. B. Khanikaev; 3;
1. University of Texas at Austin, Austin, TX, United States.
2. CIC nanoGUNE Consolider, Donostia, Spain.
3. Physics, Queens College, Queens, NY, United States.

Abstract (35 Word Limit): A combination of experimental techniques is used to demonstrate that optical field concentration and Ohmic losses in planar chiral plasmonic metasurfaces depends on the handedness of circularly polarized light. Chiral dichroism in transmission is demonstrated.
Dynamic Beam Steering in Micro-fluidic-meta-surface

L. Yan; 1; P. Wu; 1; Q. Song; 1; W. Zhu; 1; Z. Wu; 1; D. Tsai; 2; F. Capasso; 3; A. Liu; 1;

1. School of Electrical and Electronic Engineering, Nanyang Technological University, Singapore, 639798, Singapore.
2. Department of Physics, National Taiwan University, Taipei, Taiwan.
3. Harvard University, Cambridge, MA, United States.

Abstract (35 Word Limit): We present a widely tunable metasurface composed of microfluidic antennas with subwavelength thickness for dynamic beam steering. By controlling actively the length of supercell, the reflection can be tuned to arbitrary direction under normal illumination.
Diffraction Interface Theory: A nonlocal approach to metasurfaces

C. Roberts; 1; S. Inampudi; 1; V. A. Podolskiy; 1;
1. University of Massachusetts Lowell, Amesbury, MA, United States.

Abstract (35 Word Limit): We present a novel formalism to describe diffractive optics of metasurfaces, diffractive interface theory (DIT).
Abstract (35 Word Limit): We experimentally realize active tuning of electric and magnetic resonances of all-dielectric optical metasurfaces based on the temperature-dependent refractive-index change of liquid crystals. We achieve 40nm spectral tuning and modulation contrast of 500%.
Surface plasmon polariton control with Metasurfaces

P. Genevet; 1; D. Wintz; 2; A. Ambrosio; 2; A. She; 2; F. Capasso; 1;


Abstract (35 Word Limit): Acting as subwavelength converters with controllable responses, metasurfaces can now engineer surface plasmon for applications in integrated optics and flat photonics. Plasmon focusing, wavelength demultiplexing, and generation and control of plasmons wakes will be discussed.
Broadband High-Efficiency Half-Wave Plate Using Plasmonic Metasurface

F. Ding; 1, 2; Z. Wang; 1; V. M. Shalaev; 1; A. V. Kildishev; 1;

1. Birck Nanotechnology Center, School of Electrical & Computer Engineering, Purdue University, West Lafayette, IN, United States.
2. Centre for Optical and Electromagnetic Research, Zhejiang University, Hangzhou, Zhejiang, China.

Abstract (35 Word Limit): We demonstrate an ultrathin, broadband half-wave plate in the near-infrared range using a plasmonic metasurface. Simulated and experimental results indicate that such a broadband and high-efficiency performance is sustained over a wide range of incident angles.
Plasmonic Metasurface for Color Hologram

Y. Huang; 1; W. Chen; 1; W. Tsai; 1; P. Wu; 1; C. Wang; 3; G. Sun; 2; D. Tsai; 1, 4;
1. Department of Physics, National Taiwan University, Taipei, Taiwan.
2. Department of Engineering, University of Massachusetts Boston, Boston, MA, United States.
3. Institute of Opto-electronic Engineering, National Dong Hwa University, Hualien, Taiwan.
4. Research Center for Applied Sciences, Academia Sinica, Taipei, Taiwan.

Abstract (35 Word Limit): We report a full-color meta-hologram based on a reflective metasurface. The reconstructed image of the meta-hologram is polarization-dependent with three primary colors, arranged in a plasmonic array in visible light region.
Achromatic metasurfaces enable multi-wavelength flat optical components: demonstration of a dispersion-less beam deflector

F. Aieta; 1, m. kats; 1, p. genevet; 1, r. Khorasaninejad; 1, F. Capasso; 1;
1. SEAS, Harvard University, Cambridge, MA, United States.

Abstract (35 Word Limit): Achromatic metasurfaces are introduced for multiwavelength light control. A wavelength-dependent phase response preserves the functionality within a certain bandwidth. Scattering properties of dielectric resonators are explored to demonstrate a dispersion-free beam deflector and an achromatic lens.
Multi-photon Microscopy to Image Neuronal and Vascular Function in the Mammalian Brain

D. Kleinfeld;

1. University of California, San Diego, La Jolla, CA, United States.

Abstract (35 Word Limit): I will review the application of two-photon laser scanning microscopy to problems in neuroscience as well as discuss current needs and challenges for the analysis of neuronal circuits and signaling in neocortical and other forebrain structures in mouse.
Reconstructing Nervous System Development and Function with Light-Sheet Microscopy

P. Keller

1. Howard Hughes Medical Institute, Ashburn, VA, United States.

Abstract (35 Word Limit): I will present our integrated, imaging-based technology framework for reconstructing development and function of the early nervous system in vivo, which combines high-speed multi-view light-sheet microscopy with automated approaches to large-scale image analysis.
Integrated Neurophotonics: Toward Massively-Parallel Mapping of Brain Activity

M. L. Roukes; 1
1. California Institute of Technology, Pasadena, CA, United States.

Abstract (35 Word Limit): I describe a new paradigm for functional imaging that surmounts limitations of free-space optics – based on integrated nanophotonics, to distribute an ultraminiaturized imager within the brain; and optogenetics, to transduce neural signals into the optical domain.
Photoacoustic Tomography: Ultrasonically Beating Optical Diffusion and Diffraction

L. V. Wang; 1
1. Washington University in St Louis, St. Louis, MO, United States.

Abstract (35 Word Limit): Photoacoustic tomography provides \textit{in vivo} multiscale functional, metabolic, molecular, and histologic imaging across the scales of organelles, cells, tissues, and organs with consistent contrast. Penetration and resolution have reached 7 cm and 90 nm, respectively.
Nano-photonic Phenomena in van der Waals heterostructures

D. N. Basov;

1. University of California, San Diego, La Jolla, CA, United States.

Abstract (35 Word Limit): In van der Waals heterostructures assembled from atomically thin layers of graphene, hexagonal boron nitride and other related materials electronic, plasmonic and phonon polaritonic phenomena are all intertwined. We explored these effects via infrared nano-imaging.
Generation of Graphene Surface Plasmons and Their Applications in Beam Steering

P. Chen; M. Farhat; S. Guenneau; H. Bagci;

2. Wayne State University, Detroit, MI, United States.
3. Aix-Marseille University, Marseille, France.

Abstract (35 Word Limit): We propose a novel concept that uses mechanical and electronic properties of graphene to efficiently couple light to surface plasmon polaritons. A graphene-based infrared beam-former based on the concept of surface leaky-wave is also discussed.
Final ID: FTu1E.3

Plasmon Resonance in Single- and Double-layer CVD Graphene Nanoribbons

D. Wang; 1, 2; N. K. Emani; 1, 2; T. Chung; 3; L. Prokopeva; 1, 2; A. V. Kildishev; 1, 2; V. M. Shalaev; 1, 2; Y. P. Chen; 3; T. A. Boltasseva; 1, 2

1. Electrical & Computer Engineering, Purdue University, West Lafayette, IN, United States.
2. Birck Nanotechnology Center, West Lafayette, IN, United States.
3. Physics, Purdue University, West Lafayette, IN, United States.

Abstract (35 Word Limit): Dynamic tunability of the plasmonic resonance in graphene nanoribbons is desirable in the near-infrared. We demonstrated a constant blue shift of plasmonic resonances in double-layer graphene nanoribbons with respect to single-layer graphene nanoribbons.
Nanoantenna-enhanced light-matter interaction in atomically thin WS2

J. Kern; 1 A. Trügler; 2 I. Niehaus; 1 J. Ewering; 1 R. Schmidt; 1 R. Schneider; 1 S. Najmaei; 3 A. George; 3 J. Zhang; 3 J. Lou; 3 U. Hohenester; 2 S. Michaelis de Vasconcellos; 1 R. Bratschitsch; 1

1. Institute of Physics and Center for Nanotechnology, University of Münster, Münster, Germany.
2. Institute of Physics, University of Graz, Graz, Austria.
3. Department of Mechanical Engineering and Material Science, Rice University, Houston, TX, United States.

Abstract (35 Word Limit): We present a hybrid system consisting of an atomically-thin semiconductor and a plasmonic nanoantenna. The intense optical near-fields provided by the antenna increase the photoluminescence intensity of WS2 by more than one order of magnitude.
Enhanced Spontaneous Emission from an Optical Antenna Coupled WSe$_2$ Monolayer

M. Eggleston; S. Desai; K. Messer; S. Madhvapathy; J. Xiao; X. Zhang; E. Yablonovitch; A. Javey; M. C. Wu

1. University of California Berkeley, Berkeley, CA, United States.

Abstract (35 Word Limit): A self-aligned process is developed to couple monolayer WSe$_2$ (30nm x 300nm) to a silver cavity-backed slot-antenna. Optical emission measurements show 340x enhancement in spontaneous emission. Carrier lifetimes of <1ps are measured by streak camera.
Ultrafast Nonlinear Absorption and Nonlinear Refraction of 2D Layered Molybdenum Dichalcogenide Semiconductors
K. Wang; J. Wang; L. Zhang; W. Blau;
1. Trinity College Dublin, Dublin, Ireland.
2. Shanghai Institute of Optics and Fine Mechanics, Shanghai, China.

Abstract (35 Word Limit): The nonlinear optical properties of a series of layered transition metal dichalcogenides prepared by liquid-phase exfoliation technique, i.e., MoX2 (X=S, Se and Te), were investigated by open- and closed-aperture z-scan from visible to near-infrared.
Abstract (35 Word Limit): We demonstrate helicity-dependent microcavity polariton emission from 2D atomic crystal at room temperature via non-resonance pump. The observed effect is in contrast to conventional spin polariton emission above the condensation threshold.
Final ID: STu1F.1

Multicast 4x20 Silicon Photonic MEMS Switches

S. Han; T. Seok; C. Kim; R. S. Muller; M. C. Wu;
1. University of California Berkeley, Berkeley, CA, United States.

Abstract (35 Word Limit): We report on monolithic 4x20 silicon photonic MEMS switches capable of multicast functions. The switch has small footprint (1.2x4.5mm\(^2\)), low optical insertion loss (<4.0dB), fast switching (9.6µs). 1x2 and 1x4 multicasts were successfully demonstrated.
All-optical programmable integrated signal processor

H. Yu; M. Chen; H. Chen; S. Yang; S. Xie;
1. Tsinghua University, Beijing, China.

Abstract (35 Word Limit): An all-optical programmable signal processor has been proposed and experimentally demonstrated. The record resolution is measured to be 145 MHz and the processing range can be enlarged by a channelized filter to > 100 GHz.
Nonlinear integrated optoelectronics

S. Mookherjea; 1

1. University of California, San Diego, La Jolla, CA, United States.

Abstract (35 Word Limit): Compared to traditional crystal-based nonlinear optical devices, photonic integrated circuits on a silicon platform may enable advanced and parallelized functionality in chip-scale energy-efficient nonlinear optics, such as combinations of mixers, filters and photodetectors.
Unidirectional Coupling with Two Matched Dielectric and Metal Long-Period Gratings along a Polymer Waveguide

K. S. Chiang; 1; B. Zou; 1;
1. City University of Hong Kong, Kowloon, Hong Kong.

Abstract (35 Word Limit): We propose a grating structure for the achievement of unidirectional coupling, which consists of two matched dielectric and metal long-period gratings. We verify our idea theoretically and experimentally with gratings formed along a polymer waveguide.
An Opto-Electro-Mechanical Phase Shifter

T. H. Stievater; M. W. Pruessner; D. Park; D. A. Kozak; W. S. Rabinovich;
1. US Naval Research Laboratory, Washington, DC, United States.
2. NRC Postdoc, Washington, DC, United States.

Abstract (35 Word Limit): We demonstrate an opto-electro-mechanical phase shifter. A suspended microbridge is electrostatically actuated to strongly-interact with a weakly-confined waveguide mode. The resulting effective index tuning substantially exceeds that achievable with thermo-optic and electro-optic approaches.
Optofluidic Double-layer Fano Resonance Photonic Crystal Slab Liquid Sensors

S. Wang; 1  Y. Liu; 1  D. Zhao; 1  Y. Shuai; 1  H. Yang; 1  W. Zhou; 1  Y. A. Sun; 1
1. University of Texas at Arlington, Arlington, TX, United States.

Abstract (35 Word Limit): We report refractive index sensing with ultra-compact surface-normal double-layer stacked Fano resonance photonic crystal slabs. A quality factor of 6,757 and a limit of detection of 5.6x10^{-5} RIU were experimentally demonstrated, respectively.
All-Fiber Polarization-Maintaining Electrooptic Pulse-Picker

M. Malmström, 2, 1; S. Boivinet, 3, 4; O. Tarasenko, 5; J. Lecourt, 3; Y. Hernandez, 3; W. Margulis, 5, 1; F. Laurell, 1;

3. Applied Photonics Department, Multitel, Mons, Belgium.
4. Electromagnetism and Telecommunication Department, University of Mons, Mons, Belgium.

Abstract (35 Word Limit): An alignment free all-fiber pulse-picker running at variable repetition rate for selecting pulses from an 86 MHz mode-locked Yb-fiber laser at 0-0.6 MHz with better than 35 dB extinction ratio is presented.
Evaluating the temporal profile of quantum cascade laser frequency combs

D. P. Burghoff; 1, Y. Yang; 1, D. Hayton; 2, J. Gao; 2, 3, J. Reno; 4, Q. Hu; 1

1. Massachusetts Institute of Technology, Cambridge, MA, United States.
2. SRON, Groningen, Netherlands.
4. Sandia, Albuquerque, NM, United States.

Abstract (35 Word Limit): The temporal profile of frequency combs based on quantum cascade lasers has been unclear for some time. We show how the SWIFTS technique directly measures such properties, obtaining combs' intensities and frequencies versus time.
Injection Seeding and Modelocking of Metal-metal Terahertz Quantum Cascade Lasers

J. Tignon; 1 F. Wang; 1 a. Brewer; 2 1; J. Freeman; 1 3; J. Maysonnave; 1; S. Moudjji; 4; R. Colombelli; 4; I. Kundu; 3; L. Lianhe; 3; E. Linfield; 3; G. Davies; 3; H. Beere; 2; D. Ritchie; 2; S. Dhillon; 1;

1. Laboratoire Pierre Aigrain, Ecole Normale Supérieure-PSL Research University, CNRS, Université Pierre et Marie Curie-Sorbonne Universités, Université Paris Diderot-Sorbonne Paris Cité, Paris, France.
2. Semiconductor Physics Group, University of Cambridge, University of Cambridge, United Kingdom.
3. School of Electronic and Electrical Engineering University of Leeds, Leeds, United Kingdom.
4. Institut d’Électronique Fondamentale, Université Paris Sud, Orsay, France.

Abstract (35 Word Limit): Injection seeding of terahertz quantum-cascade-lasers with metal-metal waveguides is demonstrated at liquid nitrogen temperatures through injection of phase-locked terahertz pulses. Coherent detection and modelocking of the QCL are demonstrated with the generation of 11ps pulse
Investigation of Time-resolved Gain Dynamics in an Injection Seeded Terahertz Quantum Cascade Laser

S. Markmann; 1  H. Nong; 1  S. Pal; 1  N. Hekmat; 1  P. Dean; 2  R. A. Mohandas; 2  L. H. Lianhe; 2  E. Linfield; 2  G. Davies; 2  A. D. Wieck; 1  N. Jukam; 1

1. Ruhr-Universität Bochum, Bochum, Germany.
2. University of Leeds, Leeds, United Kingdom.

Abstract (35 Word Limit): The evolution of the gain of terahertz quantum cascade laser during injection seeding is probed as a function of time. Oscillations of the gain are commensurate with the variations of the field envelope.
Scanning Voltage Microscopy Study of Lasing and Non-lasing Terahertz Quantum Cascade Lasers

D. Ban; 1; R. Dhar; 1; G. Razavipour; 1; E. Dupont; 2; Z. Wasilewski; 1;
1. University of Waterloo, Waterloo, ON, Canada.
2. National Research Council, Ottawa, ON, Canada.

Abstract (35 Word Limit): Scanning voltage microscopy results clearly show that the formation of electric field domains is responsible for the missing of lasing operation in a resonant-phonon based terahertz quantum cascade laser with a highly diagonal transition.
Two-Dimensional Pump Frequency Study of THz Generation in Mid-Infrared Quantum Cascade Lasers

Y. Jiang; 1; K. Vijayraghavan; 1; F. Demmerle; 2; G. Boehm; 2; M. Amann; 2; M. A. Belkin; 1;
1. The University of Texas at Austin, Austin, TX, United States.
2. Technische Universität München, Garching, Germany.

Abstract (35 Word Limit): The dependence of THz difference-frequency generation in mid-infrared quantum cascade lasers on the position of mid-infrared pump frequencies is investigated. Experiments are performed at room-temperature using dual-diffraction-grating modified Littrow-type external cavity setup.
Laterally-Coupled Dual-Grating Distributed Feedback Lasers for Generating Mode-Beat Terahertz Signals

J. H. Marsh; 1; L. Hou; 1; M. Haji; 2; I. Eddie; 3; H. Zhu; 4;

1. School of Engineering, University of Glasgow, Glasgow, United Kingdom.
3. 3CST Global Ltd, Glasgow, United Kingdom.
4. Institute of Semiconductors, Beijing, China.

Abstract (35 Word Limit): We present a laterally-coupled AlGaInAs/InP DFB laser emitting two longitudinal modes simultaneously within the same cavity and integrated with EAM. A stable 0.82 THz beating signal was observed over a wide range of bias parameters.
Optical Sideband Generation up to Room Temperature with Mid-Infrared Quantum Cascade Lasers

J. Tignon; 1; S. Houver; 1; A. Lebreton; 1; P. Cavalié; 1; M. Renaudat Saint-Jean; 2; M. Amanti; 2; C. Sirtori; 2; L. Lianhe; 3; E. Linfield; 3; G. Davies; 3; T. Pereira; 4; S. Dhillon; 1;

1. Laboratoire Pierre Aigrain, , United States.
2. Laboratoire Matériaux et Phénomènes Quantiques, Paris, France.
4. Universidade Federal de Mato Grosso, Cuiaba Mato Grosso, Brazil.

Abstract (35 Word Limit): Room temperature sideband generation on an optical carrier is demonstrated using mid-infrared quantum cascade lasers. This is achieved via an enhancement of the nonlinear susceptibility via resonant interband and intersubband excitations, compensating the large phase-mismatch.
Long-infrared InAs-based quantum cascade lasers
A. Bousseksou; D. Chastanet; R. Colombelli; G. Lollia; M. Bahriz; A. Baranov; r. Teissier;
1. IEF, CNRS-Universite Paris Sud, Orsay, France.
2. IES, Universite Montpellier 2 and CNRS, Montpellier, France.

Abstract (35 Word Limit): We report recent developments on InAs/AlSb based quantum cascade laser operating at of 17-19 µm, with improved design and metal–metal ridge resonators. The maximum operating temperature is 333 K at $\lambda=17.9$ µm. We also report distributed feedback lasers featuring spectrally single mode operation.
Investigation of Extraordinary Optical Transmission Inside a Terahertz Parallel-Plate Waveguide

K. S. Reichel; 1  P. Y. Lu; 2  R. Mendis; 1  D. Mittleman; 1

1. Department of Electrical and Computer Engineering, Rice University, Houston, TX, United States.
2. Department of Physics, Harvard University, Cambridge, MA, United States.

Abstract (35 Word Limit): We study extraordinary optical transmission by placing a metal screen with a 1-D array of holes inside a parallel-plate waveguide at terahertz frequencies. We find excitation with TE1 or TEM mode strongly affects output transmission characteristics.
Dynamic light-induced THz resonators in a waveguide

D. G. Cooke; 1; L. Gingras; 1; M. Georgin; 1;
1. McGill University, Montreal, QC, Canada.

Abstract (35 Word Limit): We demonstrate all-optical photoinjection of a one-dimensional resonator inside a terahertz parallel-plate waveguide. The pulsed pump enables us to study dynamic effects where the structure is written on timescales faster than the terahertz transit time.
THz Artificial Dielectric Lens

R. Mendis; 1; M. Nagai; 2; Y. Wang; 1; N. Karl; 1; D. Mittleman; 1;
1. Rice University, Houston, TX, United States.
2. Osaka University, Osaka, Japan.

Abstract (35 Word Limit): We demonstrate a THz lens designed using an artificial-dielectric medium fabricated from a stack of stainless-steel plates. The lens is capable of focusing a 20 mm diameter beam to a spot size of 4 mm.
Mechanically tunable bi-layer terahertz metamaterials

D. N. Neshev; 3 L. Liu; 2, 3 W. Chen; 1 D. A. Powell; 3 W. J. Padilla; 1 F. Karouta; 4 H. T. Hattori; 2 I. Shadrivov; 3

1. Department of Physics, Boston College, Boston, MA, United States.
2. School of Engineering and Information Technology, UNSW, Canberra, ACT, Australia.
3. Nonlinear Physics Centre, Australian National University, Canberra, ACT, Australia.
4. Department of Electronic Materials Engineering, Australian National University, Canberra, ACT, Australia.

Abstract (35 Word Limit): We propose a post-processing approach for tuning terahertz metamaterials by modifying the coupling between two metamaterial layers. We demonstrate that this method allows the metamaterial resonance to be shifted by 31% of the central frequency.
Efficient Terahertz Phase Modulation Using Vanadium Dioxide Meta-Surfaces
M. Hashemi; 1; S. Yang; 1, 2; T. Wang; 3; N. Sepúlveda; 3; M. Jarrahi; 1, 2;
1. University of California, Los Angeles, Los Angeles, CA, United States.
2. University of Michigan, Ann Arbor, MI, United States.
3. Michigan State University, E. Lansing, MI, United States.

Abstract (35 Word Limit): Voltage-controlled THz phase modulation using vanadium dioxide reconfigurable meta-surfaces is presented and a proof-of-concept phase modulator for sub-THz frequencies is fabricated. We demonstrate the highest reported phase modulation of $60^\circ$ at 85 GHz through a fully-integrated device platform.
Ultrathin Flexible and Optically Tunable Terahertz Bandpass Filter with Embedded Silicon

M. Rahm; 1; M. Hoeh; 1; J. Neu; 1; K. Schmitt; 1;
1. Technische Universität Kaiserslautern, Kaiserslautern, Germany.

Abstract (35 Word Limit): A new fabrication technique for ultra-thin, flexible and optically tunable metamaterials with embedded silicon is presented. We demonstrated a 25-µm-thick optically tunable terahertz bandpass filter with a maximal amplitude transmission of 80 % and an amplitude modulation depth of 94 % at 0.65 THz.
Terahertz Surface Wave Modulation in a Dielectric Slab Metasurface

N. Karl; 1 H. Chen; 2 A. J. Taylor; 2 I. Brener; 3 A. Benz; 3 J. Reno; 3 R. Mendis; 1 D. Mittleman; 1
1. Department of Electrical and Computer Engineering, Rice University, Houston, TX, United States.
2. Center for Integrated Nanotechnologies, Los Alamos National Laboratory, Los Alamos, NM, United States.
3. Center for Integrated Nanotechnologies, Sandia National Laboratories, Albuquerque, NM, United States.

Abstract (35 Word Limit): We experimentally and numerically investigate a switchable dielectric-slab-waveguide metasurface device. We use an active metasurface to manipulate the interaction with a propagating THz surface wave, giving us dynamic control of the wave at 0.3 THz.
Terahertz Radiation Enhancement in Large-Area Photoconductive Sources by Using Plasmonic Nanoantennas

N. Yardimci; 1; S. Yang; 2; 1; C. Berry; 2; M. Jarrahi; 1, 2;
1. University of California - Los Angeles, Los Angeles, CA, United States.
2. University of Michigan, Ann Arbor, MI, United States.

Abstract (35 Word Limit): We demonstrate that incorporating plasmonic nanoantennas in large-area photoconductive sources enables record-high terahertz radiation powers as high as 3.8 mW over 0.1-5 THz and an order-of-magnitude higher optical-to-terahertz conversion efficiencies compared to conventional designs.
Miniaturized Optical Frequency References in the Telecom Regime
L. Stern; E. Talker; N. Mazurski; B. Desiatov; M. Shefer; A. Segal; U. Levy;
1. Applied Physics, Hebrew University of Jerusalem, Jerusalem, Israel.
2. Micro System and Smart Technologies, Rafael, Haifa, Israel.

Abstract (35 Word Limit): We present two platforms for miniaturized telecom optical frequency references, based on TPA in rubidium vapor. Record efficiency of light vapor interaction in a serpentine atomic cladding wave guide, and micro-machined mm-scale cells are demonstrated.
Non-reciprocal light storage in a silica microsphere

C. Dong; Z. Shen; C. Zou; Y. Zhang; W. Fu; G. Guo;
1. Univ of Science and Technology of China, Hefei, Anhui, China.

Abstract (35 Word Limit): We report an experimental study of Brillouin-scattering-induced transparency (BSIT) in a silica microsphere. Because of the phase-matching requirement, the non-reciprocal light storage based on the BSIT is observed in our experiment.
Highly Efficient Four-Wave Mixing in an AlGaAs-On-Insulator (AlGaAsOI) Nano-Waveguide

M. Pu; 1; L. Ottaviano; 1; E. Semenova; 1; K. Yvind; 1;
1. Danmarks Tekniske Universitet, Lyngby, Denmark.

Abstract (35 Word Limit): We propose an AlGaAs-on-insulator platform for nonlinear integrated photonics. We demonstrate highly efficient four-wave mixing in a 3-mm long AlGaAs-on-insulator nano-waveguide. A conversion efficiency of -21.1 dB is obtained with only a 45-mW pump.
Low-power on-chip all-optical Kerr switch with silica microcavity

W. Yoshiki; T. Tanabe; 1.
1. Keio University, Yokohama, Kanagawa, Japan.

Abstract (35 Word Limit): We achieved on-chip optical Kerr switching with an input power of 2 mW using a silica toroid microcavity. This is the lowest power for any demonstrated on-chip optical Kerr switch.
Abstract (35 Word Limit): We report a half-octave-spanning Kerr frequency comb which has the record-low phase noise floor with -130 dBc/Hz at 1 MHz offset for 18 GHz carrier frequency, and long-term Allan deviation of $7 \times 10^{-11}/\sqrt{\tau}$ with active stabilization.
Abstract (35 Word Limit): SiN micro-resonators with a cross section of 3×0.6 μm² and an FSR of 25 GHz were demonstrated with intrinsic Qs up to 17 million, showing frequency comb onset power as low as 5.6 mW.
Octave-Spanning Supercontinuum Generation in a Silicon Nitride Waveguide Pumped by a Femtosecond Fiber Laser at 1.9 μm

R. Salem; Y. Okawachi; M. Yu; M. Lamont; K. Luke; P. Fendel; M. Lipson; A. L. Gaeta;

1. PicoLuz, LLC, Jessup, MD, United States.
3. Applied and Engineering Physics, Cornell University, Ithaca, NY, United States.
4. Electrical and Computer Engineering, Cornell University, Ithaca, NY, United States.

Abstract (35 Word Limit): We report supercontinuum generation from 1250 – 2600 nm using a 2-cm-long silicon nitride waveguide pumped with an all-fiber femtosecond laser source at 1920 nm.
Low-Noise Stimulated Brillouin Lasing in a Microrod Resonator

W. Loh; J. Becker; F. N. Baynes; A. Green; D. C. Cole; F. Quinlan; H. Lee; K. Vahala; S. B. Papp; S. Diddams;

1. NIST, Boulder, CO, United States.
2. California Institute of Technology, Pasadena, CO, United States.

Abstract (35 Word Limit): We demonstrate a Brillouin microcavity laser based on a microrod resonator exhibiting a frequency noise of 140 Hz/√Hz at 10 Hz offset. The corresponding laser linewidth is measured to be below 400 Hz.
A Bistatic, Open-Path, Quantum Cascade Laser Array-Based Sensor for Methane and Nitrous Oxide Measurements

J. Kapit; A. P. Michel; M. F. Witinski; R. Blanchard; A. Gokoglu;
1. School of Engineering and Applied Sciences, Harvard University, Cambridge, MA, United States.
2. Eos Photonics, Cambridge, MA, United States.

Abstract (35 Word Limit): A next-generation bistatic, open-path sensor is currently in development that utilizes a Quantum Cascade Laser array for the source in order to achieve methane and nitrous oxide detection over path lengths exceeding 100 m.
UAV-based laser spectrometer to quantify methane from agricultural and petrochemical activities

L. Tao; 1; D. Pan; 1; L. Golston; 1; K. Sun; 1; S. Saripalli; 2; M. A. Zondlo; 1

1. Department of Civil and Environmental Engineering, Princeton University, Princeton, NJ, United States.
2. KalScott Engineering, Lawrence, KS, United States.

Abstract (35 Word Limit): A lightweight (1.8 kg) UAV-based methane sensor using a 3.27 mm GaSb DFB laser has been developed. Small UAVs can quantify very localized methane emissions but severely constrain sensor mass/volume while still requiring high-sensitivity detection.
Modeling the dependence of fork geometry on the performance of quartz enhanced photoacoustic spectroscopic sensors

S. Firebaugh; 1, A. Sampaolo; 2, P. Patimisco; 2, V. Spagnolo; 2, F. K. Tittel; 3,
1. Electrical and Computer Engineering, United States Naval Academy, Annapolis, MD, United States.
2. Dipartimento Interateneo di Fisica, Universita e Politecnico di Bari, Bari, Italy.
3. Department of Electrical and Computer Engineering, Rice University, Houston, TX, United States.

Abstract (35 Word Limit): A finite element model for Quartz Enhanced Photoacoustic Spectroscopy (QEPAS) was developed and applied to study the dependence of performance on sensor dimensions. This model can be a design tool for optimizing tuning fork dimensions.
Ultralow-Noise Infrared Spectroscopy at Single-Photon Level Based on Frequency Upconversion System

W. Wu; 1  R. Tang; 1  X. Li; 1  H. Pan; 1  E. Wu; 1  H. Zeng; 1

1. East China Normal University, Shanghai, Shanghai, China.

Abstract (35 Word Limit): We realized an efficient infrared spectrometer with high detection sensitivity at single photon level by using the wavelength tunable frequency upconversion detection technique with synchronized laser source. This kind of spectrometers also can be used in remote spectrum analysis.
Thermal Emission of GaAs Nanowire Solar Cells

S. Wu; M. Povinelli;
1. Electrical Engineering, University of Southern California, Los Angeles, CA, United States.

Abstract (35 Word Limit): Despite concentrated light absorption and low thermal conductivities, GaAs nanowire solar cells can still have larger thermal emission cooling power than planar ones, resulting in a nearly 10 K lowering in operating temperature.
Temperature-dependent Characterization of G0.94Sn0.06 Light-Emitting Diode Grown on Si via CVD

S. Ghetmiri; 2 W. Du; 2 Y. Zhou; 2 J. Margetis; 2 T. Pham; 2 A. Mosleh; 2 B. Conley; 2 A. Nazzal; 4 G. Sun; 5 R. Soref; 5 J. Tolle; 3 H. Naseem; 2 B. Li; 6 S. Yu; 2

1. University of Arkansas, , United States.
2. Electrical engineering , University of Arkansas, Fayetteville, AR, United States.
3. ASM, Phoenix, AZ, United States.
4. Electrical Engineering and Physics, Wilkes University, Wilkes-Barre, PA, United States.
5. Department of Engineering, University of Massachusetts Boston, Boston, MA, United States.
6. Arktonic LLC, Fayetteville, AR, United States.

Abstract (35 Word Limit): Temperature-dependent electroluminescence from a double heterostructure n-Ge/i-Ge0.94 Sn0.06/p-Ge LED was studied. The peak position of EL spectra showed a blue-shift as the temperature decreased. A maximum emission power of 7 mW was obtained under the current density of 800 A/cm².
Abstract (35 Word Limit): Advanced laser lift off (LLO) techniques leading to high quality and high throughput fabrication of vertical and flip chip GaN and AlN based LEDs are discussed.
Enhancement of quantum dot luminescence by using plasmonic resonance scheme of stacking asymmetric split-ring metamaterials

T. Shen;¹; T. Kao;¹; H. Kuo;¹;
¹. National Chiao Tung University, Hsinchu, Taiwan.

Abstract (35 Word Limit): Coupling of nanostructured metal with quantum dots have been widely used in various technologies. We have designed a stacking split-ring metamaterial with tunable resonance and enhanced the quantum dots fluorescence by a factor over 4.5.
Field-portable optofluidic plasmonic biosensor for wide-field and label-free monitoring of molecular interactions

A. F. Coskun; 1, 5; A. Cetin; 2, 3; B. Galarreta; 2, 4; D. A. Alvarez; 2; H. Altug; 3, 2; A. Ozcan; 5, 6;
1. Division of Chemistry and Chemical Engineering, California Institute of Technology, Pasadena, CA, United States.
2. Department of Electrical and Computer Engineering, Boston University, Boston, MA, United States.
3. Bioengineering Department, EPFL, Lausanne, Switzerland.
4. Departamento de Ciencias-Quimica, Pontificia Universidad Catolica del Peru, Lima, Peru.
5. Departments of Electrical Engineering and Bioengineering, UCLA, Los Angeles, CA, United States.
6. California NanoSystems Institute, UCLA, Los Angeles, CA, United States.

Abstract (35 Word Limit): We demonstrate a field-portable optofluidic plasmonic sensing device, weighing 40 g and 7.5 cm in height, which merges plasmonic microarrays with dual-wavelength lensfree on-chip imaging for real-time monitoring of protein binding kinetics.
Spectrally Reconfigurable Multi-Spot Trap on Optofluidic ARROW Chip

H. Schmidt; 2 K. D. Leake; 2 M. Olson; 1 D. Ozcelik; 2 A. Hawkins; 1

1. Electrical and Computer Engineering, Brigham Young University, Provo, UT, United States.
2. School of Engineering, University of California, Santa Cruz, Santa Cruz, CA, United States.

Abstract (35 Word Limit): We demonstrate an on-chip spectrally reconfigurable multi-spot trap using an integrated multimode interference waveguide. This device is able to trap multiple particles simultaneously as well as transport particles along a channel in controlled manner.
Physical insight into optical coupling between photoreceptor cell nuclei

H. T. Xuan; 1


Abstract (35 Word Limit): We study optical coupling and light transport among photoreceptor cell nuclei of mammals’ retina. This study also sheds light on light focusing and transport phenomena along microsphere-chain waveguides. The resonance’s role is discussed in details.
Optofluidic Polarization Beam Splitter

Y. Liu; 1  L. Shi; 1  X. Fan; 2  X. Zhang; 1
1. Huazhong Univ of Science and Technology, Wuhan, Hubei, China.
2. Biomedical Engineering, University of Michigan, Ann Arbor, MI, United States.

Abstract (35 Word Limit): An efficient polarization beam splitter (PBS) based on a silica microcapillary is proposed and experimentally demonstrated. This PBS relies on the inherent-geometry-induced birefringence. A maximum extinction ratio of up to 25 dB is achieved.
Optical Waveguides from a Lithographically-Defined Wetting of a High-Index Liquid

C. C. Evans; E. Hsu; M. Ji; C. Liu; J. Suntivich;
1. Cornell University, Ithaca, NY, United States.

Abstract (35 Word Limit): We present a new approach to realize liquid-core optical waveguides via selective wetting on lithographically patterned oleophobic and oleophilic patches for sensing and adaptable optics applications.
Density Assisted Optofluidic Fabrication of 3D Shaped Particles

K. Paulsen; A. Chung;
1. RPI, Troy, NY, United States.

Abstract (35 Word Limit): We present a novel method of creating complex 3D particles by flow deformation and UV light polymerization. An infinite number of particle shapes can be obtained by manipulating flow and light conditions.
Final ID: STu1K.7

Tailoring Light Flow in Microfluidics
H. Zhao; 1 L. Chin; 1 W. Zhu; 1 E. Yap; 2 W. Ser; 1 A. Liu; 1
1. School of Electrical and Electronic Engineering, Nanyang Technological University, Singapore, Singapore.
2. Lee Kong Chian School of Medicine, Nanyang Technological University, Singapore, Singapore.

Abstract (35 Word Limit): This paper proposes an approach to tailor the light flow by using the liquid diffusion-generated gradient. A microfluidic network is designed to generate the required linear and parabolic profiles. Maxwell’s fisheye lens and optical bend are realized on a single microfluidic chip.
Ultra-broadband SERS substrates for "all" excitation wavelengths
Q. Gan; 1; N. Zhang; 1; K. Liu; 1; H. Song; 1; X. Zeng; 1; D. Ji; 1;
1. State University of New York at Buffalo, East Amherst, NY, United States.

Abstract (35 Word Limit): We developed an ultra-broadband super-absorbing metasurface substrate for SERS sensing. In contrast to conventional substrates working for limited excitation wavelengths, this structure can work for almost “all” available laser lines from 450-nm to 1000-nm.
Advanced optical distance measurements using femtosecond laser pulses.
S. Kim; Y. Kim; B. Chun; K. Lee; S. Han; Y. Jang; H. Kang; 1

Abstract (35 Word Limit): Femtosecond lasers began to draw attention as a new light source for high-precision absolute distance measurements (ADMs) allowing for advanced principles such as synthetic wavelength generation, Fourier-transform-based dispersive analysis and multi-wavelength interferometry. In this talk, we present the state-of-the-art measurement principles and performance demonstrated by exploiting the unique temporal and spectral characteristics of femtosecond laser pulses for ADM applications.
High speed two-dimensional temporal compressive sampling microscopic camera

Q. Guo; 1 H. Chen; 1 M. Chen; 1 Z. Weng; 1 Y. Liang; 1 F. Xing; 1 S. Xie; 1
1. Tsinghua University, Beijing, Beijing, China.

Abstract (35 Word Limit): A two-dimensional temporal compressive sampling microscopic camera with a frame rate of 500 kHz is demonstrated in this paper, achieving higher frame rate and lower sampling bandwidth than the conventional compressive sampling cameras.
Design Challenges of a High Speed Tunable Laser Interrogator for Future Spacecraft Health Monitoring

S. Ibrahim; J. O'Dowd; R. McCue; A. Honniball; M. Farnan;

1. FAZ Technology Ltd., Dublin, Ireland.

Abstract (35 Word Limit): We report the performance results achieved for a high speed, high resolution optical FBG interrogator with a repeatability <5fm@80Hz BW and precision <200fm (p-p), designed for space applications on a launcher or atmospheric re-entry vehicle.
Safety Monitoring of Long Distance Power Transmission Cables and Oil Pipelines with OTDR Technology

H. Wu; Y. Qian; H. Li; S. Xiao; Z. Fu; Y. Rao;
1. Univ of Electronic Sci & Tech of China, Chengdu, SiChuan, China.

Abstract (35 Word Limit): This paper presents two typical applications of polarization- and phase-sensitive OTDRs, which are representative Distributed Optical Fiber Sensors (DOFSs), for on-line safety monitoring of long-distance power transmission cables and oil pipelines in the energy industry.
Curvature Sensor Based on Long-Period Grating in Dual Concentric Core Fiber

Z. Wu; 1, 2; N. Zhang; 1, 2; P. Shum; 1, 2; X. Shao; 1; H. Zhang; 1, 2; T. Huang; 1, 2; G. Humbert; 3; J. Auguste; 3; F. Gérôme; 3; J. Blondy; 3; Q. X. Dinh; 2;

1. School of Electrical and Electronics Engineering, Nanyang Technological University, Singapore, Singapore.
2. CNRS-International-NTU-Thales Research Alliance (CINTRA), Singapore, Singapore.
3. XLIM Research Institute, UMR 7252 CNRS/University of Limoges, Limoges, France.

Abstract (35 Word Limit): We report on a curvature sensor based on a long-period grating in a dual-concentric-core fiber. By measuring the relative shifting of two adjacent resonant dips, the curvature sensitivity reaches 7.635 nm/m⁻¹.
Highly Sensitive Liquid Level Sensor using a Polymer Optical Bragg Grating for Industrial Applications

C. Marques; 1; G. Peng; 2; D. J. Webb; 1;
1. Aston Institute of Photonic Technologies, Aston University B4 7ET Birmingham, UK, Birmingham, United Kingdom.
2. University of New South Wales, School of Electrical Engineering and Telecommunications, Sydney, NSW, Australia.

Abstract (35 Word Limit): A novel and highly sensitive liquid level sensor based on a polymer optical fiber Bragg grating (POFBG) is reported for the first time. The sensitivity of the sensor is found to be 57 pm/cm of liquid, enhanced by more than a factor of 5 when compared to an equivalent sensor based on silica fiber.
Integrated Fabry-Perot/Fiber Bragg Grating Sensor for Simultaneous Measurement

P. Lu; \(^1\); F. M. Abdulhussein; \(^2\);
1. Huazhong Univ of Science and Technology, Wuhan, Hubei, China.
2. Institute of laser for postgraduate studies, Baghdad University, Baghdad, Iraq.

Abstract (35 Word Limit): An all-fiber sensor for simultaneous measurements is demonstrated. Fiber Bragg grating (FBG) inside the core of all solid photonic band gap fiber (ASPBGF) was connected to FPI micro cavity for simultaneously measure load and temperature with sensitivities 4.07nm/N and 13.7pm/°C respectively.
Tailoring Light at the Source: Structured Light from Laser Resonators
A. Forbes; 1, 2;
1. CSIR National Laser Centre, Pretoria, South Africa.
2. Physics, University of the Witwatersrand, Johannesburg, South Africa.

Abstract (35 Word Limit): We outline various approaches to creating structured light directly from a laser cavity. By exploiting intra-cavity dynamic and geometric phase control, as well as complex amplitude modulation, custom modes may be generated on-demand.
High-Topological Charge Vortex Tweezers with Continuous Control of Orbital Angular Momentum by Ultrafast Laser Machining

R. Drevinskas; 1; M. Gecevičius; 1; M. Beresna; 1; P. Kazansky; 1;
1. University of Southampton, Southampton, United Kingdom.

Abstract (35 Word Limit): We demonstrate a single beam generated optical vortices of topological charge up to 100 with tunable orbital angular momentum. The continuous control of torque without altering the intensity distribution was implemented in optical trapping.
Optical Coherency Matrix Tomography of Unconventional Beams
K. Kagalwala; H. Kondacki; A. F. Abouraddy; B. E. Saleh;
1. University of Central Florida, CREOL, Orlando, FL, United States.

Abstract (35 Word Limit): We present the first experimental measurement of the coherency matrix $G$ associated with an electromagnetic beam with two binary degrees of freedom. We consider beams with polarization and a spatially varying amplitude or phase: spatial parity modes and orbital angular momentum modes, respectively.
Study of Turbulence Induced Orbital Angular Momentum Channel Crosstalk in a 1.6 km Free-Space Optical Link

M. P. Lavery; 1; B. Heim; 2; C. Peuntinger; 2; E. Karimi; 4; O. S. Magaña-Loaiza; 3; T. Bauer; 2; C. Marquardt; 2
a. willner; 5; R. W. Boyd; 3, 4; M. Padgett; 1; G. Leuchs; 2;

1. University of Glasgow, Glasgow, United Kingdom.
3. Institute of Optics, University of Rochester, Rochester, NY, United States.
4. Department of Physics, University of Ottawa, Ottawa, ON, Canada.
5. Electrical Engineering, University of Southern California, Los Angeles, CA, United States.

Abstract (35 Word Limit):

We experimentally study the turbulence induced crosstalk between orbital angular momentum channels transmitted over a 1.6 km optical link. Our presented results indicate that turbulence mitigation techniques will be required for links of this length.
Single-aperture STED illumination using a q-plate and fiber

L. Yan; 1; E. Karimi; 2; P. Gregg; 1; R. W. Boyd; 2, 3; S. Ramachandran; 1;
1. Department of Electrical and Computer Engineering, Boston University, Boston, MA, United States.
2. Department of Physics, University of Ottawa, Ottawa, ON, Canada.
3. Institute of Optics, University of Rochester, Rochester, NY, United States.

Abstract (35 Word Limit): We demonstrate single-aperture STED nanoscopy illumination with vortex-fiber modes excited by a dispersive q=1/2 plate at visible wavelengths. The vortex-fiber-compatible bias-voltage-tunable mode conversion of q-plates enables easy switching between multiple STED-wavelength pairs.
Increasing the Quantum Number, Dimensionality and Complexity of Entanglement

R. Fickler; 1, 2; M. Krenn; 1, 2; R. Lapkiewicz; 1, 2; M. Huber; 3, 4; W. N. Plick; 1, 5; S. Ramelow; 1, 6; A. Zeilinger; 1, 2;

1. Vienna Center for Quantum Science and Technology, Faculty of Physics, University of Vienna, Vienna, Austria.
2. Austrian Academy of Sciences, Institute for Quantum Optics and Quantum Information, Vienna, Austria.
3. Fisica Teorica: Informacio i Fenomens Quantics, Departament de Fisica, Universitat Autonoma de Barcelona, Barcelona, Spain.
4. ICFO-Institut de Ciencies Fotoniques, Barcelona, Spain.

Abstract (35 Word Limit): We use transverse spatial modes of photons to demonstrate quantum entanglement of angular momentum up to 300 quanta and verify (100x100)-dimensional entanglement. Additionally, we investigate entanglement of complex polarization patterns and find interesting entanglement structures.
Splicing Tapered Inhibited-coupling Hypocycloid-core Kagome Fiber to SMF Fibers

Z. XIMENG; 1 B. Debord; 1 M. Alharbi; 1 L. Vincetti; 2 F. Gérôme; 1 F. Benabid; 1

1. GPPMM group, Xlim Research Institute, UMR CNRS 7252, University of Limoges, France, Limoges, France.
2. Department of Engineering "Enzo Ferrari", University of Modena and Reggio Emilia, I-41125 Modena Italy, Modena, Italy.

Abstract (35 Word Limit): We report on tapered inhibited coupling Kagome-fiber with a down-ratio as large as 2.4 while maintaining the hypocycloid-core shape. The insertion-loss of SMF spliced to tapered Kagomefiber was measured with minimum of 0.48dB at 1550nm.
Abstract (35 Word Limit): We investigate nonlinear effects in long period gratings in a large mode area fiber. Simulations indicate that self-focusing effects can be significant at the power levels where self and cross phase modulation impair the mode conversion.
Abstract (35 Word Limit): We designed and manufactured a high power WDM to enable a high power Raman lasers. We used a custom designed glass processing machine to fuse the WDM. We tested the WDM at 100 W of power with 0.05 dB loss.
Towards a Plasma-Core PCF for Tunable UV-DUV Radiation

B. Debord; 1; F. Gérôme; 1; D. Passerieux; 1; P. Coche; 2; L. Alves; 2; F. Benabid; 1;

1. GPPMM group, Xlim Research Institute, UMR CNRS 7252, University of Limoges, France, Limoges, France.
2. Instituto de Plasmas e Fusão Nuclear, Instituto Superior Técnico, Universidade de Lisboa, Lisboa, Portugal.

Abstract (35 Word Limit): We report on recent results toward development of tunable and miniaturized UV-DUV radiation using microwave-driven plasma-core photonic crystal fiber. Gas-mixture optimized UV-DUV emission and highly efficient microwave ring resonators couplers are demonstrated.
Hollow Core Silicon-Silica Bragg Fiber

S. Chaudhuri; J. Sparks; R. He; J. Badding;

1. Pennsylvania State University, State College, PA, United States.

Abstract (35 Word Limit): A hollow core four layered Bragg fiber has been fabricated using silicon and silica as alternating layers via high-pressure chemical vapor deposition, which can be used for the guidance of near infrared light.
Inspecting of Defect-Induced Mode Coupling in Hollow-Core Photonic Bandgap Fibers Using Time-of-Flight

N. H. Wong; 1; S. Sandoghchi; 1; Y. Jung; 1; T. Bradley; 1; N. V. Wheeler; 1; N. Baddela; 1; J. R. Hayes; 1; F. Poletti; 1; M. Petrovich; 1; S. Alam; 1; P. Petropoulos; 1; d. Richardson; 1;
1. University of Southampton, Southampton, United Kingdom.

Abstract (35 Word Limit): We analyze defect-induced mode coupling in a hollow-core photonic bandgap fiber using time-of-flight, and show its utility in complementing optical time-domain reflectometry.
Kagome-type HC-PCF pulse compression: high average power (>100 W), high efficiency and very low noise performance

F. Emaury; 1; A. Diebold; 1; B. Debord; 2; F. Gérôme; 2; C. J. Saraceno; 1, 3; T. Sudmeyer; 3; F. Benabid; 2; U. Keller; 1;
1. ETH Zurich, Zurich, ZH, Switzerland.
2. XLIM, Limoges, France.
3. University of Neuchatel, Neuchatel, Switzerland.

Abstract (35 Word Limit): We present sub-100-fs external pulse compression and noise characterization from ultrafast multi-100-W thin disk lasers using gas-filled-Kagome-type HC-PCFs. We demonstrate high compression efficiency and excellent phase and amplitude low-noise properties.
Scaling Laws in Tube Lattice Fibers

L. Vincetti; 1; M. Masruri; 2; A. Cucinotta; 2;
1. Department of Engineering "Enzo Ferrari", University of Modena and Reggio Emilia, Modena, Italy.
2. Department of Information Engineering, University of Parma, Parma, Italy.

Abstract (35 Word Limit): Scaling laws of confinement loss and dielectric overlap in circularly arranged tube lattice fibers are numerically analyzed. Confinement loss scales as the 4.5 power of wavelength-core size ratio whereas dielectric overlap dependence is weaker.
Abstract (35 Word Limit): X-ray FEL facilities place challenging demands on the stability and configuration of ultrafast optical lasers for user experiments; future facilities will push the frontiers for high peak and average power ultrafast lasers.
Abstract (35 Word Limit): We demonstrate a compact 290 fs, 0.5 mJ laser source at 2-mm wavelength generated from mJ-level 3.4-ps pulses from a fiber laser seeded Ho:YLF regenerative amplifier system via pulse compression in a gas-filled Kagome type HC-PCF.
Ultrafast Diode-Pumped Ti:Sapphire Laser Generating 200-mW Average Power in 68-fs Pulses

K. Gurel; 1 M. Hoffmann; 1 C. J. Saraceno; 1, 2 V. J. Wittwer; 1 S. Hakobyan; 1 B. Resan; 3 A. Rohrbacher; 3 K. Weingarten; 3 S. Schilt; 1 T. Sudmeyer; 1

1. Laboratoire Temps-Fréquence, Université de Neuchâtel, Neuchâtel, Switzerland.
2. Institute for Quantum Electronics, ETH Zurich, Zurich, Switzerland.
3. JDSU Ultrafast Lasers AG, Schlieren, Switzerland.

Abstract (35 Word Limit): We present the highest average power from a diode-pumped Ti:Sapphire laser. Using self-starting SESAM-modelocking we obtain 200 mW in 68-fs pulses at 378 MHz. The laser is pumped by two air-cooled 520 nm AlInGaN laser diodes.
CPA-free ultrafast fiber laser source based on pre-chirp managed nonlinear amplification

D. N. Schimpf; W. Liu; T. Eidam; J. Limpert; A. Tünnermann; F. Kaertner; G. Chang;
2. The Hamburg Centre for Ultrafast Imaging, Hamburg, Germany.
3. Institute of Applied Physics, Abbe Center of Photonics, Friedrich-Schiller-Universität Jena, Jena, Germany.
4. Helmholtz Institut Jena, Jena, Germany.

Abstract (35 Word Limit): Pre-chirp managed nonlinear amplification delivering high quality 60 fs pulses is compared to conventionally employed CPA. We present a compact rod-type system that outputs >100 W at 75 MHz.
Abstract (35 Word Limit): We present SESAMs with different substrate-removal techniques, optimized for kW-power operation. These SESAMs show significant improvements in terms of surface quality without affecting their nonlinear parameters.
Multi-Terawatt CO₂ Laser with Chirped-Pulse Amplification

M. N. Polyanskiy; 1; M. Babzien; 1; I. Pogorelsky; 1;
1. Brookhaven National Laboratory, Upton, NY, United States.

Abstract (35 Word Limit): A chirped-pulse amplification technique is implemented for the first time in a picosecond CO₂ laser. A considerable increase in peak power is achieved, mainly as a result of eliminating nonlinear effects in the optical elements.
Abstract (35 Word Limit): We experimentally demonstrated a diode-pumped Kerr-lens mode-locked femtosecond laser based on a Yb:CaYAlO$_4$ crystal. Pulses with a duration as short as 33 fs at the center wavelength of 1059 nm were obtained.
Chip-to-chip quantum entanglement distribution

J. Wang; 2; M. Villa; 2; D. Bonneau; 2; R. Santagati; 2; J. W. Silverstone; 2; C. Erven; 2; S. Miki; 3; T. Yamashita; 3; M. Fujiwara; 4; S. Sasaki; 4; H. Terai; 3; M. G. Tanner; 5; R. H. Hadfield; 5; J. O’Brien; 2; M. G. Thompson; 2;

2. Centre for Quantum Photonics, H. H. Wills Physics Laboratory & Department of Electrical and Electronic Engineering, University of Bristol, Bristol, United Kingdom.
3. National Institute of Information and Communications Technology (NICT), Kobe, Japan.
4. National Institute of Information and Communications Technology (NICT), Tokyo, Japan.
5. School of Engineering, University of Glasgow, Glasgow, United Kingdom.

Abstract (35 Word Limit): We present the first experimental demonstration of quantum entanglement distribution between silicon integrated photonic chips, linked by a single mode optical fiber. Entanglement states generation, transmission, manipulation and measurement are implemented intra/inter chips.
Realization of Sub-picosecond Clock Synchronization based on Second-Order Quantum Coherence

R. Quan; 1; R. Dong; 1; Y. Zhai; 1; M. Wang; 1; S. Wang; 1; F. Hou; 1; T. Liu; 1; S. Zhang; 1

1. Key Laboratory of Time and Frequency Primary Standards, National Time Service Center, CAS, Xi'an, Shaanxi, China.

Abstract (35 Word Limit): Based on the second-order quantum interference between entangled photons generated by parametric down conversion, we have demonstrated a proof-of-principle experiment of synchronizing two clocks separated by 4-km fiber link. A sub-picosecond accuracy is achieved.
Controlling frequency distinguishability of photons using cross phase modulation

N. Matsuda; 1

1. NTT Basic Research Laboratories, Atsugi, Kanagawa, Japan.

Abstract (35 Word Limit): The frequency distinguishability of photon pairs was controlled using spectral reshaping via cross phase modulation. A non-classical dip in a Hong-Ou-Mandel quantum interference experiment was observed for the photons with diminished spectral distinguishability.
Bell State Free Dense Coding with Linear Optics

P. Lougovski; 1 D. Uskov; 2
1. Oak Ridge National Laboratory, Oak Ridge, TN, United States.
2. Department of Mathematics and Natural Sciences, Brescia University, Owensboro, KY, United States.

Abstract (35 Word Limit): We explore the possibility of implementing dense coding with linear optics and coincidence photodetection without Bell state discrimination. We discover that such implementations exist for two-photon in N-mode (N=4,6,8) scenarios and provide examples.
Experimental Reconstruction of Time-Bin-Entangled Qutrit States using Polarization Projective Measurements

S. Nowierski; 1, 2; N. N. Oza; 2; P. Kumar; 2; G. S. Kanter; 2;
1. Applied Physics, Northwestern University, Evanston, IL, United States.
2. Electrical Engineering and Computer Science, Northwestern University, Evanston, IL, United States.

Abstract (35 Word Limit): We generate and reconstruct two-photon, 100-ps-separated time-bin-entangled qutrit states. By pairwise mapping time bins onto orthogonal polarizations, we perform a tomography and demonstrate high fidelity to maximally entangled qutrit states.
Distributing Energy-Time Entangled Photon Pairs in Demultiplexed Channels over 110 km

D. Aktas; 1; B. Fedrici; 1; F. Kaiser; 1; L. Labonté; 1; S. Tanzilli; 1;

1. Université de Nice Sophia Antipolis, Laboratoire de Physique de la Matière Condensée, CNRS UMR7336, Nice, France.

Abstract (35 Word Limit):

We propose a novel approach to quantum cryptography using the latest demultiplexing technology to distribute photonic entanglement over a fully fibred network. We achieve unprecedented bit-rates, beyond the state of the art for similar approaches.
Abstract (35 Word Limit): Two-photon and four-photon interference are realized in an interferometric fiber optical gyroscope, respectively. The visibility of four-photon interference fringe is 29.4% with a high coincidence count rate of 1000 per minute.
Experimental Tests of Nonlocality with Entangled Photons

B. Christensen; 1; N. Gisin; 2; N. Brunner; 3, 4; Y. Liang; 5; P. Kwiat; 1;
1. University of Illinois, Urbana, IL, United States.
2. Group of Applied Physics, Université de Genève, Geneva, Switzerland.
3. Département de Physique Théorique, Université de Genève, Geneva, Switzerland.
4. H. H. Wills Physics Laboratory, University of Bristol, Bristol, United Kingdom.
5. Institute for Theoretical Physics, ETH Zurich, Zurich, Switzerland.

Abstract (35 Word Limit): We report on a variety of Bell tests performed with a high-quality photonic entanglement source. These tests begin to quantify nonlocal resources available in quantum mechanics, as well as place bounds on beyond-quantum theories.
Manipulating Quantum Fluids of Light in Microstructured Semiconductor Cavities

J. Bloch; 1
1. LPN, CNRS, Marcoussis, France.

Abstract (35 Word Limit): Semiconductor microcavities provide a new platform for quantum fluids of light manipulation, quantum simulation, and non-linear optical device development. Recent experimental achievements will be discussed with particular emphasis on polaritonic circuits and polaritons in lattices.
Quantum Optics for Studying Ultrafast Processes in Condensed Matter

M. Esposito; 1; F. Randi; 1; F. Giusti; 1; D. Boschetto; 2; F. Parmigiani; 1, 3; D. Fausti; 1, 3;
1. University of Trieste, Trieste, Italy.
2. ENSTA ParisTech, Palaiseau, France.

Abstract (35 Word Limit): Quantum state reconstruction techniques are used to address non equilibrium matter states. Proof of principle experiments reveal that few photons coherent pulses can be squeezed by the interaction with impulsively excited coherent phonons in quartz.
A Spin-controlled Microcavity Laser

F. Hsu; 1; W. Xie; 1; Y. Lee; 2; S. Lin; 2; C. Lai; 1;
1. Michigan State University, Lansing, MI, United States.
2. National Chiao Tung University, Hsinchu, Taiwan.

Abstract (35 Word Limit): We demonstrate highly circularly polarized lasing under non-resonant elliptically polarized optical pumping in a semiconductor microcavity at room temperature.
Polariton Condensates in Complex Potential Landscapes

C. Schneider; 1; K. Winkler; 1; A. Schade; 1; R. Dall; 2; M. Amthor; 1; E. Ostrovskaya; 2; M. Kamp; 1; S. Hoefling; 1, 3;
1. University of Würzburg, Würzburg, Germany.
2. Australian National University, Canberra, ACT, Australia.

Abstract (35 Word Limit): We establish a technology which allows for deep and tunable polariton trapping. Pronounced band structures with full gaps and condensation at high symmetry points is observed in square lattice arrangements of evanescently coupled potential traps.
Abstract (35 Word Limit): We theoretically demonstrate the implementation of AND/OR gates by means of bright dissipative-solitons of Bragg-cavity polaritons travelling in quantum wires, showing that repetition rates of 20 GHz are achievable with state-of-the-art technology.
Optical Access to Topological-Insulator Surface States with Plasmonic Rotating Fields

G. Spektor; A. David; G. Bartal; M. Orenstein; A. Hayat;
1. Technion, Israel Institute of Technology, Haifa, Israel.

Abstract (35 Word Limit): We implemented a square plasmonic cavity supporting an array of counter rotating field elements. The controlled, highly confined angular momenta array is a means for coupling to the spin helical surface states of topological insulators.
Reflections-Free Wave Propagation at the Interface of Photonic Topological Insulators: Theory and Experiment
T. Ma;¹, K. Lai;¹, G. Shvets;¹
¹. Physics, The University of Texas at Austin, Austin, TX, United States.

Abstract (35 Word Limit): A comprehensive library of photonic topological insulators (gyromagnetic, bianisotropic, and 2D-asymmetric) is established. An interface between any two of them supports reflectionless surface waves, as is experimental demonstrated for wave propagation along a zigzag interface.
Large Chern number one-way waveguides

S. Skirlo; 1; Y. Igarashi; 1; L. Lu; 1; M. Soljacic; 1;
1. MIT, Cambridge, MA, United States.

Abstract (35 Word Limit): We predict quantum anomalous Hall phases in photonic crystals with large Chern numbers of 2, 3 and 4, and demonstrate their applications. Finally, we present experimental evidence for multimode unidirectional waveguides at microwave frequencies.
Topological Control of Bloch Oscillations of Edge Modes in Photonic Lattices

Y. Plotnik; 1; M. A. Bandres; 1; Y. Lumer; 1; M. Rechtsman; 1; M. Segev; 1;
1. Technion Israel Institute of Technology, Haifa, Israel.

Abstract (35 Word Limit): We demonstrate a novel method for controlling the modal trajectories of Bloch oscillations initiated on the edge of a honeycomb lattice, via the topology of its band structure.
Single-Sided Diffraction by PT-Symmetric Metasurfaces

N. S. Nye; 1; M. Miri; 1; D. N. Christodoulides; 1;
1. University of Central Florida, CREOL, Orlando, FL, United States.

Abstract (35 Word Limit): We explore light diffraction by parity-time-symmetric metasurfaces. Such structures can lead to one-sided diffraction when operating close to their exceptional points. In this regime, the negative diffraction orders are eliminated while the positive are enhanced.
PT-symmetric cavities with simultaneous unidirectional lasing and reflectionless modes

H. Ramezani; H. Li; Y. Wang; X. Zhang;

1. University of California Berkeley, Berkeley, CA, United States.

Abstract (35 Word Limit): Using parity-time (PT) symmetric cavities, we introduce a new family of spectral singularities with highly directional response. At these singularities the PT-symmetric cavity support a simultaneous lasing mode from one side and zero reflection mode from the opposite side.
Parity-time (PT) symmetric topological interface states

M. Rechtsman; 3, 4; S. Weimann; 2; Y. Plotnik; 3; Y. Lumer; 3; K. Makris; 5, 1; M. Segev; 3; A. Szameit; 2;
1. Princeton University, Princeton, NJ, United States.
2. Institute of Applied Physics, Abbe Center of Photonics, Friedrich-Schiller-Universität Jena, Jena, Germany.
3. Physics Department and Solid State Institute, Technion-Israel Institute of Technology, Haifa, Israel.
4. Physics Department, The Pennsylvania State University, University Park, PA, United States.
5. Institute for Theoretical Physics, Vienna University of Technology, Vienna, Austria.

Abstract (35 Word Limit): We demonstrate theoretically and experimentally topological interface states in a passive
effective PT-symmetric dimerized waveguide array. The PT-symmetric system has unbroken PT symmetry: all
eigenvalues in the spectrum are real, despite the system’s non-Hermiticity.
Adaptive Optics to Study the Structure and Function of the Human Visual System
A. J. Roorda; 1
1. University of California Berkeley, Berkeley, CA, United States.

Abstract (35 Word Limit): Adaptive optics (AO) corrects the blur caused by the eye's optical imperfections, enabling optical access to single human retinal cells. An AO scanning laser ophthalmoscope is described for cellular level retinal imaging and vision testing.
Wave Front Shaping and Optogenetics

V. Emiliani; 1

1. Neurophotonic Laboratory, CNRS and University Paris Descartes, Paris, France.

Abstract (35 Word Limit): A series of optical methods (temporal focusing, computer generated holography and generalized phase contrast) for patterned ontogenetic with cellular resolution will be presented with exemplary experiments in vitro and in vivo.
Rapid Adaptive Optical Recovery of Diffraction-Limited Resolution Over Large Multicellular Volumes

E. Betzig; 1

1. Howard Hughes Medical Institute, Ashburn, VA, United States.

Abstract (35 Word Limit): The heterogeneity of biological tissue essential to life induces aberrations that wreaks havoc on image quality. I will describe our work with adaptive optical microscopy to recover optimal performance under such challenging conditions.
Ultrafast Fluorescent Probes for Brain Activity Imaging

M. Lin; 1
1. Depts. of Pediatrics and Bioengineering, Stanford University, Stanford, CA, United States.

Abstract (35 Word Limit): Methods for visualizing electrical activity in neurons would be useful for understanding circuit function. We describe the ASAP family of voltage indicators featuring cofactor independence, bright fluorescence, large responses, efficient membrane localization, and fast kinetics.
Filter Design Method for Construction of 3D Plasmonic Directional Light Sensors

M. Davis; 1, 2; J. K. Lee; 1; A. Agrawal; 2; H. J. Lezec; 2;

1. Electrical Engineering and Computer Science, Syracuse University, Syracuse, NY, United States.
2. Center for Nanoscale Science and Technology, National Institute of Standards and Technology, Gaithersburg, MD, United States.

Abstract (35 Word Limit): We propose an analytic method for plasmonic filter design, freeing the design process from time-consuming FDTD simulations. We demonstrate the utility of the design model by constructing a prototype 3D plasmonic directional light sensor.
Abstract (35 Word Limit): We suggest a novel hybrid nanoantenna, consisting of a gold nanorod and a silicon nanodisk, which provides giant enhancement of directional emission together with high radiation efficiency. We demonstrate its fabrication by two-step electron-beam lithography.
Slanted 3D Plasmonic Antenna Arrays

A. Toma; P. Zilio; M. Malerba; F. De Angelis;
1. Istituto Italiano di Tecnologia, Genoa, GE, Italy.

Abstract (35 Word Limit): We report experimental and Finite Elements simulation results of slanted silver nanoantenna dimers arrays on silver baseplate. Strong field enhancements and diffractive couplings are correlated to the peculiar near-field properties of these structures.
Parity-time symmetry breaking and amplifier-absorber transitions in plasmonic nanoparticles

N. Mohammadi Estakhri; 1, A. Alu; 1
1. Electrical and Computer Engineering, The University of Texas at Austin, Austin, TX, United States.

Abstract (35 Word Limit): Abrupt transitions in the scattering response of parity-time (PT)-symmetric nanoparticles is discussed. Based on the closed-form analytical solution of a complex scattering problem, we show that material imbalance can generate strong absorbing or amplifying scattering states above PT threshold.
Coil-type Fano Resonances: a Plasmonic Approach to Magnetic Sub-diffraction Confinement

A. Toma; 1; S. Panaro; 1; A. Nazir; 1; R. Zaccaria; 1; C. Liberale; 1; F. De Angelis; 1;
1. Italian Institute of Technology, Genoa, GO, Italy.

Abstract (35 Word Limit): Matrices of nanodisk trimers are introduced as plasmonic platforms for the generation of localized magnetic hot-spots. In Fano resonance condition, the optical magnetic fields can be squeezed in sub-wavelength regions, opening promising scenarios for spintronics.
Coupling Nano-Antennas to Microcavities: Radiative Interactions Cause Strong and Tunable Frequency Shifts

F. Ruesink; 1; H. M. Doeleman; 1; R. Hendrikx; 1; F. Koenderink; 1; E. Verhagen; 1;
1. FOM Institute AMOLF, Amsterdam, Netherlands.

Abstract (35 Word Limit): We develop coupled cavity-antenna systems in which the frequency and linewidth of the eigenmodes can be strongly tuned. Interference of cavity and antenna radiation provides the dominating contribution to changes of dispersion and dissipation.
Localized Surface Phonon Polariton Resonators in GaN

K. Feng; 1; W. Streyer; 2; S. Islam; 1; J. Verma; 1; D. Jena; 1; D. Wasserman; 2; A. Hoffman; 1
1. University of Notre Dame, South Bend, IN, United States.
2. University of Illinois Urbana Champaign, Urbana, IL, United States.

Abstract (35 Word Limit): GaN micro-disk resonator arrays were fabricated and measured within the Restrahalen band of GaN. Far-IR spectroscopy shows evidence for localized surface phonon polariton resonances, results which are confirmed by finite-element models of the fabricated structures.
Plasmonic whispering-gallery modes in a semiconductor-insulator-metal hybrid structure

C. Lee; 1; H. Yeh; 1; Y. Chen; 2; C. Wang; 2; S. Gwo; 2; J. Huang; 3; W. Chang; 1
1. Department of Electrophysics, National Chiao Tung University, Hsinchu, Taiwan.
2. Department of Physics, National Tsing Hua University, Hsinchu, Taiwan.
3. Department of Chemistry, National Tsing Hua University, Hsinchu, Taiwan.

Abstract (35 Word Limit): We demonstrate a plasmonic cavity based on a hybrid semiconductor-insulator-metal structure, which can support plasmonic whispering-gallery modes (WGMs). By optimizing the insulator gap thickness, coupled modes consisting of photonic and plasmonic WGM with efficient cavity feedback can be formed.
Hybrid 3D Photonic Integrated Circuit for Optical Phased Array Beam Steering

B. Guan; C. Qin; R. P. Scott; B. Ercan; N. K. Fontaine; T. Su; S. Yoo;

1. Department of Electrical and Computer Engineering, University of California, Davis, Davis, CA, United States.

Abstract (35 Word Limit): We demonstrate a hybrid integrated optical phased array (OPA) based on a 2D photonic integrated circuit and 3D waveguides. The 4×4 OPA supports 4.93° horizontal and vertical beam steering near 1550 nm with 7.1-dB loss.
Multi-Chip Integration of Lasers and Silicon Photonics
by Photonic Wire Bonding

M. Billah; 1; T. Hoose; 1; T. Onanuga; 1; N. Lindenmann; 1; P. Dietrich; 1; T. Wingert; 1; M. Goedecke; 1; A. Hofmann; 1; U. Troppenz; 2; A. Sigmund; 2; M. Möhrle; 2; W. Freude; 3; C. Koos; 1;
1. Karlsruhe Institute of Technology, Eggenstein-Leopoldshafen, Germany.
2. Heinrich Hertz Institute, Fraunhofer Institut for Telecommunications, Berlin, Germany.
3. Institute of Photonics and Quantum Electronics, Karlsruhe Institute of Technology, Karlsruhe, Germany.

Abstract (35 Word Limit): We demonstrate coupling of a horizontal-cavity surface-emitting laser (HCSEL) to a silicon photonic chip using photonic wire bonding. The technique does not require high-precision alignment of the chips. Measured coupling losses amount to approximately 4.1 dB.
High-Speed and Stable Operation of Highly Unidirectional III-V/Silicon Microring Lasers for On-chip Optical Interconnects

K. Ohira; H. Uemira; N. Iizuka; H. Yoshida; H. Uemura; Y. Kurita; H. Furuyama; M. Ezaki; 1. Photonics Electronics Technology Research Association, Tsukuba, Ibaraki, Japan.

Abstract (35 Word Limit): We demonstrated high-speed, stable and unidirectional microring III-V laser diodes with in-cavity feedback silicon waveguide, and the integration with III-V photodetector on a silicon-on-insulator platform to achieve on-chip data transmission with a data rate of 12.5 Gb/s.
**Abstract (35 Word Limit):** Heterogeneous integration of submicron films of lithium niobate on silicon substrates, rib-
loaded with chalcogenide glass, is used to demonstrate lithium niobate microring modulators with $Q$ of $1.2 \times 10^5$ and
Mach-Zehnder modulators with $V_{\pi}L$ of 3.8 V.cm.
Hybrid Silicon and Lithium Niobate Racetrack Modulator with Large Spurious Free Dynamic Range

L. Chen; 1; J. Chen; 1; J. T. Nagy; 1; R. M. Reano; 1;
1. Ohio State University, Columbus, OH, United States.

Abstract (35 Word Limit): We present a hybrid silicon and LiNbO$_3$ racetrack modulator with spurious free dynamic range of 98.1 dB Hz$^{2/3}$ at 1 GHz, which is comparable to a packaged LiNbO$_3$ Mach-Zehnder modulator biased at quadrature.
Si$_3$N$_4$ Multilayer Platform for Photonic Integrated Circuits

K. Shang; 1; S. Pathak; 1; B. Guan; 1; G. Liu; 1; C. Qin; 1; R. P. Scott; 1; S. Yoo; 1;
1. University of California, Davis, Davis, CA, United States.

Abstract (35 Word Limit): We design, fabricate, and demonstrate an optimized silicon nitride multilayer platform including ultra-low interlayer vertical coupling loss of 0.05 dB, multilayer crossing loss of 0.265 dB at 90° crossing angle, and 50 μm bending radius.
Crystalline Silicon on Silicon Nitride Hybrid Platform for Integrated Photonic Applications

A. Hosseinnia; 1; A. H. Atabaki; 1; Q. Li; 1; H. Moradinejad; 1; M. Sodagar; 1; F. Ghasemi; 1; A. Eftekhar; 1; A. Adibi; 1;

1. Georgia Institute of Technology, Smyrna, GA, United States.

Abstract (35 Word Limit): We demonstrate a hybrid material platform, in which a layer of crystalline silicon is placed on top of a silicon nitride on a silicon dioxide die. We also report an efficient interlayer coupling structure with 0.02 dB insertion loss. Using this hybrid platform, high-Q resonators are demonstrated.
High-Brightness Interband Cascade Lasers

J. R. Meyer; C. L. Canedy; C. S. Kim; M. Kim; W. W. Bewley; C. Merritt; I. Vurgaftman.

1. US Naval Research Laboratory, Washington, DC, United States.
2. Sotera Defense Solutions, Inc., Crofton, MD, United States.

Abstract (35 Word Limit): Mid-IR interband cascade lasers will be reviewed. Advantages include 3-6 mm spectral coverage, wallplug efficiency up to 18% when operated in cw mode at ambient temperature, and ultra-low threshold drive power.
Double-Ridge Interband Cascade Lasers for High-Power Spectroscopy in the Mid-Infrared

S. Forouhar; C. Borgentun; C. Frez; R. Briggs; M. Bagheri; M. Fradet;

1. Jet propulsion laboratory, Pasadena, CA, United States.

Abstract (35 Word Limit): Lasers employing a new double-ridge waveguide design emit 18 mW at 3.57 μm and 20 mW at 3.37 μm. The top ridge confines the optical mode while the bottom ridge limits lateral current spreading.
Abstract (35 Word Limit): Interband cascade lasers with type-I InGaAsSb/AlAsSb quantum well active regions were demonstrated. Ridge-waveguide devices exhibit room-temperature continuous-wave emission at 3.2μm, providing a potential alternative to quantum cascade and diode lasers in this wavelength range.
Ultra-Broadband (3.3-12.5 μm) Single Stack Quantum Cascade Gain Medium

L. Le; X. Wang; J. Fan; M. Troccoli; D. L. Sivco; C. F. Gmachl;

1. Princeton University, Princeton, NJ, United States.

Abstract (35 Word Limit): Electroluminescence spanning 3.3μm to 12.5μm and with a full width half maximum of 4μm is achieved using a single stack quantum cascade gain medium. The free-running laser emits from 7.4μm to 12.1μm.
High Power Spiral Cavity Quantum Cascade Superluminescent Emitter

M. Zheng; N. L. Aung; A. Basak; P. Q. Liu; X. Wang; J. Fan; M. Troccoli; C. F. Gmachl;
1. Princeton University, United States.
2. Institute of Quantum Electronics, ETH Zürich, Zürich, Switzerland.
3. AdTech Optics Inc., City of Industry, CA, United States.

Abstract (35 Word Limit): Quantum cascade devices have been shaped into compact, yet long spiral cavities to increase mid-infrared superluminescence power. A peak power of ~57 mW at 250 K is obtained with a coherence length of ~107 μm.
Final ID: STu2H.1

Terahertz Nonlinear Magnetic Response in Antiferromagnets
K. Tanaka; 1, 2; Y. Mukai; 1, 3; H. Hirori; 2, 3; T. Yamamoto; 4; H. Kageyama; 2, 4;
1. Department of Physics, Kyoto University, Kyoto, Japan.
2. Institute for Integrated Cell-Material Sciences (WPI-iCeMS), Kyoto University, Kyoto, Japan.
3. CREST, Japan Science and Technology Agency, Kawaguchi, Japan.
4. Department of Energy and Hydrocarbon Chemistry, Kyoto University, Kyoto, Japan.

Abstract (35 Word Limit): We report on the nonlinear magnetization dynamics of a HoFeO3 crystal induced by a strong terahertz magnetic field resonantly enhanced with a split ring resonator. The terahertz magnetic field induces a large magnetization change of 40% of the spontaneous magnetization. The frequency of the antiferromagnetic resonance decreases in proportion to the square of the magnetization change.
Nonlinear THz transmission of gated graphene

S. Razavipour; 1; W. Yang; 1; F. Blanchard; 1; A. Guermoune; 1; M. Hilke; 1; D. G. Cooke; 1;
1. McGill, Montreal, QC, Canada.

Abstract (35 Word Limit): THz field-induced transparency has been measured and characterized for gel-gated multilayer graphene. It is shown that upon changing the Fermi level by ionic electrostatic gating, the transmission bleaching decreases as the Fermi level approaches the Dirac point.
Abstract (35 Word Limit): Terahertz emission by the photon-assisted resonant radiative transitions between graphene layers (GLs) in double-GL structures is theoretically and experimental demonstrated. Devices such as terahertz/infrared lasers base on this technology are very promising for terahertz optoelectronics.
Intense Terahertz Field-induced Carrier Dynamics in Gated Monolayer Graphene

X. Chai; H. Hafez Eid; P. Lévesque; I. Al-Naib; M. M. Dignam; D. Ferachou; R. Martel; T. Ozaki;
1. INRS-EMT, Varennes, QC, Canada.
2. Université de Montréal, Montréal, QC, Canada.
3. Queen’s University, Kingston, ON, Canada.

Abstract (35 Word Limit): Using optical-pump/THz-probe spectroscopy on gated, undoped graphene, we find that as the amplitude of the THz probe is increased, we observe a cross-over from optically-induced transmission decrease to increase.
Graphene on nanoscale gratings for terahertz Smith-Purcell radiation
K. Tantiwanichapan; 1; X. Wang; 1; A. Swan; 1; R. Paiella; 1;
1. Electrical and Computer Engineering, Boston University, Boston, MA, United States.

Abstract (35 Word Limit): Generation of THz radiation based on the Smith-Purcell effect in graphene deposited on a periodic hole array is investigated numerically. Technologically significant output power levels at geometrically tunable THz frequencies are computed.
Polarization-Dependent Terahertz Spectroscopy of Macroscopically Aligned Carbon Nanotubes

W. Gao; 1 A. Zubair; 1 J. Robinson; 1 X. He; 1 C. C. Young; 2 D. Tsentalovich; 2 N. Alvarez; 3 R. Hauge; 4 M. Pasquali; 2, 4 J. Kono; 1, 5

1. Department of Electrical and Computer Engineering, Rice University, Houston, TX, United States.
2. Department of Chemical and Biomolecular Engineering, Rice University, Houston, TX, United States.
3. Department of Mechanical, Industrial and Nuclear Engineering, University of Cincinnati, Cincinnati, OH, United States.
4. Department of Chemistry, Rice University, Houston, TX, United States.
5. Department of Physics and Astronomy, Rice University, Houston, TX, United States.

Abstract (35 Word Limit): We have examined the anisotropic terahertz response of highly aligned single-wall, double-wall, and multiwall carbon nanotubes and quantitatively characterized their performance as low-cost terahertz polarizers.
Nonlinear and Quantum Optics with Whispering Gallery Resonators

D. V. Strekalov; 1

1. Jet Propulsion Laboratory, Pasadena, CA, United States.

Abstract (35 Word Limit): Whispering Gallery Mode resonators made from optically nonlinear crystals have small mode volume and extremely high quality factor which makes them ideal for various nonlinear conversion process at low power, ultimately at single photon level.
Surface-normal Coupled Four-wave Mixing in a High Contrast Grating Resonator

T. Sun; 1; C. J. Chang-Hansnain; 1
1. EECS, University of California, Berkeley, Berkeley, CA, United States.

Abstract (35 Word Limit): We demonstrate four-wave mixing using a Si-based high contrast gratings (HCG) resonator directly coupled in surface-normal direction. Quality-factor of the resonator is ~7000 and peak conversion efficiency is -19.5dB at low pump power levels.
Cascaded Four-Wave Mixing in Silicon-on-Sapphire Microresonators at $\lambda=4.5$ µm

S. Kalchmair; $^1$ R. Shankar; $^2$ S. Kita; $^1$ C. Mittag; $^1$ I. Bulu; $^2$ M. Loncar; $^1$

1. Harvard University, Cambridge, MA, United States.
2. Schlumberger-Doll Research Laboratory, Cambridge, MA, United States.

Abstract (35 Word Limit): We report cascaded four-wave mixing in a silicon micro-ring resonator operating at 4.5 µm wavelength. Our results present an important milestone for extending optical frequency combs further into the mid-infrared range.
Second Harmonic Generation In a GaN Photonic Crystal Cavity on Silicon

P. Boucaud, Y. Zeng, I. Roland, X. Checoury, Z. Han, M. El Kurdi, S. Sauvage, B. Gayral, C. Brimont, T. Guillet, M. Mexis, F. Semond,

1. IEF-CNRS-Univ Paris Sud, Orsay, France.
2. Univ. Grenoble Alpes, INAC-SP2M, CEA-CNRS, Grenoble, France.
3. L2C-Université Montpellier 2, Montpellier, France.
4. CRHEA-CNRS, Valbonne, France.

Abstract (35 Word Limit):

We report on near-infrared second harmonic generation in a free-standing gallium nitride photonic crystal cavity fabricated on a silicon substrate. High-resolution spatial imaging allows us to correlate harmonic emission pattern and second-order polarization $P_z$. 
Resonant Wavelength Conversion in Gallium Phosphide Nanostructures

D. Lake; 1, 2; M. Mitchell; 1, 2; A. Hryciw; 2; . Jayakumar; 1; P. E. Barclay; 1, 2;

1. Physics, University of Calgary, Calgary, AB, Canada.
2. NRC-National Institute for Nanotechnology, Edmonton, AB, Canada.

Abstract (35 Word Limit): Second Harmonic Generation in gallium phosphide microdisks is demonstrated.
Coherent Second Harmonic Generation in a Quantum Well-Metasurface Coupled System

o. wolf; 1; S. Campione; 1; A. Benz; 1; A. P. Ravikumar; 2; S. Liu; 1; E. A. Kadlec; 1; E. Shaner; 1; J. F. Klem; 1; M. B. Sinclair; 1; I. Brener; 1;

1. Sandia National laboratory, Albuquerque, NM, United States.
2. Princeton University, New Jersey, NJ, United States.

Abstract (35 Word Limit): Strongly coupling metallic nanoresonators with specially designed intersubband-transitions in quantum-wells results in efficient, saturation-limited second-harmonic (SH) generation. This method also grants full control over the polarization and phase-front of the emitted SH radiation.
Low-Power Parametric Wavelength Conversion in 45nm Microelectronics CMOS Silicon-On-Insulator Technology
C. M. Gentry; 1; M. T. Wade; 1; X. Zeng; 1; F. Pavanello; 1; M. Popovic; 1;

Abstract (35 Word Limit): We demonstrate seeded four-wave mixing in a photonic circuit fabricated within an unmodified commercial microelectronics CMOS SOI platform, using a minimally dispersive microcavity design.
Self-Tracking Concentrator for Photovoltaics

P. Kozodoy; 1; C. Gladden; 1; M. Pavilonis; 1; C. Rhodes; 1; T. Wheeler; 1; C. Casper; 1;

1. Glint Photonics, Inc., Burlingame, CA, United States.

Abstract (35 Word Limit): We present a novel solar concentrator architecture in which integrated microscale liquid optics provide passive solar tracking, eliminating the need for high-precision mechanical tracking. Optical efficiency as high as 72% and effective acceptance angle of 50° are demonstrated. The design can reduce the cost of concentrator photovoltaics and broaden its applicability.
Microphotonic spectrum-splitting & concentration for high-efficiency photovoltaic

N. Mohammed; 1; P. Wang; 1; D. Friedman; 2; K. Ramanathan; 2; L. Mansfield; 2; R. Menon; 1;
1. University of Utah, Salt Lake City, ut, United States.
2. NREL, Golden, CO, United States.

Abstract (35 Word Limit): We present a diffractive microphotonic element that can split solar spectrum into 2 or more spectral bands, and concentrate these bands onto optimal absorbers. We experimentally demonstrated an increase in output power of 35% with a 3-band configuration.
High Concentration Solar Photovoltaic Systems using Glass Dish Collectors

R. P. Angel; 2, 1
1. University of Arizona, Tucson, AZ, United States.
2. REhnu, Inc, Tucson, AZ, United States.

Abstract (35 Word Limit): Glass solar reflectors, similar to those widely used to concentrate sunlight in solar thermal plants, form the basis for REhnu's HCPV generators. Multijunction cells are housed in small, upgradeable units at each mirror focus.
Microcavity-Integrated Colored Perovskite Solar Cells

C. Ji; 1; K. Lee; 1; M. Fukuda; 1; L. Guo; 1;
1. EECS, University of Michigan, Ann Arbor, MI, United States.

Abstract (35 Word Limit): We demonstrate optical cavity-embedded perovskite solar cells capable of creating transmissive colors that can be easily tuned by altering the spacer layer thickness in the cavity and simultaneously generating ~4% of power conversion efficiency.
Wide-angle Nonimaging Optics for Concentration and Illumination; Principles and Applications

R. Winston; 1

1. University of California Merced, Merced, CA, United States.

Abstract (35 Word Limit): Nonimaging designs allow non-tracking wide angle solar concentrators to attain high temperature operation. Of special interest to the optics community is the deep connection between the “Hottel strings” and the flow-line algorithm of nonimaging optics design.
Low-Light Reflective Correlation Imaging

M. Akhlaghi Bouzan; T. Kohlgraf-Owens; A. Dogariu;

1. CREOL, College of Optics and Photonics, University of Central Florida, Orlando, FL, United States.

Abstract (35 Word Limit): Numerical and experimental evaluation of a reflective microscopy technique based on sequential random pattern illumination and integrated detection is conducted to demonstrate imaging at the low-light levels of interest for live-cell imaging.
Abstract (35 Word Limit): We introduce and demonstrate an imaging modality that performs differential interference imaging via frequency-to-space mapping and radio-frequency (RF) heterodyne detection.
Abstract (35 Word Limit): We report a synthetic-aperture-based on-chip lensfree microscope. Having a wide field-of-view of ~20.5 mm², this technique sets the largest numerical aperture (1.4) for on-chip microscopy.
Compressive 39.6-gigapixel/s continuous imaging using spectrally-structured ultrafast laser pulses

B. T. Bosworth; 1; J. Stroud; 1; D. Tran; 1; T. Tran; 1; S. Chin; 1; M. A. Foster; 1;

1. Johns Hopkins University, Baltimore, MD, United States.

Abstract (35 Word Limit): We demonstrate ultrahigh-speed spectral shaping of broadband laser pulses to create structured illumination of a high-speed flow for compressive microscopy. We achieve up to 39.6 gigapixel/s continuous imaging rates using a 720-MHz ADC sampling rate.
Compressive Optical Imaging Using Wavelength Dependent Scattering
J. Shin; 1; M. A. Foster; 1;
1. Johns Hopkins University, Baltimore, MD, United States.

Abstract (35 Word Limit): We demonstrate 2D compressive image reconstruction from wavelength-defined illumination patterns generated by wavelength-dependent scattering from a single-mode fiber with a TiO$_2$-tip.
Field-Portable Nanoparticle and Virus Sizing Enabled by On-Chip Microscopy and Vapor-Condensed Nanolenses

E. McLeod; T. U. Dincer; M. Veli; Y. N. Ertas; C. Nguyen; W. Luo; A. Greenbaum; A. Feizi; A. Ozcan;

1. University of California Los Angeles, Los Angeles, CA, United States.
2. California Institute of Technology, Pasadena, CA, United States.

Abstract (35 Word Limit): Vapor-condensed nanolenses make label-free lensfree holographic microscopy sensitive to individual particles 40 nm and larger. Detected signals correlate with particle size with accuracy ±11 nm. Automated image processing measures >10^5 particles within a single field-of-view.
A cannula-based computational fluorescence microscope for neuronal imaging

G. Kim; N. Nagarajan; A. Meiri; S. Merrill; M. Capecchi; E. Jorgensen; R. Menon;
1. University of Utah, Salt Lake City, ut, United States.

Abstract (35 Word Limit): We applied nonlinear optimization to convert a cannula into a high-resolution computational-fluorescence microscope. The microscope was used to image fluorescent microspheres, genetically-encoded mouse-brain slices, genetically-encoded and fluorescent-stained C. elegans nematodes.
Adaptive Optics in Three-Photon Fluorescence Microscopy

D. Sinefeld; ¹; H. P. Paudel; ²; D. G. Ouzounov; ¹; T. G. Bifano; ²; C. Xu; ¹;
1. Applied and engineering physics, Cornell University, Ithaca, NY, United States.
2. Photonics Center, Boston University, Boston, MA, United States.

Abstract (35 Word Limit): We demonstrate three-photon fluorescence adaptive-optics system based on 1660-nm femtosecond pulses and MEMS spatial light modulator. We use the higher nonlinearity of the signal resulting in ×700 improvement in fluorescence beads signal after aberrations correction.
Abstract (35 Word Limit): MIR spectroscopy using QCL allows sensitive, selective and fast gas detection. This is illustrated by many environmental and industrial applications. Recent developments show significant advances towards portable, high-sensitivity sensors for multiple components.
Application of a widely tunable Sampled Grating Distributed Bragg Quantum Cascade laser for multi-species spectroscopy

A. Diba; 1; F. Xie; 2; B. Gross; 1; C. Zah; 2; F. Moshary; 1;

1. Electrical Engineering, City College of New York, New York, NY, United States.
2. Science and Technology, Corning Incorporate, Corning, NY, United States.

Abstract (35 Word Limit): We demonstrate the feasibility of multicomponent trace gas sensing using a tunable sampled-grating distributed Bragg reflector QCL. We have achieved continuous fine tuning over 10 cm⁻¹ to retrieve N₂O, H₂O and CO.
Direct Calorimetric Measurement of Powder Absorptivity

A. M. Rubenchik; 1; S. S. Wu; 1; M. M. LeBlanc; 1; S. C. Mitchell; 1; N. L. Peterson; 1; I. V. Golosker; 1;
1. Lawrence Livermore National Laboratory, Livermore, CA, United States.

Abstract (35 Word Limit): We present a method for direct calorimetric measurement of powder absorptivity using a thin laser illuminated disc. Powder porosity is measured independently and a scheme eliminating the effect of convective and radiative losses is implemented.
Novel compact DPSS-laser source for LIBS analysis of steel
A. Tortschanoff, 1; M. Baumgart, 1; G. Kroupa, 1;
1. CTR AG, Villach, Austria.

Abstract (35 Word Limit): We present very first LIBS measurements with our compact high power laser source, originally developed for ignition applications in harsh environment. The results prove the feasibility and indicate the issues for further optimization.
Robust Non-Reciprocal Optical DC Phase Shift Measurement with Differential Modulation Phase Detection

X. Gu; S. V. Marchese; K. Bohnert;

1. Corporate Research, ABB Switzerland Ltd, Baden-Dättwil, Switzerland.

Abstract (35 Word Limit): We propose and experimentally demonstrate a novel differential modulation phase detection scheme, which unleashes the powerful modulation phase detection technique for use in sensors with a bulk-optic sensing element, such as an electro-optic voltage sensor.
Demonstration of Soliton Self Shifting Employing Er$^{3+}$ Doped VLMA- and HOM-Fiber Amplifiers

A. Zach; 1 W. Kaenders; 1 J. W. Nicholson; 2 J. M. Fini; 2 A. DeSantolo; 2

1. TOPTICA Photonics AG, Graefelfing, Germany.
2. OFS Labs, Somerset, NJ, United States.

Abstract (35 Word Limit): We demonstrate soliton self-frequency shifted Very-Large-Mode-Area and Higher-Order-Mode fiber amplifiers. The output wavelength is shifted more than 50 nm with a soliton pulse energy of up to 186 nJ. Subsequent, high-efficiency, frequency doubling is demonstrated.
Difference-frequency Generation of Spectrally Bright, ~1 W Average-power Mid-IR Radiation Using a ns-pulse Fiber Laser

P. Belden; 1
D. Chen; 1
F. Di Teodoro; 1

1. The Aerospace Corporation, Los Angeles, CA, United States.

Abstract (35 Word Limit): We obtained average power/pulse energy of ~1 W/5 mJ at ~3520 nm wavelength via difference-frequency generation in periodically poled lithium niobate using an all-fiber, few-ns pulsed laser source operating at 1064 nm and a 10 mW continuous-wave 1525 nm single-frequency diode laser.
Relativistic Few-cycle Cylindrical Vector Beams for Novel Table-top Particle Accelerators

S. Carbajo; 1, 2; E. A. Nanni; 1; L. Wong; 1; R. Miller; 2, 3; F. X. KAERTNER; 1, 2;
1. Massachusetts Institute of Technology, Cambridge, MA, United States.
3. University of Toronto, Toronto, ON, Canada.

Abstract (35 Word Limit): Few-cycle highly-intense radially polarized lasers unfold a novel compact accelerator uniquely capable of direct laser-to-particle energy transfer. We present the technology that proofs this concept yielding highly-directional multi-GeV/m non-relativistic electron accelerating gradients.
Topological Nature of Optical Bound States in the Continuum and its Application in Generating High-order Vector beams

B. Zhen; 1 C. Hsu; 1 L. Lu; 1 A. Stone; 2 M. Soljacic; 1
1. MIT, Cambridge, MA, United States.
2. Yale University, New Haven, CT, United States.

