QELS

Ballroom A1 and A8

8:00 a.m.–9:45 a.m.
QTuA • Nanoplasmonics I
Stefan Linden; Univ. Karlsruhe, Germany, Presider

QTuA1 • 8:00 a.m. Invited
Recent Progress in Plasmonics, *Mark L. Brongersma; Geballe Lab for Advanced Materials, USA.* Plasmonics is an exploding new field of science and technology in which the flow of light can be molded at the nanoscale using metallic nanostructures. I will provide an overview of exciting recent developments.

QTuA2 • 8:30 a.m.
Near-Field Focusing Plates: Theory and Experiment, *Anthony Grbic, Lei Jiang, Roberto Merlin; Univ. of Michigan, USA.* Using grating-like surfaces, referred to as near-field plates, we demonstrate focusing of microwave radiation in a pattern that mimics that of a negative-index slab. The measured resolution, of $\lambda/20$, is well beyond the diffraction limit.

QTuA3 • 8:45 a.m.
Fourier Plasmonics: Diffractive Focusing of In-Plane Surface Plasmon Polariton Waves, *Liang Feng, Kevin Tetz, Boris Slutsky, Vitaliy Lomakin, Yeshaiahu Fainman; Univ. of California at San Diego, USA.* An in-plane Fresnel zone plate for focusing surface plasmon polariton (SPP) fields has been designed, fabricated and tested. Diffractive SPP fields from each Fresnel zone constructively interfere and focus at the designed focal point.

Ballroom A2 and A7

8:00 a.m.–9:45 a.m.
QTuB • Single Quantum Emitters
Presider to Be Announced

QTuB1 • 8:00 a.m. Invited
Deterministic Cavity QED with Single Atoms, *Soo Y. Kim, Michael J. Gibbons, Kevin M. Fortier, Peyman Ahmadi, Michael S. Chapman; Georgia Tech, USA.* Individual atoms are delivered to a high-finesse optical cavity using an optical conveyor. Strong coupling of the atom with the cavity allows cooling and detection of atoms for up to 15 s.

QTuB2 • 8:30 a.m.
Efficient Coupling of Light to a Single Molecule, Observation of Its Fluorescence Mollow Triplet and More, *Jaesuk Hwang, Gert Wrigge, Ilja Gerhardt, Martin Pototschnig, Lutz Petersen, Gert Zumofen, Vahid Sandoghdar; Lab for Physical Chemistry, ETH Zurich, Switzerland.* Efficient coupling of laser to single quantum emitters is achieved via near- and far-field techniques. Direct detection of 11.5% extinction and the first direct measurement of the Mollow triplet in solid state system are demonstrated.

QTuB3 • 8:45 a.m.
Entanglement Detection of GHZ States of Electronic and Two Nuclear Spins in NV Center in Diamond, *Sergei Y. Kilin[1], A. Mikhalychev[1], Alexander Nizovtsev[1], S. Kuten[2], F. Jelezko[3], J. Wrachtrup[3]; [1]Stepanov Inst. of Physics, Belarus, [2]Inst. for Nuclear Problems, Belarus State Univ., Belarus, [3]Univ. of Stuttgart, Germany.* We consider creation and detection of GHZ state of one electronic and two nuclear spins of NV center in diamond. The method of entanglement detection is based on construction of an entanglement witness operator.

CLEO

Ballroom A3 and A6

8:00 a.m.–9:45 a.m.
CTuA • Ultrafast Photonics I
Lawrence Shah; IMRA America, Inc., USA, Presider

CTuA1 • 8:00 a.m.
All-Optical Streak Camera, *John E. Heebner[1], Chris H. Sarantos[1,2]; [1]Lawrence Livermore Natl. Lab, USA, [2]Univ. of California at Santa Barbara, USA.* We demonstrate a novel ultrafast measurement technique based on optical beam deflection in a planar waveguide through the activation of an array of transient prisms for high-dynamic-range, single-shot recording with < 5 ps resolution.

CTuA2 • 8:15 a.m. Invited
Silicon-Chip-Based Single-Shot Ultrafast Optical Oscilloscope, *Mark A. Foster, Reza Salem, David F. Geraghty, Amy C. Turner, Michal Lipson, Alexander L. Gaeta; Cornell Univ., USA.* We demonstrate a single-shot ultrafast optical oscilloscope using a four-wave-mixing-based parametric temporal lens integrated on a CMOS-compatible silicon photonic chip. Experimentally, we demonstrate waveform measurement with a 100-ps record length and sub-picosecond resolution.

CTuA3 • 8:45 a.m.
Experimental Demonstration of Timing Jitter Reduction Based on the Temporal Talbot Effect Using LCFBGs, *Masaki Oiwa, Jungmin Kim, Kenichiro Tsuji, Noriaki Onodera, Masatoshi Saruwatari; Natl. Defense Acad., Japan.* We demonstrate the timing-jitter reduction of repetition pulses by the temporal Talbot effect using linearly chirped fiber Bragg gratings (LCFBGs). Experimental results agree with the simulation taking into account the group delay ripple of LCFBGs.

Ballroom A4 and A5

8:00 a.m.–9:30 a.m.
CTuB • Stimulated Brillouin Scattering and Applications
Jean Toulouse; Lehigh Univ., USA, Presider

CTuB1 • 8:00 a.m.
Evolution of SBS Gain Spectra in High Power Single-Frequency Ytterbium Doped Fiber Amplifiers, *Matthias Hildebrandt, Sebastian Büsche, Peter Weßels, Maik Frede, Dietmar Kracht; Laser Zentrum Hannover e.V., Germany.* We present theoretical modelling and experimental heterodyne measurements of spontaneous and stimulated Brillouin scattering gain spectra from a single-frequency ytterbium doped fiber amplifier system delivering 130 W of output power.

CTuB2 • 8:15 a.m.
Acceleration of Slow-Light in a Brillouin Fiber Laser: Pump Power Dependence of Cavity Modes, *Radha K. Pattnaik, Jean Toulouse; Lehigh Univ., USA.* Acceleration of slow-light in a Brillouin fiber laser is reported. The resonant modes of the fiber cavity, due to nonuniform group index, shift to higher frequencies as the pump power is increased.

CTuB3 • 8:30 a.m.
Laser Beam Combining by Beam Cleanup in a Gradient Index Brillouin Ring Cavity, *Laurent Lombard, Camille Delezoide, Guillaume Canat, Véronique Jolivet, Pierre Bourdon; Office Natl. d'Études et de Recherches Aérospatiales, France.* We propose and investigate a new beam combining setup using Stimulated-Brillouin-Scattering in a multimode gradient-index-fiber within a ring cavity. 50% efficiency with 99% slope is achieved with two 1.5µm fiber amplifiers without external control.

CTuB4 • 8:45 a.m.
Polarization Dependence of SBS in Small-Core PCFs, *John E. McElhenny, Radha Pattnaik, Jean Toulouse; Lehigh Univ., USA.* Stimulated Brillouin scattering (SBS) generated from noise in small core PCFs exhibits a strong dependence on pump polarization. The birefringence of two small core PCFs is investigated, yielding unexpected results.

Room C1 and C2

QELS

8:00 a.m.–9:45 a.m.
QTuC • Periodic Nonlinear Media
Presider to Be Announced

QTuC1 • 8:00 a.m.
Low Dispersion Slow Light and Nonlinearity Enhancement in Lattice-Shifted Photonic Crystal Waveguide, *Yohei Hamachi[1,2], Shosaku Kubo[1,2], Toshihiko Baba[1,2]; [1]Yokohama Natl. Univ., Japan, [2]CREST, Japan Science and Technology Agency, Japan.* We fabricated lattice-shifted photonic crystal waveguides stably showing low dispersion slow light in a wide wavelength bandwidth. The two photon absorption and self-phase modulation were clearly enhanced for sub-ps optical pulses.

QTuC2 • 8:15 a.m.
Strong Enhancement of Local Fields and Second-Harmonic Generation in a Resonant Waveguide Grating, *Mikael Siltanen[1], Samuli Leivo[1], Pauliina Armholt[1], Martti Kauranen[1], Petri Karvinen[2], Pasi Vahimaa[2], Markku Kuittinen[2]; [1]Tampere Univ. of Technology, Finland, [2]Univ. of Joensuu, Finland.* We observe over 5000-fold enhancement of second-harmonic generation from an all-dielectric resonant waveguide grating. The enhancement is due to interaction of strong local fields with the inherent surface nonlinearity of the structure.

QTuC3 • 8:30 a.m. Invited
Quasi Phase Matching with Quasi-Periodic Poling, *Ady Arie; Tel-Aviv Univ., Israel.* Quasi periodic modulation of the nonlinear coefficient enables to phase match any arbitrary set of 3-wave mixing processes. Multi-wavelength and multi-directional doubling are experimentally demonstrated in one- and two-dimensional quasi-periodically poled ferroelectric crystals.

Room C3 and C4

CLEO

8:00 a.m.–9:45 a.m.
CTuC • Optical Frequency Comb Control
Jason Jones; Univ. of Arizona, USA, Presider

CTuC1 • 8:00 a.m.
10 W Average Power Frequency Comb with Sub-mHz Relative Linewidths from a Yb:Fiber System, *Thomas R. Schibli[1], Dylan C. Yost[1], Michael J. Martin[1], Andrew Ludlow[1], Jun Ye[1], Ingmar Hartl[2], Andrius Marcinkevičius[2], Martin E. Fermann[2]; [1]JILA, NIST, and Univ. of Colorado, USA, [2]IMRA America Inc., USA.* We present a fully phase-stabilized frequency comb with 10W average power and 136MHz repetition rate produced by a Yb:fiber system. Direct comparison with an octave-spanning Ti:sapphire comb yields record-low sub-mHz relative linewidths for frequency combs.

CTuC2 • 8:15 a.m.
A Self-Referenced Diode-Pumped Yb:KYW Frequency Comb, *Stephanie A. Meyer[1,2], Jeff A. Squier[3], Scott A. Diddams[2]; [1]Dept. of Physics, Univ. of Colorado, USA, [2]NIST, USA, [3]Ctr. for Microintegrated Optics for Advanced Bioimaging and Control, Colorado School of Mines, USA.* A diode-pumped Yb:KYW frequency comb system is described. Spectral broadening in microstructured fiber allows detection and control of the carrier-envelope offset frequency. The integrated residual phase noise on f0 is 0.3 radians (0.1 Hz-0.5 MHz).

CTuC3 • 8:30 a.m.
Non-Intrusive Sub-Two-Cycle Carrier-Envelope Stabilized Pulses Using Engineered Chirped Mirrors, *Jonathan R. Birge, Helder M. Crespo, Michelle Sander, Franz X. Kärtner; MIT, USA.* An octave spanning carrier-envelope phase stabilized frequency comb is demonstrated using selective output coupling of the *f* and 2*f* frequency components, enabling use of the full output power of the laser.

CTuC4 • 8:45 a.m.
Self-Referenced f_{CEO} Stabilization of a Low Noise Femtosecond Fiber Oscillator, *I. Hartl[1], L. B. Fu[1], B. K. Thomas[1], L. Dong[1], M. E. Fermann[1], J. Kim[2], F. X. Kärtner[2], C. Menyuk[3]; [1]IMRA America Inc., USA, [2]MIT, USA, [3]Dept. of Computer Science and Electrical Engineering, Univ. of Maryland, USA.* We spectrally broaden a low phase noise Yb-femtosecond similariton fiber oscillator to more than an octave bandwidth. Using the f-2f self-referencing scheme we detect and stabilize its carrier envelope offset frequency.

Room B1 and B2

8:00 a.m.–9:45 a.m.
CTuD • THz Metamaterials
Ajay Nahata; Univ. of Utah, USA, Presider

CTuD1 • 8:00 a.m.
Enhanced Optical Activity of a Terahertz Wave with Complimentary Double-Layered Metal Chiral Gratings, *Natsuki Kanda[1,2], Kuniaki Konishi[1,2], Makoto Kuwata-Gonokami[1,2]; [1]Univ. of Tokyo, Japan, [2]Core Res. for Evolutional Science and Technology, JST, Japan.* We demonstrate polarization rotation of a terahertz electromagnetic wave with complimentary double-layered metal chiral gratings. We obtain an isotropic polarization rotation free from the birefringence of the structures.

CTuD2 • 8:15 a.m.
A Circuit Model for Terahertz Metafilms and Effective Medium Implications, *John F. O'Hara, Evgenya Smirnova, Abul K. Azad, Hou-Tong Chen, Antoinette J. Taylor; Los Alamos Natl. Lab, USA.* A lumped-element circuit model is shown to accurately describe the behavior of terahertz metafilms, or planar metamaterials. The model provides insight into the proper applications of effective medium approximations in determining metafilm constitutive parameters.

CTuD3 • 8:30 a.m.
A Three-Dimensional Lefthanded Metamaterial Operating at THz Frequencies, *Oliver Paul, Christian Imhof, René Beigang, Remigius Zengerle; Univ. Kaiserslautern, Germany.* We present a bulk metamaterial operating in the THz frequency range. The implemented structure consists of pairs of metallic crosses for which the resulting composite medium exhibits a lefthanded transmission band at about 1.1 THz.

CTuD4 • 8:45 a.m.
Multi-Layer Planar Terahertz Electric Metamaterials on Flexible Substrates, *Abul K. Azad, Hou-Tong Chen, Elshan Akhadov, Nina R. Weisse-Bernstein, Antoinette J. Taylor, John F. O'Hara; Los Alamos Natl. Lab, USA.* Planar electric metamaterials fabricated on thin, flexible substrates are studied using terahertz-time domain spectroscopy. Transmission measurements are performed to analyze dielectric properties on single and multiple stacked samples and reveal strong resonances at 1.2 THz.

Room J2

8:00 a.m.–9:45 a.m.
CTuE • Spatial and Temporal Effects in Nonlinear Optics
Jean-Claude Diels; Univ. of New Mexico, USA, Presider

CTuE1 • 8:00 a.m.
The First Attosecond Pulse Train Reconstruction of High-Order Harmonics from Laser Ablation Plasma, *Luc Bertrand Elouga Bom[1], Tsuneyuki Ozaki[1], Stefan Haessler[2], Pascal Salières[2]; [1]Enérgie, Matériaux et Télécommunications, Inst. Natl. de la Res. Scientifique, Canada, [2]Direction des Sciences de la Matière- Dept. de Recherche sur l'État Condensé, les Atomes et les Molécules, Commissariat à l'Energie Atomique Saclay, Canada.* This work presents the first attosecond pulse train reconstruction of high-order harmonics generated from plasma. We demonstrate that, as with gas medium, plasma medium can be used to generate attosecond pulses in the XUV range.

CTuE2 • 8:15 a.m.
Two-Branch Er:Fiber Laser Emitting 11 fs Tunable Pulses with Attosecond Relative Timing Jitter, *Alexander Sell[1], Florian Adler[1,2,3], Rupert Huber[1], Alfred Leitenstorfer[1]; [1]Dept. of Physics, Univ. of Konstanz, Germany, [2]JILA and Dept. of Physics, Univ. of Colorado, USA, [3]NIST, USA.* We present an Er:fiber laser generating two 11 fs pulse trains individually tunable between 1200 and 1300 nm. A relative timing jitter of 43 as is measured after frequency conversion and compression.

CTuE3 • 8:30 a.m.
Spatio-Temporal Characterization of the Signal Pulse-Shortening in Type II Optical Parametric Amplifier Using BBO and BIBO Crystals, *Pancho Tzankov, Matthias Roth, Yufei Kong, Lin Xu, Zaza Sartania; Quantronix Corp., USA.* Comparison of the performance of an optical parametric amplifier is presented using BBO or BIBO crystals in Type II. The spatio-temporal effect of the parametric pulse-shortening is experimentally investigated with respect to the signal wavelength.

CTuE4 • 8:45 a.m.
Gravity-Like Force Suppresses Normal GVD and Blue Shifts Frequency of Femtosecond Pulses in Fibres, *Andrey V. Gorbach, Dmitry V. Skryabin; Univ. of Bath, UK.* We report a novel mechanism of localization and frequency up-conversion of light pulses with spectra in the normal GVD range of optical fibres, due to the inertial force acting on pulses from the accelerating solitons.

Room J3

Marriott San Jose Salon 1 and 2

Marriott San Jose Salon 3

Marriott San Jose Salon 4

CLEO

8:00 a.m.–9:45 a.m.
CTuF • Quantum Cascade Lasers I
Jerry Meyer; NRL, USA, Presider

CTuF1 • 8:00 a.m.
Room Temperature, CW Operation of 5.2 μm Quantum Cascade Lasers with Simple Ridge Structures, Grown by MOVPE, *Kazuue Fujita, Shinichi Furuta, Atsushi Sugiyama, Takahide Ochiai, Akio Ito, Tadataka Edamura, Naota Akikusa, Masamichi Yamanishi, Hirofumi Kan; Central Res. Lab, Hamamatsu Photonics KK, Japan.* We demonstrate room temperature, CW operation of a 5.2 μm quantum-cascade laser with single phonon resonance-continuum depopulation structure, grown by MOVPE. The laser exhibits a simple ridge structure without high reflection coatings.

CTuF2 • 8:15 a.m.
Very Small (≤ 1.2 - 1.7 W) Heat Dissipation, Room Temperature, Continuous-Wave Quantum Cascade Lasers at λ ~ 5.3 μm, *Zhijun Liu[1], Claire F. Gmachl[1], Catherine G. Caneau[2], Chung-en Zah[2]; [1]Princeton Univ., USA, [2]Corning Inc., USA.* Using a 0.5 mm short cavity and high reflectivity coating on both laser facets, room temperature, continuous-wave Quantum Cascade lasers at λ ~ 5.3 μm are realized with heat dissipation of less than 1.2-1.7 W.

CTuF3 • 8:30 a.m.
1.3 W Quantum Cascade Lasers with Optimized Design for Continuous-Wave Operation at Room Temperature, *Arkadiy Lyakh[1], Christian Pflugl[2], Laurent Diehl[2], Q. Wang[2], Federico Capasso[2], Xiaojun Wang[3], Jenyu Fan[3], Tawee Tanbun-Ek[3], Alexei Tsekoun[1], Richard Maulini[1], Rowel Go[1], Kumar Patel[1]; [1]Pranalytica Inc., USA, [2]School of Engineering and Applied Sciences, Harvard Univ., USA, [3]Adtech Optics, Inc., USA.* Continuous wave optical power of 1.32 W and wallplug efficiency over 7.1 % were demonstrated at 300 K for MOCVD-grown quantum cascade lasers emitting at 4.6 μm.

CTuF4 • 8:45 a.m. Invited
Short Wavelength Quantum Cascade Lasers Emitting around 3μm, *Roland Teissier, Jan Devenson, Olivier Cathabard, Alexei N. Baranov; Univ. Montpellier, France.* We report on recent progress in the development of short wavelength InAs/AlSb QCLs. A new short wavelength limit of 2.75 μm and high power, high temperature pulsed operation above 3 μm are demonstrated.

8:00 a.m.–9:45 a.m.
CTuG • Bulk Processing of Transparent Materials with Femtosecond Lasers
Andreas Ostendorf; Laser Zentrum Hannover e.V., Germany, Presider

CTuG1 • 8:00 a.m.
Fabrication and Characterization of Femtosecond Laser Direct Written Volume Diffractive Optical Elements in Fused Silica, *Jiyeon Choi, Martin Richardson; College of Optics and Photonics, CREOL & FPCE, USA.* We have demonstrated femtosecond laser direct written volume diffractive optical elements in a fused silica. The fabrication of a built-in coupler consisting of a direct written waveguide and a Fresnel lens has been described.