Abstract (35 Word Limit): We demonstrate all robust bound states in the continuum in photonic crystal slabs are vortex centers in the polarization directions of far-field radiation. They are robust because they carry conserved and quantized topological charges under PT symmetry. They also generate high-order vector beams.
Multiple Wavefront Shaping by a Single Gradient Metasurface

N. Shitrit; D. Veksler; E. Maguid; D. Ozeri; V. Kleiner; E. Hasman;

1. Technion-Israel Institute of Technology, Haifa, Israel.

Abstract (35 Word Limit): We report on a generic concept to control multiple wavefronts by disordered gradient metasurfaces (DGMs) with a custom-tailored geometric phase. DGMs offer all-optical manipulation by multitask wavefront shaping via a single ultrathin photonic nanodevice.
Cylindrical Vector Beams for Spectroscopic Imaging of Single Molecules and Nanoparticles and Localization with Nanometer Precision in Tunable Microresonators

A. J. Meixner; 1
1. Eberhard-Karls-Univ, Tubingen, Germany.

Abstract (35 Word Limit): Due to their unique polarization properties cylindrical vector beams are ideal for imaging and spectroscopy single nanoparticles or quantum systems in confocal optical microscopy with a high numerical aperture objective lens or a parabolic mirror.
Smaller Spot Formation by Vector Beam for Higher Resolution Microscopy

S. Sato; 1; Y. Kozawa; 1;
1. Tohoku University, Sendai, Miyagi, Japan.

Abstract (35 Word Limit): Smaller focal spot formation by using vector beams is demonstrated for achieving higher lateral resolution, which is beyond conventional diffraction limit, in confocal microscopy, two-photon microscopy and subtraction microscopy.
Optical differentiation wavefront sensor based on binary pixelated transmission filters
J. Qiao; 1, 2; A. Travinsky; 1; C. Dorrer; 2;
1. Rochester Institute of Technology, Rochester, NY, United States.
2. Aktiwave LLC, Rochester, NY, United States.

Abstract (35 Word Limit): An optical differentiation wavefront sensor based on measurements of wavefront slopes in two orthogonal directions obtained by far-field spatial modulation with a binary pixelated filter inducing a linear amplitude transmission is demonstrated.
Final ID: STu2N.2

Design and performance of an integrated phase and amplitude diversity sensor

N. Védrenne; 1; F. Cassaing; 1; L. Mugnier; 1; V. Michau; 1; G. Iaquaniello; 3; L. Blanco; 3; G. Chériaux; 3, 2;
1. Theoretical and Applied Optics Department, Onera, The French Aerospace Lab, Châtillon, France.
3. Laboratoire d'Optique Appliquée, LOA-UMR7639, Palaiseau, France.

Abstract (35 Word Limit): The practical implementation of a phase diversity sensor for high resolution measurement of disturbed laser beams is detailed here. Numerical simulations show that, with simple material, a 60x60 map of complex amplitude with lambda/100 accuracy can be obtained.
High-Contrast, Closed-Loop Control of Laser Beam Profiles
L. E. McIntire; M. Divoky; W. H. Knox; S. Bahk; J. D. Zuegel.
1. The Institute of Optics, University of Rochester, Rochester, NY, United States.
2. HiLASE, Institute of Physics ASCR, Dolní Břežany, Czech Republic.
3. Laboratory for Laser Energetics, University of Rochester, Rochester, NY, United States.

Abstract (35 Word Limit): A 1053-nm laser beam profile was controlled using the diffractive mode of a spatial light modulator in closed loop for the first time, producing high-contrast spatial intensity shaping, as well as independent wavefront control.
Abstract (35 Word Limit): We present a novel method to control the phase and amplitude of a femtosecond laser beam using a linearized version of the transport-of-intensity equation. Simulations show a peak power improvement better than 30\%.
High-throughput Lensfree Ion-Track Analysis for Laser-Driven Accelerators

W. Luo; 1; F. Shabbir; 1; C. Gong; 1; C. Gulec; 1; J. Pigeon; 1; J. Shaw; 1; A. Greenbaum; 1; T. Su; 1; A. F. Coskun; 1; S. . Tochitsky; 1; C. Joshi; 1; A. Ozcan; 1;
1. University of California Los Angeles, Los Angeles, CA, United States.

Abstract (35 Word Limit): We report a lensfree imaging based high-throughput ion-track analysis platform for laser driven accelerators. This computational on-chip imaging platform, owing to its large field-of-view of 18cm^2, provides >20-fold improved imaging speed than lens-based analysis systems.
A Time-Multiplexed Pulse-Shaping System for Generating Multiple High-Bandwidth, Low-Jitter Optical Waveforms

C. Dorrer; W. Bittle; R. Cuffney; E. Hill; J. Kelly; T. Kosc; J. D. Zuegel; 1.
1. University of Rochester, Rochester, NY, United States.

Abstract (35 Word Limit): A time-multiplexed fiber-based system that can deliver eight low-jitter optical waveforms to eight distinct laser systems using a single Mach–Zehnder pulse-shaper driven by an arbitrary waveform generator and a low-loss, high-extinction demultiplexer is described.
Sub-Femtosecond Free-Electron Laser Pulses

W. Helml; A. Maier; W. Schweinberger; I. Grguras; P. Radcliffe; G. Doumy; C. Roedig; J. Gagnon; M. Messerschmidt; S. Schorb; C. Bostedt; F. Grüner; L. DiMauro; D. Cubaynes; J. Bozek; T. Tschentscher; J. Costello; M. Meyer; R. Coffee; S. Düsterer; A. L. Cavalieri; R. Kienberger;

1. Physik-Department, Technische Universität München, Garching, Germany.
2. CFEL, Hamburg, Germany.
3. Max-Planck-Institut für Quantenoptik, Garching, Germany.
4. European XFEL, Hamburg, Germany.
5. Argonne National Laboratory, Argonne, IL, United States.
6. The Ohio State University, Columbus, OH, United States.
7. LCLS, Menlo Park, CA, United States.
8. Institut des Sciences Moléculaires d'Orsay, Orsay Cedex, France.
9. School of Physical Sciences and National Center for Plasma Science and Technology, Dublin, Ireland.
10. DESY, Hamburg, Germany.

Abstract (35 Word Limit): Deploying the so-called ‘Streaking Spectroscopy’ technique at LCLS, we demonstrate a non-invasive scheme for temporal characterization of X-ray pulses with sub-femtosecond resolution. Analyzing the substructure indicates pulse durations on the order of hundreds of attoseconds.
Remote two-color optical-to-optical synchronization between two passively mode-locked lasers

H. Li; 1, 2; L. Chen; 3; H. Cheng; 3; J. May; 2; S. Smith; 2; K. Muehlig; 2; A. Uttamadoss; 2, 4; J. Frisch; 2; A. Fry; 2; F. Kaernter; 5, 6; P. Bucksbaum; 1, 2.

1. Stanford University, Menlo Park, CA, United States.
2. SLAC National Accelerator Laboratory, Menlo Park, CA, United States.
3. Idesta Quantum Electronics, LLC., Newton, NJ, United States.
5. Department of Electrical Engineering and Computer Science, and Research Laboratory of Electronics, Massachusetts Institute of Technology, Cambridge, MA, United States.

Abstract (35 Word Limit): We present remote two-color optical-to-optical synchronization between a Ti:sapphire and Er-doped fiber laser through 360 m single-mode fiber with 3.3 fs rms jitter over 24 hours.
Electrons in Atomically Thin Two-Dimensional Crystals

T. Heinz; 1
1. Columbia University, New York, NY, United States.

Abstract (35 Word Limit): Graphene, the 2-dimensional honeycomb lattice of carbon atoms, was first isolated a decade ago. Here we describe advances in our understanding of the properties of electrons confined to this material of single-atom thickness. We emphasize light-matter interactions and potential device applications, from the THz to the ultraviolet. We also highlight the development of atomically thin materials beyond graphene. These advances are exemplified by progress in atomically thin semiconductors, like the transition metal dichalcogenides, which exhibit many distinctive and attractive optical properties, alone and in combination with one another, at monolayer thickness.
Abstract (35 Word Limit): LED lighting has been used for all kinds of applications. The current problems of LED lighting are color quality, efficiency droop, cost. New lighting technologies are required to solve these problems.
Direct measurement of the Wigner function by photon-number-resolving detection

N. Sridhar; 1 R. Shahrokhshahi; 1 A. Miller; 2 T. Gerrits; 3 A. Lita; 3 S. Nam; 3 O. Pfister; 1

1. University of Virginia, Charlottesville, VA, United States.
2. Albion College, Albion, MI, United States.

Abstract (35 Word Limit): We extended the seminal experiment of Banaszek et al. of quantum tomography by photon counting without Radon transform postprocessing to the more general case of photon fluxes with more than one photon per detection time.
Direct measurement of the quantum density matrix in the basis of azimuthal angle

M. Mirhosseini; O. S. Magaña-Loaiza; S. Hashemi Rafsanjani; C. Chen; E. Karimi; R. W. Boyd;
1. Institute of Optics, University of Rochester, Rochester, NY, United States.
2. Department of Physics, University of Ottawa, Ottawa, ON, Canada.

Abstract (35 Word Limit): We theoretically propose and experimentally demonstrate a method for directly measuring the density matrix of an unknown quantum system in the basis of azimuthal angle. We apply our method for characterizing 7-dimensional pure and mixed superpositions of orbital-angular-momentum modes.
Quantum Process Estimation with Unknown Measurements

B. J. Smith; 1; M. Cooper; 1; M. Karpinski; 1;

Abstract (35 Word Limit):
Quantum process estimation without assumptions about measurements used is presented. The detector response is characterized with a finite set of probe states. Numerical simulations for quantum optical processes demonstrate the technique for complex systems.
Reducing the Free-Space Group Velocity of Single Photons by Transverse Structuring
D. Giovannini; J. Romero; V. Potocek; G. Ferenczi; F. Speirits; S. Barnett; D. Faccio; M. Padgett;
1. School of Physics and Astronomy, University of Glasgow, Glasgow, United Kingdom.
2. School of Engineering and Physical Sciences, Heriot-Watt University, Edinburgh, United Kingdom.

Abstract (35 Word Limit): The group velocity of light in free space is decreased by controlling the transverse spatial structure of the beam. We present experimental results in the single-photon regime, supported by a simple geometric argument and a full theoretical treatment.
Hong-Ou-Mandel Interference between Transverse Spatial Waveguide Modes

A. Mohanty; 1; M. Zhang; 1; S. Ramelow; 2; P. Nussenzveig; 3; M. Lipson; 1, 4,

1. School of Electrical and Computer Engineering, Cornell University, Ithaca, NY, United States.
2. School of Applied and Engineering Physics, Cornell University, Ithaca, NY, United States.
3. Instituto de Fisica, Universidade de Sao Paulo, Sao Paulo, Brazil.

Abstract (35 Word Limit): We demonstrate Hong-Ou-Mandel interference between different transverse spatial modes in a silicon nitride multimode waveguide. We show over 90% visibility between modes, providing a promising route for scalable on-chip quantum information processing.
Quantum Walk Coherences on a Dynamical Percolation Graph

F. Elster; S. Barkhofen; T. Nitsche; J. Novotný; A. Gábris; I. Jex; C. Silberhorn;
1. Applied Physics, University of Paderborn, Paderborn, Germany.
2. Department of Physics, Faculty of Nuclear Sciences and Physical Engineering, Czech Technical University in Prague, Prague, Czech Republic.
3. Department of Theoretical Physics, University of Szeged, Szeged, Hungary.

Abstract (35 Word Limit): We implement a quantum walk on a percolation graph leveraging a time-multiplexed quantum walk architecture to create broken links between the graph nodes. We test our system by verifying non-Markovian signatures resulting from induced open system dynamics.
Efficient Boson Sampling Schemes using Dispersion and Pulse Shaping

M. Pant; 1; D. Englund; 1;

1. Massachusetts Institute of Technology, Cambridge, MA, United States.

Abstract (35 Word Limit): We present Boson Sampling schemes in the time-frequency basis that allow for more modes, fewer sources and detectors and are more tolerant to temporal mismatch than Boson Sampling schemes using photons in many spatial modes.
Abstract (35 Word Limit): Here we introduce an experimentally viable ‘repeat-until-success’ implementation of the cubic phase gate, required for universal quantum computation, using sequential photon subtractions. Our scheme offers benefits in the expected time until success, although we require a primitive quantum memory.
Ultrafast electron diffraction can visualize strong-field phenomena in graphene

V. S. Yakovlev, 1, 3, F. Krausz, 2, 3, M. Stockman, 1; P. Baum 2, 3,
1. Center for Nano-Optics (CeNO), Department of Physics and Astronomy, Georgia State University, Atlanta, GA, United States.
2. Fakultät für Physik, Ludwig-Maximilians-Universität München, Garching, Bayern, Germany.
3. Attosekundenphysik, Max-Planck-Institut für Quantenoptik, Garching, Bayern, Germany.

Abstract (35 Word Limit): We show with simulations that ultrafast electron diffraction can provide snapshots of charge-density evolution in condensed matter with few-femtosecond and sub-atomic resolutions. Using graphene as an example, we discuss real-space aspects of light-matter interaction.
Ultrafast Pseudospin Dynamics in Graphene

A. Grupp; 1; M. Trushin; 1; G. Soavi; 1, 2; A. Budweg; 1; D. De Fazio; 3; A. Lombardo; 3; A. C. Ferrari; 3; W. Belzig; 1; A. Leitenstorfer; 1; D. Brida; 1;

1. Univeristy of Konstanz, Constance, Germany.
2. Dipartimento di Fisica, Politecnico di Milano, Milano, Italy.
3. Cambridge Graphene Centre, Cambridge University, Cambridge, United Kingdom.

Abstract (35 Word Limit): We investigate pseudospin-selective ultrafast optical excitation in monolayer graphene. We track the evolution of anisotropy in momentum space as a function of excited carrier density. Results are well described by an analytical model.
Abstract (35 Word Limit): The photocurrent at graphene/metal junctions under femtosecond laser excitation is found to have its polarity fully determined by asymmetry in the electron-hole mobility; this suggests the existence of unexpected lateral photo-Dember effect in graphene.
Terahertz Generation by Dynamical Photon Drag Effect in Graphene

J. Tignon; J. Mangeney; J. Maysonnave; S. Huppert; F. Wang; S. Maero; C. Berger; W. A. de Heer; T. B. Norris; L. de Vaulchier; S. Dhillon; R. Ferreira;

1. Laboratoire Pierre Aigrain, Ecole Normale Supérieure-PSL Research University, CNRS, Université Pierre et Marie Curie-Sorbonne Universités, Université Paris Diderot-Sorbonne Paris Cité, Paris, France.
2. School of Physics, Georgia Institute of Technology, Atlanta, GA, United States.
3. University of Michigan, Ann Arbor, MI, United States.
4. Université Grenoble Alpes/CNRS, Institut Néel, Grenoble, France.

Abstract (35 Word Limit): Room temperature terahertz generation is demonstrated in graphene under femtosecond optical excitation. This is induced by dynamical photon drag, which relies on the transfer of light momentum to the carriers by ponderomotive and magnetic forces.
Abstract (35 Word Limit): We combine ultrafast time-resolved THz spectroscopy and microscopic modeling to study the hot-carrier relaxation and cooling dynamics in graphene; we demonstrate that the dynamics are the result of the intricate interplay between carrier-carrier and carrier-phonon interactions.
Ultrabroadband THz Conductivity of Non-equilibrium Dirac Fermions in Graphene

R. A. Kaindl; 1; G. Coslovich; 1; R. P. Smith; 1; S. Shi; 1, 2; J. H. Buss; 1; J. T. Robinson; 3; F. Wang; 1, 2;
1. Lawrence Berkeley National Laboratory, Berkeley, CA, United States.
2. Dept. of Physics, University of California at Berkeley, Berkeley, CA, United States.
3. Naval Research Laboratory, Washington, DC, United States.

Abstract (35 Word Limit): We employ ultrabroadband THz pulses to expose the high-frequency transport of non-equilibrium Dirac fermions in graphene. Tuning the Fermi level reveals a transient response characteristic of high-energy photo-excited carriers with strongly enhanced interactions.
Ultrafast Photo-Excitation Dynamics of Nitrogen-Vacancy Defects in Diamond

R. Ulbricht; 1, 2; S. Dong; 2; J. Schwartz; 3; H. Kim; 4; Y. Tanimura; 4; B. Mariserla; 5; K. M. Dani; 5; Z. Loh; 2;
1. Department of Physics, University of Colorado, Boulder, CO, United States.
2. Division of Chemistry and Biological Chemistry, Nanyang Technological University, Singapore, Singapore.
3. Accelerator and Fusion Research Division, Lawrence Berkeley National Laboratory, Berkeley, CA, United States.
4. Department of Chemistry, Kyoto University, Kyoto, Japan.
5. Femtosecond Spectroscopy Unit, Okinawa Institute of Science and Technology, Onna-son, Japan.

Controlling Carbon Nanotube Mechanics with Optical Microcavities

M. Zhang; 1; A. Barnard; 1; P. McEuen; 1; M. Lipson; 1;
1. Cornell University, Ithaca, NY, United States.

Abstract (35 Word Limit): We demonstrate optomechanically induced amplification of carbon nanotube (CNT) mechanical modes using optical microcavities. We also show direct imaging of the spatial profile of CNT mechanical modes using optical readout.
Optical Topological Transitions in Photonic Hypercrystals

E. E. Narimanov

1. Purdue University, West Lafayette, IN, United States.

Abstract (35 Word Limit):
We demonstrate that Dirac dispersion cones in photonic hypercrystals originate from an optical topological transition. The resulting singularity in the photonic density of states has a strong effect on the emissivity of the hypercrystal.
Observing Light Dynamics in Micro-sized Schwarzschild Metric

R. Bekenstein, 1; Y. Kabessa, 2; O. Tal, 1; M. A. Bandres, 1; A. Agranat, 2; M. Segev, 1;

1. Physics Department and Solid State Institute, Technion Israel Institute of Technology, Haifa, Israel.
2. Department of Applied Physics and the Brojde Center for Innovative Engineering and Computer Science, Hebrew University of Jerusalem, Jerusalem, Israel.

Abstract (35 Word Limit): We study the dynamics of light in the Schwarzschild metric using a specifically fabricated micro-sized curved waveguide analogous to the black hole and the wormhole metrics, demonstrating complex dynamics and tunneling through the horizon.
Dirac Plasmons in Topological Insulators

S. Lupi;
1. INFN and Dip. di Fisica, Rome, RM, Italy.

Abstract (35 Word Limit): Topological Insulators, characterized by 2D Dirac fermions on their surface, sustain Dirac plasmons. In this talk, I will discuss the terahertz response of these plasmons vs. a strong magnetic field, and their sub-ps dynamics.
One-Way Topological Transitions in Magnetoplasmonic Hyperbolic Metamaterials

A. B. Khanikaev; 1, 2; B. Stein; 1; A. Leviyev; 1; T. Galfsky; 3, 2; H. Krishnamoorthy; 1, 2; I. L. Kuskovsky; 1, 2; V. M. Menon; 3, 2;

1. Physics, Queens College of the City University of New York, Queens, NY, United States.
2. Physics, Graduate Center of the City University of New York, New York, NY, United States.
3. Physics, The City College of New York, New York, NY, United States.

Abstract (35 Word Limit): It is shown that hyperbolic metamaterials with reduced spatial symmetry and the time-reversal symmetry broken by magnetization exhibit multiple nonreciprocal hyperbolic regimes. Magnetization induced one-way topological phase transitions between elliptical and hyperbolic regimes are demonstrated.
Integrated impedance-matched photonic Dirac-cone metamaterials

Y. Li; 1; S. Kita; 1; P. Muñoz; 1; O. Reshef; 1; D. Vulis; 1; M. Loncar; 1; E. Mazur; 1;
1. Harvard University, Cambridge, MA, United States.

Abstract (35 Word Limit): We design and fabricate an on-chip Dirac-cone metamaterial with impedance-matched zero index at 1550 nm. This design can serve as an on-chip platform to implement applications of Dirac-cone metamaterials in integrated photonics, such as supercoupling.
Probing the Ultrathin Limit of Hyperbolic Meta-material: Nonlocality Induced Topological Transitions
L. Chen; 1, 2; C. Zhang; 2; J. Zhou; 2; L. Guo; 1, 2;
1. Applied Physics, University of Michigan, Ann Arbor, MI, United States.
2. Department of Electrical Engineering and Computer Science, University of Michigan, Ann Arbor, MI, United States.

Abstract (35 Word Limit): Hyperbolic meta-materials based on ultrathin metal-dielectric multilayers have been studied by considering the nonlocal response of electrons in metal. We show that nonlocality will induce topological transitions of the iso-frequency surfaces and limit light-matter interactions.
Photonic Topological Edge Modes without an Edge

Y. Tenenbaum Katan; 1; Y. Lumer; 1; Y. Plotnik; 1; M. Rechtsman; 1; M. Segev; 1;
1. Technion, Kiryat Motzkin, Israel.

Abstract (35 Word Limit): We present photonic topological modes without a topological edge: topologically protected states which reside at a non-topological interface in the bulk of a photonic topological insulator (a honeycomb lattice of helical waveguides).
Abstact (35 Word Limit): Virtually lossless self-compression of 10-mJ 3.9-um sub-100 fs pulses in bulk YAG resulting in 9-mJ 33-fs pulses is reported. Generated peak power exceeds 250 GW which is suitable for filamentation in ambient air.
Mid-IR Filamentation in Dielectrics: 3-octave-spanning Supercontinuum Generation and Sub-2-cycle Self-compression

H. Liang;¹; P. R. Krogen;¹; R. Grynko;²; O. Novak;¹; C. L. Chang;¹; G. J. Stein;¹; D. Weerawarne;²; B. Shim;²; F. Kaernter;¹,³; K. Hong;¹;
1. Massachusetts Institute of Technology, Cambridge, MA, United States.
2. Binghamton University, State University of New York, Binghamton, NY, United States.

Abstract (35 Word Limit): We report on 3-octave supercontinuum generation from ZnS in the normal dispersion regime and self-compression of mid-IR pulses to sub-2-cycle in CaF₂ in the anomalous dispersion regime. Temporal characterization shows good agreement with 3D simulations.
White-light Generation Pumped by Sub-ps Pulse
A. Calendron; 1, 2; H. Cankaya; 1, 2; G. Cirmi; 1, 2; G. M. Rossi; 1, 2; F. Kaertner; 1, 3;
1. Deutsches Elektronen Synchrotron, Hamburg, Germany.
2. Universität Hamburg, The Hamburg Centre for Ultrafast Imaging, Hamburg, Germany.

Abstract (35 Word Limit): The phase and stability characterization of white-light supercontinuum generated by sub-picosecond pulses at 1 µm in YAG and sapphire for different pump focusing and duration shows compressible pulses, suitable for applications like waveform synthesis.
Transition between linear and nonlinear focusing regimes during filamentation

M. Baudelet; 1; K. Lim; 1; M. Durand; 1; M. Richardson; 1;
1. University of Central Florida, CREOL, Orlando, FL, United States.

Abstract (35 Word Limit): The transition between linear and nonlinear regimes of focusing for laser filamentation is described and shows the balance between plasma physics and nonlinear propagation for the stability of the laser filament and its properties.
Superfilamentation in water with tight focusing laser beams

F. V. Potemkin; E. I. Mareev; A. Podshivalov; V. M. Gordienko;

1. M. V. Lomonosov Moscow State University, Moscow, Russian Federation.

Abstract (35 Word Limit): We report whole life cycle of superfilament excited in tight focusing beams in water. Extreme energy delivery achieved under superfilamention is reflected in strong post-effects (cavitation bubbles and shock waves), which can completely characterize superfilament.
Generation and Enhancement of XUV Pulse from UV Filament Interaction in Argon

D. Wang; 1; W. Li; 1; L. Ding; 1; H. Zeng; 1;
1. East China Normal University, Shanghai, Shanghai, China.

Abstract (35 Word Limit): We demonstrated the generation and enhancement of XUV pulse at 89 nm by non-collinear interaction between UV filaments in argon. The experimental result agrees well with the simulated data.
Plasma density measurement along femtosecond laser filament via enhanced THz spectroscopy

T. Wang;

1. SIOM, Chinese Academy of Sciences, Shanghai, Shanghai, China.

Abstract (35 Word Limit): We report on a longitudinally resolved measurement of plasma density along femtosecond laser filament in air via needlelike high-voltage DC electric field enhanced THz spectroscopy. Longitudinal distribution of plasma density of $\sim 10^{15}$ cm$^{-3}$ along laser filament has been successfully recorded.
Spatial Dependence of the Interaction between a Single Aerosol and a Laser Filament on its Reformation

C. Jeon; 1; D. Harper; 1; K. Lim; 1; M. Durand; 1; M. Chini; 1; M. Baudelet; 1; M. Richardson; 1,
1. University of Central Florida, CREOL, Orlando, FL, United States.

Abstract (35 Word Limit): The analysis of the filament destruction and reformation as a single aerosol is positioned along the radial and longitudinal axes of the filament provides more understanding of the propagation of filaments in aerosol-containing media.
Abstract (35 Word Limit): We observe impedance matched coupling between molecular vibrations and infrared optical antennas. Broadband synchrotron near-field spectroscopy reveals antenna-vibration hybridization, mode splitting, and tip excitation of coupled dark plasmon modes.
Abstract (35 Word Limit): We combine surface-enhanced infrared absorption and a high brilliance optical parametric light source to enable ultra-sensitive and fast Fourier-transform infrared spectroscopy of only 10 000 molecules; inaccessible with conventional thermal light sources or synchrotron radiation.
Plasmonic Nanoantennas on Nanopedestals for Ultra-Sensitive Vibrational IR-Spectroscopy

D. Etezadi; 1, A. Cetin; 1, H. Altug; 1;
1. EPFL, Lausanne, VD, Switzerland.

Abstract (35 Word Limit): We experimentally demonstrate that elevating polarization-insensitive nanoring antennas on nanopedestals enables high surface enhanced infrared absorption (SEIRA) signals. This is due to larger and accessible nearfields offering better overlap with biomolecules.
3D Plasmonic nanostar structures for recyclable SERS applications

M. CHIRUMAMILLA; A. Gopalakrishnan; A. Toma; R. Zaccaria; F. De Angelis; R. Krahne;

1. Dept. Of Physics and Nanotechnology, Aalborg University, Aalborg, Denmark.
2. Nanostructures, Istituto Italiano di Tecnologia, Genova, Italy.

Abstract (35 Word Limit): Nanofabrication of metallic nanostructures/nanoparticles enables the detection of analyte molecules at ultra-low concentrations with the aid of plasmon induced hot-spots. Here we present a cost effective approach to recycle the SERS substrates for label free bio-sensing applications.
Plasmonics of Ultranarrow Gaps Shunted by Organic Conductive Junctions

C. Tserkezis; 1 F. Benz; 2 L. O. Hermann; 2 B. de Nijs; 2 A. Sanders; 2 D. O. Sigle; 2 J. Baumberg; 2 J. Aizpurua; 1

1. Donostia International Physics Center and Centro de Fisica de Materiales CSIC-UPV/EHU, Donostia-San Sebastian, EUS, Spain.
2. Nanophotonics Centre, Cavendish Laboratory, Department of Physics, University of Cambridge, Cambridge, United Kingdom.

Abstract (35 Word Limit): The optical response of plasmonic cavities formed by metallic nanoparticles deposited on a metallic substrate separated by self-assembled monolayers of conductive organic molecules can be precisely controlled by the exact chemical composition of the monolayers.
Subwavelength Sensing Elements from Film-Coupled Silver Nanocubes

A. Powell; 1; A. Watt; 1; H. Assender; 1; J. M. Smith; 1;

Abstract (35 Word Limit): By placing a moisture-sensitive polymer spacer between a silver nanocube and an Ag film, the extreme sensitivity of the plasmon resonance excited between them to spacer thickness is exploited to create a novel sub-wavelength sensing element.
Efficient Integration of Sub-5-nm-gap Plasmonic Crystal Cavities with Plasmonic Waveguides

M. Kim; Y. Lee; 1
1. KAIST, Daejeon, Korea (the Republic of).

Abstract (35 Word Limit): We propose a three-dimensionally tapered 2-nm-gap plasmonic crystal cavity which can efficiently couple to an integrated waveguide with over 90% efficiency. Along with the theoretical study, we successfully fabricated the 3D-tapered plasmonic crystal cavity integrated with a plasmonic waveguide.
Hybridisation of antenna and cavity modes in nanoparticle-on-mirror plasmonic nanocavities

C. Tserkezis; 1; R. Esteban; 1; D. O. Sigle; 2; J. Mertens; 2; L. O. Herrmann; 2; J. Baumberg; 2; J. Aizpurua; 1;
1. Donostia International Physics Center and Centro de Fisica de Materiales CSIC-UPV/EHU, Donostia-San
Sebastian, EUS, Spain.
2. Nanophotonics Centre, Cavendish Laboratory, Department of Physics, University of Cambridge, Cambridge, United Kingdom.

Abstract (35 Word Limit): Longitudinal antenna and transverse cavity modes can be excited when bringing a faceted
plasmonic nanoparticle close to a metallic substrate. Their interaction leads to a rich optical response, understandable
in terms of the modal symmetry.
A Comb Laser-Driven DWDM Silicon Photonic Transmitter with Microring Modulator for Optical Interconnect

C. Chen; 1 T. Huang; 1 D. Livshit; 2 A. Gubenko; 2 S. Mikhrin; 2 V. Mikhrin; 2 M. Fiorentino; 1 R. Beausoleil; 1

2. Innolume GmbH, Dortmund, Germany.

Abstract (35 Word Limit): A five-channel microring modulator-based DWDM silicon photonic transmitter driven by a quantum dot comb laser is demonstrated for the first time. 10Gbps eye diagrams are shown at both 25°C and 40°C.
Abstract (35 Word Limit): We demonstrate a five-channel wavelength division multiplexed modulator module that heterogeneously integrates a 1.6nm channel-spacing arrayed-waveguide grating and a 20Gbps electroabsorption modulator array, showing the potential for 100 Gbps capacity on a 1.5x0.5 mm² footprint.
Abstract (35 Word Limit): We present a monolithic CMOS Integrated Nano Photonic transmitter with a link sensitivity comparable to a 25 Gb/s commercial reference transmitter, exhibiting a 5.2 dB extinction ratio, 4.9 dB insertion loss, and error free operation up to 32 Gb/s.
Abstract (35 Word Limit): We present 1.55 µm hybrid III-V/Si SOA designs and experimentally determine wall-plug-efficiency (WPE) values for 2 mW and 0.1 mW input power amplification. Flared SOAs yield $WPE = 12.1\%$ for output power > 10 mW and straight SOAs achieve $WPE = 7.2\%$. 
56 Gb/s PAM-4 Data Transmission Over a 1 m Long Multimode Polymer Interconnect
N. Bamiedakis; J. Wei; J. Chen; P. Westbergh; A. Larsson; R. V. Penty; I. H. White;
1. University of Cambridge, Cambridge, United Kingdom.
2. Chalmers University of Technology, Gothenburg, Sweden.

Abstract (35 Word Limit): Advanced modulation formats can enable >40 Gb/s data rates in waveguide-based optical interconnects without the need for high-specification optoelectronic components. Record 56Gb/s PAM-4 data transmission is demonstrated over a 1 m-long multimode polymer waveguide.
Abstract (35 Word Limit): We propose a PAM-4 modulation scheme with unequally spaced levels in order to mitigate chirp effects caused by IQ modulators. Experimental results of 56 Gb/s transmission over 25 km link demonstrate the robustness of this modulation concept.
6.25 Gb/s POF Link Using GaN μLED Arrays and Optically Generated Pulse Amplitude Modulation

X. Li; 1; N. Bamiedakis; 1; J. Wei; 1; J. McKendry; 2; E. Xie; 2; R. Ferreira; 2; E. Gu; 2; M. Dawson; 2; R. V. Penty; 1; I. H. White; 1;
1. University of Cambridge, Cambridge, United Kingdom.
2. Department of Physics, University of Strathclyde, Glasgow, United Kingdom.

Abstract (35 Word Limit): Optically-generated PAM schemes using μLED arrays are implemented for high-speed POF links for the first time. 6.25Gb/s PAM-16 transmission is demonstrated using 4 μLEDs, exhibiting 3.8dB greater power-margin than a link with a single μLED.
Sampled Grating Quantum Cascade Lasers with High Tuning Stability

S. Kalchmair; 1; R. Blanchard; 2; T. Mansuripur; 1; G. de Naurois; 1; L. Diehl; 2; C. Pflügl; 2; M. F. Witinski; 2; F. Capasso; 1; M. Loncar; 1

1. Harvard University, Cambridge, MA, United States.
2. Eos Photonics, Inc., Cambridge, MA, United States.

Abstract (35 Word Limit): We report a sampled grating quantum cascade laser with excellent tuning stability over the full tuning range (106 cm⁻¹). Spatial hole burning and facet reflections can cause unpredictable mode jumping. We present a stabilization method.
Abstract (35 Word Limit): We present the first realization of a single-mode surface-emitting quantum cascade laser array. The ten lasers operate over a bandwidth of 175 cm-1 from 8-10 um and show similar pumping characteristics. The device is suitable for spectroscopic applications due to its continuous wave operation.
Coherent Beam-Combining of Quantum Cascade Amplifier Arrays

B. G. Saar; 1; K. Creedon; 1; L. Missaglia; 1; C. A. Wang; 1; M. K. Connors; 1; J. Donnelly; 1; G. W. Turner; 1; A. Sanchez-Rubio; 1; W. Herzog; 1;

1. MIT Lincoln Laboratory, Lexington, MA, United States.

Abstract (35 Word Limit): Abstract: We present design, packaging and coherent beam combining of quantum cascade amplifier (QCA) arrays, measurements of QCA phase noise, the drive-current-to-optical-phase transfer function, and the small signal gain for QCAs
Room Temperature Operation of a Photonic Crystal Quantum Cascade Laser
R. Peretti;1 V. Liverini;1 J. Wolf;1 C. Bonzon;1 S. Lourdudoss;2 W. Metaferia;2 M. Beck;1 J. Faist;1
1. ETH Zurich, Zuerich, Switzerland.
2. Laboratory of Semiconductor Materials, School of ICT, KTH-Royal Institute of Technology, Kista, Sweden.

Abstract (35 Word Limit): We report on design, fabrication and investigation of a buried heterostructure photonic crystal quantum cascade laser operating in the mid-IR (8.5μm) at room temperature, leading to single mode emission on a 600μm by 600μm mesa.
Perspectives for intersubband polariton lasers and Bose-Einstein condensation of intersubband polaritons

R. Colombelli;¹; J. Manceau;¹;
1. Univ. Paris Sud and CNRS, Orsay, France.

Abstract (35 Word Limit): Intersubband polaritons are mixed states, partially micro-cavity photon and partially intersubband excitation, which behave as bosons below a certain density. We discuss the perspectives toward the development of mid-IR and THz intersubband polariton bosonic lasers.
Continuous Wave Room Temperature External Ring Cavity Quantum Cascade Laser

D. G. Revin; M. Hemingway; D. Vaitiekus; J. Cockburn; N. Hempler; G. MAKER; G. MALCOLM;

1. University of Sheffield, Sheffield, United Kingdom.
2. M Squared Lasers, Glasgow, United Kingdom.

Abstract (35 Word Limit): Mid infrared, tunable quantum cascade laser operating in free-space external ring cavity in continuous wave regime at room temperature is demonstrated for the first time. Out-coupled optical power up to 17 mW has been achieved.
Monolithic Integration of Quantum Cascade Lasers and Passive Components
J. Montoya; 1  C. A. Wang; 1  K. Creedon; 1  A. Goyal; 1  J. Daulton; 1  J. Donnelly; 1  L. Missaggia; 1  A. Sanchez-Rubio; 1  W. Herzog; 1
1. Massachusetts Inst of Tech Lincoln Lab, Lexington, MA, United States.

Abstract (35 Word Limit): We present a method to integrate quantum cascade lasers with passive components using proton implantation. Proton implantation reduces the intersubband and free-carrier absorption optical loss. We have measured a loss $\alpha=0.33 \text{ cm}^{-1}$ in proton implanted waveguides.
Self-referenced Transient THz Spectroscopy with ABCD Detection

D. Turchinovich; 1; F. D'Angelo; 1; S. Parekh; 1; M. Bonn; 1;
1. Max Planck Institute f. Polymer Research, Mainz, Germany.

Abstract (35 Word Limit): A new scheme for simultaneous acquisition of reference and sample THz signals in transient THz spectroscopy with ABCD detection is demonstrated, with demodulation at pump beam chopping and ABCD voltage switching frequencies.
Electron Dynamics in a Gold Thin Film Accelerated via an Intense Terahertz Field

Y. Minami; 1; T. D. Dao; 2; T. Nagao; 2; J. Takeda; 1; M. Kitajima; 3; I. Katayama; 1;
1. Yokohama National University, Yokohama, Kanagawa, Japan.
3. LxRay Co. Ltd, Nishinomiya, Japan.

Abstract (35 Word Limit): Nonlinear electron dynamics in gold thin films was observed via intense terahertz spectroscopy. Under the intense terahertz wave illumination, the damping constant of electrons becomes smaller due to the suppression of the grain-boundary effect on electrons induced by the intense terahertz field.
Time-resolved THz Laser spectra using a Fibre-interfaced Optical Heterodyne system

T. Folland; A. ramospulido; o. marshall; H. Beere; D. Ritchie; S. Chakraborty;
1. University of Manchester, Manchester, United Kingdom.
2. University of Cambridge, Cambridge, United Kingdom.

Abstract (35 Word Limit): We report the first fully fibre-interfaced heterodyne system for time-resolved spectral characterization of THz quantum cascade lasers. By exploiting the bias probe rise time we study the current dependant mode tuning with 50ns temporal resolution.
Terahertz Response of Long-lived Photoexcited Electrons in Silicon Observed Using Single-shot Terahertz Spectroscopy

I. Katayama; 1 K. Masuda; 1 K. Horiuchi; 1 Y. Minami; 1 J. Takeda; 1
1. Yokohama National University, Yokohama, Kanagawa, Japan.

Abstract (35 Word Limit): We observed photoexcited carriers in silicon by using single-shot terahertz spectroscopy. This technique can significantly reduce the measurement time and repetition rate of pump pulses, enabling us to observe the dynamics of long-lived photoexcited carriers without a pileup effect.
Real-Time Absolute Frequency Measurement of CW-THz Wave Based on a Free-Running THz Comb

T. Yasui; T. Ogura; K. Hayashi; H. Inaba; K. Minoshima;
1. Tokushima University, Tokushima, tokushima, Japan.
2. ERATO Intelligent Optical Synthesizer Project, Chohu, Japan.
3. The University of Electro-Communications, Chofu, Japan.

Abstract (35 Word Limit): We demonstrated a real-time frequency measurement of CW-THz wave using a single free-running THz comb. The absolute frequency of the CW-THz wave is measured with an accuracy of 8.7*10^{-12} at a rate of 10 Hz.
Generation and Stabilization of THz-waves with Extraordinary Low Line Width and Phase Noise

S. Preussler; 1; T. Schneider; 1; H. Al-Taï; 1;
1. Institut für Hochfrequenztechnik, Technische Universität Braunschweig, Braunschweig, Germany.

Abstract (35 Word Limit): The generation and stabilization of high quality mm- and THz-waves via extraction of two lines from a fs-laser, with frequencies up to 3 THz, line width below 1 Hz and phase noise of -134 dBc/Hz is presented.
Abstract (35 Word Limit): We report a coupling mode transition from pure plasmon coupling to plasmon-microcavity hybridization in THz using liquid metal whose shape can be tuned, not only from disk to droplet, but also from 2D to 3D.
Single Nanowire Terahertz Detectors

K. Peng; 1; P. Parkinson; 2; L. Fu; 1; Q. Gao; 1; N. Jiang; 1; Y. Guo; 1; F. Wang; 1; H. Joyce; 2, 3; J. Boland; 2; M. Johnston; 2; H. Tan; 1; C. Jagadish; 1;

1. The Australian National University, Canberra, ACT, Australia.

Abstract (35 Word Limit): Photoconductive terahertz detectors based on single GaAs/AlGaAs nanowire were designed, fabricated and incorporated into the pulsed time-domain technique, showing a promise for nanowires in terahertz applications such as near-field terahertz sensors or on-chip terahertz micro-spectrometers.
Nano-Silicon-Photonic Fourier Transform Infrared (FTIR) Spectrometer-on-a-Chip

B. Dong; 1, 2; H. Cai; 2; Y. Gu; 2; Z. Yang; 3; Y. Jin; 3; Y. Hao; 3; D. Kwong; 2; A. LIU; 1;
1. Nanyang Technological University, Singapore, Singapore.
2. Institute of Microelectronics, Singapore, Singapore.
3. Peking University, Beijing, China.

Abstract (35 Word Limit): This paper reports a nano-silicon-photonic Fourier transform infrared (FTIR) spectrometer-on-a-chip, which is integrated with fiber-waveguide coupler and photo detector on a waveguide based silicon photonic chip.
Monolithically Integrated Quantum Cascade Lasers, Detectors and Dielectric Waveguides at 9.5μm for Far-Infrared Lab-on-Chip Chemical Sensing

Y. Zou; 1; K. Vijayraghavan; 1; P. Wray; 1; S. Chakravarty; 2; M. A. Belkin; 1; R. T. Chen; 1, 2;
1. University of Texas at Austin, Austin, TX, United States.
2. Omega Optics Inc., Austin, TX, United States.

Abstract (35 Word Limit): We provide the first experimental demonstration of room temperature far-infrared lab-on-chip chemical sensing via monolithic integration of quantum cascade laser, quantum cascade detector and dielectric waveguides at the long infrared wavelength of 9.5μm.
Experimental Demonstration of Mid-Infrared Holey and Slotted Photonic Crystal Waveguides in Silicon on Sapphire

Y. Zou; 1; P. Wray; 1; S. Chakravarty; 2; R. T. Chen; 1, 2;

1. University of Texas at Austin, Austin, TX, United States.
2. Omega Optics Inc., Austin, TX, United States.

Abstract (35 Word Limit): We provide the first experimental demonstration of propagation characteristics of holey and slotted two dimensional photonic crystal waveguides in silicon-on-sapphire at mid-infrared wavelength of 3.43μm.
Near Field Optical Measurements of Silicon Waveguide in Mid-IR Regime Using Scanning Thermal Microscopy

M. Y. Grajower; 1;  . Sebbag; 1;  A. Naiman; 1;  B. Desiatov; 1;  U. Levy; 1;
1. Hebrew University of Jerusalem, Jerusalem, Israel.

Abstract (35 Word Limit): We observe for the first time the near field optical intensity distribution of silicon nanophotonic devices operating in the mid-IR spectrum using our scanning thermal microscopy and demonstrate its advantages over conventional NSOM technique.
On-Chip Modulation in the Mid-Infrared with Silicon-on-Lithium-Niobate Photonics

J. Chiles; 1; S. Fathpour; 1;
1. CREOL, University of Central Florida, Orlando, FL, United States.

Abstract (35 Word Limit): Mid-infrared (3.39 μm) optical modulators are demonstrated for the first time on the silicon-on-lithium-niobate platform, with a $V_{\pi} \cdot L$ of 26 V·cm, extinction ratio of 8 dB, and on-chip insertion losses of 3.3 dB.
Microscopic Analysis of Quantum-Confined Stark Effect of Group IV Quantum Wells for Mid-Infrared Si-Based Electroabsorption Modulators

T. Fujisawa; K. Saitoh;

1. Graduate school of information science and technology, Hokkaido University, Sapporo, Japan.

Abstract (35 Word Limit): Quantum-confined Stark effect of Ge(Sn)/SiGe(Sn) quantum wells (QWs) is analyzed by many-body theory. Calculated absorption spectra of Ge/SiGe-QWs are in good agreement with the experiment. Also, the effect of Sn-incorporation is investigated for mid-infrared applications.
All-optical Modulation in Germanium-on-silicon Waveguides in the Mid-infrared

L. Shen; 1  N. Healy; 1  C. Mitchell; 1  J. Penades; 1  M. Nedeljkovic; 1  G. Mashanovich; 1  A. C. Peacock; 1  

1. Optoelectronics Research Centre, University of Southampton, Southampton, United Kingdom.

Abstract (35 Word Limit): All-optical modulation is demonstrated in low loss germanium-on-silicon waveguides at mid-infrared wavelengths. The results indicate the suitability of this platform for optical signal processing in this long wavelength regime.
Abstract (35 Word Limit): We demonstrate broadband frequency comb generation in the mid-infrared from 2.3 to 3.5 µm in a Si$_3$N$_4$ microresonator with Q=850,000 fabricated using an optimized process for decreasing intrinsic losses and overcoming stress limitations.
Nitrogen oxide radicals and organic nitrate photochemistry in Earth’s atmosphere

R. Cohen;
1. University of California Berkeley, Berkeley, CA, United States.

Abstract (35 Word Limit): Textbook descriptions of atmospheric nitrogen oxide photochemistry focus on the role of NOx as a control over OH and on limiting behavior at high and low NOx. In this talk I will explore the intermediate NOx regime, focusing on the role of organic nitrates as a control over atmospheric NOx and HOx free radicals.
Abstract (35 Word Limit): We present a transportable dual-modulation Faraday rotation spectrometer with minor isotope (15NO) detection sensitivity of 0.35 ppbv•Hz-1/2, corresponding to 1.4x the shot-noise limit. NO isotope line-switching is implemented for quasi-simultaneous time-multiplexed isotope measurements.
Quantifying Primary Reactive Nitrogen Emissions Using Open-Path, Quantum Cascade Laser-Based Sensors
K. Sun; L. Tao; D. Pan; L. Golston; Y. Tian; M. Huang; J. Hu; T. Wang; M. A. Zondlo;
1. Princeton University, Princeton, NJ, United States.
2. NEC Laboratories America, Princeton, NJ, United States.

Abstract (35 Word Limit): A compact QCL-based open-path NO sensor is developed at 5.26 µm for high sensitivity and fast response. Combined with existing NH$_3$ and N$_2$O sensors, this system measures primary emissions of reactive nitrogen to the atmosphere.
Airborne Multi-Gas Sensor

D. Bomse; M. N. Ediger; A. B. Vakhtin; 1
1. Mesa Photonics, Santa Fe, NM, United States.

Abstract (35 Word Limit): Carbon dioxide and methane are detected simultaneously using two-tone frequency modulation spectroscopy. Detection limits are 1.5 ppm Hz$^{-1/2}$ and 3.5 ppb Hz$^{-1/2}$, respectively, over 0.1 to 100 s. External phase modulators apply the two tones.
CAMS - Compact Atmospheric Multi-Species Spectrometer

D. Richter; 1; P. Weibring; 1; J. Walega; 1; A. Fried; 1; S. M. Spuler; 2; M. Taubman; 3;
2. Earth Observing Laboratory, National Center for Atmospheric Research, Boulder, CO, United States.
3. Pacific Northwest National Laboratory, Richland, WA, United States.

Abstract (35 Word Limit): We present the design, development, and field performance of an airborne mid-IR spectrometer configured for the simultaneous sensitive detection of CH$_2$O (~40 pptv, 1 Hz) and C$_2$H$_6$ (~15 pptv, 1 Hz).
Advancing a Deep Sea Near-Infrared Laser Spectrometer for Dual Isotope Measurements

J. Kapit; A. P. Michel; S. Wankel; P. Girguis; M. Gupta;
2. Harvard University, Cambridge, MA, United States.
3. Los Gatos Research, Mountain View, CA, United States.

Abstract (35 Word Limit): A deep-sea near-infrared laser-based sensor, utilizing off-axis integrated cavity output spectroscopy, was enhanced to achieve in situ sensing dual isotope sensing ($\delta^{13}$CO$_2$, $\delta^{13}$CH$_4$) of both fluid and bubble samples.
Advances in Diode Laser Based Lidar for Profiling Atmospheric Water Vapor

S. M. Spuler; ¹; K. Repasky; ²; B. Morley; ¹; D. Moen; ²; T. Weckwerth; ¹; M. Hayman; ¹; A. Nehrir; ³;
1. National Center for Atmospheric Research, Boulder, CO, United States.
2. Electrical and Computer Engineering, Montana State University, Bozeman, MT, United States.
3. NASA Langley Research Center, Hampton, VA, United States.

Abstract (35 Word Limit): The design of an advanced diode laser based differential absorption lidar (DIAL) is discussed which is capable of operation over a wide range atmospheric conditions. The instrument was field tested for 50 days and the results were compared to collocated instrumentation.
Abstract (35 Word Limit): We have developed a completely new approach to measure vertical and horizontal forces of biological cells cultured on 2D substrata by interferometrically detecting deformations of a soft micro-resonator with an elastic filling.
Wide Dynamic Range Specific Detection of Therapeutic Drugs by Photonic Crystal Microcavity Arrays

H. Yan; 1, C. Yang; 1, Y. Zou; 1, N. Tang; 1, 2, S. Chakravarty; 2, R. T. Chen; 1, 2;
1. The University of Texas at Austin, Austin, TX, United States.
2. Omega Optics Inc., Austin, TX, United States.

Abstract (35 Word Limit): Six orders of magnitude wide dynamic range (0.1ng/ml to over 100μg/ml), label-free detection of gentamicin small molecules with silicon photonic crystal microcavity biosensors multiplexed by multimode interference power splitters was experimentally demonstrated. Detection specificity was confirmed.
Silicon Nitride Coupled-Resonator Optical-Waveguide-based Biosensors using Visible-Light-Scattering Pattern Recognition

J. Wang; A. W. Poon;
1. Photonic Device Laboratory, Department of Electronics and Computer Engineering, Hong Kong University of Science and Technology, Hong Kong, China.

Phospholipid-functionalized microgoblet lasers for biomolecular detection

U. R. Bog; 1 F. Brinkmann; 1 S. Wondimu; 1 T. Wienhold; 1 S. Kraemmer; 1 C. Koos; 1 H. Kalt; 1 S. Koeber; 1 T. Mappes; 3 M. Hirtz; 1 H. Fuchs; 2

1. Karlsruher Institut für Technologie, Eggenstein-Leopoldshafen, Germany.
2. Westfaelische-Wilhelms Universitaet, Muenster, Germany.
3. Carl Zeiss AG, Jena, Germany.

Abstract (35 Word Limit): We present our latest results on microgoblet lasers as biosensors. Surface functionalization is performed with high resolution and throughput by aligned microcontact stamping. We show simultaneous device readout, the resulting cross-referencing capabilities and functionalization reconfiguration.
193nm Lithography Fabricated High Sensitivity Photonic Crystal Microcavity Biosensors for Plasma Protein Detection in Patients with Pancreatic Cancer

C. Yang; N. Tang; H. Yan; S. Chakravarty; D. Li; R. T. Chen;
1. The University of Texas at Austin, Austin, TX, United States.
2. Omega Optics Inc., Austin, TX, United States.
3. UT MD Anderson Cancer Center, Houston, TX, United States.

Abstract (35 Word Limit): High sensitivity L13-type two-dimensional photonic crystal microcavities with nanoholes were fabricated by 193nm photolithography. 0.03 picomolar concentration pancreatic cancer biomarker in patient serum samples was experimentally detected to 10× lower dilution than ELISA.
High Contrast Grating Resonator for Label-Free Biosensor

T. Sun; 1; S. Kan; 2; G. Marriott; 2; C. J. Chang-Hansnain; 1;
1. EECS, University of California, Berkeley, Berkeley, CA, United States.
2. Bioengineering, University of California, Berkeley, Berkeley, CA, United States.

Abstract (35 Word Limit): We present a novel label-free biosensor using Si-based high-contrast grating resonator with Q ~3000. The biosensor is coupled using a single-mode fiber and realizes high sensitivity in the specific detection of target proteins at 100pg/ml.
On-chip Integrated Differential Optical Microring Biosensing Platform Based on a Dual Laminar Flow Scheme

D. Kim; 1; P. Popescu; 1;
1. Applied Physics, Caltech, Pasadena, CA, United States.

Abstract (35 Word Limit): We propose an on-chip integrated differential optical silicon nitride microring biosensing platform which uses a dual laminar flow scheme. This platform reduces the fabrication complexity involved in the fabrication of the reference resonator.
Lasers in the 2um SWIR spectral regime and their Applications

T. Hoult; 1
1. IPG Photonics Corp, Santa Clara, CA, United States.

Abstract (35 Word Limit): For a particular laser type to be widely adopted for industrial materials processing, a minimum laser power is required. The development of supra 100 watt thulium fiber lasers means that another laser type has now been added to that relatively short list.
High Power Laser-Sustained Plasma Lightsources for KLA-Tencor Broadband Inspection Tools
I. Bezel; G. Delgado; M. Derstine; K. Gross; R. Solarz; A. Shchemelinin; D. Shortt;
1. KLA-Tencor Corp, Milpitas, CA, United States.

Abstract (35 Word Limit): For the last 8 years, the brightness of UV lightsources in KT Broadband inspection tools increased by orders of magnitude due to advances in LSP technology. Challenges of LSP in high-power regime are discussed here.
Abstract (35 Word Limit): We report on the nonlinear compression of 330 fs and 70 µJ pulses from a high energy fiber amplifier system down to 34 fs and 50 µJ pulses using an air-filled 40 µm hypocycloid-core Kagome fiber.
1.75 kW CW Narrow Linewidth Yb-doped all-fiber Amplifiers for Beam Combining Application

Y. Qi; 1
m. lei; 1
C. liu; 1
b. he; 1
j. zhou ; 1
1. Shanghai Inst of Optics and Fine Mech, , United States.

Abstract (35 Word Limit): We reported on a Yb-doped all-fiber amplifier when seeded with a 20 GHz line-width master oscillator. By using mode controlling technology, an output power of 1.75 kW with near-diffraction limited beam quality \((M2=1.77)\) was observed.
Status and Potential of Laser based EUV Sources

A. Endo;¹

1. Institute of Physics ASCR,, HiLase Center, Dolni Brezany, Czech Republic.

Abstract (35 Word Limit): The established EUV source for lithography is driven by a high average power pulsed CO₂ laser. Micro droplet of Tin is injected as the plasma source. Present average power is more than 100W, and the scaling potential to over kW is described regarding several physical limits.
Astrophotonics: The Future of Astronomical Instrumentation

J. Bland-Hawthorn; 1
1. University of Sydney, Sydney, NSW, Australia.

Abstract (35 Word Limit): Astrophotonics has already made important contributions to astronomical and space instrumentation. The early developments built on technologies arising out of telecommunications but the field has begun to "give back" to traditional photonic fields.
Input and Output Coupling in Higher Order Mode Fibers

J. Demas; 1; L. Rishoej; 1; S. Ramachandran; 1;
1. Boston University, Boston, MA, United States.

Abstract (35 Word Limit): We convert higher order fiber modes into Gaussian beams using binary phase plates, and characterize the resulting $M^2$ and coupling efficiency to single-mode fiber (~64%). Reciprocally, the system is used to excite modes in multi-mode fiber with purity >13dB.
Abstract (35 Word Limit): We demonstrate higher-order-mode ($A_{\text{eff}} \sim 1800 \mu m^2$) propagation in a 100-μm-OD pure-silica fiber with a low-index polymer jacket commonly used for fiber-laser pump-guidance. This simple structure obviates the need for complex designs deemed necessary for realizing large-mode-area fibers.
High Energy Pulse Amplification in a Higher-Order Mode Fiber Amplifier with Axicon for Output Mode Conversion

J. W. Nicholson; 1; J. M. Fini; 1; A. DeSantolo; 1; P. S. Westbrook; 1; R. Windeler; 1; T. Kremp; 1; C. Headley; 1; D. DiGiovanni; 1;
1. OFS Laboratories, Somerset, NJ, United States.

Abstract (35 Word Limit): High energy, 700 μJ, one nanosecond pulses and 490 femtosecond, 50 μJ pulses are demonstrated in an Er-doped, higher-order-mode fiber amplifier. An axicon at the output enables efficient, nonlinearity-free reconversion to a low M² beam.
Microstructured suspended core fiber for cylindrical vector beams propagation

H. Ji; 1; Y. Ruan; 1; H. Ebendorff-Heidepriem; 1; W. Zhang; 1; S. Afshar; 1; T. Monro; 1;

1. the University of Adelaide, Adelaide, SA, Australia.

Abstract (35 Word Limit): A suspended core fiber based on lead silicate glass has been fabricated to generate doughnut beams. Preliminary results demonstrated a potential to be a good candidate for fiber based cylindrical vector beams generation and propagation.
Fano Resonance in Inhibited Coupling Kagome Fiber

A. Amsanpally; B. Debord; M. Alharbi; E. Ilinova; L. Vincetti; F. Gérôme; F. Benabid;
1. GPPMM group, Xlim Research Institute, UMR CNRS 7252, University of Limoges, France, Limoges, France.
2. Department of Engineering "Enzo Ferrari", University of Modena and Reggio Emilia, I-41125 Modena Italy, Modena, Italy.

Abstract (35 Word Limit): We report on the first experimental observation of Fano resonances in inhibited- coupling guiding Kagome fiber. A high-spectral resolution fiber-transmission showed the typical Fano asymmetric feature and a high dynamic-range near-field imaging resolved the core-cladding coupling.
Abstract (35 Word Limit): We report on design and fabrication of a new hypocycloid core-contour Kagome HC-PCF based on a triangular-like shaped core exhibiting smaller effective area and comparable confinement loss than previous hypocycloid core-contour Kagome fibers.
Abstract (35 Word Limit): We present a method for motion-picture femtophotography that performs continuous, single-shot, burst image acquisition without the need for repetitive measurements. We capture the dynamics of laser ablation and phonon propagation with the imaging method.
Ultrafast Imaging using Simultaneous Spatially and Temporally Resolved Wavelength-Multiplexed Photography (SSTWP)

T. Suzuki;  1;  F. Isa;  1;  L. Fujii;  1;  K. Hirosawa;  1;  F. Kannari;  1;
1. Keio university, Yokohama, Kanagawa, Japan.

Abstract (35 Word Limit): We propose and experimentally demonstrate the simultaneous spatially and temporally resolved wavelength-multiplexed photography device (SSTWP) with a diffractive optical element and a band-pass filter. Using frequency chirped pulses, we realize ultrafast imaging.
Imaging through permuted optical probes

B. Heshmat; I. Lee; H. Bedri; R. Raskar;
1. Massachusetts Institute of Technology, Cambridge, MA, United States.

Abstract (35 Word Limit): Using time of flight we have enabled an optical brush to calibrate itself and image with its randomly positioned fibers, this offers a flexible field of view and is intrinsically multi-spectral. Therefore, it has potential application for endoscopy, imaging in turbid media and near-field probing.
Coherent Diffraction Imaging with Absorption Contrast using Broadband Tabletop Soft X-ray Sources

R. L. Sandberg; 1; G. Cadenazzi; 2; B. K. McFarland; 1; N. r. Weisse-Bernstein; 1; M. C. Tyson; 1; G. Rodriguez; 1

1. Los Alamos National Laboratory, Los Alamos, NM, United States.
2. La Trobe University, Melbourne, VIC, Australia.

Abstract (35 Word Limit): We demonstrate nanometer scale resolution with absorption contrast without the need for scanning wavelength as is typically done. This is accomplished by applying polychromatic coherent diffraction imaging with a tabletop, ultrafast, broadband high harmonic source.
Probing Ultrafast Magnetization Dynamics using Bright Circularly Polarized High Harmonics

D. Zusin; 1, 3; R. Knut; 1, 3; P. Grychtol; 1; O. Kfir; 2; C. Gentry; 1; H. Nembach; 3; J. Shaw; 3; T. Silva; 3; A. Fleischer; 2, 4; O. Cohen; 2; H. C. Kapteyn; 1; M. M. Murnane; 1;

1. Department of Physics and JILA, University of Colorado and NIST, Boulder, CO, United States.
2. Solid State Institute and Physics Department, Technion, Haifa, Israel.
3. Electromagnetics Division, National Institute of Standards and Technology, Boulder, CO, United States.
4. Department of Physics and Optical Engineering, Ort Braude College, Karmiel, Israel.

Abstract (35 Word Limit): We generate bright circularly polarized high harmonics and use this new table-top light source to capture ultrafast magnetization dynamics for the first time by measuring laser-driven ultrafast demagnetization in a FeCr alloy.
Attenuated total reflectance infrared spectroscopy with chirped-pulse upconversion
T. Fuji; H. Shirai; C. Duchesne; Y. Furutani;
1. National Institutes of Natural Sciences, Okazaki, Aichi, Japan.

Abstract (35 Word Limit): Chirped-pulse upconversion technique has been applied to attenuated total reflectance infrared spectroscopy. The system was applied to observe the dynamics of exchanging process of buffers for biological tissues.
Real-Time Averaging of Repetitive Optical Waveforms by Non-Integer Factors based on Temporal Self-Imaging
L. Romero Cortés; 1; R. Maram Qartavol; 1; J. Azaña; 1;
1. INRS-EMT, Montreal, QC, Canada.

Abstract (35 Word Limit): We report a new method to divide the repetition-rate of a periodic waveform train by a fractional factor based on energy-preserving processes, implementing an equivalent real-time averaging of the input waveforms by the rate-division factor.
Extreme localization of light with femtosecond subwavelength rogue waves

C. Liu; 1; v. Ruben; 2; N. Rotenberg; 2; K. Kuipers; 2; T. Krauss; 3; A. Di Falco; 4; A. Fratalocchi; 1;

1. PRIMALIGHT, KAUST, Thuwal, Saudi Arabia.
2. Center for Nanophotonics, FOM Institute AMOLF, Amsterdam, Netherlands.
3. Department of Physics, University of York, York, United Kingdom.
4. School of Physics and Astronomy, University of St. Andrews, St. Andrews, United Kingdom.

Abstract (35 Word Limit): By using theory and experiments, we investigate a new mechanism based on spontaneous synchronization of random waves which generates ultrafast subwavelength rare events in integrated photonic chips.
Scaling High Peak Powers to High Average Powers – Opportunities in Innovation and Technology

J. L. Collier; 1
1. STFC Rutherford Appleton Laboratory, Didcot, Oxfordshire, United Kingdom.

Abstract (35 Word Limit): This talk will describe our programmes to scale diode pumped PW and parametric systems to high average power as a new basis for applications based on compact, efficient and reliable secondary sources.
Abstract (35 Word Limit): We report on a chirped-pulse regenerative thin-disk amplifier generating 220 mJ pulse energy at 1 kHz repetition rate with a pulse duration of 1.9 ps for pumping few-cycle optical parametric amplifiers (OPA).
Picosecond, 115 mJ Energy, 200 Hz Repetition Rate Cryogenic Yb:YAG Bulk-amplifier

M. Hemmer; 1; F. Reichert; 1; K. Zapata; 1; M. Smrz; 2, 1; A. Calendron; 1, 3; H. Cankaya; 1, 3; K. Hong; 4; F. Kaernter; 1, 3; L. E. Zapata; 1;
2. Hilase Center, Institute of Physics AS CR, Dolni Brezany, Czech Republic.
3. The Hamburg Center for Ultrafast Imaging and Department of Physics, Hamburg, Germany.

Abstract (35 Word Limit): We report on a compact, high-energy, cryogenically-cooled Yb:YAG bulk-amplifier delivering energies > 100 mJ at 200 Hz repetition rate with excellent beam quality and spectrum supporting 5-ps pulses.
100 mJ thin disk regenerative amplifier at 1 kHz as a pump for picosecond OPCPA

J. Novák; 1, 2; P. Bakule; 1; J. T. Green; 1; Z. Hubka; 1, 2; B. Rus; 1;
1. ELI-Beamlines, Institute of Physics ASCR, v. v. i. (FZU), Prague, Czech Republic.
2. Faculty of Nuclear Sciences and Physical Engineering, Czech Technical University, Prague, Czech Republic.

Abstract (35 Word Limit): Stable operation with energy >100mJ of the Yb:YAG thin disk regenerative amplifier at 1kHz has been achieved. The amplifier is being developed as a pump for the picosecond OPCPA of the L1 beamline at ELI-Beamlines.
145 W, 3 kHz Picosecond Amplifier for OPCPA Pumping

N. Bodnar; 1; B. Webb; 1; M. Chini; 1; L. Shah; 1; M. Richardson; 1;
1. University of Central Florida, Orlando, FL, United States.

Abstract (35 Word Limit): OPCPA laser systems require a high-quality, high-energy picosecond pump. The challenges of energy scaling in multi-kilohertz systems include thermal loads, depolarization and gain extraction. We address these issues for a high energy/average power MOPA System.
Final ID: STu4O.6

High Contrast Broadband Seeder for Multi-PW Laser System

O. Chalus; 1; A. Pellegrina; 1; O. Casagrande; 1; C. Derycke; 1; L. Boudjemaa; 1; C. Simon-Boisson; 1; S. Laux; 1; F. Lureau; 1; D. Sanchez; 2; J. Biegert; 2; J. Ahrens; 3; T. Binhammer; 3; O. Prochnow; 3; S. Rausch; 3;

1. Thales Optronique SA, Elancourt, France.
2. ICFO- The Institute of Photonics Sciences, Castelldefells, Barcelona, Spain.
3. VENTEON Laser Technologies GmbH, Hanover, Germany.

Abstract (35 Word Limit): A hybrid Ti:Sa CPA/BBO OPCPA system with a XPW filter inbetween the two has been developed to produce a broadband high contrast seeder of 10 mJ for the two 10 PetaWatt beamlines of ELI NP infrastructure.
Enhanced optical limiting effects in multiphoton absorbers using cylindrical vector beams

G. Bing; 1; J. Wu; 1; N. Sheng; 1; D. Liu; 1; Y. Cui; 1; 
1. Southeast University (China), Nanjing, Jiangsu, China.

Abstract (35 Word Limit): Optical limiting effects can be enhanced by designing nonlinear optical materials and by exploiting various limiting mechanisms. Here, we present the enhancement of optical limiting effects by manipulating the polarization distribution of the light field.
Abstract (35 Word Limit): We present the observation of several nonlinear effects in a two-crystal femtosecond optical parametric oscillator. Unusual parametric processes are observed when the total cavity length is detuned up to 7.3~mm within this synchronously pumped optical parametric oscillator.
Observing the effects of Time Ordering in Single Photon Frequency Conversion

N. Quesada; 1; J. E. Sipe; 1;
1. University of Toronto, Toronto, ON, Canada.

Abstract (35 Word Limit): We show how time ordering effects in single photon frequency conversion (FC) can be revealed by using the fact that the joint conversion amplitude in FC is a nonlinear function of the pump electric field.
The Effect of Orbital Angular Momentum on Nondiffracting Optical Pulses

M. Ornigotti, 1; C. Conti, 2, 3; A. Szameit, 1;
1. Friedrich-Schiller Univ IAP, Jena, Germany.
2. Institute of Complex Systems ISC-CNR, Rome, Italy.
3. Department of Physics, University Sapienza, Rome, Italy.

Abstract (35 Word Limit): We study the effects of orbital angular momentum on a nondiffracting optical pulse, and show that there exist a limit on the amount of OAM that a pulse can carry without modifying its temporal properties.
Abstract (35 Word Limit): We investigate the femtosecond dynamics of the spaser emission by combining ab-initio simulations and thermodynamic analysis. Interestingly, the emission is characterized by rotational evolution, opening to the generation of unidirectional emission from perfectly spherical nanoparticles.
Frequency Comb Generation on a Silicon Chip
A. Rogov; E. Narimanov;
1. Purdue University, West Lafayette, IN, United States.

Abstract (35 Word Limit): We present a new approach to achieving frequency comb generation on a silicon chip by means of optical switching in microring resonators.
A simple method for the measurement of the optical pulse width on-site the mass spectrometer
T. Imasaka; 1; A. Hamachi; 1; T. Okuno; 1; T. Imasaka; 1
1. Kyushu University, Fukuoka, Fukuoka, Japan.

Abstract (35 Word Limit): The laser pulse width was measured on-site the mass spectrometer by scanning a dispersion in the pulse compressor. A pulse width of 49 fs measured was close to 35 fs calculated from the spectrum.
Radiation Pressure Induced Nonlinear Optofluidics in Liquid Whispering Gallery Mode Resonator

A. Lee; 1; P. Zhang; 2; S. Jung; 2; Y. Xu; 1;

1. Electrical and Computer Engineering, Virginia Tech, Blacksburg, VA, United States.
2. Biomedical Engineering and Mechanics, Virginia Tech, Blacksburg, VA, United States.

Abstract (35 Word Limit): We analyze a nonlinear optofluidic process produced by radiation pressure of a high quality factor whispering gallery mode in a liquid droplet. Using liquid properties that are experimentally attainable, we find that such a process may lead to photon-photon interaction at single photon energy level.
Correlated Study of Terahertz Pulse Generation and Plasma Density During Two-Color Filamentation in Air

J. Zhao; 1; Y. Zhang; 2; T. Zeng; 1; J. Yang; 1; W. Liu; 1;
1. Nankai University, Tianjin, Tianjin, China.
2. Shanghai Advanced Research Institute, Shanghai, China.

Abstract (35 Word Limit): The variation of plasma density, which is sensitive to the BBO crystal rotation angle, is systematically investigated in this work. According to our results, the well-known photocurrent model could not reproduce the characteristics of the THz pulse generated in both polarization directions.
Internal Conical Diffraction of a Top-hat Beam

R. T. Darcy; J. G. Lunney; J. Donegan; 1
1. Trinity College Dublin, Dublin, Ireland.

Abstract (35 Word Limit): The evolution of a beam undergoing internal conical diffraction exhibits a sensitive dependence on the spatial profile of the incident beam. We investigate the case of a top-hat incident beam undergoing conical diffraction.
Generation of Versatile Vortex Linear Light Bullet

X. Huang; 1; Q. Cao; 2, 3; H. Li; 1; P. Li; 1; A. Chong; 1, 2;
1. University of Dayton, Dayton, OH, United States.
2. Deutsches-Elektronen Synchrotron, Hamburg, Germany.
3. Department of Physics, University of Hamburg, Hamburg, Germany.

Abstract (35 Word Limit): We demonstrate a versatile vortex linear light bullet as a vortex Airy-Bessel wave packet for the first time. Its non-varying three-dimensional (3D) vortex field in linear propagation is verified by 3D measurements.
Photon pair generation in leaky coupled-resonator optical waveguides via spontaneous four-wave mixing
M. Kamandar; M. M. Dignam;
1. Queen's University at Kingston, Kingston, ON, Canada.

Abstract (35 Word Limit): A fully quantum mechanical formalism is developed to calculate photon pair detection probabilities in leaky coupled-resonator optical waveguide. Using our formalism we have studied the effect of loss on pair evolution as well as higher order pair generations in the system.
Final ID: JTu5A.13

Surface enhanced nonlinear optics using lithography-free metasurfaces
Q. Gan; 1; K. Liu; 1; T. Zhang; 1; D. Ji; 1; J. Murphy; 1; H. Song; 1; T. Thomay; 1; K. Shi; 2; A. Cartwright; 1;
1. State University of New York at Buffalo, East Amherst, NY, United States.
2. Peking University, Beijing, China.

Abstract (35 Word Limit): We demonstrate a strong enhancement of second harmonic generation based on a three-layered super absorbing metasurface consisting of an ultrathin spacer layer sandwiched by an array of random metallic nanoparticles and a metal ground plate.
Measuring Orbital Angular Momentum of Light With a Single, Stationary Lens

S. N. Alperin; 1; M. E. Siemens; 1; R. D. Niederriter; 2; J. Gopinath; 3;
1. Department of Physics and Astronomy, University of Denver, Denver, CO, United States.
2. Department of Physics, University of Colorado, Boulder, Boulder, CO, United States.

Abstract (35 Word Limit): We demonstrate that average orbital angular momentum (OAM) can be measured with a simplified twist parameter measurement technique. This technique uses a stationary apparatus composed of only a cylindrical lens and a CCD.
Coherent Artifact Study of Multiphoton Intrapulse Interference Phase Scan

M. Rhodes; R. Trebino;
1. Georgia Institute of Technology, Atlanta, GA, United States.

Abstract (35 Word Limit): We study intensity-and-phase measurements of unstable trains of pulses using multiphoton intrapulse interference phase scan (MIIPS). MIIPS retrieves only a coherent artifact and so can under-estimates pulse lengths, but wider measured traces can indicate instability.
Parity-Time Anti-Symmetric Parametric Amplifier

A. A. Sukhorukov; 1; D. A. Antonosyan; 1; A. S. Solntsev; 1;
1. Nonlinear Physics Centre, Research School of Physics and Engineering, Australian National University, Canberra, ACT, Australia.

Abstract (35 Word Limit): We predict that directional coupler of quadratically nonlinear and lossy waveguides can perform ultrafast signal switching and parametric amplification, using the pump-controlled breaking of the parity-time anti-symmetry associated with nonlinear wave mixing.
Spectral analysis of the optical pulses produced by the interaction of optical and THz pulses in a ZnTe crystal
M. Cornet; 1; J. Degert; 1; E. Abraham; 1; E. FREYSZ; 1, 2;
1. Université de Bordeaux, Talence Cedex, France.
2. LOMA, Université de Bordeaux, UMR 5798, CNRS, 33405 Talence Cedex, France.

Abstract (35 Word Limit): The spectra of the optical pulses generated during the interaction of THz and optical pulses in a ZnTe crystal indicate that, besides sum and difference frequency mixing, spectral components associated to cross-phase modulation are produced.
Waves of constant intensity and their instabilities in non-Hermitian photonic structures

K. Makris; 2, 1; Z. Musslimani; 3; D. N. Christodoulides; 4; S. Rotter; 2

1. Princeton University, Princeton, NJ, United States.
2. Institute for Theoretical Physics, Vienna University of Technology, Vienna, Austria.
3. Mathematics, Florida State University, Tallahassee, FL, United States.

Abstract (35 Word Limit): We study, for the first time, the modulation instability of a new class of constant intensity solutions (valid also for linear non-hermitian media) of nonlinear Schrödinger equation in the presence of a complex optical potential.
Composite multi-vortex diffraction-free beams and van Hove singularities in honeycomb lattices

N. K. Efremidis; 1; V. Paltoglou; 1; Z. Chen; 2;

1. Department of Mathematics and Applied Mathematics, University of Crete, Heraklion, Crete, Greece.
2. Department of Physics and Astronomy, San Francisco State University, San Francisco, CA, United States.

Abstract (35 Word Limit): We find that honeycomb lattices support diffraction-free multi-vortices above the van-Hove singularity. Exact solutions for the spinor components are obtained in the Dirac limit. Right at the singularity the solutions become infinite extend stripes.
Hybrid Chalcogenide Microstructured Optical Fiber for Mid-infrared Soliton Self-frequency Shift
T. Cheng; 1; Y. Kanou; 1; X. Xue; 1; D. Deng; 1; L. Zhang; 1; L. Liu; 1; M. Matsumoto; 2; H. Tezuka; 2; T. Suzuki; 1; Y. Ohishi; 1;
1. ofmlab, Nagoya, Aichi, Japan.
2. Furukawa Denshi Co., Ltd., Tokyo, Japan.

Abstract (35 Word Limit): A hybrid AsSe\textsubscript{2}-As\textsubscript{2}S\textsubscript{5} microstructured optical fiber is fabricated by the rod-in-tube drawing technique. Soliton self-frequency shift with a soliton center wavelength from ~2.986 to 3.419 mm is observed at the pump wavelength of ~2.8 mm.
Tunable Pulse Compression by Nonlinear Cross-Phase Modulation using Cascaded Electro-Optic Effects

G. Li; 1; H. Jiang; 1; X. Chen; 1; Y. Chen; 1;
1. Shanghai Jiaotong University, Shanghai, Shanghai, China.

Abstract (35 Word Limit): We demonstrate the first pulse compression induced by cross-phase modulation through cascading Pockels effects. It provides first practically useful solutions for enhanced effective third-order nonlinearity independent of light intensity.
Second Harmonics of Phase Locked Laser Arrays

C. Tradonsky; 1; N. Davidson; 1; V. Pal; 1; A. A. Friesem; 1; M. Nixon; 1; E. Ronen; 1; R. Chriki; 1;
1. Weizmann Institute of Science, Rehovot, Israel.

Abstract (35 Word Limit): Second harmonic generation in coupled laser arrays is exploited to convert out-of-phase lasers into in-phase lasers and reveal hitherto unknown properties of some laser array geometries.
Tapered Seven-core Photonic Crystal Fiber for Flat Supercontinuum Generation

X. Luo; 1; J. Peng; 1; L. Chen; 1; L. Yang; 1; N. Dai; 1; H. Li; 1; J. Li; 1;
1. Wuhan National Lab for Optoelectronics, Wuhan, Hubei, China.

Abstract (35 Word Limit): We report the broadband supercontinuum (SC) generation in a tapered seven-core photonic crystal fiber (PCF). The introducing of a section of taper waist dramatically alters the group velocity and making the SC flatter.
Mechanism of THz Generation from Graphite

Y. Yin; T. Ye; Y. E; Y. Yang; S. Meng; L. Wang;
1. Cooperative Innovation Centre of Terahertz Science, Chengdu, China.
2. Central University for Nationalities, Beijing, China.
3. Institute of Physics, CAS, Beijing, China.

Abstract (35 Word Limit): We employ an electric gating method to modulate the surface field of graphite and study the THz generation. The result reveals the mechanism, the similarities and differences to semiconductors, and the effective mass difference of electrons and holes.
Quantum Nanoantennas for Making Nonlinear and Self-Modulatable Metasurface

P. Chen; M. Farhat;

2. Wayne State University, Detroit, MI, United States.

Abstract (35 Word Limit): We investigate the plasmonic nanodipole antenna with sub-microscopic nanogap. Relevant quantum conductivities, including linear and nonlinear components, are observed due to the photon-assisted quantum tunneling, realizing optical nano-radiators with enhanced amplitude and frequency modulations.
All Periodically-poled Crystals Based Source of Tunable, Continuous-wave, Single-frequency, Ultraviolet Radiation

A. A.; 1, 2; A. Chaitanya N.; 1, 2; R. Singh; 1; G. Samanta; 1;
1. Physical Research Laboratory, Ahmedabad, GJ, India.
2. Indian Institute of Technology-Gandhinagar, Ahmedabad, India.

Abstract (35 Word Limit): We report on all periodically-poled crystals based singly-resonant optical parametric oscillator (SRO) generating continuous-wave, single-frequency, tunable UV radiation with maximum output power of 336mW in 18.5 MHz line-width at 399.2nm. It has tunability of 18nm.
A Novel Graphene-Silicon Hybrid Waveguide for Nonlinearity Enhancement in Near-Infrared Band

Q. Jin; J. Lu; Q. Yan; X. Li; Q. Gao; S. Gao; 1

1. Zhejiang University, Hangzhou, Zhejiang, China.

Abstract (35 Word Limit): A novel graphene-silicon hybrid waveguide is proposed to enhance the nonlinearity in near-infrared band using a MoO$_3$ overlayer for light confinement. A four-wave mixing efficiency of -27.3 dB is numerically obtained in a 25-μm-long waveguide.
Chemical Vapor Deposition (CVD) of Graphene for Four-Wave-Mixing (FWM) Based QPSK Wavelength Conversion

X. Hu; A. Wang; M. Zeng; C. Gui; L. Fu; J. Wang;

1. Wuhan National Laboratory for Optoelectronics, Huazhong University of Science & Technology, Wuhan, Hubei, China.
2. College of Chemistry and Molecular Science, Wuhan University, Wuhan, China.

Abstract (35 Word Limit): We experimentally demonstrate FWM based wavelength conversion of a 10 Gbaud/s QPSK signal with graphene grown by CVD method. The observed OSNR penalty is around 1 dB for QPSK wavelength conversion.
Nonlinear Optical Properties Of A Graphene-Polyvinyl Alcohol Composite From 1550 nm To 2400 nm
G. Demetriou; 1  F. Biancalana; 1  H. T. Bookey; 2  A. Kar; 1
1. Institute of Photonics and Quantum Sciences, Heriot Watt University, Edinburgh, Scotland, United Kingdom.
2. Fraunhofer CAP, Glasgow, United Kingdom.

Abstract (35 Word Limit): The nonlinear optical properties of a graphene-Polyvinyl alcohol (G-PVA) composite are studied in the femtosecond temporal regime by employing the Z-scan technique. The nonlinear coefficients $\beta_{\text{eff}}$, $I_{\text{sat}}$ and $n_2$ are calculated via numerical fitting.
1.2 W-average-power, Yb-fiber-pumped, Picosecond Ultraviolet Source at 355 nm Based on BiB$_3$O$_6$

S. Chaitanya Kumar; 1; E. Sanchez Bautista; 1; M. Ebrahim-Zadeh; 1, 2;
1. ICFO - The Institute of Photonic Sciences, Castelldefels, CAT, Spain.
2. Institucio Catalana de Recerca i Estudis Avancats (ICREA), Passeig Lluis Companys 23, Barcelona, Spain.

Abstract (35 Word Limit): We report a compact, stable, 79.5-MHz, Yb-fiber-based, picosecond UV source generating 1.2-W of power at 355 nm with a stability better than 0.4% rms over 3 hours, and pointing stability <45 µrad in good spatial-beam-quality.
Kerr nonlinearity of Thulium-doped fiber near 2 μm

S. Kharitonov; 1; A. Billat; 1; L. Zulliger; 1; S. Cordette; 1; A. Vedadi; 1; C. Brès; 1;
1. STI-IEL, Photonic Systems Laboratory (PHOSL), EPFL, Lausanne, Vaud, Switzerland.

Abstract (35 Word Limit): The nonlinear coefficient and group velocity dispersion of a thulium-doped fiber near 2μm are evaluated via four-wave mixing. Nonlinearity of thulium-doped fiber can be used for the design of doped-fiber lasers in this spectral region.
Impact of Higher-Order Dispersion on the Performance of a Kerr Frequency Comb as Affected by the Generated Dispersive Wave

C. Bao; L. Zhang; Y. Yan; A. Matsko; G. Xie; L. Li; L. Kimerling; J. Michel; L. Maleki; a. willner;

1. Department of Electrical Engineering, University of Southern California, Los Angeles, CA, United States.
2. Department of Materials Science and Engineering, Massachusetts Institute of Technology, Cambridge, MA, United States.
3. OEvaves Inc., Pasadena, CA, United States.

Abstract (35 Word Limit): The dispersive wave generated from the higher-order dispersion perturbation is found to limit the Kerr comb performance in microring resonators. A negative fourth-order dispersion can potentially reduce the effect of dispersive wave.
1 MW peak power at 266 nm in nonlinear YAl$_3$(BO$_3$)$_4$ (YAB) single crystal

L. Zheng; $^1$; j. ren; $^2$; P. Loiseau; $^2$; G. Aka; $^2$; T. Taira; $^1$; D. Rytz; $^3$

1. Institute for Molecular Science, Okazaki 444-8585, Aichi, Japan.
2. PSL Research University, Institute de Recherche de Chimie Paris IRCP, Chimie ParisTech, Paris 75005, France.
3. FEE GmbH, 55743 Idar-Oberstein, Germany.

Abstract (35 Word Limit): YAl$_3$(BO$_3$)$_4$ crystal enables the highest UV power of 1.8 MW and shortest pulse of 118 ps with power conversion efficiency of 37 % at 266 nm by using LBO crystal and Nd:YAG/Cr:YAG microchip laser.
Phase-matching properties of GaS$_{0.4}$Se$_{0.6}$ for difference-frequency generation in the 100.4-1030.6μm range

N. Umemura; K. Kato; V. Petrov;

1. Chitose Inst of Science and Technology, Chitose, Hokkaido, Japan.
2. Nonlinear optics and ultrafast spectroscopy, Max-Born Institute, Berlin, Germany.

Abstract (35 Word Limit): This paper reports the phase-matching properties of GaS$_{0.4}$Se$_{0.6}$ for DFG between a Nd:YAG laser and a Nd:YAG laser-pumped BBO/OPO in the 100.4-1030.6μm range and refines the Sellmeier equations for GaS$_x$Se$_{1-x}$ (x=0, 0.4, and 1.0).
Real-time detection of formaldehyde using PPLN-based mid-infrared laser for study of sick house syndrome

M. Asobe; Y. Takemiya; S. Rin; Y. Matsuya; T. Aoki; A. Katoh; R. Someya; A. Tokura; H. Takenouchi; S. Yamaguchi;

1. Tokai University, Hiratsuka, Kanagawa, Japan.
2. NTT Device Technology Labs, Atsugi, Kanagawa, Japan.

Abstract (35 Word Limit): We studied the detection of formaldehyde using a compact 3-mm DFG light source based on a PPLN waveguide. Single-pass DFG of laser diodes enables wavelength modulation spectroscopy and real-time detection.
Abstract (35 Word Limit): A novel LiNbO$_3$ 2D aperiodic nonlinear photonic crystal was constructed to work simultaneously as a dual-wavelength Q-switch and a sum frequency generator in a Nd:YVO$_4$ laser. ~531-W peak-power orange light was obtained with this laser.
Dynamic Instabilities of Self-Excited Oscillation in Optical Ring Resonator

J. Huang;\textsuperscript{1,2}; B. Dong;\textsuperscript{2}; H. Cai;\textsuperscript{3}; Y. Gu;\textsuperscript{3}; J. Wu;\textsuperscript{1}; T. Chen;\textsuperscript{1}; A. LIU;\textsuperscript{2};

1. Xian Jiaotong University, Xian, China.
2. Nanyang Technological University, Singapore, Singapore.

Abstract (35 Word Limit): We demonstrated the nonlinear dynamic instabilities in the self-excited oscillations in the silicon ring resonators. A hysteresis loop is observed both in forward and backward tuning of the input wavelength and the input power.
Low-threshold collinear parametric Raman comb generation in calcite

V. Kubecek; M. Jelinek; H. Jelinkova; S. Smetanin;
1. Czech Technical University in Prague, Prague, Czech Republic.
2. Prokhorov General Physics Institute of Russian Academy of Sciences, Moscow, Russian Federation.

Abstract (35 Word Limit): The optimal conditions of low-threshold collinear parametric Raman-comb generation in calcite from the 477-nm second anti-Stokes to 692-nm fourth Stokes component under 20-ps laser excitation at 532-nm are demonstrated in good agreement with theoretical model.
High-power silica-based Raman fiber amplifier at 2147 nm

J. Liu; F. Tan; H. Shi; P. Wang;
1. Beijing University of Technology, Beijing, Beijing, China.

Abstract (35 Word Limit): We demonstrated a silica-based Raman all-fiber amplifier delivering as much as 14.3W of output power at a wavelength of 2147nm. The conversion efficiency for the Raman fiber amplifier was 38.5% from 1963nm to 2147nm.
Raman scattering and Kerr shock induced breather soliton in Kerr frequency comb generation

C. Yang; 1; C. Bao; 1; L. Zhang; 2; L. Kimerling; 2; J. Michel; 2;
1. Tsinghua Univ., United States.
2. MIT, Boston, MA, United States.

Abstract (35 Word Limit): We found Raman scattering and Kerr shock tend to induce breather soliton in Kerr frequency comb generation. They will also degrade the coherence property of the excited breather soliton.
Spatial and Spectral Ellipsometry of Light Filaments

L. Arissian; 1, S. Rostami; 1, J. Diels; 1,
1. University of New Mexico, United States.

Abstract (35 Word Limit): Measuring the continuum polarization against pulse ellipticity of a laser filament is introduced as a new paradigm for quantifying nonlinearities in filamentation such as ionization paths, molecular alignment, nonlinear index and field intensity.
Abstract (35 Word Limit): We present the concept of broadband phase-matching for second-harmonic generation with a dielectric-loaded surface plasmon polariton waveguide. Nonlinear coupled mode analysis is conducted to evaluate the broadband response and the conversion efficiency of second-harmonic generation.
Chip-based frequency conversion by four-wave-mixing Bragg scattering in Si$_3$N$_4$ microrings
Q. Li; $^2$; M. I. Davanco; $^2$; K. Srinivasan; $^2$;
2. National Institute of Standards and Technology, Gaithersburg, MD, United States.
2. Maryland NanoCenter, Univ. of Maryland, College Park, MD, United States.

Abstract (35 Word Limit): We demonstrate frequency conversion via four-wave-mixing Bragg scattering in Si$_3$N$_4$ microrings. The intra-chip conversion efficiency in 40-μm-radius microrings is -17 dB, a >40 dB increased compared to 1.2-cm-long Si$_3$N$_4$ waveguides under equal pumping conditions.
Full (3+1)D Split-Step Technique for Spatial Mode Analysis of White Light Generation in Bulk Kerr-Media

H. Zia; 1; A. Choudhuri; 1; I. Hartl; 2; R. Miller; 1, 3; A. Ruehl; 2;

1. Max Planck Institute for the Structure and Dynamics of Matter, Hamburg, Germany.
2. Deutsches Elektronen-Synchrotron (DESY), Hamburg, Germany.
3. Departments of Chemistry and Physics, University of Toronto, Toronto, ON, Canada.

Abstract (35 Word Limit): We present a novel full (3+1)D split-step numerical model for white-light generation including all major physical effects. We present a detailed spatial mode analysis and derive imaging systems to re-shape the spatial distribution.
Silicon Waveguide based Two-Input Simultaneous Quaternary Hybrid Doubling/Subtraction (2A-B, 2B-A) Using Degenerate FWM and QPSK

C. Gui; J. Wang;

1. Wuhan National Laboratory for Optoelectr, Wuhan, Hubei, China.

Abstract (35 Word Limit): By exploiting two degenerate four-wave mixing in a silicon waveguide and quadrature phase-shift keying (QPSK) signals, we experimentally demonstrate two-input (A, B) simultaneous optical quaternary hybrid doubling/subtraction (2A-B, 2B-A).
Efficient and ultra-compact computational metamaterials for integrated photonics and free-space applications

B. Shen; 1; P. Wang; 1; R. C. Polson; 1; R. Menon; 1;
1. University of Utah, Salt Lake City, ut, United States.

Abstract (35 Word Limit): We applied nonlinear optimization to design metamaterials as free-space polarizers, integrated fiber couplers, polarization splitter/rotators, etc. Such devices exhibit at least comparable or better performance than their conventional counterparts, but occupy a much smaller size.
Photodetector based on lateral graphene p-n junction created by electron-beam irradiation

X. Yu; Q. Wang;

1. School of Electrical and Electronic Engineering, OPTIMUS, Photonics Centre of Excellence, 50 Nanyang Ave., 639798, Singapore, Singapore.
2. Centre for Disruptive Photonic Technologies, Nanyang Technological University, 21 Nanyang Link, 637371, Singapore, Singapore.

Abstract (35 Word Limit): Graphene p-n junctions fabricated by electron irradiation method that induces n-type doping in the intrinsic p-type graphene are demonstrated. Photoresponse was obtained because the photoexcited electron-hole pairs can be separated in the graphene p-n junction by the built-in potential.
Abstract (35 Word Limit): Using FDTD and band structure simulations, we demonstrate efficient confinement of TE radiation in high-Q optical-cavities and low-loss waveguides in planar hyperuniform-disordered architectures based on a design strategy that has potential to be a general purpose platform for optical microcircuits.
Tunable Spectral Engineering of Coupled Silicon Microcavities

M. C. Souza; 1; L. A. Barea; 1; G. Wiederhecker; 1; A. A. von Zuben; 1; N. C. Frateschi; 1;
1. Universidade Estadual de Campinas, Campinas, SP, Brazil.

Abstract (35 Word Limit): We demonstrate the generation and control of optical resonance mode-splitting arising from a single-notch resonances using coupled silicon microring resonators with electrically controlled counter-propagating mode excitation.
Efficiency Improvement of Crystalline-Si Solar Cell Using the Combination of Europium Doped Silicate Phosphors

Down Shifting and SiO₂ Antireflective Coating

G. Yang; W. Ho; C. Yeh; R. Sue; Y. She; C. Hu; Y. Deng;
1. National Taipei University of Technology, Taipei, Taiwan.

Abstract (35 Word Limit): Impressive efficiency enhancement of 15.38% of crystalline-silicon solar-cell with Eu-doped silicate-phosphors and SiO₂-layer using spin-on technique is demonstrated. Reflectance, external quantum efficiency, and photovoltaic I-V characteristics are used to examine the down-shifting effectiveness.
High-index-contrast Grating Mirrors Implemented on the Polysilicon Gates of a Standard Bulk CMOS Process
Y. Hung; 1; M. Hsieh; 1;
1. National Sun Yat-sen University, Taipei, Taiwan.

Abstract (35 Word Limit): High-index-contrast grating implemented in bulk CMOS can provide 95% surface reflectivity with 50 nm bandwidth for TE polarization. Higher reflectivity is achievable by creating air cavities beneath HCGs to avoid the optical leakage to the substrate.
A Compact Polarization Beam Splitter Based on Augmented Low Index Guiding Structure

X. Sun; M. Z. Alam; J. Aitchison; M. Mojahedi;
1. University of Toronto, Toronto, ON, Canada.

Abstract (35 Word Limit): A compact broadband polarization beam splitter based on the augmented low index guiding scheme is proposed. TM and TE modes are separated in two layers with the TM mode confined in the lower index layer.
Highly Compact Polarization Insensitive Strip-Slot Waveguide Mode Converter

Q. Deng; Q. Yan; L. Liu; X. Li; Z. Zhou;

1. State Key Laboratory of Advanced Optical Communication Systems and Networks, School of Electronics Engineering and Computer Science, Peking University, Beijing, Beijing, China.

Abstract (35 Word Limit): A polarization insensitive strip-slot waveguide mode converter with large fabrication tolerance is proposed based on symmetric multimode interference (MMI). This converter can achieve efficient strip-slot waveguide coupling (TE:94.9%, TM:94.6%) while the dimensions are only 1.18μm×3μm.
Triple Metal-Film Subwavelength Gratings on Both Sides of a Silicon Substrate for Mid-Infrared polarizers

K. Shiraishi; 1; S. Higuchi; 1; H. Kakinuma; 1; J. Shimizu; 1; H. Yoda; 1; H. Ohno; 1;
1. Utsunomiya University, Utsunomiya, Tochigi, Japan.