CTuG2 • 8:15 a.m.
Nondestructive 3-D Imaging of Femtosecond Laser Written Buried Structures Using Optical Coherence Microscopy, *Jiyeon Choi, Kye-Sung Lee, Troy Anderson, Jannick Rolland, Martin Richardson; College of Optics and Photonics, CREOL, USA.* We have demonstrated nondestructive 3-D imaging of the femtosecond laser written 3-D structures of both index change and optical breakdown within fused silica by using the optical coherence microscopy providing high lateral and depth resolution.

CTuG3 • 8:30 a.m.
Wavelength-Flattened Asymmetric Directional Couplers Written by Focused Femtosecond Lasers, *Wei-Jen Chen, Shane M. Eaton, Haibin Zhang, Peter R. Herman; Univ. of Toronto, Canada.* Asymmetric directional couplers were written inside bulk borosilicate glass by a high repetition rate femtosecond laser. Wavelength-dependent coupling ratios were tuned by laser exposure and coupler geometry, yielding flattened spectral response (±5%) over >400-nm bandwidth.

CTuG4 • 8:45 a.m.
Micro- and Nanostructures inside Sapphire by FS-Laser Irradiation and Selective Etching, *Dirk Wortmann, Jens Gottmann, Nelli Brandt, Herbert Horn-Solle; Lehrstuhl für Lasertechnik, Germany.* Cavities with μm-(nm)dimensions in one, and mm-dimensions in the other direction are manufactured by fs-laser modification followed by chemical etching. Depending on the focusing conditions self-organized nanostructures or elliptical microchannels are produced.

8:00 a.m.–9:45 a.m.
CTuH • High-Speed Components
Michael Krainak; NASA Goddard Space Flight Ctr., USA, Presider

CTuH1 • 8:00 a.m.
Tunable 100 Gb/s Photonic Integrated Circuit Transmitter and Receiver, *Mark J. Missey, Masaki Kato, Sanjeev Murthy, Vikrant Lal, Jianping Zhang, Brian Taylor, Radhakrishnan Nagarajan, Mehrdad Ziari, James Stewart, Atul Mathur, Peter Evans, Jacco Pleumeekers, Ranjani Muthiah, Vince Dominic, Matthew Fisher, Alan Nilson, Shashank Agashe, Arnold Chen, Randal Salvatore, Doug Christini, Paul Liu, Johan Bäeck, Charles Joyner, Jon Rossi, Richard Schneider, Mike Reffle, Fred Kish, David F. Welch; Infinera, USA.* We demonstrate 100-Gbps tunable transmitter (Tx) and receiver (Rx) photonic integrated circuits (PICs) with minimal performance penalties over a 150 GHz tuning range.

CTuH2 • 8:15 a.m.
High Speed Cross Gain Modulation Using Quantum Dot Semiconductor Optical Amplifiers at 1.3 μm, *Christian Meuer[1], Matthias Laemmlin[1], Sven Liebich[1], Jungho Kim[1], Dieter Bimberg[1], Amir Capua[2], Gadi Eisenstein[2], Rene Bonk[3], Thomas Vallaitis[3], Juerg Leuthold[3]; [1]Technical Univ. of Berlin, Germany, [2]Israel Inst. of Technology, Israel, [3]Univ. of Karlsruhe, Germany.* We report on ultra-fast small signal sinusoidal cross-gain modulation using quantum dot semiconductor optical amplifiers exceeding a 40 GHz bandwidth in frequency and 40 nm in the wavelength domain.

CTuH3 • 8:30 a.m.
Intersubband Nonlinear Optical Processes in GaN/AlN Quantum-Well Waveguides, *Yan Li, Anirban Bhattacharyya, Christos Thomidis, Theodore D. Moustakas, Roberto Paiella; Boston Univ., USA.* We demonstrate ultrafast self- and cross-absorption saturation and self-phase modulation based on near-infrared intersubband transitions in GaN/AlN quantum-well waveguides designed to minimize the nonlinear switching energy.

CTuH4 • 8:45 a.m.
A Microelectromechanically Tunable Asymmetric Fabry-Perot Quantum Well Modulator at 1.55 Microns, *Todd H. Stievater[1], William S. Rabinovich[1], Marcel W. Pruessner[1], Doewon Park[1], Subramaniam Kanakaraju[2], Christopher J. K. Richardson[2]; [1]NRL, USA, [2]Lab for Physical Sciences, USA.* We experimentally demonstrate an InP-based microelectromechanically tunable asymmetric Fabry-Perot quantum well modulator that operates in the optical C-band. The device exhibits contrast ratios over 20 (13 dB) with less than 8 volts bias.

8:00 a.m.–9:45 a.m.
CTuI • Sensing with Ultrafast Lasers
James Gord; AFRL, USA, Presider

CTuI1 • 8:00 a.m. Tutorial
Femtosecond Coherent Anti-Stokes Raman Scattering Measurement of Gas-Phase Species and Temperature, *Robert P. Lucht[1], Paul J. Kinnius[1], Sukesh Roy[2], James R. Gord[3]; [1]Purdue Univ., USA, [2]Innovative Scientific Solutions Inc., USA, [3]AFRL, USA.* The use of femtosecond lasers for coherent anti-Stokes Raman scattering measurements in gases is reviewed. Coupling of femtosecond laser radiation with gas-phase resonances, determination of temperature from frequency-spread dephasing and single-shot measurements are discussed.

Robert Lucht is the Bailey Professor of Combustion in Mechanical Engineering at Purdue University. His projects range from research on the physics of nonlinear diagnostic techniques to application of laser diagnostics in practical combustors. He is a Fellow of the OSA and has published over 100 articles in archival journals.

Marriott San Jose
Salon 5 and 6

CLEO

8:00 a.m.–9:45 a.m.
CTuJ • Active Nanophotonic Devices
Rajeev Jagga Ram; MIT, USA, Presider

CTuJ1 • 8:00 a.m. Invited
Carrier Dynamics and Slow Light in Semiconductor Nanostructures, *Jesper Moerk, Filip Öhman, Mike van der Poel, Yaohui Chen, Weiqi Xue, Per L. Hansen, Kresten Yvind; Dept. of Communications, Optics and Materials, Technical Univ. of Denmark, Denmark.* We give an overview of slow and fast light effects in semiconductor waveguides. Experimental and theoretical results are presented, emphasizing the physics as well as the limitations imposed by the carrier dynamical processes at play.

CTuJ2 • 8:30 a.m.
Ultra Fast Electro-Optic Tuning of Optical Quality Factor, *Sasikanth Manipatruni, Carl B. Poitras, Qianfan Xu, Michal Lipson; Cornell Univ., USA.* We demonstrate ultra fast tuning of the optical quality factor of a micro-resonator on a silicon chip using electro-optic tuning. We tune the cavity quality factor from 20,000 to 6,000 in 100 ps.

CTuJ3 • 8:45 a.m.
Free-Carrier Absorption in Si Nanocrystals Probed by Microcavity Photoluminescence, *Rohan D. Kekatpure, Alex R. Guichard, Mark L. Brongersma; Geballe Lab of Advanced Materials, Stanford Univ., USA.* Resonant photoluminescence of Si-nanocrystals is used to determine their free-carrier absorption cross-section (σ_{FCA}) at visible/near-infrared wavelengths. Rate-equation modeling, including ensemble effects, yields $\sigma_{FCA} = 7.8 \times 10^{-18}$ cm^2 at 895nm. This has implications for Si-based laser design at various wavelengths.

NOTES

Ballroom A1 and A8 | Ballroom A2 and A7 | Ballroom A3 and A6 | Ballroom A4 and A5

QELS

QTuA • Nanoplasmonics I—Continued

QTuA4 • 9:00 a.m.
Effect of Hole Shape in Cathodoluminescence of Subwavelength Holes, *Jord C. Prangsma, René de Waele, Kobus L. Kuipers; FOM Inst. for Atomic and Molecular Physics (AMOLF), Netherlands.* Single and multiple holes in optically thick gold layers are investigated with cathodoluminescence. We observe striking localized effects as we vary the shape of the subwavelength holes and their relative orientation.

QTuA5 • 9:15 a.m.
Enhancing Efficiency of Electroluminescence Using Individual Metal Nanoparticles and Ordered Nanoparticle Arrays, *Jacob B. Khurgin[1], Greg Sun[2], Richard A. Soref[3]; [1]Johns Hopkins Univ., USA, [2]Univ. of Massachusetts at Boston, USA, [3]AFRL, USA.* We evaluate the efficiency enhancement of electroluminescence of the semiconductor by isolated metal nanoparticles and their arrays and show that using random assembly of isolated particles holds an advantage over the ordered arrays.

QTuA6 • 9:30 a.m.
Controlling the Quenching of Single-Molecule Fluorescence through a Plasmonic Slab, *Cédric Vandenbem[1,2], Luis S. Froufe-Pérez[1], Rémi Carminati[1]; [1]Ecole Supérieure de Physique et de Chimie Industrielles (ESPCI), France, [2]Univ. of Namur, Belgium.* The fluorescence quenching of a single molecule can be controlled using a plasmonic device made of a metallic or negative-index slab and a metallic nanoparticle. The concept of dark near-field imaging is introduced.

QTuB • Single Quantum Emitters—Continued

QTuB4 • 9:00 a.m.
Coherent Optical Spectroscopy of a Strongly Coupled Semiconductor Microcavity-Quantum Dot System, *Kartik Srinivasan[1,2], Oskar Painter[3]; [1]Ctr. for the Physics of Information, Caltech, USA, [2]Ctr. for Nanoscale Science and Technology, NIST, USA, [3]Dept. of Applied Physics, Caltech, USA.* A fiber taper waveguide is used to perform coherent optical spectroscopy of a GaAs microdisk strongly coupled to an InAs quantum dot. Vacuum Rabi splitting under weak driving and saturation under strong driving are observed.