Abstract (35 Word Limit): Triple metal-film subwavelength gratings on both sides of a thin silicon substrate are fabricated for polarizers in the mid-infrared. An extinction ratio of higher than 30dB together with insertion loss of 2 dB is obtained.
Nanobump microresonators at the fiber surface

M. I. Sumetsky; L. A. Kochkurov;

1. Aston University, Birmingham, United Kingdom.

Abstract (35 Word Limit): It is shown that an asymmetric nanometer-high bump at the fiber surface causes strong localization of whispering gallery modes. Our theory explains and describes the experimentally observed nanobump microresonators in Surface Nanoscale Axial Photonics.
Surface Mode in Photonic Crystal Fishbone Nanocavity for Highly Efficient Optical Sensing and Trapping

T. Lu; 1; P. Lee; 1;
1. National Chiao Tung University, Hsinchu, Taiwan.

Abstract (35 Word Limit): A novel one-dimensional photonic crystal fishbone (FB) with surface wave is proposed. Via designing high quality FB nanocavity, high sensitivity for optical sensing and strong optical force for optical trapping in fluidics can be obtained.
Abstract (35 Word Limit): We design dielectric meta-reflectarrays to realize Bessel beams generation and OAM multicasting. The purities of generated Bessel beams are higher than 0.93 and the crosstalks between the multicasted OAM channels and their neighboring ones are less than -14 dB.
Microring resonator design with improved quality factors using quarter Bezier curves

H. Pishvai Bazargani; J. Azaña; L. Chrostowski; J. Flueckiger;
1. INRS, Montreal, QC, Canada.
2. UBC, Vancouver, BC, Canada.

Abstract (35 Word Limit): A new design concept to improve the quality factor of ring resonators using quarter Bezier curves has been investigated. Quality factor improvements by 3 times have been achieved for a 3-µm radius ring resonator.
Optimized emission in nanorod arrays through quasi-aperiodic inverse design

P. Anderson; 1; M. Povinelli; 1;
1. University of Southern California, EE, Los Angeles, CA, United States.

Abstract (35 Word Limit): We investigate a new class of quasi-aperiodic nanorod structures for emission enhancement. Using inverse design we identify one optimized structure which produces a 1.48X enhancement in extracted power relative to a periodic array.
Lasing in optimized two dimensional iron-nail-shape nanorod photonic crystals

S. KWON; 1; S. Moon; 1; J. Choi; 2; S. Jang; 2; K. Jeong; 2; H. Park; 2; J. Yang; 1;
1. KONGJU NATIONAL UNIVERSITY, Cheonan, Korea (the Republic of).
2. Korea University, Seoul, Korea (the Republic of).

Abstract (35 Word Limit): We demonstrated lasing at the band edges in optimized two-dimensional iron-nail-shape nanorod photonic crystals by optical pumping at room temperature. The size of the nanorod gradually increased toward the edge of the pattern in order to reduce the optical loss in horizontal direction.
Optomechanical Crystal Cavity with Ultra-small Effective Motion Mass based on Split-nanobeam Structure

Y. Zhang; 1; K. Cui; 1; Z. Huang; 1; X. Feng; 1; Y. Huang; 1; F. Liu; 1; W. Zhang; 1;

1. Tsinghua University, Beijing, Beijing, China.

Abstract (35 Word Limit): A split-nanobeam optomechanical crystal cavity is proposed. By adjusting the split width, an ultra-small effective motion mass as small as 5.2fg is realized with a high mechanical frequency of 7.55GHz.
Mode Conversion Based on Dielectric Metamaterial in Silicon

D. Ohana; 1; B. Desiatov; 1; N. Mazurski; 1; U. Levy; 1;
1. The Hebrew University of Jerusalem, Jerusalem, Israel.

Abstract (35 Word Limit): We design, analyze and experimentally demonstrate a novel mode converter in silicon waveguide based on a graded index co-directional grating coupler. Numerical simulations results and microscope images of modes' far field are presented and discussed.
Design of Integrated Circularly Polarized Orbital Angular Momentum (OAM) Beam Emitter Using Microring with Interleaved Tailored Angular Gratings

J. Ma; 1 J. Du; 1 X. Hu; 1 J. Wang; 1
1. Wuhan National Laboratory for Optoelectr, Wuhan, Hubei, China.

Abstract (35 Word Limit): By exploiting microring with interleaved tailored angular gratings, we present a simple design of integrated circularly polarized orbital angular momentum (OAM) beam emitter. The Stokes parameter $S_3$ is above 0.97 with high OAM purity of 99.84%.
Multifunctional, tunable and wideband all-fiber filter based on θ shaped microfiber resonator

Z. Xu; Q. Sun; B. Li; Y. Luo; W. Lu; H. Luo; D. Liu; L. Zhang;
1. Huazhong Univ of Science and Technology, Wuhan, Hubei, China.
2. Aston University, Birmingham, United Kingdom.

Abstract (35 Word Limit): A compact θ shaped microfiber resonator for multifunctional, tunable and wideband filter is proposed. The filtering performance of reflection and transmission spectra depending on coupling coefficients and cavity length is theoretically investigated and experimentally demonstrated.
Photocurrent Density Enhancement of a III-V Inverse Quantum Dot Intermediate Band Gap Photovoltaic Device

J. Kim; 1; X. Chen; 1; X. Li; 1; J. Coleman; 1;
1. University of Illinois, Urbana, IL, United States.

Abstract (35 Word Limit): We measured the photocurrent density of quantum well (QW) and inverse quantum dot (IQD) photovoltaic devices. The photocurrent per unit area of IQD was enhanced as the carrier confinement became stronger with increasing diameter.
Plasmonic Mode-Evolution-based Polarization Rotator and Coupler
S. Kim, 1; M. Qi, 1;
1. School of Electrical and Computer Engineering and Birck Nanotechnology Center, Purdue University, West Lafayette, IN, United States.

Abstract (35 Word Limit): A plasmonic mode-evolution-based device rotates the TE mode in silicon waveguide and couples it to the hybrid plasmonic mode with a 92% peak coupling factor and -3 dB bandwidth of over 500 nm at near infrared.
Aluminum Micro-Patch Arrays for Highly-Sensitive Vibration Spectroscopy

D. Choi; 1; B. Luther-Davies; 1; V. R. Shrestha; 2; S. Lee; 2

1. The Australian National University, Canberra, ACT, Australia.
2. Kwangwoon University, Seoul, Korea (the Republic of).

Abstract (35 Word Limit): We demonstrate collective plasmonic resonance from aluminum micro-patch arrays patterned on slide glass. This cost-efficient device can be applied in extremely sensitive vibration spectroscopy.
Abstract (35 Word Limit): Plasmonic dark modes of gold nanoantennas are observed in evanescent waves. Dark mode not only has a higher extinction coefficient but also achieves higher sensitivity to the surrounding environment. The sensitivity of the dark mode is 4.84 times that of the bright mode in figure of merit.
Optionally focusing with plasmonic vortex lens

H. Zhou; J. Dong; Y. Zhou; X. Zhang;
1. Wuhan National Lab for Optoelectronics, Wuhan, China.

Abstract (35 Word Limit): We present a specific plasmonic vortex lens (PVL) structure to focus the surface plasmon polariton wave on an arbitrary spatial position.
Ultrathin High Efficiency Photodetectors Based on Near Field Enhanced Optical Absorption
M. Auslender;¹; M. Zohar;¹; S. Hava;¹;
1. Ben Gurion University of the Negev, Beersheba, Israel.

Abstract (35 Word Limit): Ultrathin photodetectors, comprising a thin film optical absorber between two transparent layers near a quarter-wave high refractive index one and subwavelength grating, are designed to attain ~100% peak spectral absorbance. Near-field enhancement mechanism of the absorption is demonstrated.
High visibility on-chip quantum interference of single surface plasmons

Y. Cai; 1; M. Li; 1; X. Ren; 1; C. Zou; 1; X. Xiong; 1; H. Lei; 1; B. Liu; 1; G. Guo; 1; G. Guo; 1;
1. Univ of science and technology of China, Hefei, Anhui, China.

Abstract (35 Word Limit): In this work, the on-chip quantum interference of two single surface plasmons was achieved and the high visibility (greater than 90%) proves the bosonic nature of single plasmons. The effect of intrinsic losses in plasmonic waveguides is also discussed.
Abstract (35 Word Limit): We propose a nanophotonic waveguide modulator with bismuth ferrite as a tunable material. Due to near-zero losses in bismuth ferrite, modulation with up to 20 dB/μm extinction ratio and 12 μm propagation length is achieved.
Optical Modulation of Graphene-Cladded Silicon Photonic Crystal Cavity
L. Gan; 1; Z. Shi; 1; T. Xiao; 1; H. Guo; 1; Z. Li; 1;
1. CAS Institute of Physics, Beijing, Beijing, China.

Abstract (35 Word Limit): We demonstrate all-optical tuning of a graphene-cladded silicon photonic crystal cavity. A continuous-wave laser is focused on the cavity and a large resonant shift is observed. Several physical reasons causing the shift are discussed in details.
Plasmonic Enhancement of Eu:Y₂O₃ Luminescence By Al Percolated Layer

N. Abdellaoui; ¹; A. Pereira; ¹; A. Berthelot; ¹; B. Moine; ¹; N. Blanchard; ¹; A. Pillonnet; ¹;
¹. Institut Lumière Matière, Villeurbanne, France.

Abstract (35 Word Limit): We propose the design of plasmonic nanostructure for Eu³⁺ luminescence enhancement. We control our crystalline structure with a nanosized precision thanks to Eu³⁺ crystalline probe and we show luminescence enhancement thanks to Al Plasmon in UV.
Abstract (35 Word Limit): We measure second harmonic generation (SHG) from symmetric and asymmetric gold nanoantennas and find that asymmetric antennas in fundamental bonding resonance with excitation can lead to four time SHG enhancement than that of symmetric nanoantennas.
Phase change dispersion of plasmonic nano-objects

Q. Gan;¹; X. Zeng;¹; H. Hu;¹; Y. Gao;²; D. Ji;¹; N. Zhang;¹; H. Song;¹; K. Liu;¹;
1. State University of New York at Buffalo, East Amherst, NY, United States.

Abstract (35 Word Limit): The phase change dispersion during the surface plasmon wave coupling process was extracted experimentally using a slit-groove interferometer and validated through numerical simulation, enriching the fundamental understanding of plasmonic subwavelength optics on a chip.
Near Field Measurements of the Scattering Phase Function with Evanescent Field Excitation

R. Rezvani Naraghi; S. Sukhov; A. Dogariu;
1. CREOL, The College of Optics and Photonics, University of Central Florida, Orlando, FL, United States.
2. Department of Physics, University of Central Florida, Orlando, FL, United States.

Abstract (35 Word Limit): Scattering phase functions of spherical particles excited with evanescent waves are measured using near-field optical scanning microscopy. Polarization dependent cross-sections and asymmetry parameters are determined to improve the predictive capabilities of light transport models.
Abstract (35 Word Limit): Rhodamine 6G random dye lasers are more efficient with ruby nanocrystal scatterers than with alumina, exhibiting reduced threshold despite the increased absorption of ruby nanocrystals.
Topological Darkness Revisited: a Four-dimensional Picture

H. Song; 1; X. Zeng; 1; D. Ji; 1; N. Zhang; 1; K. Liu; 1; Q. Gan; 1;

1. The State Univ of New York at Buffalo, Buffalo, NY, United States.

Abstract (35 Word Limit): We present a complete description of “topological darkness” in a four-dimensional space regarding optical constants (i.e. $n$ and $k$) of effective media, wavelengths and incident angles, which is essential for enhanced light-matter interaction in thin-films.
Plasmon Optical Trapping in Silicon Nitride Trench Waveguide

Q. Zhao; C. Guclu; Y. Huang; F. Capolino; O. Boyraz; 1
1. University of California, Irvine, Irvine, CA, United States.

Abstract (35 Word Limit): Optical trapping by using bowtie antennas deposited on top of a microfluidic SiN trench waveguide is investigated. We show that the presence of plasmonic field enhancement boosts the vertical trapping force by 3 orders of magnitude.
Near Total Resonant Light Absorption in a Graphene Monolayer at Multiple Tunable Wavelengths with Aperiodic Multilayer Structures

G. Veronis; I. Zand; A. Haddadpour; C. Granier; J. Dowling;
1. Louisiana State University, Baton Rouge, LA, United States.

Abstract (35 Word Limit): We investigate a one-dimensional system consisting of a graphene monolayer sandwiched between two aperiodic multilayer structures. We show that such a system can achieve near total resonant light absorption in graphene at multiple tunable wavelengths.
Visible Excitation of Surface Plasmon Polariton and Strengthened Nonlinearity in ITO coated Fe:LiNbO

H. Zhao; I. Li; H. Wang; J. Zhang;

1. Harbin Institute of Technology, Harbin, Heilongjiang, China.

Abstract (35 Word Limit): Anisotropic 2D diffraction orders were observed in ITO coated 1.0-mm thick iron-doped lithium niobate slabs, which can be satisfactorily by excitation of SPPs near ITO/LN interface modified by pyroelectric and bulk photovoltaic effects.
Enhancement of Single Quantum Emitters Using Ultra-Widely Tunable Nanofiber Bragg Cavities

A. W. Schell; 2, 1; H. Takashima; 3, 2; S. Kamioka; 4; Y. Oe; 4, 2; S. Fujita; 2; M. Fujiwara; 1, 4; O. Benson; 1; S. Takeuchi; 2, 3.

1. Humboldt-Universität zu Berlin, Nishikyo-ku, Kyoto, Japan.
2. Department of Electronic Science and Engineering, Kyoto University, Kyoto, Kyoto Prefecture, Japan.
3. Research Institute for Electronic Science, Hokkaido University, Sapporo, Japan.
4. The Institute of Scientific and Industrial Research, Osaka University, Osaka, Japan.

Abstract (35 Word Limit): We introduce nanofiber Bragg cavities fulfilling three important requirements: small mode-volume, wide tuning-range, and efficient fiber-coupling. In a first application, we show enhancement of single quantum emitters such as quantum dots and nitrogen vacancy centers.
Surface Plasmonic Array Sensors (SPIAS): From Color Sensing to Surface Enhanced Raman Spectroscopy

J. Walia; I. Khodadad; r. Khorasaninejad; S. Saini;

1. University of Waterloo, Kitchener, ON, Canada.

Abstract (35 Word Limit): A periodic arrangement of gold crescents is shown to have very high Raman scattering enhancement factors, $\sim 10^{-6}$, as well as structural color generation properties. This opens up the possibly for a two-level sensing platform which could be tailored for a wide variety of applications.
Abstract (35 Word Limit): We show the effect of high temperature on the plasmonic properties of metallic nanospheres and nano-rods. It is found that the damping modifications due to temperature change, modify both the near and far field optical response.
Greatly Enhanced Kerr Nonlinearity Induced by Subwavelength-Confined Anisotropic Purcell Factors in Plasmonic Nanocavity

Abstract (35 Word Limit): Combining the coherent effects in quantum optics and anisotropic Purcell factors given by surface plasmons, we theoretically investigate the greatly enhanced Kerr nonlinearity of double lambda atomic system with two vertical dipole moments.
A Photonic Crystal Explanation For a Butterfly Wing Color

A. Alabastri; 1; H. Wang; 1; A. Toma; 1; R. Zaccaria; 1;
1. Istituto Italiano di Tecnologia, Genoa, GE, Italy.

Abstract (35 Word Limit): We have theoretically explained the origin of the green/yellow colour emitted by the wings of the Teinopalpus Imperialis butterfly. The results well explain why the wings of this kind of butterfly reflect light in the green/yellow region of the optical spectrum.
Control of entanglement of two-level atoms using graphene

A. Nemilentsau; S. A. Hassani; G. Hanson; S. Hughes;
1. University of Wisconsin Milwaukee, Milwaukee, WI, United States.
2. Queen’s University, Kingston, ON, Canada.

Abstract (35 Word Limit): Dynamics of two-level atoms (TLAs) above lossy graphene are studied using a master equation model, and improvement of entanglement compared to the vacuum case is demonstrated. Entanglement can be controlled by graphene biasing.
Color Hologram Generation Using a Pancharatnam-Berry Phase Manipulating Metasurface

S. Choudhury; 1; A. Shaltout; 1; V. M. Shalaev; 1; A. Boltasseva; 1; A. V. Kildishev; 1
1. Purdue University, West Lafayette, IN, United States.

Abstract (35 Word Limit): We propose a new scheme to generate polychromatic holograms by manipulating the Pancharatnam-Berry phase. Using anisotropic transmission characteristics and tuning the resonant wavelengths of nanoslits, multicolor holograms can be produced for arbitrary RGB images.
Femtosecond Nanoplasmonic Dephasing of Individual Silver Nanoparticles

R. Glenn; 1; R. Mittal; 1; I. Saytashev; 1; V. Lozovoy; 1; M. Dantus; 1, 2;

1. Department of Chemistry, Michigan State University, East Lansing, MI, United States.
2. Department of Physics and Astronomy, Michigan State University, East Lansing, MI, United States.

Abstract (35 Word Limit): We detect the coherence of localized surface plasmon resonances in individual silver nanoparticles via accurately delayed femtosecond laser pulses. The Fourier transform of the time-resolved spectra reveals nanoplasmonic coherence components and their corresponding dephasing rates.
Abstract (35 Word Limit): Super-resolution images were obtained using a simple microscope formed by an ultrathin condenser and an objective lens. This was because the Fourier plane images carried more information about the object than real plane images do.
Room temperature lasing characteristics in metal-cavity GaN shallow grating and spiral structures

L. Shu-Wei; 1, 2
1. National Chiao Tung University, Hsinchu, Taiwan, Taiwan.
2. Department of Photonics & Institute of Electro-Optical Engineering, Hsinchu, Taiwan.

Abstract (35 Word Limit): We demonstrated a metal-cavity GaN spiral structure lasing at room temperature with the threshold power density about 17 W/cm$^2$ under circularly polarized pumping condition. The emission wavelength is approximately 363 nm.
Final ID: JTu5A.93

Tuning metacavity modes by the symmetry breaking of metasurface

h. liu; 1
1. nanjing university, Nanjing, Jiangsu, China.

Abstract (35 Word Limit): A metacavity composed from metasurface is designed and experimentally demonstrated. Due to the symmetry breaking of the metasurface, the degeneracy of the different polarized cavity states is lifted. It shifts the resonating frequencies of two polarized cavity modes.
Phase control by Graphene metasurface
Z. Li; 1
1. Nankai University, Tianjin, Tianjin, China.

Abstract (35 Word Limit): We numerically design and study graphene metasurface to modulate the phase of reflective light. And the phase shift from -π to π is achieved. By using graphene metasurface, we realize negative reflection and nano focusing.
Accurately Simulating Focusing Beams using Monte Carlo Techniques

B. H. Hokr; 1, 2; J. Bixler; 1, 3; G. Elpers; 4; B. Zollars; 4; R. Thomas; 3; V. Yakovlev; 1; M. O. Scully; 1, 5;

1. Texas A&M University, Bryan, TX, United States.
2. TASC Inc., San Antonio, TX, United States.
3. Bioeffects Division, Optical Radiation Branch, 711th Human Performance Wing, Human Effectiveness Directorate, Fort Sam Houston, TX, United States.
4. Nanohmics, Inc., Austin, TX, United States.
5. Baylor University, Waco, TX, United States.

Abstract (35 Word Limit):

A simple method for accurately simulating focusing beams, which obey Gaussian optics, in the context of traditional Monte Carlo simulations is presented. This technique will allow rapid implementation into existing Monte Carlo codes.
Breaking Malus' Law: Enhancing Asymmetric Light Transmission with Metasurfaces

C. Zhang; 1; C. Pfeiffer; 1; T. Jang; 1; V. Ray; 1; A. Grbic; 1; L. Guo; 1;
1. University of Michigan, Ann Arbor, MI, United States.

Abstract (35 Word Limit): A structure providing broadband asymmetric light transmission at 1.5 µm with a suppression ratio of 24:1 is achieved with a metasurface consisting of three cascaded layers of gold nano-wires, with a total thickness of λ/5.
Making Structured Metals Ultrabroadband Transparency by Surface Plasmons

R. Peng; 1; R. Fan; 1; X. Huang; 2; M. Wang; 1;
1. Nanjing University, Nanjing, Jiangsu, China.
2. Argonne National Laboratory, Argonne, IL, United States.

Abstract (35 Word Limit): We present theoretically and experimentally that one-dimensional and two-dimensional metallic gratings can become transparent and completely antireflective for extremely broadband electromagnetic waves by relying on surface plasmons or spoof surface plasmons.
Spacer-dependent coupled and decoupled super absorbing metasurfaces

H. Song; K. Liu; N. Zhang; D. Ji; X. Zeng; Q. Gan;

1. State University of New York at Buffalo, East Amherst, NY, United States.

Abstract (35 Word Limit): We differentiate the spacer-dependent peak shift in coupled and decoupled super absorbing metasurfaces based on magnetic resonance and interference mechanism, respectively, which was experimentally validated by low-cost structures fabricated by lithography-free processes.
Abstract (35 Word Limit): A metasurface is proposed to combine DC and laser induced discharges in micro scales. The structure is intended to be used as a platform for a new class of microplasma devices with electro-optical activation.
Dual-Band Metasurface Based Nano-Cavities

A. Shaltout; V. M. Shalaev; A. V. Kildishev;

1. Electrical and Computer Engineering, Purdue University, West Lafayette, IN, United States.

Abstract (35 Word Limit): Fabry-Pérot nano-cavities with metasurface mirrors are developed to obtain multi-band resonances at the wavelengths that exceed the diffraction limit. Independently tuned resonance bands are thus not limited to the integer multiples of a fundamental tone.
Theoretical Demonstration of Weyl Points in 3D srs Photonic Crystals
E. Goi; 1, 2; B. P. Cumming; 1, 2; M. . Gu; 1, 2;
1. Centre for Micro-Photonics and CUDOS, Melbourne, VIC, Australia.
2. Faculty of Science, Engineering and Technology, Swinburne University of Technology, Melbourne, VIC, Australia.

Abstract (35 Word Limit): We present the theoretical study of achiral 2-srs-networks and we show that these structures possess the frequency-isolated linear point degeneracies in their three-dimensional dispersion relations that define the Weyl points.
Ultra-broad Flat Band Light Absorber Based on Multi-sized Slow-wave Hyperbolic Metamaterial Thin-films

F. Ding; L. Mo;

1. Centre for Optical and Electromagnetic Research, Zhejiang University, Hangzhou, China.

Abstract (35 Word Limit): We realize a broadband absorber by using a hyperbolic metamaterial composed of alternating aluminum-alumina thin films based on superposition of multiple slow-wave modes. Our super absorber ensures broadband and polarization-insensitive light absorption in the visible and near-infrared regime.
Light Energy Trapping and Localization in RE$^{3+}$ Doped PLZT Ceramics

J. Zhang; 1; C. Xu; 1; L. Xu; 1; H. Zhao; 1;
1. Harbin Institute of Technology, Harbin, Heilongjiang, China.

Abstract (35 Word Limit): Single-pass gain over theoretical value and pulsation in amplified seeding light were observed in RE$^{3+}$ doped PLZT ceramic plates. Theoretical consideration based on light energy trapping and localization was given to elucidate the findings.
Weak Measurement of the Goos-Hänchen Shift Near the Critical Angle for Total Internal Reflection

L. Araujo; 1 O. Santana; 1 S. Carvalho; 1 S. de Leo; 1
1. University of Campinas, Campinas, BA, Brazil.

Abstract (35 Word Limit): We report on the experimental observation of the Goos-Hänchen effect near the critical angle for total internal reflection via weak measurement. We propose a new and improved amplification factor for the weak measurement.
Tunable VO$_2$/Au hyperbolic metamaterial

S. Prayakrao; 1 B. Mendoza; 2 A. Devine; 2 C. Kyaw; 3 R. Van Dover; 2 M. A. Noginov; 1
1. Norfolk State University, Norfolk, VA, United States.
2. Cornell University, Ithaca, NY, United States.
3. Morehouse College, Atlanta, GA, United States.

Abstract (35 Word Limit): We have fabricated and studied thin films of VO$_2$ and lamellar VO$_2$/Au metamaterials. Optical properties of the VO$_2$/Au metamaterials are consistent with the transition between the hyperbolic and metallic phases occurring at elevated temperatures.
Miniaturization Resonators in Mimicking Electromagnetically Induced Transparency

D. Meng; 1
1. hust, Wuhan, Hebei, China.

Abstract (35 Word Limit): Electromagnetically induced transparency is mimicked by nested split ring resonators. The nested resonator offers a miniaturization with polarization-insensitive properties, high quality-factors and absorptions which may have essential applications in wireless communications and phased arrays.
Abstract (35 Word Limit): We introduce a polarization-independent left-handed metamaterial. Mirrored S-shaped resonators are shown to exhibit negative refractive index; and a crossed design based on these resonators is demonstrated as a polarization insensitive metamaterial with negative index.
Quantum State Control with Atoms and Cavities

J. Raimond, 1, 2; T. Rybarczyk; 2; B. Peaudecerf; 2; M. Penasa; 2; S. Gerlich; 2; S. Gleyzes; 2; M. Brune; 2; S. Haroche; 2; I. Dotsenko; 2;

1. Université Pierre-et-Marie-Curie, Paris, France.
2. LKB, Collège de France, UPMC, CNRS, Paris, France.

Abstract (35 Word Limit): We measure the photon number in a microwave cavity probed by circular Rydberg atoms using the Past Quantum State approach. It leads to a considerable noise reduction and allows us to access normally hidden information.
Cavity-Modified Collective Rayleigh Scattering of Exactly Two Atoms

R. Reimann;¹; W. Alt;¹; T. Kampschulte;¹; T. Macha;¹; L. Ratschbacher;¹; N. Thau;¹; S. Yoon;¹; D. Meschede;¹;

¹. Physics, Bonn University - IAP, Bonn, NRW, Germany.

Abstract (35 Word Limit): We report on observing cooperative radiation of exactly two neutral atoms strongly coupled to an optical cavity. The roles of cavity backaction and of the relative atom-field coupling phases are discussed. Our results are important for the realization of phase-sensitive cavity QED protocols.
Photonic Quantum-Information Processing with Quantum Dots in Photonic Crystals

P. Lodahl;

1. University of Copenhagen, Copenhagen, Denmark.

Abstract (35 Word Limit): Quantum dots in photonic crystals have proven to be a very suitable platform for quantum-information processing. We review current progress on the ability to deterministically interface single photons and single quantum dots in photonic crystal waveguides and the chiral spin-photon interfaces.
An ultrasmall mode volume cantilever-based Fabry-Pérot microcavity

H. Kelkar; 1; D. Wang; 1, 2; B. Hoffmann; 1; S. Christiansen; 3, 1; S. Götzinger; 2, 1; V. Sandoghdar; 1, 2;

1. Max Planck Institute for the Science of, Erlangen, Germany.
2. Friedrich Alexander University Erlangen-Nuremberg, Erlangen, Germany.
3. Helmholtz Centre Berlin for Materials and Energy, Berlin, Germany.

Abstract (35 Word Limit): A tunable Fabry-Pérot microcavity consisting of a 2.6 μm curvature mirror and 0.4 numerical aperture is fabricated. We study the effect of a nanoparticle on the cavity modes and discuss the coupling of single molecules to it.
Towards Scalable Quantum Networks of Spin Qubits in Photonics Integrated Circuits

D. Englund; 1; L. Li; 1; T. Schroder; 1; E. Chen; 1; M. Walsh; 1; I. Bayn; 1; S. L. Mouradian; 1; M. E. Trusheim; 1; M. Lu; 3; M. Cotlet; 3; M. Markham; 2; D. Twitchen; 2; M. Lipson; 4; K. K. Berggren; 1;

1. Massachusetts Institute of Technology, Cambridge, MA, United States.
2. Element 6, Santa Clara, CA, United States.
3. Center for Functional Nanomaterials, Brookhaven National Laboratory, Upton, NY, United States.
4. School of Electrical and Computer Engineering, Cornell University, Ithaca, NY, United States.

Abstract (35 Word Limit): We discuss progress towards the development of on-chip quantum networks of multiple spin qubits in nitrogen vacancy (NV) centers in diamond. We report NV-nanocavity systems in the strong Purcell regime; implantation of NVs with nanometer-scale apertures, including into cavity field maxima; hybrid on-chip networks for integration of multiple functional NV-cavity systems; and scalable integration of superconducting nanowire single photon detectors on-chip.
Bright High Harmonics with Tunable Polarization

O. Cohen; ¹

¹. Technion Israel Institute of Technology, Technion, Israel.

Abstract (35 Word Limit): Generation and application of bright phase-matched high-order harmonic with fully tunable polarization - from linear through elliptic to circular - is presented
Carbon K-edge NEXFAS spectroscopy from a table-top soft x-ray high harmonics source driven by sub-2-cycle, CEP stable, 1.85-μm 1-kHz laser pulses
S. L. Cousin; 1; F. Silva; 1; S. Teichmann; 1; M. Hemmer; 1; B. Buades; 1; J. Biegert; 1, 2;
1. ICFO - The Institute of Photonic Sciences, Castelldefels (Barcelona), CAT, Spain.
2. ICREA - Institució Catalana de Recerca i Estudis Avançats, Barcelona, Spain.

Abstract (35 Word Limit): A high-flux table-top coherent soft x-ray high harmonic generation source, driven by sub-2-cycle, 1.85 μm, 1 kHz laser pulses, is applied to a condensed phase sample revealing the carbon binding orbitals of polyimide.
Suppression of Resonant-induced Harmonics of Tin with Tunable Laser Wavelengths

M. Fareed; S. Mondal; N. Thiré; M. Boudreau; y. pertot; B. E. Schmidt; F. Légaré; T. Ozaki;
1. INRS-EMT, Varennes, QC, Canada.

Abstract (35 Word Limit): We investigate the behavior of resonant-induced harmonics from tin using driving lasers with tunable wavelengths. The intensity of the resonant harmonic is suppressed by the tuning laser wavelength around 1.8μm to understand the interaction dynamics of continuum electron with the autoionizing state.
Control of attosecond pulse and XUV high-order harmonic generation with spatially-chirped laser pulses

C. Hernandez-Garcia; 1, 2; A. Jaron-Becker; 1; A. Becker; 1; C. G. Durfee; 3;
1. JILA, University of Colorado, Boulder, CO, United States.
2. Universidad de Salamanca, Salamanca, Spain.

Abstract (35 Word Limit): We present a technique to drive high-order harmonics with angularly spatially chirped pulses. Our calculations show that each harmonic is emitted with angular chirp, leading to dramatically improved control of spectral and temporal spatial resolution.
Relativistic High Harmonics Driven by Two-Color Incident Fields

M. Edwards; J. Mikhailova;
1. Princeton University, Princeton, NJ, United States.

Abstract (35 Word Limit): Particle-in-cell simulations suggest that relativistic high-harmonic generation using overdense plasmas will be substantially enhanced by adding second harmonic to the incident laser field. This mechanism also offers a new diagnostic of the laser-plasma interaction.
Abstract (35 Word Limit): We propose a method of compressing and focusing electron pulses to attosecond durations and sub-micrometer-dimensions using the optical ponderomotive force. Applications include ultrafast electron diffraction, flat electron beam creation, and free-electron-based coherent terahertz emission schemes.
Abstract (35 Word Limit): Complete population inversion of two-level atoms in a magneto-optical trap is demonstrated by off-resonant two laser pulses shaped from a single ultrafast laser pulse. The observed phenomenon is explained in the context of femto-second laser version of Stark-chirped rapid adiabatic passage.
Retrieving time-dependent Green’s functions in optics with low-coherence interferometry

A. Badon; G. Lerosey; C. Boccara; M. Fink; A. Aubry;

1. Institut Langevin, Paris, France.

Abstract (35 Word Limit): We report on the passive measurement of time-dependent Green’s functions with low-coherence interferometry. We show how the mutual coherence function of an incoherent wave-field can directly yield the Green’s functions between scatterers of a complex medium.
Preferential emission into epsilon-near-zero metamaterial

T. Galfsky; 1, 2; Z. Sun; 1, 2; Z. Jacob; 3; V. M. Menon; 1, 2;

1. Physics, Graduate Center of the City University of New York, New York, NY, United States.
2. Physics, City College of the City University of New York, New York, NY, United States.
3. Department of Electrical and Computer Engineering, University of Alberta, Edmonton, AB, Canada.

Abstract (35 Word Limit): We report preferential emission from ZnO nanoparticles into an epsilon near zero metamaterial. The structure is designed to have the parallel component of its dielectric constant approach zero at the maximum emission wavelength of ZnO.
Topological Defect Lasers
S. Knitter; 1; S. Liew; 1; W. Xiong; 1; M. I. Guy; 2, 4; G. S. Solomon; 3, 4; H. Cao; 1;
1. Department of Applied Physics, Yale University, New Haven, CT, United States.
2. Science & Research Software Core, Yale University, New Haven, CT, United States.
3. Joint Quantum Institute, University of Maryland, College Park, MD, United States.
4. National Institute of Standards and Technology, Gaithersburg, MD, United States.

Abstract (35 Word Limit): We demonstrate topological defect lasers in a GaAs membrane with embedded InAs quantum dots. By introducing a disclination to a square-lattice of elliptical air holes, we obtain spatially confined lasing modes that support powerflow vortices.
Localization of Light at Vanishingly Small Disorder-Levels with Heavy Photons
A. Baron; 1 R. Faggiani; 2 X. Zang; 2 L. Lalouat; 3 S. Schulz; 4 K. Vynck; 2 B. O’Regan; 5 B. Cluzel; 3 F. de Fornel; 3 T. Krauss; 5 P. Lalanne; 2

1. Duke University, Durham, NC, United States.
2. Université de Bordeaux, Talence, France.
3. Université de Bourgogne, Dijon, France.
4. University of Ottawa, Ottawa, ON, Canada.
5. University of York, York, United Kingdom.

Abstract (35 Word Limit): We investigate the formation of localized modes in randomly-perturbed photonic-crystal waveguides near the photonic band-edge. We show that the key parameter driving the formation process is the effective photon mass rather than the group index.
Coherent Perfect Absorbers and Coherent Enhancement of Absorption

A. Stone; 1 H. Cao; 1 Y. Chong; 2 L. Ge; 3 S. Popoff; 4 A. Goetschy; 5

1. Yale University, New Haven, CT, United States.
2. Nanyang Technical University, Singapore, Singapore.
3. CUNY Staten Island, New York, NY, United States.
4. CNRS-LTCI, Paris, France.
5. Institut Langevin, Paris, France.

Abstract (35 Word Limit): Coherent illumination and wave-front shaping can be used to make a weakly absorbing cavity perfectly absorbing and to enhance strongly the absorption of a multiple scattering medium.
Abstract (35 Word Limit): We use a diluted refractory metal as a selective emitter/absorber to enhance the efficiencies of thermal-light and light-thermal conversions. The absorptivity (emissivity) was measured at high temperatures up to 750°C.
Abstract (35 Word Limit): We present a multimode laser-linewidth formula that generalizes previous theories, including corrections for cavity losses, nonlinear gain and dispersion, but is derived in a more general setting and is therefore applicable to complex wavelength-scale lasers.
Abstract (35 Word Limit): We demonstrate robust and scalable fabrication of lithium niobate nanophotonic devices including microdisk and microring resonators. Our devices feature optical quality factors over $10^5$ and are promising for nonlinear optical applications.
A Nonlinear Polymer Waveguide Implemented Using an Augmented Low Index Guide

M. Z. Alam; X. Sun; M. Mojahedi; J. Aitchison;
1. University of Toronto, Toronto, ON, Canada.

Abstract (35 Word Limit): We propose a new scheme which is easy to implement and can be used to integrate low index nonlinear materials with silicon photonics to achieve high nonlinearity without suffering nonlinear losses.
Pump-Degenerate Phase-Sensitive Amplification in Amorphous Si Waveguides

H. Sun; K. Wang; A. C. Foster;
1. Johns Hopkins University, Baltimore, MD, United States.

Abstract (35 Word Limit): We demonstrate phase-sensitive amplification in hydrogenated amorphous silicon waveguides based on pump-degenerate four-wave mixing at 90 MHz and 10 GHz. An 11.7 dB (6.6 dB) phase-sensitive extinction ratio is achieved at 90 MHz (10 GHz).
Nonlinear Silicon Photonics and the Moment Method
C. A. Husko; 1; S. Lefrancois; 1; A. Blanco-Redondo; 1, 2; B. J. Eggleton; 1;
1. University of Sydney, Sydney, NSW, Australia.
2. Tecnalia, Bizkaia, Spain.

Abstract (35 Word Limit): We develop a moment method theory for nonlinear propagation in silicon waveguides. Expressions for pulse parameters, free-carrier blueshift and acceleration are derived. We apply this to propagation in silicon photonic crystal waveguides and nanowires.
Low Power All-Optical Switching in a Gallium Arsenide Photonic Molecule

R. Bose; J. Pelc; C. Santori; R. Beausoleil


Abstract (35 Word Limit): We demonstrate low power all-optical switching in a gallium arsenide (GaAs) photonic molecule with resonances near the material band edge. The enhanced nonlinear effects in this spectral region result in a low estimated switching energy of a few femtojoules with 45% transmission contrast.
Abstract (35 Word Limit): Single-transverse and longitudinal mode lasing is demonstrated in a PT-symmetric semiconductor microring arrangement. The proposed scheme is versatile, robust to fabrication errors, and allows for high brightness operation while maintaining spectral purity.
Spontaneous mirror-symmetry breaking in two coupled nanolasers

A. M. Giacomotti; 1; P. Hamel; 1; S. Haddadi; 1; F. Raineri; 1; P. Monnier; 1; G. Beaudoin; 1; I. Sagnes; 1; A. Levenson; 1;
1. CNRS/LPN, Marcoussis, France.

Abstract (35 Word Limit): We experimentally show spontaneous breaking of mirror-symmetry in two evanescently coupled photonic crystal nanocavity-lasers. A transition from a delocalized mode, to two spatially localized states is observed. Coexistence of these states is demonstrated.
Propagation of quantum signal in plasmonic waveguides

X. Ren; 1, 2; Y. Cai; 1, 2; M. Li; 1, 2; C. Zou; 1, 2; X. Xiong; 1, 2; H. Lei; 1, 2; B. Liu; 1, 2; G. Guo; 1, 2; G. Guo; 1, 2;

1. Key laboratory of quantum information, University of science and technology of China, Hefei, Anhui, China.
2. Synergetic Innovation Center of Quantum Information and Quantum Physics, University of Science and Technology of China, Hefei, China.

Abstract (35 Word Limit): Here we introduce two works on quantum plasmonics: high-visibility on-chip quantum interference of single surface plasmons and transmission of quantum polarization entanglement in a nanoscale hybrid plasmonic waveguide. Our works can bridge nanophotonics and quantum optics.
Abstract (35 Word Limit): We demonstrate Purcell enhancements of ~1000 from fluorescent molecules embedded in a plasmonic antenna with sub-10 nm gap between metals. Simulations and experiments reveal the high radiative efficiency and directionality of the antenna.
Enhanced Single Photon Emission from Quantum Dots Coupled to Localized Surface Plasmons

B. Demory; 1 T. Hill; 2; c. teng; 1; L. Zhang; 2; H. Deng; 2; P. Ku; 1;

1. Electrical Engineering and Computer Science, University of Michigan, Ann Arbor, MI, United States.
2. Physics, University of Michigan, Ann Arbor, MI, United States.

Abstract (35 Word Limit): The coupling between excitons and localized surface plasmons in two-level systems can lead to enhanced spontaneous emission and was studied using site-controlled InGaN quantum dots. The dynamics and the Purcell effect were measured and analyzed.
Plasmonic Giant Semiconductor Nanocrystals with Enhanced Light Output and Suppressed Blinking for Biomedical Applications

s. sampat; 1; N. karan; 2; A. Keller; 2; A. Piryatinski; 3; O. Roslyak; 4; C. Hanson; 2; Y. Ghosh; 2; h. htoon; 2; j. hollingsworth; 2; a. malko; 1;
1. U Texas at Dallas, , United States.
2. Material Physics and Applications Division, CINT, Los Alamos National Lab, Los Alamos, NM, United States.
4. Physics, Fordham University, Bronx, NY, United States.

Abstract (35 Word Limit): We study single particle PL emission signatures of giant semiconductor nanocrystals overcoated with silica shells and ultrathin gold layers. We observe complex metal/semiconductor coupling and plasmonic interactions leading to either emission quenching or photobrightening.
Quantum Model of Plasmon-Quantum Emitter Interaction in the Strong-Coupling Regime

R. Davidson; 1, 2; P. Lougovski; 2; B. Lawrie; 2;
1. Physics, Vanderbilt University, Nashville, TN, United States.
2. Quantum Information Sciences, Oak Ridge National Laboratory, Oak Ridge, TN, United States.

Abstract (35 Word Limit): A full quantum model incorporating realizable materials properties is developed for interactions between a plasmonic resonator and a single two-level quantum emitter, enabling fabrication of plasmonic nanostructures for the strong coupling regime of cavity-quantum-electrodynamics.
Efficient Fiber Collection of Nitrogen-Vacancy Center Emission from Diamond Nano Beams

H. Jayakumar; 1, B. Khanaliloo; 1, 2, P. E. Barclay; 1, 2,
1. University of Calgary, AB, Canada.

Abstract (35 Word Limit): We present tapered diamond nano beams, which allows efficient collection of diamond nitrogen vacancy emission through phase-matched coupling to a tapered optical fiber.
Carrier Multiplication in a Single Semiconductor Nanocrystal

X. Wang; F. Hu; B. Lv; C. Zhang; M. Xiao;

1. Nanjing University, Nanjing, .

Abstract (35 Word Limit): The UV-excited photoluminescence was measured for single CdSe nanocrystals and an average carrier multiplication efficiency of ~13.1% was obtained when the excitation photon energy was set at ~2.46 times of the nanocrystal energy gap.
Spin Control in Charged Quantum Dots by Twisted Light

G. Quinteiro;¹ T. Kuhn;²

¹ Universidad de Buenos Aires, Buenos Aires, Argentina.
² Universitat Muenster, Muenster, Germany.

Abstract (35 Word Limit): Strongly focused twisted light may have strong field components in the propagation direction. By manipulating light-hole excitons in a charged quantum dot with such beams the spin of an excess electron can be efficiently controlled.
Position-modulated Photonic-crystal Lasers and Control of Beam Direction and Polarization

K. Kitamura; T. Okino; D. Yasuda; Y. Liang; S. Noda; 1
1. Kyoto University, Kyoto, Japan.

Abstract (35 Word Limit): We propose and demonstrate position-modulated photonic-crystal lasers which can control the output-beam directions two-dimensionally and have various polarizations. The results promise to greatly enhance the range of possible laser-scanning applications.
Compact Vortex Beam Emitter Laterally Integrated with VCSEL Array

F. Koyama; 1; K. Tanabe; 1; X. GU; 1; A. Matsutani; 1;
1. Tokyo Institute of Technology, Yokohama, Kanagawa, Japan.

Abstract (35 Word Limit): We demonstrate the integration of VCSEL array and vortex-beam-emitters, composed of double-ring-shaped Bragg-reflector waveguides functioning as diffraction element. A possibility of compact VCSEL-based emitters, creating and multiplexing vortex beams with different orbital momentums is suggested.
Resonance Tuning and Coherent Operation in Anti-Guided Vertical-Cavity Laser Arrays

S. Fryslie; 1 M. P. Tan; 2 M. Johnson; 3 K. D. Choquette; 1
1. University of Illinois Urbana-Champaign, Champaign, IL, United States. 
2. Intel Corp., Hillsboro, OR, United States. 

Abstract (35 Word Limit): We demonstrate that photonic crystal anti-guided VCSEL arrays can be tuned to coherent operation by control of the cavity resonance by independent control of the bias currents.
Effect of In-plane Mirror Dispersion on Vertical Cavities Based on High-Contrast Grating Mirrors

A. Taghizadeh; J. Mork; I. Chung;
1. Technical University of Denmark, Kgs. Lyngby, Denmark.

Abstract (35 Word Limit): We report how the in-plane dispersion of a high-index-contrast grating reflector influences the transverse mode properties such as shorter wavelengths for lower-order transverse modes and different transverse-mode wavelength spacings for modes with the same size.
Smooth lasing transition in high β buried multiple-quantum-well 2D photonic crystal lasers

M. Takiguchi; 1, 2; H. Taniyama; 1, 2; H. Sumikura; 1, 2; D. M. Birowosuto; 1, 2; E. Kuramochi; 1, 2; A. Shinya; 1, 2; T. Sato; 1, 3; K. T. Takeda; 1, 3; S. Matsuo; 1, 3; M. Notomi; 1, 2.

1. NTT Nanophotonics Center, NTT Corporation, Atsugi, Kanagawa, Japan.
2. NTT Basic Research Laboratories, NTT Corporation, Atsugi, Kanagawa, Japan.
3. NTT Device Technology Laboratories, NTT Corporation, Atsugi, Kanagawa, Japan.

Abstract (35 Word Limit): By adopting high β buried-multiple-quantum-well photonic crystal nanocavities, we have demonstrated smooth lasing operation, which indicates thresholdless-like lasing theoretically predicted, by mean of light-in vs light-out curve analysis, linewidth analysis, and photon correlation measurements.
Final ID: SW1F.6

Broadband Self-Swept High Contrast Grating VCSEL

S. Gerke; W. Yang; K. Ng; C. Chase; Y. Rao; C. J. Chang-Hansnain;
1. University of California Berkeley, Berkeley, CA, United States.
2. Bandwidth10 Inc., San Jose, CA, United States.

Abstract (35 Word Limit): We demonstrate a 1550 nm broadband self-swept VCSEL with 23-nm wavelength range at 131 kHz sweep rate. The mechanical oscillation of the ultra-lightweight HCG top mirror is excited optomechanically by photons inside the lasing cavity.
Printed Photonic Crystal Bandedge Surface-emitting Lasers on Silicon
S. Liu; D. Zhao; H. Yang; Z. Ma; C. Reuterskiöld-Hedlund; M. Hammar; W. Zhou;
1. University of Texas at Arlington, Arlington, TX, United States.
2. Electrical and Computer Engineering, University of Wisconsin-Madison, Madison, WI, United States.
3. School of Information and Communication Technology, KTH-Royal Institute of Technology, Kista, Sweden.

Abstract (35 Word Limit): We report experimental demonstration of a hybrid III-V/Si photonics crystal surface-emitting laser (PCSEL) based on membrane transfer printing technique. Single mode operation was observed with linewidth of 5 Å and side-mode suppression ratio (SMSR) greater than 20 dB.
Electrically Tunable Organic Vertical Cavity Surface Emitting Laser

W. Chang; 1; A. Murarka; 1; A. Wang; 1; V. Bulovic; 1; J. H. Lang; 1;

1. Electrical Engineering and Computer Science, Massachusetts Institute of Technology, Cambridge, MA, United States.

Abstract (35 Word Limit): Using solvent-free composite membrane transfer, we demonstrate an electrically tunable organic visible light-emitting laser with reversible tuning range of 10nm under 6V actuation. Large-area scalability of utilized fabrication methods suggests potential use in all-optical pressure-sensing surfaces.
Mid-Infrared frequency comb for rapid detection of CH$_4$ and H$_2$O in open air

S. A. Diddams; 1; L. Nugent-Glandorf; 1; F. R. Giorgetta; 1;

Abstract (35 Word Limit): We present open-air trace-gas spectroscopy utilizing a mid-infrared frequency comb. The MIR beam spanning 300 nm propagates through 26 m of atmosphere and absorption spectra are collected in 2 ms with a Virtual-Image Phased-Array spectrometer.
Dual-Frequency Comb Measurements of Atmospheric Absorption: Comparison with HITRAN Database Parameters

G. B. Rieker,1, 2; F. R. Giorgetta;2; W. C. Swann;2; L. C. Sinclair;2; C. L. Cromer;2; E. Baumann;2; I. R. Coddington;2; N. R. Newbury;2;


Abstract (35 Word Limit): Near-infrared frequency-comb spectroscopy is used to measure CO₂ absorption over a 2-km outdoor path under well-mixed atmospheric conditions. We compare integrated area, linecenter, and Lorentz widths extracted from Voigt fits to the data with HITRAN.
Dual-Comb Spectroscopy based on Quantum Cascade Laser Frequency Combs

G. Villares; 1,  F. Cappelli; 1, 2,  A. Hugi; 1, 3,  S. Blaser; 4,  J. Faist; 1

1. IQE, Physics Department, ETH Zurich, Zürich, ZH, Switzerland.
2. CNR-INO and LENS, Florence, Italy.
3. IRsweep GmbH, Zurich, Switzerland.
4. Alpes Lasers SA, Neuchatel, Switzerland.

Abstract (35 Word Limit): Mid-infrared dual-comb spectroscopy by means of quantum cascade laser frequency combs is demonstrated. Broadband high resolution molecular spectroscopy is performed, showing the potential of quantum cascade laser combs as a compact, all solid-state, chemical sensor.
Noise properties in multi-heterodyne spectrometers based on quantum- and interband-cascade lasers

J. Westberg; 1; A. Hangauer; 1; M. Soskind; 2, 1; E. J. Zhang; 1; G. Wysocki; 1;
1. Princeton University, Princeton, NJ, United States.
2. Rutgers, New Brunswick, NJ, United States.

Abstract (35 Word Limit): The noise properties of two multi-heterodyne spectrometers based on multi-mode semiconductor lasers (QCLs and ICLs) are investigated to determine their performance limitations. Both technologies provide well-defined multi-heterodyne beat-note structures suitable for spectroscopic measurements.
Multiheterodyne Spectroscopy with Electro-Optic Frequency Combs

D. Long; ¹; A. J. Fleisher; ¹; J. T. Hodges; ¹; D. F. Plusquellic; ²;
¹. NIST, Gaithersburg, MD, United States.
². NIST, Boulder, CO, United States.

Abstract (35 Word Limit): Waveguide-based, electro-optic modulators were used to generate pitch-agile, optical frequency combs from a single continuous-wave laser. These combs are then detected via a multiheterodyne approach where the absorption information is down-converted into the radiofrequency domain.
Broadband, Comb-resolved, High-Finesse Enhancement Cavity Spectrometer with Graphene Modulator

K. F. Lee; 1, G. Kowzan; 1, 2; C. Lee; 3; C. Mohr; 1; J. Jiang; 1; T. R. Schibli; 3; P. Maslowski; 2; M. E. Fermann; 1,

1. IMRA America, Inc., Ann Arbor, MI, United States.
2. Nicolaus Copernicus University, Torun, Poland.

Abstract (35 Word Limit): We transmit a frequency comb through an enhancement cavity by PDH locking with a graphene modulator. We comb-resolve the 1940 to 2115 nm spectrum with stable repetition rate and offset frequency via Fourier transform spectrometry.
Optical Frequency Combs of Multi-GHz Line-spacing for Real-time Multi-heterodyne Spectroscopy
A. Ishizawa; 1; T. Nishikawa; 2, 3; M. Yan; 3, 4; G. Millot; 5; H. Gotoh; 1; T. Hänsch; 3, 4; N. Picqué; 3, 4;
1. NTT Basic Research Laboratories, Atsugi, Kanagawa, Japan.
2. Tokyo Denki University, Adachi-ku, Japan.
3. Max-Planck-Institut für Quantenoptik, Garching, Germany.
4. Ludwig-Maximilians-Universität München, Munchen, Germany.
5. Laboratoire Interdisciplinaire Carnot de Bourgogne, Dijon, France.

Abstract (35 Word Limit): Dual-comb spectroscopy using electro-optic-modulator-based frequency combs broadened in a highly nonlinear fiber opens up new opportunities for analytical spectroscopy. One hundred thousand spectra per second are measurable with a 10-THz span and a 157-GHz resolution.
Mid-Infrared Optical Frequency Combs based on Difference Frequency Generation for Dual-Comb Spectroscopy

F. C. Cruz; D. L. Maser; T. Johnson; G. Ycas; A. Klose; L. C. Sinclair; I. Coddington; N. R. Newbury; S. Diddams;

Abstract (35 Word Limit): Dual optical frequency combs at 2.8-3.4 μm with powers >210 mW were produced with femtosecond fiber-lasers and difference frequency generation. Interferograms between the combs have been demonstrated as a step towards mid-infrared dual-comb spectroscopy.
Solid State Light Field Sampling and Light Phase Detection

T. Paasch-Colberg$^{1}$

1. Max-Planck-Institut fur Quantenoptik, Garching, Germany.

Abstract (35 Word Limit): The conductivity of a solid state device is reversibly increased by several orders of magnitude on a femtosecond timescale using the instantaneous electric field of an intense few-cycle laser pulse to create ultrafast detectable currents.
Final ID: SW1H.2

Electro-optic Sampling of Mid-to-Near-Infrared Waveforms

N. E. Karpowicz; 1, S. Keiber; 1, S. Sederberg; 1, A. Schwarz; 1, O. Razskazovskaya; 1, 2, M. K. Trubetskov; 1, 3, V. Pervak; 1, 2, F. Krausz; 1, 2.

1. Max-Planck-Institut für Quantenoptik, Garching, Germany.
2. Department für Physik, Ludwig-Maximilians-Universität, Garching, Germany.
3. Moscow State University, Research Computing Center, Russian Federation.

Abstract (35 Word Limit): Electro-optic sampling is a valuable tool in the terahertz range for sensitive, time-resolved electric field measurement. We show that this technique can be extended to the near infrared for unambiguous measurement of broadband, phase-locked pulses.
Cross-Correlation Frequency-Resolved Optical Gating for Characterization of A Train of Monocycle Optical Pulses

Y. Nakano; 1 Y. Kida; 1 K. Motoyoshi; 1 T. Imasaka; 1, 2

1. Department of Applied Chemistry, Kyushu University, Graduate School of Engineering, Fukuoka, Fukuoka, Japan.
2. Division of Optoelectronics and Photonics, Kyushu University, Center for Future Chemistry, Fukuoka, Fukuoka, Japan.

Abstract (35 Word Limit): A cross-correlation frequency-resolved optical gating is developed for the characterization of an optical pulse train consisting of monocycle pulses. An optical beat is employed for resolving the ultrafast temporal intensity variation in the train.
A Spectrally Resolved Lateral-Shearing Interferometer for Measurement of Relative Group Delay Using a Periodic Entrance Slit in a Spectrometer

S. Bahk; C. Dorrer; R. Roides; J. Bromage;

1. University of Rochester, Rochester, NY, United States.

Abstract (35 Word Limit): A concept for a spectrally resolved lateral-shearing interferometer is proposed to measure pulse front and radial group delay. A periodic slit in a spectrometer enables a simpler spatial interference scheme than a Mach–Zehnder interferometer.
Abstract (35 Word Limit): MIIPS is a popular method for compressing femtosecond pulses. It is not ideal for complex pulses, like those produced by self-phase modulation. We show that several limitations are fixed by an improvement called G-MIIPS.
Ultrafast Graphene Photodetector for On-chip Broadband Auto-correlator

R. Shiue; 1; Y. Gao; 2; J. Hone; 2; D. Englund; 1;
1. Massachusetts Institute of Technology, United States.

Abstract (35 Word Limit): We report an integrated graphene photodetector on top of a silicon waveguide with a maximum responsivity of 0.36 A/W and a 3dB high-speed cut-off frequency of 42 GHz. Furthermore, nonlinear photocurrent in graphene under pulse excitation enables direct on-chip characterization of ultrafast pulses.
Quantitative Characterization of Polarization States of Axisymmetrically Polarized Pulses Generated by Coherent Beam Combining

M. Suzuki; 1, K. Yamane; 1, 2; K. Oka; 1; Y. Toda; 1, 2; R. Morita; 1, 2;
1. Hokkaido University, Sapporo, Hokkaido, Japan.
2. JST, CREST, Sapporo, Japan.

Abstract (35 Word Limit): By using the extended Stokes parameters and the degree of polarization defined for the spatial distribution (DOP-SD), we fully quantitatively characterize the polarization states of arbitrary (DOP-SD>0.96) axisymmetrically-polarized femtosecond pulses generated by coherent beam combining.
Integrated Photonic Devices with Single Quantum Dots

A. Fox; E. Clarke; R. Coles; J. Dixon; I. J. Luxmoore; M. Hugues; M. Makhonin; J. O’Hara; N. Prtljaga; A. Ramsay; B. Royall; N. Wasley; M. S. Skolnick;

1. Physics & Astronomy, University of Sheffield, Sheffield, United Kingdom.
2. EPSRC National Centre for III-V Technologies, University of Sheffield, Sheffield, United Kingdom.

Abstract (35 Word Limit): The integration of InAs quantum dots as on-chip single-photon sources in GaAs photonic circuits is reviewed. A Hanbury Brown-Twiss effect is demonstrated using a monolithic directional coupler, together with coherent emission under resonant excitation.
Observation of Einstein's Rings and Optical Gravitational Collimation

R. Bekenstein,\textsuperscript{1} C. Sheng,\textsuperscript{2} H. Liu,\textsuperscript{2} S. Zhu,\textsuperscript{2} M. Segev,\textsuperscript{1}

\textsuperscript{1} Technion Israel Institute of Technology, Haifa, Israel.
\textsuperscript{2} National Laboratory of Solid State Microstructures & Department and Physics, Collaborative Innovation Center of Advanced Microstructures, Nanjing University, Nanjing, China.

Abstract (35 Word Limit): We experimentally observe Einstein's Rings caused by gravitational lensing by designing a refractive index profile analogous to the curvature of a star. We employ the experiment to produce collimated optical beams in homogenous media.
Theory and Practice of Resonant Antireflection

K. Wang; S. Fan;

1. Stanford University, Stanford, CA, United States.

Abstract (35 Word Limit): Antireflection can be achieved using optical resonances. We show theoretically that complete resonant antireflection is possible if the resonances radiate in a balanced manner and the periodicity of the structure is subwavelength for normal incidence.
Silicon Super-Resolution in the Visible
A. David; 1; B. Gjonaj; 1; G. Bartal; 1;
1. Technion Israel Institute of Technology, Haifa, Israel.

Abstract (35 Word Limit): Planar Silicon waveguides provide up to 4 times wavelength compression, yielding sub-100nm focusing for visible light. Our near-field measurements for red light (671nm) show both wavelength compression (280nm) and super-focusing (80nm, bright and dark spots).
Design Rule of 2D High Contrast Gratings and Engineering of Orbital Angular Momentum of Light

P. Qiao; \(^1, 2\); L. Zhu; \(^2\); C. J. Chang-Hansnain; \(^2\);
1. Univ of Illinois at Urbana-Champaign, Urbana, IL, United States.
2. Univ. California at Berkeley, Berkeley, CA, United States.

Abstract (35 Word Limit): A design rule to obtain broadband high reflection and transmission in 2D high contrast gratings is proposed. Our design method is convenient for engineering the orbital angular momentum of light using 2D grating array.
Cloaking of Metal Contacts on Solar Cells

M. F. Schumann; 1, 2; S. Wiesendanger; 3; J. Goldschmidt; 4; K. Bittkau; 5; U. W. Paetzold; 5; A. Sprafke; 6; R. B. Wehrspohn; 6; C. Rockstuhl; 2, 7; M. Wegener; 1, 2

1. Institute of Applied Physics, Karlsruhe Institute of Technology (KIT), Karlsruhe, Germany.
2. Institute of Nanotechnology, Karlsruhe Institute of Technology (KIT), Karlsruhe, Germany.
5. Institut für Energie- und Klimaforschung (IEK-5), Forschungszentrum Jülich GmbH, Jülich, Germany.
6. Institute of Physics, Martin Luther University Halle-Wittenberg, Halle, Germany.
7. Institute of Theoretical Solid-State Physics, Karlsruhe Institute of Technology (KIT), Karlsruhe, Germany.

Abstract (35 Word Limit): We design by transformation optics, fabricate by three-dimensional direct laser writing, and characterize experimentally polymer-based cloaks for 20 µm wide gold-wire contacts on a silicon wafer. The contact shadowing effect is reduced by 90%.
Photovoltaic performance Improvement of Si HIT Solar Cell by Incorporating Flower-Like light trapping Structures

S. Tsai; 1 M. Lee; 2 V. Su; 2 S. Lin; 4 C. Hsu; 2 Y. You; 2, 3 P. Chen; 2, 3 Y. Chen; 2 Z. Hung; 1 C. Kuan; 1, 2

1. Graduate Institute of Photonics and Optoelectronics, National Taiwan University, Taipei City, Taiwan.
2. Graduate Institute of Electronics Engineering, National Taiwan University, Taipei City, Taiwan.
3. R&D Division, Kingwave Corporation, Taipei City, Taiwan.
4. Department of Electrical Engineering, TungHai University, Taichung, Taiwan.

Abstract (35 Word Limit): We implemented the flower-like light trapping structures on the surface of HIT solar cell to achieve a great reflectance reduction and effectively improve the $J_{SC}$ from 34.32 mA/cm$^2$ to 39.4 mA/cm$^2$ compared to the reference.
Abstract (35 Word Limit): We present interleaved OCT as a unique strategy to exploit long coherence lengths for novel spectral multiplexing schemes that permit multi-purpose information encoding and streamlined image acquisition.
Quantitative Imaging of Tissue Polarization Property by Jones Matrix Optical Coherence Tomography

Y. Yasuno; 1
1. University of Tsukuba, Tsukuba, Ibaraki, Japan.

Abstract (35 Word Limit): A quantitative polarization sensitive optical coherence tomography which measures tissue Jones matrix is presented. Jones matrix based signal processing is applied to obtain quantitative birefringence. Its clinical utility is examined by measuring in vivo human eyes.
The Ultimate Road to Real Time 3D Optical Coherence Tomography Imaging

P. Xue; 1; T. Huo; 1; X. Zhang; 1; C. Wang; 1; T. Chen; 1; W. Liao; 1; W. Zhang; 1; S. Ai; 1; J. Hsieh; 1;
1. State Key Laboratory of Low-dimensional Quantum Physics and Department of Physics, Tsinghua University and Collaborative Innovation Center of Quantum Matter, Beijing, China.

Abstract (35 Word Limit): We have presented linear-in-wavenumber swept laser and all-optical 40MHz swept-source as the optical source, and compressed sensing and time serial optical computing to process the massive imaging data for real time 3D optical coherence tomography imaging.
Differential Mueller-matrix formalism for polarization sensitive optical coherence tomography

M. Villiger; 1, 2; N. Lippok; 1, 2; B. Bouma; 1, 2;

1. Wellman Center for Photomedicine, Boston, MA, United States.
2. Harvard Medical School, Boston, MA, United States.

Abstract (35 Word Limit): The differential Mueller matrix offers useful insight into the polarization properties of biological tissue imaged with polarization sensitive optical coherence tomography. We present the theory and experimentally demonstrate local depolarization in addition to local retardation.
Effects of Wavelength and Side Lobes on Airy Beam for Optical Coherence Tomography

M. Zhang; 1; P. Yu; 1; Z. Ren; 2;
2. Zhejiang Normal University, Jinghua, China.

Abstract (35 Word Limit): Optical coherence tomography system using a broad wavelength band Airy beam generated by a transmissive cubic phase mask. We experimentally show that the detrimental effects from the side lobes and wavelength dependent curvature are negligible.
Fabrication of complex three-dimensional metallic microstructures based on femtosecond laser micromachining

F. Chen; Q. Yang; C. Shan;

1. Xi'an Jiaotong University, Xi'an, Shaanxi, China.

Abstract (35 Word Limit): The fabrication of complex metallic microstructures based on femtosecond laser micromachining and metal microsolidify process is demonstrated. This method is beneficial for building complex embedded 3D metal microstructures, electronic components, and hybrid electronic–microfluidic devices.
Abstract (35 Word Limit): The fs-laser induced refractive index change in zinc aluminum phosphate glasses and its underneath structural modifications have been investigated both at the surface and in bulk.
Optical Aspect of Ultrafast Laser Ablation on Transparent Dielectrics: Ciliary White Light

Y. Liu; 1; Y. Brelet; 1; Z. He; 2; L. Yu; 3; Y. Zhong; 4; Z. Zeng; 4; R. Li; 4; A. Houard; 1; A. Couairon; 5; A. Mysyrowicz; 1;

1. Laboratoire d’Optique Appliquée, ENSTA/CNRS/Ecole Polytechnique, Palaiseau Cedex, France.
2. Electron Microscopy for Materials Research (EMAT), University of Antwerp, Antwerp, Belgium.
3. Laboratoire de Physique des Interfaces et des Couches Minces, Ecole Polytechnique, Palaiseau, France.
4. Shanghai Institute of Optics and Fine Mechanics, Shanghai, China.
5. Centre de Physique Théorique, Ecole Polytechnique, Palaiseau, France.

Abstract (35 Word Limit): We report on a new nonlinear optical phenomenon during laser ablation on transparent dielectrics, coined as ciliary white light. It is universally observed on 14 different dielectrics with femtosecond pulses at 800 nm and 1.8 μm.
Formation of nanogratings in porous glass initiated by excitation of plasma waves at interfaces

Y. Cheng;¹ Y. Liao;¹ J. Ni;¹ L. Qiao;¹ M. Huang;²
¹. Shanghai Inst of Optics and Fine Mech, Shanghai, Shanghai, China.
². Sun Yat-sen University, Guangzhou, China.

Abstract (35 Word Limit): The evolution of nanogratings in a porous glass was directly observed, revealing that the nanogratings origin from the standing plasma waves at the interfaces excited by femtosecond laser pulses.
Board-Level Optical Interconnect Using Glass

s. Huang; 1; C. Chen; 1; M. Li; 2;
1. University of Pittsburgh, , United States.

Abstract (35 Word Limit): This paper reports ultrafast laser fabrication of waveguide circuits and 45° vertical coupling micromirrors in fused silica for board-level optical interconnect applications. Excellent micromirror surface quality was obtained and 0.24-dB per reflection at l=632nm was demonstrated.
Direct Laser Writing of 3D Gratings and Diffraction Optics

M. Moebius;  K. Vora; S. Kang; P. Muñoz; G. Deng; E. Mazur;

1. Harvard University, Cambridge, MA, United States.

Abstract (35 Word Limit): We fabricate 3D gratings and diffraction optics using direct laser writing. Diffraction patterns of gratings agree with Laue theory. We demonstrate zone plates for visible wavelengths. Direct laser writing is promising for integrated diffraction optics.
Harnessing Polarization Spatio-Temporal Coupling: A New Degree of Freedom in Ultrafast Laser Material Processing

A. Patel; 1; M. Beresna; 1; P. Kazansky; 1;
1. University of Southampton, Southampton, United Kingdom.

Abstract (35 Word Limit): Polarization spatio-temporal coupling reveals new degree of freedom in ultrafast laser material processing. Control of modification in fused silica is demonstrated with the use of prism compressors and polarization azimuth of ultrashort pulse laser beam.
Phase Diversity Method for Optical Coherent Receiver

T. M. Hoang; 1; M. Osman; 1; M. Chagnon; 1; Q. Zhuge; 1; D. Patel; 1; D. Plant; 1;
1. McGill University, Montreal, QC, Canada.

Abstract (35 Word Limit): We present the first phase-diversity coherent receiver for an arbitrary hybrid. Colorless experiment of 10x132-Gb/s PDM-QPSK is demonstrated with reduced components and with less than 0.5 dB in OSNR penalty compared to traditional coherent receivers.
Multi-Gigabit Coherent Communications Using Low-Rate FEC to Approach the Shannon Capacity Limit

D. J. Geisler; 1; V. Chandar; 1, 2; T. M. Yarnall; 1; M. L. Stevens; 1; S. A. Hamilton; 1;

1. Massachusetts Inst of Tech Lincoln Lab, Lexington, MA, United States.

Abstract (35 Word Limit): Combining a rate-¼ forward error-correcting code, a coherent receiver, and an optical phase-locked loop yields near error-free performance with 2-dB photon-per-bit sensitivity, which is <3-dB from the Shannon limit for a rate-¼, pre-amplified, coherent receiver.
Phase Noise-Robust LLR Calculation with Linear/Bilinear Transform for LDPC-Coded Coherent Communications
T. Koike-Akino; D. S. Millar; K. Kojima; K. Parsons;
1. Mitsubishi Electric Research Labs, Cambridge, MA, United States.

Abstract (35 Word Limit): We propose a modified log-likelihood ratio (LLR) calculation for an LDPC decoder to be robust against residual phase noise at the demodulator. The proposed scheme is based on a linear/bilinear transform offers 1 to 2dB gain in the presence of large phase noise.
FPGA-based Non-binary QC-LDPC Coding for High-Speed Coherent Optical Transmission

D. Zou; I. B. Djordjevic;

1. University of Arizona, United States.

Abstract (35 Word Limit):
We present a large-girth-non-binary QC-LDPC code suitable for beyond 100 Gb/s optical transmission and describe its implementation in FPGA. Great performance with Q-limit of 5.0 dB at BER of 10^-10 has been found, which corresponds to NCG of 11.95 dB at 10^-15.
Experimental Demonstration of Simultaneous Phase Noise Suppression and Automatically Locked Tunable Homodyne Reception for a 20-Gbaud QPSK Signal

A. Mohajerin Ariaei; 1; M. Ziyadi; 1; a. almaina; 1; y. cao; 1; M. Chitgarha; 1; Y. akasaka; 2; J. Yang; 2; m. sekiy; 2; j. touch; 3; M. Tur; 5; c. langrock; 4; M. M. Fejer; 4; a. willner; 1;
1. University of Southern California (USC), Los Angeles, CA, United States.
2. Fujitsu Laboratories of America, Richardson, TX, United States.
3. Information Sciences Institute, Marina del Rey, CA, United States.
5. Tel Aviv University, Ramat, Israel.

Abstract (35 Word Limit): We experimentally demonstrate simultaneous phase-noise suppression and automatically locked homodyne reception for 20-Gbaud QPSK signal. The phase noise deviation can be reduced by a factor ~3. Open I/Q eyes are obtained after the noise mitigation.
Enhanced Spectral Efficiency of 2.36 bits/s/Hz using Multiple Layer Overlay Modulation for QPSK over a 14-km Single Mode Fiber Link

G. Xie; L. Li; Y. Ren; H. Huang; Z. Zhao; p. liao; a. alomain; y. cao; Y. Yan; C. Bao; N. Ahmed; Z. Wang; N. Ashrafi; S. Ashrafi; R. Linquist; m. tur; a. willner;

1. U. of Southern California, Los Angeles, CA, United States.
2. NxGen Partners, Dallas, TX, United States.
3. University of Texas at Dallas, Richardson, TX, United States.
4. Tel Aviv University, Ramat Aviv, Israel.

Abstract (35 Word Limit): A multiple-layer-overlay (MLO) modulation format is employed for a 14-km optical fiber link and an enhanced spectral efficiency of 2.36 bits/s/Hz is achieved by multiplexing 3-layer signals with each layer carrying a 2-Gbit/s QPSK signal.
DSP-complexity Reduction of QAM-based Coherent Optical Networks Enabled by Seed Lightwave Distribution

J. Sakaguchi; M. Kumagai; Y. Li; T. Ido; Y. Awaji; N. Wada;
1. NICT, Koganei, Tokyo, Japan.

Abstract (35 Word Limit): A new network scheme employing stable seed lightwave distribution is investigated for reducing QAM demodulation complexity. We perform 150 km seed distribution before 100 km WDM-PDM-64QAM transmission and achieve simple demodulation without phase estimation.
Abstract (35 Word Limit): Chalcogenide glass fibers offer a fruitful playground for mid-infrared nonlinear optics but are hampered by mechanical fragility and high chromatic dispersion. I review recent efforts on novel of chalcogenide fibers that address these perennial issues.
Tunable Single Longitudinal Mode Tm-doped Fiber Ring Laser

J. Yoo¹, ²; S. Lim¹, ²; S. Kim¹;

1. Physical Metrology, Korea Research Institute of Standards and Science, Daejeon, Korea (the Republic of).
2. Measurement Science, Korea University of Science and Technology, Daejeon, Korea (the Republic of).

Abstract (35 Word Limit): We present a tunable single longitudinal mode Tm-doped fiber ring laser incorporating a self-constructed saturable absorption grating and a blazed grating with wavelength tunability of over 100 nm. The spectral and temporal characteristics of the laser output are described.
Resonantly Pumped Amplification in a Thulium-doped Large Mode Area Photonic Crystal Fiber

A. Sincore; 1; L. Shah; 1; M. Richardson; 1;
1. University of Central Florida, Orlando, FL, United States.

Abstract (35 Word Limit): We demonstrate resonantly pumped amplification in a thulium-doped photonic crystal fiber. This enables greatly increased efficiencies compared to 795nm or 1550nm pumping and is attractive for pulsed amplification.
Tunable Single-Frequency DFB Fiber Laser at 2.8 μm

V. Michaud-Belleau; 1 M. Bernier; 1 V. Fortin; 1 J. Genest; 1 R. Vallée; 1

1. Centre d'optique, photonique et laser, Université Laval, Québec, QC, Canada.

Abstract (35 Word Limit): We report a tunable single-frequency laser emission near 2.8 μm from an all-fiber distributed feedback laser. A 20 kHz linewidth is measured with a tunability of ~1 nm at a step resolution of 3 pm.
Wavelength Tunable Mid-infrared Er\textsuperscript{3+}:ZBLAN Fiber Laser at 3.5 μm using Dual Wavelength Pumping

O. Henderson-Sapir; J. Munch; D. J. Ottaway;

1. University of Adelaide, Oaklands Park, SA, Australia.

Abstract (35 Word Limit): An Er\textsuperscript{3+} ZBLAN glass fiber laser which lases at 3.5 μm and produces 370 mW when operated at room temperature is reported. Good efficiency is obtained using a dual wavelength pumping scheme. Over 200 nm of wavelength tuning is demonstrated using a three mirror resonator configuration.
Power Scaling of 2.94 μm Fiber Lasers
V. Fortin; M. Bernier; R. Vallée;
1. Centre d'optique, photonique et laser, Université Laval, Québec, QC, Canada.

Abstract (35 Word Limit): Recent advances in high power erbium-doped fluoride fiber lasers near 2.94 μm are reviewed. Based on an all-fiber architecture, a 20 W record output power was achieved at this wavelength of interest for medical applications.
Two-Octave Mid-Infrared Supercontinuum Generation in As-Se Suspended Core Fibers

U. Møller; 1 C. R. Petersen; 1 I. Kubat; 1 Y. Yu; 2 X. Gai; 2 L. Brilland; 3 D. Méchin; 3 C. Caillaud; 4 J. Troles; 4 B. Luther-Davies; 2 O. Bang; 1 5

1. DTU Fotonik, Department of Photonics Engineering, Technical University of Denmark, Kongens Lyngby, Denmark.
2. Centre for Ultrahigh bandwidth Devices for Optical Systems, Laser Physics Centre, Australian National University, Canberra, ACT, Australia.
4. Institut des Sciences Chimiques de Rennes, Université de Rennes 1, Rennes Cedex, France.
5. NKT Photonics, Birkerod, Denmark.

Abstract (35 Word Limit): A more than two-octave mid-infrared supercontinuum with an average output power of 15.6 mW covering 1.7-7.5 μm (1333-5900 cm⁻¹) is generated in a low-loss As₃₈Se₆₂ suspended core fiber with core diameter of 4.5 μm.
Abstract (35 Word Limit): We propose a new implementation of a QPSK modulator using a simple single ring resonator. That requires only < $\pi/10$ phase shift. Signal generated have a better dispersion tolerance than from a single phase modulator.
Automated Calibration of High-Order Microring Filters

J. Mak; W. Sacher; J. Mikkelsen; T. Xue; Z. Yong; J. Poon;
1. Edward S. Rogers Sr. Department of Electrical & Computer Engineering, University of Toronto, Toronto, ON, Canada.

Abstract (35 Word Limit): We demonstrate the automated calibration of a 5th-order silicon microring filter using an optimization algorithm. The procedure only requires a single input wavelength and was implemented on a microcontroller with simple ADC and DAC circuitry.
Selected Applications of Ultra-high Q Whispering Gallery Mode Resonators

L. Maleki;
1. OEWaves Inc, Pasadena, CA, United States.

Abstract (35 Word Limit): Emerging applications aided by advances in physics and technology of Whispering Gallery Mode microresonators will be discussed.
Silicon Photonic Filters for Compact High Extinction Ratio Power Efficient (CHERPe) Transmitters

S. Spector; ¹; J. M. Knecht; ¹; R. T. Schulein; ¹; D. O. Caplan; ¹;
1. Massachusetts Inst of Tech Lincoln Lab, Lexington, MA, United States.

Abstract (35 Word Limit): We experimentally investigate integrated photonic microring resonator filters as frequency windows in CHERPe transmitters. The impact of filter-order on optical loss, power handling, modulation extinction ratio enhancement, and waveform distortion is assessed.
28 Gb/s BPSK Modulation in a Coupling-tuned Silicon Microring Resonator

R. Yang;¹; L. Zhou;¹; h. zhu;¹; J. Chen;¹;
¹. Shanghai Jiao Tong University, China.

Abstract (35 Word Limit): We demonstrate 28 Gb/s binary phase-shift keying modulation in a silicon microring integrated with a Mach-Zehnder coupler. The BPSK signal has a Q-factor of 6.3 dB and an EVM of 23.3% with 3 V drive voltage.
Tailoring Nonlinear Interactions with Aperiodic QuasiPhaseMatching

M. M. Fejer; 1
1. Stanford University, Stanford, CA, United States.

Abstract (35 Word Limit): The evolution of three-wave mixing processes can be controlled with aperiodic QPM structures. We describe underlying concepts, engineering of spectral amplitude and phase, and adiabatic processes, illustrated with examples including few-cycle OPCPA, octave spanning frequency combs, and quantum frequency conversion.
Chirped Quasi-Phase-Matching Grating Design for Broad-Bandwidth, Engineerable-Phase Adiabatic Second-Harmonic Generation

Y. Lin;¹ C. Phillips;² M. M. Fejer;¹
1. Stanford University, Stanford, CA, United States.
2. ETH Zurich, Zurich, Switzerland.

Abstract (35 Word Limit): The use of adiabatic conversion for broadband, efficient, and robust second-harmonic generation with engineerable spectral phase is analyzed theoretically and numerically, and verified by experiment. The advantages compared with conventional methods are also discussed.
Toward Multi-Octave Pulse Shaping by Adiabatic Frequency Conversion

P. Krogen; 1; H. Suchowski; 2; H. Liang; 1; F. X. KAERTNER; 1, 3; J. Moses; 4, 1;

1. Department of Electrical Engineering and Computer Science and Research Laboratory of Electronics, Massachusetts Institute of Technology, Cambridge, MA, United States.
2. Raymond and Beverly Sackler School of Physics and Astronomy, Tel Aviv University, Tel Aviv, Israel.
3. Center for Free-Electron Laser Science, DESY and Physics Department, University of Hamburg, Notkestraße, Hamburg, Germany.
4. School of Applied and Engineering Physics, Cornell University, Ithaca, NY, United States.

Abstract (35 Word Limit): We demonstrate complex mid-IR spectral phase and amplitude shaping spanning 2.5-5 um, based on down-conversion of a shaped near-IR source, using chirped-pulse adiabatic difference frequency generation. The technique can be extended to multi-octave bandwidths.
Soliton Modelocking With Normal Dispersion via Adiabatic Excitation of $\chi^{(2)}$ Solitons in Apodized Fanout PPLN Devices

C. R. Phillips; A. Mayer; A. Klenner; U. Keller;
1. ETH Zurich, Zurich, ZH, Switzerland.

Abstract (35 Word Limit): We demonstrate soliton modelocking of a Yb:CALGO laser via cascaded second-order nonlinearities whereby the second-harmonic is adiabatically excited/de-excited in an apodized-fanout-PPLN crystal. We obtain 100-fs pulses at 540 MHz with 760 mW average power.
Abstract (35 Word Limit): We report on a picosecond OPO combining an aperiodically poled nonlinear crystal and a rapidly tunable intracavity spectral filter. Fast tuning over 80 nm around 3.84 µm is carried out in less than few milliseconds.
Quantum random number generation using photon arrival time selectively without post-processing

J. Wang; J. Wang; T. Xie; H. Zhang; D. Yang; C. Xie;

1. Univ. of Sci. & Tech. of China, Hefei, Anhui, China.
2. Electrical & Information Engineering Department, Huang Shan University, Huangshan, China.

Abstract (35 Word Limit): We present a high-speed quantum random number generator (QRNG) without post-processing using photon arrival time selectively in accordance with the number of photon detection events within a sampling time interval in attenuated light.
Abstract (35 Word Limit): The simultaneous generation of both co-polarized and cross-polarized polarization entangled photons from a monolithic semiconductor chip is demonstrated. High quality entanglement is achieved with no use of any off-chip compensation, interferometry or filtering.
Avoiding Entanglement Sudden Death Using Quantum Measurement Reversal on Single-qubit

K. Hong;¹; H. Lim;¹; J. Lee;¹; Y. Kim;¹;
1. Pohang Univ of Sci & Tech (POSTECH), , United States.

Abstract (35 Word Limit): Decoherence on two-qubit systems degrades entanglement, and sometimes even causes entanglement sudden death (ESD). We show quantum measurement reversal on only one subsystem can avert ESD, providing methods for practical entanglement distribution under decoherence.
Measurement of Energy Correlations of Photon Pairs Generated in Silicon Ring Resonators

M. Liscidini; 1 D. Grassani; 1 A. Simbula; 1 M. Galli; 1 S. Pirotta; 1 T. Baher-Jones; 2 M. Hochberg; 2 N. Harris; 3 C. Galland; 4 J. E. Sipe; 5 D. Bajoni; 6
1. Physics, Universita degli Studi di Pavia, Pavia, PV, Italy.
2. East West Photonics Pte Ltd, Singapore, Singapore.
3. Electrical Engineering and Computer Science, Massachusetts Institute of Technology, Boston, MA, United States.
4. Stuttgart University, Stuttgart, Germany.
5. Physics, University of Toronto, Toronto, ON, Canada.
6. Ingegneria Industriale e dell'Informazione, Università degli Studi di Pavia, Pavia, Italy.

Abstract (35 Word Limit):
With unprecedented resolution we measure the joint spectral density of photon pairs that would be generated by spontaneous four-wave-mixing in a silicon ring resonator, and show how the quantum correlations can be tailored.
Quantum information interface for orbital angular momentum photons

R. Tang; X. Li; W. Wu; H. Pan; H. Zeng; E. Wu;
1. East China Normal University, Shanghai, Shanghai, China.

Abstract (35 Word Limit): We have demonstrated a quantum interface based on the frequency upconversion for photons carrying orbital angular momentum (OAM) states from telecom wavelength to visible regime by sum-frequency generation with high quantum conversion efficiency.
Generation and Characterization of Continuous Variable Quantum Correlations Using a Fiber Optical Parametric Amplifier

X. Li; X. Guo; N. Liu; Y. Liu;
1. College of Precision Instrument and Opto-electronics Engineering, Tianjin University, Tianjin, Tianjin, China.

Abstract (35 Word Limit): We generate the quadrature entanglement and the Gaussian discord using a fiber optical parametric amplifier, and investigate the factors influencing the values of inseparability $I$ and discord $D$, respectively.
Fortifying Single Photon Detectors to Quantum Hacking Attacks by Using Wavelength Upconversion

G. S. Kanter; 1, 2
1. NuCrypt, Evanston, IL, United States.
2. Center for Photonic Communication and Computing, Northwestern University, Evanston, IL, United States.

Abstract (35 Word Limit): Upconversion detection can isolate the temporal and wavelength window over which light can be efficiency received. Using appropriate designs the ability of an eavesdropper to damage, measure, or control QKD receiver components is significantly constricted.
A Controlled-NOT (CNOT) Gate Based on Quantum Interference in Cascaded Silicon Dual-ring Resonators
Z. Yao; 1; L. Zhang; 1, 2; L. Yang; 2; A. W. Poon; 1;
1. Photonic Device Laboratory, Department of Electronic and Computer Engineering, The Hong Kong University of Science and Technology, Hong Kong, China.
2. State Key Laboratory on Integrated Optoelectronics, Institute of Semiconductors, Chinese Academy of Sciences, Beijing, China.

Abstract (35 Word Limit): We propose a controlled-NOT (CNOT) gate based on two-photon quantum interference in cascaded silicon dual-ring resonators with Mach-Zehnder interferometer-assisted coupling. We illustrate the working principle and the design parameters of the device by theoretical modeling.
Photonic Quantum Walks on Finite Graphs and with Non-Localised Initial States

F. Elster; S. Barkhofen; T. Nitsche; J. Novotný; A. Gábris; I. Jex; C. Silberhorn

1. Applied Physics, University of Paderborn, Paderborn, Germany.
2. Department of Physics, Faculty of Nuclear Sciences and Physical Engineering, Czech Technical University in Prague, Prague, Czech Republic.
3. Department of Theoretical Physics, University of Szeged, Szeged, Hungary.

Abstract (35 Word Limit): We present a time-multiplexed quantum walk in a fibre loop setup and introduce a fast switching electro optic modulator. Hence we can limit the spread of the wavefunction by choice and study the evolution of non-localized initial states.
Final ID: JW2A.10

Multi-party Agile QKD Network with a Fiber-based Entangled Source
E. Y. Zhu; 1 C. Corbari; 2 A. V. Gladyshev; 3 P. Kazansky; 2 H. Lo; 1 L. Qian; 1
1. University of Toronto, North York, ON, Canada.
2. University of Southampton, Southampton, United Kingdom.
3. Fiber Optics Research Center of the Russian Academy of Sciences, Moscow, Russian Federation.

Abstract (35 Word Limit): A multi-party quantum key distribution scheme is demonstrated by utilizing a poled fiber-based broadband polarization-entangled source and dense wavelength-division multiplexing. Entangled photon pairs are delivered over 40-km of fiber, with secure key rates of more than 20 bits/s observed.
Spectral Engineering and Entanglement Generation in Poled Optical Fibers

E. Y. Zhu; 1; C. Corbari; 2; A. V. Gladyshev; 3; A. Kosolapov; 3; M. Yashkov; 4; P. Kazansky; 2; L. Qian; 1;
1. University of Toronto, Toronto, ON, Canada.
2. Optoelectronics Research Centre, University of Southampton, Southampton, United Kingdom.
3. Fiber Optics Research Center of the Russian Academy of Sciences, Moscow, Russian Federation.
4. Institute of Chemistry of High-Purity Substances of the Russian Academy of Sciences, Nizhny Novgorod, Russian Federation.

Abstract (35 Word Limit): The joint spectra of the two type-II phase-matchings that add coherently to give rise to the generation of polarization-entangled photon pairs in a poled fiber are measured. Optimal parameters are identified for the generation of high-quality entanglement.
Abstract (35 Word Limit): In this work we experimentally demonstrate a fully integrated photon-counting device based on a divide-and-conquer technique using linear optics in combination with on-off detectors. Our scheme is based on click-counting statistics instead of photon-counting statistics.
High-Q Microresonator as a Five-Partite Entanglement Generator via Cascaded Parametric Processes

G. He; 1; Y. Wen; 1; Q. Lin; 2;
1. Department of Electronic Engineering, Shanghai Jiaotong University, Shanghai, China.
2. Department of Electrical and Computer Engineering, University of Rochester, New York, NY, United States.

Abstract (35 Word Limit): We propose to produce five-partite entanglement via cascaded four-wave mixing in a high-Q microresonator that may become a key to future one-way quantum computation on chip.
Integrated-photonic generation of general EPR-states

A. Szameit; M. Graefe; R. Heilmann; S. Nolte;
1. Institute of Applied Physics, Jena, Germany.

Abstract (35 Word Limit): We present a novel method to generate arbitrary path-encoded EPR-states on-chip by a single operation only. Such states can be utilized to mimic the quantum statistics of fermions, bosons, and anyons.
Secure Communication App on Mobile Phone Enabled by Sharing Quantum Random Numbers

L. Qiao; 1, 2; L. Li; 1; X. Lin; 1, 2; X. Jin; 1, 2;

1. State Key Laboratory of Advanced Optical Communication Systems and Networks, Department of Physics and Astronomy, Shanghai Jiao Tong University, Shanghai, China.
2. Synergetic Innovation Center of Quantum Information and Quantum Physics, University of Science and Technology of China, Hefei, Anhui, China.

Abstract (35 Word Limit): We develop a mobile phone app for secure communication in which all data including text, voice, email and any other files are all encrypted and decrypted with shared quantum random numbers.
Quantum Repeater with Quantum Frequency Conversion

X. Li;¹ N. Solmeyer;² Q. Quraishi;²

1. Joint Quantum Institute, College Park, MD, United States.
2. U.S. Army Research Laboratory, Adelphi, MD, United States.

Abstract (35 Word Limit): We report the progress of a quantum repeater with quantum frequency conversion to telecom wavelengths, which allows for quantum communication over long distances.
Quantum State Engineering in Integrated Couplers

R. P. Marchildon; 1; A. S. Helmy; 1;
1. University of Toronto, Toronto, ON, Canada.

Abstract (35 Word Limit): The utilization of integrated couplers beyond their function as 50:50 splitters is examined. Their dispersive properties offer novel possibilities for state engineering, interference visibility behaviour, and entanglement sensitivity. Implications for photon pair separation are explored.
Compressive Imaging of Broadband Single-Photon Sources With Superconducting Detectors

J. Schaake; 1
1. University of Tennessee at Knoxville, Oak Ridge, TN, United States.

Abstract (35 Word Limit): We experimentally characterize the spatio-spectral properties of photon pairs generated by spontaneous parametric down-conversion in a Type-0 PPKTP waveguide using compressive imaging techniques combined with superconducting single photon detectors and dispersive fiber spectrometer.
Simulation Study of the Stability of Polarization Structure in Disordered Photonic Crystal Waveguides

R. Oulton; 1; B. Lang; 1; D. Beggs; 1; J. Rarity; 1; A. Young; 1;
1. University of Bristol, Bristol, United Kingdom.

Abstract (35 Word Limit): The effects of short range disorder on the polarization characteristics of light in W1 photonic crystal waveguides were simulated. It was found that points of local circular polarization were robust in both quantity and location.
Two-photon evolution equation for multiport optical systems

A. P. Leija; 1; M. Graefe; 1; R. Heilmann; 1; M. N. Lebugle; 1; S. Nolte; 1; H. Moya-Cessa; 2; D. N. Christodoulides; 3; A. Szameit; 1

1. Friedrich-Schiller-Universität Jena, Jena, Germany.
2. Optics Department, INAOE, Puebla, Mexico.
3. CREOL, University of Central Florida, Orlando, FL, United States.

Abstract (35 Word Limit): In this work we demonstrate, theoretically and experimentally, that two-photon probability amplitudes describing propagation of light in any two-photon state are governed by an evolution equation identical to a 2D tight-binding equation.
Abstract (35 Word Limit): We present focused ion beam implantation as a prospective tool for realizing a patterned rare-earth spin-ensemble in a solid-state substrate. We demonstrate a successful implantation with 20% of luminescent ion activation for Erbium ions in Y$_2$SiO$_5$ crystals.
Efficient Collisional Blockade Single Atom Loading in Tight Optical Microtraps

Y. Fung; 1 M. Andersen; 1
1. Jack Dodd Centre for Quantum Technology, University of Otago, Dunedin, New Zealand.

Abstract (35 Word Limit): Collisional blockade loading of single atom in tight FORT has about 50% efficiency in previous works. We experimentally observe an enhancement to about 80% by inducing controlled inelastic collisions during loading, which is supported by an analytical theory.
Preservation of Transverse Spatial Coherence of an Optical Pulse in Atomic Vapor Quantum Memory

J. Lee; 1, K. Park; 1, Y. Cho; 1, Y. Kim; 1,

1. Physics, Pohang University of Science and Technology, Pohang, Korea (the Republic of).

Abstract (35 Word Limit): We report preservation of transverse spatial coherence of an optical pulse stored in atomic vapor quantum memory. Using Young-type spatial interference, it is clearly demonstrated that the atomic vapor quantum memory preserves transverse spatial coherence.
Coulomb Interaction and Delocalized States in Self-assembled InGaAs Lateral Quantum Dot Molecules

X. Zhou; 1 M. Royo; 2 W. o. Liu; 1 J. Lee; 3 4 G. Salamo; 4 J. Climente; 2 M. Doty; 1

1. University of Delaware, , United States.
2. Departament de Quimica Fisica i Analitica, Universitat Jaume I, Castello, Spain.
3. School of Electronics and Information, Kwangwoon University, Seoul, Korea (the Republic of).
4. Institute of Nanoscale Science and Engineering, University of Arkansas, Fayetteville, AR, United States.

Abstract (35 Word Limit): We study self-assembled lateral quantum dot molecules (LQDMs) under varying electric and magnetic fields and deduce the electronic structure, charge configurations and delocalized states that lead to the observed photoluminescence spectra.
Resonance Fluorescence Spectrum from a Quantum Dot Driven by a Periodically-Pulsed Laser

k. konthasinghe; 1; M. Peiris; 1; B. Petrak; 1; Y. yu; 2; Z. Niu; 2; A. muller; 1;
1. Physics, University of South Florida, Tampa, FL, United States.
2. Chinese Academy of Sciences, Beijing, China.