QTuB5 • 9:15 a.m.
Coherent Optical Spectroscopy of a Strongly Driven Quantum Dot, *Xiaodong Xu[1], Bo Sun[1], Paul R. Berman[1], Duncan G. Steel[1], Allan S. Bracker[2], Dan Gammon[2], Lu J. Sham[3]; [1]Univ. of Michigan, USA, [2]NRL, USA, [3]Univ. of California at San Diego, USA.* We report the demonstration of the Autler-Townes splitting and Mollow absorption spectrum by means of coherent optical spectroscopy of a strongly driven quantum dot.

QTuB6 • 9:30 a.m.
Strong Interaction between Light and a Single Trapped Atom without a Cavity, *Tey Meng Khoon[1], Zilong Chen[1,2], Syed Abdullah Aljunid[1], Brenda Chng[1], Gleb Maslennikov[1], Christian Kurtsiefer[1]; [1]Ctr. for Quantum Technologies, Natl. Univ. of Singapore, Singapore, [2]Inst. for Materials Res. and Engineering, Singapore.* We measured the extinction of 7.2% for a focused beam by a single ^{87}Rb atom localized in an optical dipole trap without cavity assistance. This result opens new perspectives for an efficient atom-photon interface.

CLEO

CTuA • Ultrafast Photonics I—Continued

CTuA4 • 9:00 a.m.
Time-Multiplexed Optical Waveform Generation for High-Resolution Imaging, *Kevin W. Holman, David G. Kocher, Sumanth Kaushik; MIT Lincoln Lab, USA.* We have developed a time-multiplexed technique for controlling the amplitude and phase of the individual frequency components of a mode-locked laser to generate a precisely linear chirped waveform. We have demonstrated a 20-GHz, 1-µs chirp.

CTuA5 • 9:15 a.m.
Integrated, Ultrahigh-Fidelity 17x40 GHz OAWG, *Nicolas K. Fontaine[1], Ryan P. Scott[1], Chunxin Yang[2], David J. Geisler[1], Katsu Okamoto[1], Jonathan P. Heritage[1], S. J. Ben Yoo[1]; [1]Dept. of Electrical and Computer Engineering, Univ. of California at Davis, USA, [2]Dept. of Applied Science, Univ. of California at Davis, USA.* We demonstrate ultrahigh-fidelity ($G' < 0.4\%$) optical arbitrary waveform generation using an integrated arrayed-waveguide-grating pair based 128-channel Fourier pulse shaper with computer-controlled-feedback, a 17-mode 40-GHz optical-frequency comb source, and cross-correlation frequency-resolved optical-gating measurements.

CTuA6 • 9:30 a.m.
640 GHz Real-Time Recording Using Temporal Imaging, *Corey V. Bennett[1], Bryan D. Moran[1], Carsten Langrock[2], Martin M. Fejer[2], Morten Ibsen[3]; [1]Lawrence Livermore Natl. Lab, USA, [2]Stanford Univ., USA, [3]Univ. of Southampton, UK.* 640 GHz chirped beat waves are recorded on a real-time scope and 2.2 ps pulses are recorded on a single-shot streak camera with 1000:1 dynamic range after –30x time magnification.

CTuB • Stimulated Brillouin Scattering and Applications—Continued

CTuB5 • 9:00 a.m.
Forward Brillouin Scattering in Tapered Optical Fibers, *Myeong Soo Kang[1], Andre Brenn[1], Gustavo S. Wiederhecker[2], Philip St.J. Russell[1]; [1]Max-Planck Res. Group, Inst. of Optics, Information and Photonics, Univ. of Erlangen-Nuremberg, Germany, [2]Ctr. de Pesquisas em Óptica e Fotônica, Inst. de Física, Univ. Estadual de Campinas, Brazil.* We experimentally study forward Brillouin scattering in tapered fibers. Circularly symmetric acoustic phonons resonant in fibers are observed by using a novel photoacoustic measurement technique. Strong acousto-optic interaction can take place in highly tapered fibers.

CTuB6 • 9:15 a.m.
Highly Efficient Brillouin Slow Light Generation Using a Single Mode Tellurite Fiber, *Guanshi Qin[1], Hideyuki Sotobayashi[2], Masahito Tsuchiya[2], Atsushi Mori[3], Takenobu Suzuki[1], Yasutake Ohishi[1]; [1]Res. Ctr. for Advanced Photon Technology, Toyota Technological Inst., Japan, [2]Natl. Inst. of Information and Communications Technology, Japan, [3]NTT Photonics Labs, Japan.* We demonstrate highly-efficient Brillouin slow-light-generation in a low loss tellurite fiber. A time-delay of 74ns is achieved for an input pulse of 40ns width in a 200m long fiber with a pump power of 19.7mW.

10:00 a.m.–10:30 a.m., Coffee Break, *Exhibit Hall*

10:00 a.m.–5:00 p.m., Exhibit Hall Open

Room C1 and C2	Room C3 and C4	Room B1 and B2	Room J2
QELS	CLEO		

QTuC • Periodic Nonlinear Media—Continued

QTuC4 • 9:00 a.m.
Investigation of Relations Among Matrix Elements of Second-Order Nonlinear Susceptibility Tensor of GaSe Crystal, *Xiaodong Mu[1], Yujie J. Ding[1], Ioulia B. Zotova[2]; [1]Lehigh Univ., USA, [2]ArkLight, USA.* By investigating dependence of THz output power on pump polarization, ratios of elements for second-order nonlinear susceptibility tensor have been measured for GaSe, which significantly deviate from those dictated by Kleinman's symmetry and structural symmetry.

QTuC5 • 9:15 a.m.
Observations of Cavity Dipole Solitons and Vortex Soliton Clusters in VCSELs with a Surface Photonic Crystal Structure, *YuanYao Lin[1], Wun-Jhang Lin[2], Han-Zhong Liao[2], Jin-Shan Pan[3], Tsin-Dong Lee[2], Ray-Kuang Lee[1]; [1]Inst. of Photonics Techologies, Natl. Tsing-Hua Univ., Taiwan, [2]Graduate School of Optoelectronics, Natl. Yunlin Univ. of Science and Technology, Taiwan, [3]TrueLight Corp., Taiwan.* We report experimental observation of nonlinear transverse optical pattern distributions in a photonic crystal surface-structured VCSEL by using near-field scanning optical microscope. Rotating cavity dipole solitons and vortex soliton clusters are demonstrated.

QTuC6 • 9:30 a.m.
From Fast Optical Bistability to Thermo-Optical Excitability in a Two-Dimensional Photonic Crystal, *Alejandro Yacomotti, Paul Monnier, Fabrice Raineri, Rama Raj, Ariel Levenson; Lab de Photonique et de Nanostructures, CNRS, France.* We show excitable optical pulses in an InP-based Photonic Crystal slab close to bistable operation. Possible applications of excitability such as the realisation of all-optical delay lines in coupled micro cavities will be discussed.

CTuC • Optical Frequency Comb Control—Continued

CTuC5 • 9:00 a.m.
Significant Carrier Envelope Offset Frequency Linewidth Narrowing in a Prism-Based Cr:Forsterite Frequency Comb, *Karl A. Tillman, Rajesh Thapa, Brian R. Washburn, Kristan L. Corwin; Kansas State Univ., USA.* We report a dramatic reduction in the linewidth of the carrier envelope offset frequency of a frequency comb generated by a femtosecond prism-based Cr:forsterite laser due to changes in the wavelength-dependent intracavity loss.

CTuC6 • 9:15 a.m.
Frequency Dependence of the Fixed Point in a Fluctuating Frequency Comb, *David R. Walker, Thomas Udem, Christoph Gohle, B. Stein, Theodor W. Hänsch; Max-Planck-Inst. für Quantenoptik, Germany.* Modulating the pump power of a mode-locked laser causes the frequency comb to expand and contract about a fixed point in frequency. We report the first measurement of this fixed point in a tunable laser.

CTuC7 • 9:30 a.m.
Semi-Automatic, Octave-Spanning Optical Frequency Counter, *Tze-An Liu, Ren-Huei Shu, Jin-Long Peng; Industrial Technology Res. Inst., Taiwan.* We used a monochrometer to determine the mode number difference between two laser combs and derived the comb number without using a wavemeter or scanning the repetition rate for the semi-autometic, octave-spanning optical frequency counter.

CTuD • THz Metamaterials—Continued

CTuD5 • 9:00 a.m.
Terahertz Near Field Microscopy of Metamaterials, *Guillermo P. Acuna[1], Florian Kuchler[1], Roland Kersting[1], Hou Tong Chen[2], Antoinette Taylor[2], Arthur Gossard[3]; [1]LMU Univ. Munich, Germany, [2]Ctr. for Integrated Nanotechnologies, Materials Physics and Applications Div., Los Alamos Natl. Lab, USA, [3]Materials Dept., Univ. of California at Santa Barbara, USA.* We apply terahertz microscopy for studying metamaterials with resonances in the terahertz band. The data provides insight into the metamaterial's local response on scales much smaller than the unit cell of the structure.

CTuD6 • 9:15 a.m.
THz Polarimetric Metamaterials, *Xomalin G. Peralta[1], Igal Brener[1], Abul Azad[2], Evgenya Smirnova[3], Antoinette J. Taylor[2], John F. O'Hara[2]; [1]CINT, Sandia Natl. Labs, USA, [2]MPA-CINT, Los Alamos Natl. Lab, USA, [3]ISR-6, Los Alamos Natl. Lab, USA.* We demonstrate a THz-metamaterial that exhibits a frequency selective resonant response based on the polarization of the incident field. The metamaterial is based on an asymmetric split-ring resonator structure. A polarization-insensitive design is also presented.

CTuD7 • 9:30 a.m.
Terahertz Optical Activity of a Subwavelength Helix, *Kenneth J. Chau, Abdulhakem Y. Elezzabi; Univ. of Alberta, Canada.* We study terahertz pulse propagation through a subwavelength helix; it is shown that polarization rotation accrues linearly within the helix, revealing a direct relationship between the optical activity of a helix and its geometrical chirality.