Abstract (35 Word Limit): We report the measurement of the resonance fluorescence spectrum from a quantum dot under periodically-pulsed excitation. The evolution of multiple sidebands and Rabi oscillations for coherently and incoherently scattered light were observed.
Deterministic Generation of a Triexciton in a Quantum Dot

E. Schmidgall; I. Schwartz; L. Gantz; D. Cogan; D. Gershoni;
1. Technion, Haifa, Israel.

Abstract (35 Word Limit): We demonstrate deterministic generation of a quantum dot-confined triexciton in a well-defined coherent state using a sequence of three laser pulses.
Abstract (35 Word Limit):

We studied experimentally and theoretically a single-photon source consisting of a quantum dot coupled to a micropillar cavity. The influence of the LA-phonon bath on the brightness of the source and the indistinguishability of the emitted photons will be discussed.
Interactions of Space Variant Polarization Beams with Zeeman-shifted Rubidium Vapor

L. Stern; 1; A. Szapiro; 1; U. Levy; 1;
1. hebrew university of Jerusalem, Jerusalem, Israel.

Abstract (35 Word Limit): We experimentally demonstrate the interaction between space variant polarization beams with a Zeeman shifted rubidium vapor operating as a controlled circular birefringence and dichroism media. Full Stokes parameters measurements allows for mapping the polarization distribution.
A Subluminal Laser

with Extreme Insensitivity to Cavity Length Change

Z. Zhou; J. Yablon; Y. Wang; J. Scheuer; S. M. Shahriar;

1. Northwestern University, Evanston, IL, United States.
2. School of Electrical Engineering, Tel Aviv University, Tel Aviv, Israel.

Abstract (35 Word Limit): With a narrow peak on top of a broad-band gain profile in a laser, the group-velocity of light becomes significantly subluminal. The lasing frequency becomes extremely insensitive to cavity length change in such a laser.
Simple and Efficient Filter for Single Photons from a Cold Atom Quantum Memory

D. T. Stack; 1; Q. Quraishi; 1;
1. US Army Research Laboratory, Adelphi, MD, United States.

**Abstract (35 Word Limit):** Filtering unwanted light signals is critical to the operation of neutral atom quantum memories. The addition of a novel frequency filter increases the non-classical correlations and readout efficiency of our quantum memory by ≈ 35%.
Optimized scalable circular grating with efficient photon extraction for Nitrogen Vacancy centers in a bulk diamond

J. Zheng; 1, 2; E. Chen; 2; L. Li; 2; F. Dolde; 2; D. Englund; 2;

1. Department of Electrical Engineering, Columbia University, New York, NY, United States.
2. Department of Electrical Engineering and Computer Science, Massachusetts Institute of Technology, Cambridge, MA, United States.

Abstract (35 Word Limit): We numerically demonstrate an optimized circular grating for Nitrogen-Vacancy centers with collection efficiency of 35.8% for Zero-Phonon emission into NA within 0.5, which is improved to 63.9% by adding a conductive layer. The optimal structure is fabricated using transferred hard mask lithography.
Laser and Optical Subsystem for NASA’s Cold Atom Laboratory

J. M. Kohel; J. R. Kellogg; E. R. Elliott; M. C. Krutzik; D. C. Aveline; R. J. Thompson;

1. Jet Propulsion Laboratory, Pasadena, CA, United States.

Abstract (35 Word Limit): We describe the design and validation of the laser and optics subsystem for NASA’s Cold Atom Laboratory, a multi-user facility being developed for studies of ultra-cold quantum gases in the microgravity environment of the International Space Station.
A New Algorithm for Attosecond Pulse Characterization

P. D. Keathley; 1; S. Bhardwaj; 1; J. Moses; 1; G. Laurent; 1; F. X. KAERTNER; 1, 2;

1. Electrical Engineering and Computer Science and Research Laboratory of Electronics, Massachusetts Institute of Technology, Cambridge, MA, United States.
2. Center for Free-Electron Laser Science and Dept. of Physics, DESY and University of Hamburg, Hamburg, Germany.

Abstract (35 Word Limit): An algorithm for characterizing attosecond EUV pulses which is not bandwidth-limited, requires no interpolation of the experimental data, and makes no approximations beyond SFA while fully retrieving both the IR and EUV pulses is introduced.
Versatile Simulation Package for Ultrafast Pulse Propagation and High Harmonic Generation

G. J. Stein; C. Lai; P. D. Keathley; P. R. Krogen; H. Liang; C. L. Chang; K. Hong; G. Laurent; F. X. KAERTNER;
1. Massachusetts Institute of Technology, United States.
2. CFEL, Hamburg, Germany.

Abstract (35 Word Limit): A simulation package for 3D pulse propagation and HHG is reported. Our package is capable of emulating pulse propagation for a host of geometries and nonlinear effects, and has been employed to reproduce experimental HHG spectra.
Towards Observing Dynamical Localization within the Quantum Linear Rotor

a. kamalov; 1, 2; D. Broege; 1, 2; P. Bucksbaum; 2, 1;
1. Stanford University, Menlo Park, CA, United States.
2. PULSE Institute, SLAC National Accelerator Laboratory, Menlo Park, CA, United States.

Abstract (35 Word Limit): We discuss novel approaches towards observation of dynamical localization, a phenomenon believed to occur in the periodically δ-kicked quantum linear rotor and is related to one-dimensional Anderson localization.
Ultrafast Rotational Spectroscopy Based on a Free-space Nitrogen Ion Laser

B. Zeng; H. Xie; H. Zhang; G. Li; W. Chu; J. Yao; C. Jing; J. Ni; Y. Cheng;
1. Shanghai Institute of Optics and Fine Mechanics, Shanghai, China.

Abstract (35 Word Limit): We demonstrated that ultrafast rotational spectroscopy can be performed with a cavityless nitrogen ion laser with both high temporal and spectral resolutions. Quantum beating between the molecular rotational wave packets have been observed.
Highly Efficient High–order Harmonics with Large Cutoff from Carbon Molecules using Various Laser Wavelengths

M. Fareed; 1; N. Thiré; 1; S. Mondal; 1; y. pertot; 1; M. Boudreau; 1; B. E. Schmidt; 1; F. Légaré; 1; T. Ozaki; 1;
1. INRS-EMT, Varennes, QC, Canada.

Abstract (35 Word Limit): Carbon molecules are used to generate intense high-order harmonics using driving lasers with 0.8 µm - 1.71 µm wavelengths. By driving plasma of reduced size (~200µm) with 1.71µm laser, we could extend the cutoff to ~70eV, while reducing the peak intensity by only ~31%.
Interaction of Metal Oxide Nanoparticles, Generated via Microparticle Ablation, with Intense XUV Pulses
S. Bruce; 1, 2; A. M. Helal; 1, 2; T. Ha; 1, 2; H. J. Quevedo; 1, 2; A. C. Bernstein; 1, 2; J. Keto; 1, 2; T. Ditmire; 1, 2

1. Center for High Energy Density Science, Austin, TX, United States.
2. Physics, The University of Texas at Austin, Austin, TX, United States.

Abstract (35 Word Limit): We have designed and assembled an experiment to evaluate the role of continuum lowering in XUV nanocluster ionization. Metal oxide nanoparticles, generated via laser ablation of microparticles, will be irradiated by intense coherent XUV pulses.
Abstract (35 Word Limit): Wavelength-scale platinum wires were irradiated by a 1-micron wavelength laser at relativistic intensities, accelerating electrons in the laser-matter interaction. Wire diameters and angles relative to laser polarization were varied, and emitted electron distributions were measured.
Density-chopped Far-infrared Transmission Spectroscopy to Probe Subband-Landau Splittings and Tune Intersubband Transitions

S. Pal; H. Nong; S. R. Valentin; N. Kukharchyk; A. Ludwig; N. Jukam; A. D. Wieck;
1. Lehrstuhl für Angewandte Festkörperphysik, Ruhr-Universität Bochum, D-44780 Bochum, Germany.
2. AG Terahertz Spektroskopie und Technologie, Ruhr-Universität Bochum, D-44780 Bochum, Germany.

Abstract (35 Word Limit): We study the half-field subband-Landau resonant splitting of a two-dimensional electron gas and demonstrate the possibility to tune the intersubband spacings via density-chopped far-infrared transmission spectroscopy in the absence of external magnetic field.
Optical Generation of High Spin Polarization in GaSe Nanoslabs

Y. Tang; W. Xie; K. C. Mandal; J. A. McGuire; C. Lai;
1. Michigan State University, East Lansing, MI, United States.
2. University of South Carolina, Columbia, SC, United States.

Abstract (35 Word Limit): We report nearly complete preservation of "spin memory" between optical absorption and photoluminescence under excitation >0.2 eV above the band gap in nanometer GaSe slabs.
Control of Energy Relaxation Pathways in Graphene: Carrier-Carrier Scattering vs Phonon Emission

D. Turchinovich; 1 Z. Mics; 1 S. Jensen; 1 I. Ivanov; 1 S. Varol; 1 F. Koppens; 2 M. Bonn; 1 K. Tielrooij; 2
1. Max Planck Institute f. Polymer Research, Mainz, Germany.
2. ICFO The Institute of Photonic Sciences, Barcelona, Spain.

Abstract (35 Word Limit): We investigate the relaxation pathways of photoexcited carriers in graphene. These carriers relax their energy through either carrier-carrier scattering or phonon emission, depending on photoexcitation conditions and the Fermi level.
Spin vortices of polariton condensates in tunable microcavities with strong lateral confinement

F. Li; 1; S. Dufferwiel; 1; L. Giriunas; 1; E. Cancellieri; 1; A. Trichet; 2; D. M. Whittaker; 1; P. M. Walker; 1; E. Clarke; 3; J. M. Smith; 2; M. S. Skolnick; 1; D. N. Krizhanovskii; 1;

1. Department of Physics and Astronomy, University of Sheffield, Sheffield, United Kingdom.
2. Department of Materials, University of Oxford, Oxford, United Kingdom.
3. EPSRC National Centre for III-V Technologies, University of Sheffield, Sheffield, United Kingdom.

Abstract (35 Word Limit): We present tunable open microcavities as a novel versatile tool for exciton-polariton studies. Their unique geometry and flexibility allow spontaneous generation and manipulation of spin vortices and textures of polariton condensates.
Exciton States in InGaN Nano-disks in GaN Nanowires Revealed Using Nonlinear Laser Spectroscopy.

C. Nelson; 1; A. Liu; 1; S. Desphande; 1; S. Jahangir; 1; P. K. Bhattacharya; 1; D. G. Steel; 1;
1. University of Michigan, Ann Arbor, MI, United States.

Abstract (35 Word Limit): Linear and coherent non-linear resonant high resolution laser spectroscopy was used to characterize In$_{0.54}$Ga$_{0.46}$N disks in nanowires. Nonlinear optical spectroscopy and PLE reveal narrow excitonic resonances and evidence of coupling between separate excited states.
Many-Body Interactions Between Excitons in GaAs Quantum Wells Quantified Using Two-Dimensional Coherent Spectroscopy

R. Singh;¹ T. Autry;¹ G. Moody;² G. Nardin;¹ B. Sun;¹ T. Suzuki;¹ S. Cundiff;¹

1. JILA, University of Colorado/NIST, Boulder, CO, United States.
2. NIST, Boulder, CO, United States.

Abstract (35 Word Limit): We have quantified excitonic many-body interaction energies in GaAs quantum wells using two-dimensional coherent spectroscopy. The anharmonic oscillator model for excitons is used to extract the inter- and intra-mode interaction energies from 2D spectra.
Optical Pump - Multi-THz Probe Spectroscopy of a Single Crystal Organic Hybrid Lead Halide Perovskite

D. A. Valverde-Chavez; 1; C. Ponseca; 2; C. Stoumpos; 3; A. Yartsev; 2; M. Kanatzidis; 3; V. Sundström; 2; D. G. Cooke; 1;

1. Physics, McGill University, Montreal, QC, Canada.
2. Chemical Physics, Lund University, Lund, Sweden.
3. Chemistry, Northwestern University, Evanston, IL, United States.

Abstract (35 Word Limit): We analyzed ultrafast photocarrier generation in single crystal CH$_3$NH$_3$PbI$_3$ perovskite through time-resolved terahertz spectroscopy. We find a Drude-Lorentz type conductivity spectra with a carrier mobility of 35 cm$^2$/Vs and a Lorentzian component at 45 meV possibly due to intra-excitonic transitions.
THz transient non-perturbative detection of spin reorientation transition in NdFeO$_3$ single crystal

G. Ma; $^1$

1. Shanghai University, Shanghai, Shanghai, China.

Abstract (35 Word Limit): Magnetic field-induced spin switching of NdFeO$_3$ crystal was demonstrated with TDS spectroscopy. The critical magnetic field to achieve the magnetic phase transition is modulated by temperature. A useful one-way spin switching has been found in NdFeO$_3$ crystal.
Ultrafast Laser-Induced Field Emission from a Single Carbon Nanotube Based Nanotip

M. Bionta; 1 B. Chalopin; 1 M. Delmas; 2 F. Houdellier; 2 A. Masseboeuf; 2 J. Mauchain; 1 B. Chatel; 1
1. LCAR-IRSAMC Université Paul Sabatier, Toulouse Cedex 9, France.
2. CEMES, Toulouse, France.

Abstract (35 Word Limit): We present the first demonstration of ultrafast laser-induced field emission from a carbon nanotube based nanotip, and measurement of the energy distribution of the electrons.
Abstract (35 Word Limit): Laser assisted electron emission from a free standing, non-aligned carbon nanotube film is observed with low power (<100 mW) continuous wave (785 nm) laser excitation. An increase in emission current by 330 times is realized.
Two Dimensional Coherent Spectroscopy of CdSe/ZnS Colloidal Quantum Dots at Cryogenic Temperatures

B. Sun; 1 D. B. Almeida; 1 R. Singh; 1, 2 G. M. Diederich; 3 M. E. Siemens; 3 L. A. Padilha; 4 W. K. Bae; 5 J. Pietryga; 6 V. Klimov; 6 S. Cundiff; 1, 2

1. JILA, National Institute of Standards and the University of Colorado, Boulder, CO, United States.
2. Physics, University of Colorado, Boulder, CO, United States.
3. Department of Physics and Astronomy, University of Denver, Denver, CO, United States.
4. Instituto de Fisica, Universidade Estadual de Campinas, Campinas, Brazil.
5. Photo-Electronic Hybrid Research Center, Korea Institute of Science and Technology, Seoul, Korea (the Republic of).
6. Chemistry Division, Los Alamos National Laboratory, Los Alamos, NM, United States.

Abstract (35 Word Limit): We demonstrate 2D coherent spectroscopy of CdSe/ZnS nanocrystals and measure the exciton homogeneous linewidth as a function of temperature from 10K to 300K. The spectra reveal contributions to the linewidth from discrete acoustic phonon modes.
Hybrid Metal Wire-Dielectric THz Fibers: Design and Perspectives

A. Markov; 1; H. Guerboukha; 1; M. Skorobogatiy; 1;
1. Ecole Polytechnique de Montreal, Montreal, QC, Canada.

Abstract (35 Word Limit): We investigate the optical characteristics of terahertz two-wire plasmonic waveguides, porous, and foam-based dielectric waveguides. Our group demonstrates a low-loss and low-dispersion hybrid metal wire-dielectric fiber resulting from fusion of the aforementioned types of waveguides.
Graded Index Porous Optical Fibers – Dispersion Management in Terahertz Range

A. Markov; 1; T. Ma; 1, 2; M. Skorobogatyi; 1;
1. Ecole Polytechnique de Montreal, Montreal, QC, Canada.
2. Xi’an Institute of Optics and Precision Mechanics of CAS, Xi’an, China.

Abstract (35 Word Limit): Graded index porous fiber incorporating an air-hole array featuring variable air-hole diameters and inter-hole separations is proposed. We experimentally demonstrate smaller pulse distortion, larger bandwidth and higher excitation efficiency compared to fibers with uniform porosity.
Efficiency Scaling of Narrowband Terahertz Wave Generation in PPLN by Optimizing the Pump-Pulse Format.
S. Carbajo; J. Schulte; K. Ravi; D. N. Schimpf; F. Kaernter;
2. Department of Physics, University of Hamburg, Hamburg, Germany.
3. Department of Electrical Engineering and Computer Science, Massachusetts Institute of Technology, Cambridge, MA, United States.

Abstract (35 Word Limit): We demonstrate a $1.5 \times 10^{-4}$ room temperature conversion efficiency and 0.29 µJ pulse energy for narrowband terahertz generation in PPLN pumped with ultrafast pulses at 800nm by experimentally and numerically optimizing the pump-pulse format.
Ultra High Dynamic Range Electro Optic Sampling for Terahertz Detection Using Fiber Based Spectral Domain Interferometry

A. Ibrahim; D. Férachou; G. Sharma; K. Singh; T. Ozaki;
1. INRS-EMT, Advanced Laser Light Source, Université du Québec, 1650 boul. Lionel- Boulet, J3X 1S2, Varennes, QC, Canada.
2. University of Massachusetts Lowell, 1 University Avenue, 01854, Lowell, MA, United States.
3. Harvard Medical School, Massachusetts General Hospital, 40 Blossom Street, 02114, Boston, MA, United States.

Abstract (35 Word Limit): We demonstrate a novel fiber-based spectral-domain interferometry (SDI) technique for terahertz electric field measurement. Signal-to-noise ratio is enhanced by more than four folds while the scanning window is extended to >30 picoseconds compared to conventional SDI techniques.
Freestanding Terahertz Metamaterials Fabricated by Laser Beam Machining

J. C. Balzer; 1; N. Born; 1; R. Gente; 1; I. Al-Naib; 2; M. Koch; 1;

1. Philipps Universitat Marburg, Marburg, Germany.
2. Department of Physics, Queen’s University, Kingston, ON, Canada.

Abstract (35 Word Limit): We demonstrate freestanding terahertz metamaterials, fabricated by laser-beam machining of commercial Aluminum-foil. This method allows for cost-efficient and rapid prototyping. Low insertion losses and outstanding transmission characteristics render the samples as high performance filters.

D. Turchinovich; K. Krewer; K. Jiang; Z. Mics; Z. Jin; K. Bley; H. Elmers; K. Landfester; M. Bonn;

1. Max Planck Inst. for Polymer Research, Mainz, Germany.

Abstract (35 Word Limit): Nano-structuring materials can change their properties extraordinarily, but so can defects caused by manufacturing. We study the effect of capacitive defects on terahertz transmission in golden nanomeshes, and find their influence crucial.
Evaluation of trace amounts of liquid using THz waves
K. Serita; 1; E. Matsuda; 1; I. Kawayama; 1; H. Murakami; 1; M. Tonouchi; 1;
1. Osaka University, Suita, Osaka, Japan.

Abstract (35 Word Limit): We demonstrated terahertz near-field measurements of trace amounts of liquid. The obtained data show that the information of the solute less than nanogram in the trace amounts of liquid can be sensitively detected.
Measurement of Terahertz Spectrum Using Heterodyne Technique with LO signal Generated by an MZM-Based Flat Comb Source

I. Morohashi; Y. Irimajiri; M. Kumagai; A. Kawakami; T. Sakamoto; N. Sekine; T. Kawanishi; A. Kasamatsu; I. Hosako;
1. NICT, Koganei, Tokyo, Japan.

Abstract (35 Word Limit): We demonstrated rapid measurement of spectra of terahertz (THz) radiation from a quantum cascade lasers. THz waves generated by photonic down-conversion using Mach-Zehnder-modulator-based flat comb generator were used for local oscillator signals.
Effects of Photoexcitation on Intense Terahertz Field-induced Nonlinearity in Monolayer Epitaxial Graphene

T. Ozaki; 1; H. Hafez Eid; 1; 1. INRS-EMT, Varennes, QC, Canada.

Abstract (35 Word Limit): Terahertz field-induced transmission enhancement in monolayer epitaxial graphene is observed with increasing terahertz field. Photoexcitation leads to further transmission enhancement that is found to be less for the higher terahertz field amplitudes.
Synthesis and all-optical self-referenced measurement of vectorial optical arbitrary waveform

S. Yang; 1 C. Chen; 1

1. Institute of Photonics Technologies, National Tsing Hua University, Hsinch, Taiwan.

Abstract (35 Word Limit): We demonstrated an integrated system that can manipulate and measure vectorial field spanning up to the entire repetition period without ambiguity, iteration, and reference.
Large Time-Bandwidth Product Integrated Microwave Photonic Hilbert Transformer

C. Sima; B. Liu; W. YANG; D. Liu; Y. YU; J. C. GATES; C. Holmes; M. Zervas; P. Smith;
1. Next Generation Internet Access National Engineering Laboratory (NGIA), Huazhong Univ of Science and Technology, Wuhan, Hubei, China.
2. Wuhan National Laboratory for Optoelectronics, Wuhan, China.
3. Optoelectronics Research Centre, University of Southampton, Southampton, United Kingdom.

Abstract (35 Word Limit): We demonstrate an integrated largest time-bandwidth product (TBP) microwave photonic Hilbert transformer, using synthesized Bragg grating design and fabrication techniques. Devices operate from 50 GHz to 2.5 THz, with the TBP approaching 50.
Two-dimensional Nanomaterial Tungsten Disulfide (WS\textsubscript{2}) As Saturable Absorber for Mode-locked Laser Near 1550 nm

K. Wu; 1; X. Zhang; 2; J. Wang; 2; X. Li; 1; J. Chen; 1;
1. Shanghai Jiao Tong University, Shanghai, China.
2. Shanghai Institute of Optics and Fine Mechanics, CAS, Shanghai, China.

Abstract (35 Word Limit): Saturable absorption has been discovered in two-dimensional nanomaterial tungsten disulfide (WS\textsubscript{2}) near 1550nm. The mode-locked laser based on WS\textsubscript{2} saturable absorber have been demonstrated, which indicates the potential of WS\textsubscript{2} for ultrafast photonic applications.
Abstract (35 Word Limit): A modified algorithm is presented which significantly reduces the rate of false reconstructions of SHG FROG spectrograms.
A procedure to obtain error bars is given; they allow to gauge the quality of the reconstruction.
Twisted-Nematic Liquid Crystal Polarization Rotators for Broadband Laser Applications

C. Dorrer; 1; P. Fiala; 1; K. Marshall; 1
1. University of Rochester, Rochester, NY, United States.

Abstract (35 Word Limit): Liquid crystal twisted-nematic polarization rotators in the Mauguin condition are shown to be more achromatic, less prone to high-frequency modulations caused by internal reflections than compound wave plates, and can be fabricated cost effectively at multi-inch apertures.
Incoherent-light implementation of the photonic time stretch concept

B. Li; 1, 2; S. Lou; 2; J. Azaña; 1
1. INRS – Energie, Varennes, QC, Canada.
2. School of Electronic and Information Engineering, Beijing Jiaotong University, Beijing, China.

Abstract (35 Word Limit): We propose and experimentally demonstrate photonic time stretch of radio-frequency signals by using a time-gated (pulsed) incoherent light source, with time-stretch factors of 0.83 and 8.66, and a time-bandwidth product of > 340.
Nonstoichiometric Si$_{1-x}$Ge$_x$ Based Tunable Saturable Absorber for Mode-Locked Erbium-doped Fiber Laser

C. Yang; 1; Y. Lin; 1; G. Lin; 1
1. National Taiwan University, Taipei, Taiwan.

Abstract (35 Word Limit): Free-standing thin-film flexible Si$_{1-x}$Ge$_x$ saturable absorber with Si/Ge composition-ratio dependent saturable absorbance is demonstrated to passively mode-lock the erbium-doped fiber laser for delivering a pulsewidth of 330 fs at a modulation depth of 16%.
Final ID: JW2A.71

16 W All-Normal-Dispersion Mode-Locked Yb-Doped Fiber Laser With Large Core Diameter

Z. Lv; 1; H. Teng; 2; L. Wang; 2; Z. Wei; 2;
1. School of Physics and Optoelectronic Engineering, Xidian University, Xi'an, Shaanxi Province, China.
2. Beijing National Laboratory for Condensed Matter Physics, Institute of Physics, Chinese Academy of Sciences, Beijing 100190, China, Beijing National Laboratory for Condensed Matter Physics, Institute of Physics, Chinese Academy of Sciences, Beijing 100190, China, Beijing, China.

Abstract (35 Word Limit): A mode-locked all-normal-dispersion rod-fiber laser with large core diameter was demonstrated. Output power of 16 W with 270 fs pulse duration is generated. To best knowledge this is the first laser operation with 85 mm core fiber.
Time Resolved Measurements of Relativistic Laser Hole Boring Using Broadband Relay Imaged GRENOUILLE

C. Wagner; ¹; A. C. Bernstein; ¹; G. M. Dyer; ¹; T. Ditmire; ¹;

¹. Center for High Energy Density Science, University of Texas at Austin, Austin, TX, United States.

Abstract (35 Word Limit): To measure relativistic laser hole boring velocities up to 0.18c, an ultra-broadband diagnostic capable of retrieving the full time resolved pulse phase is required. The design of such a device based on GRENOUILLE is presented.
Single-Shot Measurement of High-Harmonic Generation Intensity Waveforms by Spatially Encoded Transmission Switching

H. Chu; C. Yang; J. Liu; J. Wang;
1. National Central University, Jhongli, Taiwan.
2. Institute of Atomic and Molecular Sciences, Academia Sinica, Taipei, Taiwan.

Abstract (35 Word Limit): Single-shot measurement of high-harmonic generation intensity waveforms is demonstrated by utilizing tunneling ionization of H₂ gas for transmission switching. This method can be applied to different kinds of ultrashort coherent extreme-UV sources.
Passively Mode-locked Fiber Laser based on CVD WS$_2$

R. Khazaeinezhad; $^1$; S. Hosseinzadeh Kassani; $^1$; H. Jeong; $^2$; D. Yeom; $^2$; K. Oh; $^1$;

1. Yonsei University, , United States.
2. Ajou University, Suwon, Korea (the Republic of).

Abstract (35 Word Limit): We investigated nonlinear characteristics and applications of WS$_2$ for mode-locked fiber laser. The saturable absorber was prepared by transferring the synthesized CVD WS$_2$ onto a fabricated side-polished fiber. WS$_2$ showed promising potential for ultrafast-pulse generation.
Real-time and Ultrafast Phase Retrieval in Optical Time-stretch Using a Modified Gerchberg-Saxton Algorithm

Y. Xu; Z. Ren; K. Wong; K. K. Tsia;
1. The University of Hong Kong, United States.

Abstract (35 Word Limit): We report a new and practical scheme of using optical time-stretch with Gerchberg Saxton (GS)-like algorithm for ultrafast real-time phase retrieval, with the phase error significantly suppressed even at a wide signal bandwidth.
χ(2)-Lens Mode-Locking of a Nd:YVO₄ Laser with High Average Power and Repetition Rate up to 600 MHz

I. Buchvarov; V. S. Aleksandrov; H. Iliev;

Abstract (35 Word Limit): We demonstrate χ(2)-lens mode-locking of a diode pumped Nd:YVO₄ laser. The output power is 6 W, the pulse duration is 6 ps for repetition rates from 110 MHz up to 600 MHz.
Deviations from Theory by Femtosecond Lasers due to Noise

M. Dantus; G. Rasskazov; V. Lozovoy;

1. Michigan State University, East Lansing, MI, United States.

Abstract (35 Word Limit): We compare deviations from theory in the yield of second harmonic generation in order to characterize high-repetition rate femtosecond laser sources where the amplitude and phase differs from pulse to pulse. Experimental results are presented for cases with phase noise and a post-pulse.
Vertically Stacked AllPolymer WhisperingGallery Mode Lasers for Biosensing Applications

S. Wondimu; 1, T. Siegle; 3; U. Bog; 1, 4; S. Kraemmer; 3; H. Kalt; 3; T. Mappes; 1, 2; S. Koeber; 1, 5; T. Wienhold; 1, C. Koos; 1, 5;

1. Institute of Microstructure Technology (IMT), Karlsruhe Institute of Technology (KIT), Karlsruhe, Germany.
2. Corporate Research and Technology, Carl Zeiss AG, Jena, Germany.
3. Institute of Applied Physics (APH), Karlsruhe Institute of Technology (KIT), Karlsruhe, Germany.
4. Institute of Nanotechnology (INT), Karlsruhe Institute of Technology (KIT), Karlsruhe, Germany.
5. Institute of Photonics and Quantum Electronics (IPQ), Karlsruhe Institute of Technology (KIT), Karlsruhe, Germany.

Abstract (35 Word Limit): We report on the fabrication of polymeric whispering-gallery mode (WGM) lasers. Our approach enables high packing density by vertical stacking and multiplexed readout of resonators and lends itself to signal referencing or multi-target sensing.
Fiber Optical Tweezers for Simultaneous Force Exertion and Measurements in a 3D Hydrogel Compartment

C. Ti; 1; G. M. Thomas; 2; Q. Wen; 2; Y. Liu; 1;

1. Mechanical Engineering Department, Worcester Polytechnic Institute, Worcester, MA, United States.
2. Physics Department, Worcester Polytechnic Institute, Worcester, MA, United States.

Abstract (35 Word Limit): We developed an inclined dual fiber optical tweezers (DFOTs) for simultaneous force application and measurements in a 3D hydrogel matrix. The inclined DFOTs provide a potential solution for cell mechanics study in a three-dimensional matrix.
Implementation of optical multiplicative spike-timing-dependent plasticity with adaptive current feedback of semiconductor optical amplifiers
Y. Zhang; Q. Ren; J. Zhao;
1. Peking University, Beijing, Beijing, China.

Abstract (35 Word Limit): We present the optical multiplicative spike-timing-dependent-plasticity (STDP) by adaptive control of current injection to the semiconductor optical amplifiers. As a result, we can mimic the behavior of biological STDP synapses more realistically.
Resonantly-Enhanced Sensing Using Surface Plasmon Polaritons in a Sagnac Interferometer

B. Hake; 1; H. Grotewohl; 1; M. Deutsch; 1;
1. University of Oregon, Eugene, OR, United States.

Abstract (35 Word Limit): We present analysis of a resonantly enhanced Sagnac interferometer. While one output port is highly sensitive to nonreciprocal phenomena and robust to reciprocal fluctuations, the complementary output can be used to simultaneously monitor reciprocal drifts.
Abstract (35 Word Limit): Wavelength-encoded tomography (WET) is upgraded to a triple-time-lens system to perform ultrafast cross-sectional imaging through 68.4x-temporal magnification. 60-MHz A-scan rate is demonstrated by imaging a glass sample with 180-μm axial resolution.
Manipulation of Nanoparticles using Quadrangular Microlens

Y. Shi; L. Chin; J. Wu; T. Chen; A. Liu;
1. School of Mechanical Engineering, Xi'an Jiaotong University, Xi'an, China.
2. School of Electric and Electronic Engineering, Nanyang Technological University, Singapore, Singapore.

Abstract (35 Word Limit): We present an optical element, quadrangular microlens, for the generation of Bessel beam, bottle beams, slowly divergent self-healing beam and the discrete interference pattern. Thus, it can be used for the transporting, trapping, cooling, sorting and patterning of nanoparticles.
Hologram Acquisition by Using Time Resolved Heterodyne Method in Optical Scanning Holography

M. Lee; 1; G. Min; 1; N. Kim; 1; B. Lee; 1;
1. ETRI, Gwangju, Korea (the Republic of).

Abstract (35 Word Limit): We propose the new hologram acquisition method based on the time resolved heterodyne analysis in optical scanning holography. By applying the FFT or four phase picking algorithm method, we obtain complex hologram without reference signal.
Hybrid Mid-IR OCT System for Imaging and Spectroscopy Using New High Power Low-Coherence Quantum Cascade Superluminescent Emitters

D. Varnell, M. Zheng, N. L. Aung, A. Musse, S. Lee, C. F. Gmachl;
1. Princeton University, Princeton, NJ, United States.

Abstract (35 Word Limit): We have successfully constructed and tested a new mid-infrared optical coherence tomography imaging system capable of simultaneous imaging and spatial spectroscopy using new quantum cascade superluminescent emitters.
Ellipsometry-based opto-fluidic platform for characterizing 10,000 biomolecular reactions on solid supports in real time and for identifying inhibitors against specific protein-receptor interactions

X. Zhu; ¹

¹. University of California at Davis, Davis, CA, United States.

**Abstract (35 Word Limit):** We developed an optical detection platform based on nulling ellipsometry for simultaneously characterizing 10,000 biomolecular reactions on solid supports and for highly efficient identification of inhibitory molecules against specific protein-protein interactions from large compound libraries.
Optical Measurement on Cell Membrane Roughness Influenced by Paclitaxel and Gold Nanoparticles

C. Lee; L. Jang; H. Pan;
1. Research Center for Applied Sciences, Academia Sinica, Taipei, Taiwan.
2. Institute of Biophotonics, National Yang-Ming University, Taipei, Taiwan.

Abstract (35 Word Limit): We measured the membrane roughness of neuroblastoma cells under the treatments of gold nanoparticles and paclitaxel. The stabilization of microtubules by paclitaxel reduced the membrane roughness. The positive charges on nanoparticles led to similar results.
Improvement in In-Plane Localization Precision of Nanoparticles Using Interference Analysis

A. Meiri; C. Ebeling; J. Martineau; Z. Zalevsky; J. Gerton; R. Menon;
1. University of Utah, Salt Lake City, UT, United States.
2. Bar Ilan University, Ramat Gan, Israel.

Abstract (35 Word Limit): We present a method to improve the localization precision of nanoparticles over Gaussian fitting by imposing an interference pattern on the Point-Spread-Function. Localization precision of 0.1nm for a single emitter was obtained.
Optofluidic Detection for Virus Infection Monitoring using Effective Refractive Index

P. Liu; 1, 2; L. Chin; 2; W. Ser; 2; T. Ayi; 3; E. Yap; 3; T. Bourouina; 1; Y. Leprince-Wang; 1;

1. Université Paris-Est, Paris, France.
2. Nanyany Technological University, Singapore, Singapore.
3. DSO National Laboratories, Singapore, Singapore.

Abstract (35 Word Limit): This paper presents an optofluidic imaging system to detect influenza virus infection via the change of refractive index based on scattering signature. This method allows for a direct monitor of the influenza flu virus.
Virtual Acousto-optic Beam Paths for Steerable Deep-tissue Optical Stimulation and Imaging

M. Chamanzar; 1 M. Huh; 1 N. DO; 1 M. Alam; 1 M. Maharbiz; 1

1. University of California Berkeley, Berkeley, CA, United States.

Abstract (35 Word Limit): Here we present the first non-invasive methodology for optical delivery and steering deep inside the brain through creating reconfigurable light paths by ultrasonic waves via modulating the refractive and diffractive properties of the medium.
Ce-doped Fibers with High Axial Resolution for Optical Coherence Tomography Applications

L. Chun-Nien; 1 Y. Huang; 2 P. Huang; 1 S. Huang; 3 W. Cheng; 1

1. Department of Photonics, National Sun Yat-Sen University, Kaohsiung, Taiwan.
2. CEO office, Brogent Technologies Inc., Kaohsiung, Taiwan.
3. Graduate Institute of Photonics and Optoelectronics, National Taiwan University, Taipei, Taiwan.

Abstract (35 Word Limit): The fabrication of CeDFs with drawing-tower is demonstrated. The CeDFs exhibited a 160-nm broadband emission with 1.47-μm axial resolution. This CeDF may be functioned as a high-resolution light source for OCT applications.
Noninvasive flow cytometry by heterodyne self-mixing interferometry.

O. Hugon; M. Inglebert; O. Jacquin; H. Guillet de Chatellus; E. Lacot; C. Misbah; B. Van der Sanden;

1. LiPhy, Grenoble, France.
2. Clinatec, Grenoble, France.

Abstract (35 Word Limit): We present a device for characterizing red blood cells flows in capillaries (speed, hematocrit, aggregation, …). We've used the LOFI technique on a microfluidic system that mimics the human skin and subcutaneous tissues.
All-Fiber Tunable Ring Laser Based on an Acousto-Optic Tunable Coupler

L. Huang; 1; W. Zhang; 2; D. Mao; 2; F. Gao; 1; W. Peng; 1; F. Bo; 1; G. Zhang; 1; J. Xu; 1;
1. Nankai University, China, Tianjin, Tianjin, China.
2. Northwestern Polytechnical University, Xi’an, China.

Abstract (35 Word Limit): An all-fiber tunable ring laser consisted of an acousto-optic tunable notch filter and a tapered fiber was demonstrated with a tunable wavelength range from 1532.1 nm to 1570.4 nm and a linewidth of 0.2 nm.
Supercontinuum Generated by Noise-like Pulses for Spectral-domain Optical Coherence Tomography

Y. You; 1; C. Wang; 2; P. Xue; 2; A. Zaytsev; 3; C. Pan; 1, 3

1. Institute of Photonics Technologies, National Tsing Hua University, Hsinchu, Taiwan.
2. State Key Laboratory of Low-dimensional Quantum Physics, Department of Physics, Tsinghua University, Beijing, China.
3. Department of Physics, National Tsing Hua University, Hsinchu, Taiwan.

Abstract (35 Word Limit): A supercontinuum with over 420-nm of spectral bandwidth is generated in a single-mode-fiber pumped by noise-like-pulses from an Yb-doped fiber laser. The supercontinuum source is successfully employed in a spectral-domain optical coherence tomography imaging system.
Annular Cladding Erbium-Doped Multi-Core Fiber for SDM Amplification
C. Jin; 1, 2; B. Ung; 3; Y. Messaddeq; 4, 2; S. LaRochelle; 1, 2;
1. Département de génie électrique et de génie informatique, Université Laval, Québec, QC, Canada.
2. Centre d'optique, photonique et laser, Québec, QC, Canada.
3. Département de génie électrique, École de technologie supérieure, Montréal, QC, Canada.
4. Département de physique, de génie physique et d'optique, Université Laval, Quebec, QC, Canada.

Abstract (35 Word Limit): An annular cladding ED-MCF is proposed to enhance pump power efficiency. Simulations suggest single core amplification with over 29 dB gain and less than 7.5 dB at 1550 nm using a single Watt-level pump.
Abstract (35 Word Limit): Tapered photonic crystal fibers with different transition profiles were designed and fabricated to control the visible dispersive wave generation process, and broadband visible supercontinuum (350-700 nm) was achieved.
Design of Supermode Fiber for Orbital Angular Momentum (OAM) Multiplexing

S. Li; 1; J. Wang; 1;
1. Wuhan National Lab for Optoelectronics, Wuhan, Hubei, China.

Abstract (35 Word Limit): We present a supermode fiber to support orbital angular momentum (OAM) multiplexing. The designed supermode fiber can guide multiple OAM modes with favorable performance of low mode coupling, low nonlinearity, and low modal dependent loss.
Wide tunable Raman laser in a tellurite fiber ring cavity

D. Deng; 1; L. Liu; 1; T. Cheng; 1; X. Xue; 1; L. Zhang; 1; M. Yamada; 2; T. Suzuki; 1; Y. Ohishi; 1;

1. Toyota Technological Institute, Nagoya, Aichi, Japan.
2. Osaka Prefecture University, Osaka, Japan.

Abstract (35 Word Limit): A widely tunable Raman laser covering a 170-nm bandwidth was demonstrated using a single-mode tellurite fiber embedded in a ring cavity.
Small signal gain for Nd/Cr:YAG ceramics at high temperature

Y. Honda; S. Motokoshi; T. Jitsuno; N. Miyanaga; K. Fujioka; M. Nakatsuka; M. Yoshida;
1. Osaka University, Suita, Osaka, Japan.
2. Institute for Laser Technology, Osaka, Japan.
3. Kinki University, Osaka, Japan.

Abstract (35 Word Limit): The gain coefficient of the Nd/Cr:YAG ceramics excited by the absorption line of Cr$^{3+}$ increased with increasing temperature up to 400 K.
Simulated Tempering Markov Chain Monte Carlo for Full Waveform Analysis

W. He; 1; W. Yin; 1; F. Shi; 2; G. Gu; 1; Q. Chen; 1;
1. Nanjing Univ of Science and Technology, Nanjing, Jiangsu, China.
2. Science & Technology on Low-light-level Night Vision Laboratory, Xi'an, China.

Abstract (35 Word Limit): A new approach of Simulated Tempering Markov Chain Monte Carlo (STMCMC) for full waveform LIDAR signal analysis was proposed and demonstrated. We present the theory, algorithm as well as the practical examples.
The design and performance of SGII upgrade laser facility third harmonic frequency convertor

L. Ji; 1

1. Shanghai institute of laser and plasma, Shanghai, Shanghai, China.

Abstract (35 Word Limit): We have designed a third harmonic convertor for the SGII upgrade laser facility. The maximum $3\omega$ energy reaches 5295J with 31cm×31cm aperture and 4.5ns pulse-length and the conversion efficiency is 72.3% in the preliminary experiments.
Hybrid White Light-emitting Diodes by Organic-Inorganic materials

K. Chen; Y. Lai; B. Lin; C. Lin; S. Chiu; Z. Tu; M. Shih; P. Yu; P. Lee; X. Li; H. Meng; G. Chi; T. Chen; H. Kuo;

1. National Chiao Tung University, Hsinchu, Taiwan.
2. Research Center for Applied Sciences, Taipei, Taiwan.
3. Department of Electrical and Computer Engineering, University of Illinois at Urbana-Champaign Urbana, Champaign, IL, United States.

Abstract (35 Word Limit): This study demonstrated the high uniformity hybrid white light-emitting diodes with polyfluoren (PFO) polymer and quantum dot (QD) with different CCT range from 3000K to 9000K.
Flat-Plate Photovoltaics with Solar-Tracking Origami Micro-Concentrator Arrays

C. Chien; 1; K. Lee; 1; M. Shlian; 2; S. Forrest; 1; M. Shtein; 3; P. Ku; 1;

1. Department of Electrical Engineering and Computer Science, University of Michigan, Ann Arbor, MI, United States.
2. School of Art and Design, University of Michigan, Ann Arbor, MI, United States.
3. Department of Materials Science and Engineering, University of Michigan, Ann Arbor, MI, United States.

Abstract (35 Word Limit): A new PV architecture combining the advantages of concentration and flat-plate PVs is shown. Using origami techniques, fabrication and solar tracking of micro-concentrators were achieved with minimally added complexity to the existing flat-plate PVs.
Application of Fractional Fourier Transform for Interferometry

M. Lu; F. Zhang; R. Tao; G. Ni; T. Bai;
1. Beijing Institute of Technology, Beijing, Beijing, China.

Abstract (35 Word Limit): The Fractional Fourier transform can be understood as a chirp-based decomposition. Accordingly it can be used to process fringe patterns with quadratic phase, including denoising, quantization error reduction, sampling and reconstruction, and phase derivative estimation.
Cavity-QED with a Trapped Ion in an Optical Fiber Cavity

M. Köhl; 1
1. Universität Bonn, Bonn, Germany.

Abstract (35 Word Limit): We report on cavity-QED experiments with trapped ions in fiber-based high-finesse optical cavities. We observe single photon emission and absorption and, in particular, demonstrate coupling to a semiconductor quantum dot by exchange of a single photon between the atomic and solid state quantum emitters.
Fiber-Based Cavities for Ion-Trap Quantum Networks

T. Northup; 1; K. Schüppert; 1; F. Ong; 1; B. Casabone; 1; K. Friebe; 1; M. Lee; 1; J. Reichel; 2; R. Blatt; 1, 3;

1. University of Innsbruck, Innsbruck, Austria.
3. Institute for Quantum Optics and Quantum Information, Innsbruck, Austria.

Abstract (35 Word Limit): Fiber-based cavities offer a promising route toward the strong-coupling regime of cavity QED. I will discuss the development of a fiber-cavity experiment for single trapped calcium ions, focusing on mirror characterization and quantum-network prospects.
Nanophotonic Quantum Memory Based on Rare-Earth-Ions Coupled to an Optical Resonator

T. Zhong; 1 J. Kindem; 1 E. Miyazono; 1 A. Faraon; 1

1. California Institute of Technology, Pasadena, CA, United States.

A Solid-State Spin-Photon Transistor

S. Sun;¹ H. Kim;¹ G. S. Solomon;² ³ E. Waks;¹ ³
1. Institute for Research in Electronics and Applied Physics, University of Maryland, College Park, MD, United States.
2. NIST, Gaithersburg, MD, United States.
3. Joint Quantum Institute, University of Maryland, College Park, MD, United States.

Abstract (35 Word Limit): We experimentally realize a solid-state spin-photon transistor using a quantum dot strongly coupled to a photonic crystal cavity. We are able to control the light polarization through manipulation of the quantum dot spin states.
Nanoscale Optical Positioning of Single Quantum Dots for Efficient Quantum Photonic Devices

L. Sapienza; M. I. Davanco; A. Badolato; K. Srinivasan;

1. Center for Nanoscale Science and Technology, National Institute of Standards and Technology, Gaithersburg, MD, United States.
2. Department of Physics and Astronomy, University of Rochester, Rochester, NY, United States.
3. School of Physics and Astronomy, University of Southampton, Southampton, United Kingdom.

Abstract (35 Word Limit): We locate single quantum dots with nanoscale accuracy through photoluminescence imaging. This enables nanophotonic device fabrication with engineered light-matter coupling, enabling bright (48±5% extraction efficiency), Purcell-enhanced (=3), on-demand single-photon emission with >99% purity.
Exploring Cavity QED with Superconducting Circuits

A. Wallraff; 1
1. ETH Zurich, Zurich, Switzerland.

Abstract (35 Word Limit): Using modern micro and nano-fabrication techniques we realize superconducting quantum electronic circuits based on which we probe fundamental quantum effects of microwave radiation and develop components for applications in quantum technology.
Abstract (35 Word Limit): Spectral bandwidth in attosecond pulses can span multiple energy levels simultaneously, complicating time-resolved photoemission applications. We seek to adapt attosecond sources to study condensed-matter dynamics with sub-eV resolution, unfolding on the corresponding femtosecond timescale.
Experimental Distinction between Femtosecond Transient Demagnetization and Spin Current Dynamics in Metals

Z. Jin; 1; J. Arabski; 2; G. Schmerber; 2; E. Beaurepaire; 2; M. Bonn; 1; D. Turchinovich; 1;
1. MPI for Polymer Research, Mainz, Germany.
2. Institut de Physique et Chimie des Matériaux de Strasbourg (IPCMS), UMR 7504 CNRS – Université de Strasbourg, Strasbourg, France.

Abstract (35 Word Limit): Using terahertz emission spectroscopy we probe the elementary spin dynamics in ferromagnetic metal on a femtosecond timescale, and distinguish between the two major contributions – transient demagnetization and spin current by hot electrons.
Ultrafast Pump-probe Spectroscopy in Gallium Arsenide at 25 Tesla
D. J. Hilton; 1; J. Curtis; 1; T. Tokumoto; 1; N. Nolan; 1; L. McClintock; 1; J. Cherian; 2; S. McGill; 2;
1. University of Alabama at Birmingham, Birmingham, AL, United States.
2. National High Magnetic Field Lab, Tallahassee, FL, United States.

Abstract (35 Word Limit): We have conducted pump-probe spectroscopy of bulk GaAs in the Split Florida- Helix at 15 K and 25 T. We observe an electronic rise followed by a slower decay with a superimposed oscillatory response.
Abstract (35 Word Limit): We extended the characterization of photoinduced quantum phase transitions into the nanoscale. We demonstrate this for VO$_2$ by accessing spatial inhomogeneities in the insulator-to-metal transition due to local strain and defects.
Abstract (35 Word Limit): We study the skyrmion structure in Cu$_2$OSeO$_3$ using resonant x-ray spectroscopy. The skyrmion structure shows long range fluctuations of ferrimagnetic ordering, and above-gap optical excitation reduces the magnetic ordering on a 40 picosecond timescale.
Ultrafast terahertz spectroscopy of the inverse giant piezoresistance effect in silicon nanomembranes

J. Kim; 1 H. Jang; 1 M. Kim; 4 J. Cho; 3 2 J. Ahn; 1 H. Choi; 1
1. Yonsei University, Seoul, Korea (the Republic of).
2. School of Chemical Engineering, Sungkyunkwan university, Suwon, Korea (the Republic of).
3. SKKU Advanced Institute of Nanotechnology (SAINT), Sungkyunkwan University, Suwon, Korea (the Republic of).

Abstract (35 Word Limit): We observe the clear inverse piezoresistance effect in the silicon nanomembranes. Thickness-dependent optical-pump terahertz spectroscopy strongly corroborate that the effect originates from the carrier-concentration changes via charge carrier trapping into strain-induced defect states.
Tailored Light-Matter Interaction through Epsilon-Near-Zero Modes

S. Campione; 2, 1; S. Liu; 2, 1; A. Benz; 2, 1; J. F. Klem; 1; M. B. Sinclair; 1; I. Brener; 2, 1;

1. Sandia National Laboratories, Albuquerque, NM, United States.
2. Center for Integrated Nanotechnologies, Sandia National Laboratories, Albuquerque, NM, United States.

Abstract (35 Word Limit): We use epsilon-near-zero modes in semiconductor nanolayers to design a system whose spectral properties are controlled by their interaction with multi-dipole resonances. This design flexibility renders our platform attractive for efficient nonlinear composite materials.
Final ID: FW3C.1

Spatial Coherence of Random Raman Lasing Emission
B. H. Hokr; 1, 2; M. Schmidt; 3; J. Bixler; 1, 3; P. Dyer; 2; G. Noojin; 2; B. Redding; 4; R. Thomas; 3; B. Rockwell; 3; H. Cao; 4; V. Yakovlev; 1; M. Scully; 1, 5.
1. Texas A&M University, Bryan, TX, United States.
2. TASC Inc., San Antonio, TX, United States.
3. Bioeffects Division, Optical Radiation Branch, 711th Human Performance Wing, Human Effectiveness Directorate, Fort Sam Houston, TX, United States.
4. Yale University, New Haven, CT, United States.
5. Baylor University, Waco, TX, United States.

Abstract (35 Word Limit): Random Raman laser emission is demonstrated to be an excellent source of narrow-band, high intensity, short duration light for speckle-free imaging. Spatial coherence measurement and strobe photography of cavitation bubbles are presented.
Critical States Embedded in the Continuum
A. G. Yamilov; 1; M. Koirala; 1; A. Basiri; 3; Y. Bromberg; 2; H. Cao; 2; T. Kottos; 3;
1. Physics, Missouri University of Science and Technology, Rolla, MO, United States.
2. Applied Physics, Yale University, New Haven, CT, United States.
3. Physics, Wesleyan University, Middletown, CT, United States.

Abstract (35 Word Limit): We introduce a class of critical states which are embedded in the continuum (CSC) of one-dimensional optical waveguide array with a non-Hermitian defect.
Quantitative test of the ab initio intrinsic laser linewidth theory

A. Cerjan; 1; A. Pick; 2; Y. Chong; 3; A. Rodriguez; 4; S. Johnson; 5; A. Stone; 1;
1. Yale University, New Haven, CT, United States.
2. Physics, Harvard University, Boston, MA, United States.
3. Division of Physics and Applied Physics, Nanyang Technological University, Singapore, Singapore.
5. Applied Math, Massachusetts Institute of Technology, Boston, MA, United States.

Abstract (35 Word Limit): Direct FDTD simulations of the Maxwell-Bloch equations coupled to Langevin noise equations are shown to quantitatively agree with a recent analytic linewidth formula and predicted scaling relations.
Opportunities for Imaging in Heavily Scattering Random Media with Spatial Intensity Correlations

K. J. Webb; 1; J. A. Newman; 1;
1. Purdue University, West Lafayette, IN, United States.

Abstract (35 Word Limit): We describe a method that allows imaging of objects moving within heavily scattering random media. This should prove valuable in biological imaging and other applications.
Optical Detection and Imaging in Complex Media: How the Memory Effect Can Help Overcome Multiple Scattering

Abstract (35 Word Limit): We report on optical imaging through turbid media. Our approach is based on the measurement of a reflection matrix and a separation of the single scattering and multiple scattering contributions based on the memory effect.
Abstract (35 Word Limit): We present a method for designing highly multimode lasers for use as effectively incoherent light sources in optical imaging techniques.
Correlation effects in Anderson localization and light transport in a 2D photonic disorder

J. Armijo; 1; M. Boguslawski; 2; R. Allio; 1, 4; L. Sanchez-Palencia; 3; C. Denz; 2;
1. Universidad de Chile, Santiago, Chile.
2. University of Muenster, Muenster, Germany.
3. Laboratoire Charles Fabry, Institut d'Optique, Palaiseau, France.

Abstract (35 Word Limit): We study the propagation of tailored wave packets in a computer controlled photo-induced disorder. Disorder correlations cause in real space a ballistic front of exponential Anderson Localization, and novel effects are observed in Fourier space.
Nonlinear Effects Driven by Optically-induced Magnetic Response

Y. S. Kivshar; ¹
1. Australian National University, Canberra, ACT, Australia.

Abstract (35 Word Limit): We discuss novel nonlinear effects in nanostructured metasurfaces driven by optically-induced electric and magnetic responses associated with Mie-type resonances of their metallic and dielectric structural elements including the generation of multipole harmonics and substantial power enhancement.
Studying the Interplay of Electric and Magnetic Resonance-Enhanced Second Harmonic Generation: Theory and Experiments

R. Chandrasekar; 1 N. K. Emani; 1 A. Lagutchev; 1 V. M. Shalaev; 1 C. Ciraci; 2, 3 D. R. Smith; 2 A. V. Kildishev; 1

1. Electrical and Computer Engineering, Purdue University, West Lafayette, IN, United States.
2. Electrical and Computer Engineering, Duke University, Durham, NC, United States.
3. Center for Biomolecular Nanotechnologies, Istituto Italiano di Tecnologia, Via Barsanti, Arnesano, Italy.

Abstract (35 Word Limit): We present an experimental study of a metasurface, which exhibits electric and magnetic resonances, in order to understand their independent contributions to second-harmonic generation. A hydrodynamic model framework is used to match experimental results.
Semiconductor-Superconductor Two-Photon Amplifier

R. Marjieh; 1, E. Sabag; 1, A. Hayat; 1

1. Technion, Haifa, Israel.

Abstract (35 Word Limit): We study a new effect of Cooper-pair-based two-photon gain in semiconductor-superconductor structures, showing broadband enhancement of singly- and fully-stimulated ultrafast two-photon gain. These effects can have important implications in optoelectronics and in coherent-control applications.
Four-fold Enhancement of Transverse Optical Magnetism in Unstructured Solids

A. Chakrabarty; 1; A. Fisher; 1; E. F. Dreyer; 1; S. C. Rand; 1;
1. University of Michigan, Ann Arbor, MI, United States.

Abstract (35 Word Limit): Scattering experiments on second-order induced magnetization in transparent Gadolinium Gallium Garnet (GGG) crystals show four times the maximum magnetic response measured previously in liquids.
Ultrafast Magneto-Photocurrents in GaAs: Separation of Surface and Bulk Contributions

C. Schmidt; 1 S. Priyadarshi; 1 M. Bieler; 1
1. Physikalisch-Technische Bundesanstalt, Braunschweig, Germany.

Abstract (35 Word Limit): We generate ultrafast magneto-photocurrents in bulk GaAs and non-invasively separate surface and bulk contributions to the overall current. This method enables the investigation of processes such as anisotropic-distribution relaxation and the inverse Spin Hall effect.
Analysis of soliton fission induced by free-carryers

C. A. Husko; S. Lefrancois; M. Wulf; S. Combrie; A. De Rossi; L. Kuipers; B. J. Eggleton;
1. University of Sydney, Sydney, NSW, Australia.
2. FOM Institute AMOLF, Amsterdam, Netherlands.
3. Thales Research and Technology, Palaiseau, France.

Abstract (35 Word Limit): Previously we presented measurements of soliton fission induced by free-carriers. Here we report the derivation of a normalized free-carrier perturbation parameter to describe both those experiments and to extract more general properties of this mechanism.
Beam Deflection Measurements of Nondegenerate Nonlinear Refractive Indices in Direct-gap Semiconductors

P. Zhao; 1; M. Reichert; 1; T. Ensley; 1; D. J. Hagan; 1; E. W. Van Stryland; 1;

1. CREOL University of Central Florida, Orlando, FL, United States.

Abstract (35 Word Limit): We use the beam-deflection method to measure nondegenerate nonlinear refractive indices of ZnO and ZnSe and show, in agreement with theory, extremely nondegenerate nonlinear refraction is significantly larger than in the degenerate or near-degenerate case.
Quantum-Coherently Assisted Deep-UV Localization of Photonic States in Active Stopped-Light Plasmonic Heterostructures

K. Tsakmakidis; 1; P. K. Jha; 1; Y. Wang; 1; X. Zhang; 1;
1. UC Berkeley, Berkeley, CA, United States.

Abstract (35 Word Limit): We introduce a new method to localize lightwaves. We show how the interaction of a gain medium with a planar deep-UV plasmonic heterostructure, at its zero-$\gamma$ point, strongly localizes light. A quantum-coherent drive provides a means to control the localization and dramatically improve the dynamics.
Optical Switching of Mid-Infrared Plasmonic Nanoantennas Based on Germanium

M. Fischer; 1 C. Schmidt; 1 J. Stock; 1 E. Sakat; 2 A. Samarelli; 3 J. Frigerio; 4 P. Biagioni; 2 D. J. Paul; 3 G. Isella; 4 A. Leitenstorfer; 1 D. Brida; 1
1. Department of Physics and Center for Applied Photonics, Universität Konstanz, Konstanz, Germany.
2. Dipartimento di Fisica, Politecnico di Milano, Milano, Italy.
3. School of Engineering, University of Glasgow, Glasgow, United Kingdom.
4. L-NESS, Dipartimento di Fisica, Politecnico di Milano, Como, Italy.

Abstract (35 Word Limit): Germanium nanoantennas are activated by triggering a mid-infrared plasma response via ultrafast interband excitation. Femtosecond control of the intrinsic semiconductor allows complete activation of the plasmonic resonance for hundreds of picoseconds.
Enhanced Near- and Far-Field Faraday Rotation with a Monolayer Array of Core-Shell Nanoparticles

A. Davoyan; 1; N. Engheta; 1;

Abstract (35 Word Limit): We study Faraday rotation by magnetized core-shell nanoparticles. We theoretically show enhanced polarization rotation in the near-zone and several-fold increase of the Faraday effect in the far-zone for a periodic array of nanoparticles.
Plasmon-mediated emission in the strong coupling regime
T. Tumkur; G. Zhu; D. Courtwright; M. A. Noginov;
1. Norfolk State University, Norfolk, VA, United States.

Abstract (35 Word Limit): We demonstrate the strong coupling of SPPs and localized plasmons to dye molecules, characterized by splitting of the dispersion curve. We further observe an anomalous behavior in the emission of molecules strongly coupled to plasmons.
Final ID: FW3E.5

Time-Domain Model of 4-Level Gain System Fitted to Nanohole Array Lasing Experiment

J. Fang; J. Liu; Z. Wang; X. Meng; L. Prokopeva; V. M. Shalaev; A. V. Kildishev;
1. Birck Nanotechnology Center, School of Electrical and Computer Engineering, Purdue University, West Lafayette, IN, United States.

Abstract (35 Word Limit): We developed an accurate three dimensional time domain model of a 4-level gain system fitted to lasing experiment with a silver nanohole array. The simulated emission intensity showed clear lasing effects confirmed by optical experiments.
Final ID: FW3E.6

Room Temperature Continuous Wave Blue Lasing in High Quality Factor III-Nitride Nanobeam Cavity on Silicon

R. Butte; 1  N. Vico Triviño; 1  J. Carlin; 1  N. Grandjean; 1

1. Ecole Polytechnique Federale de Lausanne, Lausanne, Switzerland.

Abstract (35 Word Limit): Lasing is demonstrated in III-nitride photonic crystal nanobeam cavities grown on silicon. Laser characteristics are well accounted for by the large spontaneous emission coupling factor inherent to nanobeams and the InGaN quantum well material gain.
Plasmonic Random Lasing in Strongly Scattering Regime with Slanted Silver Nanorod Array

Z. Wang; X. Meng; S. Choi; Y. Kim; V. M. Shalaev; A. Boltasseva;

1. School of Electrical & Computer Engineering and Birck Nanotechnology Center, Purdue University, West Lafayette, IN, United States.
2. Weldon School of Biomedical Engineering, Purdue University, West Lafayette, IN, United States.

Abstract (35 Word Limit): We present a plasmonic approach employing a slanted silver nanorod array for achieving controllable random lasing in a strongly scattering regime. Such random lasers can serve as a bright optical source for speckle-free imaging.
Blackbody metamaterial lasers

A. Fratalocchi; 1 C. Liu; 1 J. Huang; 2 S. Masala; 3 E. Alarousu; 3 Y. Han; 2
1. PRIMALIGHT, KAUST, Thuwal, Saudi Arabia.
2. Advanced Membranes and Porous Materials Center, Division of Physical Sciences and Engineering, KAUST, Thuwal, Saudi Arabia.
3. Solar and Photovoltaics Engineering Research Center, Division of Physical Sciences and Engineering, KAUST, Thuwal, Saudi Arabia.

Abstract (35 Word Limit):
We investigate both theoretically and experimentally a new type of laser, which exploits a broadband light "condensation" process sustained by the stimulated amplification of an optical blackbody metamaterial.
Electrically Pumped 1.3-µm InAs/GaAs Quantum Dot Laser Monolithically Grown on Si Substrate Lasing up to 111°C

Abstract (35 Word Limit): A silicon-based InAs/GaAs quantum dot laser that lases up to 111°C, with a threshold current density of 200 A/cm² and an output power exceeding 100 mW at room temperature, has been achieved.
Hybrid III-V/SOI single-mode vertical-cavity laser with in-plane emission into a silicon waveguide

G. C. Park; 1 W. Xue; 1 E. Semenova; 1 J. Mork; 1 I. Chung; 1
1. Technical University of Denmark, , Denmark.

Abstract (35 Word Limit): We report a III-V-on-SOI vertical-cavity laser emitting into an in-plane Si waveguide fabricated by using CMOS-compatible processes. The fabricated laser operates at 1.54 mm with a SMSR of 33 dB and a low threshold.
Ultra-compact Wavelength Tunable Quantum Dot Laser with Silicon Photonic External Cavity

T. Kita; 1; N. Yamamoto; 2; T. Kawanishi; 2; H. Yamada; 1;
1. Tohoku University, , United States.

Abstract (35 Word Limit): Ultra-compact wavelength tunable laser diode with wide tunability was successfully developed with combining quantum dot optical amplifier and silicon micro-ring filters. The single mode laser oscillation was demonstrated with 25 nm wavelength tuning range.
1.3-μm InAs/GaAs Quantum Dot Lasers on Silicon-on-Insulator Substrates by Metal-Stripe Bonding

1. Institute of Industrial Science, University of Tokyo, Tokyo, Japan.
2. Institute for Nano Quantum Information Electronics, University of Tokyo, Tokyo, Japan.

Abstract (35 Word Limit): We demonstrate InAs/GaAs quantum dot lasers on silicon-on-insulator substrates by metal-stripe wafer bonding technology. Our III-V-on-Si bonded laser exhibits room-temperature lasing at 1.3 μm with current injection through the bonding metal stripe.
High Temperature Hybrid Silicon Micro-ring Lasers with Thermal Shunts

C. Zhang; 1, 2; D. Liang; 2; G. Kurczveil; 2; J. Bowers; 1; R. Beausoleil; 2;
1. UCSB, United States.
2. HP Laboratories, Palo Alto, CA, United States.

Abstract (35 Word Limit): We demonstrate a hybrid silicon micro-ring laser design with novel thermal shunts. With this technique the hybrid silicon ring lasers with a 50 mm diameter operate continuous wave up to 105 °C.
High-Q Silicon Resonators For High-Coherence Hybrid Si/III-V Semiconductor Lasers

C. Santis; ¹; A. Yariv; ¹;
1. California Institute of Technology, Pasadena, CA, United States.

Abstract (35 Word Limit): We report on the design and experimental demonstration of high-Q Si resonators with $Q \sim 10^6$, a fundamental figure of merit of the phase coherence of hybrid Si/III-V semiconductor lasers.
Si-SOA Hybrid Wavelength Tunable Laser with a Tunable Coupler for High-Power Operation

Y. Kawamura; 1; H. Yamazaki; 1; Y. Ueda; 2; S. Kamei; 2; T. Hashimoto; 1;
1. NTT Device Technology Laboratories, Atsugi, Kanagawa, Japan.
2. NTT Device Innovation Center, Atsugi, Kanagawa, Japan.

Abstract (35 Word Limit): We devised an output configuration for the Si-SOA hybrid laser which is suitable for high-power operation in terms of slope efficiency and suppression of nonlinear effects. These advantages were theoretically evaluated. A proof-of-concept experiment demonstrated.
Passively Mode-locked III-V/Silicon Lasers with Low Time Jitter Using CW Optical Injection

Y. Cheng; X. Luo; J. Song; T. Liow; G. Lo; Y. Cao; X. Hu; P. Lim; Q. Wang;
1. Nanyang Technological University, Singapore, Singapore.
2. Institute of microelectronics,a*star, Singapore, Singapore.
3. DSO National Laboratory, Singapore, Singapore.

Abstract (35 Word Limit): We demonstrate 30 GHz mode-locked quantum well lasers on silicon platform using continuous-wave optical injection, which emit at the L-band wavelength with integrated root-mean-square time jitter of 1.0 ps and radio-frequency-linewidth of 150 kHz.
Dual-Comb Femtosecond Enhancement Cavity for Precision Measurements of Plasma Dynamics and Spectroscopy in the XUV

D. R. Carlson; 1; T. Wu; 1; R. Jones; 1;

1. University of Arizona, Tucson, AZ, United States.

Abstract (35 Word Limit): We show two high power 100 fs frequency combs can be coupled to the same enhancement cavity for performing time-resolved measurements of optical nonlinearities and for simplifying dual-comb spectroscopy in the XUV.
Broadband Dual-comb Spectroscopy with Cascaded-electro-optic-modulator-based Frequency Combs

T. Nishikawa; 1 A. Ishizawa; 2 M. Yan; 1, 3 H. Gotoh; 2 T. Hänsch; 1, 3 N. Picqué; 1, 3
1. Max-Planck-Institut für Quantenoptik, Garching, Germany.
2. NTT Basic Research Laboratories, Atsugi, Japan.
3. Ludwig-Maximilians-Universität München, München, Germany.

Abstract (35 Word Limit): Dual-comb spectroscopy without mode-locked lasers is demonstrated in the telecommunication region. As a proof-of-principle, we measure Doppler-limited rovibrational spectra of the $2\nu_3$ band of $^{13} \text{C}^{14}\text{N}$ spanning more than 4 THz with resolved comb lines.
Ramsey-comb Spectroscopy: Power and Precision Combined

K. S. Eikema; 1; R. K. Altmann; 1; L. S. Dreissen; 1; S. A. Galtier; 1;
1. LaserLaB, VU University (FEW), Amsterdam, Netherlands.

Abstract (35 Word Limit): Ramsey-comb spectroscopy enables ultra-high precision spectroscopy with amplified pairs of high-power frequency comb laser pulses, and we extended it to the deep-UV for precision spectroscopy in krypton and molecular hydrogen.
Measuring Part-per-Billion Line Shifts and Frequencies with Direct-Frequency-Comb Vernier Spectroscopy

P. Cancio Pastor; 1; M. Siciliani de Cumis; 1; R. Eramo; 1; P. De Natale; 1; N. Coluccelli; 2; M. Cassinerio; 2; G. Galzerano; 2; P. Laporta; 2;
1. INO-CNR, Sesto Fiorentino, FI, Italy.
2. Politecnico di Milano, Milano, Italy.

Abstract (35 Word Limit): Accurate frequency measurements of CO2 transitions around 2 mum are performed by direct frequency-comb Vernier spectroscopy. Measurements of pressure line shifts at the ppb. accuracy level demonstrates the application of comb sources in precision molecular spectroscopy.
Abstract (35 Word Limit): We present the first semiconductor disk laser simultaneously emitting two gigahertz modelocked pulse trains. This simply allows to establish a link from the optical domain to a microwave frequency comb. The relative carrier-envelope-offset frequency can be accessed directly.
Abstract (35 Word Limit): A stabilized Fabry-Perot cavity with a 2.2 MHz-linewidth resonance-mode and a 566MHz FSR was fully characterized over the spectral range from 186 to 200 THz by discrete Fourier transform infrared spectroscopy using precisely periodic pulse.
A compact iodine-stabilized diode laser at 531 nm

T. Kobayashi; D. Akamatsu; K. Hosaka; H. Inaba; S. Okubo; T. Tanabe; M. Yasuda; A. Onae; F. Hong;

1. NMIJ, Tsukuba, Ibaraki, Japan.

Abstract (35 Word Limit): A compact iodine-stabilized laser at 531 nm is developed with a frequency stability at the $10^{-12}$ level using a coin-sized diode laser module. This laser will be used for applications including interferometric measurements.
Label-Free Optical Molecular Imaging for Clinical Tissue Diagnostics

M. Mycek; 1

1. University of Michigan, Ann Arbor, MI, United States.

Abstract (35 Word Limit): Label-free nonlinear optical molecular imaging methods could enable the rapid, reliable, and non-invasive assessment of living tissue-engineered constructs, potentially addressing a critical regulatory requirement in tissue engineering and regenerative medicine.
Abstract (35 Word Limit): A new whole-body Fluorescence Molecular Tomography approach based on wide-field time-resolved structured illumination will be presented. Current instrumental, theoretical and experimental efforts will be summarized as well as its application to image FRET in vivo.
Molecular Imaging with Sum-frequency Generation Microscopy

E. O. Potma; Y. Han; J. Hsu; N. Ge;

1. Chemistry, University of California, Irvine, Irvine, CA, United States.

Abstract (35 Word Limit): We present an overview of the recent developments and biological imaging applications of sum-frequency generation (SFG) microscopy.
Fluorescence lifetime imaging of cellular heterogeneity in cancer drug response

M. Skala; 1
1. Vanderbilt University, Nashville, TN, United States.

Abstract (35 Word Limit): Cancer is a heterogeneous disease, and sub-populations of cells can drive drug resistance. Fluorescence lifetime imaging of metabolic co-factors is used to monitor drug response on a cellular level, to optimize treatment strategies for patients.
Nanophotonics based on Metasurfaces

F. Capasso; 1

1. School of Engineering and Applied Sciences, Harvard University, Cambridge, MA, United States.

Abstract (35 Word Limit): Metasurfaces enable new phenomena that are distinctly different from those observed in 3D metamaterials, providing us with unique capabilities to fully control wavefront and surface wave propagation with planar elements and thus realize “flat photonics”
Simultaneous and Complete Control of Light Polarization and Phase using High Contrast Transmitarrays

A. Arbabi; Y. Horie; M. Bagheri; A. Faraon;
1. T. J. Watson Laboratory of Applied Physics, California Institute of Technology, Pasadena, CA, United States.
2. Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA, United States.

Abstract (35 Word Limit): We report an efficient dielectric metasurface platform for complete control over polarization and phase of light with subwavelength spatial resolution. Using this platform, we experimentally demonstrate polarization switchable phase holograms and vector beam generators.
Liquid Crystal Tunable Plasmonic Color

D. Franklin; 1; D. Chanda; 1;
1. University of Central Florida, Orlando, FL, United States.

Abstract (35 Word Limit): We demonstrate a liquid crystal-tunable reflective surface where the color of the metasurface is changed as a function of applied voltage. Reflection spectra are compared with finite-difference time-domain numeric simulations.
Nanophotonic Metastructures: Functionality at the Extreme

N. Engheta; 1

Abstract (35 Word Limit): We have been exploring the light-matter interaction in metastructures with scenarios that include extreme dimensionality, processing at nanoscales, extreme parameter values, unusual topology, and extreme near zones. We give an overview of our ongoing study.
Molecular Guided Surgery - Quantitative Immunologic Guidance with Optical Imaging

B. W. Pogue; 2, 1;

1. Wellman Center for Photomedicine, Massachusetts General Hospital, Boston, MA, United States.
2. Thayer School of Engineering, Dartmouth College, Hanover, NH, United States.

Abstract (35 Word Limit): Molecular guided surgery is just now reaching substantial clinical trials stage, with multiple imaging systems, and a groundswell of GMP fluorescent molecular probes. Quantifying receptor expression is one potential way to guide cancer surgery.
Clinical Potential of Light-Activated Tissue Crosslinking

R. Redmond; I. E. Kochevar; M. C. McCormack; W. G. Austen;
1. Harvard Medical School, Boston, MA, United States.
2. Wellman Center for Photomedicine, Massachusetts General Hospital, Boston, MA, United States.
3. Surgery, Massachusetts General Hospital, Boston, MA, United States.

Abstract (35 Word Limit): Photocrosslinking can alter biomechanical and biological properties of tissue and close surgical wounds. This contribution focuses on potential clinical applications in vascular surgery and plastic surgery.
Optical Surgical Navigation for Medulloblastoma

C. Contag; 1
1. Stanford University, Stanford, CA, United States.

Abstract (35 Word Limit): We have developed miniaturized confocal microscope designs coupled with wide-field fluorescence micorendocopes scopes for the detection of molecular probes to improve resection of medulloblastoma of children.
Title to be Determined

V. Yang;

1. Sunnybrook Health Sciences Centre, Toronto, ON, Canada.

Abstract (35 Word Limit): tbd
Fluid Coupled Optomechanical Oscillators

H. Tang; 1

1. Yale University, New Haven, CT, United States.

Abstract (35 Word Limit): We demonstrate an optomechanical resonator operating in transparency window of water with optical Q beyond 1.5 million, which allows the detection of mechanical motion at 15am/rtHz resolution with attogram mass sensitivity in liquid environment.
Surface Sensitive Microfluidic Optomechanical Ring Resonator Sensors

K. Kim; X. Fan;
1. University of Michigan, Ann Arbor, MI, United States.

Abstract (35 Word Limit): Sensitivity of the optomechanical resonator to the surface mass change is demonstrated to be 1.2 Hz per pg/mm² by gradually removing SiO₂ molecules from the resonator surface. A detection limit of 83 pg/mm² is achieved.
Single Molecule Detection with an Optomechanical Nanosensor

W. Yu; W. Jiang; Q. Lin; T. Lu;
1. University of Victoria, Victoria, BC, Canada.
2. Electrical and Computer Engineering, University of Rochester, Rochester, NY, United States.
3. Institute of Optics, University of Rochester, Rochester, NY, United States.

Abstract (35 Word Limit): We report 50-milli-Hertz-linewidth optomechanical oscillation of a silica microsphere immersed in a buffer solution. Using the microsphere as a nanosensor, single 10-nm-radius silica beads and Bovine serum albumin (BSA) protein molecules were detected.
Real-time Size/Mass Spectrometry in Solution using Whispering Gallery Micro-Global Positioning

S. Arnold; 1 D. Keng; 1
1. NYU Polytechnic School of Engineering, New York, NY, United States.

Abstract (35 Word Limit): The goal of real-time nano-particle size/mass spectrometry by a microcavity in solution has been illusive for lack of binding position metrology. We demonstrate through Reactive Sensing theory and experiment that this limitation has been overcome.
Abstract (35 Word Limit): By harnessing the photo-induced heating of a single plasmonic nanostructure and AC E-field in our research at the interface between plasmonics and optofluidics we demonstrate on-demand fluid flow control with unparalleled micron per second-scale velocities.
Spontaneous Light-driven Heat Cycles in Metallic Nanofluids with Nanobubbles

L. Vuong; 1, 2; J. Dominguez; 1; M. Moocarme; 1, 2;
1. Physics, Queens College of CUNY, Flushing, NY, United States.
2. Physics, Graduate Center of CUNY, New York, NY, United States.

Abstract (35 Word Limit): We present the first experiments of spontaneous oscillatory behavior in binary-solvent nanofluids, which occurs when collimated light grazes menisci. The robust heat cycles identify nanobubbles, new mechanisms for probing nanoparticle-solvent chemistry, and novel thermo-mechanical dynamics.
Microwave Photonics Mixer based on Polarization Rotation in Semiconductor Optical Amplifier

Q. Zhou; M. P. Fok;
1. University of Georgia, United States.

Abstract (35 Word Limit): A wideband microwave photonics mixer is experimentally demonstrated based on the use of phase coherent orthogonal carriers, generated from single sideband modulation in dual drive Mach-Zehnder modulator and polarization-rotation in semiconductor optical amplifier.
Photonically-Enabled Phase Shift Keying of 50 GHz Bandwidth Radio-Frequency Arbitrary Waveforms

A. Rashidinejad; 1; D. E. Leaird; 1; A. M. Weiner; 1;
1. Purdue University, West Lafayette, IN, United States.

Abstract (35 Word Limit): We experimentally realize phase shift keying of ultrabroadband radio-frequency arbitrary waveforms. BPSK, QPSK and 16-PSK modulation are demonstrated for 50-GHz-bandwidth spread spectrum RF waveforms.
Dispersion Compensation Scheme for Ultra-Wideband Coherent Matched Detection

T. Sakamoto;

1. National Institute of Information and Communications Technology, Tokyo, Japan.

Abstract (35 Word Limit): We propose and investigate a digital processing technique for dispersion compensation in coherent matched detectors, by which ultra-wideband multi-carrier signals beyond electrical bandwidth are orthogonally demultiplexed and demodulated, fully electrically dispersion compensated.
Widely Tunable Optoelectronic Oscillator Utilizing an Optical Notch Filter Based on the Deamplification of Stimulated Brillouin Scattering

H. Peng; 1; Y. Xu; 1; C. Zhang; 1; P. Guo; 1; L. Zhu; 1; W. Hu; 1; Z. Chen; 1;
1. Peking University, Beijing, Beijing, China.

Abstract (35 Word Limit): A novel tunable optoelectronic oscillator utilizing an optical notch filter based on stimulated Brillouin scattering is demonstrated. Tunable 3.36 to 31.4 GHz signals with phase noise of -120 dBc/Hz at 10 kHz offset are obtained.
Experimental Demonstration of Optical Switching of Tbit/s Data Packets for High Capacity Short-Range Networks

A. Medhin; 1; V. Kamchevska; 1; H. Hu; 1; M. Galili; 1; L. K. Oxenløwe; 1;
1. Technical University of Denmark, Kongens Lyngby, Denmark.

Abstract (35 Word Limit): Record-high 1.28-Tbit/s optical data packets are experimentally switched in the optical domain using a LiNbO$_3$ switch. An in-band notch-filter labeling scheme scalable to 65,536 labels is employed and a 3-km transmission distance is demonstrated.
High speed and high resolution demodulation system for hybrid WDM/FDM based fiber microstructure sensor network by using Fabry-Perot filter
Q. Sun; J. Cheng; F. Ai;
1. Huazhong Univ of Science and Technology, Wuhan, Hubei, China.

Abstract (35 Word Limit): Hybrid WDM/TDM enabled microstructure based optical fiber sensor network with large capacity is proposed. Assisted by Fabry-Perot filter, the demodulation system with high speed of 500Hz and high wavelength resolution less than 4.91pm is realized.
Abstract (35 Word Limit): A detection scheme for discriminating coherent states in quantum key distribution systems employing PSK is proposed. It is simple and uses only standard components. Its applicability at extremely low power levels of as low as 0.045 photons per symbol is experimentally verified.
Abstract (35 Word Limit): I review recent progress in chip-based nonlinear optics with a focus on emerging applications in quantum information processing, microwave photonics and midinfrared photonics.
Phase-insensitive fiber parametric amplifier system with clamped output phase

K. Inoue; 1
1. Osaka University, Suita, Osaka, Japan.

Abstract (35 Word Limit): This paper proposes a phase-insensitive fiber parametric amplifier system that outputs a phase-clamped signal. It consists of an orthogonally pumped fiber with polarization-aligned signal and a fiber loop with a polarization beam splitter.
Spectral Narrowing of CW Light in Optical Fibers with Normal Dispersion

S. Papernyi; 1 A. Bednyakova; 2 S. Tyritsyn; 3

1. Lasers, MPB Communications Inc, Pointe Claire, QC, Canada.
2. Novosibirsk State University, Novosibirsk, Russian Federation.
3. Aston Institute of Photonic Technologies, Birmingham, United Kingdom.

Abstract (35 Word Limit): Spectrum narrowing of CW light was observed experimentally in optical transmission fibers with normal dispersion. The effect’s theoretical interpretation as an effective self-pumping parametric amplification of the spectrum’s central part is confirmed by numerical modeling.
Dual-peaked Laser Spectral Compression Generated in a Dispersion-increasing Fiber

Y. Lin; C. Huang;

1. National Tsing Hua University, Hsinchu, Taiwan.

Abstract (35 Word Limit): Adiabatic pulse propagation in a dispersion-increasing fiber is used to generate dual spectrally compressed peaks with tunable amplitudes. Our experimental results are in excellent agreements as compared to numerical calculations.
Raman-Enhanced Phase-Sensitive Fiber Optical Parametric Amplifier

X. Fu; X. Guo; C. Shu; 1

1. Chinese University of Hong Kong, Shatin, Hong Kong.

Abstract (35 Word Limit): Backward Raman amplification is applied to enhance the performance of phase-sensitive fiber optical parametric amplification. The gain extinction ratio and the maximum signal gain are increased by 9.2 and 18.7 dB, respectively.
High-speed Energy-efficient Silicon-polymer Hybrid Integrated Slot Photonic Crystal Waveguide Modulator

X. Zhang; 1; A. Hosseini; 2; H. Subbaraman; 2; J. Luo; 3; A. K. Jen; 3; C. Chung; 1; R. Nelson; 4; R. T. Chen; 1

1. University of Texas at Austin, Austin, TX, United States.
2. Omega Optics, Inc., Austin, TX, United States.
4. Air Force Research Laboratory at Wright Patterson, Dayton, OH, United States.

Abstract (35 Word Limit): We present a high-performance silicon-polymer hybrid integrated slot photonic crystal waveguide modulator. A record-high effective in-device $r_{33}$ of 1230pm/V, $V_{π}×L$ of 0.282V×mm, 3-dB bandwidth of 15GHz, and energy consumption of 94.4fJ/bit are experimentally demonstrated.
WDM Transmitter Using Si Photonic Crystal Optical Modulators

H. Ito; Y. Terada; N. Ishikura; T. Baba;

1. Yokohama National University, Yokohama, Kanagawa, Japan.

Abstract (35 Word Limit): We fabricated a WDM transmitter consisting of Si photonic crystal MZ modulators, triangular-shaped coupled-microring multiplexers and optical switches. 25 Gbps/ch operation and hitless switching of channel wavelength were successfully obtained.
Abstract (35 Word Limit): We present a silicon modulator with a measured E-O bandwidth of 41 GHz at -4 V bias. Open eye diagrams are visible up to 60 Gbps. With DSP, 112 Gbps PAM-4 transmission below FEC threshold is demonstrated.
OOK and QPSK Operation with Wide Working Spectrum in 200-300 μm Si Photonic Crystal Slow Light Modulators

Y. Terada; Y. Hinakura; K. Hojo; N. Yazawa; T. Watanabe; T. Baba;

1. Yokohama National University, Kanagawa, Japan.

Abstract (35 Word Limit): 25 Gbps error-free operation and 16-nm working spectrum were obtained in 200-μm photonic crystal slow light MZ OOK modulators. QPSK modulation was also obtained in a 300-μm device (1.0 × 0.5 mm² footprint).
Abstract (35 Word Limit): We propose a method for linearizing the response of depletion-mode silicon waveguide modulator based on the engineering of modal overlap with the depletion region. Simulations show suppression of nonlinearities in index-voltage transfer function, enabling SFDR of $116 \text{ dB/Hz}^{2/3}$ in MZM configuration.
Linearity Measurement of a Silicon Single-Drive Push-Pull Mach-Zehnder Modulator

Y. Zhou; 1; L. Zhou; 1; F. Su; 1; J. Xie; 1; H. Zhu; 1; X. Li; 1; J. Chen; 1;
1. Shanghai Jiao Tong University, , United States.

Abstract (35 Word Limit): We investigate the linearity of a silicon Mach-Zehnder modulator with single-drive push-pull configuration. The spurious free dynamic range for second harmonic distortion (SFDR\textsubscript{SHD}) is 86 dB·Hz\textsuperscript{1/2} with 4 dB improvement over previous best result.
64 Gb/s silicon QPSK modulator with single-drive push-pull traveling wave electrodes

H. Zhu; L. Zhou; T. Wang; L. Liu; C. Wong; Y. Zhou; j. wang; q. wu; a. xie; R. Yang; z. li; X. Li; J. Chen;

1. Shanghai jiao tong university, , United States.
2. Huawei, Shenzhen, China.

Abstract (35 Word Limit): We demonstrate a silicon QPSK modulator consisting of two nested Mach-Zehnder interferometers with 3.5 mm long traveling-wave electrodes. 64 Gb/s QPSK modulation is achieved with an EVM of 24.4% and power consumption of 7.1 pJ/bit.
Monolithically Integrated Quantum Dot Optical Modulator with Semiconductor Optical Amplifier for High-speed Optical Data Generation

N. Yamamoto;¹; K. Akahane;¹; T. Umezawa;¹; T. Kawanishi;¹;
¹. National Inst Information & Comm Tech, Tokyo, Tokyo, Japan.

Abstract (35 Word Limit): High-speed optical data signal generation of >6.8 Gb/s with an error-free operation was successfully demonstrated using newly developed monolithically integrated quantum dot optical modulator and semiconductor optical amplifier operated in an ultra-broad optical frequency bandwidth.
First OPO Based on Orientation-Patterned Gallium Phosphide (OP-GaP)

P. G. Schunemann; L. A. Pomeranz; D. J. Magarrell; 1
1. BAE Systems Inc, Nashua, NH, United States.

Abstract (35 Word Limit): Optical parametric oscillation was achieved for the first time in OP-GaP. Tm-fiber-pumped Ho:YAG (2090nm, 20W, 20kHz, 12ns) generated 350 mW signal (3.54-microns) plus idler (5.1-microns) from a 92.7-micron grating period crystal in a linear DRO.
Multi-Milliwatt, Continuous-Wave, Mid-Infrared Source for the 6.4-7.5 μm Spectral Range Based on Orientation-Patterned GaAs

K. Devi; 1; P. G. Schunemann; 2; M. Ebrahim-Zadeh; 1, 3;
1. ICFO -The Institute of Photonic Sciences, Castelldefels, CAT, Spain.
2. BAE Systems, Nashua, NH, United States.
3. Institucio Catalana de Recerca i Estudis Avancats (ICREA), Barcelona, Spain.

Abstract (35 Word Limit): We report a cw mid-infrared source based on OP-GaAs, tunable across 6460-7517nm, providing 51.1mW at 6790nm, with passive power stability of ~2.3% rms (>1 hour) and frequency stability of 1.8GHz (>1 minute), in high-beam quality.
High Power and High Energy Infrared Parametric Sources

E. Lippert; 1
1. Forsvarets Forskningsinstitutt, Kjeller, Norway.

Abstract (35 Word Limit): We report on ZnGeP₂-based parametric sources pumped by holmium lasers which are resonantly pumped by thulium fiber lasers. Using this scheme, we have built one source with up to 22 W average power and another with more than 0.2 J pulse energy in the mid-infrared region.
Abstract (35 Word Limit): The first 1064-nm-pumped OP-GaP OPO was successfully demonstrated. A Q-switched Nd:YVO$_4$ laser (~1W, 3.3ns, 10kHz) pumped OP-GaP (16.5-mm-long, 20.8-micron grating period) yielded temperature-tunable signal and idler output wavelengths of 1385-1361 nm and 4591-4876 nm respectively.
Abstract (35 Word Limit): We report on a single-frequency nested cavity OPO based on OP-GaAs, pumped by a pulsed Tm:YAP microlaser. A threshold energy of 10 μJ has been measured and temperature tuning enables to cover the 10.3–10.9 μm range.
Electro-Optically Spectrum Tailorable, Aperiodically Poled Lithium Niobate Optical Parametric Oscillators

Y. Chen; 1 H. Chung; 1 W. Chang; 1 C. Tseng; 1
1. National Central University, Jhongli, Taiwan.

Abstract (35 Word Limit): An electro-optically spectrum tailorable intracavity optical parametric oscillator (IOPO) was built based on a novel integrated aperiodically poled lithium niobate. Spectral narrowing and manipulation of the IOPO signal was demonstrated simply by electro-optic control.
Widely tunable 1μm optical vortex laser

T. Omatsu; 1, 2; A. Abulkemem; 1; T. Yusufu; 1; K. Miyamoto; 1;
1. Chiba University, Chiba, Chiba, Japan.
2. JST, CREST, Tokyo, Japan.

Abstract (35 Word Limit): We developed a widely tunable 1-μm optical vortex laser formed of a 0.5-μm vortex pumped optical parametric oscillator by employing non-critical phase-matching LiB₃O₅ crystals. Tunable vortex output was obtained in the wavelength range of 880-1345nm.
Implementation of the Classical and Quantum Fourier Transform in Photonic Lattices

S. Weimann; 1; A. Perez-Leija; 1; M. Lebugle; 1; A. Szameit; 1;
1. Institut für angewandte Physik, Jena, Germany.

Abstract (35 Word Limit): We report on the experimental realization of an optical version of the fractional and standard Fourier transform using discrete photonic lattices. Our approach is fully integrated and free of bulk optical components. We investigate the transformation of classical and quantum light.
Programmable Nanophotonic Processor for Arbitrary High Fidelity Optical Transformations

G. Steinbrecher, 1 | N. C. Harris, 1 | J. Mower, 1 | M. Prabhu, 1 | D. Englund, 1

1. Research Laboratory of Electronics, Massachusetts Institute of Technology, Cambridge, MA, United States.

Abstract (35 Word Limit): We present an architecture for programmable nanophotonic processors capable of arbitrary discrete transformations for quantum and classical applications. A method to combat fabrication imperfections with high fidelity is discussed along with initial experimental results.
A Fermionic Quantum Computer with Ultracold Atoms

J. T. Barreiro; 1
1. University of California, San Diego, San Diego, CA, United States.

Abstract (35 Word Limit): I will discuss how state-of-the-art experiments with ultracold atoms in optical lattices can be extended to realize fermionic quantum computations for chemistry, achieved by engineering arbitrary hoping and specific many-body interactions of fermions.
Topological Protection of Path Entanglement in Photonic Quantum Walks

M. Rechtsman;1 Y. Lumer;2 Y. Plotnik;2 A. Perez-Leija;3 A. Szameit;3 M. Segev;2
1. Physics Department, The Pennsylvania State University, University Park, PA, United States.
2. Physics Department, Technion Israel Institute of Technology, Haifa, Israel.
3. Institute of Applied Physics, Friedrich-Schiller-Universität Jena, Jena, Germany.

Abstract (35 Word Limit): We show that entangled photons propagating along the edge of a photonic topological insulator preserve their entanglement despite edge defects of any kind. This represents a novel methodology for the transport of quantum information.
Quantum Random Walks in a Programmable Nanophotonic Processor

N. C. Harris;  G. Steinbrecher;  J. Mower;  Y. Lahini;  D. Englund;
1. Massachusetts Institute of Technology, Cambridge, MA, United States.

Abstract (35 Word Limit): We present our recent theoretical and preliminary experimental results on the role of disorder and decoherence in quantum random walks implemented in a large-scale, programmable nanophotonic processor.
Discorrelated Quantum States
T. J. Bartley; 1, 2; E. Meyer-Scott; 3; L. Shalm; 1;
1. National Institute of Standards and Technology, Boulder, CO, United States.
2. Applied Physics, University of Paderborn, Paderborn, Germany.
3. Institute for Quantum Computing and Department of Physics & Astronomy, University of Waterloo, Waterloo, ON, Canada.

Abstract (35 Word Limit): Using the building blocks of quantum optics - single photons, coherent states, beam splitters and projective measurement - we construct a two-mode quantum state for which coincident photon number terms in each mode are removed.
Hybridization: When two wrongs make a right

W. Munro; 1; Y. Matsuzaki; 1; H. Toida; 1; K. Kakuyanagi; 1; N. Mizuochi; 3; K. Nemoto; 2; K. Semba; 2; H. Yamaguchi; 1; S. Saito; 1;

1. NTT Basic Research Laboratories, Tokyo, Tokyo, Japan.
2. National Institute of Informatics, Tokyo, Japan.

Abstract (35 Word Limit): We show in this presentation how the coherence properties of single electron spins (or ensembles) can be dramatically increased just by it coupling with the superconducting qubit, that is two systems with limited coherence properties can form a combined system with a much longer coherence time.
Enhanced Multi-Photon Emission from Single NV Center Coupled to Graphene by Laser-Shaping

J. Liu; 1, 2; Y. Hu; 3; P. Kumar; 3; M. Y. Shalaginov; 2, 4; A. Lagutchev; 2, 4; V. M. Shalaev; 2, 4; G. Cheng; 3; J. M. Irudayaraj; 1, 2;

1. Department of Agricultural and Biological Engineering, Purdue University, West Lafayette, IN, United States.
2. Birck Nanotechnology Center, Purdue Univ., West Lafayette, IN, United States.
3. School of Industrial Engineering, Purdue Univ., West Lafayette, IN, United States.
4. School of Electrical and Computer Engineering, Purdue Univ., West Lafayette, IN, United States.

Abstract (35 Word Limit): We experimentally demonstrated the enhanced multi-photon emission from single NV center coupled to 2D and 3D graphene by a nanoscale laser-shaping technique. Our results provide new non-classical light source for quantum optics and light harvesting.
Abstract (35 Word Limit): We report the all-electrical control over cavity-emitter systems, consisting in Stark-tunable quantum dots embedded in mechanically reconfigurable photonic crystal membranes. Purcell-effect from a single dot is demonstrated at distinct wavelengths.
Single NV Zero-Phonon Line Emission into Waveguide-Coupled GaP-on-Diamond Disk Resonators

M. Gould; 1; N. K. Thomas; 1; Y. Song; 2; M. Lee; 2; K. Fu; 3;

1. Electrical Engineering, University of Washington, Seattle, WA, United States.
2. Electrical Engineering, Yale University, New Haven, CT, United States.
3. Physics, University of Washington, Seattle, WA, United States.