CTuE • Spatial and Temporal Effects in Nonlinear Optics—Continued

CTuE5 • 9:00 a.m.
Transition from Bright to Dark and from Discrete to Gap Spatial Solitons by Varying Optical Beam Orientation, *Peng Zhang[1], Jianlin Zhao[1], Sheng Liu[1], Yuhan Gao[1], Cibo Lou[2], Jingjun Xu[2], Zhigang Chen[2]; [1]Inst. of Optical Information Science and Technology and Shaanxi Key Lab of Optical Information Technology, School of Science, Northwestern Polytechnical Univ., China, [2]Key Lab of Weak-Light Nonlinear Photonics, Ministry of Education and TEDA Applied Physics School, Nankai Univ., China.* We show that a nonconventionally biased photorefractive crystal can support one-dimensional spatial solitons. Transition from bright to dark, and from discrete to gap solitons is realized for the first time by varying optical beam orientation.

CTuE6 • 9:15 a.m.
Experimental Observation of Noncollinear Coupling of Filaments in Air, *Xuan Yang, Jian Wu, Yan Peng, Shuai Yuan, Heping Zeng; East China Normal Univ., China.* We experimentally demonstrate the strong interactions of femtosecond-pulse-induced filaments in air with various crossing angles and polarizations. A significantly enhanced third-harmonic generation up to 16 times is observed as the filaments are coupling together.

CTuE7 • 9:30 a.m.
Observation of Energy Exchange between Intersecting Filament-Forming Beams Freely Propagating in Air, *Aaron C. Bernstein, Matthew W. McCormick, James C. Sanders, Todd Ditmire; Univ. of Texas at Austin, USA.* We demonstrate two-beam coupling between crossed filament-producing beams freely propagating in atmosphere, producing energy transfers of 10%, controllable by a relative delay of +/-20 fs. Prospects of filament regeneration and control will be discussed.

10:00 a.m.–10:30 a.m., Coffee Break, *Exhibit Hall*

10:00 a.m.–5:00 p.m., Exhibit Hall Open

Room J3	Marriott San Jose Salon 1 and 2	Marriott San Jose Salon 3	Marriott San Jose Salon 4

CLEO

CTuF • Quantum Cascade Lasers I—Continued

CTuF5 • 9:15 a.m.
Low Voltage Defect Heterogeneous Quantum Cascade Laser, *Anthony J. Hoffman[1], Stephan Schartner[1,2], Scott S. Howard[1], Kale J. Franz[1], Fred Towner[3], Claire Gmachl[1]; [1]Princeton Univ., USA, [2]TU Vienna, Austria, [3]Maxion Technologies, Inc., USA.* We demonstrate a quantum cascade laser employing two different injector regions and matched 4.6µm optical transitions for low-voltage-defect operation. The laser has a pulsed wall-plug efficiency of 19% at 80K and operates pulsed at 300K.

CTuF6 • 9:30 a.m.
Gain Measurements in Quantum Cascade Lasers at High Temperatures, *Tobias Gresch[1], Marcella Giovannini[2], Jérôme Faist[1]; [1]Quantum Optoelectronics Group, Inst. for Quantum Electronics, ETH Zürich, Switzerland, [2]Inst. of Microtechnology, Univ. of Neuchâtel, Switzerland.* Multisection-cavity gain measurements of quantum cascade lasers operating near room temperature are presented. In some devices clear evidence of Bloch gain is reported. A strain compensated 4.7 µm laser is also discussed.

CTuG • Bulk Processing of Transparent Materials with Femtosecond Lasers—Continued

CTuG5 • 9:00 a.m.
Ridge Waveguides of Rare Earth Doped ZBLAN by Pulsed Laser Deposition and Ultrafast Laser Micromachining for Green Integrated Waveguide Lasers, *Dirk Wortmann, Jens Gottmann, Dimitri Ganser, Larisa Starovoytova, Maren C. Horstmann-Jungemann; Lehrstuhl für Lasertechnik, Germany.* Ridge waveguides are manufactured using laser radiation for thin film deposition and micro-structuring. The optical properties of erbium and praseodymium doped ZBLAN waveguides are investigated in view of the manufacturing of green integrated waveguide lasers.

CTuG6 • 9:15 a.m.
Microstructured Chalcogenide Glasses Using Femtosecond Laser Irradiation or Photolithography, *Troy P. Anderson[1], Nathan Carlie[2], Juejun Hu[3], Laeticia Petit[2], Anuradha M. Agarwal[3], Jiyeon Choi[1], Lionel C. Kimerling[3], Kathleen Richardson[2], Martin Richardson[1]; [1]College of Optics and Photonics, CREOL, USA, [2]Advanced Materials Res. Lab, Clemson Univ., USA, [3]Microphotonics Ctr., MIT, USA.* We present the microstructuring of bulk and film chalcogenide glasses using IR femtosecond laser exposure and photolithography for molecular sensing.

CTuG7 • 9:30 a.m.
Large-Scale 3-D Microporous Structures by Two-Photon Laser Machining, *Yihong Liu, Laura J. Pyrak-Nolte, David D. Nolte; Dept. of Physics, Purdue Univ., USA.* We fabricate large-scale 3-D microporous structures fabricated with two-photon polymerization in broad-area SU-8 photoresist. This approach enables the fabrication of microporous structures simulating complex 3-D microfluidic systems.

CTuH • High-Speed Components—Continued

CTuH5 • 9:00 a.m. Invited
High-Speed Switching of a 1.55-µm Symmetric SEED, *Gordon A. Keeler, Darwin K. Serkland, Alan Y. Hsu, Kent M. Geib, Mark E. Overberg, John F. Klem; Sandia Natl. Labs, USA.* We demonstrate high-speed switching of a symmetric self-electrooptic effect device (S-SEED) operating at 1550 nm. Transitions faster than 10 ps are observed, verifying the suitability of this technology for integrated logic operations beyond 40 GHz.

CTuH6 • 9:30 a.m.
40-GS/s All-Optical Sampling Using Four-Wave Mixing with a Time- and Wavelength-Interleaved Laser Source, *Gordon Kin Pang Lei, Mable P. Fok, Chester Shu; Dept. of Electronic Engineering and Ctr. for Advanced Res. in Photonics, The Chinese Univ. of Hong Kong, Hong Kong.* We demonstrate 40-GS/s all-optical wavelength division sampling using four-wave mixing in a dispersion-flattened photonic crystal fiber. Our 4x10-GHz time- and wavelength-interleaved sampling laser source is generated through multiwavelength cross-absorption modulation and optical dispersion management.

CTuI • Sensing with Ultrafast Lasers—Continued

CTuI2 • 9:00 a.m.
Real-Time Sensing of Gas Phase Mixtures via Coherent Raman Spectroscopy, *Dmitry Pestov, Xi Wang, Diego Cristancho, Kenneth R. Hall, Alexei V. Sokolov, Marlan O. Scully; Texas A&M Univ., USA.* Hybrid CARS experiments on ambient air and gas mixtures suggest that the technique, developed initially for biohazard detection, might become indispensable for local sensing of gas composition, e.g. real-time quality control of pipeline natural gas.

CTuI3 • 9:15 a.m.
Nanosecond Interrogation of Surface Plasmon Resonance Sensors Using Chirped Femtosecond Optical Pulses, *Zheng Zheng[1], Yuhang Wan[1], Xin Zhao[1], Jinsong Zhu[2]; [1]Beihang Univ., China, [2]Natl. Ctr. for Nanoscience and Technology of China, China.* A novel interrogation technique using chirped femtosecond pulses to realize high speed SPR measurements is proposed. The scanning time can be as short as several nanoseconds. Its ability to make sensitive measurements is experimentally demonstrated.

CTuI4 • 9:30 a.m.
Thin-Film Sensing with Terahertz Split-Ring Resonators, *John F. O'Hara[1], Ranjan Singh[2], Xomalin G. Peralta[3], Igal Brener[3], Eric A. Shaner[3], Darren W. Branch[3], Jiaguang Han[2], Antoinette J. Taylor[1], Weili Zhang[2]; [1]Los Alamos Natl. Lab, USA, [2]Oklahoma State Univ., USA, [3]Sandia Natl. Labs, USA.* We investigate the limitations of using THz metamaterials as thin-film chem-bio sensors, by depositing dielectric overlayers onto split-ring resonator arrays. We also study resonance shifts by conjugating biomolecules using avidin/silane linkers attached to the resonators.

10:00 a.m.–10:30 a.m., Coffee Break, *Exhibit Hall*

10:00 a.m.–5:00 p.m., Exhibit Hall Open

Marriott San Jose
Salon 5 and 6

CLEO

CTuJ • Active Nanophotonic Devices—Continued

CTuJ4 • 9:00 a.m.
Excitation of Silicon-Based Random Photonic Crystal Nanocavities with PbSe Colloidal Quantum Dots, *Jun Yang[1], Junseok Heo[1], Jian Xu[2], Frank Vollmer[3], Juraj Topolancik[3], Rob Ilic[4], Pallab Bhattacharya[1]; [1]Solid State Electronics Lab, Dept. of Electrical Engineering and Computer Science, Univ. of Michigan, USA, [2]Dept. of Engineering Science and Mechanics, Pennsylvania State Univ., USA, [3]Rowland Inst. at Harvard, USA, [4]Cornell NanoScale Facility, Cornell Univ., USA.* Coupling of quantum dot photoluminescence from lead selenide colloidal nanocrystals into high-Q nanocavities supported by disordered photonic crystal waveguides in free-standing silicon membranes is observed.