Abstract (35 Word Limit): We present results from waveguide-coupled GaP-on-diamond disk resonators coupled to single nitrogen-vacancy centers in diamond. We estimate zero-phonon line emission rates into one direction of a bus waveguide as high as $1.2 \times 10^4$ s$^{-1}$. 
Tunable Squeezing Using Coupled Ring Resonators on a Silicon Nitride Chip

A. Dutt; S. Miller; K. Luke; A. L. Gaeta; P. Nussenzveig; M. Lipson;
1. Cornell University, Ithaca, NY, United States.
2. Universidade de São Paulo, São Paulo, Brazil.

Abstract (35 Word Limit): We demonstrate continuous tuning of the degree of squeezing from 0.5 to 2 dB (0.9 to 4 dB inferred on chip) by externally controlling the coupling condition of a Si$_3$N$_4$ double ring OPO using integrated microheaters.
Effect of Pure Dephasing and Phonon Scattering on the Coupling of Semiconductor Quantum Dots to Optical Cavities

C. Jarlov; 1; E. Wodey; 1; A. Lyasota; 1; M. Calic; 1; P. Gallo; 1; B. Dwir; 1; A. Rudra; 1; E. Kapon; 1; 1. Ecole Polytechnique Fédérale de Lausanne, Lausanne, VD, Switzerland.

Abstract (35 Word Limit): We investigate the effect of decoherence mechanisms in semiconductor quantum dot-cavity systems by performing photoluminescence measurements of InGaAs/GaAs site-controlled quantum dots coupled to photonic crystal cavities and comparing the results to a theoretical model.
Proposed Method of Optical Spin Read-out in a Quantum Dot using the AC Stark Effect

E. Flagg; 1

1. Department of Physics and Astronomy, West Virginia University, Morgantown, WV, United States.

Abstract (35 Word Limit): We propose a method to read-out the spin-state of an electron in a quantum dot in a Voigt geometry magnetic field via cycling transitions induced by the AC Stark effect.
Measurement of Nonlinear Polariton Dispersion Curves Reveals the Tavis-Cummings Quantum Ladder.

T. Autry; 1, 2; G. Nardin; 1; D. Bajoni; 3; A. Lemaître; 4; S. Bouchoule; 4; J. Bloch; 4; S. Cundiff; 1, 2;
1. JILA, Boulder, CO, United States.
2. Physics, University of Colorado, Boulder, CO, United States.
3. Dipartimento di Ingegneria Industriale e dell’Informazione, Università di Pavia, Pavia, Italy.
4. Laboratoire de Photonique et Nanostructures, NRS, Marcoussis, France.

Abstract (35 Word Limit): The nonlinear dispersion curves of the Tavis-Cummings quantum ladder are measured for exciton-polaritons. This quantum ladder remixes the exciton-cavity system in a manner analogous to a quantum beam splitter, realizing a light-matter n=2 nOOn state.
Control of Coherent Backscattering in a Multimode Fiber Using Nonreciprocal Phase Modulation

Y. Bromberg; B. Redding; H. Cao;

1. Department of Applied Physics, Yale University, New Haven, CT, United States.

Abstract (35 Word Limit): We used a magneto-optical effect to control coherent backscattering in a multimode fiber. A continuous transition from a backscattered peak to a dip was realized by manipulating the relative phase between reciprocal paths.
Abstract (35 Word Limit): The most sophisticated theory of Casimir forces in realistic materials, Lifshitz theory, diverges in inhomogeneous media. Inspired by transformation optics, we have constructed a regularization procedure that appears to converge in planar materials.
All-Solid-State Invisibility Cloak for Diffuse Light

R. Schittny; 1; A. Niemeyer; 1; M. Kadic; 1; T. Bückmann; 1; A. Naber; 1; M. Wegener; 1;
1. Karlsruhe Institute of Technology, Karlsruhe, Germany.

Abstract (35 Word Limit): We realize an all-solid-state version of a macroscopic broadband omnidirectional invisibility cloak for diffuse visible light based on polydimethylsiloxane doped with titania nanoparticles. This cloak is portable, easy to handle, and suitable for school demonstrations.
Metasurface Optical Antireflection Coatings

H. Chen; 1 B. Zhang; 2 J. Guo; 2 J. Hendrickson; 3 N. Nader; 3
1. Los Alamos National Laboratory, Los Alamos, NM, United States.
2. University of Alabama in Huntsville, Huntsville, AL, United States.
3. Air Force Research Laboratory, Wright Patterson Air Force Base, OH, United States.

Abstract (35 Word Limit): We demonstrate a new strategy of optical antireflection coatings employing metasurfaces with designer surface properties in the mid-wave infrared. It has very little requirement on the choice of materials and is scalable to other wavelengths.
Analytic Modeling of Metamaterial Absorbers

P. Bowen; 1; A. Baron; 1; D. R. Smith; 1;

1. Duke University, , United States.

Abstract (35 Word Limit): We present a fully analytical model that describes ideal absorbing metasurfaces composed of film-coupled optical nanoantennas. The model predicts the spectrum and the angular dependence of the absorption and is compared to full-wave numerical simulations.
Highly Efficient Modulation of THz Metamaterials Using Graphene Surface Plasmons

I. J. Luxmoore; 1; P. Q. Liu; 2; S. A. Mikhailov; 3; N. A. Savostyanova; 3; F. Valmorra; 2; J. Faist; 2; G. R. Nash; 1;
1. University of Exeter, United States.
2. ETH Zurich, Zurich, Switzerland.
3. University of Augsburg, Augsburg, Germany.

Abstract (35 Word Limit): We introduce hybrid metamaterials consisting of split ring resonators and a graphene nanoribbon array. Electrostatic control of the graphene plasmon resonance provides dynamic control of the transmission of THz radiation with modulation depth of ~50%.
Dielectric Metasurface Analogue of Electromagnetically Induced Transparency

Y. Yang;¹  I. I. Kravchenko;²  D. Briggs;²  J. Valentine;¹

¹. Vanderbilt University, Nashville, TN, United States.  ². Center for Nanophase Materials Sciences, Oak Ridge National Laboratory, Oak Ridge, TN, United States.

Abstract (35 Word Limit): We present an experimental demonstration of a metasurface analogue of electromagnetically induced transparency based on silicon instead of lossy plasmonic metal, therefore achieved a record-high quality factor of 483 and a sensing figure-of-merit of 103.
Plasmonic Metasurface for Efficient Laser-Driven Particle Acceleration

D. Bar-Lev; 1; J. Scheuer; 1;
1. Department of Physical Electronics, School of Electrical Engineering, Tel Aviv University, Tel Aviv, Israel.

Abstract (35 Word Limit): A laser-driven particle accelerator based on plasmonic metasurfaces is proposed and analyzed. The concept utilizes a unique slot-patch nanoantennas combination and is shown to support ultra-short laser pulses while providing high acceleration gradients reaching 11.6GV/m.
Spatiotemporal Dynamics of Multimode Optical Solitons

L. Wright; 1; W. H. Renninger; 1; D. N. Christodoulides; 2; F. W. Wise; 1;
1. Cornell University, Ithaca, NY, United States.
2. College of Optics and Photonics, CREOL, University of Central Florida, Orlando, FL, United States.

Abstract (35 Word Limit): We study multimode optical solitons with up to roughly 10 spatial modes. This work provides the first evidence for solitons involving more than a few modes, and for spatiotemporal multimode soliton fission and Raman shifting.
Abstract (35 Word Limit): Numerical simulations of spontaneous modulation instability show that localized structures in the chaotic instability field are well-described by analytic elementary and higher order soliton on finite background solutions of the nonlinear Schrödinger equation.
Abstract (35 Word Limit): Based on a birefringence tellurite microstructured optical fiber, multiple solitons are generated by tuning the pump power and the polarization orientation. The central wavelength of the first soliton can be tuned over about 680 nm.
Polarization dynamics of dissipative solitons in a erbium doped fiber laser passively mode locked by carbon nanotube polymer composite

C. Mou; S. Sergeyev; S. Kolpakov; R. Arif; A. Rozhin; M. Chernysheva; S. Turitsyn;

1. Aston Institute of Photonic Technologies, Birmingham, United Kingdom.

Abstract (35 Word Limit): Here we present first investigation of polarization dynamics from a carbon nanotube mode locked erbium doped fiber laser. Both vector and polarization switching dissipative soliton have been observed.
How Optical Spectrum of Random Fiber Laser is Formed

D. V. Churkin; 1, 3; I. Kolokolov; 4, 5; E. V. Podivilov; 2, 3; I. Vatnik; 2, 3; M. Nikulin; 2; S. Vergeles; 4; I. Terekhov; 3, 6; V. Lebedev; 4, 5; G. Falkovich; 7, 8; S. A. Babin; 2, 3; S. Turitsyn; 1, 3;

1. Aston Institute of Photonic Technologies, Birmingham, United Kingdom.
2. Institute of Automation and Electrometry, Novosibirsk, Russian Federation.
3. Novosibirsk State University, Novosibirsk, Russian Federation.
4. Landau Institute for Theoretical Physics, Chernogolovka, Russian Federation.
5. Moscow Institute of Physics and Technology, Dolgoprudny, Russian Federation.
6. The Budker Institute of Nuclear Physics, Novosibirsk, Russian Federation.
7. Weizmann Institute of Science, Rehovot, Israel.
8. Institute for Information Transmission Problems, Moscow, Russian Federation.

Abstract (35 Word Limit): We experimentally and theoretically describe formation of random fiber laser’s optical spectrum. We propose a new concept of active cycled wave kinetics from which we derive first ever nonlinear kinetic theory describing laser spectrum.
Graphene Coated Microfiber For Cascaded Four-Wave-Mixing Generating
B. Yao; 1; Y. Wu; 1; Q. Feng; 1; Z. Wang; 1, 2; Y. Rao; 1; Y. Chen; 1; K. S. Chiang; 1, 3;
1. UESTC, Chengdu, SiChuan, China.
2. Aarhus University, Aarhus, Denmark.
3. City University of Hong Kong, Hong Kong, Hong Kong.

Abstract (35 Word Limit): Cascaded four-wave-mixing was effectively demonstrated in a graphene-coated-microfiber, by using a pulsed pump at 1550 nm, which may be useful for realization of graphene based fiber-optic nonlinear devices, e.g. lasers, filters, modulators and regenerators.
Temporal cloaking enhancements for optical communication

J. M. Lukens; 1; A. J. Metcalf; 1; D. E. Leaird; 1; A. M. Weiner; 1;
1. Purdue University, West Lafayette, IN, United States.

Abstract (35 Word Limit): We demonstrate a temporal cloak with the capability to simultaneously hide and transmit optical data, as well as prevent corruption by an interfering event. Our results significantly expand the potential of time cloaking in telecommunications.
Photon Spin Induced Collective Electron Motion on a Metasurface

X. Ni; J. Xiao; S. Yang; Y. Wang; X. Zhang
1. University of California, Berkeley, Berkeley, CA, United States.
2. Lawrence Berkeley National Laboratory, Berkeley, CA, United States.

Abstract (35 Word Limit): Strong spin-orbit interaction can be induced by light-bending metasurfaces. We show that the photon spin momentum can be directly transferred to collective motion of electrons on a conductive metasurface with this interaction.
Active Epsilon-Near-Zero Infrared Metamaterials

N. Arju; 1 T. Ma; 1 S. Trendafilov; 1 J. Lee; 1 M. A. Belkin; 1 G. Shvets; 1
1. University of Texas at Austin, Austin, TX, United States.

Abstract (35 Word Limit): Metal-insulator-metal based epsilon-near-zero (ENZ) metamaterials are shown to support optical modes localized in the vicinity of a polarizable defect. ENZ-based infrared absorbers are fabricated using SiC and electrically controlled quantum wells structures.
Abstract (35 Word Limit): We experimentally demonstrate spectrally broad ($\lambda_0=1200–1800$ nm) in-plane negative diffraction of SPPs in an array of gap-plasmonic waveguides with negative mutual coupling resulting in negative refraction on the array's interface and refocusing in an adjacent metal layer.
Controlled steering of Cherenkov surface plasmon wakes with a one-dimensional metamaterial

D. Wintz; 1; P. Genevet; 1; A. Ambrosio; 1; A. She; 1; R. Blanchard; 1; F. Capasso; 1;
1. Harvard University, Cambridge, MA, United States.

Abstract (35 Word Limit): We show that by creating a running wave of polarization along a 1D metallic nanostructure consisting of subwavelength spaced rotated apertures that propagates faster than the surface plasmon phase velocity, we can generate surface plasmon wakes, which are the 2D analogue of Cherenkov radiation.
Three-Dimensional Metasurface Carpet Cloak

X. Ni; 1; Z. Wong; 1; Y. Wang; 1; X. Zhang; 1, 2;
1. University of California, Berkeley, Berkeley, CA, United States.
2. Lawrence Berkeley National Laboratory, Berkeley, CA, United States.

Abstract (35 Word Limit): We experimentally demonstrate a three-dimensional ultra-thin metasurface carpet cloak can cover on an arbitrary-shaped object and make it undetectable by the visible light owing to the phase control capability of the metasurface.
Metasurface Engaged with a Plasmonic Spiral Achieve Super Functional Lensing

G. Spektor; 1  A. David; 1  G. Bartal; 1  M. Orenstein; 1

1. Technion, Israel Institute of Technology, Haifa, Israel.

Abstract (35 Word Limit): We realized metasurface spiral plasmonic lenses, mitigating efficiency and functionality issues of conventional plasmonic lenses. The lens enhances the efficiency of linear-polarization-invariant focusing and enhances even further the efficiency of high contrast, circular dichroic detection.
Creating Surface Plasmon Orbital Angular Momentum in a Gold Metasurface

C. Chen; 1; C. Ku; 1; M. Pan; 2; P. Wei; 2; C. Huang; 1;
1. Institute of Photonics Technologies, National Tsing Hua University, Hsinchu, Taiwan.
2. Research Center for Applied Sciences, Academia Sinica, Taipei, Taiwan.

Abstract (35 Word Limit): Nanocavities inscribed in a gold thin film is optimized and arranged to form a metasurface. We demonstrate both numerically and experimentally that surface plasmon vortex carrying orbital angular momentum can be generated under linearly-polarized optical excitation.
Abstract (35 Word Limit): Electrically injected MOVPE grown InPAs quantum dot lasers emitting at wavelengths longer than 770nm are demonstrated with 300K threshold current density of 260Acm⁻² for 2mm long uncoated facet devices and operation up to 370K.
Quantum cascade laser-based Kerr frequency comb generation
C. Lecaplain; 1; C. Javerzac-Galy; 1; E. Lucas; 1; J. D. Jost; 1; T. Kippenberg; 1;
1. EPFL, Lausanne, Switzerland.

Abstract (35 Word Limit): We report mid-infrared Kerr comb generation based on a quantum cascade laser pumping a crystalline microresonator. For the first time QCL light is coupled into a microresonator via a tapered chalcogenide fiber allowing mid-IR Kerr comb generation.
Very Small Lasers and Resonators

Y. Lee; ¹; H. Jang; ¹;

¹. Physics, Korea Advanced Inst of Science & Tech, Daejon, Korea (the Republic of).

Abstract (35 Word Limit): Evolution of small resonant lasers/cavities, from 1D vertical cavity surface emitting lasers to 2D photonic crystal lasers and back to 1D nanobeam lasers, will be discussed. Emphases will be placed on ultra-low threshold nanobeam lasers.
Waveguide-integrated Unidirectional-Emission Microspiral Lasers for Optical Interconnects
Y. Zhang; 1 A. W. Poon; 1
1. Photonics Device Laboratory, Department of Electronic and Computer Engineering, The Hong Kong University of Science and Technology, Hong Kong, China.

Abstract (35 Word Limit): We demonstrate a room-temperature continuous-wave electrically injected unidirectional-emission AlGaInAs/InP multiple-quantum-well microspiral disk laser with a 44mA threshold current. Above 130 mA, the laser shows a unidirectional emission from the waveguide butt-coupled to the microspiral notch.
Room Temperature UV-C Lasers with Nitride Microdisks on Silicon

P. Boucaud; J. Sellés; C. Brimont; T. Guillet; G. Cassabois; B. Gayral; M. Mexis; F. Semond; I. Roland; Y. Zeng; X. Checoury;

1. IEF-CNRS-Univ Paris Sud, Orsay, France.
2. L2C-Univ. Montpellier 2, Montpellier, France.
3. Univ. Grenoble Alpes, INAC-SP2M, CEA-CNRS , Grenoble, France.
4. CRHEA-CNRS, Valbonne, France.

Abstract (35 Word Limit):

We demonstrate room temperature lasing in the UV-C spectral range (~275 nm) with nitride microdisks. The nitride materials are directly grown on a silicon substrate. The active region consists of ultra-thin GaN/AlN quantum wells.
Wide and reversible tuning of an individual nanowire laser using hydrostatic pressure

S. Liu; 1, 2; C. Li; 3; J. Figiel; 1; I. Brener; 1, 2; S. Brueck; 3; G. Wang; 1

1. Sandia National Laboratories, Albuquerque, NM, United States.
2. The Center for Integrated Nanotechnologies, Albuquerque, NM, United States.
3. Center for High Technology Materials, University of New Mexico, NM, United States.

Abstract (35 Word Limit): We report wide, continuous, and reversible tunable lasing between 367-337 nm from single GaN nanowires by applying hydrostatic pressure up to ~7 GPa. The pressure coefficients observed are 40% larger compared with bulk GaN or GaN microstructures.
Room Temperature Continuous Operation of Sub-µW Threshold Nanobeam Laser
H. Jang; 1; I. Karnadi; 1; P. Pramudita; 1; Y. Lee; 1;
1. Physics, KAIST, Daejeon, Korea (the Republic of).

Abstract (35 Word Limit): Nanobeam laser with threshold 230 nW is demonstrated in continuous-wave operation at room-temperature. This is achieved by reducing the size of active medium to 1.5×0.3×0.02 µm³ via selective wet-etching of a single quantum well layer.
Octave Spanning Frequency Comb Generation in a Dispersion-Controlled Short Silicon-Wire Waveguide with a Fiber

Abstract (35 Word Limit): We demonstrate on-chip frequency comb generation spanning from 900 to 2300 nm, the widest bandwidth with a laser oscillator (only 50-pJ pulse energy), by controlling dispersion and propagation distance of silicon-wire waveguides.
A Hybrid III-V-Graphene Device for Modelocking and Noise Suppression in a Frequency Comb

C. Lee; K. Silverman; A. Feldman; T. Harvey; R. P. Mirin; T. R. Schibli; 1, 3;
1. Physics, University of Colorado at Boulder, Boulder, CO, United States.
3. JILA, National Institute of Standards and Technology and University of Colorado, Boulder, CO, United States.

Abstract (35 Word Limit): We demonstrate a device that integrates a III-V semiconductor saturable absorber mirror with a graphene electro-optic modulator, which provides a monolithic solution to modelocking and noise suppression in a frequency comb.
A Robust 2f-to-3f Collinear Interferometer with a Dual-Pitch Periodically Poled Lithium Niobate Ridge Waveguide
K. Hitachi; 1; A. Ishizawa; 1; O. Tadanaga; 2; H. Mashiko; 1; T. Nishikawa; 3; T. Sogawa; 1; H. Gotoh; 1;
1. NTT Basic Research Laboratories, Atsugi-shi, Kanagawa, Japan.
2. NTT Device Technology Laboratories, Atsugi-shi, Kanagawa, Japan.
3. Tokyo Denki University, Adachi-ku, Tokyo, Japan.

Abstract (35 Word Limit): We demonstrated that a 2f-to-3f collinear interferometer is robust against environmental noise. The out-of-loop Allan deviation of the collinear interferometer is $7 \times 10^{-15}$ at gate time of 1 s, irrespective of environmental perturbation.
Ultra low noise all polarization-maintaining fiber-based Er optical frequency combs

N. Kuse; 1; C. Lee; 2; J. Jiang; 1; C. Mohr; 1; T. R. Schibli; 2; M. E. Fermann; 1;
1. IMRA America Inc, Ann Arbor, MI, United States.
2. Department of Physics, University of Colorado, Boulder, CO, United States.

Abstract (35 Word Limit): We demonstrated all polarization-maintaining (PM) Er fiber frequency combs with record-low noise by using two fast actuators, a graphene-based EOM and a bulk EOM.
Thin-Disk Lasers for Multi-100-W Average Power Frequency Combs: Challenges and Analysis
A. Diebold; 1 F. Emaury; 1 A. Klenner; 1 C. J. Saraceno; 1, 2 S. Schilt; 2 T. Sudmeyer; 2 U. Keller; 1
1. Department of Physics, ETH Zurich, Zurich, Switzerland.
2. Laboratoire Temps-Fréquence, Université de Neuchâtel, Neuchâtel, Switzerland.

Abstract (35 Word Limit): We compare the noise characteristics and cavity dynamics of a CEO-stabilized 80-fs Yb:CALGO SESAM-modelocked thin-disk-laser (TDL) and a 140-W SESAM-modelocked Yb:YAG TDL with CEO detection. Guidelines towards tight CEO-locking in the >100-W regime are presented.
Highly Efficient Self-Referencing of a 1-GHz Diode-Pumped Solid-State Laser Using a Silicon Nitride Chip

A. Mayer, 1; A. Klenner, 1; A. R. Johnson, 2; K. Luke, 2; M. R. Lamont, 2; Y. Okawachi, 2; M. Lipson, 2; A. L. Gaeta, 2; U. Keller, 1;
1. ETH Zurich, Zurich, ZH, Switzerland.
2. Cornell University, Ithaca, NY, United States.

Abstract (35 Word Limit): We present the first carrier-envelope-offset (CEO) frequency detection based on multi-octave-spanning supercontinuum generation in a CMOS-compatible Si3N4 waveguide. Strong CEO-beat-signals (>30 dB) of a gigahertz-Yb:CALGO-laser were obtained with only 36 pJ of coupled pulse energy.
Spectrally Flattened, Broadband Astronomical Frequency Combs

R. Probst; 1; Y. Wu; 1; T. Steinmetz; 2; S. Stark; 2; T. Hänsch; 1; T. Udem; 1; R. Holzwarth; 1, 2;

1. Max-Planck-Institut für Quantenoptik, Garching, Germany.

Abstract (35 Word Limit): We demonstrate the generation of broadband, visible astronomical frequency combs with flattened spectral envelopes. The flat-top region of the spectrum ranges from about 450 to 730 nm, at mode spacings of 18 and 25 GHz.
A low-dispersion Fabry-Perot cavity for generation of a 30 GHz astrocomb spanning 140 nm

D. Hackett; 1, 2; G. Ycas; 1, 2; S. Diddams; 2, 1;

1. University of Colorado Boulder, Boulder, CO, United States.

Abstract (35 Word Limit): For broadband filtering of a frequency comb, ultra-low dispersion mirrors with reflectivity 99.2 – 99.6% are fabricated and characterized. A Fabry-Perot cavity is constructed, and used to filter 140 nm of optical bandwidth to 30 GHz.
Molecular Contrast in Interferometric Imaging

A. Wax; 1

1. Bioomedical Engineering, Duke University, Durham, NC, United States.

Abstract (35 Word Limit): Interferometric imaging offers many advantages for biomedical applications such as optical sectioning/depth resolution. Inclusion of molecular contrast information improves utility but requires additional efforts to either isolate spectroscopic information or detect contrast agents.
Multi-Scale Optical Molecular Imaging

Y. Chen

1. University of Maryland at College Park, College Park, MD, United States.

Abstract (35 Word Limit): An array of fluorescence molecular imaging technologies for multi-scale imaging will be presented, including planar fluorescence for macroscopic samples, fluorescence laminar optical tomography for mesoscopic samples, and two-photon fluorescence microscopy for intravital imaging.
Fiber-optic Endomicroscopy for Label-free Optical Histology

X. Li; 1

1. Johns Hopkins University, Baltimore, MD, United States.

Abstract (35 Word Limit): We report on recently developed high-resolution, fiber-optic scanning endomicroscopy technology and its capability of performing label-free optical histologic imaging in vivo and in situ. Technological advances and examples of biological tissue imaging will be presented.
Ultra High-Resolution Photoacoustic Microscopy Using a Novel Transient Absorption Technique

B. E. Applegate; ¹

1. Texas A&M University, College Station, TX, United States.

Abstract (35 Word Limit): We have recently harnessed transient absorption for ultrahigh resolution photoacoustic microscopy, achieving nearly an order of magnitude improvement in axial resolution. We will discuss recent progress in system development and time resolved measurements for hemoglobin oxygen saturation.
Microdisk Cavity-Coupled MoS$_2$ with Tunable Narrowband Emission

J. C. Reed; $^1$; A. Y. Zhu; $^1$; H. Zhu; $^1$; E. Cubukcu; $^1$

1. University of Pennsylvania, United States.

Abstract (35 Word Limit): We incorporate monolayer MoS$_2$ into a microdisk optical resonator cavity to produce narrowband emission with quality-factors of 900. The integrated photonic device has high spatial and temporal coherence and is wavelength tunable.
Abstract (35 Word Limit): We report on fabrication and characterization of 1D photonic crystal on a single erbium chloride silicate nanowire. Design and simulation show that a microcavity laser with Q-factor over 10000 is feasible from a single nanowire.
Two-Dimensional Material Nanophotonics

F. Xia; 1

1. Yale University, Orange, CT, United States.

Abstract (35 Word Limit): We discuss optical properties of two-dimensional materials ranging from insulating hexagonal boron nitride, semiconducting transition metal dichalcogenides such as molybdenum disulfide and black phosphorus, to semi-metallic graphene. We also cover their potential applications in photonics.
30 GHz Zeno-based Graphene Electro-optic Modulator

C. T. Phare; 1; Y. Lee; 1; J. Cardenas; 1; M. Lipson; 1;
1. Cornell University, Ithaca, NY, United States.

Abstract (35 Word Limit): We experimentally demonstrate the first ultrafast graphene modulator by exploiting Zeno coupling effects in a graphene-on-silicon-nitride ring resonator.
Small Footprint Barium Titanate Photonic Crystal Modulators for Photonic Integrated Circuits

P. Girouard; 2; P. Chen; 2; Y. Tu; 1; Y. Jeong; 2; Z. Liu; 2; S. Ho; 1; B. W. Wessels; 2;
1. Electrical Engineering and Computer Science, Northwestern University, Evanston, IL, United States.
2. Materials Science and Engineering, Northwestern University, Evanston, IL, United States.

Abstract (35 Word Limit): We report on the design, fabrication, and characterization of photonic crystal phase modulators on epitaxial barium titanate thin films. Modeling indicates that >50 GHz bandwidth and 0.25 V·cm voltage-length product are achievable in sub-millimeter long devices.
Electrically Controllable Extraordinary Optical Transmission in Metallic Surface Gratings on VO$_2$

J. Jeong; 1; A. Joushaghani; 1; S. Paradis; 2; D. Alain; 2; J. K. Poon; 1;
1. University of Toronto, , United States.
2. Defence Research and Development Canada, Valcartier, QC, Canada.

Abstract (35 Word Limit): We present metallic gratings on a VO$_2$ film with electrical control of the transmission spectrum. The extraordinary optical transmission was tunable by up to a factor of 2.75X to achieve an extinction ratio of 26 dB/μm.
Lithium Niobate on Insulator (LNOI) Grating Couplers

M. Mahmoud; 1  S. Ghosh; 1  G. Piazza; 1

Photosurgery for the skin: Younger, Healthier and Easier

B. L. Goo,$^1,2$;

1. Lutronic Corporation, Gyeonggi-do, Gyounggi, Korea (the Republic of).
2. Clinique L Dermatology, Goyang, Korea (the Republic of).

Abstract (35 Word Limit): Surgeons use sophisticated but imperfect clinical algorithms to analyze visible skin conditions for precise decision making. Algorithmic approaches, current limitations and future ideas will be discussed.
Delineation of Basal Cell Carcinoma Margins with Combined RCM/OCT Imaging

N. Iftimia, 1

1. Physical Sciences Inc., Andover, MA, United States.

Abstract (35 Word Limit): We demonstrate a novel approach for delineation of basal cell carcinoma (BCC) margins based on combined Reflectance Confocal Microscopy (RCM)/ Optical Coherence Tomography (OCT) imaging. BCC margins delineation is very important for both disease staging and therapy guidance.
Simple optical configuration for continuous curvilinear capsulorhexis

H. Lee,1 J. Choi,1 Y. Kim,2
1. Lutronic Center, Goyang-si, Gyeonggi-Do, Korea (the Republic of).
2. Kyunghee University, Yongin-si, Korea (the Republic of).

Abstract (35 Word Limit): A simple optical system using a wedge prism instead of a scanner for continuous curvilinear capsulorhexis [CCC] was studied.
Clinical Embodiments of Laser Speckle Imaging for Real-Time Blood-Flow Monitoring

B. Choi; 1, 2;
1. Surgery and Biomedical Engineering, University of California, Irvine, Irvine, CA, United States.
2. Beckman Laser Institute and Medical Clinic, Irvine, Armed Forces Pacific, United States.

Abstract (35 Word Limit): Laser Speckle Imaging (LSI) is used widely in preclinical studies of blood flow, especially in neurobiology. However, clinical application of LSI remains underexplored. Here, I describe our experiences in developing clinic-friendly embodiments of LSI.
Towards Endoscopic Image-Guided Laser Coagulation Using a Double-Clad Fiber Coupler

K. Beaudette; 1, 2; J. Ren; 2; M. Villiger; 2; M. Strupler; 1; W. Madore; 1; M. Shishkov; 2; N. Godbout; 1; B. Bouma; 2; 3; C. Boudoux; 1.

1. Ecole Polytechnique de Montreal, Montreal, QC, Canada.
2. Wellman Center for Photomedicine, Harvard Medical School and Massachusetts General Hospital, Boston, MA, United States.
3. Division of Health Sciences and Technology, Harvard-Massachusetts Institute of Technology, Cambridge, MA, United States.

Abstract (35 Word Limit): We demonstrate a double-clad fiber (DCF) based system using a novel DCF coupler to simultaneously combine optical coherence tomography and laser coagulation. Such a system allows monitoring of dynamic thermal processes during laser irradiation, thus enabling image-guided laser marking and therapy.
Wide-field Imaging of Pathology Slides using Lensfree On-chip Microscopy

Y. Zhang; 1; A. Greenbaum; 1; A. Feizi; 1; P. Chung; 1; W. Luo; 1; S. R. Kandukuri; 1; A. Ozcan; 1

1. UCLA, Los Angeles, CA, United States.

Abstract (35 Word Limit): Three-dimensional lensfree imaging of pathology slides over a large field-of-view is achieved using multi-height phase recovery that incorporates transport-of-intensity equation and rotational field transformations to overcome stagnation in iterative image reconstruction.
Photonic Crystal Enhanced Microscopy

B. T. Cunningham; 1, 2; w. chen; 1; k. d. long; 2; Y. Zhuo; 2; J. S. Choi; 3; B. A. Harley; 3;
1. Electrical and Computer Engineering, University of Illinois at Urbana-Champaign, Urbana, IL, United States.
2. Department of Bioengineering, University of Illinois at Urbana-Champaign, Urbana, IL, United States.
3. Department of Chemical and Biological Engineering, University of Illinois at Urbana-Champaign, Urbana, IL, United States.

Abstract (35 Word Limit): By modifying a microscope to perform hyperspectral imaging of reflectance from a photonic crystal, we describe a new microscopy approach that enables quantitative, spatially resolved imaging of the interaction of cells and nanoparticles with surfaces.
Microfluidic Isolation and Fluorescence Microscopy in a Fully Automated Digital Diagnostic Instrument (SIMOA HD-1)
W. McGuigan; 1
1. STRATEC Biomedical USA, Inc., Newbury Park, CA, United States.

Abstract (35 Word Limit): tbd
Optofluidic Microreactors for Visible-Light Photocatalysis

X. Zhang; 1
1. Hong Kong Polytechnic University, Hung Hom, Kowloon, Hong Kong.

Abstract (35 Word Limit): Photocatalysis and optofluidics have an intrinsic synergy as both deal with the same objects – light, fluids and solvents. This study presents different designs of optofluidic microreactors to solve some major problems of current photocatalytic technology.
Electrowetting-Based Variable Tuning Prism

S. Terrab; ¹; A. Watson; ¹; K. Dease; ¹; J. Gopinath; ¹; V. Bright; ¹;
¹. University of Colorado Boulder, Boulder, CO, United States.

Abstract (35 Word Limit): We demonstrate an electrowetting-based variable prism with dual prism-lens operation. A prism apex angle change of 19° at 35 V and curvature change to infinite focal length at 18.9 V are demonstrated.
What Is the Microfluidics Doing in Electrowetting Displays?

L. Shui; T. He; m. jin; x. chen; g. zhou;

1. Institute of Electronic Paper Displays, South China Academy of Advanced Optoelectronics, South China Normal University, Guangzhou, Guangdong, China.

Abstract (35 Word Limit): Electrowetting display (EWD) is realized by electrically driven fluidic flow in micro-pixels. The fluidic properties including interfacial tension, viscosity and conductivity have been investigated to understand the dual-phase microfluidic behavior in micro-pixels of EWDs.
Dense Space Division Multiplexed Transmission Technology

T. Mizuno; H. Takara; A. Sano; Y. Miyamoto;
1. NTT Network Innovation Laboratories, Yokosuka, Kanagawa, Japan.

Abstract (35 Word Limit): We review recent progress in ultra-high capacity transmission based on dense space division multiplexing (DSDM) for future scalable optical transport networks, and present the latest multi-core multi-mode fiber, spatial multi/demultiplexers, and MIMO signal processing technique.
Experimental Demonstration of N-Dimensional 1-to-1100 Multicasting (25 Wavelengths x 22 Orbital Angular Momentum Modes x 2 Polarizations) of OFDM-mQAM Signal

J. Wang; 1; S. Li; 1; J. Liu; 1; C. Li; 1; L. Zhu; 1; J. Du; 1; M. Luo; 2; Q. Yang; 2; S. Yu; 2;

1. Wuhan National Laboratory for Optoelectronics, School of Optical and Electronic Information, Huazhong University of Science and Technology, Wuhan, China.
2. State Key Laboratory of Optical Comm. Technologies and Networks, Wuhan, China.

Abstract (35 Word Limit): We present N-dimensional multicasting exploiting wavelength, orbital angular momentum (OAM) and polarization dimensions. 1-to-1100 multicasting (25 wavelengths x 22 OAM modes x 2 polarizations) of OFDM-16/32QAM signal is demonstrated. All 1100-fold channels achieve BER <2e-3.
Q-plates for Switchable Excitation of Fiber OAM Modes
P. Gregg; 1 M. Mirhosseini; 2; A. Rubano; 3 L. Marrucci; 3; E. Karimi; 4; R. W. Boyd; 4, 2; S. Ramachandran; 1
1. Boston University, Boston, MA, United States.
2. University of Rochester, Rochester, NY, United States.
3. Universita di Napoli Federico II, Napoli, Italy.
4. University of Ottawa, Ottawa, ON, Canada.

Abstract (35 Word Limit): We demonstrate that a $|q|=1/2$ plate plus polarization optics can tunably excite all linear combinations of $|L|=1$ fiber OAM modes with up to $\sim30$ dB purity, enabling switch fabrics in fiber-OAM networks and disentangling of degenerate mode mixing effects in long fibers.
160 Gbaud Single Nyquist Channel Transmission through Emulated 4 km Free-space Turbulence Link
D. Kong; J. Wu; T. Xu; Y. Li; M. Yu; D. Zheng; Y. Zuo; Y. Lei; W. Li; H. Guo; J. Lin
1. State Key Laboratory of Information Photonics and Optical Communications, Beijing University of Posts and Telecommunications, Beijing, Beijing, China.

Abstract (35 Word Limit): A single 160 Gbaud Nyquist channel transmission based on coherent matched sampling under 4 km lab-emulated free-space turbulence link is demonstrated. Turbulence induced power fluctuation is found to be main reason of performance deterioration.
Experimental Demonstration of a 400-Gbit/s Free Space Optical Link Using Multiple Orbital-Angular-Momentum Beams with Higher Order Radial Indices

L. Li; 1; G. Xie; 1; Y. Yan; 1; Y. Ren; 1; p. liao; 1; N. Ahmed; 1; Z. Zhao; 1; C. Bao; 1; Z. Wang; 1; N. Ashrafi; 2; S. Ashrafi; 2; R. Linquist; 2; m. tur; 4; a. willner; 1;
1. University of Southern California, , United States.
2. NxGen Partners, Dallas, TX, United States.
3. University of Texas at Dallas, Dallas, TX, United States.
4. Tel Aviv University, Ramat Aviv, Israel.

Abstract (35 Word Limit): We report a transmission of 400 Gbit/s signal over a four-channel, 1-meter mode-division-multiplexed free space optical communication link using multiple orbital-angular-momentum beams with non-zero radial indices, achieving a power penalty less than 6 dB.
Towards nonlinear optics with cold Rydberg atoms inside a hollow core fiber

P. Windpassinger; ¹; M. Langbecker; ¹; M. Noaman; ¹
¹Johannes Gutenberg Universitat Mainz, Mainz, Germany.

Abstract (35 Word Limit): We present an experimental setup for studying strongly nonlinear light-matter interactions using cold atoms inside a hollow core fiber. A Rydberg EIT process can potentially be used to generate strong and tunable effective photon-photon interactions.
SBS Suppression in Nanosecond Fiber Amplifier with Controlled Frequency Chirp

P. Ionov; 1; F. Di Teodoro; 1; T. Rose; 1;
1. The Aerospace Corporation, El Segundo, CA, United States.

Abstract (35 Word Limit): We observe a nearly 9-fold increase in the SBS threshold for a pulsed Yb fiber amplifier by applying a linear frequency-chirp to the input seed pulse. The chirp is achieved by pulse driving a phase modulator. SBS threshold data and transient SBS gain for various degrees of chirp are reported.
Stimulated Forward Brillouin Scattering in Hollow-core Photonic Crystal Fiber

W. H. Renninger; 1; H. Shin; 1; R. O. Behunin; 1; P. Kharel; 1; E. Kittlaus; 1; P. T. Rakich; 1;
1. Yale University, New Haven, CT, United States.

Abstract (35 Word Limit): Stimulated forward Brillouin scattering is observed in hollow-core photonic bandgap fiber. Multiple acoustic closely-spaced resonances exist below 100 MHz. A quality factor enhancement is observed when air is evacuated from the fiber.
L. Zhang; L. Zhan; M. Qin; J. Liu;
1. Shanghai Jiao Tong University, Shanghai, Shanghai, China.
2. East China Normal University, Shanghai, China.

Abstract (35 Word Limit): We propose and experimentally validate superluminal propagation using a single-longitudinal-mode long-cavity Brillouin fiber laser with a saturable absorber. The transmission distance of Brillouin-induced superluminal propagation is stretched to 100m in optical fibers.
Abstract (35 Word Limit): Reduction of four-wave-mixing crosstalk in multi-wavelength amplification is achieved using a backward Raman pump in a fiber optical parametric amplifier. The receiver sensitivity is improved by 1.6 dB in the amplification of three data channels.
Addressing a cavity with patterns at ultra-wideband detune

X. Wei; 1, Y. Xu; 1, S. Tan; 1, S. Xu; 2, Z. Yang; 2, K. K. Tsia; 1, K. Wong; 1

1. Department of Electrical and Electronic Engineering, The University of Hong Kong, Hong Kong, Hong Kong.
2. Institute of Optical Communication Materials and State Key Laboratory of Luminescent Materials and Devices, South China University of Technology, Guangzhou, Guangdong, China.

Abstract (35 Word Limit): We demonstrate an amplified fiber ring cavity at telecommunication window addressed by optical pattern at 1.0 μm. A storage time longer than 38 μs and an ultra-wideband wavelength conversion of ~500 nm have been obtained.
Critical Review of the Gain Factor of 16 for Calculation of the Raman Threshold in Fibers

R. Engelbrecht;

1. Institute of Microwaves and Photonics, Friedrich-Alexander-University Erlangen-Nuremberg (FAU), Erlangen, Germany.

Abstract (35 Word Limit): Analytic approximations yielding the well-known gain factor of 16 in formulas for SRS threshold in fibers are compared to rigorous simulations. This factor is shown to be larger for short and modern fibers, as used for high-power lasers.
Abstract (35 Word Limit): We demonstrate photonics monolithically integrated in a 32nm SOI microelectronics process, including grating couplers, tunable filters, and modulators, the first migration of zero-change CMOS photonics moving down the microelectronics technology-node ladder, from the 45nm node.
III-V Nanopillar Phototransistor Directly Grown on Silicon

I. Bhattacharya; 1, W. Ko; 1, F. Lu; 1, S. Gerke; 1, C. J. Chang-Hansnain; 1

1. University of California Berkeley, Berkeley, CA, United States.

Abstract (35 Word Limit): We demonstrate InP nanopillar bipolar junction phototransistors monolithically integrated on a Silicon substrate. With a responsivity of 4 A/W and bandwidth of 7.5 GHz, these receivers indicate a route towards efficient on-chip optical interconnects.
Performance Evaluation of GaN/InGaN Heterojunction Phototransistors

S. Shen; T. Kao; J. Kim; Y. Lee; M. Ji; A. Haq; T. Detchprohm; R. D. Dupuis;
1. Georgia Institute of Technology, Atlanta, GA, United States.

Abstract (35 Word Limit): We present a high-performance InGaN/GaN heterojunction phototransistor with the responsivity ($R_\lambda$) > 8 (A/W), low noise-equivalent-power (NEP) < 1.1x10^{-17} (W-Hz^{0.5}) and high detectivity ($D^*$) > 1.2x10^{14} (cm-Hz^{0.5}-W^{-1}).
Photocurrent gain in graphene-silicon p-i-n junction

T. Gu; 1, 2; N. Petrone; 1; A. van der Zande; 1; y. li; 1; T. Heinz; 1; P. Kim; 3, 1; j. Hone; 1; C. Wong; 1; C. M. Santori; 2; R. Beausoleil; 2;

1. Columbia University, New York, NY, United States.
2. Hewlett-Packard Laboratory, Palo Alto, CA, United States.
3. Physics, Harvard University, Cambridge, MA, United States.

Abstract (35 Word Limit): We demonstrate single atomic cladding layer of graphene enhance the photocurrent profile of the monolithic silicon p-i-n junction, by spatially- and spectrally- resolved photocurrent measurement.
First Demonstration of an Integrated Photonic Phase-Sensitive Amplifier

W. Li;¹; M. Lu;³; L. Johansson;²; M. Mashanovitch;²; D. Dadic;¹; S. Arafin;¹; L. Coldren;¹;
1. ECE, University of California, Santa Barbara, Santa Barbara, CA, United States.
2. freedomphotonics, Santa Barbara, CA, United States.
3. infinera, San Francisco, CA, United States.

Abstract (35 Word Limit): For the first time, an integrated photonic phase-sensitive amplifier is reported. Approximately 6.3 dB extinction of on-chip phase-sensitive gain based on a signal-degenerate dual pump four-wave mixing architecture has been achieved.
Polarization Transparency for Silicon Photonics

J. Caspers; 1, 2; J. St-Yves; 3; L. Chrostowski; 4; W. Shi; 3; M. Mojahedi; 1;
1. University of Toronto, Cologne, Germany.
3. Department of Electrical and Computer Engineering and the Center for Optics, Photonics, and Lasers (COPL), Université Laval, Québec, QC, Canada.
4. Department of Electrical and Computer Engineering, University of British Columbia, Vancouver, BC, Canada.

Abstract (35 Word Limit): We experimentally demonstrate the ability to couple any polarization state from a fiber to the TE-mode of a single waveguide in an integrated silicon photonics circuit. We obtain less than ±0.6 dB standard deviation across all input polarization states at a wavelength of 1.55 µm.
Thermal-tuned optical pulse shaper for arbitrary waveform generation with integrated waveguides

S. Liao; 1; Y. Ding; 2; T. Yang; 1; H. Zhou; 1; X. Chen; 1; J. Dong; 1; X. Zhang; 1;
1. Wuhan National Lab for Optoelectronics, Wuhan, Hubei, China.
2. Technical University of Denmark, Lyngby, Denmark.

Abstract (35 Word Limit): We demonstrate an on-chip thermal-tuned optical pulse shaper based on the four-path finite impulse response (FIR). Four typical waveform are demonstrated by tuning the phase and amplitude of each path.
All-Optical Flip-Flop Memory Based on V-cavity Laser

Y. Wu; Y. Zhu; X. Liao; J. He;
1. Zhejiang University, Hangzhou, Zhejiang, China.

Abstract (35 Word Limit): We experimentally demonstrate an all-optical flip-flop memory based on the bistability of tunable V-cavity laser with short storing and erasing response time of about 150ps and 159ps, respectively.
High-average-power, Mid-infrared Femtosecond Optical Parametric Oscillator at 7 µm Based on CdSiP$_2$

S. Chaitanya Kumar; $^1$; J. Krauth; $^2$; K. Zawilski; $^3$; P. G. Schunemann; $^3$; H. W. Giessen; $^2$; M. Ebrahim-Zadeh; $^{1,4}$

1. ICFO -The Institute of Photonic Sciences, Castelldefels, CAT, Spain.
2. 4th Physics Institute and Research Center SCOPE, University of Stuttgart, Pfaffenwaldring 57, 70550 Stuttgart, Germany.
3. BAE Systems, New Hampshire, CA, United States.
4. Institucio Catalana de Recerca i Estudis Avancats (ICREA), Passeig Lluis Companys 23, Barcelona 08010, Spain.

Abstract (35 Word Limit): We report a mid-infrared femtosecond OPO based on CdSiP$_2$ tunable across 6786-7069 nm, generating record power of 110-mW at 7 mm, with passive power and wavelength stability below 3% rms (1-hour) and 0.1% rms (15-min), respectively.
Cr:ZnS Laser-pumped Subharmonic GaAs OPO with an Instantaneous Bandwidth 3.6-5.6 μm

V. O. Smolski; 1; S. Vasilyev; 2; P. G. Schunemann; 3; S. B. Mirov; 2, 4; K. Vodopyanov; 1;
1. CREOL, University of Central Florida, Orlando, FL, United States.
2. Mid-IR Lasers, IPG Photonics, Birmingham, AL, United States.
3. BAE Systems, Nashua, NH, United States.
4. Department of Physics, University of Alabama at Birmingham, Birmingham, AL, United States.

Abstract (35 Word Limit): High-power (110mW) mid-IR output suitable for ultra-broadband frequency comb generation was produced in a low-threshold (20mW) subharmonic GaAs optical parametric oscillator that was synchronously pumped (175MHz) by a compact 0.5-W femtosecond Cr:ZnS (2.38μm) oscillator.
Mid-Infrared Femtosecond Optical Parametric Oscillator Synchronously-Pumped Directly by a Ti:sapphire laser

M. Ebrahim-Zadeh; ¹, ²

¹. Nonlinear Optics, ICFO-Institute of Photonic Sciences, Castelldefels, Spain.
². ICREA-Catalan Institute of Research and Advanced Studies, Barcelona, Catalunya, Spain.

Abstract (35 Word Limit): We report a deep-mid-IR femtosecond OPO based on CdSiP₂ using direct synchronous pumping by a Ti:sapphire laser, providing continuous wavelength coverage across 6-8 μm under rapid static cavity delay tuning with high output stability.
Abstract (35 Word Limit):
We report on a synchronously pumped degenerate OPO operated at 250 MHz that generates 280 mW of transform-limited sub-100fs pulses at 2.09μm using a compact dispersion-compensated fiber feedback cavity.
Final ID: SW4Q.5

Broadband 7 μm OPCPA pumped by a 2 μm picosecond Ho:YLF CPA system

D. Sanchez; 1; M. Hemmer; 1; M. Baudisch; 1; S. L. Cousin; 1; K. Zawilski; 2; P. G. Schunemann; 2; V. Smirnov; 3; H. Hoogland; 4, 5; R. Holzwarth; 4; O. Chalus; 6; C. Simon-Boisson; 6; J. Biegert; 1, 7; 1. ICFO-Institut de Ciencies Fotoniques, Mediterranean Technology Park, 08860 Castelldefels, Barcelona, Spain. 2. BAE Systems, MER15-1813, P.O. Box 868, Nashua, NH, United States. 3. OptiGrate Corp., 562 S. Econ Circle, Oviedo, FL, United States. 4. Menlo Systems GmbH, Am Klopferspitz 19a, 82152 Martinsried, Germany. 5. Department of Physics, Friedrich-Alexander University Erlangen, Erlangen, Germany. 6. THALES Optronique S.A.S., Laser Solutions Unit, 2 avenue Gay-Lussac, 78995 Elancourt Cedex, France. 7. Institució Catalana de Recerca i Estudis Avançats (ICREA), Passeig Lluis Companys 23, Barcelona 08010, Spain.

Abstract (35 Word Limit): We generate 260 μJ energy optical pulses at 7 μm with an OPCPA pumped by an optically synchronized 2 μm picosecond CPA system. The mid-IR pulses exhibit a bandwidth supporting sub-4 optical cycle duration.
Final ID: SW4O.6

High Power, Phase-Coherent Multi-Color Source from UV to Mid-IR for Femtosecond-Resolved Pump-Probe Experiments

M. Baudisch; 1, M. Hemmer; 1; J. Biegert; 1, 2;
1. ICFO - Institut de Ciencies Fotoniques, Mediterranean Technology Park, 08860 Castelldefels, Barcelona, Spain.
2. ICREA - Institució Catalana de Recerca i Estudis Avançats, 08010 Barcleona, Spain.

Abstract (35 Word Limit): We present a parametric source operating at 160 kHz repetition rate providing simultaneously phase-coherent, femtosecond pulses at 3100, 1620, 810, 405 and 270 nm wavelengths with energies suitable for strong-field pump-probe experiments.
Front-End of Yb-based High-Energy Optical Waveform Synthesizer

H. Cankaya; A. Calendron; G. Cirmi; F. Kaertner.

2. Centre for Ultrafast Imaging and Department of Physics, Universitaet Hamburg, Hamburg, Germany.
3. Department of Electrical Engineering and Computer Science and Research Laboratory of Electronics, Massachusetts Institute of Technology, Cambridge, MA, United States.

Abstract (35 Word Limit): We demonstrate a front-end of an Yb-based passively CEP-stable, two-octave wide, two-channel optical parametric synthesizer driven by slightly sub-picosecond pump pulses from a multi-mJ regenerative amplifier at 1 kHz.
Final ID: SW4O.8

Quarter-harmonic generation of femtosecond pulses at 4.18 μm from a mode-locked Yb:fiber laser

A. Marandi; 1; K. Ingold; 1; R. L. Byer; 1;
1. Stanford University, Stanford, CA, United States.

Abstract (35 Word Limit): We report generation of 104 mW of 110-fs pulses at 4.18 μm using two cascaded sub-harmonic PPLN-based optical parametric oscillators pumped by a 950-mW Yb:fiber mode-locked laser at 250 MHz with expected intrinsic phase-locking.
Abstract (35 Word Limit): That light travels in straight lines is a statement of the obvious. But within light beams energy and momentum can twist and twirl, carrying angular momentum that can spin particles, encode information and test quantum mechanics.
Energy savings by LED Lighting

S. Nakamura; 1
1. University of California Santa Barbara, Santa Barbara, CA, United States.

Abstract (35 Word Limit): All the nuclear power plants in Japan have stopped operation, but before the March 2011 tsunami 30% of the total electricity generation had been supplied by nuclear power plants. It is predicts that by 2020, penetration of the LED lighting in Japan will be more than 70%, by which we can reduce 7% of the electricity. In this presentation, current and future energy savings by GaN and related compounds will be discussed.
Noise Figure Improvement and Quantum Information Tapping in a Fiber Optical Parametric Amplifier with Correlated Quantum Fields

X. Li; X. Guo; N. Liu; Y. Liu; Z. Ou;

1. Tianjin University, Tianjin, Tianjin, China.
2. Indiana University-Purdue University, Indianapolis, IN, United States.

Abstract (35 Word Limit): We demonstrate a low noise fiber-optical parametric amplifier (FOPA), with noise figure 0.7dB lower than a regular FOPA having vacuum at the unused input port. The scheme can be used as a quantum information tap.
Propagation of Two-qubit States using Interference in a Distributed Phase Sensitive Amplifier

A. Agarwal; J. M. Dailey; P. Toliver; N. A. Peters;


Abstract (35 Word Limit): We experimentally demonstrate transmission of non-orthogonal two-qubit states in a $\chi^{(3)}$-based optical phase-sensitive amplifier (OPSA). State analysis shows that the OPSA improves the transmission probability of both non-orthogonal states without measurable degradation in two-photon visibility.
Effects of Distributed Amplifiers on Quantum Coherence

J. D. Franson; 1; B. T. Kirby; 1;
1. University of Maryland Baltimore County, Baltimore, MD, United States.

Abstract (35 Word Limit): The propagation of coherent states using a network of distributed amplifiers is analyzed. This technique can be used to calculate the coherence of other quantum states such as Schrödinger cats.
Enhanced Photon-Pair Detection Using Phase-Sensitive Pre-amplification

J. M. Dailey; 1; A. Agarwal; 1; P. Toliver; 1; N. A. Peters; 1;


Abstract (35 Word Limit): We describe an experimental demonstration of fiber-based optical phase-sensitive amplification for improved detection of correlated single-photon pairs. A measured coincidence gain of 4.5dB provides 3dB improvement in the detection system signal-to-noise ratio.
Engineering large-scale entanglement in the quantum optical frequency comb

P. Wang; 1; W. Fan; 1; M. Chen; 1; O. Pfister; 1;
1. University of Virginia, Charlottesville, VA, United States.

Abstract (35 Word Limit): We report on experimental progress toward scaling our recent 60-entangled-qumode experiment [1] to thousands of qumodes in the quantum optical frequency comb. We present a model which predicts that 3,200 entangled modes can be achieved.
Frequency-Resolved Reconstruction of the Biphoto Polarization State via Stimulated Emission Tomography

B. Fang; J. E. Sipe; V. Lorenz; M. Liscidini;

1. Department of Physics and Astronomy, University of Delaware, Newark, DE, United States.
2. Department of Physics, University of Pavia, Pavia, Italy.
3. Department of Physics and Institute for Optical Sciences, University of Toronto, Toronto, ON, Canada.

Abstract (35 Word Limit): We reconstruct the polarization-entangled state of individual frequency components of the biphoto wave function by stimulated emission tomography. The frequency-resolved polarization state enables new insight into frequency-polarization correlations of the quantum process.
Abstract (35 Word Limit): We use classical stimulated four-wave mixing to directly characterize quantum spectral correlations generated in a silicon nanowire for two different pump durations. Signal to noise is increased and acquisition time reduced compared to coincidence detection.
Temporal Position Modulation of Biphoton Correlations through Pump Frequency Tuning

O. D. Odele; J. M. Lukens; J. A. Jaramillo-Villegas; c. langrock; M. M. Fejer; D. E. Leaird; A. M. Weiner;

1. Purdue University, West Lafayette, IN, United States.
2. Stanford University, Stanford, CA, United States.

Abstract (35 Word Limit): We describe and demonstrate a novel approach for controlling the temporal position of the biphoton correlation by pump frequency tuning. Our method relies on precise waveguide engineering as well as the nonlocal dispersion cancellation effect.
Quantum Zeno Dynamics with Rydberg Atoms
A. FACON; 1
1. Laboratoire Kastler Brossel, Collège de France, CNRS, ENS-PSL Research University, UPMC-Sorbonne, Paris, France.

Abstract (35 Word Limit): The back-action of a quantum measurement with a degenerate eigenvalue confines the evolution of the system inside the corresponding eigenspace. Using the Stark sublevels of a Rydberg atom, we report the first observation of such quantum Zeno dynamics in a non-trivial 51-dimension Hilbert space.
Feedback Cooling of a Nanomechanical Oscillator to Near its Quantum Ground State

d. wilson; 1 t. kippenberg; 1 V. Sudhir; 1 N. Piro; 1 R. Schilling; 1
1. epfl, Lausanne, VD, Switzerland.

Abstract (35 Word Limit): Cavity-enhanced interferometry is used to resolve the displacement of a 4.3 MHz nanobeam oscillator with an imprecision 40 dB below that at the standard quantum limit. Employing this measurement as an error signal, radiation pressure is used to feedback cool the oscillator to 5.3 mechanical quanta.
Search For a Permanent Electric Dipole Moment (EDM) of $^{225}$ Ra Atom

M. Kalita; 1, 3; M. Bishof; 1; K. Bailey; 1; m. Dietrich; 5; J. Greene; 1; R. Holt; 1; W. Korsch; 3; Z. Lu; 1, 2; N. Lemke; 1; P. Mueller; 1; T. O'Connor; 1; R. Parker; 1, 2; J. Taggart Singh; 4;

1. Argonne National Laboratory, Lemont, IL, United States.
2. University of Chicago, Chicago, IL, United States.
3. University of Kentucky, Lexington, KY, United States.
4. Michigan State University, East Lansing, MI, United States.
5. Northwestern University, Evanston, IL, United States.

Abstract (35 Word Limit): We are searching for a permanent EDM of the $^{225}$ Ra atom. Recently we have observed spin precession of $^{225}$ Ra atoms in parallel electric and magnetic fields.
Nonlinear optical magnetometry with accessible in situ optical squeezing

N. Otterstrom; 1, 2; R. Pooser; 2; B. Lawrie; 2;

1. Department of Physics and Astronomy, Brigham Young University, Provo, UT, United States.
2. Quantum Information Science Group, Computational Science and Engineering Division, Oak Ridge National Laboratory, Oak Ridge, TN, United States.

Abstract (35 Word Limit): We demonstrate compact and accessible squeezed-light magnetometry using four-wave-mixing in a single hot rubidium vapor cell. This framework enables 4.7 dB of quantum-noise-reduction while simultaneously adding nonlinear-magneto-optical-rotation (NMOR) signals from the probe and conjugate fields.
Final ID: FTh1B.5

Making the World’s Best Atomic Clock

J. Ye; 1
1. University of Colorado at Boulder JILA, Boulder, CO, United States.

Abstract (35 Word Limit): I will report our recent effort towards realizing the full potential of a many-particle clock with a state-of-the-art stable laser. We have achieved fractional stability of $2.2 \times 10^{-16}$ at 1 s for the JILA Sr optical atomic clock. We have also reduced the total uncertainty of our clock to $2.1 \times 10^{-18}$ in fractional frequency units. Both represent new records for the performance of an atomic clock.
Getting Beyond Unity Fusion Fuel Gain in an Inertially Confined Fusion Implosion
O. Hurricane; 1
1. Lawrence Livermore National Laboratory, Livermore, CA, United States.

Abstract (35 Word Limit): In this talk, we will discuss the progress towards ignition on the National Ignition Facility (NIF) at Lawrence Livermore National Laboratory (LLNL) in Northern California. We will cover some of the setbacks encountered during the progress of the research at NIF, but also cover the great advances that have been made including the achievements of greater than unity fusion 'fuel gain' and alpha-heating dominated fusion plasmas. The research strategy for the future will also be discussed.
Laser Generation of Scaled Astrophysical Blast Waves in a Dynamically-Significant Magnetic Field

N. Riley; 1; M. Wisher; 1, 2; S. Lewis; 1, 2; C. Wagner; 1; V. Minello; 1; R. Bengtson; 1; T. Ditmire; 1;
1. University of Texas at Austin, Austin, TX, United States.
2. Sandia National Laboratories, Albuquerque, NM, United States.

Abstract (35 Word Limit): We report preliminary results on the stability of a magnetized laser-launched blast wave scaled to simulate a supernova remnant. Magnetic fields appear to suppress the Vishniac overstability at high mode numbers, possibly facilitating gravitational star formation.
Laser Acceleration and Deflection of 96.3keV Electrons with a Silicon Dielectric Structure

K. Leedle; 1; F. Pease; 1; R. L. Byer; 1; J. S. Harris; 1;
1. Stanford University, Stanford, CA, United States.

Abstract (35 Word Limit): Dielectric laser accelerators are a compact and scalable alternative to radio frequency accelerators. We present the first demonstration of over 200 MeV/m acceleration and deflection gradients with a silicon structure at 96.3keV electron energy.
He Ion Acceleration in Near Critical Density Plasma

S. Tochitsky; 1 C. Gong; 1 J. Pigeon; 1 F. Fiuza; 2 C. Joshi; 1
1. University of California Los Angeles, Los Angeles, CA, United States.
2. Lawrence Livermore National Laboratory, Livermore, CA, United States.

Abstract (35 Word Limit): The CO2 laser-plasma interactions are uniquely placed for Shock Wave Acceleration of He or other light ions. We report on experimental and numerical studies of He ion acceleration in a gas jet plasma.
Difference-Frequency Generation of Optical Radiation from Two-Color X-Ray Pulses

E. Shwartz; S. Shwartz;

1. Physics, Bar Ilan University, Ramat Gan, Israel.
2. The Institute for Nanotechnology and Advanced Materials, Bar Ilan University, Ramat Gan, Israel.

Abstract (35 Word Limit): We describe the process of difference-frequency generation of optical radiation from X-ray pulses. We find that the efficiency is orders of magnitude higher than similar effects, and highlight its potential application to probe atomic-scale structures.
Investigation of the Newly Proposed Carrier-Envelope-Phase Stable Attosecond Pulse Source

Z. Tibai; 1; G. Tóth; 2; Z. Nagy-Csiha; 1; J. Fülöp; 2; G. Almási; 1, 2; J. Hebling; 1, 2,
2. MTA-PTE High Field Terahertz Research Group, Pécs, Hungary.

Abstract (35 Word Limit): The carrier-envelope-phase and energy stability of formerly proposed accelerator-based attosecond source is investigated numerically. Carrier-envelope-phase stable pulses with tens of nJ energy and 80 as duration are predicted with 31 mrad phase stability.
Intense broadband THz pulse generation from relativistic laser-plasma interaction

S. Mondal;
1. INRS-Énergie Matériaux Télécommunication, Varennes, QC, Canada.

Abstract (35 Word Limit): We demonstrate intense broadband terahertz pulse generation from the interaction of high intensity femtosecond laser with solid density plasmas. We measure substantial enhancement of terahertz pulse energy (32 mJ/pulse) by using aligned copper nanorod targets.
Temporal Cavity Solitons: From Fiber Resonators to Microresonators

S. Coen; 1; J. K. Jang; 1; S. G. Murdoch; 1; M. Erkintalo; 1;
1. University of Auckland, Auckland, New Zealand.

Abstract (35 Word Limit): We will present our latest experiments with temporal cavity solitons, including writing/erasing, temporal tweezing, merging, annihilation, and spontaneous excitation. We will also highlight their relevance in the context of microresonator Kerr frequency combs.
Monolithic microresonator for simultaneous lasing feedback and intracavity hyperparametric oscillation

Z. Xie; w. liang; A. A. Savchenkov; J. McMillan; j. Burkhart; V. S. Ilchenko; A. B. Matsko; L. Maleki; C. Wong;
1. Columbia University, New York, NY, United States.
2. University of California, Los Angeles, Los Angeles, CA, United States.

Abstract (35 Word Limit): We demonstrate simultaneous lasing and parametric oscillation with high-Q (> $10^{10}$) MgF$_2$ monolithic microresonators. Stable lasing around 698nm is achieved with sub-25kHz linewidth and 8.8nm tuning range. Multi-pair hyperparametric oscillation is observed over 137.2THz span.
Silicon Carbide Microresonators with High Optical Q and Large Kerr Nonlinearity for Nonlinear Optics

X. Lu; 1; J. Y. Lee; 1; S. Rogers; 1; Q. Lin; 1;
1. University of Rochester, Rochester, NY, United States.

Abstract (35 Word Limit): We demonstrate an amorphous silicon carbide (a-SiC) microresonator with optical Q up to $1.3 \times 10^5$. This enables us to characterize the third-order nonlinearity of a-SiC with $n_2 = (5.9 \pm 0.7) \times 10^{-15}$ cm$^2$/W.
Frequency Comb-enhanced Coupling in Silicon Nitride Microresonators

P. Wang; Y. Xuan; X. Xue; Y. Liu; J. Wang; D. E. Leaird; M. Qi; A. M. Weiner;
1. Purdue University, West Lafayette, IN, United States.

Abstract (35 Word Limit): We investigate enhanced coupling of the pump laser as a result of power transfer to the frequency comb in a silicon nitride microring designed with an over-coupled bus-waveguide.
Final ID: FTh1D.5

Tunable Frequency Combs based on Dual Microring Resonators

S. Miller; Y. Okawachi; K. Luke; A. L. Gaeta; M. Lipson; 1, 3;
1. School of Electrical and Computer Engineering, Cornell University, Ithaca, NY, United States.
2. School of Applied and Engineering Physics, Cornell University, Ithaca, NY, United States.

Abstract (35 Word Limit): We demonstrate tunable coupling condition of a silicon nitride microresonator frequency comb. Using a dual-coupled resonator geometry and integrated microheaters, we achieve 13.3 dB of extinction tuning and observe 10-fold increase in generated power.
Synchronization of multiple parametric frequency combs

Y. H. Wen; 1 M. R. Lamont; 1 A. L. Gaeta; 1

1. Cornell University, Ithaca, NY, United States.

Abstract (35 Word Limit): We theoretically demonstrate passive synchronization of solitons in systems of two- and three-microresonator-based parametric frequency combs resulting in time-locked pulses and frequency-locked comb lines.
A New Route for Fabricating On-Chip Chalcogenide Microcavity Resonators
O. Aktas; 1, 2; E. Huseyinoglu; 2, 3; M. Bayindir; 1, 2,
1. Bilkent University, Ankara, Ankara, Turkey.
2. UNAM-National Nanotechnology Research Center, Bilkent University, Ankara, Turkey.
3. Institute of Materials Science and Nanotechnology, Bilkent University, Ankara, Turkey.

Abstract (35 Word Limit): We report a novel versatile method for the high yield production and on-chip integration of self-assembled globally oriented high-Q Whispering Gallery Mode (WGM) chalcogenide microresonators. The results of optical and material characterization of the microresonators are given.
Interferometric Plasmon Propagation and Lensing with Nanohole Arrays in Gold Films: Visualization by Nonlinear Photoemission Electron Microscopy

W. Hess;

1. Pacific Northwest National Laboratory, Richland, WA, United States.

Abstract (35 Word Limit): Nonlinear photoemission electron microscopy, of nanohole arrays litho-graphically etched in gold films, is used to map propagating surface plasmon polaritons (SPPs). The recorded photoemission patterns are attributed to interferences between SPPs launched from the individual nanoholes.
Advanced Disc-Ring Optical Nanoantennas Investigated by Photoelectron Emission Microscopy (PEEM)

T. Kaiser; 1, 2; M. Falkner; 1, 2; J. Qi; 3, 2; M. Steinert; 1, 2; C. Menzel; 1, 2; C. Rockstuhl; 4, 5; T. Pertsch; 1, 2

1. Institute of Applied Physics, Friedrich-Schiller-Universität, Jena, Germany.
2. Abbe Center of Photonics, Friedrich-Schiller-Universität, Jena, Germany.
3. Institute of Condensed Matter Theory and Solid State Optics, Friedrich-Schiller-Universität, Jena, Germany.
4. Institute of Theoretical Solid State Physics, Karlsruhe Institute of Technology, Karlsruhe, Germany.
5. Institute of Nanotechnology, Karlsruhe Institute of Technology, Karlsruhe, Germany.

Abstract (35 Word Limit): We theoretically and experimentally investigate circular plasmonic disc nanoantennas enhanced in their performance by a surrounding Bragg grating ring structure. PEEM investigations are demonstrated to provide unprecedented insights into the field localization and enhancement.
Electron-Light Interaction in Optical Near-Fields studied by Ultrafast Transmission Electron Microscopy

A. Feist; 1; K. E. Echternkamp; 1; J. Schauss; 1; S. V. Yalunin; 1; S. Schäfer; 1; C. Ropers; 1;
1. IV. Physical Institute, University of Göttingen, Göttingen, Germany.

Abstract (35 Word Limit): Photon-induced scattering of swift electrons with confined light is studied by ultrafast transmission electron microscopy (UTEM) and employed to locally map optical near-fields. Fluence-dependent kinetic energy spectra reveal quantum coherent scattering features.
Ultrafast pump-probe photo-induced force microscopy at nanoscale

J. Jahng; J. Brocious; d. Fishman; E. O. Potma;

1. University of California, Irvine, Irvine, CA, United States.

Abstract (35 Word Limit): We perform time-resolved pump-probe microscopy measurements by recording the local force between a sharp tip and the photo-excited sample as a readout mechanism for the material's nonlinear polarization.
Spatially-Resolved, Three-Dimensional Investigation of Surface Plasmon Resonances in Complex Nanostructures

J. Hachtel; 1, 2; D. Mayo; 3, 4; A. Mouti; 2; C. Marvinney; 3; R. Mu; 4; R. F. Haglund; 1, 3; A. Lupini; 2; M. Chisholm; 2; S. Pantelides; 1, 2

1. Department of Physics and Astronomy, Vanderbilt University, Knoxville, TN, United States.
2. Materials Science and Technology Division, Oak Ridge National Laboratory, Oak Ridge, TN, United States.
3. Interdisciplinary Materials Science Program, Vanderbilt University, Nashville, TN, United States.
4. Department of Physics, Fisk University, Nashville, TN, United States.

Abstract (35 Word Limit): We report a three-dimensional study of surface plasmons in random-morphology nanoparticles by combining spatially resolved electron energy loss spectroscopy, which probes optical excitations, and cathodoluminescence, which probes radiative decay, in a scanning transmission electron microscope.
Extremely confined gap surface-plasmon modes probed by electron energy-loss spectroscopy (EELS)

N. Stenger; 1, 2; S. Raza; 1, 2;
1. Department of Photonics Engineering, Technical University of Denmark, Kongens Lyngby, Denmark.
2. Center for Nanostructured Graphene, Technical University of Denmark, Kongens Lyngby, Denmark.

Abstract (35 Word Limit): Applying EELS to ultra-sharp convex grooves in gold, we directly probe extremely confined gap surface-plasmon (GSP) modes excited by swift electrons in nanometer-wide gaps, down to approximately 5 nm.
Coherent Control in Single Plasmonic Nanostructures

A. Comin;¹; R. Ciesielski;¹; A. Bouhelier;²; A. Hartschuh;¹;
1. Department Chemie, Ludwig-Maximilians-Universitaet, Muenchen, Bayern, Germany.
2. Laboratoire Interdisciplinaire Carnot de Bourgogne, Université de Bourgogne, Dijon, France.

Abstract (35 Word Limit): Coherent control in plasmonic nanostructures is a door to space-time confinement of optical excitation and femtosecond super-resolution spectroscopy. Towards this goal, here we demonstrate femtosecond pulse-shaping of single gold nanostructure and local phase compensation.
Efficient silicon PIC mode multiplexer using grating coupler array with aluminum mirror for few-mode fiber

Y. Ding; 1 K. Yvind; 1
1. DTU Fotonik, Department of Photonics Engineering, Technical University of Denmark, Kgs. Lyngby, Denmark.

Abstract (35 Word Limit): We demonstrate a silicon PIC mode multiplexer using grating couplers. An aluminum mirror is introduced for coupling efficiency improvement. A highest coupling efficiency of –10.6dB with 3.7dB mode dependent coupling loss is achieved.
Integrated Switch for Mode-Division Multiplexing (MDM) and Wavelength-Division Multiplexing (WDM)

B. Stern; 1 X. Zhu; 2 C. Chen; 2 L. Tzuan; 1 J. Cardenas; 1 K. Bergman; 2 M. Lipson; 1, 3
1. Cornell University, Ithaca, NY, United States.
2. Columbia University, New York, NY, United States.

Abstract (35 Word Limit): We demonstrate the first integrated switch for mode-division multiplexing (MDM) and wavelength-division multiplexing (WDM). We show on-chip routing of four 10 Gb/s channels with <-20 dB crosstalk and 0.5-1.4 dB power penalty.
Abstract (35 Word Limit): Mode division multiplexing of modes in a silicon waveguide supporting three optical modes is demonstrated in the silicon on insulator platform. The extinction ratio is also observed to increase from 5 dB to 15dB and >25dB as mode order increases, implying an increasing cross coupling coefficient.
Mode Multiplexer Based on Integrated Horizontal and Vertical Polymer-Waveguide Directional Couplers

J. Dong; 1 K. S. Chiang; 1 W. Jin; 1
1. City University of Hong Kong, Kowloon, Hong Kong.

Abstract (35 Word Limit): We propose an integrated polymer-waveguide mode (de)multiplexer based on cascaded horizontal and vertical directional couplers for combining/separating the three lowest-order modes. Our experimental device shows crosstalks lower than -15.6 dB in the C-band.
Abstract (35 Word Limit): We demonstrate an on-chip WDM-compatible mode multiplexing system with function of phase demodulation. The proposed scheme can be useful at the interface of long-haul and on-chip communication systems, which prefer phase and intensity modulated formats respectively.
Demonstration of Distance Emulation for an Orbital-Angular-Momentum Beam

N. Ahmed; 1; M. P. Lavery; 2, 1; P. Liao; 1; G. Xie; 1; H. Huang; 1; L. Li; 1; Y. Ren; 1; Y. Yan; 1; Z. Zhao; 1; Z. Wang; 1; N. Ashrafi; 3, 4; S. Ashrafi; 4; R. Linquist; 4; M. Tur; 5; A. Willner; 1;

1. University of Southern California, Los Angeles, CA, United States.
2. University of Glasgow, Glasgow, United Kingdom.
3. University of Texas at Dallas, Richardson, TX, United States.
4. NxGen Partners, Dallas, TX, United States.
5. Tel Aviv University, Ramat Aviv, Israel.

Abstract (35 Word Limit): We design and experimentally demonstrate a free-space distance emulator for propagating OAM beams over long distances in a lab environment. The performance of the system is assessed by measuring spot radius and radius of curvature of propagated beams.
Detecting orbital angular momentum of light with an arc slit

H. Zhou; J. Dong; P. Zhang; Y. Zhou; X. Zhang;
1. Wuhan National Lab for Optoelectronics, Wuhan, Hubei, China.
2. MOE Key Laboratory for Nonequilibrium Synthesis and Modulation of Condensed Matter, Department of Applied Physics, Xi’an Jiaotong University, Xi’an, China.

Abstract (35 Word Limit): When the orbital angular momentum (OAM) beam is incident on a 90 degree arc slit, a focus will be generated and have a displacement which is nearly linear with the topological charge of the incoming OAM beam. It can detect the OAM beams with a very simple structure.
Abstract (35 Word Limit): We demonstrated adiabatic 3-dB couplers on silicon-on-insulator strip waveguides. We obtained average splitting ratios, from 1500 nm to 1600 nm, of 44.5%/55.5% and 50.5%/49.5% for our transverse electric and transverse magnetic couplers, respectively.
Properties of Gallium Lanthanum Sulphide Glass

P. Bastock; 1; C. Craig; 1; K. Khan; 1; E. Weatherby; 1; J. Yao; 1; D. W. Hewak; 1;
1. University of Southampton, Southampton, United Kingdom.

Abstract (35 Word Limit): A series of gallium lanthanum sulphide (GLS) glasses has been studied in order to ascertain properties across the entire glass forming region. This is the first comprehensive study of GLS glass over a wide compositional range.
Fluorescence in Erbium Doped Gallium Lanthanum Sulphide: Potential for mid-IR Waveguide Laser
G. Demetriou; 1; F. Thorburn; 1; A. Lancaster; 1; C. Craig; 2; E. Weatherby; 2; D. W. Hewak; 2; A. Kar; 1;
1. Institute of Photonics and Quantum Sciences, Heriot Watt University, Edinburgh, Scotland, United Kingdom.
2. Optoelectronics Research Centre, University of Southampton, Southampton, United Kingdom.

Abstract (35 Word Limit): Fluorescence is reported in waveguides fabricated via the ultrafast laser inscription technique in Erbium doped Gallium Lanthanum Sulphide (Er^{3+}:GLS) for mid-infrared laser applications. The pump wavelength was 980nm leading to mid-infrared transition at 2.75 μm.
Photo-Induced Tuning of Chalcogenide-on-Silicon Photonic Integrated Circuits
A. Zadok; 1; R. Califa; 1; H. Genish; 1; D. Munk; 1; Y. Kaganovskii; 1; I. Bakish; 1; M. Rosenbluh; 1;
1. Bar-Ilan University, Givat Shmuel, Israel.

Abstract (35 Word Limit): Silicon photonic devices are tuned by selective photo removal of upper chalcogenide glass layers. Phase delays in cascaded interferometer filters and couplers of ring resonators are arbitrarily adjusted. Responses remain stable following trimming.
Visible up-conversion luminescence induced by 1535-nm excitation in (ErSc)₂O₃ epitaxial layers are observed. We investigate fast up-conversion rate and propose its suppression structure by photonic band-gap for realizing higher optical gain devices on Si wafers.
Highly Yb-doped KGd(WO₄)₂ Thin-film Amplifier

Y. Yong; 1, 2; S. Aravazhi; 1; S. A. Vázquez-Córdova; 1, 2; S. M. García-Blanco; 1, 2; M. Pollnau; 1, 3;

1. Integrated Optical MicroSystems Group, MESA+ Institute for Nanotechnology, University of Twente, Enschede, Netherlands.
2. Optical Sciences Group, MESA+ Institute for Nanotechnology, University of Twente, Enschede, Netherlands.
3. Department of Materials and Nano Physics, School of Information and Communication Technology, KTH—Royal Institute of Technology, Kista, Sweden.

Abstract (35 Word Limit): We report record-high small-signal gain of 1050 dB/cm at 981 nm wavelength in a KGd₀.₄₂₅
Yb₀.₅₇₅(WO₄)₂ thin film. The sensitivity of gain to the shift of beam-focus position, which is critical under non-
waveguiding conditions, is investigated.
Extremely Low-Loss Chalcogenide Photonics Devices with Chlorine-Based Plasma Etching

J. Chiles; 1; M. Malinowski; 1; A. Rao; 1; S. Novak; 1, 3; K. Richardson; 1, 3; S. Fathpour; 1, 2;

1. University of Central Florida, CREOL, United States.
2. Department of Electrical Engineering and Computer Science, University of Central Florida, Orlando, FL, United States.
3. School of Materials Science and Engineering, Clemson University, Clemson, SC, United States.

Abstract (35 Word Limit): Chlorine-based plasma is employed to produce extremely low propagation loss as low as 0.42 dB/cm in chalcogenide waveguides, record-high intrinsic Q-factors of 450,000 microring resonators and fiber-to-waveguide grating couplers with a coupling efficiency of 37%.
Characterization of Ge$_{28}$Sb$_{12}$Se$_{60}$ Waveguides

M. R. Krogstad; 1; S. Ahn; 1; W. Park; 1; J. Gopinath; 1;


Abstract (35 Word Limit): Single-mode Ge$_{28}$Sb$_{12}$Se$_{60}$ waveguides, fabricated with thermal evaporation and lift-off, were characterized at 1.03 and 1.53 µm. Measured linear propagation loss agrees with theoretical predictions, and large nonlinear absorption at 1.03 µm has optical limiting applications.
Solution processed Chalcogenide photonic crystal

T. Gu; 1, 2; C. Lu; 3; T. Heinz; 1; A. Rodriguez; 3; C. Arnold; 3;
1. Columbia University, New York, NY, United States.
2. Hewlett-Packard Laboratory, Palo Alto, CA, United States.

Abstract (35 Word Limit): We demonstrate formation of amorphous chalcogenide photonic crystal light emitter by using microtrench filling method in solution processing.
DIRECT MEASUREMENT OF PLASMA MIRROR EXPANSION FOR CONTROLLED LASER DRIVEN ELECTRON
AND HARMONIC BEAMS

M. Bocoum; 1; F. Bohle; 1; B. Beaurepaire; 1; A. Vernier; 1; A. Jullien; 1; J. Faure; 1; R. B. Lopez-Martens; 1;
1. 91762, Laboratoire d’Optique Appliquée, Palaiseau, France.

Abstract (35 Word Limit): We present a new method of visualizing plasma expansion at the surface of a plasma mirror
over a few fractions of laser wavelength and validate it by selectively generating high-order harmonics or fast
electrons.
Ultrabroadband Mid-Infrared Pump-Probe Spectroscopy using Chirped-Pulse Upconversion

H. Shirai; T. Yeh; Y. Nomura; C. Luo; T. Fuji;
1. Institute for Molecular Science, Okazaki, Aichi, Japan.
2. Department of Electrophysics, National Chiao Tung University, Hsinchu, Taiwan.

Abstract (35 Word Limit): We demonstrated ultrabroadband mid-infrared pump-probe spectroscopy combined with chirped-pulse upconversion in a gas. Ultrafast reflectivity-change signal of an intrinsic germanium was observed in the region from 200 to 5000 cm$^{-1}$. 
Relaxation dynamics of the OH stretching overtones in isolated HDO molecules observed by IR pump-repump-probe spectroscopy

D. Hutzler; J. Werhahn; R. Heider; M. Bradler; R. Kienberger; E. Riedle; H. Iglov;
1. Technische Universität München, Garching, Germany.
2. Ludwig-Maximilian-Universität München, München, Germany.

Abstract (35 Word Limit): We report on a novel, purely vibrational pump–repump–probe spectroscopy technique to access the overtones of the OH stretching in isolated HDO molecules. Approaching higher-lying states, a continuous decrease of the energy separation and a reduction of the respective lifetimes is observed.
Tunable All-Optical Modulation by Period Multiplication in a Synchronously-Pumped Optical Parametric Oscillator

T. Steinle;¹; V. Kumar;²; A. Steinmann;¹; M. Marangoni;²; G. Cerullo;²; H. W. Giessen;¹;
1. 4th Physics Institute, University of Stuttgart, Stuttgart, Germany.
2. IFN-CNR, Dipartimento di Fisica, Politecnico di Milano, Milano, Italy.

Abstract (35 Word Limit): We present the first observation of period multiplication in a synchronously-pumped OPO, enabling tunable all-optical modulation for ultrafast pulses beyond 10 MHz. Elegant pump-probe spectroscopy without external modulation is demonstrated by stimulated Raman scattering.
Abstract (35 Word Limit): We present a broadband two-crystal optical parametric oscillator for mid-infrared dual-comb spectroscopy. The measured absorption and dispersion spectra of methane between 2850 cm\(^{-1}\) and 3200 cm\(^{-1}\) are demonstrated with a 0.2 cm\(^{-1}\) spectral resolution.
Visualization of the Internal Structure of Orientation-Patterned III-V Semiconductors

P. Karpinski; 1, 2; X. Chen; 1; V. Shvedov; 1; C. Hnatovsky; 1; A. Grisard; 3; E. Lallier; 3; B. Luther-Davies; 1; W. Krolikowski; 1, 4; Y. S; 1;

1. Laser Physics Centre, Research School of Physics and Engineering, Australian National University, Canberra, ACT, Australia.
2. Wroclaw University of Technology, Wroclaw, Poland.
3. Thales Research and Technology, Palaiseau, France.
4. Texas A & M University at Qatar, Doha, Qatar.

Abstract (35 Word Limit): We investigate nonlinear diffraction in orientation-patterned semiconductors and identify Čerenkov second harmonic generation in a transverse geometry of interaction. Čerenkov second harmonic allows nondestructive 3D visualization of the internal structure of orientation-patterned semiconductor.
High-Resolution Sub-Surface Microscopy of CMOS Integrated Circuits Using Radially Polarized Light

M. Rutkauskas; C. Farrell; C. Dorrer; K. Marshall; T. Lundquist; P. Vedagarbha; D. T. Reid;
1. Heriot-Watt University, Edinburgh, United Kingdom.
2. University of Rochester, Rochester, NY, United States.
3. DCG Systems Inc., Fremont, CA, United States.

Abstract (35 Word Limit): Comparison of high-resolution sub-surface microscopy shows that illumination with linear polarization resolves an edge with resolutions of 95 nm and 120 nm, depending on E-field orientation, while radial polarization achieves a resolution of 98 nm.
3-D Scanning Mid-IR Imaging of Buried Structures Using Extremely Nondegenerate Two-photon Absorption in a GaN Photodiode

H. S. Pattanaik; 1, M. Reichert; 1, D. J. Hagan; 1, E. W. Van Stryland; 1;
1. University of Central Florida, CREOL, Orlando, FL, United States.

Abstract (35 Word Limit): We demonstrate a scanning 3-D IR imaging technique using extremely nondegenerate two-photon absorption in an uncooled GaN photodiode, and obtain ~2 µm depth resolution at a wavelength of ~5 µm in buried semiconductor structures.
Tandem Photodetectors Containing Silicon Nanowires with Selective Spectral Absorption

H. Park; 1, K. B. Crozier; 1, 2
1. School of Engineering and Applied Sciences, Harvard University, Cambridge, MA, United States.
2. Department of Electrical and Electronic Engineering, University of Melbourne, Melbourne, VIC, Australia.

Abstract (35 Word Limit): We fabricate a vertically stacked photodetector device containing silicon nanowire photodetectors formed above a silicon substrate that also contains a photodetector. The substrate photodetector converts light not absorbed by the nanowires to photocurrent.
Waveguide-Coupled Superconducting Nanowire Single-Photon Detectors
A. Beyer; 1; R. Briggs; 1; F. Marsili; 1; J. D. Cohen; 2; S. M. Meenehan; 2; O. J. Painter; 2; M. Shaw; 1;
1. Jet Propulsion Laboratory, Pasadena, CA, United States.
2. California Institute of Technology, Pasadena, CA, United States.

Abstract (35 Word Limit): We have demonstrated WSi-based superconducting nanowire single-photon detectors coupled to SiN\textsubscript{x} waveguides with integrated ring resonators. This photonics platform enables the implementation of robust and efficient photon-counting detectors with fine spectral resolution near 1550 nm.
Final ID: STh1I.3

Series-Nanowire Photon Number Resolving Detector Counting up to 24 Photons
A. Gaggero; 1 F. Mattioli; 1 Z. Zhou; 2 R. Gaudio; 2 R. Leoni; 1 A. Fiore, 2
1. Ist di Fotonica e Nanotecnologie-IFN CNR, , Italy.
2. University of Technology, COBRA Research Institute, Eindhoven, Netherlands.

Abstract (35 Word Limit): A 24-pixel photon-number-resolving-detector (PNRD) based on superconducting nanowires in a series configuration is demonstrated. Distinct output levels corresponding to the detection of 0-25 photons are observed, due to the high signal-to-noise ratio.
Abstract (35 Word Limit): We design, optimize and demonstrate a silicon-graphene avalanche Schottky photodetector with photoresponsivities of 1A/W and 0.5A/W for visible and telecom wavelengths respectively.
Graphene on Silicon-on-Sapphire Waveguide Photodetectors

Z. Cheng; J. Wang; K. Xu; H. Tsang; C. Shu;
1. The Chinese University of Hong Kong, Hong Kong, Hong Kong.

Abstract (35 Word Limit): We describe the transfer of chemical vapor deposition grown graphene onto silicon-on-sapphire waveguides to form heterostructure waveguide photodetectors which had responsivities of 0.9 mA/W and 4.5 mA/W at 1.55 μm and 2.75 μm wavelengths, respectively.
A CMOS-Compatible Plenoptic Sensor for Smart Lighting Applications

J. Ghasemi; 1; A. Neumann; 1; S. Nezhadbadeh; 1; X. Nie; 1; P. Zarkesh-Ha; 1; S. Brueck; 1;
1. CHTM (Center for High Tech Materials), Univ. of New Mexico, Albuquerque, NM, United States.

Abstract (35 Word Limit): A CMOS-compatible, visible, plenoptic (angle, polarization and wavelength) detector, based on a grating-coupled waveguide structure, is demonstrated with an angular resolution of < 1° and a corresponding wavelength resolution of < 5 nm.
Enhanced Responsivity up to 2.85 A/W of Si-based Ge$_{0.9}$Sn$_{0.1}$ Photoconductors by Integration of Interdigitated Electrodes

T. Pham; 1; B. Conley; 1; J. Margetis; 2; H. Tran; 1; S. Ghetmiri; 1; A. Mosleh; 1; W. Du; 1; G. Sun; 3; R. Soref; 3; J. Tolle; 2; H. Naseem; 1; B. Li; 4; S. Yu; 1;

1. University of Arkansas, Fayetteville, AR, United States.
2. ASM, Phoenix, AZ, United States.
3. University of Massachusetts Boston, Boston, MA, United States.
4. Arktonics, Fayetteville, AR, United States.

Abstract (35 Word Limit): The Ge$_{0.9}$Sn$_{0.1}$ photoconductor was fabricated with interdigitated structures on Si using a CMOS-compatible process. Temperature-dependent responsivity and specific detectivity were measured. The peak responsivity of 2.85 A/W at 77K was achieved due to enhanced photoconductive gain.
Dual-Drifting-Layer Uni-Traveling Carrier Photodiode for Wide Bandwidth and High Power Performance

L. Jin; X. Bing; S. Changzheng; Y. Luo; 1.
1. Tsinghua University, Beijing, Beijing, China.

Abstract (35 Word Limit): Uni-traveling-carrier photodiodes with novel dual-drifting-layer structure is proposed to realize wide bandwidth and high saturation power performance. High-speed operation at high bias voltage is demonstrated by optimizing the electric field profile within the dual-drifting-layer structure.
Label-free imaging of biological tissues with nonlinear photothermal microscopy

J. He; 1, 2; J. Miyazaki; 1, 2; N. Wang; 1, 2; T. Kobayashi; 1, 2;
1. University of Electro-Communications, Chofu, Tokyo, Japan.
2. JST,CREST, Tokyo, Japan.

Abstract (35 Word Limit): Nonlinear photothermal microscopy has been applied in imaging of mouse melanoma and spinal cord without any staining. The resolution is higher compared with linear mechanism.
Transmittance of \textit{Ex vivo} Bovine Lens Capsule from 800 cm\(^{-1}\) to 40000 cm\(^{-1}\)

H. N. Le; \(^1\); D. Kim; \(^2\); M. Hassan; \(^2\); W. Calhoun; \(^2\); Y. Huang; \(^1\); I. Ilev; \(^2\); J. U. Kang; \(^1\); 
1. Johns Hopkins University, Baltimore, MD, United States. 
2. Food and Drug Administration, Center for Devices and Radiological Health, Silver Spring, MD, United States.

Abstract (35 Word Limit): Here we present detailed transmission measurements of ex-vivo lens capsules from 40,000 cm\(^{-1}\) to 800 cm\(^{-1}\). Time-dependent measurements were also performed to eliminate water absorption.
MEMS-Based Shadowless-illuminated variable-angle TIRF (SIVA-TIRF)

X. Huang; 1
1. Inst of Molecular Medicine, Peking Univ, , United States.

Abstract (35 Word Limit): We demonstrate a new MEMS-Based Shadowless-illuminated variable-angle TIRF (SIVA-TIRF), which can realize two-plane, two-color TIRF imaging at the speed of 25Hz.
Characterization of optical resolution photoacoustic microscopy in comparison to confocal microscopy

P. U-Thainual; D. Kim;
1. Food and Drug Administration, Silver Spring, MD, United States.

Abstract (35 Word Limit): Lateral resolution and depth discrimination in turbid samples was measured with optical resolution photoacoustic microscopy (ORPAM) and compared to confocal microscopy (CM). ORPAM signal strength and CM resolution were relatively less affected by scattering.
Degenerate Volume Holographic Imaging Techniques and Instruments for Subsurface Tissue Visualization

R. K. Kostuk; 1 ; I. D. Howlett; 1 ; M. Gordon; 1 ; J. Brownlee; 1 ; E. de Leon; 1 ; G. Orsinger; 1 ; J. Watson; 1 ; M. Romanowski; 1 ; K. Hatch; 1 ; Y. Luo; 2 ; G. Barbastathis; 3 ; J. Barton; 1 ;

1. University of Arizona, Tucson, AZ, United States.
2. National Taiwan University, Taipei, Taiwan.
3. Massachusetts Institute of Technology, Cambridge, MA, United States.

Abstract (35 Word Limit): Degenerate Bragg matching with a volume hologram can lead to reduction in image contrast. Incorporating very high selectivity holograms, high numerical aperture objectives, and image processing can provide image information comparable with histology stained images.
High-throughput Imaging of Self-luminous Objects through a Single Optical Fiber

R. Barankov; 1; J. Mertz; 1;
1. Boston University, Boston, MA, United States.

Abstract (35 Word Limit): We demonstrate a strategy of imaging through a fiber in which the spatial information is encoded into distinct spectrum codes spanning the bandwidth of the object spectrum, enabling high-throughput 2D imaging insensitive to fiber bending.
Three-color two-photon three-axis digital scanned light-sheet microscopy (3C2P3S-DSLM)

W. Zong; Z. Liu; F. Niu; S. Li; J. Zhao; A. Wang; L. Chen;
1. Peking University, Beijing, Beijing, China.
2. China Department of Cognitive Sciences, Institute of Basic Medical Sciences, Beijing, China.

Abstract (35 Word Limit): We demonstrate a new two-photon light-sheet microscopy with three-color excitation, diffraction-limited thickness and tailorable illumination area, capable of multi-color multi-scale live imaging in one setup.
Monolithic Quantum Cascade Laser Arrays for Broadband Portable Infrared Spectroscopy

M. F. Witinski; 2, 1; C. Pflügl; 2;
1. Harvard University, Cambridge, MA, United States.
2. Eos Photonics, Cambridge, MA, United States.

Abstract (35 Word Limit): Eos manufactures arrays of DFB QCLs, with each element at a different wavelength than its neighbor. In spectroscopy systems, such as standoff and in situ analyzers, this increases sensitivity, allowing for fast all-electronic wavelength tuning.
Enhancement of Signal to Noise in Mid-IR Photothermal Spectroscopy by Optimization of Fiber Probe Lasers

M. Y. Sander; A. Totachawattana; H. Liu; S. Erramilli;

1. Boston University, Boston, MA, United States.

Abstract (35 Word Limit): Continuous-wave and mode-locked fiber lasers are incorporated into label-free mid-IR photothermal spectroscopy. Optimization of probe laser parameters leads to significant enhancement in the signal to noise ratio and the peak-to-baseline contrast.
Advanced wideband cavity enhanced spectroscopy

T. K. Boyson; 1; C. C. Harb; 1;
1. School of Engineering and Information Technology, UNSW Australia, Canberra, ACT, Australia.

Abstract (35 Word Limit): We present new results from a variant of cavity enhanced spectroscopy that allows large spectral bandwidths to be analysed in real time, and demonstrate new methods to apply the technique to real-time monitoring of species with broad absorbances.
Broadband dual-comb coherent anti-Stokes Raman spectroscopy at high signal-to-noise ratio

M. Yan; S. Holzner; T. Hänsch; N. Picqué;

1. Max Planck Institute of Quantum Optics, United States.
2. Physics department, Ludwig-Maximilians-Universität München, Munich, Germany.

Abstract (35 Word Limit): Coherent anti-Stokes Raman spectroscopy is achieved on microsecond time scale with two frequency combs and a heterodyne detection with a local oscillator. The vibrational transitions reach a signal-to-noise ratio of 1600 with linear concentration dependence.
Depolarization Sensitive Optical Inspection of Semiconductor Integrated Circuits
A. yurt; 1; M. Grogan; 1; S. Unlu; 1; B. Goldberg; 1;
1. Boston University, , United States.

Abstract (35 Word Limit): We demonstrate dark-field, through-silicon imaging of semiconductor integrated circuits by exploiting depolarization-sensitive, high aperture angle reflectivity.
External Cavity Semiconductor Laser Optimized for Frequency Metrology
L. Maleki; W. Liang; V. S. Ilchenko; D. Eliyahu; E. Dale; A. A. Savchenkov; D. Seidel; A. B. Matsko;
1. OEwaves Inc, Pasadena, CA, United States.

Abstract (35 Word Limit): A frequency modulatable 795 nm semiconductor laser is created. The laser is characterized with residual amplitude modulation below -80 dB and frequency noise better than 300 Hz/Hz^{1/2} at offset frequencies ranging from 100 Hz to 10 MHz.
Materials Processing based on Unconventional Femtosecond Laser Beams

C. Hnatovsky; V. Shvedov; W. Krolikowski;

1. Australian National University, Canberra, ACT, Australia.
2. Texas A & M University at Qatar, Doha, Qatar.

Abstract (35 Word Limit): We demonstrate the generation of femtosecond vector beams using a combination of a uniaxial and a biaxial crystal. The proposed beam synthesizer is achromatic and can withstand high light intensities.
Tuning into Tyndall windows

B. Groever; B. Heshmat; R. Raskar;
1. MIT, United States.

Abstract (35 Word Limit): We report certain liquid mixtures that exhibit exotic Tyndall effects due to large contrast in refractive index modulation of their components. A sharp minimum in scattering enables these mixtures to notably modulate their optical diffusion. This can be applied in imaging, sensing, and displays.
Abstract (35 Word Limit): A tractor beam is a propagation invariant beam that pulls objects towards a light source. Here, an efficient tractor beam with improved stability is generated by illuminating a dielectric metasurface with a Gaussian beam.
Laser Micromachining with Femtosecond Higher-order Bessel Beams

W. Cheng; 1; P. G. Polynkin; 1;
1. College of Optical Sciences, University of Arizona, Tucson, AZ, United States.

Abstract (35 Word Limit): We use femtosecond higher-order Bessel beams for micromachining of borosilicate glass plates. The self-focusing of the beams inside the glass results in the production of beaded ring structures on the back surfaces of the plates.
Light Localization in Axisymmetric Nano-Structured Plasmonic Gratings
A. Lozano; 1, 2; M. Shayegannia; 1; A. Montazeri; 1; Y. Fang; 3; K. Moussakhani; 1; N. Kherani; 1, 4;
1. Department of Electrical and Computer Engineering, University of Toronto, Toronto, ON, Canada.
2. Department of Physics, University of Toronto, Toronto, ON, Canada.
3. Department of Physics, University of California, Berkeley, Berkeley, CA, United States.
4. Department of Materials Science and Engineering, University of Toronto, Toronto, ON, Canada.

Abstract (35 Word Limit): We present a novel technique for spectral decomposition of light in a sub-wavelength plasmonic bull’s eye grating structure. Controlling plasmon coupling through the variation of groove width enables spatial control over light localization in the grating.
Ultra-broadband Tunable Polarization Converter for Micro-fluidic-meta-surfaces

P. Wu; ³ ; L. Yan; ² ; Q. Song; ² ; W. Zhu; ² ; Z. Wu; ² ; D. Tsai; ¹, ⁴ ; F. Capasso; ⁵ ; A. LIU; ² ;

1. National Taiwan University, Taipei, Taiwan.
2. Nanyang Technological University, Singapore, Singapore.
3. Nanyang Technological University, Singapore, Singapore.
4. Academia Sinica, Taipei, Taiwan.
5. Harvard University, Cambridge, MA, United States.

Abstract (35 Word Limit): We present a widely tunable polarization converter with ultra-broad working frequency for microfluidic metasurface. By adjusting the configuration of L-shaped antenna, both cross and circular polarization conversion can be achieved under a linear-polarized illumination.
Unraveling the Effects of Radiation Forces in Water

N. G. Astrath; ^1^2; L. Malacarne; ^1; M. Baesso; ^1; G. Lukasievicz; ^1; S. Bialkowski; ^2;  
1. Universidade Estadual de Maringá, Maringá, Pr, Brazil.  
2. Utah State University, Logan, UT, United States.  

Abstract (35 Word Limit): We measure the surface deformation at the air-water interface induced by laser excitation and match this to rigorous theory of radiation forces. The experimental results are quantitatively described by the numerical calculations of radiation forces.
Ultralow-Jitter Mode-Locked Fiber Lasers and Their Applications

J. Kim; 1

Abstract (35 Word Limit): We present the most recent progress in the design and implementation of sub-femtosecond timing jitter mode-locked fiber lasers and their applications in ultralow-noise microwave signal generation, synchronization and remote transfer.
High power synchronously pumped femtosecond Raman fiber laser

D. Churin; J. Olson; R. Norwood; N. Peyghambarian; K. Kieu;

1. University of Arizona, Tucson, AZ, United States.

Abstract (35 Word Limit): We report a synchronously pumped femtosecond Raman fiber laser operating in normal dispersion regime. The laser produces chirped pulses with up to 18nJ energy, 0.76W average power, 88% efficiency, and pulse duration ~133fs after external compression.
Fast Wavelength-Tunable Picosecond Pulses from Mode-Locked Er Fiber Laser using an Intracavity Filter with Repetition Rate Compensator
Y. Ozeki; 1; D. Tashiro; 1;
1. The University of Tokyo, Bunkyo-ku, Tokyo, Japan.

Abstract (35 Word Limit): We present a polarization-maintaining, SESAM-mode-locked fiber laser with a wavelength-tuning speed of <5 ms and a duration of ~10 ps. Within the tunability of >30 nm, the variation in the repetition rate was <300 Hz.
Passively Mode-locked Holmium-doped Fiber Oscillators Optimized for Ho:YLF Amplifier Seeding

P. Li; 1; A. Ruehl; 1; C. Bransley; 1, 2; I. Hartl; 1;
1. Deutsches Elektronen Synchrotron, Hamburg, Germany.
2. Physics Department, University of Dayton, Dayton, OH, United States.

Abstract (35 Word Limit): We present soliton operation of holmium-doped fiber oscillators with independently tunable central wavelengths from 2040nm to 2070nm and spectral widths from 5nm to 10nm, which can be matched to the requirements of Ho:YLF amplifiers.
Reducing Nonlinear Limitations of Ytterbium Mode-Locked Fibre Lasers with Hollow-Core Negative Curvature Fibre

C. Harvey; 1; F. Yu; 1; J. C. Knight; 1; W. Wadsworth; 1; P. Almeida; 2;
1. University of Bath, Bath, United Kingdom.
2. Fianium Ltd., Southampton, United Kingdom.

Abstract (35 Word Limit): Ultralow nonlinearity hollow-core negative curvature fibre is used in a mode-locked Ytterbium fibre laser to prevent the onset of pulse breakup at low repetition-rates. Identical pulse peak-power limit at 37MHz and 11MHz is experimentally demonstrated.
Timing Jitter of Normal-Dispersion Mode-Locked Er- and Yb-Fiber Lasers

J. Shin;¹ P. Qin;² K. Jung;¹ Y. Song;² M. Hu;² C. Wang;² J. Kim;¹
2. Tianjin Univ, Tianjin, China.

Abstract (35 Word Limit): We experimentally identify that narrow bandpass-filtering can significantly reduce the timing jitter in normal-dispersion fiber lasers. Both the split-step method-based jitter simulation and the modified Namiki-Haus analytic model agree well with the measured jitter spectrum.
Final ID: STh1L.7

Generation of 10 W, 100 fs, 10 GHz pulse train using high power EDFA-MOPA system with cascaded Raman pumping

A. Fujisaki; 1, 2; M. Yoshida; 1; T. Hirooka; 1; M. Nakazawa; 1;
1. Tohoku University, Sendai, Miyagi, Japan.
2. Furukawa Electric, Ichihara, Chiba, Japan.

Abstract (35 Word Limit): We demonstrate a record high output power 10 W, 100 fs 10 GHz pulse train using an all-fiber MOPA system at 1562 nm with a high-power EDFA and 1480 nm cascaded Raman laser pumping.
A Passively Phase-Locked Er: Fiber Frequency Comb: Free-Running Performance and Active Linewidth Narrowing

D. Fehrenbacher; P. Sulzer; D. Seletskiy; A. Leitenstorfer;
1. Department of Physics and Center for Applied Photonics, University of Konstanz, Konstanz, BW, Germany.

Abstract (35 Word Limit): An offset-free frequency comb generated by difference frequency mixing is established and characterized. mHz-level direct locking of the repetition rate to $^{85}\text{Rb}$ and reference-limited linewidth narrowing via an extra-cavity electro-optic modulator are demonstrated.
Offset-free supercontinuum frequency comb for optical clocks

T. Nakamura; 1, I. Ito; 1, 2, A. Silva; 1, 2, S. Tani; 1, Y. Kobayashi; 1, 2,
1. The Institute for Solid State Physics, Kashiwa, Chiba, Japan.
2. Exploratory Research for Advanced Technology, Tokyo, Japan.

Abstract (35 Word Limit): Difference-frequency mixing two portions of a broadened Yb:fiber laser spectrum leads to an offset-free supercontinuum. To demonstrate full phase stabilization of the comb, a single comb mode was locked to an optical reference.
Final ID: STh1N.3

Visible to Mid-Infrared Frequency Comb Generation Using a Waveguide PPLN

K. Iwakuni; 1, 2; S. Okubo; 2; O. Tadanaga; 3; H. Inaba; 2; A. Onae; 2; F. Hong; 2, 4; H. Sasada; 1;
1. Keio University, Yokohama, Kanagawa, Japan.
2. National Metrology Institute of Japan (NMIJ), National Institute of Advanced Industrial Science and Technology (AIST), Tsukuba, Ibaraki, Japan.
3. NTT Device Technology Laboratories, Atsugishi, Kanagawa, Japan.
4. Department of Physics, Yokohama National University, Yokohama, Japan.

Abstract (35 Word Limit): We succeeded in generating a coherent optical frequency comb covering more than 3 octaves from visible to mid-infrared with a waveguide-type PPLN. The generated comb is demonstrated to be useful for metrology and spectroscopic applications.
Abstract (35 Word Limit): We measure the carrier envelope offset frequency of a degenerate optical parametric oscillator. We verify that it has half the value of the pump frequency comb, and sub-Hertz level relative linewidth.
Abstract (35 Word Limit): We demonstrate a record-wide mid-IR comb using Tm-fiber-laser-pumped near-degenerate GaAs OPO. By varying intracavity dispersion, we observe a transition from a single-comb to a two-comb state, where two combs are offset by a constant value.
1-GHz Harmonically Pumped Femtosecond Optical Parametric Oscillator Frequency Comb

K. Balskus; S. Leitch; Z. Zhang; R. McCracken; D. T. Reid;
1. Heriot Watt University, United States.

Abstract (35 Word Limit): We present the first example of a femtosecond optical parametric oscillator frequency comb by using a 333-MHz Ti:sapphire laser to achieve a stabilized comb at 1-GHz mode spacing in the 1.1–1.6-µm wavelength band.
Mid-Infrared 333-MHz Frequency Comb Continuously Tunable from 1.95 µm to 4.0 µm

K. Balskus; 1 Z. Zhang; 1 R. A. McCracken; 1 D. T. Reid; 1

1. Heriot Watt University, , United States.

Abstract (35 Word Limit): Idler pulses from a 333-MHz femtosecond optical parametric oscillator were carrier-envelope-offset stabilized using a versatile locking technique which allowed the resulting comb to be tuned continuously over a range from 1.95 µm to 4.0 µm.
Adaptive Sampling Dual Comb Spectroscopy in Terahertz Region Using Unstabilized Dual Femtosecond Lasers

T. Yasui; 1, 2; R. Ichikawa; 1; Y. HSIEH; 1, 2; K. Hayashi; 1; K. Minoshima; 3, 2; H. Inaba; 4, 2;

1. Tokushima University, Tokushima, Tokushima, Japan.
2. ERATO Intelligent Optical Synthesizer Project, JST, Chofu, Japan.
3. The University of Electro-Communications, Chofu, Japan.

Abstract (35 Word Limit): The adaptive sampling clock was extracted by dual THz-comb-referenced spectrum analyzers and used for THz dual comb spectroscopy (THz-DCS) with unstabilized dual lasers. The demonstrated results implied better spectroscopic performance than THz-DCS with stabilized lasers.
A High Speed All-Optical NAND Logic Gate Using Four-Wave Mixing

K. Li; 1; H. Ting; 1; M. A. Foster; 1; A. C. Foster; 1;
1. Johns Hopkins University, Baltimore, MD, United States.

Abstract (35 Word Limit): We demonstrate a high speed all-optical NAND gate based on four-wave mixing Bragg scattering in highly nonlinear fiber. A 15.2-dB depletion of the signal is obtained and time domain measurements show 10-Gb/s NAND operation.
Kerr Nonlinear Switching in a Core-shell Microspherical Resonator Fabricated From the Silicon Fiber Platform

F. Suhailin; 1, 2; N. Healy; 1; M. . Sumetsky; 3; J. Ballato; 4; A. Dibbs; 5; U. Gibson; 5; A. C. Peacock; 1

1. Optoelectronics Research Centre, University of Southampton, Southampton, Hampshire, United Kingdom.
2. School of Fundamental Science, Universiti Malaysia Terengganu, Kuala Terengganu, Malaysia.
3. Engineering and Applied Science, Aston University, Birmingham, United Kingdom.
4. COMSET, School of Materials Science and Engineering, Clemson University, Clemson, SC, United States.
5. Department of Physics, Norwegian University of Science and Technology, Trondheim, Norway.

Abstract (35 Word Limit): We investigate the Kerr nonlinearity in a core-shell microspherical resonator fabricated from a silicon fiber. By exploiting the ultrafast wavelength shifting, sub-picosecond modulation is demonstrated.
High-accuracy heterodyne detection of THz radiation exploiting telecommunication technologies

T. Folland; 1; A. ramospulido; 1; o. marshall; 1; H. Beere; 2; D. Ritchie; 2; S. Chakraborty; 1;
1. University of Manchester, Manchester, United Kingdom.
2. University of Cambridge, Cambridge, United Kingdom.

Abstract (35 Word Limit): We report the first open-loop heterodyne technique using standard telecom optical fibre components for spectral characterization of THz semiconductor lasers. This allows the measurement of continuous modal tuning with sub-GHz accuracy and 20dB dynamic range.
Experimental Demonstration of Tunable Homodyne Detection for Two Channels Simultaneously using Nonlinear Optical Signal Processing to Automatically Lock a Single “Local” Pump Laser to Two 20-Gbaud BPSK Data Signals

a. almiman; 1 M. Ziyadi; 1 A. Mohajerin Ariaei; 1 y. cao; 1 M. Chitgarha; 1 p. liao; 1 Y. akasaka; 5 J. Yang; 5 m. sekiya; 5 j. touch; 3 c. langrock; 2 M. M. Fejer; 2 m. tur; 4 a. willner; 1
1. university of southern california, Los angeles, CA, United States.
2. Stanford University, Stanford, CA, United States.
3. Information Sciences Institute, Marina del rey, CA, United States.
4. Tel Aviv University, Ramat Aviv, Israel.
5. Fujitsu Laboratories of America, Richardson, TX, United States.

Abstract (35 Word Limit): we demonstrate homodyne detection for multiple channels using nonlinear optical signal processing to automatically lock a single “local” pump laser to these data channels simultaneously and perform experimental demonstration with two 20-Gbaud BPSK channels.
Experimental Demonstration of Tunable and Automatically-Locked Homodyne Detection for Dual-Polarization 20-32-Gbaud QPSK Channels using Nonlinear Mixing and Polarization Diversity

M. Ziyadi; 1; A. Mohajer Ariaei; 1; a. almaiman; 1; y. cao; 1; M. Chitgarha; 1; p. liao; 1; Y. akasaka; 2; J. Yang; 2; m. sekiya; 2; j. touch; 3; m. tur; 4; c. langrock; 5; M. M. Fejer; 5; a. willner; 1;

1. University of Southern California, Pasadena, CA, United States.
2. Fujitsu Laboratories of America, Richardson, TX, United States.
3. Information Sciences Institute, USC, Los Angeles, CA, United States.
4. Tel Aviv University, Tel Aviv, Israel.
5. Stanford University, Stanford, CA, United States.

Abstract (35 Word Limit): We experimentally demonstrate a tunable homodyne receiver on polarization multiplexed QPSK signals. PPLN waveguides inside the polarization diversity loops are used to frequency/phase lock the signals with the LO. Open eye diagrams with BER measurements are shown.
Demonstration of Tunable and Automatic Frequency/Phase Locking for Multiple-Wavelength QPSK and 16-QAM Homodyne Receivers using a Single Nonlinear Element

M. Ziyadi; 1; A. Mohajerin Ariaei; 1; M. Chitgarha; 1; y. cao; 1; a. almainan; 1; Y. akasaka; 2; J. Yang; 2; G. Xie; 1; p. liao; 1; m. sekiya; 2; j. touch; 3; m. tur; 4; c. langrock; 5; M. M. Fejer; 5; a. willner; 1;
1. University of Southern California, Pasadena, CA, United States.
2. Fujitsu Laboratories of America, Richardson, TX, United States.
3. Information Sciences Institute, USC, Los Angeles, CA, United States.
4. Tel Aviv University, Tel Aviv, Israel.
5. Stanford University, Stanford, CA, United States.

Abstract (35 Word Limit): We experimentally demonstrate a tunable homodyne receiver on multiple-wavelength QPSK and 16-QAM channels at 20/30 Gbaud. A single PPLN waveguide is used to frequency/phase lock the signals with their tones. Open eye diagrams with BER measurements are shown.
Final ID: STh10.7

All-Optical Ultrafast Wavelength and Mode Converter Based on Inter-Modal Nonlinear Wave Mixing in Few-Mode Fibers

Y. Weng; 1; X. He; 1; J. Wang; 2; Z. Pan; 1;

1. Department of Electrical & Computer Engineering, University of Louisiana at Lafayette, Lafayette, LA, United States.
2. Qualcomm Technologies Inc., San Diego, CA, United States.

Abstract (35 Word Limit): An ultrafast all-optical simultaneous wavelength and mode conversion scheme is purposed based on intermodal nonlinear wave mixing, with the capability of switching state of polarization and mode degeneracy orientation in few-mode fibers with high efficiency.
Record Phase Sensitive Extinction Ratio in a Silicon Germanium Waveguide

M. A. Ettabib; 1; F. Parmigiani; 1; A. Kapsalis; 2; A. Bogris; 2; M. Brun; 3; P. Labeye; 3; S. Nicoletti; 3; K. Hammani; 4; D. Syvridis; 2; D. Richardson; 1; P. Petropoulos; 1;

1. University of Southampton, Southampton, United Kingdom.
2. Department of Informatics and Telecommunications, National and Kapodistrian University of Athens, Athens, Greece.
3. CEA-Leti, Grenoble, France.
4. Laboratoire Interdisciplinaire Carnot de Bourgogne, Dijon, France.

Abstract (35 Word Limit): A binary step-like phase response and phase-sensitive extinction ratio in excess of 28dB under CW pump operation was demonstrated in a 20mm-long low birefringence SiGe waveguide, using a polarization-assisted phase sensitive amplifier scheme.
Abstract (35 Word Limit): A broadband chaos generation scheme using monolithic integrated mode-beating amplified feedback laser under self-injection is presented. A robust chaotic spectrum that extends over 50 GHz with a flatness of ±5 dB is experimentally achieved.
Lithographic VCSEL Reliability Under Extreme Operating Conditions

X. Yang; 1; G. Zhao; 2; M. Li; 1; D. Deppe; 1, 2;
1. CREOL, The College of Optics&Photonics, University of Central Florida, Orlando, FL, United States.
2. sdPhotonics, LLC, Oviedo, FL, United States.

Abstract (35 Word Limit): Data are presented showing lithographic VCSELs has higher reliability than oxide VCSELs in a stress test with a severe condition. The increased reliability is consistent with its lower junction temperature and reduced internal stress.
Improved Performance of Tunable Single Mode Laser Array Based on Non Uniformly Spaced Slots
A. Abdullaev; 1 Q. Y. Lu; 1 W. H. Guo; 2 M. Wallace; 1 M. Nawrocka; 1 J. O. Callaghan; 3 J. Donegan; 1
1. Trinity College Dublin, , United States.
2. School of Electrical and Electronic Engineering, Wuhan University, Wuhan, Hubei, China.
3. Tyndall National Institute, Cork, Ireland.

Abstract (35 Word Limit): We present a 12-channel wavelength-tunable single-mode laser array based on non-uniformly spaced slots. A quasi-continuous tuning range of >36 nm is obtained over 35°C (from 10°C-45°C) temperature range with side mode suppression ratio >50 dB.
Arrayed Waveguide Grating Based Monolithic Multi-wavelength Mode-locked Semiconductor Laser

s. liu; Q. Ke; M. Sun; D. Lu; R. Zhang; C. Ji;
1. Institute of Semiconductors, CAS, Beijing, Beijing, China.

Abstract (35 Word Limit): We report a novel monolithic multi-wavelength mode-locked semiconductor laser design based on arrayed waveguide grating (AWG) for the first time. 19.6 ps pulses at a repetition rate of 2.9 GHz are obtained.
Fiber Pump-Delivery System for Spectral Narrowing and Wavelength Stabilization of Broad-Area Lasers

J. P. Leidner; 1  J. R. Marciante; 1
1. The Institute of Optics, Rochester, NY, United States.

Abstract (35 Word Limit): Off-axis far-field coupling of a broad-area laser to a single-mode fiber containing a fiber Bragg grating is used for spatio-spectral filtering. This results in a ~10x narrower spectral width and potential spatial brightness improvements.
Fabrication of Semiconductor Nanomembrane Lasers

C. Ning; 1; J. Diaz; 1; Z. Liu; 1; K. Ding; 1; G. Stracke; 2; J. Schulze; 2; D. Bimberg; 2;
1. Arizona State University, Gilbert, AZ, United States.
2. TU Berlin, Berlin, Germany.

Abstract (35 Word Limit): We present a process to fabricate semiconductor nanomembrane lasers by using photoresist to anchor the membrane to the substrate during the release step. A 250 nm-thick membrane operated at room temperature under optical injection is demonstrated.
High performance 2150 nm InAs/InGaAs/InP quantum well lasers grown by metalorganic vapor phase epitaxy

T. Yang;¹ L. Shuai;¹ J. Haiming;¹ F. Gao;¹ X. Yang;¹

¹Key Laboratory of Semiconductor Materials Science, Institute of Semiconductors, CAS, Beijing, China.

Abstract (35 Word Limit): We demonstrate high performance 2150 nm InAs/InGaAs/InP quantum well (QW) lasers grown by metalorganic vapor phase epitaxy (MOVPE).
GaSb-based Mid Infrared Photonic Crystal Surface Emitting Laser

C. Pan; 1; C. Lin; 2; T. Chang; 3; T. Lu; 3; C. Lee; 2;
1. CNST, National Chiao Tung University, Hsinchu, Taiwan.
2. Department of Electronics Engineering, National Chiao Tung University, Hsinchu, Taiwan.
3. Department of Photonics, National Chiao Tung University, Hsinchu, Taiwan.

Abstract (35 Word Limit): We demonstrate an optically pumped GaSb-based mid-Infrared photonic crystal surface emitting laser (PCSEL) at 2.3μm with line width of 0.3nm. The PCSEL was operated with temperature up to 350K, showing a shift rate of 0.21 nm/K.
Modulation-Frequency Dependence of the Phase-Amplitude Coupling in Quantum Dot Lasers

F. Grillot; 1 C. Wang; 1, 2 M. A. Osinski; 1, 3 K. Schires; 1 J. Even; 2
2. Institut National des Sciences Appliquées, Rennes, France.
3. The University of New-Mexico, Albuquerque, NM, United States.

Abstract (35 Word Limit): The phase-amplitude coupling of quantum dot lasers is studied by taking into account carrier dynamics and the contribution of off-resonant states to the refractive index change. Calculations reveal a strong dependence on the modulation frequency.
Volume Holographic Grating Stabilized 780 nm Ridge Waveguide Laser With an Output Power of 380 mW

S. Rauch; 1 J. Sacher; 1
1. Sacher Lasertechnik GmbH, Marburg, Germany.

Abstract (35 Word Limit): A ridge waveguide laser stabilized by a compact holographic grating-cavity with an output power of 380 mW, a linewidth of 18 kHz and a nearly diffraction-limited beam for saturation spectroscopy of rubidium is presented.
Broadband quantum cascade laser at wavelength $\lambda \sim 10$ mm based on continuum-to-continuum design

Q. Wang; 1; B. Meng; 1; Y. Zeng; 1; E. Rodriguez; 1;
1. Nanyang Technological University, Singapore, Singapore.

Abstract (35 Word Limit): Broadband mid-infrared quantum cascade lasers (QCLs) at $\sim 10$ mm based on the continuum-to-continuum design are presented. The prototypes show broadband lasing spectra (978 cm$^{-1}$ -1055 cm$^{-1}$), 580 mW peak powers and 0.5 W/A slope efficiencies.
Timing Jitter Reduction of a Passively Mode-Locked External-Cavity Semiconductor Laser Via Repetition Rate Transitions and Optical Feedback

S. Rauch; 1; L. Drzewietzki; 2; A. Klehr; 3; J. Sacher; 1; W. Elsässer; 2; S. Breuer; 2;

1. Sacher Lasertechnik GmbH, Marburg, Germany.
2. Institute of Applied Physics, Technische Universität Darmstadt, Darmstadt, Germany.
3. Ferdinand-Braun-Institut, Leibniz-Institut für Höchstfrequenztechnik, Berlin, Germany.

Abstract (35 Word Limit): We investigate experimentally the influence of harmonic mode-locking and optical feedback on the timing-jitter of a passively mode-locked external-cavity diode laser yielding a jitter reduction of up to a factor of 10 and we compare the results with numerical simulations.
A Modulated Segmented Contact Method for the Measurement of Internal Optical Mode Loss

P. Rees; 1; R. Pascoe; 1; P. M. Smowton; 1; P. Blood; 1;
1. Cardiff University, Cardiff, United Kingdom.

Abstract (35 Word Limit): An order of magnitude improvement in the precision of measurements of internal optical mode losses to better than 0.1cm\(^{-1}\) is demonstrated using a modulated segmented contact method.
The Effect on Dot Gain Behaviour of Confining Layer Composition in InP/(Al)GaInP Quantum Dot Lasers

M. Smith;  S. Elliott;  M. Kasim;  P. M. Smowton;  A. Krysa;
1. Cardiff University, Cardiff, United Kingdom.
2. Sheffield University, Sheffield, United Kingdom.

External Cavity Quantum Cascade Laser Based on Fabry-Perot Reflector

D. Vaitiekus; 1; M. Hemingway; 1; A. Krysa; 1; J. Cockburn; 1; D. G. Revin; 1;
1. The University of Sheffield, Sheffield, United Kingdom.

Abstract (35 Word Limit): External cavity quantum cascade laser based on Fabry-Pérot etalon design is demonstrated for the first time. Fabry-Pérot reflector was adjusted to produce single mode emission across the whole gain region.
Femtosecond Laser Repairing of the effects in Glass Materials Induced by Ion Implantation

Q. Cao; J. Zhang;

1. Beijing Institute of Technology, Beijing, Beijing, China.

Abstract (35 Word Limit): Metal ion implantation in glass causes lots of defects in lattice during its fabricating process. We found that the femtosecond laser irradiation have a great efficiency to repair these defects with high spatial selectivity.
Frequency Degenerate Two Beam Coupling In Organic Media Using a Single Nanosecond Pump

J. Slagle; 2, 1; J. Haus; 3; S. Guha; 2; D. McLean; 2, 1; D. Krein; 2, 4.

1. Leidos, Inc., Beavercreek, OH, United States.
2. Materials and Manufacturing Directorate, Air Force Research Laboratory, Wright-Patterson AFB, OH, United States.
4. General Dynamic Information Technology, Dayton, OH, United States.

Abstract (35 Word Limit): We present degenerate two-beam coupling in organic dye solutions using a single nanosecond beam where the probe originates from a Fresnel reflection and the phase and frequency shifts are the result of transient self-phase modulation.
Stabilization of Premixed High Flow Speed Methane/air Flames Using a Nanosecond Laser Induced Plasma

X. Li; 1, 2; X. Yu; 1, 2; Y. Yu; 1, 2; R. Fan; 1, 2; D. Chen; 1, 2; R. Sun; 3;

1. National Key Laboratory of Science and Technology on Tunable Laser, Harbin Institute of Technology, Harbin, China.
2. Institute of Opto-electronics, Harbin Institute of Technology, Harbin, Heilongjiang, China.
3. Institute of Combustion Engineering, Harbin Institute of Technology, Harbin, China.

Abstract (35 Word Limit): Stabilization of premixed methane/air flames with a flow speed up to 20 m/s was realized using a 50 Hz nanosecond Nd:YAG laser induced plasma. The stability of the flames in terms of blow off limit and the temporal evolution of the flame kernel generated by the laser plasmas were investigated.
Photon-stimulated desorption surface spectroscopy by VUV emissions from a laser-produced plasma

M. Kaku; 1; D. Kai; 1; M. Katto; 1; A. Yokotani; 1; W. Sasaki; 2; S. Kubodera; 1;
1. University of Miyazaki, Miyazaki, Miyazaki, Japan.
2. NTP inc., Miyazaki, Japan.

Abstract (35 Word Limit): We have developed photon-stimulated desorption surface spectroscopy system using broadband VUV emissions from a laser-produced plasma. Observed desorbed atoms or molecules from material surfaces depended on bond energy or molecular structure.
Optical Scattering of Airy Beam and Gaussian Beam Through Turbid Medium

P. Yu; 1 R. Hutchins; 1 M. Zhang; 1 L. Ma; 1

Abstract (35 Word Limit): We compared optical scattering of Airy and Gaussian beams, generated simultaneously using a LCD panel, through a turbid medium. The Airy beam had a smaller speckle size due to its self-healing property.
Generalizing and extending Kubelka-Munk theory
C. Sandoval; ¹; A. D. Kim; ¹;
1. Applied Mathematics, University of California, Merced, Merced, CA, United States.

Abstract (35 Word Limit): Kubelka-Munk theory is an intuitive theory that approximates the flow of power through a plane parallel slab of a scattering medium. We derive it from the radiative transport equation, accounting for general boundary sources and non-homogeneous terms, and then generalize it to three dimensions.
Fano Resonance Structural Color in Patterned Dielectric Surfaces

E. Regan; Y. Shen; M. Soljacic;

1. Physics, Wellesley College, Wellesley, MA, United States.
2. Physics, Massachusetts Institute of Technology, Cambridge, MA, United States.

Abstract (35 Word Limit): Fano resonance is used to generate structural color in microscopically structured dielectric materials that can be tuned through the visible spectrum.
Sm$^{3+}$ Ions Doped Phosphate Glasses for Multiband Visible Laser Applications
N. Jha; 1 K. Linganna; 2 C. Jayasankar; 2 A. Kar; 1
1. Heriot-Watt University, Edinburgh, United Kingdom.
2. Physics, Sri Venkateswara University, Tirupati, India.

Abstract (35 Word Limit): Sm$^{3+}$ ions doped phosphate glasses have been fabricated. Their absorption and emission properties have been studied. Significant amplification in emission with side pumping is being reported indicating its potential application for visible lasers.
GaN-based Ridge Waveguides with Very Smooth and Vertical Sidewalls by ICP Dry Etching and Chemical Etching

W. Li; 1; Y. Luo; 1; B. Xiong; 1; S. Changzheng; 1; W. Lai; 1; J. Wang; 1; H. Yanjun; 1; J. Yan; 2; T. Wei; 2; H. Lu; 2

1. Tsinghua University, Beijing, Beijing, China.
2. Chinese Academy of Sciences, Beijing, China.

Abstract (35 Word Limit): GaN-based ridge waveguides with very smooth and vertical sidewalls are fabricated with combined inductively coupled plasma (ICP) etching and chemical etching. Reduction in scattering loss is estimated to be 2 dB/mm at 1.55 μm.
Inband-Pumped Ho:KLu(WO$_4$)$_2$ Microchip Laser Q-switched with a PbS-Quantum-Dot-Doped Glass

X. Mateos; 1, P. Loiko; 2, J. Serres; 1, K. Yumashev; 2, A. Malyarevich; 2, A. Onushchenko; 3, V. Petrov; 4, U. Griebner; 4, M. Aguilo; 1, F. Diaz; 1;

1. Universitat Rovira i Virgili, Tarragona, Spain.
2. Center for Optical Materials and Technologies, Belarusian National Technical University, Minsk, Belarus.
3. Vavilov State Optical Institute, St. Petersburg, Russian Federation.
4. Max Born Institute, Berlin, Germany.

Abstract (35 Word Limit): Maximum average output power of 84 mW, slope efficiency of 42%, and pulse duration of 55 ns are achieved at 2.06 µm with a passively Q-switched Ho:KLu(WO$_4$)$_2$ microchip laser inband-pumped by a Tm:KLu(WO$_4$)$_2$ microchip laser.
A new type of Yb$^{3+}$ doped fiber with an octagonal-shaped core

W. Yibo; 1; N. zhao; 1; L. Liao; 1; N. Dai; 1; J. Peng; 1; H. Li; 1; J. Li; 1;

1. Wuhan National Laboratory of Eletroptics, Wuhan, China.

Abstract (35 Word Limit): A new type of Yb$^{3+}$ doped fiber with an octagonal-shaped core is fabricated. This fiber has the potential to be applied into the laser system to optimize the beam quality. When this type of fiber core is introduced into the CCC fiber, an easier coupling of the HOM to the side cores can be observed.
Structural optimization for modulation efficiency enhancement in a top-gated graphene optical modulator

Y. Kobayashi; 1; K. Warabi; 1; R. Kou; 2, 3; H. Nishi; 2, 3; S. Tanabe; 3; T. Yamamoto; 3; K. Yamada; 2, 3; H. Nakajima; 1; 1. Waseda University, , United States. 2. NTT Nanophotonics Center, Atsugi, Japan. 3. NTT Device Technology Labs., Atsugi, Japan.

Abstract (35 Word Limit): We investigated a top-gated graphene optical modulator on a CMOS compatible silicon photonic platform. The structural optimization results revealed that the modulation efficiency is able to reach to 0.05 dB/μm with very low insertion loss.
Growth and Electroluminescent Property of Multi-Facet InGaN/GaN Multiple Quantum Well Light Emitting Device
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3. Department of Photonics and Institute of Electro-Optical Engineering, National Chiao Tung University, Hsinchu, Taiwan.

Abstract (35 Word Limit): We report the study of InGaN/GaN multiple quantum wells (MQWs) grown on multi-facet microrods. The multi-facet MQWs have broad emission spectrum. Electrical injection was demonstrated with emission color ranged from red to blue.
Silicate Spin-on-Glass as an Overcoat Layer for SiO₂ Ridge Waveguides

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1. Electrical and Computer Engineering, Brigham Young University, Provo, UT, United States.
2. University of California, Santa Cruz, Santa Cruz, CA, United States.

Abstract (35 Word Limit): Silicate spin-on-glass is used to coat PECVD SiO₂ waveguides in order to smooth out surface topology and act as a moisture barrier. The measured optical throughput improved compared to uncoated waveguides.
Fabrication and Characterization of Fiber Waveguides from Single-Crystal Er$^{3+}$-Doped YAG

E. F. Dreyer; 1; L. Stagg; 1; S. Trembath-Reichert; 2; C. Hoef; 2; C. D. Nie; 3; J. A. Harrington; 3; S. C. Rand; 1, 2

1. Electrical Engineering and Computer Science, University of Michigan, Ann Arbor, MI, United States.
2. Physics, University of Michigan, Ann Arbor, MI, United States.
3. Material Science, Rutgers University, Piscataway, NJ, United States.

Abstract (35 Word Limit): Rod-in-tube preforms and laser heated pedestal growth were used successfully to fabricate graded-index Erbium doped YAG fibers suitable for low-loss waveguides in laser gain or power delivery applications.
Strain Relaxation in InGaN/GaN Multiple-Quantum Wells by Nano-Patterned Sapphire Substrates with Smaller Period

P. Chen; 4, 1; V. Su; 4; M. Lee; 4; Y. You; 4, 1; Y. Chen; 4; Z. Hung; 5; T. Hsu; 2; Y. Lin; 2; R. Lin; 3; C. Kuan; 4,

1. Kingwave Corporation, Taipei, Taiwan.
2. Epistar Corporation, Hsinchu, Taiwan.
3. Graduate Institute of Electronic Engineering and Green Technology Research Center, Chang Gung University, Taoyuan, Taiwan.
4. Graduate Institute of Electronics Engineering, Department of Electrical Engineering, National Taiwan University, Taipei, Taiwan.
5. Graduate Institute of Photonics and Optoelectronics, Department of Electrical Engineering, National Taiwan University, Taipei, Taiwan.

Abstract (35 Word Limit): The growth of InGaN-based light-emitting diodes (LEDs) on dry-etched patterned sapphire substrates (DPSSs) with nano-sized periods can relax the residual compressive strain in InGaN/GaN multiple-quantum wells (MQWs), given that the stronger the light emitted.
Extraordinary Optical Properties of Atomic-Layer Doped Transparent Conductive Oxide Superlattices

D. Lee; J. Kim; G. E. Fernandes; J. Kim; C. Bledt; K. Kim; J. Xu;
1. Brown University, Providence, RI, United States.
2. Seoul National University, Seoul, Korea (the Republic of).

Abstract (35 Word Limit): Atomic-layer doped transparent conductive oxide superlattices are prepared by ALD. Extraordinary optical properties, such as enhanced optical transparency, bandgap widening, and improved crystallinity with atomic-layers doping, that counter expectations based on conventional models, are observed.
Numerical Study of a 10 GHz Optical Flip-Flop Based on a Short Asymmetric DFB Laser

a. abbasi; 1; G. Roelkens; 1; G. Morthier; 1;
1. Department of Information Technology, University of Ghent-IMEC, Ghent, Belgium.

Abstract (35 Word Limit): We report on a numerical optimization of an all-optical flip-flop based on an asymmetric DFB laser. For the optimized design the repetition rate can increase up to 10 GHz and the switching time can reduce to 5 ps.
Dispersion Engineering Employing Curved Space Mapping and Chromo-Modal Excitation

H. Park; 1; M. Asghari; 1; B. Jalali; 1;
1. UCLA, Los Angeles, CA, United States.

Abstract (35 Word Limit): We report a new optical design capable of providing large group delay dispersion with tunable nonlinear dispersion profile.
Integrated Photonic Reservoir Computing based on Hierarchical Time-multiplexing Structure

H. Zhang; X. Feng; B. Li; Y. Wang; K. Cui; F. Liu; W. Dou; Y. Huang;
1. Tsinghua University, Beijing, Beijing, China.

Abstract (35 Word Limit): An integrated photonic reservoir computing based on hierarchical time-multiplexing structure is proposed by numerical simulations. Error rates of 2.2–6.5% for chaotic time series prediction are achieved with the sample rate of 1.3–0.4Gbps and bandwidth of 40–10GHz.
Stable, Tuneable, All-optical Pulse Generation with 1 Hz Phase Noise

A. S. Helmy;¹; F. Li;¹;
1. University of Toronto, Toronto, ON, Canada.

Abstract (35 Word Limit): Feedback-free, RF-free, long-term stable, all optical, short pulse generation utilizing gain-induced FWM is demonstrated. The approach utilizes passive mode-locked (10 MHz) laser for injection locking to provide pulses with a phase noise of 1 Hz.
Metamaterial Electric-LC Resonators on Electro-Optic Modulator for Wireless THz-Lightwave SignalConversion
Y. Wijayanto; 1; A. Kanno; 1; T. Kawanishi; 1;
1. NICT, Tokyo, Japan.

Abstract (35 Word Limit): Metamaterial electric-LC resonators on an electro-optic modulators are proposed for wireless THz-lightwave signal conversion. Strong electric field can be induced on the resonators by wireless THz irradiation and converted to lightwave signals through electro-optic modulation.
Robust Large-Port-Count Hybrid Switches with Relaxed Control Tolerances

Q. Cheng; A. Wonfor; R. V. Penty; I. H. White;

1. University of Cambridge, Cambridge, United Kingdom.

Abstract (35 Word Limit): The control tolerances of large-port-count optical switches with up to $128 \times 128$ ports using the MZI-SOA hybrid design are investigated. The first quantitative analysis is presented showing tolerant control requirements of the hybrid switch design.
A Multi-frequency Optoelectronic Oscillator based on a Single Phase-Modulator

P. Zhou; 1; F. Zhang; 1; S. Pan; 1;
1. Nanjing Univ Aeronautics & Astronautics, Nanjing, Jiangsu, China.

Abstract (35 Word Limit): A multi-frequency optoelectronic oscillator is proposed based on a single phase modulator. Simultaneous generation of 10 and 40 GHz signals is demonstrated and the phase noise is -100.62 dBC/Hz and -84.64 dBC/Hz@ 10kHz offset, respectively.
Abstract (35 Word Limit): We demonstrate high spurious suppression ratio single-sideband modulation by a high extinction-ratio parallel Mach-Zehnder modulator. An electrical third-order nonlinearity suppression technique can enhance the suppression ratio as high as 47 dB.
High-Speed Data Transmission Through Silicon Contra-Directional Grating Coupler Optical Add-Drop Multiplexers

M. Caverley; 1; R. Boeck; 1; L. Chrostowski; 1; N. A. Jaeger; 1;

Abstract (35 Word Limit): We demonstrate 12.5 Gbit/s data transmission through a silicon contra-directional grating coupler optical add-drop multiplexer while signals are being simultaneously added and dropped at the same wavelength.
Suppressed XMD in Multi-carrier, RF-amplified RF Photonic Link by Cascaded MZMs

X. Liang; F. Yin; Y. Dai; J. Li; K. Xu;
1. Beijing University of Posts and Telecoms, Beijing, China.

Abstract (35 Word Limit): We experimentally demonstrate the elimination of cross-modulation distortion (XMD) in multicarrier, intensity-modulation direct-detection (IMDD) analog photonic links by cascaded Mach-Zehnder modulators (MZMs). XMD, from both the MZMs and electrical amplifiers, is suppressed by 33 dB.
Optical Leaky Wave Antenna Experiment Demonstration and Electronic Modulation Investigation

Q. Zhao; Y. Huang; C. Guclu; F. Capolino; O. Boyraz;
1. University of California, Irvine, Irvine, CA, United States.

Abstract (35 Word Limit): Fabrication and characterization of optical leaky wave antennas with dielectric waveguides and semiconductor perturbations is presented. Directive radiation at 1550nm is measured. Detailed study on electrical modulation capability with bandwidth exceeding 75GHz is presented.
A Time-to-frequency Converter Utilizing a Modified Time Lens

D. Wang; L. Huo; Y. Xing; C. Lou;
1. Tsinghua University, United States.

Abstract (35 Word Limit): A time-to-frequency converter based on a modified time lens is proposed and demonstrated experimentally. Return-to-zero pulse with a duty cycle of 33 % and 67 % are both accurately mapped into the spectral domain.
Wide-spectrum-range Power-efficient Compact Thermo-optic Switch Based on Coupled Photonic Crystal Microcavities

X. Zhang; 1 S. Chakravarty; 2 C. Chung; 1 Z. Pan; 1 R. T. Chen; 1, 2
1. University of Texas at Austin, Austin, TX, United States.
2. Omega Optics, Inc., Austin, TX, United States.

Abstract (35 Word Limit): We demonstrate a thermo-optic switch comprising a 3.78μm-long coupled photonic crystal resonators coupled to a photonic crystal waveguide. The device has 6nm optical bandwidth, 20dB optical extinction ratio, 18.2mW switching power, and 14.8μsec rise time.
Permanently trimming silicon ring resonator filters by thermal modification

S. Spector; J. M. Knecht; P. W. Juodawlkis

1. Massachusetts Inst of Tech Lincoln Lab, Lexington, MA, United States.

Abstract (35 Word Limit): Reported here is a method for trimming the resonant frequency of microring resonators by permanent thermal modification of a waveguide cladding. This method would use in-situ heaters, avoiding the need for highly specialized equipment.
High-speed Directly Modulated Laterally-coupled Twin Stripe Lasers for Optical Interconnects

H. Taniguchi; 1 H. Dalir; 1 F. Koyama; 1
1. Tokyo Institute of Technology, Yokohama, Kanagawa, Japan.

Abstract (35 Word Limit): We present the modeling of a laterally coupled twin-stripe laser for boosting the modulation bandwidth far beyond relaxation frequencies. The 3dB-modulation bandwidth is increased to be doubled thanks to optical feedback in laterally coupled cavities.
Photonically-Enabled Microwave Function Generation Via Tailored Distortion
A. Bhatia; 1; H. Ting; 1; M. A. Foster; 1;
1. Johns Hopkins University, Baltimore, MD, United States.

Abstract (35 Word Limit): We demonstrate a microwave function generator based on precisely engineering the distortion in a microwave photonic link. By distorting a 5-GHz sinusoid we are able to generate a 5-GHz triangle wave and square pulse train.
Fiber Nonlinearity Tolerance of Traceback Equalization for Non-Uniformly Distorted QAM Signals

T. Sakamoto; 1; G. Lu; 1; T. Kawanishi; 1;
1. NICT, Tokyo, Japan.

Abstract (35 Word Limit): We investigate fiber nonlinearity tolerance of traceback equalization (TBE) for mitigating non-uniform distortion caused by unbalance of modulation electrodes in QAM transmitters. TBE outperforms conventional FIR-based adaptive equalizers in an adequately linear transmission regime.
Real-time heterodyne-based measurements of fiber laser spectral dynamics

D. V. Churkin;¹ ⁴; S. Sugavanam;¹; S. Fabbri;¹; T. L. Son;¹; I. Lobach;²; S. I. Kablukov;²; S. Khorev;³;
1. Aston Institute of Photonic Technologies, Birmingham, United Kingdom.
2. Institute of Automation and Electrometry, Novosibirsk, Russian Federation.
3. Zecotek Photonics, Richmond, BC, Canada.
4. Novosibirsk State University, Novosibirsk, Russian Federation.

Abstract (35 Word Limit): We present a method to measure in real-time the instantaneous generation spectrum of fiber lasers over consecutive cavity round-trips.
Analytical Step-Size Selection Rule for Simulation of Signal Propagation in Vector Optical Fiber Channel

Q. Zhang; L. Xing; H. Min; M. Hayee;
1. Minnesota State University Mankato, Mankato, MN, United States.
2. University of Minnesota Duluth, Duluth, MN, United States.
3. University of Massachusetts Dartmouth, North Dartmouth, MA, United States.

Abstract (35 Word Limit): An analytical step-size selection rule is proposed for the simulation of polarization multiplexed signal propagation through the single mode optical fiber. The method leads to approximately constant one step simulation error and high computational efficiency.
Novel Unipolar Sign Encoded OFDM for Next Generation PONs

M. Mohammed; Z. A. El-Sahn;

1. Photonics Group, Electrical Engineering Department, Alexandria University, Alexandria, Egypt.

Abstract (35 Word Limit): We propose a novel unipolar encoding technique for orthogonal frequency-division multiplexing (OFDM) that increases the bandwidth efficiency by 33% and reduces computational complexity by 50% compared to conventional intensity modulation/direct detection (IM/DD) OFDM systems.
Evaluation of Nonlinear Interference in Few-Mode Fiber Using the Gaussian Noise Model
A. E. El-Fiqi; 2; A. A. I Ali; 2; Z. A. El-Sahn; 3; H. M. Shalaby; 2, 3; R. K. Pokharel; 1;
1. E-JUST Center, Kyushu University, Fukuoka, 819-0395, Japan.
2. Elect. and Commun. Dept., Egypt-Japan University of Science and Technology (E-JUST), Alexandria, 21934, Egypt.
3. Photonics Group, Electrical Engineering Department, Alexandria University, Alexandria, 21544, Egypt.

Abstract (35 Word Limit): The nonlinear propagation in few-mode fibers (FMFs) is modeled using a Gaussian approach, where a closed-form formula for the nonlinear interference is derived. The impacts of different nonlinearity penalties are investigated using this model.
Fiber-Optic Distribution of Arbitrary Radio-Frequency Waveforms with Stabilized Group Delay

A. Zadok; A. Ben Amram; Y. Stern;
1. Bar-Ilan University, Givat Shmuel, Israel.

Abstract (35 Word Limit): Arbitrary RF waveforms are distributed over long fiber with stable group delay, using chromatic dispersion. Input and control waveforms modulate separate tunable lasers. Tracking of the control wave phase is used to adjust both wavelengths.
Symbol Rate Identification Using Asynchronous Delayed Sampling
J. Shang, S. Cui, C. Ke, Z. Xia, S. Fu, D. Liu
1. School of OEI, Huazhong Uni. of Sci.&Tech., Wuhan, Hubei, China.
2. NGIA, Wuhan, Hubei, China.

Abstract (35 Word Limit): A symbol rate identification method is proposed for optical signals with commonly used modulation formats. Numerical simulation and experimental results show it is accurate and robust to different link impairments.
Frequency Transfer and Time Synchronization Via Urban Fiber

Y. Gui; 2; N. Cheng; 1; W. Chen; 1; Q. Liu; 2; D. Xu; 1; F. Yang; 1; H. Cai; 1;

1. Shanghai Key Laboratory of All Solid-State Laser and Applied Techniques, Shanghai Institute of Optics and Fine Mechanics, Chinese Academy of Sciences, Jiading, Shanghai, China.
2. Key Laboratory for Quantum Optics, CAS, Shanghai Institute of Optics and Fine Mechanics, Chinese Academy of Sciences, Jiading, China.

Abstract (35 Word Limit): The frequency transfer and time synchronization system over 110km urban fiber link is described. The precise frequency transfer and accurate time synchronization are verified experimentally and demonstrated in the paper.
Tunable, narrow line-width silicon micro-ring laser source for coherent optical communications

Y. Qiu

1. WRI, Wuhan, Hubei, China.

Abstract (35 Word Limit): We demonstrate a tunable laser source based on a silicon microring. 1.1 kHz line-width, >8 mW output power and wide tuning range are achieved. 4-QAM and 16-QAM coherent transmissions using this laser are also demonstrated.
Frequency Chirp Reducing of a Colorless Laser Diode for 40-Gbit/s 256-QAM OFDM Transmission

C. Tsai; Y. Chi; G. Lin;
1. National Taiwan University, Taipei, Taiwan.

Abstract (35 Word Limit): A wavelength controlled and frequency chirp reduced colorless laser diode is directly modulated by 256-QAM-OFDM data to achieve a high spectral efficiency of 8 bit/sec/Hz at 40 Gbit/s with an optimized BER of $3.7 \times 10^{-3}$. 
LDPC-Coded 16-Dimensional Modulation Based on the Nordstrom-Robinson Nonlinear Block Code

T. Koike-Akino; 1; D. S. Millar; 1; K. Kojima; 1; K. Parsons; 1; K. Sugihara; 2; Y. Miyata; 2; T. Yoshida; 2;
1. Mitsubishi Electric Research Labs, Cambridge, MA, United States.
2. Information Technology R&D Center, Mitsubishi Electric Corporation, Ofuna, Kanagawa, Japan.

Abstract (35 Word Limit): We propose a new high-dimensional modulation (HDM) format, based on the Nordstrom-Robinson code, which is the best-known nonlinear block code in 16 dimensions. With EXIT chart, we optimize LDPC codes for various HDM formats, and show their benefits.
Routing Algorithm to Optimize Loss and IPDR for Rearrangeably Non-Blocking Integrated Optical Switches

M. Ding; Q. Cheng; A. Wonfor; R. V. Penty; I. H. White;

1. Department of Engineering, University of Cambridge, Cambridge, Cambridgeshire, United Kingdom.

Abstract (35 Word Limit): A practical path-selection algorithm is proposed to optimize the worst-case path loss and IPDR for large-scale integrated switches. The modeling of an 8×8 Clos-tree switch shows an improvement of up to 2.7dB/1.9dB in loss/IPDR.
SNR Equalized Optical Direct-Detected OFDM Transmission with CAZAC Equalization

Z. Feng; 1, M. Tang; 1; R. Lin; 1, 2; R. Wang; 1; Q. Wu; 1; L. Zhang; 1; L. Xu; 1; X. Wang; 1; C. Zhou; 1; J. Wu; 1; S. Zhou; 1; L. Deng; 1; S. Fu; 1; D. Liu; 1; P. Shum; 3.

1. Huazhong Univ of Science & Technology, Wuhan, Hubei, China.
2. School of Information and Communication Technology, The Royal Institute of Technology (KTH), Kista, Sweden.
3. Nanyang Technological University, Singapore, Singapore.

Abstract (35 Word Limit): 50Km SSMF optical direct-detected OFDM transmission with Constant Amplitude Zero Auto Correlation Sequence (CAZAC) equalization is experimentally demonstrated with over 15dB power budget. 2.5dB enhancement in sensitivity has been achieved simultaneously with 3dB PAPR suppression.
Performance Metrics for a Free-space Communication Link Based on Multiplexing of Multiple Orbital Angular Momentum Beams with Higher Order Radial Indice

G. Xie; 1; L. Li; 1; Y. Yan; 1; Y. Ren; 1; Z. Zhao; 1; p. liao; 1; N. Ahmed; 1; Z. Wang; 1; N. Ashrafi; 2, 3; S. Ashrafi; 2; R. Linquist; 2; m. tur; 4; a. willner; 1;
1. U. of Southern California, Los Angeles, CA, United States.
2. NxGen Partners, Dallas, TX, United States.
3. University of Texas at Dallas, Richardson, TN, United States.
4. Tel Aviv University, Ramat Aviv, TX, United States.

Abstract (35 Word Limit): We analyze and measure the performance metrics for a free-space communication link using OAM beams with non-zero radial index $p$. The received power of OAM beams with $p=1$ is ~6 dB higher than $p=0$. 
Experimental Demonstration of Using Multi-Layer-Overlay Technique for Increasing Spectral Efficiency to 1.18 bits/s/Hz in a 3 Gbit/s Signal over 4-km Multimode Fiber

G. Xie; C. Bao; Y. Ren; Y. Yan; a. almainan; L. Li; p. liao; Z. Zhao; N. Ahmed; Z. Wang; y. cao; H. Huang; N. Ashrafi; S. Ashrafi; R. Linquist; m. tur; a. willner;

1. U. of Southern California, Los Angeles, CA, United States.
2. NxGen Partners, Dallas, TX, United States.
3. University of Texas at Dallas, Richardson, TX, United States.
4. Tel Aviv University, Ramat Aviv, Israel.

Abstract (35 Word Limit): We report a transmission of 3 Gbit/s signal over a 4-km grade-index multimode fiber within a bandwidth of 2.54 GHz using multiple-layer-overlay (MLO) modulation format, achieving a spectral efficiency of 1.18 symbols/s/Hz.
Low-Cost In-Band OSNR Monitoring based on Coherent Hybrid in CO-OFDM System

L. Zhang; Z. Feng; R. Wang; R. Lin; L. Xu; X. Wang; C. Zhou; J. Wu; S. Zhou; L. Deng; S. Fu; M. Tang; D. Liu;
2. The Royal Institute of Technology, Kista, Sweden.

Abstract (35 Word Limit): We proposed and demonstrated a cost-effective in-band optical signal to noise ratio (OSNR) monitoring technique based on coherent hybrid in 20Gb/s CO-OFDM system. Less than 0.5dB monitoring error is achieved with 400MHz balanced photodetector (PD).
Abstract (35 Word Limit): We perform injection-locking of a passively mode-locked Fabry-Perot quantum dash laser at 40 GHz using 10 Gbps PRBS data in NRZ-OOK format after spectral enrichment and thus demonstrate all-optical clock recovery through sub-harmonic injection-locking.
56 Gb/s WDM transmitter module based on silicon microrings using comb lasers

H. Füser; A. Giesecke; A. Prinzen; S. Suckow; C. Porschatis; D. Schall; H. Lerch; M. M. Tarar; J. Bolten; T. Wahlbrink; H. Kurz;

1. AMO GmbH, Aachen, Germany.
2. Institut für Halbleiterotechnik, RWTH Aachen University, Aachen, Germany.

Abstract (35 Word Limit): We demonstrate the performance and the reliable fabrication process of a 56 Gb/s wavelength-division multiplexing transmitter module with integrated feedback structures. The device is based on microring silicon depletion modulators, optimized for O-band comb-laser operation.
Experimental Demonstration of Free-Space Optical Communications Using Orbital Angular Momentum (OAM)

Abstract (35 Word Limit): We present a novel free-space communication link using orbital angular momentum (OAM) array encoding/decoding.
Arrays of WSi Superconducting Nanowire Single Photon Detectors for Deep Space Optical Communications

M. Shaw; 1 F. Marsili; 1 A. Beyer; 1 J. Stern; 1 G. Resta; 1 P. Ravindran; 2 S. Chang; 2 J. Bardin; 2 F. Patawaran; 1 V. Verma; 3 R. P. Mirin; 3 S. Nam; 3 W. Farr; 1

1. Jet Propulsion Laboratory, United States.
2. Electrical Engineering, University of Massachusetts, Amherst, MA, United States.

Abstract (35 Word Limit): We have developed 64 pixel free space coupled arrays of WSi SNSPDs as a pathfinder for the ground detector in a deep space optical communication system. Our receiver prototype was used to close a real time deep space optical communication link at 47 Mbps.
A Colorless ONU Scheme for WDM-OFDM-PON with Symmetric Bitrate and Low-cost Direct-detection Receivers

C. Lei; 1 M. Chen; 1 H. Chen; 1 S. Yang; 1 S. Xie; 1

1. Tsinghua University, Beijing, China.

Abstract (35 Word Limit): By suppressing one of the conjugated sidebands, the phase-modulated downstream OFDM signal can be directly detected and remodulated for upstream transmission simultaneously. Thus, colorless ONU can be realized with symmetric bitrate and low-cost direct-detection receiver.
Experimental Demonstration of Bandwidth Reduction using Nyquist Shaped PSK for Flexible udWDM

J. Altabas; 1; J. Lazaro; 2; F. Sotelo; 1; I. Garces; 1;
1. University of Zaragoza, Zaragoza, Spain.
2. Universitat Politècnica de Catalunya, Barcelona, Spain.

Abstract (35 Word Limit): Nyquist shaped PSK for flexible udWDM is proposed. 1.25Gb/s (2.5Gb/s) Nyquist-PSK with a 120º homodyne coherent receiver reduces the used optical bandwidth to 3.75GHz (5GHz) with receiver sensitivity of -48.5dBm at BER=10^{-3}. 
Dynamic Adaptation of Bandwidth Granularity for Multipath Routing in Elastic Optical OFDM Networks

L. Altarawneh; 1; S. Taebi; 1;
1. Electrical and Computer Engineering, Southern Illinois University, Carbondale, IL, United States.

Abstract (35 Word Limit): We introduce the concept of bandwidth granularity dynamic adaptation for spectrum allocation using multipath provisioning in elastic optical OFDM networks. Results show that dynamic bandwidth adaptation significantly improves the performance in terms of throughput and blocking probability.
Study of Methane Saturated Dispersion Resonances Amplitude near 2.36 μm over the Temperature Range 77-300 K

M. K. Tarabrin; 1; V. A. Lazarev; 1; V. E. Karasik; 1; A. N. Kireev; 2; A. S. Shelkovnikov; 2; Y. P. Podmarkov; 2, 4; Y. V. Korostelin; 2; M. P. Frolov; 2, 4; V. I. Kozlovsky; 2; M. A. Gubin; 2, 3;

1. Science and Education Center Photonics and IR-Techniques, Bauman Moscow State Technical University, Moscow, Russian Federation.
2. P. N. Lebedev Physical Institute of the Russian Academy of Sciences, Moscow, Russian Federation.
3. National Research Nuclear University MEPhI, Moscow, Russian Federation.
4. Moscow Institute of Physics and Technology, Moscow, Russian Federation.

Abstract (35 Word Limit): Saturated dispersion resonances of the methane E(2)-line ν₁+ν₄-band over the temperature range 77-300 K were observed with two-mode Cr²⁺:ZnSe laser with intracavity absorption cell. The resonances amplitudes were measured and compared with calculations.
Phase Noise Measurement of Microwave Signal Sources based on Microwave Photonic Technologies

F. Zhang; 1; D. Zhu; 1; S. Pan; 1;
1. Nanjing Univ Aeronautics & Astronautics, Nanjing, Jiangsu, China.

Abstract (35 Word Limit): Phase noise measurement of microwave signal sources using microwave photonic technologies is demonstrated. Accurate measurement is achieved in an operation bandwidth from 5 to 40 GHz, and the sensitivity is below -130 dBc/Hz@10 kHz offset.
Proposal and Experimental Verification of Brillouin Optical Correlation Domain Reflectometry with Lock-in Detection Scheme

Y. Yao; M. Kishi; K. Hotate; 1.
1. The University of Tokyo, Tokyo, Tokyo, Japan.

Abstract (35 Word Limit): We have newly proposed a Brillouin optical correlation domain reflectometry with lock-in detection scheme. The scheme is verified by experiments using intensity and phase modulation. The phase modulation suppresses the background noise effectively.
Abstract (35 Word Limit): We report a fully-stabilized synchronously-pumped optical parametric oscillator frequency comb at 1-GHz repetition frequency, comprising pump, signal and idler combs as well as combs at their sum-frequency and second-harmonic frequencies.
Laser Noise Improvement Through Pulse Nonlinear Propagation in a Dispersion-Increasing Fiber

M. Lin; C. Huang;
1. National Tsing Hua University, Hsinchu, Taiwan.

Abstract (35 Word Limit): We demonstrate experimentally that laser amplitude and timing jitters can be improved when the laser pulse undergoes adiabatic spectral compression in a dispersion-increasing fiber.
Doppler-free spectroscopy of $^2\!\!\,^3\!\!\,^3\!\!\,P\rightarrow^3\!\!\,^3\!\!\,^D$ and spin-forbidden $^2\!\!\,^3\!\!\,^3\!\!\,P\rightarrow^1\!\!\,^3\!\!\,^D$ transitions at 588 nm

P. Luo; 1  J. Hu; 2  Y. Feng; 2  L. Wang; 1  J. Shy; 1, 3

1. Department of Physics, National Tsing Hua University, Hsinchu, Taiwan.
2. Shanghai Key Laboratory of Solid State Laser and Application and Shanghai Institute of Optics and Fine Mechanics, Chinese Academy of Sciences, Shanghai, China.
3. Institute of Photonics Technologies, National Tsing Hua University, Hsinchu, Taiwan.

Abstract (35 Word Limit): We demonstrated the Doppler-free intermodulated fluorescence spectroscopy of the $^4\!\!\,^3\!\!\,^P\rightarrow^3\!\!\,^3\!\!\,^D$ transitions using a one-watt compact laser system at 588 nm. The power-dependent spectra of the $^2\!\!\,^3\!\!\,^P\rightarrow^3\!\!\,^3\!\!\,^D$ transitions were studied and the Doppler-free spectrum of the $^2\!\!\,^3\!\!\,^P\rightarrow^1\!\!\,^3\!\!\,^D$ transitions was first achieved.
Semiconductor Optical Amplifier with Holding Beam Injection for Single Path Accurate Time Transmission

J. Vojtech; J. Radil; V. Smotlacha;
1. CESNET, Prague, Czech Republic.

Abstract (35 Word Limit): We experimentally demonstrated an accurate time transfer over 200 km single fiber path using semiconductor optical amplifiers in bidirectional operation with holding beam injection. Experiments show significant reductions of spontaneous lase of the fiber path.
Ultra-Narrow Linewidth, Micro-Integrated Semiconductor External Cavity Diode Laser Module for Quantum Optical Sensors in Space

C. Pyrlic; 1; W. Lewoczko-Adamczyk; 1, 2; S. Schwertfeger; 1; J. Häger; 1; A. Wicht; 1, 2; A. Peters; 1, 2; G. Erbert; 1; G. Tränkle; 1;

1. Ferdinand Braun Institute, Berlin, Germany.
2. Humboldt Universität zu Berlin, Berlin, Germany.

Abstract (35 Word Limit): We present an external-cavity-diode-laser for quantum sensor applications based on distributed feedback diode laser with resonant feedback from an external cavity. The intrinsic linewidth is 31 Hz. Design, micro-integration concept and experimental results are shown.
Frequency-Control Characteristics of an Erbium-Based Mode-Locked Fiber Laser with an Optically Pumped Ytterbium Fiber

H. Inaba; S. Okubo; M. Schramm; K. Gunji; F. Hong; K. Hosaka; A. Onae;
1. National Metrology Institute of Japan (NMIJ), Tsukuba, Japan.

Abstract (35 Word Limit): Frequency-control characteristics of a mode-locked erbium-fiber laser with an intracavity optically pumped ytterbium-fiber were investigated. The fixed frequency of the comb when the pump power to the ytterbium-fiber is changed varies with the power.
Photonic Generation of Linearly-Chirped Microwave Waveform With Tunable Center Frequency and Time-Bandwidth Product

H. Zhang; W. Zou; J. Chen;

1. State Key Lab of Advanced Optical Communication Systems and Networks, Department of Electronic Engineering, Shanghai Jiao Tong University, Shanghai, Shanghai, China.

Abstract (35 Word Limit): A novel approach is presented to generate linearly-chirped microwave waveforms with tunable center frequency and expandable time-bandwidth product (TBWP). Different types of waveforms are demonstrated and the maximum measured TBWP is up to ~166.4.
Investigation of Trace Gas Sensor Based on QEPAS Method Using Different QTFs

Y. Ma; G. Yu; J. Zhang; X. Yu; H. Luo; D. Chen; R. Sun; F. K. Tittel;

1. Harbin Institute of Technology, Harbin, Heilongjiang, China.
2. Department of Electrical and Computer Engineering, Rice University, Houston, TX, United States.

Abstract (35 Word Limit): A trace gas sensor platform based on quartz-enhanced photoacoustic spectroscopy using quartz tuning forks (QTFs) with resonant frequency of 38 kHz and 40 kHz were experimentally investigated and theoretically analyzed for the first time.
Optical Heterodyne Micro-Vibration Measurement Based on All-Fiber Acousto-Optic Frequency Shifter

L. Huang; 1 W. Peng; 1 W. Zhang; 2 F. Gao; 1 F. Bo; 1 G. Zhang; 1 J. Xu; 1
1. TEDA Applied Physics Institute and School of Physics, Nankai University, Tianjin, Tianjin, China.
2. Northwestern Polytechnical University, Xi’an, Shanxi, China.

Abstract (35 Word Limit): We provide an optical heterodyne detection configuration based on an all-fiber acousto-optic structure, which acts as both frequency shifter and coupler simultaneously, with a resolution of 0.01 nm from 10 kHz to 90 kHz.
Dual-parameters sensing based on multimode microfiber with Fresnel reflection

H. Luo; 1 Q. Sun; 1, 2 Z. Xu; 1 D. Liu; 1 L. Zhang; 2 X. Sun; 1

1. Huazhong Univ of Science and Technology, Wuhan, Hubei, China.
2. Aston Institute of Photonic Technologies, Aston University, Birmingham, United Kingdom.

Abstract (35 Word Limit): A compact and low cost fiber sensor based on microfiber with Fresnel reflection is proposed and demonstrated for simultaneous measurement of refractive index (RI) and temperature with high sensitivities.
Analysis of signal amplitude in Chirped Laser Dispersion Spectroscopy

M. P. Nikodem, J. Wodecki
1. Wroclaw Research Centre EIT+, Wroclaw, Poland.

Abstract (35 Word Limit): Signals measured with Chirped Laser Dispersion Spectroscopy setup implemented with intensity modulator are analyzed experimentally. Potential strategies for signal retrieval and amplitude enhancement possibilities are described.
Cylindrical multipass reflection cells for optical trace gas sensing

L. Emmenegger; 1; M. Mangold; 1, 2; B. Tuzson; 1; H. Looser; 3;
1. Empa, , United States.
2. IRsweep, Zürich, Switzerland.
3. FHNW, Windisch, Switzerland.

Abstract (35 Word Limit): Single-piece cylindrical multipass cells effectively fold a long optical path in a small detection volume. We present a systematic survey of various cell configurations and the respective mirror shapes for enhanced path-to-volume ratios.
Doppler-Based Flow Rate Sensing in Microfluidic Channels
A. Bakal; 1; L. Stem; 1; m. tzur; 1; m. Veinguer; 1; N. Mazurski; 1; n. cohen; 2; U. Levy; 1;
1. The Hebrew University of Jerusalem, Israel.
2. Tel Aviv University, Tel Aviv, Israel.

Abstract (35 Word Limit): We design, fabricate and experimentally demonstrate a novel generic method to detect flow rates velocity in microfluidic devices. The method is appealing for variety of applications where a simple and accurate speed measurement is needed.
Stand-off Detection of Liquid Thin Films using Active Mid-Infrared Hyperspectral Imaging
L. Maidment; 1, 2; Z. Zhang; 1; C. Howle; 2; S. Lee; 3; A. Christie; 3; D. T. Reid; 1;
1. Scottish Universities Physics Alliance (SUPA), Institute of Photonics and Quantum Sciences, School of Engineering and Physical Sciences, Heriot-Watt University, Edinburgh, United Kingdom.
2. Defence Science and Technology Laboratory, Porton Down, Salisbury, United Kingdom.
3. Thales Optronics, Glasgow, United Kingdom.

Abstract (35 Word Limit): The idler output of an ultrafast optical parametric oscillator is used with a mid-infrared camera to distinguish between water and deuterium oxide, demonstrating the potential for standoff detection of a wide range of liquids.
Filaments for Raman Spectroscopy

C. Feng; 1; J. Hendrie; 1; J. Diels; 1; L. Arissian; 1;
1. CHTM, University of New Mexico, Albuquerque, NM, United States.

Abstract (35 Word Limit): Impulsive rotational/vibrational Raman scattering of molecules excited by IR filaments and thereafter probed by a narrow line-width UV beam is proposed. We show results of rotational Raman scattering of air molecules for preliminary demonstration.
Experimental and Numerical Analysis of Commercial and Homemade Tuning Forks for QEPAS.

A. Godard; 1; G. Aoust; 1; R. Levy; 1; M. Raybaut; 1; B. Bourgeteau; 1; J. Dherbecourt; 1; J. Melkonian; 1; M. Lefebvre; 1.

1. ONERA, the french aerospace lab, Palaiseau, France.

Abstract (35 Word Limit): Characteristics of two commercial quartz tuning forks and a homemade tuning fork are compared for standard QEPAS experiments. An analytical model is also derived to compare theory and experiment with a reasonable agreement.
Electronics-assisted ultra-narrow optical filtering and its application in low phase noise lasing

Y. Dai; 1; Z. Zhang; 1; F. Yin; 1; Y. Zhou; 1; J. Li; 1; K. Xu; 1;
1. Beijing Univ of Posts & Telecom, Haidian, Beijing, China.

Abstract (35 Word Limit): A MHz-level optical filtering is achieved by frequency conversion pair between optical and radio carriers as well as electronic filtering. Narrowlinewidth lasing is then obtained with 20-kHz 20-dB linewidth and 65-dB side-mode suppression ratio.
A New Method of Longitudinal Mode Selection in Q-switched Lasers

E. A. Khazanov; 1, 2; A. Shaykin; 1; K. Burdonov; 1;

2. National University of Science and Technology “MIIS”, Moscow, Russian Federation.

Abstract (35 Word Limit): The effect of post-pulse (the second giant pulse at the neighboring longitudinal mode) generation in a Q-switched laser was revealed in experiment. Based on this effect, a new method of longitudinal mode selection was implemented.
Laser Eigenvalue, Coherence Time, Q-factor, and Linewidth

M. Pollnau; 1; M. Eichhorn; 2;
1. Department of Materials and Nano Physics, KTH-Royal Institute of Technology, Kista, Sweden.
2. French-German Research Institute of Saint-Louis ISL, Saint Louis, France.

Abstract (35 Word Limit): We generalize the theory of continuous-wave lasers by considering spontaneous emission in
the photon rate equation. We relate the laser coherence time, Q-factor, and linewidth to the passive-resonator
parameters, thereby unifying resonator and laser theory.
Nonlinear Polarization Switching and Preservation Effects in 55 µm Core Polygonal-CCC Fibers

I. Hu; 1; C. Zhu; 1; M. Haines; 1; T. McComb; 2; G. Fanning; 2; R. Farrow; 2; A. Galvanauskas; 1;
1. University of Michigan, Ann Arbor, MI, United States.
2. nLight, Vancouver, WA, United States.

Abstract (35 Word Limit): Study of nonlinear, intensity-dependent polarization evolution in 55µm core polygonal-CCC fibers reveals that both nonlinear polarization switching as well as robust and intensity-independent polarization maintenance can be achieved depending on input signal polarization.
Novel Design of Simple and Compact Tunable Fiber Laser

Y. Fujimoto;¹; O. Ishii;²; M. Yamazaki;³;
1. Osaka University, Suita, Osaka, Japan.
2. Production Engineering Section, Optical Glass Production Department, Sumita Optical Glass, Inc., Minamiaizu, Japan.

Abstract (35 Word Limit): We propose and demonstrate a novel design of simple and compact tunable fiber laser skillfully using chromatic aberration of a lens relay and a slit-like effect of optical fiber core.
Spatially-resolved Pulse-front-tilt and Pulse-width Distributions of Q-switched Pulses from an Unstable Nd:YAG Resonator

C. Feng; X. Xu; J. Diels;
1. CHTM, University of New Mexico, Albuquerque, NM, United States.

Abstract (35 Word Limit): Pulse-front-tilt and negligible pulse-width spread across the laser beam are reported, both experimentally and numerically, for pulses from a Q-switched unstable resonator with a variable-reflectivity-mirror under different operation conditions.
Single Frequency 310ps, 1.67J Laser Pulses Generation with Nonfocusing-pumped Stimulated Brillouin Scattering
X. Zhu; Z. Lu; Y. Wang; H. Zhang;
1. Harbin Institute of Technology, Harbin, Heilongjiang, China.

Abstract (35 Word Limit): We obtained single frequency laser pulses with energy of 1.67-J and duration of 310-ps based on the nonfocusing-pumped stimulated Brillouin scattering. A high-power Nd:glass laser system delivers 3-ns super-Gaussian-shaped pulses is used as the light-source.
Widely-tunable high-power narrow-linewidth thulium-doped all-fiber superfluorescent source

J. Liu; 1; H. Shi; 1; C. Liu; 1; P. Wang; 1;

1. Beijing University of Technology, Beijing, Beijing, China.

Abstract (35 Word Limit): Power scaling of narrow-linewidth thulium-doped fiber superfluorescent source with wavelength tunable from 1940~2010nm is reported. The all-fiber superfluorescent source yielded 364W of output power at central wavelength of 1980nm with 3dB spectral bandwidth of 1.9nm.
UV Laser Beam Stabilization System for the European XFEL Electron Injector Laser Beamlne

S. Köhler; F. Kaiser; F. Peters; L. Winkelmann; I. Hartl;
1. DESY, Hamburg, Germany.

Abstract (35 Word Limit): We present a beam drift stabilization system for the 22 m UV-laser beam delivery to the electron gun of the European XFEL. The camera-based system is robust to dynamic variations in power, beam size and shape.
Abstract (35 Word Limit): We demonstrate post-growth thermal diffusion rates of praseodymium ions into ZnSe. Near and middle infrared luminescence spectra and kinetics of Pr:ZnSe crystals were studied at RT.
Power Scaling of Femtosecond Ti:sapphire Laser Double-Side-Pumped by High-Power Green InGaN Diode Lasers

R. Sawada; H. Tanaka; R. Kariyama; K. Hirosawa; F. Kannari;

1. Department of Electronics and Electrical Engineering, Keio University, Yokohama, Japan.

Abstract (35 Word Limit): We demonstrate a mode-locked Ti:sapphire laser pumped by high-power green InGaN diode lasers from both sides of the crystal and achieved a highest laser power of 50 mW.
Developed objective system for measuring the visibility of the display with metal mesh as a capacitive touch sensor

K. T. Young; 1, 2;
1. SAMSUNG, Seoul, Korea (the Republic of).
2. center of information storage devices, yonsei university, Seoul, Korea (the Republic of).

Abstract (35 Word Limit): In this paper, we introduce a new method to measure the visibility of a metal-mesh ITO-replacement touch panels. The reason why we have developed this system is to clear up the ambiguity of the visibility estimation or readability property of the metal mesh electrodes in touch sensors.
Fabrication of Gratings with Low Spacing Error by the Dual-Beam Exposure System with Spherical Lenses

S. Wang; 1; L. Zeng; 1;
1. Tsinghua University, United States.

Abstract (35 Word Limit): We propose a feedback method of adjusting the dual-beam exposure system with spherical collimation lenses based on deducing the spacing error from diffraction wavefront. The grating of 0.03 λ in 70×70 mm² can be achieved.
Dynamic Optics for Three-Dimensional Laser Material Processing

M. J. Booth; ¹
¹ University of Oxford, Oxford, United Kingdom.

Abstract (35 Word Limit): Dynamic optical elements, including spatial light modulators and deformable mirrors, improve the capabilities of laser fabrication systems. Advantages include aberration correction, parallelization and spatial control over the temporal intensity profile of ultrashort pulses.
Laser Written 3D Lightwave Circuits and Applications

M. J. Withford; 1; S. Gross; 1; N. Riesen; 2; J. Love: 3;

1. Macquarie University, Sydney, NSW, Australia.
2. The University of Adelaide, Adelaide, SA, Australia.
3. The Australian National University, Canberra, ACT, Australia.

Abstract (35 Word Limit): Three dimensional lightwave circuits, fabricated using femtosecond laser direct-write techniques, are enabling new applications in quantum optics, astronomy and telecommunications. We review those and highlight our recent work on 3D compact, passive mode selective couplers.
3D Printing Sets New Standards in Microfabrication

M. Hermatschweiler;


Abstract (35 Word Limit): Two-photon polymerization has emerged as highest precision additive manufacturing standard for micro- to mesoscale fabrication and superior maskless lithography technique. Design freedom, resolution and processing speed drive diverse scientific as well as industrial applications.
Achromatic polarization rotator imprinted in glass by ultrafast laser nanostructuring

M. Lancry; R. Desmarchelier; M. Gecevivius; M. Beresna; P. Kazansky; B. Poumellec;
1. Universite de Paris Sud, Orsay, France.
2. ORC, Southampton, United Kingdom.

Abstract (35 Word Limit): We demonstrate an achromatic polarization rotator imprinted by femtosecond laser nanostructuring in silica glass. The broadband 600-1500nm operation is achieved by replicating the structure of twisted nematic liquid crystal.
Characterization of melt-flow dynamics in selective laser melting (SLM) processes

M. J. Matthews; 1; S. Rubenchik; 1; G. Guss; 1; n. norman; 1;
1. Lawrence Livermore National Laboratory, Livermore, CA, United States.

Abstract (35 Word Limit): High speed microscopic imaging and thermography of stainless steel microsphere assemblies exposed to high power laser light is analyzed to understand the melt-flow dynamics associated with selective laser melting processes.
Deterministic High-yield Creation of Nitrogen Vacancy Centers in Diamond Photonic Crystal Cavities and Photonic Elements
T. Schroder; L. Li; E. Chen; M. Walsh; M. E. Trusheim; I. Bayn; J. Zheng; S. Mouradian; H. Bakhru; O. Gaathon; D. Englund;
1. MIT, Cambridge, MA, United States.

Abstract (35 Word Limit): We demonstrate the high-yield creation of nitrogen-vacancy centers in the mode-maxima of a variety of functional photonic elements with less than 30nm precision. We create 1.1 NVs per photonic-crystal-cavity and show strong Purcell enhancement.
Direct laser writing aligned with nano-diamonds containing NV-centers as single-photon emitters

Q. Shi; J. Fischer; P. Rath; B. Sontheimer; A. Schell; W. Pernice; O. Benson; A. Naber; M. Wegener;

1. Karlsruhe Institute of Technology, Karlsruhe, Germany.
2. Humboldt-Universität zu Berlin, Berlin, Germany.

Abstract (35 Word Limit):

We present and apply an instrument allowing for localizing NV-centers in nano-diamonds in a photoresist, measuring the correlation function without exposing the photoresist, and performing three-dimensional direct laser writing aligned with the single-photon emitters.
Efficient collection from a nitrogen-vacancy qubit in a circular grating

L. Li; 1; E. Chen; 1; J. Zheng; 2; S. Mouradian; 1; F. Dolde; 1; T. Schroder; 1; S. Karaveli; 1; M. Markham; 3; D. Twitchen; 3; D. Englund; 1;
1. MIT, Cambridge, MA, United States.
2. Columbia University, New York, NY, United States.
3. Element Six, Santa Clara, CA, United States.

Abstract (35 Word Limit): We demonstrate a circular ‘bullseye’ diamond grating enabling efficient collection of single photons from a single nitrogen-vacancy center with a spin coherence time of 1.7 ms. Back-focal-plane studies indicate efficient redistribution into low-NA modes.
Strain coupling of diamond nitrogen vacancy centers to nanomechanical resonators

S. Meesala; 1; Y. Sohn; 1; H. A. Atikian; 1; M. J. Burek; 1; S. Kim; 1; J. Choy; 1; M. Loncar; 1;

1. Harvard University, Cambridge, MA, United States.

Abstract (35 Word Limit): We fabricate high quality factor diamond cantilevers containing nitrogen vacancy (NV) centers. Strain-mediated coupling of the NV spin to the displacement of a mechanical mode is observed in optically detected electron spin resonance measurements.
Atom–Photon Coupling from Nitrogen-vacancy Centers Embedded in Tellurite Microspheres

Y. Ruan; B. C. Gibson; D. W. Lau; A. Greentree; H. Ji; H. Ebendorff-Heidepriem; B. C. Johnson; T. Ohshima; T. Monro;

1. School of Applied Science, RMIT University, Melbourne, VIC, Australia.
2. School of Physics, University of Melbourne, Melbourne, VIC, Australia.
4. University of South Australia, Adelaide, SA, Australia.
5. School of Chemistry & Physics, University of Adelaide, Adelaide, SA, Australia.

Abstract (35 Word Limit): A technique was developed for creating tellurite microspheres with embedded nanodiamonds. The whispering gallery mode modulated fluorescence of the nitrogen vacancy centers in the nanodiamonds was observed with resonance Q over 10,000.
Electrochemical potential control of charge state and fluorescence of nitrogen vacancy centers in nanodiamonds

S. Karaveli; 1, 2; O. Gaathon; 1, 3; A. Wolcott; 1, 4; R. Sakakibara; 1; D. Peterka; 5; J. S. Owen; 4; R. Yuste; 5; D. Englund; 1;
1. Department of Electrical Engineering and Computer Science, Massachusetts Institute of Technology, Cambridge, MA, United States.
2. Department of Electrical Engineering, Columbia University, New York, NY, United States.
5. Department of Biological Sciences, Columbia University, New York, NY, United States.

Abstract (35 Word Limit): We use spectro-electrochemical microscopy to demonstrate that the equilibrium charge state and fluorescence of nitrogen vacancy centers in nanodiamonds can be dynamically controlled by externally applied potentials.
Nanoscale Magnetic Imaging using Quantum Defects in Diamond

R. Walsworth; 1

1. Physics, Harvard University, Cambridge, MA, United States.

Abstract (35 Word Limit): I describe recent progress in nanoscale magnetic imaging using Nitrogen-Vacancy (NV) quantum defects in diamond, which provide an unparalleled combination of magnetic field sensitivity and spatial resolution in a room-temperature solid, with wide-ranging applications.
Attosecond Ionization Dynamics and Time Delays

U. Keller, 1
1. ETH Zurich, Zurich, ZH, Switzerland.

Abstract (35 Word Limit): Although time is not an quantum-mechanical operator, novel attosecond techniques can measure very fundamental time delays. Using the tunneling time as an example, this tutorial should give a better insight on current issues and hot topics.
Fano Resonances in the Time Domain

A. Kaldun; C. Ott; A. Blättermann; T. Ding; A. Fischer; P. Raith; K. Meyer; M. Laux; J. Evers; C. H. Keitel; T. Pfeifer; C. H. Greene;

1. Max-Planck-Institut für Kernphysik, 69117 Heidelberg, Germany.
2. Department of Physics, Purdue University, West Lafayette 47907, IN, United States.

Abstract (35 Word Limit): The Fano phase formalism enables measurement and control of phase and amplitude of an emitting dipole. Here, we use this formalism to measure and understand the dynamics of bound states in strong laser fields.
Quantum Beats in Attosecond Transient Absorption of Krypton Autoionizing States

Y. Cheng; M. Chini; X. Tong; A. Chew; J. Biedermann; Y. Wu; E. Cunningham; Z. Chang;

1. University of Central Florida, Orlando, FL, United States.
2. University of Tsukuba, Tsukuba, Japan.
3. Friedrich-Schiller Universität, Jena, Germany.

Abstract (35 Word Limit): Quantum beats with periods of 5-10 fs are observed in various near-threshold autoionizing states of krypton atoms in an attosecond transient absorption experiment, such measurement allows reconstruction of the valence state wave packets.
Excitation Energy Dependent Attosecond Photoemission Timing in Tungsten

J. Riemensberger; 1, 3; M. Jobst; 1, 3; S. Neppl; 2; M. Ossiander; 1, 3; M. Schäffer; 1, 3; E. Bothschafter; 4; M. Gerl; 1, 3; A. Kim; 3, 1; J. Barth; 3; F. Krausz; 1, 5; P. Feulner; 3; R. Kienberger; 3, 1;

1. Max Planck Institute for Quantum Optics, Munich, Germany.
2. Ultrafast X-Ray Science Laboratory, Lawrence Berkeley National Lab, Berkeley, CA, United States.
3. Technical University Munich, Munich, Germany.
4. Paul Scherrer Institut, Villigen, Switzerland.
5. Ludwig Maximilians University, Munich, Germany.

Abstract (35 Word Limit): A multitude of physical effects have been proposed to determine the photoemission delay between core and valence electrons in tungsten. We present selected streaking experiments that clarify its origins.
Final ID: FTh3C.5

Attosecond Transient Absorption Explores Coupling Mechanisms of Autoionizing States

B. Bernhardt; 1, 2; X. Li; 1; A. Beck; 1, 2; E. R. Warrick; 1, 2; D. J. Haxton; 1; C. W. McCurdy; 1, 3; D. M. Neumark; 1, 2; S. R. Leone; 1, 2;

1. Lawrence Berkeley National Laboratory, Berkeley, CA, United States.
2. Department of Chemistry, UC Berkeley, Berkeley, CA, United States.
3. Department of Chemistry, UC Davis, Davis, CA, United States.

Abstract (35 Word Limit): High spectral resolution attosecond transient absorption spectroscopy in xenon is used to validate quantum dynamical multi-level simulations of the on and off resonant absorption behavior of highly excited states and their strong-field induced coupling mechanisms.
Anderson Localization in Synthetic Photonic Lattices

D. V. Churkin; I. Vatnik; A. M. Tikan; A. A. Sukhorukov;
1. Institute of Automation and Electrometry SB RAS, Novosibirsk, Russian Federation.
2. Novosibirsk State University, Novosibirsk, Russian Federation.
3. Aston Institute of Photonic Technologies, Birmingham, United Kingdom.
4. The Australian National University, Canberra, ACT, Australia.

Abstract (35 Word Limit): We experimentally demonstrate Anderson localization for optical pulses in time domain, using a photonic mesh lattice implemented with coupled optical fiber loops. We also discuss interplay of photonic band-gaps and disorder in such lattices.
Experimental realization of a topological Anderson insulator

S. Stützer; 1 M. Rechtsman; 2 P. Titum; 3 Y. Plotnik; 2 Y. Lumer; 2 J. M. Zeuner; 1 S. Nolte; 1 G. Refael; 3
N. Lindner; 2 M. Segev; 2 A. Szameit; 1

1. Institute of Applied Physics, Friedrich-Schiller-Universität, Jena, Germany.
2. Department of Physics, Israel Institute of Technology, Haifa, Israel.
3. Department of Physics, Institute of Quantum Information and Matter, Pasadena, CA, United States.

Abstract (35 Word Limit): We experimentally demonstrate that disorder can induce a topologically non-trivial phase. We implement this „Topological Anderson Insulator“ in arrays of evanescently coupled waveguides and demonstrate its unique features.
Topological Insulators in PT-Symmetric Lattices

G. Harari; 1; Y. Plotnik; 1; M. A. Bandres; 1; Y. Lumer; 1; M. Rechtsman; 1; M. Segev; 1;

1. Physics department, Technion Israel Institute of Technology, Haifa, Israel.

Abstract (35 Word Limit): We present the first PT-symmetric topological insulator system: topologically-protected transport of edge states in PT-symmetric photonic honeycomb lattices.
Topological Transport in Photonic Quasicrystals

M. A. Bandres; 2; M. Rechtsman; 1; M. Segev; 1;
1. Physics, Technion, Haifa, Israel.
2. Physics, Technion, Haifa, Israel.

Abstract (35 Word Limit): We show that it is possible to have topological transport in photonic quasicrystals, and therefore this lattices have one-way extended edgestates that are topologically protected against backscattering as they pass through defects or around corners.
Abstract (35 Word Limit): We present a new strategy for regulating light emission dynamics in high power laser arrays. Our approach is based on engineering the properties of non-Hermitian supersymmetric optical arrays and offers several advantages over previous investigations.
Asymmetric conical diffraction and generation of non-integer phase singularities in photonic graphene

D. Song; 1  S. Liu; 2, 3  V. Paltoglou; 4  D. Gallardo; 3  L. Tang; 1  J. Xu; 1  N. K. Efremidis; 4  Z. Chen; 3, 1
1. Nankai University, Tianjin, China.
2. Northwestern Polytechnical University, Xi’an, China.
3. San Francisco State University, San Francisco, CA, United States.
4. University of Crete, Crete, Greece.

Abstract (35 Word Limit): We demonstrate asymmetric conical diffraction accompanied by pseudospin-mediated non-integer phase singularities when two sublattices of photonic graphene are equally excited near the Dirac points. Experimental and numerical results agree with analysis of the Dirac equation.
Generalized three-dimensional Dirac points and $Z_2$ gapless surface states in a topological photonic crystal
L. Lu; 1; C. Fang; 1; T. H. Hsieh; 1; L. Fu; 1; S. Johnson; 1; J. D. Joannopoulos; 1; M. Soljacic; 1;
1. Massachusetts Institute of Technology, Cambridge, MA, United States.

Abstract (35 Word Limit): We discover robust three-dimensional generalized Dirac points – linear four-fold point degeneracies – in a non-symmorphic photonic crystal readily realizable at near-infrared wavelengths. The surface states exhibit gapless line-nodes characterized by a $Z_2$ topological invariant.
Abstract (35 Word Limit): We investigate scattering properties of supersymmetric partner structures. We show that SUSY transformations can be used as a new type of transformation optics to address inverse scattering problems in one-dimensional optical settings.
Ultrafast Coherent Charge Transfer in Solar Cells and Artificial Light Harvesting Systems: Toward Movies of Electronic Motion

C. Lienau; 1

1. Institute of Physics, Carl von Ossietzky University Oldenburg, Oldenburg, Germany.

Abstract (35 Word Limit): We have recently established a new approach, combining high-time resolution optical spectroscopy and time-dependent density functional theory to probe the most elementary processes of light-to-current conversion in nanostructures. I will present an overview and discuss most recent findings.
Atomically-thin van der Waals Heterostructure Solar Cells

T. Mueller; M. Furchi; A. Zechmeister; S. Schuler; A. Pospischil;
1. Vienna University of Technology, Vienna, Austria.

Abstract (35 Word Limit): We present atomically-thin photovoltaic solar cells based on van der Waals heterostructures of transition metal dichalcogenides and other two-dimensional semiconductors.
Plasmonic Internal Photoemission Detectors with Responsivities above 0.12 A/W

S. Muehlbrandt; 1; A. Melikyan; 1; K. Köhnle; 1; T. Harter; 1; A. Muslija; 1; P. Vincze; 1; S. Wolf; 1; P. Jakobs; 1; Y. Fedoryshyn; 2; W. Freude; 1; J. Leuthold; 2; C. Koos; 1; M. Kohl; 1;

1. Karlsruhe Institute of Technology, Karlsruhe, Germany.
2. ETH- Zurich, Zurich, Switzerland.

Abstract (35 Word Limit): We demonstrate first plasmonic photodetectors based on internal photoemission featuring responsivities exceeding 0.12 A/W at 1550 nm. The devices consist of ultra-compact plasmonic waveguides with electrode spacing below 100 nm receiving on-off-keying signals at 40 Gbit s⁻¹.
Hot Electron Schottky Detection Based on Internal Photoemission in Silicon Structures

B. Desiatov; 1; N. Mazurski; 1; J. Shapir; 1; J. Khurgin; 2; U. Levy; 1

1. Hebrew University of Jerusalem, Jerusalem, Israel.
2. Electrical and Computer Engineering, Johns Hopkins University, Baltimore, MD, United States.