CTuJ5 • 9:15 a.m.
Nonlinear Response of Silicon Double-Notch-Shaped Microdisk Resonators with Non-Evanescent Coupling, *Hui Chen[1], Chao Li[2], Andrew W. Poon[1], Hon K. Tsang[2]; [1]Hong Kong Univ. of Science and Technolgy, Hong Kong, [2]Chinese Univ. of Hong Kong, Hong Kong.* We report double-notch-shaped microdisk resonators for silicon nonlinear-optic applications with direct in/out coupling via the microdisk notches. We measure optical bistability and resonance wavelength redshifts induced by the notch-coupled pump light.

CTuJ6 • 9:30 a.m.
Fast and Efficient Analysis and Design of Three-Dimensional Photonic Crystal Structures for Functional Dispersive Devices, *Majid Badieirostami, Babak Momeni, Ali Adibi, Vincent W. Chen, Joseph W. Perry; Georgia Tech, USA.* We show the propagation of optical beams inside three-dimensional photonic crystals can be efficiently described by an approximate scalar diffraction model. We use this model for design of photonic crystal dispersive devices such as demultiplexers.

10:00 a.m.–10:30 a.m.
Coffee Break, *Exhibit Hall*

10:00 a.m.–5:00 p.m.
Exhibit Hall Open

NOTES

10:30 a.m.–12:15 p.m.
QTuD • Nanoplasmonics II
Romain Quidant; Inst. de Ciencies Fotoniques, Spain, Presider

QTuD1 • 10:30 a.m.
Exciton-Plasmon Interactions in Hybrid Structures of Semiconductor Nanocrystals and Metal Disc Arrays, *Yikuan Wang, Tianyu Yang, Mark Tuominen, Marc Achermann; Univ. of Massachusetts at Amherst, USA.* Using time resolved optical spectroscopy we show that by angle tuning dispersive plasmon modes of metal disc arrays into resonance with emission of adjacent semiconductor nanocrystals we achieve fivefold enhancement of radiative transition rates.

QTuD2 • 10:45 a.m.
Coupling of Self-Assembled InAs Quantum Dots to Surface Plasmon Polaritons, *Mads L. Andersen, Søren Stobbe, Jeppe Johansen, Peter Lodahl; COM•DTU, Technical Univ. of Denmark, Denmark.* InAs quantum dots have been placed at different distances to a silver mirror. We extract the coupling of quantum dots to surface plasmon polaritons as a function of the distance by time-resolved spontaneous emission measurements.

QTuD3 • 11:00 a.m.
Coherent Exciton–Surface Plasmon Polariton Interactions in Hybrid Metal Semiconductor Nanostructures, *P. Vasa[1,2], R. Pomraenke[1], S. Schwieger[2], Yu. I. Mazur[3], Vas. Kunets[3], P. Srinivasan[4], E. Johnson[4], E. Runge[2], G. Salamo[3], C. Lienau[1]; [1]Carl von Ossietzky Univ. Oldenburg, Germany, [2]Technische Univ. Ilmenau, Germany, [3]Univ. of Arkansas, USA, [4]Univ. of North Carolina at Charlotte, USA.* We report on the coherent coupling between surface plasmon polaritons and quantum well excitons in a hybrid metal-semiconductor nanostructure. The coupling is probed by angle-resolved low temperature spectroscopy and analyzed within a coupled oscillator model.

QTuD4 • 11:15 a.m.
Strongly Coupled Surface Plasmon-Exciton Excitations in Small-Diameter Carbon Nanotubes, *Igor Bondarev[1], Kevin Tatur[2], Lilia Woods[2]; [1]Physics Dept., North Carolina Central Univ., USA, [2]Physics Dept., Univ. of South Florida, USA.* The strong exciton-surface-plasmon coupling effect is shown theoretically for small diameter carbon nanotubes. The exciton absorption line splits by ~0.1 eV (Rabi splitting) as the exciton energy is tuned to the nearest nanotube plasmon resonance.

10:30 a.m.–12:15 p.m.
QTuE • Single-Photon Sources
Jonathan Dowling; Louisiana State Univ., USA, Presider

QTuE1 • 10:30 a.m.
Extraction of Single Photons by a Cavity-QED System, *Kazuki Koshino[1,2]; [1]Tokyo M and D Univ., Japan, [2]PRESTO, Japan Science and Technology Agency, Japan.* The nonlinear dynamics of a classical photon pulse occurring at a two-sided cavity QED system in the weak-coupling regime is investigated theoretically. It is shown that this system functions as a single-photon filter.

QTuE2 • 10:45 a.m.
Photon Statistics of Superradiant Photon Pairs, *Vasily V. Temnov, Ulrike Woggon; Experimentelle Physik IIb, Univ. Dortmund, Germany.* Photon statistics in the cooperative spontaneous emission (Dicke's superradiance) is investigated by Monte-Carlo simulations. Giant photon bunching due to generation of superradiant photon pairs is predicted.

QTuE3 • 11:00 a.m.
Conditional and Unconditional $g^{(2)}(0)$ Measurements of a Microstructure-Fiber-Based Heralded Single-Photon Source, *Elizabeth A. Goldschmidt, Matthew D. Eisaman, Jingyun Fan, Sergey Polyakov, Alan Migdall; NIST, USA.* Using photon pairs created via four-wave mixing in a microstructure fiber, we measure $g^{(2)}(0)$ of idler photons heralded by a signal photon to be well below one, and six times less than unconditional $g^{(2)}(0)$.

QTuE4 • 11:15 a.m.
Single-Photon Generation Using Excitation Energy Transfer between Quantum Dots via an Optical Near Field, *Tadashi Kawazoe[1], Shunsuke Tanaka[1], Motoichi Ohtsu[1,2]; [1]Univ. of Tokyo, Japan, [2]SORST, Japan Science and Technology Agency, Japan.* We demonstrated a single photon generator using quantum dots coupled by an optical near field. This nanometric single photon generator has two blockade mechanisms to create an ideal single photon source.

10:30 a.m.–12:15 p.m.
CTuK • Ultrafast Photonics II
Zhiwen Liu; Penn State Electro-Optics Ctr., USA, Presider

CTuK1 • 10:30 a.m. Invited
Ultrafast Fiber Amplifier Systems: Status, Perspectives and Applications, *Andreas Tünnermann[1,2], Jens Limpert[1,2], Stefan Nolte[1,2]; [1]Inst. of Applied Physics, Friedrich-Schiller-Univ. Jena, Germany, [2]Fraunhofer Inst. for Applied Optics and Precision Engineering, Germany.* We will discuss the status of high repetition rate high energy femtosecond fiber laser systems, review their scaling potential in terms of average power, pulse energy and peak power. First micro-machining applications demonstrate the potential.

CTuK2 • 11:00 a.m.
Ultra Stable Coupled Optoelectronic Oscillator Based on Slab-Coupled Optical Waveguide Amplifier, *Sarper Ozharar[1], Ibrahim Ozdur[1], Franklyn Quinlan[1], Peter J. Delfyett[1], Jason J. Plant[2], Paul W. Juodawlkis[2]; [1]CREOL, College of Optics and Photonics, Univ. of Central Florida, USA, [2]MIT Lincoln Lab, USA.* We built an ultra stable coupled optoelectronic oscillator using a slab coupled optical waveguide amplifier, generating pulses at 10.24 GHz with a repetition rate drift of only 513 Hz in 10 minutes without active stabilization.

CTuK3 • 11:15 a.m.
Amplification of High Energy Picosecond Pulses Using Slab-Coupled Waveguide Amplifiers at 1550 nm, *Mikhail Kats, David Y. Tseng, Faisal R. Ahmad, Edgar A. Peralta, Farhan Rana; Cornell Univ., USA.* We demonstrate amplification of picosecond pulses at 1550 nm using Slab-Coupled Waveguide Amplifiers. For currents less than 1A, we obtained a maximum unsaturated gain of 12.3dB and a pulse saturation energy of ~50 pJ.

10:30 a.m.–12:15 p.m.
CTuL • Raman Lasers and Amplifiers
Jay E. Sharping; Univ. of California at Merced, USA, Presider

CTuL1 • 10:30 a.m.
High-Brightness 210 µJ Pulsed Raman Fiber Source, *Akira Shirakawa, Christophe A. Codemard, Junhua Ji, Kang K. Chen, Andrew Malinowski, David J. Richardson, Jayanta K. Sahu, Johan Nilsson; Optoelectronics Res. Ctr., Univ. of Southampton, UK.* We report a 210 µJ pulsed high-brightness fiber source based on a cladding-pumped Raman fiber. It delivers Stokes light at 1112 nm, of 500 ns duration, 420 W peak power, and M^2 1.8.

CTuL2 • 10:45 a.m.
Efficient Mid-IR Spectral Generation via Forth Order Cascaded-Raman Amplification, *Peter T. Rakich, Marin Soljacic, Yoel Fink; MIT, USA.* A simple and robust 2.14 µm fiber-based laser source is demonstrated via higher order cascaded Raman scattering in silica. The temporal and spectral characteristics of the laser are compared with simulations.

CTuL3 • 11:00 a.m.
Multicanonical Monte Carlo Study of Noisy Signal Evolution in 2R All-Optical Regenerators with Normal and Anomalous Average Dispersions, *Taras I. Lakoba[1], Michael Vasilyev[2]; [1]Univ. of Vermont, USA, [2]Univ. of Texas at Arlington, USA.* We show that evolutions of optical noise on the background of a strongly nonlinear signal pulse are similar in Mamyshev-type regenerators employing maps with either normal or anomalous average dispersion.

CTuL4 • 11:15 a.m.
Sub-Watt Threshold CW Raman Fiber-Gas-Laser Based on H_2-Filled Hollow-Core Photonic Crystal Fiber, *Francois Couny, Fetah Benabid, Phil S. Light; Ctr. for Photonics and Photonic Materials, Dept. of Physics, Univ. of Bath, UK.* A single pass CW Raman laser based on a hollow-core PCF filled with hydrogen exhibits 50% conversion quantum efficiency even at atmospheric pressure. The addition of fiber-Bragg-gratings reduces the Raman threshold power below 600mW.

Room C1 and C2

QELS

10:30 a.m.–12:15 p.m.
QTuF • Spectroscopy/ Filamentation
Selim M. Shahriar; Northwestern Univ., USA, Presider

QTuF1 • 10:30 a.m.
Filamentation in Turbulent Air, *Arnaud Couairon[1], Aurelien Houard[2], Michel Franco[2], Bernard Prade[2], Andre Mysyrowicz[2], Anne Durecu[3], Laurent Lombard[3], Pierre Bourdon[3], Olivier Vasseur[3], Bruno Fleury[3], Clelia Robert[3], Vincent Michau[3]; [1]Ctr. de Physique Theorique, Ctr. Natl. de Recherche Scientifique, Ecole Polytechnique, France, [2]Lab d'Optique Appliquée, ENSTA, Ecole Polytechnique, Ctr. Natl. de Recherche Scientifique, France, [3]Dept. d'Optique Théorique et Appliquée, ONERA, France.* We present experimental and theoretical results on the robustness, beam pointing accuracy and survival probability of femtosecond filaments in turbulent air.

QTuF2 • 10:45 a.m.
Demonstration of Spontaneously Generated Conical Waves during Ultrashort Laser Pulse Filamentation in Air, *Alessandro Averchi[1], Daniele Faccio[1], Antonio Lotti[1], Paolo Di Trapani[1,2], Arnaud Couairon[3], Dimitris Papazoglou[4,5], Stelios Tzortzakis[4]; [1]CNISM, Dept. of Physics and Mathematics, Univ. a dell'Insubria, Italy, [2]Dept. of Quantum Electronics, Vilnius Univ., Lithuania, [3]Ctr. Natl. de Recherche Scientifique, France, [4]Inst. of Electronic Structure and Laser, Foundation for Res. and Technology Hellas, Greece, [5]Materials Science and Technology Dept., Univ. of Crete, Greece.* Measurements and simulations show that X-waves are spontaneously generated during filamentation in air. This explains the sub-diffractive propagation of filaments beyond the end of the plasma channel generated by multiphoton ionization.

QTuF3 • 11:00 a.m.
Optical Confinement by Filamentation-Induced Molecular Alignment, *Francesca Calegari, Caterina Vozzi, Enrico Benedetti, Sergei Gasilov, Giuseppe Sansone, Mauro Nisoli, Sandro De Silvestri, Salvatore Stagira; Politecnico di Milano, Italy.* Experimental analysis on the spatio-temporal effects in the wake of a filament propagating in Nitrogen is presented. At suitable time-delays, a probe light pulse experiences spatial confinement and spectral broadening at the same time.

QTuF4 • 11:15 a.m.
Coherent Enhancement in Raman Spectroscopy, *Arthur Dogariu[1], Alexander Goltsov[1], Gurusamy Balakrishnan[2], Thomas G. Spiro[2], Marlan O. Scully[1,3]; [1]Princeton Univ., USA, [2]Univ. of Washington, USA, [3]Texas A&M Univ., USA.* We present direct measurements of almost 10 orders of magnitude enhancement in coherent over spontaneous Raman. The measured ground state coherence is in good agreement with theory and is verified by the molecular concentration dependence.

Room C3 and C4

CLEO

10:30 a.m.–12:15 p.m.
CTuM • Novel Optical Combs and Clocks
Thomas R. Schibli; JILA, USA, Presider

CTuM1 • 10:30 a.m. Invited
Going Optical: Clocks and Combs in Space, *Ronald Holzwarth; Menlo Systems GmbH, Germany.* Optical frequency combs combined with optical local oscillators and optical clocks offer intriguing possibilities for space applications. As a first step this project sponsored by ESA is aiming to put a frequency comb in space.

CTuM2 • 11:00 a.m.
An Optimized Frequency Locked Loop in a Small Scale CPT Based Rubidium Atomic Clock, *Matan Kahanov, Ido Ben-Aroya, Gadi Eisenstein; Israel Inst. of Technology, Israel.* We describe optimization of Frequency Locked Loop in atomic clock which is based on Coherent Population Trapping in ^{87}Rb-D_2 transition. The clock performance was optimized to have an Allan deviation of $2.8{\cdot}10^{-11}$ at 1 sec.

CTuM3 • 11:15 a.m.
Self-Stabilization of the Optical Frequencies and Pulse Repetition Rate in a Coupled Optoelectronic Oscillator, *Franklyn J. Quinilan, Charles Williams, Sarper Ozharar, Peter J. Delfyett; CREOL, College of Optics and Photonics, Univ. of Central Florida, USA.* A self-stabilized coupled optoelectronic oscillator is described where a single intracavity etalon is used for optical supermode selection, optical frequency stabilization and repetition rate determination and stabilization.

Room B1 and B2

10:30 a.m.–12:15 p.m.
CTuN • Terahertz Spectroscopy
Abdul Elezzabi; Univ. of Alberta at Edmonton, Canada, Presider

CTuN1 • 10:30 a.m.
Fully Flexible Terahertz Bragg Reflectors Based on Titania Loaded Polymers, *Christian Jansen[1], Steffen Wietzke[1], Victoria Astley[2], Daniel M. Mittleman[2], Martin Koch[1]; [1]Technische Univ. Braunschweig, Germany, [2]Rice Univ., USA.* We demonstrate fully flexible, high performance terahertz Bragg reflectors and filters based on TiO_2-loaded polymers. Broadband terahertz reflection measurements with corresponding transfer matrix simulations are shown and the effect of curvature is analyzed.

CTuN2 • 10:45 a.m.
Heterogeneous Dielectric Mixtures in the Terahertz Frequency Range: Theory and Experiment, *Maik A. Scheller[1], Steffen Wietzke[1], Christian Jansen[1], Stephan Kipp[2], Martin Koch[1]; [1]Inst. für Hochfrequenztechnik, Technische Univ. Braunschweig, Germany, [2]Inst. für Physikalische und Theoretische Chemie, Technische Univ. Braunschweig, Germany.* We present a new physical model for describing heterogeneous dielectric mixtures in the terahertz frequency range, which overcomes drawbacks of established models. The theory is confirmed by highly accurate data on polymeric compounds.

CTuN3 • 11:00 a.m.
THz Photonic Crystal Waveguide Coupled Cavities, *Adam L. Bingham, Daniel Grischkowsky; Oklahoma State Univ., USA.* Numerical simulations are used to design integrated metallic photonic crystal waveguide coupled cavities with sharp resonances. THz time-domain spectroscopy (THz-TDS) is used to characterize these waveguides. A good match between theory and experiment is shown.

CTuN4 • 11:15 a.m.
Terahertz Birefringence of β-BaB_2O_4 (BBO) Crystal, *Elmer S. Estacio[1], Shigeki Saito[1], Tomoharu Nakazato[1], Yusuke Furukawa[1], Toshihiro Tatsumi[1], Minh Hong Pham[2], Marilou Cadatal[2], Carlito Ponseca Jr.[2], Hiroshi Mizuseki[3], Yoshiyuki Kawazoe[3], Nobuhiko Sarukura[1]; [1]Inst. of Laser Engineering, Osaka Univ., Japan, [2]Graduate Univ. for Advanced Studies, Japan, [3]Inst. for Materials Res., Tohoku Univ., Japan.* Birefringence was observed for a β-BaB_2O_4 crystal in the 0.1 to 1.1 terahertz region. The calculated Δn value was ~0.296. Moreover, an angle-dependent absorption band observed at ~0.65 terahertz is attributed to low-frequency phonon modes.

Room J2

10:30 a.m.–12:15 p.m.
CTuO • Nonlinear Optics of High-Generation Harmonics
Vladimir V. Shkunov; Raytheon Corp., USA, Presider

CTuO1 • 10:30 a.m.
High-Energy Femtosecond Optical Parametric Amplifier for Soft X-Ray Harmonic Generation, *Eiji J. Takahashi, Yasuo Nabekawa, Tsuneto Kanai, Katsumi Midorikawa; RIKEN, Japan.* A total output energy exceeding 8-mJ with 50-fs duration has been achieved in the infrared region by power scaling of a parametric amplifier chain, making this source suited as a driver for soft-x-ray harmonic pulses.

CTuO2 • 10:45 a.m. Tutorial
High Harmonic Generation and Extreme Nonlinear Optics, *Christian Spielmann; Univ. Würzburg, Germany.* With the recent developments of new x-ray light sources and measurement techniques, the field of ultrafast x-ray science has tremendously advanced. Laser based high harmonic sources deliver nowadays attosecond and or keV x-ray pulses.

Christian Spielmann obtained his Ph.D. from the Vienna University of Technology, Austria in 1992. He was a post-doctoral researcher at the same university and at the University of California in San Diego. In 1999 he became an Assistant Professor in Vienna and in 2002 he joined the University of Würzburg, Germany as Professor. In mid-2008 he will move to the University of Jena, Germany. His research interests are the generation and application of ultrashort light pulses from the visible to the x-ray spectral range.

CLEO

10:30 a.m.–12:15 p.m.
CTuP • Quantum Cascade Lasers II
Claire Gmachl; Princeton Univ., USA, Presider

CTuP1 • 10:30 a.m.
Laser Action at High k-Space Values in Anti-Correlated Multi-Wavelength Quantum Cascade Lasers, *Stefan Menzel[1,2], Kale J. Franz[2], Daniel Wasserman[2], Anthony J. Hoffman[2], John W. Cockburn[1], Claire F. Gmachl[2]; [1]Univ. of Sheffield, UK, [2]Princeton Univ., USA.* A two-wavelength Quantum Cascade laser is reported in which one wavelength lases between subband states high in the k-space. Laser action at the two wavelengths is strongly anti-correlated in output power and threshold behaviour.