Abstract (35 Word Limit): We demonstrate the design, fabrication and characterization of plasmonic enhanced silicon photo-detector for infrared light. Theoretical model, experimental results and comparison between different geometric configurations will be presented and discussed.
Hot-Electron Plasmonics: Quantum Transport Limitations

1. Hossain; 1; A. A. Yanik; 1;
1. University of California, Santa Cruz, Santa Cruz, CA, United States.

Abstract (35 Word Limit): Hot-electron plasmonics has created much excitement for solar-energy harvesting. However, experimental quantum efficiencies are too low for practical applications. Here, we develop a bottom-up quantum-transport model and introduce design parameters to achieve high efficiency solar-cells.
Abstract (35 Word Limit): We demonstrate an integrated four quadrant detector in silicon for infrared light, based on integration of plasmonic splitting, focusing an plasmonic enhanced internal photoemission detection on a single silicon plasmonic chip.
Controlling Plasmon Drag with Illumination and Surface Geometry

N. Noginova; V. Rono; A. Jackson; M. Durach;

1. Norfolk State University, Virginia Beach, VA, United States.
2. Purdue University, West Lafayette, IN, United States.
3. Georgia Southern University, Statesboro, GA, United States.

Abstract (35 Word Limit): We study electric signals associated with surface plasmon propagation in rough and smooth silver films. The polarity of the signal can be controlled with light illumination conditions and system geometry.
Linearized Intensity-Modulation Link by a Direct-Detection Intermodulation-Compensation Receiver

D. Tu; 1; F. Yin; 1; X. Liang; 1; Y. Dai; 1; J. Li; 1; K. Xu; 1;
1. Beijing University of Posts and Telecommunications, Beijing, Beijing, China.

Abstract (35 Word Limit): By the bias-voltage-dependent responsivity, a direct-detection photo detector is proposed to eliminate the third-order intermodulation for the intensity-modulation analog photonic link. Spurious-free dynamic range of 123.4 dB within 1-Hz bandwidth is achieved with 18.1-dB improvement.
Abstract (35 Word Limit): We present a microwave photonic multiband bandpass filter with four selectable operating states, which can either work as an all-block, single-pass or multi-pass bandpass filter with up to 46 dB sidelobe suppression.
Silicon-photonics-based Signal Processing for Microwave Photonic Frontends

M. Chen; 1; H. Yu; 1; J. Wang; 1; H. Chen; 1; S. Yang; 1; S. Xie; 1;

1. Tsinghua University, Beijing, Beijing, China.

Abstract (35 Word Limit): Integrated signal processors offer potential high resolution, tunability and programmable microwave photonic signal processing. The high performance integrated FIR/IIR signal processors have been presented, accompanying an application for the full-band microwave photonic frontends.
Final ID: STh3F.4

Tunable Microwave Photonic Phase Shifter Using On-Chip Stimulated Brillouin Scattering

M. Pagani; 1 D. Marpaung; 1 D. Choi; 2 S. Madden; 2 B. Luther-Davies; 2 B. J. Eggleton; 1

1. School of Physics, University of Sydney, Sydney, NSW, Australia.
2. Australian National University, Canberra, ACT, Australia.

Abstract (35 Word Limit): We present the first microwave photonic phase shifter using on-chip stimulated Brillouin scattering. We show that shorter integrated platforms can potentially achieve lower insertion loss than fiber implementations, due to their higher pump depletion threshold.
Photonic Generation of High-Power Pulsed Microwave Signals with Peak Powers up to 14.2 Watt

X. Xie; 1; K. Li; 1; Q. Li; 1; A. Beling; 1; J. C. Campbell; 1;

1. Department of Electrical and Computer Engineering, University of Virginia, Charlottesville, VA, United States.

Abstract (35 Word Limit): We demonstrate photonic generation of pulsed 1 GHz and 10 GHz microwave signals with peak power levels as high as 41.5 dBm (14.2 W) and 40 dBm (10 W), respectively, using a modified uni-traveling carrier (MUTC) photodiode.
Impact of the Coulomb Interaction on the Franz-Keldysh Effect in a High-Current Photodetector

Y. Hu; C. R. Menyuk; M. Hutchinson; V. J. Urick; K. J. Williams;
1. University of Maryland Baltimore County, Baltimore, MD, United States.
2. Naval Research Laboratory, Washington, DC, United States.

Abstract (35 Word Limit): The Franz-Keldysh effect causes semiconductor absorption to oscillate as a function of wavelength. We include this effect in calculating the nonlinear response of a high-current photodetector and obtain excellent agreement with experiments.
Improved Carrier-to-Sideband Ratio for Free Space Millimeter Wave-Coupled Electro-Optic Polymer High Speed Phase Modulators

D. Park; 1, 2; V. R. Pagán; 1, 2; T. E. Murphy; 2; J. Luo; 3; A. K. Jen; 3; W. N. Herman; 1

1. Laboratory for Physical Sciences, College Park, MD, United States.
2. Electrical and Computer Engineering, University of Maryland, College Park, MD, United States.

Abstract (35 Word Limit): The carrier-to-sideband ratio was improved more than 20 dB by using a SiO₂ protection layer in antenna-coupled electro-optic phase modulators operating at 37 GHz based on an in-plane polymeric waveguide using the nonlinear polymer. We also demonstrate detection of 3-GHz modulation of the RF carrier.
Heterogeneous 2D and 3D Photonic Integration for Future Chip-Scale Microsystems

S. Yoo;
1. University of California Davis, Davis, CA, United States.

Abstract (35 Word Limit): This tutorial reviews state-of-the-art heterogeneous 2D/3D photonic integration technologies involving various novel fabrication techniques leading to realization of chip-scale microsystems with photonic-electronic-integrated-circuits. Future prospects and challenges in computing and networking applications will also be discussed.
Fabrication of Gray-Scale Semiconductor Structures with Dynamic Digital Projection Photochemical Etching

L. L. Goddard; 1; K. Wang; 1; C. Edwards; 1; S. N. Srivastava; 1;
1. University of Illinois at Urbana-Champaign, Urbana, IL, United States.

Abstract (35 Word Limit): Digital projection photochemical etching is a novel single-step process for fabricating customized gray-scale semiconductor structures. Several features including a variable height pyramid array are fabricated, demonstrating the resolution, range, accuracy, and dynamics of the technique.
Ultra-High Q Silicon Resonators In Planarized LOCOS
A. Naiman; 1; B. Desiatov; 1; L. Stern; 1; N. Mazurski; 1; J. Shapir; 1; U. Levy; 1;
1. The Hebrew University of Jerusalem, Jerusalem, Israel.

Abstract (35 Word Limit): We describe a modified local oxidation of silicon process as a platform for the fabrication of waveguides and ultra-high Quality factor (5.3 million) silicon resonators, with nearly fully planar interface for multilayer silicon integration.
Improvement of Silicon Dioxide Ridge Waveguides Using Low Temperature Thermal Annealing

J. Parks; 1; H. Cai; 1; T. Wall; 2; M. Stott; 2; R. Chu; 2; E. Hamilton; 2; A. Hawkins; 2; H. Schmidt; 1;
1. University of California Santa Cruz, Santa Cruz, CA, United States.
2. Brigham Young University, Provo, UT, United States.

Abstract (35 Word Limit): Penetration of liquids into SiO₂ ridge waveguides during standard processing steps is shown to cause poor mode confinement and increased loss. Thermal annealing repeatedly restores a core with uniform index and low-loss mode confinement.
Photonic Damascence Process for high-Q SiN Microresonator Fabrication for Nonlinear Photonics

M. Pfeiffer; 1; A. Kordts; 1; V. Brasch; 1; C. Lecaplain; 1; J. D. Jost; 1; M. Geiselmann; 1; t. kippenberg; 1;
1. Ecole Polytechnique Federale de Lausanne, Lausanne, VD, Switzerland.

Abstract (35 Word Limit): Integrated microresonators based on SiN waveguides are an attractive platform for nonlinear optics. Here we present a new photonic Damascene fabrication process that solves common problems in SiN waveguide fabrication and demonstrate frequency comb formation.
Nonlinear Optical Processes and DUV Generation in Random Domain Structures of SBO

A. S. Aleksandrovsky; 1, 2
1. L.V.Kirensky Insitute of Physics, Krasnoyarsk, Russian Federation.
2. Photonics and Laser Technologies Department, Siberian Federal University, Krasnoyarsk, Russian Federation.

Abstract (35 Word Limit): Random domain structures in strontium tetraborate enhance nonlinear optical conversion for variety of processes within transparency window (121 nm). Properties of material, frequency doubling, autocorrelation measurements and conversion of supercontinuum to UV are described.
Generation of Coherent Vacuum UV Radiation in Randomly Quasi-Phase-Matched Strontium Tetraborate

V. Petrov; 1; P. Trabs; 1; F. Noack; 1; A. S. Aleksandrovsky; 2, 4; A. Zaitsev; 2, 3;
1. Max Born Institute, Berlin, Germany.
2. L. V. Kirensky Institute of Physics, Krasnoyarsk, Russian Federation.
4. Siberian Federal University, Krasnoyarsk, Russian Federation.

Abstract (35 Word Limit): Tunable coherent radiation is generated in the VUV down to 121 nm using random quasi-phase-matching in strontium tetraborate, the shortest wavelength ever produced with a second-order nonlinear optical process in a solid-state material.
Frequency Conversion in Periodically Oriented Gallium Nitride

S. R. Bowman; 1; C. G. Brown; 2; J. Hite; 1; F. J. Kub; 1; C. Eddy; 1; I. Vurgaftman; 1; J. R. Meyer; 1; J. H. Leach; 3; K. Udwary; 3,

1. US Naval Research Laboratory, Washington, DC, United States.
2. University Research Foundation, Greenbelt, MD, United States.

Abstract (35 Word Limit): Broadband transparency, high thermal conductivity, and strong nonlinearity make gallium nitride a promising material for high power frequency conversion. We have fabricated and tested periodically oriented gallium nitride (PO-GaN) devices for quasi-phase matched (QPM) frequency conversion.
Violet second harmonic generation in adhered slab waveguide based on periodically poled lithium tantalate

H. Lim; S. Kurimura; K. Fujii; M. Okano; S. Takeuchi;

1. National Institute for Materials Science, Tsukuba, Ibaraki, Japan.
2. Kyoto University, Kyoto, Japan.
3. Hokkaido University, Sapporo, Japan.

Abstract (35 Word Limit): We demonstrated CW SHG at 400 nm in a first-order QPM adhered slab waveguide with a periodically-poled Mg-doped stoichiometric lithium tantalate core. The measured SHG normalized conversion efficiency was 34.7%/W for a 20 mm length.
PP-LBGO device with 2nd-order QPM structure for 266nm generation

J. Hirohashi; 1; T. Taniuchi; 2; K. Imai; 1; Y. Furukawa; 1,
1. Oxide Corporation, Hokuto, Yamanashi, Japan.
2. FRIS, Tohoku University, Sendai, Japan.

Abstract (35 Word Limit): Second harmonic 266nm generation was demonstrated by periodically-poled LaBGeO5 (PP-LBGO) with 2nd-order QPM structure. More than 15mW of 266nm was obtained from nano-second-pulsed 532nm laser. Circular beam at 266nm without walk-off was obtained.
Tunable Second Harmonic Generation of a Continuous-wave Carbon Dioxide Laser Using 3 mm Thick Orientation Patterned GaAs Crystals in Fan-out and Single-grating-period Configurations

S. Guha; J. Barnes; L. P. Gonzalez; P. G. Schunemann;
1. US Air Force Research Laboratory, Wright Patterson AFB, OH, United States.
2. BAE Corporation, Nashua, NH, United States.
3. UES, Inc., Dayton, OH, United States.

Abstract (35 Word Limit): We report room temperature frequency doubling of a continuous-wave carbon dioxide laser tuned from 9.26 to 10.65 micrometers using large-aperture OPGaAs crystals (>3 mm thick by >7.5 mm wide) in fan-out and single grating configurations.
Third harmonic generation in ultrathin epsilon-near-zero media

T. Luk; 4, 6; D. de Ceglia; 2; G. Keeler; 4; R. P. Prasankumar; 1, 3; M. A. Vincenti; 2; S. Liu; 4, 6; M. Scalora; 5; M. B. Sinclair; 4; S. Campione; 4, 6;

1. Los Alamos National Laboratory, Albuquerque, NM, United States.
2. National Research Council-AMRDEC, Redstone Arsenal, AL, United States.
4. Sandia National Laboratories, Albuquerque, NM, United States.
5. Charles M. Bowden Research Laboratory AMRDEC, Redstone Arsenal, AL, United States.

Abstract (35 Word Limit): We demonstrate efficient third harmonic generation from a 21.6nm indium tin oxide film on glass substrate for a pump fundamental wavelength of 1350nm using the field enhancement properties of optical modes supported by epsilon-near-zero media.
Diamond Electro-optomechanical Devices with Resonance Frequencies above 100 MHz

P. Rath; S. Ummethala; S. Diewald; G. Lewes-Malandrakis; D. Brink; N. Heidrich; C. Nebel; W. Pernice;

1. Institute of Nanotechnology, Karlsruhe Institute of Technology, Eggenstein-Leopoldshafen, Germany.
2. Center for Functional Nanostructures, Karlsruhe Institute of Technology, Karlsruhe, Germany.
3. Fraunhofer Institute for Applied Solid State Physics, Freiburg, Germany.

Abstract (35 Word Limit): We realize diamond electro-optomechanical resonators operated at frequencies above 100 MHz. The nanomechanical motion is read-out via on-chip diamond photonic circuits showing Q-factors above 1300.
GaAs nanobeam piezo-optomechanical crystals
K. C. Balram; 1, 2; M. I. Davanco; 1; J. Lim; 3; J. Song; 3; K. Srinivasan; 1;
1. Center for Nanoscale Science and Technology, National Institute of Standards and Technology, Gaithersburg, MD, United States.
2. Maryland Nanocenter, University of Maryland, College Park, MD, United States.

Abstract (35 Word Limit): We demonstrate GaAs optomechanical crystals with large coupling rates (g0/2π≈1.1MHz) through the photoelastic effect. We show a significant orientation (∼30%) dependence of g0, observe 2.5 GHz regenerative oscillations, and explore excitation via piezoelectrically-driven surface-acoustic-waves.
Diamond Nanobeam Waveguide Optomechanics

B. Khanaliloo; 1, 2; H. Jayakumar; 1; D. Lake; 1; P. E. Barclay; 1, 2;
1. University of Calgary, Calgary, ON, Canada.

Abstract (35 Word Limit): Single crystal diamond (SCD) waveguide nanomechanical resonators with mechanical quality factors exceeding $7 \times 10^5$ in cryogenic conditions are demonstrated. Mechanical self-oscillations are observed with amplitudes of 200 nm.
Enhanced Coupling in Si$_3$N$_4$ Slot-Mode Optomechanical Crystals via Stress Tuning

K. Grutter; 1; M. I. Davanco; 1; K. Srinivasan; 1;
1. NIST, Gaithersburg, MD, United States.

Abstract (35 Word Limit): We demonstrate Si$_3$N$_4$ slot-mode optomechanical crystals with optical $Q$s up to $1.65 \times 10^5$ and mechanical frequencies around 3.4 GHz. Tensile stress tunes gap widths down to 24 nm, enhancing coupling and enabling radiation-pressure-driven self-oscillation.
Subharmonics radio-frequency division in chip-scale optomechanical oscillators

J. Wu; 1, 2; Y. Huang; 1, 3; M. Yu; 4; D. Kwong; 4; C. Wong; 1;

1. Department Of Electrical Engineering, University of California, Los Angeles,, Mesoscopic Optics and Quantum Electronic, Los Angeles, CA, United States.
2. Southwest University, School of Physics, Chongqing, Chongqing, China.
3. School of Communication and Information Engineering, University of Electronic Science and Technology of China, Centre for RFIC and System Technology, Chengdu, China.
4. The Institute of Microelectronics,, 11 Science Park Road,, Singapore.

Abstract (35 Word Limit): Subharmonics radio-frequency division and generation are experimentally demonstrated in nano-optomechanical cavity. The dual-coupled intracavity nonlinear optomechanical and Drude plasma oscillators demonstrate new dynamics regimes, with free-running high amplitude low-phase-noise clocking.
Synchronization and Phase Noise Reduction in Arrays of Optomechanical Oscillators

M. Zhang; M. Lipson; 1

1. Cornell University, Ithaca, NY, United States.

Abstract (35 Word Limit): We demonstrate the reduction of phase noise 10 dB below the thermomechanical noise limit of individual oscillators in arrays up to seven synchronized self-sustaining optomechanical oscillators.
Frequency instability and phase noise characterization of an integrated chip-scale optomechanical oscillator

Y. Huang; 1, 3; J. Wu; 1, 2; X. Luan; 2; S. Huang; 1, 2; M. Yu; 4; G. Lo; 4; D. Kwong; 4; G. Wen; 3; C. Wong; 1, 2

1. Electrical Engineering Department, University of California at Los Angeles, Los Angeles, CA, United States.
2. Mechanical Department, Columbia University, New York, NY, United States.
3. Univ of Electronic Sci & Tech of China, Chengdu, SiChuan, China.
4. The Institute of Microelectronics, Singapore, Singapore.

Abstract (35 Word Limit): We characterize the frequency instability and single-sideband phase noise of chip-scale optomechanically-driven oscillators, with integrated Ge photoreceivers. At 400-μW, an open-loop frequency instability at 10^{-8} is observed, with -125 dBC/Hz phase noise at 10-kHz offset.
Multi-stable Synchronization of Delay-Coupled Optomechanical Oscillators

S. Y. Shah; 1; M. Zhang; 1; M. Lipson; 1, 2;

1. School of Electrical and Computer Engineering, Cornell University, Ithaca, NY, United States.
2. Kavli Institute at Cornell, Cornell University, Ithaca, NY, United States.

Abstract (35 Word Limit): We demonstrate synchronisation between two independent optomechanical oscillators coupled through an optical delay of 138.76ns. By varying the coupling strengths, we observe multiple stable synchronised states with different frequencies, enabling applications in reconfigurable RF networks.
Finding Bugs in your Ear: Clinical Imaging of Middle-Ear Infections and Biofilms using OCT

S. A. Boppart; 1
1. Univ of Illinois at Urbana-Champaign, Urbana, IL, United States.

Abstract (35 Word Limit): Handheld OCT scanners have been developed for screening and characterizing middle-ear infections that are highly prevalent in the pediatric population. OCT enables non-invasive identification of bacterial biofilms that will impact clinical treatment of this disease.
Integrative Advances for OCT-Guided Ophthalmic Surgery and Intraoperative OCT
Y. K. Tao; M. El-Haddad; S. Srivastava; D. Feiler; A. Noonan; A. Rollins; J. Ehlers;
1. Cole Eye Institute Cleveland Clinic, Cleveland, OH, United States.
2. Biomedical Engineering, Case Western Reserve University, Cleveland, OH, United States.

Abstract (35 Word Limit): Microscope-integrated intraoperative OCT (iOCT) allows live cross-sectional imaging concurrent with ophthalmic surgery and dynamic visualization of tissue-instrument interactions. We present a microscope-integrated iOCT system with heads-up display (HUD) and novel semi-transparent ophthalmic surgical instruments.
Deuterated Cholesterol Uptake Revealed With Stimulated Raman Microscopy

A. Alfonso Garcia; 1; S. Pfisterer; 2; H. Riezman; 3; E. Ikonen; 2; E. O. Potma; 1

1. University of California Irvine, Irvine, CA, United States.
2. Institute of Biomedicine, University of Helsinki, Helsinki, Finland.
3. Department of Biochemistry, Université de Genève, Genève, Switzerland.

Abstract (35 Word Limit): Cholesterol is involved in multiple vital processes, thus in multiple diseases. Synergies between coherent Raman microscopy and deuterated compounds provide the ultimate tool towards live visualization of cholesterol pathways.
Dynamic vocal fold imaging by integrating optical coherence tomography with laryngeal high-speed video endoscopy
N. Iftimia, 1 G. Maguluri, 1 E. Chang, 1
1. Physical Sciences Inc., Andover, MA, United States.

Abstract (35 Word Limit): We demonstrate three-dimensional vocal fold imaging during phonation by integrating optical coherence tomography with high-speed videoendoscopy. Results from ex vivo larynx experiments yield reconstructed vocal fold surface contours for ten phases of periodic motion.
Imaging Patient Derived Breast Cancer Xenografts in an Orthotopic Mammary Window Chamber Model

H. M. Leung; 1, 2; R. Schafer; 1, 4; A. F. Gmitro; 1, 3;
1. University of Arizona (OSC), Tucson, AZ, United States.
2. College of Optical Sciences, Tucson, AZ, United States.
3. Department of Medical Imaging, University of Arizona, Tucson, AZ, United States.
4. Department of Biomedical Engineering, University of Arizona, Tucson, AZ, United States.

Abstract (35 Word Limit): We demonstrate for the first time optical and magnetic resonance imaging of breast cancer patient derived xenografts in an orthotopic mammary window chamber model. In vivo imaging of oxygen saturation, apparent diffusion coefficient and blood perfusion were performed.
Highly Selective VOC Breath Analysis Using a 3.3 μm Broadly-Tunable VECSEL

J. Jägerská; 1; H. Looser; 2; B. Tuzson; 1; F. Felder; 3; L. Tappy; 4; L. Emmenegger; 1;
1. EMPA, Dübendorf, Switzerland.
2. FHNW, Windisch, Switzerland.
3. Camlin Technologies AG, Zürich, Switzerland.
4. Université de Lausanne, Lausanne, Switzerland.

Abstract (35 Word Limit): Mid-infrared VECSEL tunable over 50 cm$^{-1}$ is employed to measure trace gas concentrations of acetone in human breath. A detection limit of 25 ppb is demonstrated without any sample preparation.
Brillouin microscopy for tissue and cell biomechanics

G. Scarcelli; 2, 1;
1. Harvard Medical School, Cambridge, MA, United States.
2. Bioengineering, University of Maryland, College Park, MD, United States.

Abstract (35 Word Limit): We have developed an all-optical approach to measure material mechanical properties using Brillouin light scattering. Brillouin imaging uses the elastic modulus as contrast mechanism. We demonstrate its application in vivo for tissue and cellular biomechanics.
Enhanced Detection of Longitudinal Field of a Radially Polarized Beam in Confocal Laser Microscopy
Y. Kozawa; S. Sato;
1. Institute of Multidisciplinary Research for Advanced Materials, Tohoku University, Sendai, Miyagi, Japan.

Abstract (35 Word Limit): The wave scattered by the longitudinal component of a tightly focused radially polarized beam is clearly detected in a confocal system, which may lead to the enhancement of the spatial resolution in confocal microscopy.
Towards Automated Detection of Basal Cell Carcinoma from Polarization Sensitive Optical Coherence Tomography Images of Human Skin

T. Marvdashti; 1, L. Duan; 1, K. Ransohoff; 1, S. Aasi; 1, J. Tang; 1, A. Ellerbee; 1;
1. Stanford University, Stanford, CA, United States.

Abstract (35 Word Limit): We report on the initial results of the first automated classifier to distinguish basal cell carcinomas and healthy skin using polarization sensitive optical coherence tomography (PS-OCT) with a sensitivity and specificity of 84.2% and 85.8%
Phase-inverted sidelobe-annihilated optical coherence tomography to break through the temporal diffraction limit

Abstract (35 Word Limit): Understand the tomography system as a temporal microscopy by space-time duality, a simple adjustment was performed on a conventional swept-source optical coherence tomography (SS-OCT), and achieved sharper resolution (~4 μm) for the single layer measurement.
Ultrafast spectral-domain optical coherence tomography realized by parametric spectro-temporal analyzer

C. Zhang; 1, X. Wei; 1; Y. Xu; 1; J. Xu; 1; L. Yu; 1; B. Li; 1; S. Tan; 1; A. Lau; 1; X. Wang; 1; X. Xu; 1; K. K. Tsia; 1; K. Wong; 1;
1. University of Hong Kong, Hong Kong, Hong Kong.
2. Wuhan National Laboratory for Optoelectronics, Huazhong University of Science and Technology, Wuhan, Hubei, China.

Abstract (35 Word Limit): Performance of the spectral-domain optical coherence tomography is limited by its A-scan rate, namely the frame rate of spectrometer. In this paper, 60-MHz A-scan rate is achieved by adopting a recently demonstrated parametric spectro-temporal analyzer.
Abstract (35 Word Limit): A photothermal imaging microscope for single metal nanoparticles using single element interferometer has been developed. In this report, 20-nm gold nanoparticles in scattering environment was detected selectively with SNR ~20.
Dynamic Label-free Imaging of Live-cell Adhesion Using Photonic Crystal Enhanced Microscopy (PCEM)

Y. Zhuo; 1, 2; J. S. Choi; 3, 4; H. Yu; 5, 2; B. A. Harley; 3, 4; B. T. Cunningham; 1, 2;

1. Department of Bioengineering, University of Illinois at Urbana-Champaign, Urbana, IL, United States.
2. Micro and Nanotechnology Laboratory, University of Illinois at Urbana-Champaign, Urbana, IL, United States.
3. Department of Chemical and Biomolecular Engineering, University of Illinois at Urbana-Champaign, Urbana, IL, United States.
4. Institute for Genomic Biology, University of Illinois at Urbana-Champaign, Urbana, IL, United States.
5. Department of Electrical and Computer Engineering, University of Illinois at Urbana-Champaign, Urbana, IL, United States.

Abstract (35 Word Limit): We demonstrate label-free imaging of cell attachment upon a photonic-crystal biosensor surface. Newly-implemented image-analysis software is used to dynamically visualize individual live-cell movement and demonstrate the spatiotemporal-distribution of cellular material during adhesion and motion.
Final ID: STh3M.1

Rapid and highly-sensitive detection using Fano resonances in ultrathin plasmonic nanogratings

B. Zeng; 1

1. Lehigh University, Bethlehem, PA, United States.

Abstract (35 Word Limit): We developed a nanoplasmonic sensor employing extraordinary optical properties of 30nm-thick ultrathin Ag nanogratings. An order-of-magnitude improvement in the temporal and spatial resolutions was achieved relative to state-of-the-art nanoplasmonic sensors, for comparable detection resolutions.
Far-field Scattering Measurement of a Single Gold Nanorod Using Total-Internal-Reflection Illumination

D. Kim; 1; K. Jeong; 2; H. Ee; 1; H. Park; 2; M. Seo; 1;
1. Physics, Korea Advanced Institute of Science and Technology(KAIST), Daejeon, Korea (the Republic of).
2. Physics, Korea University, Seoul, Korea (the Republic of).

Abstract (35 Word Limit): We demonstrate a novel method for measuring far-field scattering of a single nanostructure with a high signal-to-background ratio using total-internal-reflection illumination. Direct far-field scanning overcomes the numerical aperture limit of the typical back-focal plane imaging.
Fabrication of high-Q lithium niobate microresonators using femtosecond laser micromachining for second harmonic generation

J. Lin; 1; Y. Xu; 2; Z. Fang; 1; M. Wang; 1; J. Song; 1; N. Wang; 1; L. Qiao; 1; W. Fang; 2; Y. Cheng; 1;

2. Department of Optical Engineering, Zhejiang University, State Key Laboratory of Modern Optical Instrumentation, Hangzhou, China.

Abstract (35 Word Limit): We report on fabrication of high-Q (i.e., a quarter million) lithium niobate whispering-gallery-mode microresonators using femtosecond laser micromachining. Second harmonic generation with a normalized conversion efficiency of $1.35\times10^{-5}$/mW has been experimentally demonstrated.
Cavity-Enhanced Mid-IR Optical Frequency Comb Spectroscopy: Enhanced Time and Spectral Resolution
O. H. Heckl; 1; B. Spaun; 1; P. B. Changala; 1; B. Bjork; 1; D. Patterson; 2; J. M. Doyle; 2; J. Ye; 1;
1. JILA, CU Boulder, Boulder, CO, United States.
2. Department of Physics, Havard University, Cambridge, MA, United States.

Abstract (35 Word Limit): CE-DFCS has been applied to buffer gas cooled acetylene achieving a Doppler-limited spectral resolution of 90 MHz. Additionally TRFCS allows for the detection of trans-DOCO in photolysis reaction kinetics with a molecular sensitivity of $10^{10}$ cm$^{-3}$. 
3D Laser Ablation of Biocompatible Silk Fibroin Hydrogels for Biomedical Applications

M. Applegate; 1; B. P. Partlow; 1; J. Coburn; 1; J. Moreau; 1; B. Marelli; 1; D. Kaplan; 1; F. Omenetto; 1, 2;
1. Biomedical Engineering, Tufts University, Medford, MA, United States.
2. Physics, Tufts University, Medford, MA, United States.

Abstract (35 Word Limit): Voids were created inside biocompatible, optically transparent silk fibroin hydrogels via multi-photon ablation in arbitrary 3D patterns at a maximum depth of nearly 1 cm without exogenous photoinitiators.
Super-resolution Optical Nanolithography: Beyond the far-field diffraction limit

A. Majumder, 1 F. Masid, 1 B. Pollock, 2 T. Andrew, 2 R. Menon, 1

1. University of Utah, Salt Lake City, UT, United States.
2. University of Wisconsin-Madison, Madison, WI, United States.

Abstract (35 Word Limit): We report on overcoming the far-field diffraction limit using an approach that we call Absorbance Modulation Optical Lithography (AMOL).
The optical absorption in zincblende and wurtzite GaP nanowire polytypes

M. Aghaeipour; 1; N. Anttu; 1; G. Nylund; 1; L. Samuelson; 1; S. Lehmann; 1; M. Pistol; 1;

Abstract (35 Word Limit): Diameter-dependent absorption resonances in semiconductor nanowires are promising for tunable detectors. Here, we show that the optical resonances for both wurtzite and zincblende GaP nanowires can be tuned down to $\lambda \approx 330$ nm by decreasing the diameter of the nanowires to 35 nm.
Strong exciton-photon coupling in monolayer heterostructures in tunable microcavities

S. Schwarz; 1; S. Dufferwiel; 1; F. Withers; 2; A. Trichet; 3; F. Li; 1; C. Clark; 4; K. Novoselov; 2; J. M. Smith; 3; M. S. Skolnick; 1; D. N. Krizhanovskii; 1; A. Tartakovskii; 1;
1. University of Sheffield, Sheffield, United Kingdom.
2. University of Manchester, Manchester, United Kingdom.
4. Helia Photonics, Livingston, United Kingdom.

Abstract (35 Word Limit): Strong light-matter interaction in two-dimensional molybdenum diselenide (MoSe2) is observed using a tunable optical microcavity. Polariton states with a Rabi splitting of 20 and 29 meV are observed for a monolayer MoSe2 and a 'double-well' MoSe2/hBN/MoSe2, respectively.
All-fiber bidirectional optical parametric oscillator for precision rotation sensing
K. Q. Kieu; 1; R. Gowda; 1; N. Nguyen; 1; J. diels; 2; R. Norwood; 1; N. Peyghambarian; 1;
1. University of Arizona, Tucson, AZ, United States.
2. Physics, University of New Mexico, Albuquerque, NM, United States.

Abstract (35 Word Limit): We demonstrate the first all-fiber bidirectional OPO which generates two highly coherent frequency combs in opposite directions. The OPO may find important applications in precision measurements including rotation sensing with ultra-large sensing area and sensitivity.
Pulse-to-pulse spectral evolution of breathing bound solitons in a mode-locked fiber laser

D. V. Churkin; 1, 2; S. Sugavanam; 1; C. Mou; 1, 2; J. Peng; 1;

1. Aston Institute of Photonic Technologies, Birmingham, United Kingdom.
2. Novosibirsk State University, Novosibirsk, Russian Federation.

Abstract (35 Word Limit): We make first direct observation of breathing bound solitons in mode-locked laser. We measure pulse-to-pulse spectrum evolution and reveal internal interactions between bound solitons in real-time.
Dissipative soliton thulium fiber laser with pulse energy above 10 nJ

Y. Tang; 1; F. W. Wise; 1;
1. Cornell University, Ithaca, NY, United States.

Abstract (35 Word Limit): Dissipative-soliton operation of a Tm fiber laser yields 11 nJ pulses, which is several times the energy of prior femtosecond Tm fiber lasers. The pulses can be dechirped to 200 fs duration.
Observing the spectral dynamics of a mode-locked laser with ultrafast parametric spectro-temporal analyzer

X. Wei; C. Zhang; B. Li; K. Wong;

1. Wuhan National Laboratory for Optoelectronics & School of Optical and Electronic Information, Huazhong University of Science and Technology, Wuhan 430074, China, Wuhan, China.

Abstract (35 Word Limit): We experimentally observe the spectral dynamics of a passively mode-locked fiber laser by using a parametric spectro-temporal analyzer (PASTA) with a frame rate up to 100 MHz, and different non-repeating transient dynamics has been observed.
Nonlinearity Engineering of Ultrafast Lasers and Laser-Material Interactions

F. Ilday, 1, 2

1. Department of Electrical and Electronics Engineering, Bilkent University, Cankaya, Ankara, Turkey.
2. Department of Physics, Bilkent University, Ankara, Turkey.

Abstract (35 Word Limit): From novel mode-locking regimes to laser-induced self-assembly of nanostructures, it is not only possible, but highly rewarding to exploit the underlying nonlinear dynamics of photonic systems towards achieving superior technical functionality. These different dissipative systems manifest similar phenomena, such as nonlinear gain, feedback, and modulation instability.
Ultra-low Jitter Timing Transfer over a Multi-km Fiber Network with $10^{-21}$ Relative Stability

K. Shafak; 1; M. Xin; 1; M. Y. Peng; 2; F. X. KAERTNER; 1, 2;

2. Department of Electrical Engineering and Computer Science and Research Laboratory of Electronics, Massachusetts Institute of Technology, Cambridge, MA, United States.

Abstract (35 Word Limit): Long-term stable timing transfer over a multi-km fiber network is reported. Output of two independently timing-stabilized fiber links shows only 0.73 femtoseconds RMS total jitter over 35 hours corresponding to $10^{-21}$ relative link stability.
Simultaneous Time and Frequency Transfer over a 158-km-Long Fiber Network Using a Mode-Locked Laser

M. Lessing; 1, 2; H. S. Margolis; 1; C. Brown; 2; G. Marra; 1
1. National Physical Laboratory, Teddington, United Kingdom.
2. School of Physics and Astronomy, University of St Andrews, St Andrews, United Kingdom.

Abstract (35 Word Limit): We present a technique for simultaneous optical and microwave frequency transfer as well as time transfer using a mode-locked laser. We demonstrate a time deviation of 300 fs at 10 s averaging time on an installed 158 km fiber link.
Ultrastable Frequency Dissemination Based on Feed-forward Digital Phase Compensation Technology

X. Chen; J. Zhang; J. Lu; Y. Cui; X. Lu; Z. Lv; X. Tian; C. Ci; B. Liu; H. Wu; T. Tang; K. Shi; Z. Zhang;
1. Peking University, Beijing, Beijing, China.
2. Nankai University, Tianjin, China.

Abstract (35 Word Limit): We demonstrate a feed-forward digital compensation scheme in an optical frequency comb based microwave frequency dissemination system over 120-km telecommunication fiber link. The dissemination fractional frequency instability (Λ-counter) was measured at 5.28×10^{-16}/s.
Phase Stabilized Radio Frequency Signal Transmission via Optical Fiber Link

A. Zhang, F. Yin, Y. Dai, J. Li, K. Xu

1. Beijing University of Posts and Telecommunications, Beijing, Beijing, China.

Abstract (35 Word Limit): A phase-stabilized RF transmission scheme is demonstrated with suppressed noise. A 2.48GHz signal has been transferred through a 60km optical fiber link, with stability of $8.1 \times 10^{-14}$ at 1s and $1.1 \times 10^{-16}$ at 2000s averaging time, respectively.
Frequency and Timing Distribution using Optical Methods

N. R. Newbury;¹


Abstract (35 Word Limit): With the ever-increasing performance of optical clocks, it is important to develop parallel methods for optically-based frequency/timing distribution. I will review frequency combs, established methods for distribution over fiber-optics, and recent demonstrations over free-space links.
Monostatic All-Fiber Rangefinder System

J. Leach; ¹, S. R. Chinn; ², L. Goldberg; ¹,
1. NVESD, Fort Belvoir, VA, United States.
2. Fulcrum Company, Centerville, VA, United States.

Abstract (35 Word Limit): An all-fiber monostatic laser rangefinder, using a double cladding fiber to transmit and receive light through a single lens is described. Ranging to >50 m with 12 uJ, 8 ns, 1540 nm pulses is shown. The all-fiber system is compact and needs no precise receiver/transmitter beam alignment.
Continuous-Wave Laser Range Finder Based on Incoherent Compression of Periodic Sequences

A. Zadok; 1; N. Arbel; 1; L. Hirschbrand; 1; S. Weiss; 1; N. Levanon; 2;
1. Bar-Ilan University, Givat Shmuel, Israel.
2. Tel Aviv University, Tel Aviv, Israel.

Abstract (35 Word Limit): Continuous and incoherent laser range finder is presented, based on repeating transmission of Legendre amplitude codes and post detection compression. The cyclic correlation sidelobes of the sequences are identically zero. The concept is demonstrated experimentally.
Experimental Demonstration of Differential Synthetic Aperture Ladar

Z. W. Barber; J. R. Dahl; 1

1. Montana State University - Spectrum Lab, Bozeman, MT, United States.

Abstract (35 Word Limit): Differential SAL measures phase slopes to reduce the inherent sensitivity to piston phase errors during the data collection process. The first experimental demonstrations of the technique and comparisons to image based phase compensation are presented.
Rapid Swept-Wavelength External Cavity Quantum Cascade Laser for Open Path Sensing

B. Brumfield; M. C. Phillips; 1
1. Pacific Northwest National Laboratory, Richland, WA, United States.

Abstract (35 Word Limit): A rapidly tunable external cavity quantum cascade laser system is used for open path sensing. The system permits acquisition of transient absorption spectra over a 125 cm⁻¹ tuning range in less than 0.01 s.
Low Power Integrated Path Differential Absorption Lidar Detection of CO$_2$, CH$_4$ and H$_2$O over a 5.5 km Path using a Waveform Driven EO Sideband Spectrometer


Abstract (35 Word Limit): A rapid-scan remote-sensing spectrometer based on an arbitrary waveform driven electro-optic phase modulator for spectral scans over 37 GHz and a telescope/photon counting system for detection was used to measure long term ambient level concentrations of greenhouse gases from natural targets.
Progress toward a high-resolution single-photon camera based on superconducting single photon detector arrays and compressive sensing

T. Gerrits; S. Allman; D. Lum; V. Verma; J. Howell; R. P. Mirin; S. Nam;
2. Department of Physics and Astronomy, University of Rochester, Rochester, NY, United States.

Abstract (35 Word Limit): We present our results on utilizing an SNSPD array and compressive imaging techniques to perform single photon imaging and present our progress toward a high-resolution single-photon camera for the mid-IR.
Computational Optical Density-Density Correlation Sensing

M. Akhlaghi Bouzan; 1; A. Dogariu; 1;
1. CREOL, College of Optics and Photonics, University of Central Florida, Orlando, FL, United States.

Abstract (35 Word Limit): Numerical and experimental results demonstrate a stochastic sensing technique based on enhancing intensity fluctuations. Statistical moments of reflectivity can be recovered, which characterize scattering from static and dynamic targets placed in random environments.
Standoff Detection of Buried Landmines Using Genetically Engineered Fluorescent Bacterial Sensors

Y. Kabessa; O. Eyal; O. Bar-On; S. Yagur-Kroll; S. Belkin; A. Agranat;
1. HUJI, Nof Ayalon, Israel.

Abstract (35 Word Limit): A Standoff detection scheme for buried landmines and concealed explosive charges based on genetically engineered bacterial biosensors is presented. Concentrations of 4 mg/L of 2,4-DNT on soil were detected from a distance of 50 meters.
Strategies for Nanofabrication based on Optothermal Manipulation of Plasmonic Nanoparticles

T. Lohmüller; 1
1. Physics, LMU Munich, Munich, Germany.

Abstract (35 Word Limit): Optothermal manipulation of individual gold nanoparticles renders it possible to control polymerization reactions and thermal curing of polymers at the nanoscale. This can be used to synthesize polymer nanoparticles and -wires with sub-diffraction limited resolution.
Multiphoton Processing Technologies for Applications in Biology and Tissue Engineering
J. Torgersen; 1 A. Ovsianikov; 2 R. Liska; 3 J. Stampfl; 2
1. Nanoscale Prototyping Laboratory, Stanford University, Stanford, CA, United States.
2. Institute of Materials Science and Technology, Vienna University of Technology, Vienna, Austria.
3. Institute of Applied Synthetic Chemistry, Vienna University of Technology, Vienna, Austria.

Abstract (35 Word Limit): Versatile microfabrication technologies are presented utilizing photochemistry induced by multiphoton absorption of ultra-short laser pulses. Processing novel biophotopolymers, we show how customized cell microenvironments can be fabricated mimicking the complexity of the natural extra-cellular matrix.
Hybrid Subtractive and Additive Micromanufacturing using Femtosecond Laser for Fabrication of True 3D Biochips
K. Sugioka; 1 D. Wu; 1 J. Xu; 1 F. Sima; 1 K. Midorikawa; 1
1. RIKEN Center for Advanced Photonics, Wako, Saitama, Japan.

Abstract (35 Word Limit): We propose conjugation of subtractive and additive 3D manufacturing using femtosecond laser for fabrication of functional biochips. Specifically, femtosecond laser 3D glass micromachining followed by two-photon polymerization are performed to realize true 3D biochips.
Bad Cavities for Good Memories: Storing Broadband Photons with Low Noise

T. F. Champion; 1, J. Nunn; 1, J. Munns; 1, 2, C. Qiu; 1, 3, D. Saunders; 1, I. A. Walmsley; 1;
2. Physics, Imperial College, London, United Kingdom.
3. Physics, East China Normal University, Shanghai, China.

Abstract (35 Word Limit): Quantum memories are vital for synchronising photonic operations. Broadband, room-temperature storage in Raman memories is hampered by four-wave mixing noise. Here we show how to eliminate the noise with a low-finesse cavity.
Complete Control of Frequency-Time Correlation of Narrow-Band Biphotos from Cold Atoms

K. Park; 1; Y. Cho; 1, 2; J. Lee; 1; Y. Kim; 1;
1. Pohang University of Science and Technology (POSTECH), Pohang, Korea (the Republic of).
2. Quantum Science, Centre for Quantum Computation and Communication Technology, Canberra, ACT, Australia.

Abstract (35 Word Limit): The nonclassical photon pair is naturally endowed with a specific form of frequency-time quantum correlations. Here, we report complete control of time quantum correlations of narrowband biphotos generated in a cold atomic ensemble.
Optical Nanofibers as Light-Matter Interfaces for Quantum Networks

B. Gouraud; 1; D. Maxein; 1; A. Nicolas; 1; O. Morin; 1, 2; J. Laurat; 1;

1. Laboratoire Kastler Brossel, UPMC-Sorbonne Universités, CNRS, ENS-PSL Research University, Collège de France, Paris, France.
2. Max-Planck-Institut für Quantenoptik, Garching, Germany.

Abstract (35 Word Limit): We report the single-photon-level storage of light tightly guided in an optical nanofiber. Our setup is based on electromagnetically induced transparency for atoms interacting with the evanescent field surrounding the nanofiber.
THz-bandwidth molecular memories for light

B. Sussman; 1; P. J. Bustard; 1; J. Erskine; 1; D. England; 1; R. Lausten; 1;

1. National Research Council Canada, Ottawa, ON, Canada.

Abstract (35 Word Limit): We use the vibrational levels of hydrogen molecules as a memory for light to store 100-fs pulses. We also demonstrate non-classical correlations in an emissive quantum memory using rotational levels of hydrogen molecules.
Storage and retrieval of ultrafast single photons using a room-temperature diamond quantum memory

K. Fisher; 1; D. England; 2; J. Maclean; 1; P. Bustard; 2; R. Lausten; 2; K. J. Resch; 1; B. Sussman; 2;
1. University of Waterloo, Kitchener, ON, Canada.
2. National Research Council of Canada, Ottawa, ON, Canada.

Abstract (35 Word Limit): We experimentally demonstrated the storage and retrieval of THz-bandwidth single photons in a room-temperature diamond quantum memory. We have shown that the non-classical nature of retrieved light is preserved by the memory process.
Scalable Integration of Solid State Quantum Memories into a Photonic Network

S. L. Mouradian; 1; T. Schroder; 1; C. B. Poitras; 2; L. Li; 1; J. Goldstein; 1; E. Chen; 1; J. Zheng; 3; I. Bayn; 3; J. Mower; 1; N. C. Harris; 1; A. Dane; 1; K. K. Berggren; 1; M. Lipson; 2; D. Englund; 1;

1. Massachusetts Institute of Technology, Somerville, MA, United States.
2. EECS, Cornell University, Ithaca, NY, United States.
3. Columbia University, New York, NY, United States.

Towards Detection of Single Rare-Earth-Ions in a Nanophotonic Resonator

T. Zhong; J. Kindem; E. Miyazono; A. Faraon;
1. California Institute of Technology, Pasadena, CA, United States.

Abstract (35 Word Limit): We report a scheme for detecting single rare-earth-ions coupled to an Yttrium Orthosilicate (YSO) nanophotonic resonator, which could enable precise optical addressing of individual ions as single qubits for quantum information applications.
Coupling an erbium spin ensemble to a 3D superconducting cavity at zero magnetic field

Y. Chen; X. Fernandez-Gonzalvo; J. Longdell; 1.

1. University of Otago, Dunedin, New Zealand.

Abstract (35 Word Limit): We report zero-magnetic-field electron-paramagnetic-resonance experiments of an $^{167}$Er:Y$_2$SiO$_5$ crystal coupled to a tunable 3D superconducting cavity of a $10^5$ Q-factor.
Abstract (35 Word Limit): Attosecond solid state spectroscopy tracks electronic excitation mechanisms in solids. Here the technique is used to show that few-cycle laser pulses can create a transient metallization in dielectrics or permanent population transfer in semiconductors both with sub-femtosecond response time.
Final ID: FTh4C.2

**Using Attosecond Transient Absorption to Study Non-Adiabatic Molecular Dynamics**

* C. Liao; 1  X. Li; 2  D. J. Haxton; 2  C. W. McCurdy; 3, 2  A. Sandhu; 4, 1;

1. College of Optical Sciences, University of Arizona, Tucson, AZ, United States.
2. Chemical Sciences Division, Lawrence Berkeley National Laboratory, Berkeley, CA, United States.
3. Department of Chemistry, University of California, Davis, CA, United States.
4. Department of Physics, University of Arizona, Tucson, AZ, United States.

**Abstract (35 Word Limit):** We investigate superexcited Oxygen using attosecond transient absorption. Spectral lineshape evolution is used to resolve the autoionization dynamics and strong-field control is explored. We find that the symmetry of electronic states plays an important role.
Photoionization Time Delay Dynamics in Noble Gases

S. Heuser; 1; M. Sabbar; 1; R. Boge; 1; M. Lucchini; 1; L. Gallmann; 2; C. Cirelli; 1; U. Keller; 1;
1. Physics Department, ETH Zurich, Zurich, ZH, Switzerland.
2. Institute of Applied Physics, University of Bern, Bern, Bern, Switzerland.

Abstract (35 Word Limit): For the first time, we implemented both RABBITT and attosecond energy streaking using an AttoCOLTRIMS apparatus and exploit its advantages to determine energy- and angle-resolved single-photon ionization time delays for different noble gases.
Structure Tomography of Argon Trimer with Laser-Driven Coulomb Explosion Imaging

C. Wu; \(^1\); X. Xie; \(^1\); Q. Gong; \(^1\);

1. Peking University, Beijing, China.

Abstract (35 Word Limit): The structure distribution of argon trimer was experimentally reconstructed with laser-driven Coulomb explosion imaging technique and compared with our finite-temperature ab initio calculations.
Explosion Dynamics of Methane Clusters

Irradiated by 38 nm XUV Laser Pulses

A. M. Helal; 2, 1; S. Bruce; 2, 1; H. J. Quevedo; 2, 1; A. C. Bernstein; 2, 1; J. Keto; 2, 1; T. Ditmire; 2, 1;
1. University of Texas at Austin, Austin, TX, United States.
2. Center for High Energy Density Science, Austin, TX, United States.

Abstract (35 Word Limit): Explosions of methane clusters using 38 nm XUV laser pulses were studied. Ion fragmentation dynamics depends upon cluster size. Coulomb explosion of protons followed by recombination of methane fragments has been observed.
Direct Observation of Rescattering from Strong Field Ionization by Two-Color Circularly Polarized Laser Fields

C. A. Mancuso; 1, 2; D. Hickstein; 1, 2; P. Grychtol; 1, 2; R. Knut; 1, 2; O. Kfir; 3; X. Tong; 4; F. Dollar; 1, 2; D. Zusin; 1, 2; M. Gopalakrishnan; 1, 2; C. Gentry; 1, 2; E. Turgut; 1, 2; J. Ellis; 1, 2; M. Chen; 5; A. Fleischer; 3, 6; O. Cohen; 3; H. C. Kapteyn; 1, 2; M. M. Murnane; 1, 2;

2. JILA, Boulder, CO, United States.
3. Physics, Solid State Institute, Haifa, Israel.
4. Division of Material Science, University of Tsukuba, Ibaraki, Japan.
5. Institute for Photonics Technologies, National Tsing Hua University, Hsinchu, Taiwan.

Abstract (35 Word Limit): The photoelectron distribution from strong field ionization by a two-color counter-rotating circularly polarized laser field uniquely exhibits distinct low-energy features. These can be attributed to electron-ion Coulomb rescattering, providing a new window into this process.
Final ID: FTh4C.7

Sub-Ångström Scale Imaging of Aligned Acetylene

B. Wolter; 1; M. G. Pullen; 1; A. Le; 2; M. Baudisch; 1; M. Sclafani; 1; H. Pires; 1; M. Hemmer; 1; A. Senftleben; 3; C. Schröter; 4; J. Ullrich; 4, 5; R. Moshammer; 4; C. Lin; 2; J. Biegert; 1, 6

1. ICFO -The Institute of Photonic Sciences, Castelldefels (Barcelona), CAT, Spain.
2. J. R. Macdonald Laboratory, Physics Department, Kansas State University, Manhattan, KS, United States.
3. Institute of Physics, Center for Interdisciplinary Nanostructure Science and Technology (CINSaT), University of Kassel, Kassel, Germany.
4. Max-Planck-Institut für Kernphysik, Heidelberg, Germany.
5. Physikalisch-Technische Bundesanstalt (PTB), Braunschweig, Germany.
6. ICREA - Institucio Catalana de Recerca i Estudis Avancats, Barcelona, Spain.

Abstract (35 Word Limit): We present the simultaneous measurement of the C-C and C-H bond lengths of aligned acetylene. Our approach combines an ultrafast 160 kHz mid-IR source with 3D electron-ion coincidence detection towards imaging of molecular dynamics.
Abstract (35 Word Limit): We observed high-lying \( n>238 \) Rydberg states which survived from strong field interaction of atoms and molecules with electron and ion coincidence detection. The high-lying Rydberg states are measured through field ionization with weak DC fields.
Probing and Controlling Quantum Matter in Crystals of Light

I. Bloch; 1, 2;
1. Max-Planck-Institut fur Quantenoptik, Garching b. München, Germany.
2. Fakultät für Physik, Ludwig Maximilians University, Munich, Germany.

Abstract (35 Word Limit): The tutorial will focus on the remarkable opportunities offered by ultracold quantum gases trapped in optical lattices to address fundamental physics questions ranging from condensed matter physics over statistical physics to high energy physics with table-top experiment.
Optically tunable entangled photon state generation in a nonlinear directional coupler

F. Setzpfandt; 1, 2; A. S. Solntsev; 1; J. Titchener; 1; C. W. Wu; 1; C. Xiong; 3; T. Pertsch; 2; R. Schiek; 4; D. N. Neshev; 1; A. A. Sukhorukov; 1;

1. Centre for Ultrahigh Bandwidth Devices for Optical Systems (CUDOS) and Nonlinear Physics Centre, Research School of Physics and Engineering, Australian National University, Canberra, ACT, Australia.
2. Institute of Applied Physics, Abbe Center of Photonics, Friedrich-Schiller-Universität Jena, Jena, Germany.
3. CUDOS, the Institute of Photonics and Optical Science (IPOS), School of Physics, University of Sydney, Sydney, NSW, Australia.

Abstract (35 Word Limit): We propose and experimentally demonstrate an all-optically tunable biphoton quantum light source using a nonlinear directional coupler. The source can generate high-fidelity N00N states, completely split states, and states with variable degrees of entanglement.
Nondegenerate Two-Photon Gain in GaAs

M. Reichert; 1; D. J. Hagan; 1; E. W. Van Stryland; 1;
1. University of Central Florida, CREOL, Orlando, FL, United States.

Abstract (35 Word Limit): We present data indicating two-photon gain using extremely nondegenerate (END) photons in optically excited GaAs. These results are consistent with our demonstration of END two-photon absorption enhancement and points a possible way to two-photon lasing.
Optical Bistability in Electrically Driven Polariton Condensates

M. Amthor; T. Liew; C. Metzger; S. Brodbeck; L. Worschech; M. Kamp; I. Shelykh; A. Kavokin; C. Schneider; S. Höfling;

1. Technische Physik, University of Würzburg, Würzburg, Germany.
2. Division of Physics and Applied Physics, Nanyang Technological University, Singapore, Singapore.
3. Spin Optics Laboratory, St-Petersburg State University, St.-Petersburg, Russian Federation.
4. Physics and Astronomy School, University of Southampton, Southampton, United Kingdom.

Abstract (35 Word Limit): We observe a bistability in an electrically driven polariton condensate, which is manifested by a memory dependent threshold characteristic. The bistability is explained by a dependence of the electron-hole tunneling lifetime on the carrier density.
Near-Field Radiative Heat Transfer between Integrated Nanostructures using Silicon Carbide

R. St-Gelais; L. Zhu; B. Guha; S. Fan; M. Lipson;
1. Cornell University, Ithaca, NY, United States.
2. Stanford University, Stanford, CA, United States.

Abstract (35 Word Limit): We present the first experimental demonstration near-field radiative heat transfer using silicon carbide. We achieve a 110× near-field enhancement, relative to the far-field limit, of the radiative heat transfer between integrated nanostructures.
The analog of superradiant emission in quantum emitters leads to the well-known superradiant

M. Zhou; 1 S. Yi; 1 T. Luk; 2 Q. Gan; 3 Z. Yu; 1

1. Electrical and Computer Engineering, University of Wisconsin at Madison, Madison, WI, United States.
2. Sandia National Laboratories, Albuquerque, NM, United States.
3. Electrical and Computer Engineering, State University of New York at Buffalo, Buffalo, NY, United States.

Abstract (35 Word Limit): The superradiant spontaneous emission is caused by the collective interaction of quantum emitters. Such collective interaction also exists in nanoscale resonant thermal emitters, resulting in the analog of superradiance in thermal emission.
Near complete violation of detailed balance in thermal radiation
L. Zhu; 1; S. Fan; 1;
1. Stanford University, Stanford, CA, United States.

Abstract (35 Word Limit): We introduce general principles for maximally violating detailed balance in thermal radiation. We validate these principles by direct calculations, based on fluctuational electrodynamics, on thermal emitters constructed from magneto-optical photonic crystals.
Controlling Guided Waves In Telecom Waveguides Using One Dimensional Phased Antenna Arrays
Z. Li;¹; M. Kim;¹; N. Yu;¹;
1. Columbia University, New York, NY, United States.

Abstract (35 Word Limit): We theoretically demonstrate a few novel small-footprint and broadband integrated photonic devices based on optical waveguides patterned with phased antenna arrays. These devices include waveguide mode converters, polarization rotators, perfect absorbers, and optical power diodes.
Epsilon-near zero wave diffraction in the optical domain

D. Ploss; A. Kriesch; J. Naeger; U. Peschel;


Abstract (35 Word Limit): We experimentally demonstrate wave propagation in 2D nanophotonic epsilon-near-zero (ENZ) waveguides. We show an ENZ double-slit experiment, investigate ENZ diffraction and observe the disappearance of wavelength-scale obstacles close to the cut-off of the waveguide mode.
Coupling Control Based on Adiabatic Elimination in Densely Integrated Nano-Photonics

M. Mrejen; 1; H. Suchowski; 1; T. Hatakeyama; 1; C. Wu; 1; L. Feng; 1; K. O'Brien; 1; Y. Wang; 1; X. Zhang; 1
1. University of California Berkeley, Berkeley, CA, United States.

Abstract (35 Word Limit): We experimentally demonstrate a novel approach based on adiabatic elimination scheme to control the coupling between densely packed waveguides. At the nano-scale, cancellation of the coupling between the waveguides can be achieved.
Plasmonic Waveguide Array: Simulating Topological Photonic States and Massless Dirac Fermion
Q. Cheng; 1, 2; T. Li; 1, 2;
1. College of Engineering and Applied Sciences, Nanjing University, Nanjing, China.
2. National Laboratory of Solid State Microstructures, Nanjing University, Nanjing, China.

Abstract (35 Word Limit): In the binary plasmonic waveguide array (PWA), we experimentally demonstrated a topologically protected optical mode with immunity against structural disorders, and theoretically proposed an optical analogue of massless Dirac Fermion by alternating positive and negative couplings.
DPSK Demodulation Using Coherent Perfect Absorption
R. R. Grote; 2, 1; J. M. Rothenberg; 2; J. B. Driscoll; 2; R. M. Osgood; 2;

Abstract (35 Word Limit): We propose a scheme for on-chip DPSK demodulation with balanced detection by using coherent perfect absorption (CPA) in a microring resonator. Device operation is demonstrated with finite-difference time-domain simulations.
Continuous 119.2-GSample/s Photonic Compressed Sensing of Sparse Microwave Signals

J. Stroud; B. Bosworth; D. Tran; T. McKenna; T. Clark; T. Tran; S. Chin; M. A. Foster;
1. Johns Hopkins University, Baltimore, MD, United States.

Abstract (35 Word Limit): We demonstrate 119.2-GSample/s compressive microwave frequency detection using spectrally-encoded ultrafast laser pulses. We sense sparse tones over > 35-GHz instantaneous bandwidth with 2-MHz accuracy using < 300 consecutive compressive measurements acquired at a 400-MHz rate.
Experimental Demonstration of Arbitrary Waveform Generation Using Anamorphic Stretch Transform

G. Hongbiao; 1, 2; M. Asghari; 2; B. Jalali; 2;

1. Tsinghua University, Beijing, Beijing, China.
2. University of California, Los Angeles, Los Angeles, CA, United States.

Abstract (35 Word Limit): We experimentally demonstrate, for the first time, that using anamorphic stretch transform, the time-bandwidth product of photonic-assisted time-stretch arbitrary waveform generation can be greatly increased above the fundamental limit set by the spectral encoding.
Novel Photonic Radio-frequency Arbitrary Waveform Generation based on Photonic Digital-to-Analog Conversion with Pulse Carving

J. Liao; 1; B. Chen; 1; S. Li; 1; X. Yang; 1; X. Zheng; 1; H. Zhang; 1; B. Zhou; 1;
1. Tsinghua University, Beijing, Beijing, China.

Abstract (35 Word Limit): We firstly propose a photonic radio-frequency arbitrary waveform generator based on photonic digital-to-analog conversion with pulse carving, and demonstrate 10GS/s 4-bit resolution arbitrary waveform generations with 15GHz and 30GHz up-converting.
All-Optical Optomechanical Modulation Enabling Real-Time Signal Tracking

J. Huang,1,2; B. Dong;2; H. Cai;3; J. Wu;1; T. Chen;1; Y. Gu;3; A. Liu;2;
1. Xian Jiaotong University, Xian, China.
2. Nanyang Technological University, Singapore, Singapore.

Abstract (35 Word Limit): We present a novel all-optical light tracker by taking advantage of the nonlinear optomechanical signal amplification and modulation, which can transfer the information carried by a signal light to tracking light without electro-optical converting.
Towards Highly Linear Intensity Modulator for High Resolution Photonic ADCs Using a Three-Section Mode-Locked Laser

E. Sarailou; 1; P. J. Delfyett; 1;
1. College of Optics and Photonics, CREOL, University of Central Florida, Orlando, FL, United States.

Abstract (35 Word Limit): A novel highly linear intensity modulator is proposed using an injection-locked three-section mode-locked laser. Modulating the passive section of the mode-locked laser reduces $V_{\pi}$ to 1.1 mV and should greatly increase SFDR.
On-Chip Instantaneous Microwave Frequency Measurement System based on a Waveguide Bragg Grating on Silicon

M. Burla; 1; X. Wang; 2; M. Li; 3; L. Chrostowski; 2; J. Azaña; 1;

1. Institut National de la Recherche Scientifique, Varennes, QC, Canada.
2. University of British Columbia, Vancouver, BC, Canada.
3. Institute of Semiconductors, Chinese Academy of Sciences, Beijing, China.

Abstract (35 Word Limit): We experimentally demonstrate an instantaneous frequency measurement system based on a 65 μm-long integrated Bragg grating filter. An amplitude comparison function based on its transmission and reflection responses allows identification of unknown RF frequencies above 30 GHz.
Abstract (35 Word Limit): We present a novel software-defined radio transceiver, which takes advantages of RF photonic techniques to realize the state-of-the-art performance in the aspect of the frequency range to cover from C band to Ka band.
Metamaterials Assembled by Light

S. Yang; 1, 2; X. Ni; 1; X. Yin; 1; B. KANTE; 1; Y. Wang; 1; X. Zhang; 1, 2;

1. NSF Nano-scale Science and Engineering Center (NSEC), University of California Berkeley, Berkeley, CA, United States.
2. Materials Sciences Division, Lawrence Berkeley National Laboratory, Berkeley, CA, United States.

Abstract (35 Word Limit): Metamaterials are designed to achieve unprecedented light-matter interactions. Here we demonstrate a novel viable and scalable assembly route to optical metamaterials with structures dictated by their own light-matter interactions.
Self-assembled Micro-reflectors for Signal Enhancement in Fluorescence Microscopy

Z. Göröcs; 1; E. McLeod; 1; S. Acharya; 1; A. Ozcan; 1, 2;
1. Electrical Engineering, UCLA, Los Angeles, CA, United States.
2. Bioengineering, UCLA, Los Angeles, CA, United States.

Abstract (35 Word Limit): Three-fold enhancement of fluorescent light collection in low numerical aperture optical systems is demonstrated using self-assembled micro-reflectors around individual micro-particles.
Electrospun dye-doped fiber networks: Lasing emission from randomly distributed cavities
S. Kraemmer; 1; C. Vannahme; 2; C. L. Smith; 2; T. Grossmann; 1; M. Jenne; 1; S. Schierle; 1; L. Jørgensen; 3; M. Tran; 1; A. Kristensen; 2; I. Chronakis; 3; H. Kalt; 1;
1. Institute of Applied Physics, Karlsruhe Institute of Technology, Karlsruhe, Germany.
2. Department of Micro- and Nanotechnology, Technical University of Denmark, Kgs. Lyngby, Denmark.
3. DTU Food, Technical University of Denmark, Kgs. Lyngby, Denmark.

Abstract (35 Word Limit): Dye-doped polymer fiber networks fabricated with electrospinning exhibit comb-like laser emission. We identify randomly distributed ring resonators being responsible for lasing emission by making use of spatially resolved spectroscopy. Numerical simulations confirm this result quantitatively.
Fabrication of Optically Functional Microstructures on Curved Surfaces Using Femtosecond Laser Micromachining and Transfer Process

H. Liu; Y. Huang; H. Jiang;
1. University of Wisconsin-Madison, Madison, WI, United States.

Abstract (35 Word Limit): We propose a hybrid fabrication process to generate smooth 3D microstructures on curved substrates, which can be used in novel micro-optical devices. As an example, parabolic micro-mirrors were fabricated on a hemispherical shell.
Light-induced Material Displacement in Polymer Films: A New Tool for Optical Materials Structuring

E. Orabona; 1; P. Maddalena; 1; a. ambrosio; 1, 2;

1. CNR-SPIN, Napoli, Italy.
2. School of Engineering and Applied Sciences, Harvard University, Cambridge, MA, United States.

Abstract (35 Word Limit): Isomerization cycles of light-activated molecular switches in a polymeric matrix can result into the polymer surface structuring with nanometric resolution. This still debated phenomenon allows designing and realizing complex architectures in plasmonic and photonic devices.
Etch-Free Patterning of PEDOT:PSS for Optoelectronics

S. A. Rutledge; 1 ; A. S. Helmy; 1 ;
1. University of Toronto, Toronto, ON, Canada.

Abstract (35 Word Limit): A process was developed to enable polymer-based optoelectronics without need for any etch steps. The process root causes were established using optical spectroscopy. It was then used to fabricate OLED arrays and touch sensor matrices.
Microfluidic Reconfigurable Metasurface: A Demonstration of Tunable Focusing from Near Field to Far Field

W. Zhu; 1
1. Nanyang Technological University, , United States.

Abstract (35 Word Limit): We present a reconfigurable transmission metasurface based on microfluidic system. As a proof of concept, the focal length of the metasurface is tuned from near-field region (1 λ) to far-field region (18 λ).
On-Demand Fabrication of Micro-Wired Rods and Nano-Coupling Control for 3D Polymeric Optical System

H. Yoshioka; \textsuperscript{1} ; N. Hirakawa; \textsuperscript{1} ; M. Nakano; \textsuperscript{1} ; Y. Oki; \textsuperscript{1} ;

\textsuperscript{1}. Department of Electronics, Kyushu University, Fukuoka, Fukuoka, Japan.

Abstract (35 Word Limit): Fully polymeric 3D microcavity system was proposed and demonstrated in which integrates whisper-gallery-mode microrod lasers and output coupling waveguide. As on-site additive-manufacturing technique, microdispensing wired 7.3 \textmu m\textsuperscript{φ} polymer-microrods. Their repositioning accuracy \textless 100 nm was attained.
Highly Efficient Backward Stimulated Polariton Scattering in Periodically Poled KTiOPO$_4$

V. Pasiskevicius; $^1$; H. Jang; $^1$; A. Zukauskas; $^1$; C. Canalias; $^1$

1. Royal Institute of Technology (KTH), Stockholm, Sweden.

Abstract (35 Word Limit): $\chi^{(2)}$-nonlinearity enhanced by crystal lattice contribution in the THz-region is behind backward stimulated polariton scattering with efficiencies exceeding 50% in PPKTP where forward scattering process is suppressed. 10-times compression of counter-propagating signal is observed.
Laser Induced Damage Thresholds of KTiOPO$_4$ and Rb:KTiOPO$_4$ at 1 µm and 2 µm

R. Coetzee; 1; N. Thilmann; 1; A. Zukauskas; 1; C. Canalias; 1; V. Pasiskevicius; 1;  
1. Royal Institute of Technology (KTH), Stockholm, Sweden.

Abstract (35 Word Limit): Optimum design of high-energy parametric down-conversion schemes mandate investigation of nanosecond laser-induced damage threshold in KTiOPO$_4$ and Rb:KTiOPO$_4$ at 1.064 µm and 2 µm. A surface damage threshold of 10 J/cm$^2$ at 2 µm was determined for both materials.
Enhanced Spontaneous Raman Signal Collected Evanescently by Silicon Nitride Slot Waveguides

A. Dhakal; 1; F. Peyskens; 1; A. Subramanian; 1; N. Le Thomas; 1; R. Baets; 1;
1. INTEC, University of Ghent, Ghent, Belgium.

Abstract (35 Word Limit): We investigate the effect of waveguide geometry on the conversion efficiency of Raman signals collected by integrated photonic waveguides. Compared to strip-type photonic wires, we report a six-fold increase in conversion efficiency for silicon-nitride slot-waveguides.
Final ID: STh4H.4

Inhibiting Stimulated Brillouin Scattering in a Highly Nonlinear Waveguide

M. Merklein; 1; I. Kabakova; 1; T. Buettner; 1; D. Choi; 2; S. Madden; 2; B. Luther-Davies; 2; B. J. Eggleton; 1;

1. Center for Ultrahigh bandwidth Devices for Optical Systems (CUDOS), Institute of Photonics and Optical Science (IPOS), School of Physics, University of Sydney, Sydney, NSW, Australia.
2. CUDOS, Laser Physics Centre, Australian National University, Canberra, ACT, Australia.

Abstract (35 Word Limit): We demonstrate the inhibition of stimulated Brillouin scattering using a Bragg grating in a highly nonlinear chalcogenide rib waveguide on a chip.
Abstract (35 Word Limit): We demonstrate a new approach to broadband stimulated Raman scattering based on time-domain-Fourier-transform detection of the stimulated Raman gain. Our method blends the sensitivity of single-channel lock-in detection with the spectral resolution of Fourier-transform spectroscopy.
Handedness Control Of Mid-infrared (9-12μm) Vortex Laser

T. Omatsu; 1, 2; M. Horikawa; 1; A. Ogawa; 1; K. Furuki; 1; K. Miyamoto; 1;

1. Chiba University, Chiba, Chiba, Japan.
2. JST, CREST, Tokyo, Japan.

Abstract (35 Word Limit): Handedness control of the mid-infrared vortex output from a ZnGeP₂ difference frequency generator pumped by a 1-μm vortex pumped KTiOPO₄ optical parametric oscillator was demonstrated over a frequency range of 9-12 μm.
Electrically Controllable Saturable Absorption in Hybrid Graphene-Silicon Waveguides

K. Alexander; 1, 2; Y. Hu; 1, 2; M. Pantouvaki; 3; S. Brems; 3; I. Asselberghs; 3; S. Gorza; 4; C. Huyghebaert; 3; J. Van Campenhout; 3; B. Kuyken; 1, 2; D. Van Thourhout; 1, 2.

1. Photonics Research Group, Department of Information Technology, Ghent University-IMEC, Gent, Belgium.
2. Center for Nano- and Biophotonics (NB-Photonics), Ghent University, Gent, Belgium.
3. IMEC, Leuven, Belgium.
4. Service OPERA-photonique, Université libre de Bruxelles (U.L.B.), Brussels, Belgium.

Abstract (35 Word Limit): Electrical tunability of saturable absorption is demonstrated in a graphene/SOI hybrid waveguide. The saturation modulation depth is tunable between 0 and 2.2 dB (~0-40% decrease of absorption at saturation), with saturation powers between ~1.25-2.5 W.
Ultra-low power passive mode-locking using an integrated nonlinear microring resonator

C. Reimer; M. Kues; B. Wetzel; P. Roztocki; B. E. Little; S. T. Chu; D. Moss; R. Morandotti;

1. INRS-EMT, Longueuil, QC, Canada.
2. Xi’an Institute of Optics and Precision Mechanics of CAS, Xi’an, China.
3. Department of Physics and Material Science, City University of Hong Kong, Hong Kong, China.
4. School of Electrical and Computer Engineering, RMIT University, Melbourne, VIC, Australia.

Abstract (35 Word Limit): Using high nonlinear enhancement in a CMOS compatible microring resonator incorporated in a SOA based nonlinear loop-mirror laser architecture, we observe passive mode-locking at extremely-low power levels generating 570ps pulses at a 14.8MHz repetition rate.
Chip-based Silica Microspheres for Cavity Optomechanics

X. Jiang; M. Kuzyk; T. Oo; H. Wang;
1. University of Oregon, Eugene, OR, United States.

Abstract (35 Word Limit): We realized on-chip silica microspheres, featuring excellent thermal coupling to the silicon-wafer. These chip-based microspheres can overcome the problem of thermal bistability and are especially suitable for optomechanical studies in vacuum or at low temperature.
An Optomechanical Induced Short Pulse Raman Laser

W. Yu; 1; W. Jiang; 2; Q. Lin; 2, 3; T. Lu; 1;
1. University of Victoria, Victoria, BC, Canada.
2. Institute of Optics, University of Rochester, Rochester, NY, United States.
3. Electrical and Computer Engineering, University of Rochester, Rochester, NY, United States.

Abstract (35 Word Limit): We observed pulsations of Raman lasing on an optomechanically oscillating silica microsphere. The harmonic tones from the oscillation regeneratively produce 223.5-ns-width Raman laser pulses above a pump threshold of 186 μW.
Abstract (35 Word Limit): We demonstrated the nonlinear mechanics of an optomechanically driven silicon membrane suspended 100nm over a nearby substrate. The estimated optical force-induced Duffing nonlinearity is $10^{-28}\text{Hz}^2\text{m}^{-2}$, significantly larger than that afforded by the nonlinear Casimir potential.
Unifying Brillouin scattering and cavity optomechanics in silicon photonic wires

R. Van Laer; B. Kuyken; R. Baets; D. Van Thourhout;

1. Ghent University - imec, Ghent, Belgium.

Abstract (35 Word Limit): We prove a connection between the Brillouin gain and the zero-point optomechanical coupling rate. Moreover, we report on observations of Brillouin scattering in silicon photonic nanowires -- showing efficient coupling between near-infrared light and gigahertz sound.
Optomechanical Nonlinearities in Microstructured Optical Fibers

P. S. Russell; 1; A. Butsch; 1; J. Koehler; 1; R. E. Noskov; 1; M. Pang; 1;
1. Max-Planck-Inst Physik des Lichts, Erlangen, Germany.

Abstract (35 Word Limit): Light-driven mechanical motion or vibration in microstructured glass fibers can result in very large Raman-like optomechanical nonlinearities that may be used, e.g., to mode-lock fibre ring lasers at a high harmonic of their round-trip frequency.
Microwave Frequency Traveling Surface Acoustic Wave Induced Transparency

H. Li; 1, S. A. Tadesse; 1, 2, Q. Liu; 1, M. Li; 1

1. Department of Electrical and Computer Engineering, University of Minnesota, Minneapolis, MN, United States.
2. School of Physics and Astronomy, University of Minnesota, Minneapolis, MN, United States.

Abstract (35 Word Limit): Inter-digital transducers and photonic crystal cavities are integrated on a piezoelectric aluminum nitride film sputtered on an oxidized silicon wafer, which leads to the first demonstration of microwave frequency traveling surface acoustic wave induced transparency.
Surface Acoustic Wave Modulation of Optical Cavities on a Suspended Membrane

S. Tadesse; 1; H. Li; 1; Q. Liu; 1; M. Li; 1;
1. university of Minnesota, Saint Paul, MN, United States.

Abstract (35 Word Limit): Optical race-track resonators and one-dimensional photonic crystal cavities are integrated with surface acoustic wave devices on a suspended piezoelectric aluminum nitride film to realize strong, ultrafast sound-light interaction.
Blood Coagulation Sensing at the Point of Care

S. K. Nadkami; 1, 2;
1. Harvard Medical School, Boston, MA, United States.
2. Wellman Center for Photomedicine, Massachusetts General Hospital, Boston, MA, United States.

Abstract (35 Word Limit): We describe a new approach that measures a patient’s coagulation status at the bedside from laser speckle fluctuations. This technology addresses the critical unmet need to manage patients at risk of life-threatening hemorrhage.
Multi-spectral Imaging for Determining End-point of Photo-thermal Damage on Tissue

D. Kim; ¹
1. Food and Drug Administration, Silver Spring, MD, United States.

Abstract (35 Word Limit): Multi-spectral imaging (MSI) and its analysis methods were investigated to determine end-point of photothermal damage of tissue. MSI revealed denatured porcine tissue after irradiation of laser with irradiance lower than photothermal damage threshold.
Design and Implementation of a Volume Holographic Imaging Endoscope

I. D. Howlett; M. Gordon; G. Orsinger; J. Brownlee; M. Romanowski; J. Barton; R. K. Kostuk;
1. University of Arizona, Tucson, AZ, United States.

Abstract (35 Word Limit): The design and packaging of a volume holographic imaging endoscope suitable for clinical studies is presented. The system is capable of simultaneous image projection from multiple tissue depths. Preliminary results show resolution to 4 μm.
Abstract (35 Word Limit): *In vivo* Longitudinal repetitive observation of microvasculature and fluorescent cells in a small intestinal tract of single mouse in minimally invasive manner was demonstrated by using GRIN lens based side-view confocal endomicroscopy.
In Vivo Real-time Observation of ICG Pharmacokinetics by NIR Laser-scanning Confocal Microscopy

Y. Hwang; 1; H. Yoon; 1; K. Choe; 1; J. Park; 1; P. Kim; 1;
1. Korea Advanced Inst of Science & Tech, , Korea (the Republic of).

Abstract (35 Word Limit): By utilizing custom-design video-rate near-infrared laser-scanning confocal microscope, we imaged the pharmacokinetic dynamics of intravenously injected ICG at the skin and liver of mouse in sub-cellular scale in vivo.
Field-Portable Smartphone Microscopy Platform for Wide-field Imaging and Sizing of Single DNA molecules

Q. Wei; W. Luo; S. Chiang; T. Kappel; C. Mejia; D. Tseng; R. Chan; E. Yan; H. Qi; F. Shabbir; H. Ozkan; S. Feng; A. Ozcan;

1. University of California Los Angeles, Los Angeles, CA, United States.

Abstract (35 Word Limit): We demonstrate a field-portable smartphone-based fluorescence microscopy platform for imaging and sizing of single DNA molecules across ~2 mm2 field-of-view with <1 kbp length accuracy.
Abstract (35 Word Limit): Fluorescence localisation microscopy is a powerful tool for imaging cell structures at a
lengthscale of tens of nm, but its utility for live cell imaging is limited, as it takes a long time to acquire the data needed
for a super-resolution image. However, the data acquisition time can be cut by more than two orders of magnitude by
using advanced algorithms which can analyse dense data. Different algorithms offer tradeoffs between acquisition and
processing time, and quality of the fitted data.
An Azimuthal Polarizer Assures Localization Accuracy in Single-Molecule Super-Resolution Fluorescence Microscopy
M. D. Lew; 1, 2; W. Moerner; 1;
1. Department of Chemistry, Stanford University, Stanford, CA, United States.
2. Department of Electrical Engineering, Stanford University, Stanford, CA, United States.

Abstract (35 Word Limit): Imaging only azimuthally-polarized light from single fluorescent molecules avoids emission from the z component of their transition dipole moments, resulting in accurate measurement of location regardless of emitter orientation and degree of objective lens misfocus.
Maximally Informative Point Spread Functions for 3D Super-Resolution Imaging

Y. Shechtman; 1; S. J. Sahl; 1, 2; A. S. Backer; 1; W. Moerner; 1;

1. Stanford University, Stanford, CA, United States.
2. Max Planck Institute for Biophysical Chemistry, Göttingen, Germany.

Abstract (35 Word Limit): We generate optimal point spread functions (PSFs) for 3D super-resolution imaging, and demonstrate their application in biological conditions. These PSFs exhibit significantly improved precision and depth of field over the current state of the art.
Adaptive optics for single molecule switching nanoscopy

M. J. Booth; 1

Abstract (35 Word Limit): Specimen-induced aberrations frequently affect image quality in high-resolution microscopes. Aberration effects can be even more problematic in super-resolution methods. We show adaptive aberration correction in STORM microscopy of deep cell and tissue specimens.
Abstract (35 Word Limit): We present a novel technique to algorithmically enhance the resolution in optical microscopy. To do that, we exploit the characteristic features of biological images to construct a dictionary which enables sparsity-based reconstruction of sub-wavelength features.
First-principles calculations for ultrafast laser-induced damage in dielectrics
S. Sato; K. Yabana; Y. Shinohara; T. Otobe; K. Lee; G. F. Bertsch;
1. University of Tsukuba, Tsukuba, Ibaraki, Japan.
2. Max Planck Institute, Halle, Germany.
3. Institute for Basic Science, Gwangju, Korea (the Republic of).

Abstract (35 Word Limit): Irradiation of intense and ultrashort laser pulses on dielectric surface is calculated using a
first-principles theory. It is found that calculated energy distribution transferred from light to matter explains measured
laser damage threshold.
Doping-controlled Coherent Electron-Phonon Coupling in Vanadium Dioxide

K. Appavoo, 2, 1

1. Vanderbilt University, Upton, NY, United States.
2. Center for Functional Nanomaterials, Brookhaven National Laboratory, Upton, NY, United States.

Abstract (35 Word Limit): Broadband femtosecond transient spectroscopy and density functional calculations reveal that substitutional tungsten doping of a phase-change thin-film of vanadium dioxide modifies the coherent phonon response compared to the undoped film due to altered electronic and structural dynamics.
Unusual Conductivity Increase Related to UV-light Assisted Domain Inversion in Mg-doped Lithium Niobate Crystals

X. Wang; 1; F. Bo; 1; S. Chen; 1; J. Chen; 1; Y. Kong; 1; J. Xu; 1; G. Zhang; 1
1. Nankai University, Tianjin, Tianjin, China.

Abstract (35 Word Limit): We observed an unusual conductivity increase during and after the ultraviolet-light assisted domain inversion in Mg-doped lithium niobate crystals, which may be related to the dislocation of Nb ions during the domain inversion process.
Non-thermal ablation and deposition of graphite induced by ultrashort pulsed laser radiation

C. Kalupka; 1

1. RWTH Aachen, Aachen, Germany.

Abstract (35 Word Limit): We study the non-thermal ablation threshold of graphite in dependence on the applied ultrashort pulse duration. Our results indicate lattice motions to play a relevant role in the non-thermal ablation process.
Abstract (35 Word Limit): Finite difference time domain results support the design of microcavities which can be produced with unparalleled fidelity to the modelled surface with a focused ion beam. Coupling of NV centres at low temperature is also shown.
Electrical Valley Excitation by Spin Injection in Monolayer TMDC

Y. Ye;¹; X. Yin;¹,²; H. Wang;³; Z. Ye;¹; H. Zhu;¹; Y. Wang;¹; J. Zhao;³; X. Zhang;¹,⁴;

1. UC Berkeley, Berkeley, CA, United States.
2. University of Colorado Boulder, Boulder, CO, United States.
3. Chinese Academy of Sciences, Institute of Semiconductors, Beijing, China.
4. Lawrence Berkeley National Laboratory, Materials Sciences Division, Berkeley, CA, United States.

Abstract (35 Word Limit): We show experimentally the new valley indices of carriers can be electrically generated by spin injection, unifying the spintronics and emerging valleytronics.
Multi-shots ablation of polymethylmethacrylate by two-color femtosecond synthesized waveform

C. Lin; 1; C. Yang; 2; A. Zaytsev; 2; C. Pan; 2, 1;
1. Institute of Photonics Technologies, National Tsing Hua University, Hsinchu, Taiwan.
2. Department of Physics, National Tsing Hua University, Hsinchu, Taiwan.

Abstract (35 Word Limit): We observed clear modulation in ablated area and threshold as a function of relative phase between the $\omega$ and $2\omega$ beams and the increase of incubation coefficient up to 0.83 compared to single color case.
Control of Absorption in Femtosecond Laser-Dielectric Interaction with the Polarization of a Seeding Pulse

M. Green; 1; T. Her; 1; C. Lin; 2; C. Pan; 2;
1. University of North Carolina at Charlotte, Charlotte, NC, United States.
2. National Tsing Hua University, Hsinchu, Taiwan.

Abstract (35 Word Limit): We investigate femtosecond pulse transmission through BK7 in the presence of its second harmonic as a seeding pulse. Enhanced absorption is observed when the pulses are co-polarized. Such phenomenon can be used to control absorption.
Cladding-pumped Yb-doped Fiber Laser with Vortex Output Beam

D. Lin; W. A. Clarkson;
1. University of Southampton, Southampton, United Kingdom.

Abstract (35 Word Limit): A simple technique for selectively generating a donut-shaped LP\textsubscript{11} mode with vortex phase front in a cladding-pumped ytterbium-doped fiber laser is reported. The laser yielded 36W of output with a slope efficiency of 74%.
All-fiber passively Q-switched fiber laser based on the multimode interference effect

S. Fu; Q. Sheng; X. Zhu; W. Shi; J. Yao; R. Norwood; N. Peyghambarian; 1, 3
1. College of Precision Instrument and Optoelectronics Engineering, Tianjin University, Tianjin, Tianjin, China.
2. College of Optical Sciences, University of Arizona, Tucson, AZ, United States.
3. Tianjin Institute of Modern Laser & Optics Technology, Tianjin, China.

Abstract (35 Word Limit): An all-fiber passively Q-switched Er-Yb co-doped fiber laser (EYDFL) using a single mode-multimode-single mode (SMS) fiber structure based on the multimode interference (MMI) effect was proposed and experimentally demonstrated for the first time.
Enhancement of OCT Imaging Depth by Pulse-modulated Dispersion-tuned Swept Fiber Laser
Y. Takubo; S. Yamashita;  
1. , Meguro-ku, Tokyo, Japan.

Abstract (35 Word Limit): The linewidth of dispersion-tuned fiber laser was improved by pulse modulation. The laser was applied to swept-source optical coherence tomography system and images with deeper imaging range were obtained.
Pulse Coherence in Self-sweeping Fiber Laser

I. A. Lobach; S. I. Kablukov; E. V. Podivilov; A. A. Fotiadi; S. A. Babin;
1. Institute of Automation and Electrometry, Novosibirsk, Russian Federation.
2. Novosibirsk State University, Novosibirsk, Russian Federation.
3. Faculté Polytechnique de Mons, Service d'Electromagnétisme et de Télécommunications, Mons, Belgium.
4. Ulyanovsk State University, Ulyanovsk, Russian Federation.

Abstract (35 Word Limit): Investigation of a self-sweeping fiber laser with regular dynamics shows that the phases of modes generated with different pulses are not random. A superposition of 18 consequent laser pulses inside an external ring fiber cavity highlights their coherent combining into a train of nanosecond pulses.
Rogue Waves in a Normal-Dispersion Fiber Laser

Z. Liu; 1 S. Zhang; 2 F. W. Wise; 1
1. Cornell University, Ithaca, NY, United States.
2. Hebei Normal University, Shijiazhuang, China.

Abstract (35 Word Limit): The first observations of rogue-wave formation in a normal-dispersion fiber laser are reported. With an interference filter in the cavity, non-Gaussian distributions with pulses as large as 6 times the significant wave height are observed.
High Peak Power Single-Frequency Efficient Erbium-Ytterbium Doped LMA Fiber

G. Canat; 1 W. Renard; 1 T. Robin; 2 B. Cadier; 2 J. Le Gouët; 1 L. Lombard; 1 A. Durécu; 1 P. Bourdon; 1

1. DOTA, ONERA, Palaiseau, France.
2. iXfiber, Lannion, France.

Abstract (35 Word Limit): We report on single-frequency all-fiber amplifiers based on Er-Yb doped P2O5·Al2O3·SiO2 fibers. Peak power up to 1120 W at 1545 nm for 108 ns pulse duration has been obtained with 18 % slope-efficiency. Continuous-wave operation generated up to 14 W.
2.6 mJ Energy and 81 GW Peak Power Femtosecond Laser-Pulse Delivery and Spectral Broadening in Inhibited Coupling Kagome Fiber

B. Debord; F. Gérôme; P. Paul; A. Husakou; F. Benabid;

1. GPPMM group, Xlim Research Institute, UMR CNRS 7252, Université de Limoges, France, Limoges, France.
2. Amplitudes Technologies, 2-4 rue du Bois Chaland CE 2926, 91029 Evry, France, Evry, France.
3. Max Born Institute, Max-Born-Str. 2a, D-12489 Berlin, Germany, Berlin, Germany.

Abstract (35 Word Limit): We report on 800nm laser-pulse delivery record by using inhibited coupling Kagome fiber. Strong spectral broadening and projected pulse compression down to ~10fs were achieved with input 2.6mJ energy and 81GW peak power.
Abstract (35 Word Limit): We theoretically investigate the role of point reflector’s reflectivity in the performance of forward-pumped high power random fiber lasing, and demonstrate that the maximum 1st-oder random lasing output power can even increase when the reflectivity decreases from 0.9 to 0.01.
Photonic Chip Based Optical Frequency Comb Using Soliton Induced Cherenkov Radiation

V. Brasch; 1; M. Geiselmann; 1; T. Herr; 3; G. Lihachev; 2; M. Pfeiffer; 1; M. Gorodetsky; 2; t. kippenberg; 1; 1. EPFL, Lausanne, VD, Switzerland. 2. Moscow State University, Moscow, Russian Federation. 3. CSEM, Neuchatel, Switzerland.

Abstract (35 Word Limit): We show for the first time a fully coherent frequency comb generated in a SiN photonic chip which spans 2/3 of an octave using solitons and soliton induced Cherenkov radiation. Additionally we stabilize the spectrum.
Parametric soliton formation in narrow-band laser-gain driven microresonators

Y. H. Wen; 1; M. Lamont; 1; A. L. Gaeta; 1;
1. Cornell University, Ithaca, NY, United States.

Abstract (35 Word Limit): We investigate comb formation in laser-gain driven microresonators for various gain bandwidths and show that broadband cavity solitons exist for gain as narrow as one cavity mode, in close correspondence to parametric frequency combs.
Spectral broadening of Kerr Frequency Combs Generated from a Normal Dispersion Silicon Nitride Microresonator

Y. Liu; A. J. Metcalf; Y. Xuan; X. Xue; P. Wang; M. Qi; A. M. Weiner;
1. Purdue University, West Lafayette, IN, United States.

Abstract (35 Word Limit): We demonstrate a scheme to broaden the bandwidth of the Kerr frequency comb generated through mode interaction in a normal dispersion SiN microresonator. The broadened comb has a bandwidth of over 5 THz and can be compressed to the bandwidth limited time profile via dispersive fiber propagation.
Microwave to Optical Link Using an Optical Microresonator

J. D. Jost; 1; T. Herr; 1, 2; C. Lecaplain; 1; E. Lucas; 1; V. Brasch; 1; M. Pfeiffer; 1; T. Kippenberg; 1;
1. EPFL, Lausanne, VD, Switzerland.
2. CSEM, Neuchatel, Switzerland.

Abstract (35 Word Limit): Microresonator based optical frequency combs have the potential to greatly extend optical frequency measurements. Here we demonstrate the first self-referenced microresonator based optical comb suitable for optical frequency metrology applications.
Self-referencing a 10 GHz Electro-optic Comb

D. C. Cole; 1; K. Beha; 1; F. N. Baynes; 1; P. Del'Haye; 1; A. Rolland; 1; T. M. Fortier; 1; F. Quinlan; 1; S. Diddams; 1; S. B. Papp; 1;
1. NIST Boulder, Boulder, CO, United States.

Abstract (35 Word Limit): An octave-spanning frequency comb is generated using electro-optic modulation of a 1550 nm laser and nonlinear broadening. With this comb we demonstrate offset frequency detection, precise metrology, and ultrastable synthesis of 10 GHz microwaves.
Low-Phase-Noise Millimeter-Wave Signal Generator assisted with Frequency Comb based on Electro-Optics-Modulators

A. Ishizawa; 1 T. Nishikawa; 2 T. Goto; 2 K. Hitachi; 1 T. Sogawa; 1 H. Gotoh; 1

1. NTT Basic Research Laboratories, Atsugi, Kanagawa, Japan.
2. Tokyo Denki University, Adachi-ku, Japan.

Abstract (35 Word Limit): By employing 25-GHz-mode-spacing electro-optics-modulator-based optical frequency comb at telecommunications wavelengths, we have successfully demonstrated that phase noise in a commercially available signal generator at 25 GHz can be dramatically reduced to less than ever before.
Low Phase-noise Tunable Optoelectronic Comb Generator

A. J. Metcalf; 1 F. Quinlan; 2 T. M. Fortier; 2 S. Diddams; 2 A. M. Weiner; 1

1. Purdue University, West Lafayette, IN, United States.
2. Time and Frequency Division, National Institute of Standards and Technology, Boulder, CO, United States.

Abstract (35 Word Limit): We investigate the phase-noise properties of a tunable single-pass optoelectronic frequency comb generator. Residual phase noise at 1 Hz offset from a 10 GHz carrier is as low as -100 dBc/Hz.
Advances in Tunable Diode Laser Absorption Spectroscopy (TDLAS) for Measurements of Gas Properties in Combustion Systems

R. K. Hanson; 1

1. Stanford University, Stanford, CA, United States.

Abstract (35 Word Limit): Laser absorption is ideal for monitoring reactive systems with applications ranging from fundamental studies of combustion chemistry to control of power plant emissions. Sensor design, new schemes for sensitivity in harsh environments, and successful applications are reviewed.
Cavity-Enhanced Optical Frequency Comb Spectroscopy of High-Temperature Water in a Flame

A. Khodabakhsh; Z. Qu; C. Abd Alrahman; A. Johansson; L. Rutkowski; F. M. Schmidt; A. Foltynowicz-Matyba;

1. Department of Physics, Umeå University, Umeå, Sweden.
2. Thermochemical Energy Conversion Laboratory, Department of Applied Physics and Electronics, Umeå University, Umeå, Sweden.

Abstract (35 Word Limit): We demonstrate detection of broadband high-temperature water spectra in a laminar, premixed methane/air flat flame using high-resolution near-infrared cavity-enhanced optical frequency comb spectroscopy incorporating a fast-scanning Fourier transform spectrometer.
Fiber Optical Chemical Sensors Rated for 800°C Operation

A. Yan; R. Chen; Z. L. Poole; P. R. Ohodnicki; T. Elsmann; T. Habisreuther; M. Rothhardt; H. Bartelt; K. P. Chen;

1. University of Pittsburgh, PA, United States.
2. Leibniz Institute of Photonic Technology, Jena, Germany.
3. National Energy Technology Laboratory, Pittsburgh, PA, United States.

Abstract (35 Word Limit): A high-temperature fiber optical hydrogen sensor is demonstrated. The sensor is based on single-crystal sapphire fiber coated with nanostructured Pd-doped TiO$_2$ thin film. The sensitivity of the sensor was evaluated for hydrogen concentrations varying from 0.02 % to 3% at temperature up to 800°C.
Monitoring of Hydraulic Fracturing Using DFB Fiber Laser Acoustic Sensors

R. Chen; 1; A. Yan; 1; M. Zaghloul; 1; G. Lu; 4; A. P. Bunger; 4, 3; G. A. Miller; 2; G. Cranch; 2; K. P. Chen; 1;
1. Department of Electrical and Computer Engineering, University of Pittsburgh, Pittsburgh, PA, United States.
2. Naval Research Laboratory, Washington, DC, United States.
3. Department of Chemical and Petroleum Engineering, University of Pittsburgh, Pittsburgh, PA, United States.
4. Department of Civil and Environmental Engineering, University of Pittsburgh, Pittsburgh, PA, United States.

Abstract (35 Word Limit): This paper studies acoustic emission from hydraulic fracturing using DFB fiber laser sensors interrogated by a 3×3 coupler. This study shows that fiber lasers are useful tools to monitor fracturing processes for oil gas extraction.
Demonstration of a Differential Absorption Lidar for Emissions Measurement of a Coal-Fired Power Plant

M. Wojcik; B. Crowther; R. Lemon; P. Valupadas; L. Fu; B. Leung; Z. Yang; Q. Huda; A. Chambers;

1. Space Dynamics Laboratory, North Logan, UT, United States.
3. AEMERA, Edmonton, AB, Canada.
4. AITF, Edmonton, AB, Canada.

Abstract (35 Word Limit): A mobile Differential Absorption Lidar (DIAL) system for measurement of aerosols, CO₂ and CH₄ is presented. The DIAL system can operate in day/night conditions. A system overview and representative field trial results are presented.
Device-Independent Quantum Key Distribution

A. Acin; 1, 2;
1. ICFO-The Institute of Photonic Sciences, Castelldefels, CAT, Spain.
2. ICREA-Institucio Catalana de Recerca i Estudis Avançats, Barcelona, Spain.

Abstract (35 Word Limit): Device-independent quantum key distribution protocols allow distributing a secret key whose security does not rely on any assumption on the inner working of the devices in the implementation. We discuss recent progress on the problem.
Practical High-Dimensional Quantum Key Distribution with Decoy States

D. Bunandar; 1; Z. Zhang; 1; J. Shapiro; 1; D. Englund; 1

1. Massachusetts Institute of Technology, Cambridge, MA, United States.

Abstract (35 Word Limit): We propose a high-dimensional quantum key distribution protocol secure against photon-number splitting attack by employing only one or two decoy states. Decoy states dramatically increase the protocol's secure distance.
Multi-Photon Quantum Key Distribution Based on Double-Lock Encryption

K. C. Chan; 1; M. El Rifai; 1; P. Verma; 1; S. Kak; 2; Y. Chen; 3;
1. School of Electrical and Computer Engineering, University of Oklahoma-Tulsa, Tulsa, OK, United States.
2. School of Electrical and Computer Engineering, Oklahoma State University, Stillwater, OK, United States.
3. Department of Electrical and Computer Engineering, University of Houston, Houston, TX, United States.

Abstract (35 Word Limit): We present a quantum key distribution protocol based on the double-lock cryptography. It exploits the asymmetry in the detection strategies between the legitimate users and the eavesdropper. With coherent states, the mean photon number can be as larger as 10.
Quantum Teleportation over 100 km of Fiber using MoSi Superconducting Nanowire Single-Photon Detectors

H. Takesue; 1; S. D. Dyer; 2; M. J. Stevens; 2; V. Verma; 2; R. P. Mirin; 2; S. Nam; 2;

1. NTT Basic Research Laboratories, Atsugi, Kanagawa, Japan.

Abstract (35 Word Limit): Using high-efficiency superconducting nanowire single-photon detectors based on MoSi, we successfully achieved quantum teleportation of weak coherent states over 100 km of fiber with an average fidelity of 82.9% for six distinct input states.
Polarization Insensitive 100 MHz Clock Subcarrier Quantum Key Distribution over a 45 dB Loss Optical Fiber Channel

A. V. Gleim; 1; V. Egorov; 1; Y. V. Nazarov; 1; S. V. Smirnov; 1; V. V. Chistyakov; 1; O. I. Bannik; 1; A. A. Anisimov; 1; S. M. Kynev; 1; R. J. Collins; 2; S. A. Kozlov; 1; G. S. Buller; 2;

1. Department of Photonics and Optical Information Technology, ITMO University, Saint Petersburg, Russian Federation.
2. Institute of Photonics and Quantum Sciences, Heriot-Watt University, Edinburgh, United Kingdom.

Abstract (35 Word Limit): We experimentally demonstrate quantum key distribution at 28 bit/s rate in a telecommunications fiber channel with 45 dB loss using a subcarrier wave approach. This approach offers polarization independency, high bitrates and wide multiplexing capabilities.
Abstract (35 Word Limit): We demonstrate a fully integrated photonic transmitter for time-bin based multi-protocol quantum key distribution. This GHz rate Indium Phosphide device prepares states for Coherent One Way (COW), Differential Phase Shift (DPS), and BB84 protocols.
Quantum hacking of continuous-variable quantum key distribution systems: realtime Trojan-horse attacks

B. Stiller; 1, 2; I. Khan; 1, 2; N. Jain; 1, 2; P. Jouguet; 3; S. Kunz-Jacques; 3; E. Diamanti; 4; C. Marquardt; 1, 2; G. Leuchs; 1, 2;

1. Max-Planck-Institut for the Science of Light, Erlangen, Germany.
2. Institute for Optics, Information and Photonics, Erlangen, Germany.

Abstract (35 Word Limit): We experimentally demonstrate successful Trojan-horse attacks on laboratory and commercial continuous-variable quantum key distribution systems with binary and Gaussian modulation. Furthermore, we analyze appropriate countermeasures regarding their spectral performance.
Abstract (35 Word Limit): We demonstrate the emission of highly indistinguishable photons from a quasi-resonantly pumped coupled quantum dot-microcavity system operating in the weak coupling regime. Furthermore we model the degree of indistinguishability with our novel microscopic theory.
Screening Nuclear Field Fluctuations in Quantum Dots for Indistinguishable Photon Generation

B. Gerardot;¹; R. Malein;¹; T. Santana;¹; J. Zajac;¹; P. Petroff;²;
1. Institute of Photonics and Quantum Sciences, Heriot-Watt University, Edinburgh, United Kingdom.
2. Materials Department, University of California, Santa Barbara, CA, United States.

Abstract (35 Word Limit): We probe the effect of nuclear spin interaction with a resident electron spin in a quantum dot using resonance fluorescence spectroscopy and two-photon interference experiments. Screening of the nuclear field fluctuations is demonstrated to successfully generate indistinguishable single photons.
Phonon-Assisted Population Inversion of a Single Quantum Dot

A. Brash; 1 J. H. Quilter; 1 F. Liu; 1 M. Glässl; 2 A. Barth; 2 V. M. Axt; 2 A. Ramsay; 3 M. S. Skolnick; 1 A. Fox; 1

1. University of Sheffield, Sheffield, United Kingdom.
2. Institut für Theoretische Physik III, Universität Bayreuth, Bayreuth, Germany.
3. Hitachi Cambridge Laboratory, University of Cambridge, Cambridge, United Kingdom.

Abstract (35 Word Limit): We demonstrate a new method to produce a population inversion in an InGaAs quantum dot by quasi-resonant, incoherent excitation within the LA phonon sideband. A maximum exciton population of 0.67 is measured; applications include single photon sources and single QD lasers.
Coherent Writing of the Dark Exciton State Using One Picosecond Long Optical Pulse
I. Schwartz; 1; D. Cogan; 1; E. R. Schmidgall; 1; L. Gantz; 1; Y. Don; 1; D. Gershoni; 1
1. Physics, Technion, Haifa, Israel.

Abstract (35 Word Limit): We demonstrate a one to one correspondence between the polarization of a picosecond optical pulse and the coherent spin state of the long lived dark exciton that it deterministically photogenerates in a single quantum dot.
Single Emitter Vacuum Rabi Splitting Measured Through Direct Free Space Spontaneous Emission

Y. Ota; 1 R. Ohta; 2 N. Kumagai; 1 S. Iwamoto; 1, 2 Y. Arakawa; 1, 2
1. Nanoquine, University of Tokyo, Tokyo, Tokyo, Japan.
2. IIS, The University of Tokyo, Tokyo, Tokyo, Japan.

Abstract (35 Word Limit): We measured the vacuum Rabi splitting of a single quantum emitter through direct free space spontaneous emission. This lays the groundwork for accessing diverse cavity quantum electrodynamics phenomena manifesting themselves only in the spontaneous emission.
Two-Photon Spectrum of the Light Scattered by a Quantum Dot

M. Peiris; 1 B. Petrak; 1 k. konthasinghe; 1 Y. yu; 2 Z. Niu; 2 A. muller; 1
1. University of South Florida, Tampa, FL, United States.
2. Chinese Academy of Sciences, Beijing, China.

Abstract (35 Word Limit): We report the measurement of the two-photon spectrum of the light scattered by a single InAs quantum dot interacting with a strong near-resonant monochromatic laser.
Abstract (35 Word Limit): We report narrowing of nuclear spin fluctuations in a self-assembled InAs quantum dot molecule in the two-electron regime via coherent population trapping. The two-electron spin decoherence time is measured to be greater than one microsecond.
Optical Spin State Preparation of Two Electrons Confined in an InAs Quantum Dot Molecule

C. M. Chow; 2, 1; A. M. Ross; 1; D. Gammon; 3; A. S. Bracker; 3; L. J. Sham; 4; D. G. Steel; 1, 2;

1. H. M. Randall Laboratory of Physics, University of Michigan, Ann Arbor, MI, United States.
2. Electrical Engineering and Computer Science, University of Michigan, Ann Arbor, MI, United States.
4. Department of Physics, University of California San Diego, La Jolla, CA, United States.

Abstract (35 Word Limit): An InAs quantum dot molecule is charged with one electron in each dot. Measurements show that cw optical pumping initializes 3 of the 4 spin ground states. Experimental progress for initializing the $T_0$ state is also presented.
Nanophotonics in material-systems of Large Sizes

M. Soljačić; 1
1. Massachusetts Institute of Technology, Cambridge, MA, United States.

Abstract (35 Word Limit): Recent nano-fabrication developments enabled implementation of many nanophotonic techniques to macroscopic scales, which is crucial for many applications of interest (e.g. energy conversion, displays, lighting). Some exciting new opportunities in this area will be presented.
Circularly Polarized Light Emission of Quantum Dots at the Band Edge of Three-Dimensional Chiral Photonic Crystals

S. Takahashi; 1 T. Tajiri; 1 Y. Ota; 1 J. Tatebayashi; 1 S. Iwamoto; 1 Y. Arakawa; 1
1. University of Tokyo, Tokyo, Japan.

Abstract (35 Word Limit): We demonstrate highly circularly polarized emission from quantum dots in semiconductor chiral photonic crystals. The emission is influenced by the difference in density of states between the orthogonal circular polarizations at the polarization band edge.
Enhanced Transverse Photo-Induced Voltage by Slow Light

N. Proscia; 1, 2; I. Ketzschmar; 2; R. Koder; 2; V. M. Menon; 2; L. T. Vuong; 1;
1. Queens College-CUNY, Flushing, NY, United States.
2. Physics, City College of New York-CUNY, New York, NY, United States.

Abstract (35 Word Limit): We demonstrate the presence of spin-polarized transverse voltage in a metal-dielectric two-dimensional photonic crystal in the visible regime and determine that the presence of slow light at the photonic band edge leads to voltage enhancement.
Abstract (35 Word Limit): A photonic crystal (PC) incorporating two interleaved regions, each with distinct periods in orthogonal directions, enables simultaneous resonant coupling of ultraviolet excitation photons to quantum dots and visible emission for up to 5.8X enhancement of photon extraction for multiple types of QDs.
Abstract (35 Word Limit): GaN L3 photonic crystal cavities were fabricated based on a genetic algorithm optimization. Optical characterization of several replicas led to an average unloaded quality factor of 16900, which is well accounted for by first-principles simulations.
Abstract (35 Word Limit): We demonstrate the first near-infrared optical parametric oscillator in a semiconductor waveguide. With an AlGaAs/AIOx heterostructure placed in a 2 μm-centered doubly-resonant monolithic cavity, we reach the threshold at 210 mW in the CW regime.
Exact Solutions and Scaling Laws for Kerr Frequency Combs

W. H. Renninger; 1; P. T. Rakich; 1
1. Yale University, New Haven, CT, United States.

Abstract (35 Word Limit): An exact, closed-form solution is analyzed for Kerr frequency combs. The model reproduces the behavior of both soliton and wavetrain regimes. Simple scaling laws validate the results and predict new regimes of performance.
Final ID: SF1D.3

Generation of Mid-IR Radiation by Four-Wave Mixing in Metal Coated Waveguides

T. Flöry; 1; P. Malevich; 1; A. Pugzlys; 1; A. Voronin; 2; A. Zheltikov; 2, 3; A. Baltuska; 1;
1. Photonics Institute, TU Vienna, Vienna, Austria.
2. Physics Department, International Laser Center, M.V. Lomonosov Moscow State University, Moscow, Russian Federation.
3. Department of Physics and Astronomy, Texas A&M University, College Station, TX, United States.

Abstract (35 Word Limit): 2.7-μm microjoule femtosecond pulses are generated in a metal coated hollow fiber thru four-wave-mixing parametric amplification. Numerical simulations predict generation of few-cycle optical pulses with the central wavelength extending beyond 10 μm.
Signal Gain from Four-Wave Mixing in Anomalous AlGaAs nanowaveguides

P. Kultavewuti; 1 V. Pusino; 2 M. Sorel; 2 J. Aitchison; 1

1. Department of Electrical and Computer Engineering, University of Toronto, Toronto, ON, Canada.
2. School of Engineering, University of Glasgow, Glasgow, United Kingdom.

Abstract (35 Word Limit): We experimentally demonstrate efficient four-wave mixing with a net signal gain of 4.1 dB and a conversion efficiency of 5.3 dB in low-loss AlGaAs nanowaveguides in an anomalous dispersion regime.
Abstract (35 Word Limit): We demonstrate low-noise mid-infrared frequency comb generation using a silicon microresonator. Using an integrated PIN-diode detector, we show a transition to a low RF-amplitude-noise state consistent with demonstrations of phase-locking in other microresonator platforms.
Final ID: SF1D.6

Mode-Locked and Repetition-Rate-Tunable Comb Generation Using Dual Coupled Microrings
X. Xue; Y. Xuan; P. Wang; Y. Liu; D. E. Leaird; M. Qi; A. M. Weiner;
1. School of Electrical and Computer Engineering, Purdue University, West Lafayette, IN, United States.
2. Birck Nanotechnology Center, Purdue University, West Lafayette, IN, United States.

Abstract (35 Word Limit): A method incorporating controllable mode interaction is proposed for Kerr frequency comb
generation in normal-dispersion microresonators. Repetition-rate-tunable combs and broadband mode-locking
transitions are demonstrated by using dual silicon nitride microrings.
Abstract (35 Word Limit): We show the first demonstration of frequency conversion via four wave mixing in a silicon carbide channel waveguide with a conversion efficiency as high as -19.5 dB over a 180 nm wavelength range.
Multilayer Optics for Ultrafast Applications

M. K. Trubetskov; 1, 2
1. Laboratory for Attosecond Physics, Max Planck Institute of Quantum Optics, Garching, Germany.
2. Research Computing Center, Moscow State University, Moscow, Russian Federation.

Abstract (35 Word Limit): Design and production of multilayer optical coatings is considered as multi-stage integral problem. The combination of state-of-the-art design methods and modern deposition techniques advances coating performance to theoretical limits.
Abstract (35 Word Limit): The implementation of multilayer optics for the compression and delivery of few-cycle femtosecond pulses will be discussed in the case of several cutting-edge applications.
Ultra-broadband Spectral Beam Combiner

E. Stanton; 1 M. J. Heck; 1 J. Bovington; 1 A. Spott; 1 J. Bowers; 1

1. University of California Santa Barbara, Goleta, CA, United States.

Abstract (35 Word Limit): A novel ultra-broadband spectral beam combiner is designed and demonstrated spanning greater than four octaves from ultraviolet to mid-wave infrared bands with low M squared output.
Mobility Enhancement of Graphene Nanoribbon by ALD HfO$_2$ and Its Optoelectronic Properties

X. Yu; Q. Wang; 1, 2

1. OPTIMUS, Photonics Centre of Excellence, School of Electrical and Electronic Engineering, Nanyang Tech Univ, Singapore 639798, Singapore.
2. Centre for Disruptive Photonic Technologies, Nanyang Technological University, 21 Nanyang Link, 637371, Singapore, Singapore.

Abstract (35 Word Limit): We demonstrated that depositing HfO$_2$ film on graphene nanoribbons greatly enhance the mobility through weakening the Coulombic interactions. As a result, the graphene nanoribbon photodetectors with HfO$_2$ layer exhibits high responsivity of ~2A/W at room temperature.
Selective Lasing and Nonlinear Relaxation of Confined Exciton-Polaritons
G. Grosso; 1, 2; S. Trebaol; 1, 3; J. Wouters; 4; F. Morier-Genoud; 1; M. Portella Oberli; 1; B. Deveaud; 1;
1. ICMP, École Polytechnique Fédérale de Lausanne (EPFL), Lausanne, VD, Switzerland.
2. EECS, Massachusetts Institute of Technology, Cambridge, MA, United States.
3. UMR Foton, Université de Rennes, Enssat, France.
4. TQC, University of Antwerp, Antwerpen, Belgium.

Abstract (35 Word Limit): We detail an innovative laser device based on a new relaxation mechanism for confined exciton-polaritons which preserves nonlinearity. We demonstrate the selective activation of polariton lasers at different wavelengths allowing to perform all-optical logic operations with fully coherent output.
All-Optical Tunable Multilevel Amplitude Regeneration Based on Coherent Polarization Mixing

Z. Bakhtiari; A. Sawchuk;
1. USC, Los Angeles, CA, United States.

Abstract (35 Word Limit): We propose an all-optical phase-preserving scheme for multilevel amplitude regeneration based on coherent polarization mixing for optical star-8QAM/star-16QAM signals with a power ratio of 1:5. A regeneration factor of 5.3 for star 8-QAM is achieved.
Mid-IR and Near-IR Photoluminescence of Fe$^{2+}$ and Cr$^{2+}$ Ions in ZnSe Excited via Ionization Transitions

J. Peppers; 1; V. V. Fedorov; 1; S. B. Mirov; 1;
1. University of Alabama at Birmingham, Birmingham, AL, United States.

Abstract (35 Word Limit): Spectroscopic characterization of Iron and Chromium doped ZnSe under visible excitation into the charge transfer bands of Transition Metal ions is reported. Energy transfer rates to the upper laser level are sufficient for population inversion.
High Average Power (35 W) Pulsed Fe:ZnSe laser tunable over 3.8-4.2 µm

D. V. Martyshkin; 1; V. V. Fedorov; 1; M. Mirov; 1; I. Moskalev; 1; S. Vasilyev; 1; S. B. Mirov; 1;
1. IPG Photonics Mid-IR Lasers, Birmingham, AL, United States.

Abstract (35 Word Limit): We report to the best of our knowledge the highest output average power of 35W (0.35J per pulse) of Fe:ZnSe laser operating at 100 Hz repetition rate in nonselective cavity, and 23 W (0.23J per pulse) in dispersive cavity. The lasing wavelength was tuned over 3.88-4.17 µm at 77K.
High Energy and Low Noise Ho:YLF Regenerative Amplifiers: A Noise and Stability Analysis

P. Kroetz, 1, 2; A. Ruehl, 3; k. murari, 2, 3; H. Cankaya, 2, 3; A. Calendron, 2, 3; F. Kaertner, 2, 3; I. Hartl, 3; R. Miller, 1, 2.

1. The Atomically Resolved Dynamics Division, Max-Planck Institute for the Structure and Dynamics of Matter (MPSD), Hamburg, 22761, Germany.
3. Deutsches Elektronen-Synchrotron (DESY), Hamburg, Germany.

Abstract (35 Word Limit): The dynamics and stability of Ho:YLF regenerative amplifiers is studied experimentally and numerically, whereas operating conditions are analyzed with respect to energy fluctuations. We propose a low-noise laser design operating at a second stability point.
Abstract (35 Word Limit): Our quasi-continuous wave Ce:Nd:YAG solid-state laser was directly pumped by LED arrays, yielding a maximum of 8mJ/pulse. Comparison of pumping at 460nm and 810nm allows analysis of the performance and potential of this laser system.
Compact, Passively Q-Switched 523-nm Laser

B. Pati; 1; E. D. Park; 1; K. Stebbins; 1;
1. Q-Peak, Inc., Bedford, MA, United States.

Abstract (35 Word Limit): We have developed a compact, passively Q-switched, intra-cavity frequency doubled Nd:YLF laser that produces 1-mJ of energy in a 10-ns pulse at a 1-20 Hz repetition rate.
Microchip Tm:KYW Laser with 2.5 W of Output Power

M. S. Gaponenko; 1; N. Kuleshov; 2; T. Sudmeyer; 1;
1. Université de Neuchâtel, Neuchatel, NE, Switzerland.
2. BNTU, Minsk, Belarus.

Abstract (35 Word Limit): Diode-pumped 1.9-um Tm:KYW microchip laser with 1.6 W TEM_{00} cw output power operates with 72% slope eff. to absorbed pump power. Output power of 2.5 W is achieved with generation of a "doughnut" mode. Q-switched operation with pulse duration of 2.2 ns at 1.5 MHz repetition rate is demonstrated.
Synchronously Pumped Mid-IR Hollow Core Fiber Gas Laser

M. Abu Hassan; 1 F. Yu; 1 Z. Wang; 1, 2 W. Belardi; 1 W. Wadsworth; J. Knight; 1
1. Department of Physics, Centre for Photonics and Photonic Materials, University of Bath, Bath, United Kingdom.

Abstract (35 Word Limit): We report a synchronously pumped 3.16 μm acetylene fiber laser based entirely on low-loss silica hollow-core fiber. Our system oscillates at 2.568 MHz repetition rate, when pumped with a modulated amplified 1.53 μm diode laser.
Abstract (35 Word Limit): Single-frequency crystalline Raman amplifier at 1178 nm was demonstrated. After three stages of amplifications, the output pulse energy was 26.7 mJ and the pulse width was 2.9 ns. The linewidth was less than 500 MHz.
All-carbon photodetectors

F. Wang; 1; Y. Liu; 1; X. Wang; 2; E. Flahaut; 3, 4; Y. Li; 1; X. Wang; 5; X. Wang; 1; Y. Xu; 1; Y. Shi; 1; R. Zhang; 1;

1. School of Electronic Science and Engineering, Nanjing University, Nanjing, Jiangsu, China.
2. Department of Electrical Engineering, Yale University, New Haven, CT, United States.
3. UPS, INP; Institut Carnot Cirimat, Université de Toulouse, Toulouse, France.
4. CNRS; Institut Carnot Cirimat, Toulouse, France.
5. School of Chemistry and Chemical Engineering, Nanjing University, Nanjing, China.

Abstract (35 Word Limit): We demonstrate a graphene/nanotube hybrid phototransistor, in which photogating provided by the nanotube layer leads to a dramatically enhanced photoresponsivity (>100A/W) in the visible range, corresponding to \( \sim 10^4 \) enhancement with respect to a graphene-only device.
Abstract (35 Word Limit): A highly efficient LED is demonstrated by incorporating the colloidal quantum dots and sodium chloride. Further lifetest shows great stability up to 104 hours under 194 mW/cm$^2$ of UV pump power.
Inhibited Coupling Kagome Fibers with Ultra-large Hollow-core Size for High Energy Ultrafast Laser Applications
B. Debord; 1; A. Amsanpally; 1; M. Alharbi; 1; L. Vincetti; 2; J. Blondy; 1; F. Gérôme; 1, 3; F. Benabid; 1, 3;
1. GPPMM group, Xlim Research Institute, UMR CNRS 7252, University of Limoges, France, Limoges, France.
2. Department of Engineering "Enzo Ferrari", University of Modena and Reggio Emilia, I-41125 Modena Italy, Modena, Italy.
3. GLOphotonics S.A.S, Limoges, France.

Abstract (35 Word Limit): We report on enlarged hollow-core diameter inhibited coupling Kagome fibers with record loss of 100 dB/km and ppm power overlap with silica surround, suitable for high energy ultrafast laser handling.
Electro-optic effect in silicon nitride

S. Miller; 1; Y. Lee; 1; J. Cardenas; 1; A. L. Gaeta; 2, 3; M. Lipson; 1, 3;
1. School of Electrical and Computer Engineering, Cornell University, Ithaca, NY, United States.
2. School of Applied and Engineering Physics, Cornell University, Ithaca, NY, United States.

Abstract (35 Word Limit): We present the first demonstration of the electro-optic effect in Si$_3$N$_4$ by using a multi-slot waveguide structure. We measure the maximum EO coefficient of 8.31±5.6fm/V, and demonstrate EO modulation at 1GHz.

Y. Kabessa; A. Agranat; 1;
1. HUJI, Nof Ayalon, Israel.

Abstract (35 Word Limit): Suppression of optical damage in a KLTN based electrooptical modulator operated with 30 W/cm² light beam at λ=445 nm is demonstrated. The modulator is driven by bipolar voltage which prevents the induced space-charge from accumulating.
Graphene-Based Saturable Absorber for Passive Q-switching of Tm:KLu(WO₄)₂ Microchip Laser

X. Mateos;¹; J. Serres;¹; P. Loiko;²,¹; K. Yumashev;²; V. Petrov;³; U. Griebner;³; M. Aguilo;¹; F. Diaz;¹;
¹. Universitat Rovira i Virgili, Tarragona, Spain.
2. Center for Optical Materials and Technologies, Belarusian National Technical University, Minsk, Belarus.
3. Max Born Institute, Berlin, Germany.

Abstract (35 Word Limit): A diode-pumped Q-switched Tm:KLu(WO₄)₂ microchip laser generated a maximum average output power of 310 mW with M² < 1.2 at 1947 nm. The shortest pulse duration was 285 ns at a pulse repetition rate of 190 kHz.
A ZnO/InN/GaN Heterojunction Photodetector with Extended Infrared Response

L. Hsu; S. Hsu; H. Lee; Y. Tsai; D. Lin; H. Kuo; Y. Hwang; Y. Chen; J. He; Y. Cheng; S. Lin; C. Lin;

1. Institute of Lighting and Energy Photonics, National Chiao Tung University, Tainan, Taiwan.
2. Institute of Photonic System, National Chiao Tung University, Tainan, Taiwan.
3. Department of Photonics, National Cheng Kung University, Tainan, Taiwan.
4. Institute of Electro-Optical Engineering, National Chiao Tung University, Hsinchu, Taiwan.
5. Institute of Photonics and Optoelectronics, National Taiwan University, Taipei, Taiwan.

Abstract (35 Word Limit): An extended infrared photoresponse is observed in a ZnO/InN/GaN heterojunction diode with InN grown by MOCVD. The external quantum efficiency is measured between 1200 and 1800 nm and can be as high as 3.55%.
Visible Photoluminescence in Cubic (3C) Silicon Carbide Coupled to High Quality Microdisk Resonators

M. Radulaski; T. M. Babinec; K. Muller; K. G. Lagoudakis; J. L. Zhang; S. M. Buckley; K. Alassaad; G. Ferro; J. Vuckovic;

1. Stanford University, San Francisco, CA, United States.
2. Universite de Lyon, Villeurbanne Cedex, France.

Abstract (35 Word Limit): We present the design, fabrication and characterization of cubic (3C) silicon carbide microdisk resonators with high quality factor modes at visible and near infrared wavelengths which couple to the intrinsic luminescence in silicon carbide.
Silicon Cabide Nanobeam Cavities with High Q/V

J. Lee; ¹; X. Lu; ¹; Q. Lin; ¹;
1. University of Rochester, Rochester, NY, United States.

Abstract (35 Word Limit): We demonstrate photonic-crystal nanobeam cavities in amorphous SiC. The fundamental mode exhibits intrinsic-Q of $7.69 \times 10^4$ with mode volume of $\sim 0.60(\lambda/n)^3$. This is, to the best of our knowledge, the highest Q/V value in SiC cavities.
Monolithic Single Crystal Diamond High-Q Optical Microcavities

M. Mitchell; 1, 2; B. Khanaliloo; 1, 2; A. Hryciw; 2, 3; P. E. Barclay; 1, 2;
1. Institute for Quantum Science & Tech., Calgary, AB, Canada.
2. NRC-National Institute for Nanotechnology, Edmonton, AB, Canada.
3. nanoFAB, University of Alberta, Edmonton, AB, Canada.

Abstract (35 Word Limit): Monolithic whispering gallery mode (WGM) optical microcavities are fabricated from bulk single crystal diamond (SCD) via a scalable process. Optical quality factors of $Q_i \sim 1.15 \times 10^5$ at 1.5 μm are demonstrated.
Optical Microresonators as Single-Molecule Spectrometers

K. H. Heylman; 1; K. Knapper; 1; E. H. Horak; 1; R. H. Goldsmith; 1;
1. University of Wisconsin Madison, Madison, WI, United States.

Abstract (35 Word Limit): A new approach is described for sensing and spectroscopy of single non-luminescent nano-objects which combines the spatial and spectral selectivity of laser microscopy with the tremendous sensitivity of ultrahigh-quality factor optical microresonators.
Photocurrent-induced Peak-dragging in a Nanobeam Photonic Crystal Cavity

M. Sodagar; 1; M. Miri; 1; A. Eftekhar; 1; A. Adibi; 1;
1. Georgia Institute of Technology, Atlanta, GA, United States.

Abstract (35 Word Limit): We demonstrate here the peak-dragging phenomenon in a nanobeam photonic crystal cavity with low optical power thresholds. In our device, Joule-heating mechanism enhances the absorption-induced heat by collecting the generated photocarries in a reverse-biased pn-junction.
Free-Space Read-Out of WGM Lasers Using Circular Micromirrors
T. Wienhold; 1, S. Kraemmer; 3, A. Bacher; 1, H. Kalt; 3, C. Koos; 1, 4, S. Koeber; 1, 4, T. Mappes; 1, 2.
1. Institute of Microstructure Technology (IMT), Karlsruhe Institute of Technology (KIT), Karlsruhe, Germany.
2. Corporate Research and Technology, Carl Zeiss AG, Jena, Germany.
3. Institute of Applied Physics (APH), Karlsruhe Institute of Technology (KIT), Karlsruhe, Germany.
4. Institute of Photonics and Quantum Electronics (IPQ), Karlsruhe Institute of Technology (KIT), Karlsruhe, Germany.

Abstract (35 Word Limit): We report on efficient free-space read-out of whispering-gallery mode microlasers using circular micromirrors. A ten-fold improvement in detection efficiency can be achieved by directing emission from all azimuthal angles of the cavity to the detector.
Yb$^{3+}$-doped Silica WGM Milled Microrod laser

S. Bakhtiari Gorajoobi; 1; G. Senthil Murugan; 1; M. Zervas; 1;
1. Optoelectronics Research Centre, University of Southampton, Southampton, United Kingdom.

Abstract (35 Word Limit): A fast and versatile fabrication method for high Q milled microrod resonators, directly on rare-earth doped fibers, is demonstrated using a pulsed CO$_2$ laser. Evanescently pumped WGM microlaser with $\sim 9\mu W$ output power has been achieved.
Final ID: SF1H.8

Demonstration of the first monolithically integrated self-rolled-up tube based vertical photonic coupler
X. Chen; 1; X. Yu; 1; E. Arbabi; 1, 2; X. Li; 1; L. L. Goddard; 1;
1. Univ of Illinois at Urbana-Champaign, Urbana, IL, United States.
2. California Institute of Technology, Pasadena, CA, United States.

Abstract (35 Word Limit): We demonstrated the first monolithically integrated self-rolled-up SiN_x tube based vertical photonic coupler on top of a planar ridge waveguide. The coupling efficiency between the elements is >10 times higher than similar non-integrated device.
Abstract (35 Word Limit): Wavelength tuning in a single mode parity-time (PT) symmetric semiconductor microring laser is demonstrated. Stable continuous tuning over a spectral range of 4 nm has been obtained at telecom wavelengths by adjusting the ambient temperature.
Widely-tunable narrow-linewidth lasers with monolithically integrated external cavity

T. Komljenovic; S. Srinivasan; M. Davenport; E. Norberg; G. Fish; J. Bowers;
1. UCSB, Santa Barbara, CA, United States.
2. Aurrion Inc, Goleta, CA, United States.

Abstract (35 Word Limit): We demonstrate preliminary results from a monolithically integrated tunable laser with narrow-linewidth. We show tuning in excess of 54 nm in the O-band as well as significant reduction in linewidth due to the external cavity. The measured linewidth, limited by measurement setup, is around 150 kHz.
Continuously Tunable Laser Based on Multiple-Section DFB Laser Technology for 1.25 Gbps WDM-PON Applications

D. McIntosh-Dorsey; R. Bikky; H. Zhang; K. Anselm; J. Lii; H. Wang; H. Liao; I. Ho; H. Xie; L. Bo; P. Lorenzo; Y. Wang; J. Zheng;

1. Applied Optoelectronics Inc, Sugar Land, TX, United States.

Abstract (35 Word Limit): A low-cost continuously tunable laser based on multiple in-line DFB sections and thermal tuning is demonstrated. It is capable of 16 channel tuning and 1.25 Gbps operation. Transceiver performance will also be shown.
All-Optical Carrier Recovery Using a Single Injection Locked Semiconductor Laser Stabilized by an Incoherent Optical-Feedback
A. Albores-Mejia; 1, T. Kaneko; 2, E. Banno; 3, K. Uesaka; 3, H. Shoji; 3, H. Kuwatsuka; 1;
1. National Institute of AIST, , United States.

Abstract (35 Word Limit): Novel all-optical-hardware-efficient carrier recovery unit for carrier-suppressed BPSK signals is demonstrated. For the first time, carrier recovery with an optically stabilised injection-locked semiconductor laser enabled successful homodyne detection of 32-Gbit/s carrier-suppressed BPSK signals.
Double Half-Wave-Coupled Rectangular Ring-FP Semiconductor Laser with 19-nm Quasi-Continuous Tuning Range

M. Sun; L. Wu; X. Xiong; X. Liao; J. He;
1. Department of Optical Engineering, Zhejiang University, Hangzhou, Zhejiang, China.

Abstract (35 Word Limit): We present our latest experimental results of the double half-wave-coupled rectangular ring-FP laser in a XMD TOSA package. A 19-nm quasi-continuous tuning range with over 30dB side mode suppression ratio is obtained.
Effect of microcavity size to the RIN and 40 Gb/s data transmission performance of high speed VCSELs

F. Tan; M. Wu; C. Wang; M. Liu; M. Feng; N. Holonyak;

1. Department of Electrical and Computer Engineering, University of Illinois at Urbana-Champaign, Urbana, IL, United States.

Abstract (35 Word Limit): We demonstrated that larger aperture VCSELs have better performance in 40Gb/s error free data transmission, and smaller aperture VCSELs have lower laser RIN. Medium aperture VCSELs may excel in high fidelity and high speed applications.
Millimeter-wave Modulation of 850 nm VCSELs for Radio over Fiber Applications

H. Dalir; F. Koyama;

1. Electronics and Applied Physics, Tokyo Institute of Technology, Yokohama, Kanagawa, Japan.
2. Electronics and Applied Physics, Tokyo Institute of Technology, Tokyo, Japan.

Abstract (35 Word Limit): A slow-light modulator-integrated with 850nm-VCSEL is presented, exhibiting small signal response of over 55dB enhancement at frequencies beyond 35GHz. Also, the direct modulation bandwidth is expanded beyond 20GHz thanks to optical-feedback in the integrated device.
Abstract (35 Word Limit):
We experimentally and theoretically investigate microwave signal generation using a 1550nm VCSEL subject to two-frequency orthogonal optical injection. It is found that microwave linewidth is given by the sum of the linewidths of the two master lasers.
Abstract (35 Word Limit): Freeze drying is used to produce dry solid from a solution to improve product stabilization. We have applied absorption spectroscopy to monitor water sublimation rates and determine product temperature during drying, a critical process parameter.
Real-time Full Characterization of Colloidal Dynamics

J. R. Guzman-Sepulveda; 1; A. Dogariu; 1;

1. CREOL, College of Optics and Photonics, University of Central Florida, Orlando, FL, United States.

Abstract (35 Word Limit): We present an optical technique capable of measuring simultaneously hydrodynamic size and mass density of colloidal suspensions. The technique is fiber optic-based, non-invasive, and permits continuous online measurements over a broad range of colloidal parameters.
Indentation hardness and scratch tests for thin layers manufactured by sol-gel process

H. PIOMBINI; 1; C. Ambard; 1; F. Compoint; 1; K. Valle; 1; P. Belleville; 1; C. Sanchez; 2;
1. CEA Le Ripault, Monts, France.

Abstract (35 Word Limit): We introduce our first tests to characterize the mechanical properties of elastic layer manufactured by sol-gel process obtained with an indenter designed from a microscope. They are performed with a microscope and a diamond tip.
Fiber-optic SERS detection enabled by light-induced gold nano-particle aggregation

Z. Zheng; 1, 2; H. Liu; 1; J. Liu; 1; L. Chen; 1; H. Zhou; 1;
1. School of Electronic and Information Engineering, Beihang University, Beijing, Beijing, China.
2. Collaborative Innovation Center of Geospatial Technology, Wuhan, China.

Abstract (35 Word Limit): We demonstrated a SERS detection scheme where fiber-optic light-induced aggregation of gold nano-particles enhances the Raman signal by 30-fold over the non-aggregation case, even by exciting and collecting light through low-cost, standard silica fibers.
Picometer-Scale Surface Roughness Measurements Inside Hollow Glass Fibres

X. Buet; 1, 2; C. Brun; 1, 3; B. Bresson; 1; M. Ciccotti; 1; M. Petrovitch; 4; F. Poletti; 4; d. Richardson; 4; D. Vandembroucq; 1; G. Tessier; 1;
1. ESPCI, United States.
3. Institut langevin, Paris, France.
4. orc, Southampton, United Kingdom.

Abstract (35 Word Limit): A differential optical profilometry technique with picometre-range sensitivity is adapted to the non invasive measurement of the roughness inside hollow glass fibres by use of immersion objectives and index-matching liquid.
Abstract (35 Word Limit): Industrial technologies based on single photons are emerging. We report on work to develop traceable metrology for the quantum optical devices used in quantum key distribution (QKD), one of the most commercially-advanced quantum technologies.
Frequency comparisons of Sr, Yb, and Hg based optical lattice clocks and their applications

H. Katori; 1, 2
1. University of Tokyo, Bunkyo-ku, Tokyo, Japan.
2. Quantum Metrology Laboratory, RIKEN, Wako, Saitama, Japan.

Abstract (35 Word Limit): We report recent progress of optical lattice clocks with strontium, ytterbium and mercury atoms with an emphasis on their synchronous frequency comparison inside a laboratory and inter-laboratories connected by a phase-stabilized fiber link.
Broadband Phase Noise Limit in the Direct Detection of Ultralow Jitter Optical Pulses

F. Quinlan; W. Sun; T. M. Fortier; J. Deschenes; Y. Fu; J. C. Campbell; S. Diddams;
2. Dept. of Electrical and Computer Engineering, University of Virginia, Charlottesville, VA, United States.

Abstract (35 Word Limit): The lowest measured phase noise floors of photonically generated microwave signals are orders-of-magnitude above the quantum limit. We show this discrepancy is likely due to photocarrier scattering in high speed, high linearity photodetectors.
Electro-optical frequency division and stable microwave synthesis

X. Yi; J. Li; H. Lee; S. Diddams; K. Vahala;

1. California Institute of Technology, Pasadena, CA, United States.

Abstract (35 Word Limit): Optical frequency division and stable microwave generation is demonstrated using an electro-optical-based frequency comb created through phase modulation of two stable optical signals. The technique is simple, tunable and scalable to higher division ratios.

K. Jung; 1; J. Kim; 1;

Abstract (35 Word Limit): We show timing jitter spectrum measurement of free-running mode-locked lasers from 1-mHz to 40-MHz Fourier frequency. The demonstrated method can resolve different noise mechanisms that cause specific jitter characteristics from <100-ns to >1000-s time scales.
Attosecond Timing Jitter Characterization of Mode-locked Lasers Using Optical Heterodyne Techniques

D. Hou; C. Lee; Z. Yang; K. Silverman; A. Feldman; T. Harvey; R. P. Mirin; T. R. Schibli;
1. University of Colorado Boulder, Boulder, CO, United States.

Abstract (35 Word Limit): We demonstrate timing jitter characterization of mode-locked lasers with attosecond-resolution using optical heterodyne techniques. The measured integrated jitter for a free-running mode-locked Er:Yb:glass laser was found below 20 as from 10 kHz to 5 MHz.
Fiber-based portable optical frequency standard for telecommunication

M. Triches; 1, 2; A. Brusch; 1; J. Hald; 1; J. Lægsgaard; 2; O. Bang; 2;
1. DFM A/S - Danish Fundamental Metrology Institute, Kgs. Lyngby, Denmark.
2. Department of Photonics Engineering, Technical University of Denmark, Kgs. Lyngby, Denmark.

Abstract (35 Word Limit): Gas-filled hollow-core fiber-based portable optical frequency standard is developed for laser stabilization to the $^{13}\text{C}_2\text{H}_2$ transition at 1.5 μm using saturated absorption. The system, assembled in an easy-to-use configuration, has an Allan deviation $<8\times10^{-11}$ (1<τ<1000 s) with 60 kHz locking accuracy.
Compact and robust laser system for precision atom interferometry based on a frequency doubled telecom fiber bench

F. THERON; N. Zahzam; Y. Bidel; M. Cadoret; A. Bresson;

1. ONERA, Palaiseau Cedex, France.

Abstract (35 Word Limit): We present a compact and robust narrow linewidth laser system for onboard Rubidium atom interferometry using only one laser source based on a frequency doubled telecom fiber bench.
High Speed and Flexible Optical Transport Network

T. J. Xia; 1; G. A. Wellbrock; 1;
1. Verizon Communications Inc, Richardson, TX, United States.

Abstract (35 Word Limit): Optical network operators have been focused on increasing channel speeds and fiber capacities to meet high data traffic demand growth in past decades. Network efficiency improvement with flexible optics will be network operators' next focus.
Experimental Demonstration of 3D Elastic Optical Networking in Space, Time and Frequency

C. Qin; 1; B. Guan; 1; R. P. Scott; 1; R. Proietti; 1; N. K. Fontaine; 2; S. Yoo; 1;
1. University of California Davis, Davis, CA, United States.
2. Bell Laboratories, Holmdel, NJ, United States.

Abstract (35 Word Limit): We demonstrate elasticity in time, frequency and space domains for an optical link at 960-Gb/s with 6.4-b/s/Hz spectral efficiency. Modulation format and number of spatial modes are selected based on Shannon's Law and crosstalk-dependent impairments.
Wavelength Conflict Resolution by Spectral Overlap of Two Nyquist-WDM Signals

L. Huang; 1 S. Gao; 2 C. Chan; 2
1. Center for Optical and Electromagnetic Research, Zhejiang University, Hangzhou, Zhejiang, China.
2. Department of Information Engineering, The Chinese University of Hong Kong, Hongkong, China.

Abstract (35 Word Limit): Two Nyquist-WDM signals are spectrally overlapped to resolve the possible wavelength conflict in network routing. Recovery of individual signals is realized by digital signal processing techniques and has been experimentally demonstrated and characterized.
High Energy and Power Optical Waveform Synthesizers

F. X. KAERTNER$^{2,1}$
1. Massachusetts Institute of Technology, Cambridge, MA, United States.

Abstract (35 Word Limit): We report on recent progress in high-energy optical waveform synthesis with optical parametric amplifiers pumped by high-energy Ti:Sapphire and Yb-based lasers delivering more than 2-octave spanning sub-cycle waveforms with multi-mJ energy.
Third-generation femtosecond technology

H. Fattahi; 1; N. E. Karpowicz; 1; T. Metzger; 2; Z. Major; 1; F. Krausz; 1;
1. Max-Planck-Institut für Quantenoptik, Garching bei Muenchen, Germany.
2. TRUMPF Scientific Lasers, Munich, Germany.

Abstract (35 Word Limit): The design of a 3-channel OPCPA system, generating ultrashort pulses with terawatt peak and sub-kilowatt average powers is presented. Coherent synthesis of the channels is predicted to produce intense, sub-cycle transients, presenting a route toward keV attosecond pulses.
Sub-Two-Cycle Millijoule Optical Pulses at 1600 nm from a BiB$_3$O$_6$ Optical Parametric Chirped-Pulse Amplifier

N. Ishii; K. Kaneshima; T. Kanai; S. Watanabe; J. Itatani;

1. Institute for Solid State Physics, Kashiwa, Chiba, Japan.
2. Tokyo University of Science, Noda, Japan.

Abstract (35 Word Limit): We report on the generation of 10.1-fs, 1.5-mJ pulses at 1 kHz from a BiB$_3$O$_6$ OPCPA with passive CEP stabilization. This light source is promising for the generation of high-flux isolated soft x-ray pulses.
High-Energy Infrared Femtosecond Pulses by Dual-Chirped Optical Parametric Amplification

Y. Fu; E. J. Takahashi; K. Midorikawa;
1. Attosecond Science Research Team, RIKEN Center for Advanced Photonics, RIKEN, Wako-shi, Saitama, Japan.

Abstract (35 Word Limit): A total output energy exceeding 30 mJ has been achieved in the infrared region by dual-chirped optical parametric amplifier for generating soft x-ray harmonic pulses. Obtained spectrum supports a pulse duration shorter than 40 fs.
Improved Characteristics of High Repetition Rate Non-Collinear Optical Parametric Amplifiers for Electron-Ion Coincidence Spectroscopy

F. J. Furch; 1; A. Anderson; 1; S. Birkner; 1; Y. Wang; 1; A. Giree; 1, 2; C. Schulz; 1; M. Vrakking; 1;

1. Max Born Institute, Berlin, Germany.
2. Amplitude Technologies, Evry, France.

Abstract (35 Word Limit): A non-collinear optical parametric amplifier (NOPA) for applications in attosecond science is presented. The amplifier delivers carrier-envelope phase (CEP) stable few-cycle pulses at an average power of 5 W at 400 and 800 kHz.
High-Power 300-kHz OPCPA System Generating CEP-Stable Few-Cycle Pulses

M. Schultze; 1; S. Prinz; 1, 2; M. Haefner; 1; C. Teisset; 1; R. Bessing; 1; K. Michel; 1; T. Metzger; 1;
1. TRUMPF Scientific Lasers, Munich, Germany.
2. Department of Physics, Technische Universität München, Munich, Germany.

Abstract (35 Word Limit): An OPCPA system with 15 W of average power at 300 kHz repetition rate generating CEP-stable few-cycle pulses is presented. The system exhibits pulse durations below 6 fs, a peak power of 4.5 GW and an excellent long-term performance over hours of operation with power fluctuations of less than 1.5%.
Low-jitter single-photon detector arrays integrated with silicon and aluminum nitride photonic chips

F. Najafi; J. Mower; N. C. Harris; F. Bellei; A. Dane; C. Lee; X. Hu; S. Mouradian; T. Schroder; P. Kharel; F. Marsili; S. Assefa; K. K. Berggren; D. Englund;

1. Massachusetts Institute of Technology, Cambridge, MA, United States.
2. Columbia University, New York, NY, United States.
3. Jet Propulsion Laboratory, Pasadena, CA, United States.
4. IBM TJ Watson Research Center, Yorktown Heights, NY, United States.

Abstract (35 Word Limit): We present progress on a scalable scheme for integration of single-photon detectors with silicon and aluminum nitride photonic circuits. We assemble arrays of low-jitter waveguide-integrated single-photon detectors and show up to 24% system detection efficiency.
Final ID: FF2A.2

Probing Number-Correlated States of up to 50 Photons

G. Harder; 1; T. J. Bartley; 2, 1; A. Lita; 2; S. Nam; 2; T. Gerrits; 2; C. Silberhorn; 1;
1. Applied Physics, University of Paderborn, Paderborn, Germany.

Abstract (35 Word Limit): Using spontaneous parametric down-conversion in ppKTP waveguides, we probe photon-number correlated states of up to 50 photons with a Klyshko efficiency of >60%, in a single mode characterised by an unheralded marginal $g^{(2)}(0)=1.87\pm0.05$. 
Saturated Photon Detection Efficiency in NbN Superconducting Photon Detectors

R. Murphy; 1  M. Grein; 1  T. Gudmundsen; 1  A. McCaughan; 2  F. Najafi; 2  K. K. Berggren; 2  F. Marsili; 3  E. Dauler; 1

1. MIT Lincoln Laboratory, Lexington, MA, United States.
2. Research Laboratory of Electronics, Massachusetts Institute of Technology, Cambridge, MA, United States.
3. Jet Propulsion Laboratory, Pasadena, CA, United States.

Abstract (35 Word Limit): In this work, we demonstrate saturated photon detection efficiency with narrow NbN nanowires and SNAPs to boost the signal-to-noise ratio, and we demonstrate a stabilizing choke inductance that is part of the optically-active area.
Polarization-Insensitive Superconducting Nanowire Single-Photon Detectors

S. D. Dyer; 1; H. Takesue; 2; V. Verma; 1; R. Horansky; 1; R. P. Mirin; 1; S. Nam; 1;
2. NTT Basic Research Laboratories, NTT, Atsugi, Japan.

Abstract (35 Word Limit): We report MoSi superconducting nanowire single-photon detectors (SNPDs) with low polarization sensitivity over a 120 nm wavelength range, covering the standard fiber telecom wavelengths. Our models indicate that this low polarization sensitivity is consistent with the design geometry.
Superconducting Nanowire Detectors Based on MgB$_2$

F. Marsili; D. P. Cunnane; R. Briggs; M. D. Shaw; B. S. Karasik; M. Wolak; N. Acharya; X. Xi;

1. Jet Propulsion Laboratory, Pasadena, CA, United States.
2. Temple University, Philadelphia, PA, United States.

Abstract (35 Word Limit): We fabricated and characterized the optical response of MgB$_2$ nanowires with critical temperature $T_C = 33$ K. The devices showed optical response at 4 K and sub-nanosecond relaxation time. The detectors responded to the simultaneous absorption of three photons, but not to single photons.
A Robust Optical Coupler for Alignment of Superconducting Nanowire Detector Array

R. H. Shepard; 1; A. Guzman; 1; M. Grein; 1; E. Dauler; 1; D. Rosenberg; 1; T. Gudmundsen; 1; R. Murphy; 1;
1. Massachusetts Inst of Tech Lincoln Lab, Lexington, MA, United States.

Abstract (35 Word Limit): We present an athermalized design and performance analysis of a robust imaging system used to couple light from an input fiber to a superconducting nanowire single photon detector.
Using Double Compressive Sensing in Simultaneous Imaging of Spatial Entanglement

S. H. Knarr; 1, 2; G. Howland; 3; J. Schneeloch; 1, 2; D. Lum; 1, 2; J. Howell; 1, 2;
1. University of Rochester, Rochester, NY, United States.
2. Center for Coherence and Quantum Optics, University of Rochester, Rochester, NY, United States.
3. Air Force Research Laboratory, Rome, NY, United States.

Abstract (35 Word Limit): We use compressive sensing in the image and Fourier planes of a spontaneous parametric downconversion source to simultaneously gather the joint position and momentum distributions. We witness entanglement by violating a continuous variable steering inequality.
Abstract (35 Word Limit): We describe a classical-state system capable of mimicking the essential features of Barreto Lemos et al.'s quantum imaging with undetected photons [Nature, 512, 409-412 (2014)], but with a much higher signal-to-noise ratio.
Giant Polarization Rotation Induced by a Single Spin: a Cavity-Based Spin-Photon Interface
L. Lanco; 1, 2; J. Demory; 1; C. Arnold; 1; V. Loo; 1; A. Lemaître; 1; I. Sagnes; 1; M. Glazov; 3; O. Krebs; 1; P. Voisin; 1; P. Senellart; 1;
1. LPN-CNRS, Marcoussis, France.
2. Université Paris Diderot Paris 7, Paris, France.
3. Ioffe Physical-Technical Institute, St Petersburg, Russian Federation.

Abstract (35 Word Limit): We report the amplification by three orders of magnitude of the spin-photon interaction, using a single hole spin in a quantum dot-pillar cavity system: a macroscopic and spin-dependant polarization rotation is induced on incident photons by a single spin, initialized either in the up or down state.
Macroscopic Kerr Rotation from a Bright Negatively Charged Quantum Dot in a Low-Q Micropillar Cavity

P. Androvitsaneas; 1, A. Young; 1, C. Schneider; 2, S. Höfling; 2, 3, M. Kamp; 2, E. Harbord; 1, J. Rarity; 1, R. Oulton; 1.

1. University of Bristol, Bristol, United Kingdom.
2. Universitat Wurzburg, Wurzburg, Germany.

Abstract (35 Word Limit): We report the measurement of macroscopic phase shifts of several degrees for reflected incident light resonant with a bright negatively charged quantum dot (QD) in a micropillar structure of Q-factor less than 200.
Optical Pumping of Individual Spins in Self-Assembled and Site-Controlled Quantum Dots

K. Lagoudakis; 1; P. L. McMahon; 1; K. Fischer; 1; K. Muller; 1; T. Sarmiento; 1; S. Puri; 1; D. Dalacu; 2; P. Poole; 2; M. Reimer; 3; V. Zwiller; 3; Y. Yamamoto; 4; J. Vuckovic; 1;

1. Stanford University, Stanford, CA, United States.
2. National Research Council of Canada, Ottawa, ON, Canada.
4. National Institute of Informatics, Tokyo, Japan.

Abstract (35 Word Limit): We investigate optical spin pumping of self-assembled p-type δ-doped InAs quantum dots as well as site-controlled InP nanowire quantum dots and find that they are both promising for scalable quantum information processing platforms.
Nonlinear Optics with Single Molecules
B. Gmeiner; 1, 2; A. Maser; 1, 2; T. Utikal; 1, 2; S. Götzinger; 1, 2; V. Sandoghdar; 1, 2;
1. Max Planck Institute, Erlangen, Germany.
2. Friedrich Alexander University, Erlangen, Germany.

Abstract (35 Word Limit): We report on four-wave mixing in a single organic molecule placed at the tight focus of two near resonant laser beams. By directly monitoring the intensity of a weak probe beam after the interaction with the molecule, we observe a rich set of resonance profiles in excellent agreement with theory. <!–EndFragment-->
Xenon-based Nonlinear Fabry-Perot Interferometer for Quantum Information Applications

G. Hickman; 1; T. B. Pittman; 1; J. D. Franson; 1;
1. University of Maryland, Baltimore County, Baltimore, MD, United States.

Abstract (35 Word Limit): We describe a nonlinear Fabry-Perot interferometer useful for optical quantum information applications. We observe self-phase modulation and other nonlinear effects with ultra-low input powers using metastable xenon in a high-finesse cavity.
Experimental Generation of Quadruple Quantum Correlated Beams from Cascaded Four-Wave Mixing Processes in Hot Rubidium Vapors

J. Jing; ¹
1. East China Normal University, Shanghai, China.

Abstract (35 Word Limit): We report on our recent experimental results of generating quadruple quantum correlated beams by using cascaded four-wave mixing processes in hot rubidium vapor. The intensity-difference squeezing of the four beams is about 8.0 dB.
Continuous Generation of Rubidium Vapor in a Hollow Core Photonic Band-Gap Fiber

P. Donvalkar; S. Ramelow; S. Clemmen; A. L. Gaeta;

1. Cornell University, Ithaca, NY, United States.

Abstract (35 Word Limit): We demonstrate high optical depths of > 50 lasting over 100 minutes in a Rubidium filled PBGF using an off-resonant CW laser beam, which enables straightforward measurement of cross-phase modulation at the single photon level.
High-Contrast Nanoparticle Sensing using a Hyperbolic Metamaterial
T. Xu; 1 W. Zhu; 1 A. Agrawal; 1 H. J. Lezec; 1
1. NIST, USA, Gaithersburg, MD, United States.

Abstract (35 Word Limit): Using planar hyperbolic metamaterials composed of alternating layers of metal (Ag) and
dielectric (SiO₂), we demonstrate a transmission device for nanoparticle sensing that exhibits extremely high optical
contrast.
Gap Mode Formation in Metallic, Nanofocusing SNOM Tapers for High Spatial Resolution Broadband Spectroscopy

M. Esmann; 1; S. Becker; 1; K. Yoo; 1, 2; H. Kollmann; 1; P. Gross; 1, 3; R. Vogelgesang; 1; N. Park; 2; C. Lienau; 1

1. Carl V. Ossietzky Universität, Oldenburg, Germany.
2. Seoul National University, Seoul, Korea (the Republic of).
3. Universität Osnabrück, Osnabrück, Germany.

Abstract (35 Word Limit): Nanofocusing of surface plasmon polaritons enables broadband elastic scattering spectroscopy on individual nanoantennas without any signal demodulation. Clear experimental signatures of tip-sample gap mode formation hint at a potential increase in lateral resolution to single nanometers.
Holographic 3D Superlocalization of Brownian Scattering Particles for Stochastic Optical Mapping

a. martinez-marrades; J. Rupprecht; M. Gross; G. Tessier;
1. Institut Langevin, ESPCI, CNRS UMR 7587, Paris, France.
2. Neurophotonics lab, Université Paris Descartes, Paris, France.
3. Laboratoire de Physique Théorique de la Matière Condensée, UPMC, UMR CNRS 7600, Paris, France.
4. Laboratoire Charles Coulomb, UMR CNRS 5221, Université Montpellier 2, Montpellier, France.

Abstract (35 Word Limit): We present a wide field microscopy technique for the 3D mapping of optical intensity using Brownian gold nanoparticles as local probes. Localization by off-axis holography allows stochastic subwavelength optical characterization in water-based systems.
FRET-based Scanning Probe Microscopy with a Donor Dye Coated AFM Tip

B. Kalanooor; 1
1. Bar Ilan University, Ramat Gan, Israel.

Abstract (35 Word Limit): A FRET-based method of near-field fluorescence lifetime imaging is developed. Lumogen dye attached to the apex of an AFM tip acts as a nanometric light source for exciting the sample via non-radiative energy transfer.
**Optical Trapping of a Colloidal Quantum Dot**

I. Huang; R. Jensen; O. Chen; J. Choy; T. Bischof; M. Bawendi; M. Loncar;

1. Harvard University, Cambridge, MA, United States.
2. Massachusetts Institute of Technology, Cambridge, MA, United States.

**Abstract (35 Word Limit):** Bowtie apertures fabricated by lift-off were used to optically trap a 30-nm silica coated quantum dot (scQD) with 1.56-MW/cm² intensity at 1064-nm wavelength. The trapped scQD emitted fluorescence by two photon excitation from the trapping laser.
Nonreciprocal Optical Interaction of Dissimilar Particles

S. Sukhov; 1; A. Shalin; 2; D. Haefner; 1; A. Dogariu; 1;
1. University of Central Florida, CREOL, Orlando, FL, United States.

Abstract (35 Word Limit): We show that optical interaction of dissimilar particles results in apparent violation of *actio et reactio* principle. Interaction asymmetry in an optically-bound dimer can lead to unexpected movement transversal to the direction of light propagation.
Optical manipulation of Janus nanoparticles

O. Ilic; I. Kaminer; Y. Lahini; H. Buljan; M. Soljacic;

1. Massachusetts Institute of Technology, Cambridge, MA, United States.
2. Department of Physics, University of Zagreb, Zagreb, Croatia.

Abstract (35 Word Limit): We explore optical forces and torques acting on Janus nanoparticles in a plane electromagnetic wave. We find rotationally stable points and propose a scheme for all-optical manipulation of orientation and position of Janus nanoparticles.
Simultaneous Transport of Multiple Nanoparticles Across a Patterned Plasmonic Substrate

J. Ryan; 1 Y. Zheng; 1 P. Hansen; 1 T. Huang; 1 L. Hesselink; 1
1. Stanford University, Mountain View, CA, United States.

Abstract (35 Word Limit): We demonstrate the controlled transport of simultaneous nano-scale particles across a patterned gold film. Nanopillars patterned onto the gold surface load particles onto nearby plasmonic conveyor belts formed from C-shaped engravings.
Coherent Supercontinuum from a Silicon Nitride Waveguide

A. R. Johnson; 1; A. Mayer; 2; A. Klenner; 2; K. Luke; 3; E. S. Stranford; 1; M. Lamont; 1, 3; Y. Okawachi; 1; F. W. Wise; 1; M. Lipson; 3, 4; U. Keller; 2; A. L. Gaeta; 1, 4;

1. School of Applied and Engineering Physics, Cornell University, Ithaca, NY, United States.
2. Department of Physics, Institute of Quantum Electronics, ETH Zurich, Zurich, Switzerland.
3. School of Electrical and Computer Engineering, Cornell University, Ithaca, NY, United States.

Abstract (35 Word Limit): We show experimentally and theoretically that the coherence of a two-octave-spanning supercontinuum generated in a silicon nitride waveguide via 1-μm-pumping with ~100-fs pulses is fully coherent over most of its bandwidth.
Blue-enhanced supercontinuum generation pumped by a giant-chirped SESAM mode-locked fiber laser

S. Gao; R. Sun; D. Jin; P. Wang;

1. Institute of Laser Engineering, Beijing University of Technology, Beijing, Beijing, China.

Abstract (35 Word Limit): We report a blue-enhanced supercontinuum generation pumped by a giant-chirped SESAM mode-locked ytterbium-doped fiber laser. An extremely wide optical spectrum spanning from 380 nm to 2400 nm with total power of 3 W is obtained.
Silicon-on-Sapphire Nanowire for Mid-IR Supercontinuum Generation

N. Singh; 1; D. Hudson; 1; Y. Yu; 2; C. Grillet; 3; A. Read; 4; P. Atanackovic; 4; S. Duval; 4; S. Madden; 2; D. Moss; 5; B. Luther-Davies; 2; B. J. Eggleton; 1;

1. University of Sydney, Sydney, NSW, Australia.
2. Australian National University, Canberra, ACT, Australia.
3. University of Lyon, Lyon, France.
4. Silanna Semiconductor, Sydney, NSW, Australia.
5. RMIT, Melbourne, NSW, Australia.

Abstract (35 Word Limit): We demonstrate an octave spanning, 1.9-6.2 µm supercontinuum generation in a low loss silicon on a sapphire (SOS) nanowire. This establishes SOS as a promising new platform for integrated nonlinear photonics in the mid-IR.
Relative Timing Jitter of Raman Solitons and its Effect on Nonlinear Wavelength Conversion

G. Zhou; 1, 2, M. Xin; 1, F. Kaernter; 1, 2, G. Chang; 1, 3,
1. CFEL, DESY, Hamburg, Germany.
2. University of Hamburg, Hamburg, Germany.
3. Massachusetts Institute of Technology, Cambridge, MA, United States.

Abstract (35 Word Limit): We demonstrate that shorter fiber length and the excitation pulse with shorter duration and higher energy can reduce a Raman soliton’s relative timing jitter and leads to reduced noise in nonlinear wavelength conversion.
Abstract (35 Word Limit): Supercontinuum generation by filamentation in molecular gases is optimized by studying the
ellipticity of the pulse polarization during the interaction with the species of the gas medium via strong field ionization
and molecular alignment effects.
Visible-to-near-Infrared Octave Spanning Supercontinuum Generation in a Partially Underetched Silicon Nitride Waveguide

H. Zhao; 1, 2; B. Kuyken; 1, 2; F. Leo; 1, 2; S. Clemmen; 1, 2; E. Brainis; 2, 3; G. Roelkens; 1, 2; R. Baets; 1, 2;
1. Photonics Research Group, Department of Information Technology, Ghent University-imec, Ghent, Belgium.
2. Center for Nano- and Biophotonics (NB-Photonics), Ghent University, Ghent, Belgium.
3. Physics and Chemistry Nanostructures Group, Department of Electronics and Information Systems, Ghent University, Ghent, Belgium.

Abstract (35 Word Limit): The generation of an octave spanning supercontinuum covering most of the visible spectrum is demonstrated for the first time in a silicon nitride waveguide. This result is achieved by dispersion engineering through partially underetching a waveguide.
Mid-Infrared Supercontinuum Generation Spanning More Than 11 μm in a Chalcogenide Step-Index Fiber

C. R. Petersen; 1; U. Möller; 1; I. Kubat; 1; B. Zhou; 1; S. Dupont; 2; J. Ramsay; 2; T. Benson; 3; S. Sujecki; 3; N. Abdel-Moneim; 3; Z. Tang; 3; D. Furniss; 3; A. Seddon; 3; O. Bang; 1, 4

1. DTU Fotonik, Department of Photonics Engineering, Danmarks Tekniske Universitet, Kgs. Lyngby, Denmark.
2. Department of Chemistry, Aarhus University, Aarhus, Denmark.
3. George Green Institute for Electromagnetics Research, University of Nottingham, Nottingham, United Kingdom.
4. NKT Photonics A/S, Birkerød, Denmark.

Abstract (35 Word Limit): Supercontinuum generation covering an ultra-broad spectrum from 1.5-11.7 μm and 1.4-13.3 μm is experimentally demonstrated by pumping an 85 mm chalcogenide step-index fiber with 100 fs pulses at a wavelength of 4.5 μm and 6.3 μm, respectively.
Laser-Induced Ionization and Damage of High-Performance Optics by Ultrashort Pulses

V. Gruzdev; ¹;
¹. University of Missouri-Columbia, Columbia, MO, United States.

Abstract (35 Word Limit): Damage of high-performance optics by ultrashort laser pulses is attributed to the laser-induced ionization and electron excitation. New theoretical models and current state of knowledge in the field are overviewed and critically analyzed based on the recent developments and results.
Laser-induced damage of nodular defects in dielectric multilayer coatings

Z. Wang; 1; X. Cheng; 1; J. Zhang; 1; T. Ding; 1; H. Jiao; 1; B. Ma; 1;
1. Tongji University, Shanghai, China.

Abstract (35 Word Limit): This paper reviews our recent studies on the laser-induced damage of nodules in dielectric multilayer coatings, where the influence of the electric-field enhancement and the mechanical stability on the thermomechanical damage of nodules is discussed.
Generating Structural Colors from Dielectric Surface Resonances

Y. Shen; V. Rinnerbauer; M. Soljacic; J. D. Joannopoulos; i. wang;

1. Massachusetts Institute of Technology, Cambridge, MA, United States.

Abstract (35 Word Limit): We propose a new structural color generation mechanism that produces colors by the Fano resonance effect. We experimentally realize the proposed idea by fabricating the samples that show resonance-induced colors with weak angular dependence.
Laser Damage of Interference Coatings at \( \lambda = 1.6 \, \mu \text{m} \) with an Optical Parametric Chirped Pulse Amplifier

C. S. Menoni; 1; D. Schiltz; 1; D. Patel; 1; C. Baumgarten; 1; B. Reagan; 1; J. J. Rocca; 1;

1. Electrical and Computer Engineering, Colorado State University, Fort Collins, CO, United States.

Abstract (35 Word Limit): Laser damage of interference coatings is investigated with 1.6 \( \mu \text{m} \) wavelength, 2 picosecond pulses from an optical parametric chirped pulse amplification system. 7 J/cm\(^2\) damage thresholds are achieved and deviation from conventional damage models is reported.
Full-range Gate-controlled Terahertz Phase Modulation with Graphene Metasurfaces
Z. Miao; 1 Q. Wu; 1 X. Li; 1 Q. He; 1 K. Ding; 1 Z. An; 1 Y. Zhang; 1 L. Zhou; 1
1. Fudan University, Shanghai, Shanghai, China.

Abstract (35 Word Limit): Combining metasurfaces with gate controlled graphene, we experimentally demonstrate ±180° phase modulation can be realized at certain frequencies in THz domain, and describe a practical scheme to achieve full-range active phase modulation with such graphene metasurfaces.
Novel Diode Pumped Sulfur Oxide Laser: DPSOL

W. F. Krupke; 1
1. WFK Lasers, Pleasanton, CA, United States.

Abstract (35 Word Limit): The concept of a diode pumped molecular gas laser is introduced, with energy storing sulfur monoxide (SO) as the active molecule. Key spectroscopic and kinetic characteristics are presented, along with a kW laser point design.
Diode Pumped Sodium Molecular Laser

W. Luhs; 1; B. Wellegehausen; 2;
1. Photonic Engineering Office, Bad Krozingen, Germany.
2. Institut für Quantenoptik, Universität Hannover, Hannover, Germany.

Abstract (35 Word Limit): First continuous laser oscillation around 554 nm on $B^1\Pi_u \rightarrow X^1\Sigma^+_g$ transitions of Na$_2$ has been obtained, optically pumped with a common cw blue emitting InGaN diode laser at 461 nm. Spectroscopic investigations and laser experiments are reported.
Doubly-Resonant Fabry-Perot Cavity for Power Enhancement of Burst-Mode Picosecond Ultraviolet Pulses
A. Rakhman; ¹, ²
¹. Oak Ridge National Laboratory, Farragut, TN, United States.
². Department of Physics and Astronomy, University of Tennessee, Knoxville, TN, United States.

Abstract (35 Word Limit): We report on a first experimental demonstration of locking a doubly-resonant Fabry-Perot cavity to burst-mode 402.5MHz/50ps ultraviolet (UV) pulses with a MW level peak power by using a temperature controlled dispersion compensation method at the Spallation Neutron Source.
Abstract (35 Word Limit): Gain is observed in a double pass of a Helium-Xenon gas DC discharge in a 90cm long flexible hollow core fibre. Output at 3.5µm increases with discharge current up to the maximum of 0.55mA.
The Physical Origin of Kramers-Kronig Self-Phasing in Coherent Laser Beam Combination

J. R. Leger; 1; H. Chiang; 1; J. Hanson; 1;
1. University of Minnesota Twin Cities, Minneapolis, MN, United States.

Abstract (35 Word Limit): The Kramers-Kronig self-phasing observed in coherently coupled fiber laser arrays is experimentally shown to originate from a change in the supermode intensity distribution. The conditions that lead to accurate self-phasing are modeled and experimentally confirmed.
Phase Locking of Many Lasers by Combined Talbot Cavity and Fourier Filtering

C. Tradonsky; V. Pal; R. Chriki; A. A. Friesem; N. Davidson;

1. Weizmann Institute of Science, Rehovot, Israel.

Abstract (35 Word Limit): Efficient in-phase coupling of hundreds of lasers by means of combined Talbot cavity and intra-cavity spatial Fourier filtering is developed. Simulated and experimental results for square, triangular and honeycomb laser arrays are presented.
Abstract (35 Word Limit): We study transverse mode competition in index-antiguided planar lasers theoretically and experimentally. Robust fundamental mode operating 10 times above lasing threshold is predicted and confirmed experimentally.
Realization of A SOI-Like III-V Platform Based On the Integration of GaAs With Silicon

R. Sharma; 1; H. Lin; 1; M. W. Puckett; 1; Y. Fainman; 1;
1. University of California, San Diego, La Jolla, CA, United States.

Abstract (35 Word Limit): We demonstrate the integration of gallium arsenide with silicon to create a SOI-like platform capable of exploiting the optical properties of III-V materials. We fabricate nanoscale waveguides and design Bragg gratings on this new platform.
Recovery Time Control in a Nanophotonic Nonlinear Gate Using Atomic Layer Deposition
G. Moille; 1; S. Combrié; 1; G. Lehoucq; 1; L. Morgenroth; 2; F. Neuilly; 2; D. Decoster; 2; A. De Rossi; 1;
1. Thales Research & Technology, Palaiseau, France.
2. Institut d'Electronique de Microelectronique et de Nanotechnologie, Villeneuve d'Ascq, France.

Abstract (35 Word Limit): Atomic Layer Deposition is used to control the surface recombination of carriers in GaAs photonic crystal cavities. All-optical wavelength conversion at a GHz repetition rate is demonstrated with recovery time below 10 ps
1.5μm High Density Quantum Dots Waveguide Photodetector with Avalanche Effect

T. Umezawa; 1; K. Akahane; 1; N. Yamamoto; 1; A. Kanno; 1; T. Kawanishi; 1;

Abstract (35 Word Limit): We have fabricated a waveguide photodetector using a 1.55-um high-density InAs quantum dot absorption layer. A high responsivity (0.4 A/W) without using fiber coupling designs, and a large avalanche multiplication factor of over 10 could be successfully achieved.
Monolithically Integrated Multi-Color (Blue and Green) Light-Emitting Diode Chips

C. Teng; 1; L. Zhang; 1; Y. Tsai; 2; C. Lin; 2; H. Kuo; 2; H. Deng; 1; P. Ku; 1;
1. University of Michigan, , United States.
2. National Chiao Tung University, Hsinchu, Taiwan.

Abstract (35 Word Limit): An LED chip with monolithically integrated, individually addressable multi-color pixels was demonstrated with a color tuning range from blue to green on a single epitaxial wafer.
GaInAs/InP MQW light-emitting diode fabricated on wafer bonded InP/Quartz substrate
K. Matsumoto; 1; M. Takasu; 1; Y. Kanaya; 1; J. Kishikawa; 1; K. Shimomura; 1;
1. Sophia University, Chiyoda, Tokyo, Japan.

Abstract (35 Word Limit): GaInAs/InP multi quantum wells light-emitting diode, emitting at 1.3-um, was fabricated by metal organic vapor phase epitaxy on wafer bonded InP/Quartz substrate. The device has been operated under continuous wave operation at room temperature.
Phosphor-free Monolithic High-Efficiency White Light-Emitting-Diodes on Ternary InGaN Substrates

Y. Ooi; 1; J. Zhang; 1;
1. Department of Electrical and Microelectronics Engineering, Rochester Institute of Technology, Rochester, NY, United States.

Abstract (35 Word Limit): Phosphor-free monolithic high-efficiency tunable white LEDs are realized on ternary InGaN substrates. This proof-of-concept study demonstrates that high quantum efficiency and stable white color emission are achieved by using ternary substrates and correctly-engineered device structures.
Over-1mm-long Wideband on-Chip Slowlight Waveguides Realized by 1,000 Coupled L3 Nanocavities

E. Kuramochi; N. Matsuda; K. Nozaki; H. Takesue; M. Notomi;
1. NTT Corporation, Atsugi, Kanagawa, Japan.

Abstract (35 Word Limit): Enhanced coupling in slanted L3 nanocavity array expanded bandwidth to 4 THz at telecom wavelength. High-Q tuned L3 nanocavity realized 1,000 coupled cavities with acceptable propagation loss and delay-bandwidth product over 100.
Systematic tuning of ultrahigh-Q no-missing-hole (H0) nanocavity

E. Kuramochi; 1; H. Duprez; 1; H. Taniyama; 1; H. Sumikura; 1; K. Nozaki; 1; A. Shinya; 1; M. Notomi; 1;
1. NTT Corporation, Atsugi, Kanagawa, Japan.

Abstract (35 Word Limit): Systematic multi-hole tuning of H0 nanocavity with theoretical $Q \approx 10^7$ is reported that outperforms L3 and other a-few-missing-hole nanocavities over a wide slab-thickness range. Experimental $Q \approx 10^6$ is achieved.
Bending Behavior of Flexible Crystalline Silicon Nanomembrane Photonic Crystal Microcavities

X. Xu; H. Subbaraman; S. Chakravarty; R. T. Chen;
1. University of Texas at Austin, Austin, TX, United States.
2. Omega Optics, Inc., Austin, TX, United States.

Abstract (35 Word Limit): We demonstrated a flexible crystalline silicon nanomembrane photonic crystal microcavity with a quality factor of 22,000 and experimentally studied its bending behavior.
Abstract (35 Word Limit): We demonstrated 1.5-μm-band optical switching using the Kerr effect in hydrogenated amorphous silicon (a-Si:H) photonic crystal nanocavities. Switching with pulse energies down to 18 fJ using a degenerate pump-probe technique was observed in cavities with Q-factors up to 30,000.
Experimental demonstration of non-reciprocal transmission in a nonlinear photonic-crystal Fano structure

Y. Yu; Y. Chen; H. Hu; W. Xue; K. Yvind; J. Mork;

Abstract (35 Word Limit): We demonstrate a photonic-crystal structure with >30 dB difference between forward and backward transmission levels. The non-reciprocity relies on the combination of ultrafast carrier nonlinearities and spatial symmetry breaking in a Fano structure employing a single nanocavity.
Abstract (35 Word Limit): We demonstrate an efficient adiabatic mode converter for coupling light into a silicon slot photonic crystal waveguide with slot width as large as 320nm. The loss of the mode converter is measured to be 0.08dB.
Flat-top Drop Filter based on a Single Topology Optimized Photonic Crystal Cavity

X. Guan; 1; L. H. Frandsen; 1; Y. Elesin; 2; O. Sigmund; 3; K. Yvind; 1;
1. DTU Fotonik, Dep. Photonics Engineering, Kgs. Lyngby, Denmark.
2. Haldor Topsoe, Lyngby, Denmark.
3. Department of Mechanics Engineering, DTU Mekanik, Lyngby, Denmark.

Abstract (35 Word Limit): A flat-top drop filter has been realized in silicon-on-insulator material by applying 3D topology optimization to a single L3 photonic crystal cavity. Measurements reveal that the pass-band of the drop channel is flat within 0.44 dB over a wavelength range of 9.7 nm with an insertion loss <0.85 dB.
Photonic Surfaces for Designable Nonlinear Power Shaping

R. Biswas; 1  M. Povinelli; 1
1. University of Southern California, Los Angeles, CA, United States.

Abstract (35 Word Limit): We introduce a mechanism for nonlinear optical power transmission using partially absorptive resonances in photonic crystal slabs. We experimentally demonstrate increasing, decreasing, and nonmonotonic transmission as a function of optical power.
Nano-Ablation by Femtosecond Laser-Matter Interactions

S. Sakabe; 1, 2; M. Hashida; 1, 2;

1. Institute for Chemical Research, Kyoto University, Uji, Kyoto, Japan.
2. Graduate School of Science, Kyoto University, Sakyō-ku, Kyoto, Japan.

Abstract (35 Word Limit): Distinguishing ablation characteristic, nanometer phenomena such as surface morphology and ion emission, resulting from femtosecond laser-matter interactions for metals, and some their applications are reviewed, comparing with conventional nanosecond laser-matter interactions and ablation.
Deep and Near Sub wavelength Ripples on Natural MoS₂ Induced by Femtosecond Laser with Threshold Dependence

Q. Wu;¹  Y. Pan;¹  Y. Li;¹  J. Yao;¹  J. Xu;¹  
¹. Nankai University, Tianjin, Tianjin, China.

Abstract (35 Word Limit): We generate deep and near sub-wavelength ripples on MoS₂ by femtosecond laser irradiation with incident fluence dependence and pulse number insensitivity. Raman analysis demonstrates that no amorphous or oxidative exhibition remains after laser processing.
Laser fluence dependence of periodic structures on metals produced by femtosecond double pulse laser

M. Hashida; 1  L. Gemini; 2  T. Nishii; 1  Y. Miyasaka; 1  H. Sakagami; 3  S. Inoue; 1  J. Limpouch; 2  T. Mocek; 4  S. Sakabe; 1

1. Kyoto University, Uji, Kyoto, Japan.
2. FNSPE, Czech Technical University, Prague, Czech Republic.
4. Institute of Physics, HiLASE Project, Prague, Czech Republic.

Abstract (35 Word Limit): The formation mechanism of LIPSS has been investigated for titanium irradiated by double pulse. We found that variation of the surface plasma density characterized by first pulse led to a variation of the grating interspaces.
Polarization Sensitive Printing by Ultrafast Laser Nanostructuring in Amorphous Silicon

R. Drevinskas; M. Beresna; M. Gecevičius; M. Khenkin; A. G. Kazanski; O. I. Konkov; P. Kazansky

1. University of Southampton, Southampton, United Kingdom.
2. Physics Department, M.V. Lomonosov Moscow State University, Moscow, Russian Federation.

Abstract (35 Word Limit): We demonstrate femto- and picosecond laser assisted nanostructuring of hydrogenated amorphous silicon (a-Si:H). The laser-induced periodic sub-wavelength structures exhibit the dichroism and giant form birefringence giving extra dimensions to the polarization sensitive image recording.
Influence of Self-scattering on the Fabrication of Surface Nanostructures in Zinc Phosphate Glass Using Fs-laser Pulses

J. Clarijs; J. Hernandez Rueda; M. Scholten; H. Zhang; D. Krol; D. van Oosten;
1. University of California Davis, Davis, CA, United States.
2. Utrecht University, Utrecht, Netherlands.

Abstract (35 Word Limit): Zinc-phosphate glass surface ablation was investigated using tightly focused fs-laser pulses. Evidences of self-scattering effects due to the interaction between the laser light and a transient plasma generated during surface ablation have been investigated.
Silicon on Sapphire Chip Based Photonic Crystal Waveguides for Detection of Chemical Warfare Simulants

And Volatile Organic Compound
Y. Zou; 1 P. Wray; 1 S. Chakravarty; 2 R. T. Chen; 1, 2
1. University of Texas at Austin, Austin, TX, United States.
2. Omega Optics Inc., Austin, TX, United States.

Abstract (35 Word Limit): We experimentally demonstrate the first holey and slotted photonic crystal waveguides in silicon-on-sapphire at mid-infrared wavelength of 3.43μm. Chemical warfare simulant triethylphosphate was detected in gas phase at 10ppm concentration via optical absorbance signature.
Abstract (35 Word Limit): A graphene coated D-shaped fiber chemical-gas sensor demonstrated, with maximum sensitivity ~0.04ppm and ~0.1ppm for NH₃ and H₂O gas detections, respectively. This work may pave a way to explore graphene based lab-on-fiber devices.
Mid-infrared detection of atmospheric CH\textsubscript{4}, N\textsubscript{2}O and H\textsubscript{2}O based on a single continuous wave quantum cascade laser

F. K. Tittel\textsuperscript{1}; Y. Cao\textsuperscript{1}; N. P. Sanchez\textsuperscript{1}; R. Griffin\textsuperscript{1};

1. Rice University, Houston, TX, United States.

Abstract (35 Word Limit): A continuous wave, distributed feedback quantum cascade laser based absorption system was developed and demonstrated for simultaneous atmospheric CH\textsubscript{4}, N\textsubscript{2}O and H\textsubscript{2}O detection, with minimum detection limits below 2\% of their typical atmospheric concentrations.
Abstract (35 Word Limit): Consumer electronics gave us powerful mobile platforms, compact batteries, displays, user interfaces, while telecomm photonics has revolutionized miniature optics, sources and detectors. Handheld spectrometers are now routinely used for chemical sensing and security applications.
An Interband Cascade Laser based Sulfur Dioxide Sensor for Emission Monitoring Applications

P. Geiser; 1 O. Bjorøy; 1 P. Kaspersen; 1 L. Nähle; 2 J. Scheuermann; 2 M. von Edlinger; 2 J. Koeth; 2
2. nanoplus Nanosystems and Technologies GmbH, Gerbrunn, Germany.

Abstract (35 Word Limit): A mid-infrared sensor for sulfur dioxide in emission monitoring applications using a monomode DFB ICL at 4 µm and second harmonic detection has been developed. The detection limit of the sensor is below 3 ppm·m.
Abstract (35 Word Limit): We demonstrate a 100Gb/s short reach system using a multi-carrier transmitter based on a gain switched monolithically integrated laser. 25km SSMF transmission of a 5x20Gb/s WDM-SSB-DD-OFDM channels with a SE of 1.6b/s/Hz is reported.
Up to 16 Gb/s CAP16 Modulation over 100 km IM/DD Dispersion Uncompensated Transmission using Dual-EML

M. Chaibi; 1; C. Kazmierski; 2; D. Erasme; 1;
1. Institut MINES-TELECOM, TELECOM ParisTech, Paris, France.
2. III-V Lab-Common laboratory of “Alcatel-Lucent Bell Labs France”, “Thales Research and Technology” and “CEA Leti”, Marcoussis, France.

Abstract (35 Word Limit): Transmissions at 16 Gb/s of 16-QAM CAP signals over 100 km IM/DD dispersive channel are reported. They are performed in an optical SSB context generated with an integrated Dual-EML.
Abstract (35 Word Limit): We investigate three EDFA only amplification architectures for 100G unrepeatered transmission. With > 4 dBQ margin, pre-amplifier only, booster only and both booster and pre-amplifier amplifications can achieve 130, 150 and 220 km reach respectively.
Software-Defined Intra-PON Optical Flow Transmission via a Quasi-Passive Reconfigurable (QPAR) Node

S. Yin; 1; T. Shen; 1; Y. Bi; 1; J. Jin; 1; L. Kazovsky; 1.
1. Stanford University, Stanford, CA, United States.

Abstract (35 Word Limit): This paper demonstrates Intra-PON optical Flow transmission via a QPAR node. Simulations show 2 to 20x traffic waiting time reduction comparing to no or fixed Intra-PON designs. Experiments show error-free Intra- and Inter-traffic with/without QPAR reconfiguration.
8-User PAM-ECDMA PON with 25.6 Gb/s Aggregate Data Rate

X. Guo; X. Li; A. Wonfor; L. Zhou; L. Fang; R. V. Penty; I. H. White;
1. University of Cambridge, Cambridgeshire, United Kingdom.
2. Huawei Technologies, Shenzhen, China.

Abstract (35 Word Limit): We report a PAM-ECDMA PON system with 2.5-fold performance improvement over the prior NRZ-ECDMA system. Error-free transmission of two channels in an 8-user 25.6 Gb/s aggregate-data-rate PON is achieved in a proof-of-principle demonstration.
Fiber-based optical frequency comb interferometer with nm-stability and meters-wide scanning range

Y. Nakajima; 2, 1; K. Minoshima; 2, 1;

1. JST, ERATO, Chofu, Tokyo, Japan.
2. The University of Electro-Communications, Chofu, Japan.

Abstract (35 Word Limit): A 167-m fiber-based optical frequency comb interferometer was stabilized to nm-level with extremely wide scanning of 2.8 m by frequency scanning. Fiber noise cancellation with direct use of a frequency comb was also demonstrated.
Attosecond-Resolution Time-of-Flight Stabilization of Optical Pulse Train in 76-m Indoor Atmospheric Link

J. Shin; 1; J. Kang; 1; C. Kim; 1; K. Jung; 1; J. Kim; 1;


Abstract (35 Word Limit): We demonstrate sub-100-attosecond-resolution time-of-flight stabilization method for optical pulse trains in atmospheric links. The rms excess fluctuation in timing for 76.2-m-long indoor free-space transfer is suppressed from >230 fs to 2.6 fs over 130-hour.
Dual-comb absolute ranging using balanced optical cross-correlator as time-of-flight detector

H. Shi; 1; Y. Song; 1; F. Liang; 1; L. Xu; 1; M. Hu; 1; C. Wang; 1;
1. Tianjin University, , Tianjin, China.

Abstract (35 Word Limit): We demonstrate dual-comb absolute ranging using balanced optical cross correlator as high resolution pulse time-of-flight detector. Actual test performed at ~3 meters target distance proves a 200 nm ranging precision at 50 ms acquisition time.
Dual-comb Reciprocal Temporal Scanning for Absolute Distance Measurement

H. Zhang; X. Wu; H. Wei; Y. Li;
1. Tsinghua University, Beijing, China.

Abstract (35 Word Limit): Pulse trains from dual combs with different repetition rates are coupled and directed onto a target for simultaneous absolute distance measurement. Non-ambiguity range extension is immune to drift and accuracy is about 100 nm.
Stabilization of Squeezed Vacuum States Using Weak Pump Depletion

M. Heurs; 1; T. Denker; 1; D. Schütte; 1; M. H. Wimmer; 1; T. Wheatley; 3; E. H. Huntington; 2;
1. Max-Planck-Institut für Gravitationsphysik (Albert-Einstein-Institut), and Institut für Gravitationsphysik, Leibniz Universität Hannover, Hannover, Germany.
2. College of Engineering and Computer Science, Australian National University, Canberra, ACT, Australia.
3. School of Engineering and Information Technology, University of New South Wales, Canberra, ACT, Australia.

Abstract (35 Word Limit): We present a new phase-locking technique based on weak pump depletion. It allows for the first experimental realization of a pump-phase lock of an optical parametric oscillator by reading out the pre-existing phase information in the pump field. No degradation of the detected squeezed states occurs.
Factor of 18 Enhancement in the Sensitivity-Bandwidth Product of the aLIGO Gravitational Wave Detector Using a White Light Cavity

M. Zhou; Z. Zhou; S. M. Shahriar;
1. Northwestern University, Evanston, IL, United States.

Abstract (35 Word Limit): We show that the sensitivity-bandwidth product of the aLIGO gravitational wave detector can be enhanced by a factor of 18, while remaining below the standard quantum limit, by employing a white light cavity configuration.
Nested Fabry-Perot in mode-locked lasers to monitor minute changes of index

J. Hendrie; 1; L. Arissian; 1; K. Masuda; 1; A. Hecht; 1; J. Diels; 1;
1. University of New Mexico, , United States.

Abstract (35 Word Limit): An uncoated glass etalon inserted in a mode-locked laser results generating two nested frequency combs. The ratio of their frequencies, insensitive to external parameters, is an accurate measure of the optical path in the etalon.
Ultrahigh Resolution Frequency-to-Time Mapping Based on Frequency Shifting Recirculating Lasers

H. Guillet de Chatellus; 1; J. Azaña; 2;
1. LIPhy, Saint Martin d'Hères, France.
2. EMT-INRS, Varennes, QC, Canada.

Abstract (35 Word Limit): We demonstrate a novel implementation of frequency-to-time mapping based on a frequency shifting recirculating laser, achieving a 10 kHz-frequency resolution and a time-bandwidth product greater than 1000.
Tunable Few-optical-Cycle Pulses by Group-velocity-matched OPAs

G. Cerullo; ¹; C. Manzoni; ¹; D. Brida; ²;

1. Politecnico di Milano, Milan, Italy.
2. University of Konstanz, Konstanz, Germany.

Abstract (35 Word Limit): We review our work on the development of ultra-broadband OPAs. By group-velocity matching between signal and idler waves, we generate pulses with duration of few optical cycles and tunability from the visible to the infrared.
Abstract (35 Word Limit): We present different approaches for high repetition rate, few-cycle pulse generation with µJ-level energy from compact OPCPA systems. The sources are based on octave spanning Ti:Sa oscillators with all-optical synchronization to state-of-the-art Ytterbium based amplifiers.
Broadband 2D-QPM Frequency Domain OPA

C. R. Phillips; B. Mayer; L. Gallmann; U. Keller;

1. ETH Zurich, Zurich, ZH, Switzerland.
2. University of Bern, Bern, Switzerland.

Abstract (35 Word Limit): We demonstrate broadband mid-IR frequency-domain OPA (FOPA) in the Fourier-plane of a 4f pulse shaper via two-dimensional (2D) quasi-phasematching (QPM) device adapted to the pump intensity profile and spatial chirp of the mid-infrared beam.
500 kHz OPCPA-Based UV-XUV Light Source For Time-Resolved Photoemission Spectroscopy

M. Puppin; 1; Y. Deng; 1; C. Nicholson; 1; C. Monney; 1; M. Krenz; 1; O. Prochnow; 2; J. Ahrens; 2, 4; T. Binhammer; 2; U. Morgner; 4; M. Wolf; 1; R. Ernstorfer; 1;

1. Fritz-Haber Institut, Berlin, Germany.
2. VENTEON Laser Technologies, Hannover, Germany.
3. Department of Physics, Zurich University, Zürich, Switzerland.
4. Institute of Quantum Optics, Leibniz Universität Hannover, Hannover, Germany.

Abstract (35 Word Limit): A 15 W, sub-20 fs OPCPA based on an Yb laser is used to demonstrate 6.3 eV fourth harmonic-based UV photoelectron spectroscopy with sub-60 fs time resolution and XUV high harmonic generation at 500 kHz.
Multi-mJ, kHz, intense picosecond deep-ultraviolet source

K. Hong; C. L. Chang; P. R. Krogen; H. Liang; G. J. Stein; J. Moses; C. Lai; J. P. Siqueira; L. E. Zapata; F. X. KAERTNER

1. Department of Electrical Engineering and Computer Science and Research Laboratory of Electronics, Massachusetts Institute of Technology, Cambridge, MA, United States.
2. Department of Physics, University of Hamburg, Center for Free-Electron Laser Science, DESY, Hamburg, Germany.

Abstract (35 Word Limit): We demonstrate a 2.74 mJ, 1 kHz, ~4.2 ps DUV laser at ~257.7 nm with M²~2.54 from a frequency-quadrupled hybrid Yb-doped chirped-pulse amplifier. An infrared-to-UV conversion efficiency of ~10% is achieved.

O. Isaienko; V. Klimov;

1. Los Alamos National Laboratory, Los Alamos, NM, United States.

Abstract (35 Word Limit): We report on considerable photon energy losses of [signal+idler] pair (~60 meV) in KTiOPO$_4$ optical parametric amplifier pumped by <40-fs 800-nm pulses and explain it by optical rectification enhanced by coupling to large third-order nonlinearity.