CTuP2 • 10:45 a.m.
Coherent Coupling of Multiple Transverse Modes in a Quantum Cascade Laser, *Nanfang Yu[1], Laurent Diehl[1], Ertugrul Cubukcu[1], David Bour[2], Scott Corzine[2], Jintian Zhu[2], Gloria Höfler[2], Aleksander Wojcik[3], Kenneth B. Crozier[1], Alexey Belyanin[3], Federico Capasso[1]; [1]Harvard Univ., USA, [2]Agilent Labs, USA, [3]Texas A&M Univ., USA.* We investigate phase coherence of multi-transverse modes in quantum cascade lasers through both near- and far-field mode measurements. We explain the observed phase locking by four-wave mixing of longitudinal modes belonging to different transverse modes.

CTuP3 • 11:00 a.m.
Time-Domain Measurements of Group-Velocity Dispersion in Quantum Cascade Lasers, *Hyunyong Choi[1], Theodore B. Norris[1], Laurent Diehl[2], Federico Capasso[2], David Bour[3], Scott Corzine[3], Jintian Zhu[3], Gloria Höfler[3]; [1]Univ. of Michigan, USA, [2]Harvard Univ., USA, [3]Agilent Labs, USA.* Time-resolved mid-infrared upconversion based on sum-frequency generation was applied to measure the group-velocity dispersion in quantum cascade lasers; material, waveguide, and gain contributions were distinguished, and used to model the temporal pulse broadening.

CTuP4 • 11:15 a.m.
Correlation between the Subband Electronic Temperatures and the Internal Quantum Efficiency of THz Quantum Cascade Lasers, *Miriam S. Vitiello[1], Gaetano Scamarcio[1], Giacomo Scalari[2], Christoph Walther[2], Jerome Faist[2], Harvey Beere[3], David Ritchie[3], Vincenzo Spagnolo[4]; [1]INFM Regional Lab LIT3, Univ. of Bari, Italy, [2]Zurich Physics Dept. Inst. of Quantum Electronics, Switzerland, [3]Cavendish Lab, Univ. of Cambridge, UK, [4]Politecnico of Bari, Italy.* We have measured the electronic temperature of the upper laser level (T_E^u) during continuous-wave operation in THz quantum-cascade lasers and found an experimental correlation with the occurrence of stimulated emission and the internal quantum efficiency.

10:30 a.m.–12:15 p.m.
CTuQ • Single Frequency and High-Power Green Lasers
Martin Ostermeyer; Univ. of Potsdam, Germany, Presider

CTuQ1 • 10:30 a.m.
Pound-Drever-Hall Frequency Stabilization of Q-Switched Solid State Laser Oscillators in the Sub-MHz Range, *Alexander Sträßer, Martin Ostermeyer; Inst. of Physics, Univ. of Potsdam, Germany.* Frequency stabilization of Q-switched laser oscillators following a Pound-Drever-Hall (PDH) method is demonstrated for a dual rod Nd:YAG oscillator. It emits pulses of 21mJ pulse energy at 400Hz repetition rate with stability better 1MHz.

CTuQ2 • 10:45 a.m.
Extending the Tunability and Spectral Narrowing of Ti:Sapphire Oscillator via Volume Bragg Grating Based Feedback, *Michael Hemmer, Yann Joly, Vadim Smirnov, Leonid Glebov, Michael Bass, Martin Richardson; CREOL, College of Optics and Photonics, USA.* A Ti:Sapphire oscillator tunable over 138 nm and maintaining a spectral linewidth less than 15 pm with no spectral jitter is presented. Outputs in the 200 mW regime with an excellent beam quality were achieved.

CTuQ3 • 11:00 a.m.
Mode Discrimination in Injection Locked High-Power Single-Frequency Lasers, *Lutz Winkelmann, Oliver Puncken, Bastian Schulz, Sascha Wagner, Christian Veltkamp, Ralf Wilhelm, Peter Wessels, Maik Frede, Dietmar Kracht; Laser Zentrum Hannover e.V., Germany.* We present an injection locked single-frequency laser with asymmetric resonator for transversal mode control. To characterize the laser at the operation point the TEM_{00} mode content was measured in respect to the pump power.

CTuQ4 • 11:15 a.m.
Inherently Directional Lasing from a Thermal-Induced-Deformation High-Q Microcavity, *Yun-Feng Xiao[1,2], Chun-Hua Dong[1], Chang-Ling Zou[1], Zheng-Fu Han[1], Lan Yang[2], Guang-Can Guo[1]; [1]Univ. of Science and Technology of China, China, [2]Washington Univ. in St. Louis, USA.* We experimentally report a novel asymmetrical spherical microcavity with thermal-induced deformation, in which whispering gallery modes possess not only ultra-high quality factors (Q) but also remarkably directional escape emission from the microsphere boundary.

10:30 a.m.–12:15 p.m.
CTuR • Optical Modulators and Switches
David C. Hutchings; Univ. of Glasgow, UK, Presider

CTuR1 • 10:30 a.m.
Material Properties in Si-Ge/Ge Quantum Wells for Silicon-Integrated Electro-Absorption Devices, *Rebecca K. Schaevitz[1], Jonathan E. Roth[1], Shen Ren[1], Onur Fidaner[2], David A. B. Miller[1]; [1]Stanford Univ., USA, [2]Photonic Corp., USA.* The quantum-confined Stark effect demonstrated in Si-Ge/Ge quantum wells promises integration of optics with silicon ICs. Using photocurrent, tunneling resonance and nonparabolicity, we propose more accurate values of key parameters for device design.

CTuR2 • 10:45 a.m.
Efficient Phase and Intensity Modulation in Substrate Removed GaAs/AlGaAs Nanowires, *JaeHyuk Shin, Yu-Chia Chang, Nadir Dagli; Univ. of California at Santa Barbara, USA.* Substrate-removed GaAs/AlGaAs nanowire phase modulators with 0.51V pi phase shift efficiency were fabricated. Quasi push-pull driven Mach-Zehnder intensity modulators made out of these phase modulators have record low 0.3V drive voltage for 7mm long electrode.

CTuR3 • 11:00 a.m.
Optical Beam Shaping by Spatial Light Phase Modulator with Bidirectional Tilt-Piston Micromirror Array, *Shinji Yamashita[1], Makoto Mita[2], Hiroyuki Fujita[3], Tsuyoshi Yamamoto[1], Masaaki Kawai[1], Mitsuhiro Yano[4]; [1]Fujitsu Labs Ltd., Japan, [2]Japan Aerospace Exploration Agency, Japan, [3]Univ. of Tokyo, Japan, [4]Adamant Kogyo Co. Ltd., Japan.* We have succeeded in controlling the optical beam profile by MEMS spatial light phase modulator experimentally. The modulator proposed by our group has 1-D array of bidirectional tilt-piston micromirrors driven by electrostatic force.

CTuR4 • 11:15 a.m.
Optofluidic 1x4 Switch, *Steve Zamek, Kyle Campbell, Lin Pang, Alex Groisman, Yeshaiahu Fainman; Univ. of California at San Diego, USA.* Optofluidic 1x4 switch made of a blazed grating in silicon elastomer integrated with microfluidic channel was designed, fabricated and tested. Experiments show 1.7dB insertion loss, extinction ratio of 9.8dB, and response time of 60ms.

10:30 a.m.–12:15 p.m.
CTuS • Waveguide Devices
William S. Brocklesby; Univ. of Southampton, UK, Presider

CTuS1 • 10:30 a.m.
Mono-Crystalline Rare Earth Doped $(Gd,Lu)_2O_3$ Waveguiding Films Produced by Pulsed Laser Deposition and Structured by Reactive Ion Etching, *Andreas Kahn[1], Teoman Gün[1], Bilge Ileri[1], Henning Kühn[1], Klaus Petermann[1], Günter Huber[1], Jonathan Bradley[2], Feridun Ay[2], Kerstin Wörhoff[2], Markus Pollnau[2], Yun Luo[3], Patrik Hoffmann[3]; [1]Inst. of Laser-Physics, Univ. of Hamburg, Germany, [2]Integrated Optical MicroSystems Group, MESA+ Inst. of Nanotechnology, Univ. of Twente, Netherlands, [3]Advanced Photonics Lab, Ecole Polytechnique Fédérale de Lausanne, Switzerland.* Epitaxially grown Nd(0.5%):$(Gd,Lu)_2O_3$ and Er(0.6%):$(Gd,Lu)_2O_3$ waveguides deposited on Y_2O_3 by Pulsed Laser Deposition, providing peak emission cross sections comparable with those of Lu_2O_3 bulk crystals, have been fabricated and structured. Rib waveguiding has been shown.

CTuS2 • 10:45 a.m.
Direct Electron-Beam Structuring of Optical Waveguides in Organic Electro-Optic Crystals, *Lukas Mutter, Manuel Koechlin, Mojca Jazbinsek, Peter Gunter; ETH Zurich, Switzerland.* We report on a new, flexible, single-step technique to directly pattern electro-optically active channel waveguiding structures in the highly nonlinear optical organic crystal DAST using e-beam irradiation.

CTuS3 • 11:00 a.m.
Channel Waveguide Formed by "One Shot" Implantation of He^+ Ions, *Har'el Ilan, Alexander Gumennik, Galina Perepelitsa, Abraham Israel, Aharon J. Agranat; Hebrew Univ. of Jerusalem, Israel.* Channel waveguide was fabricated in a KLTN crystal. The waveguide was produced by a selective implantation of He^+ ions into the crystal through a gold stopping mask, which created a trough shaped cladding.

CTuS4 • 11:15 a.m.
Poor Man's Channel Waveguide Laser: $KY(WO_4)_2$:Yb, *Dimitri Geskus, Jonathan D. B. Bradley, Shanmugam Aravazhi, Kerstin Wörhoff, Markus Pollnau; Univ. of Twente, Netherlands.* Using low-cost fabrication methods, liquid phase epitaxy and strip-loading a short fiber piece with a fluid, channel waveguide lasing is demonstrated in $KY(WO_4)_2:Yb^{3+}$. Threshold is 82 mW, slope efficiency 30%, and output power 14 mW.

Marriott San Jose Salon 5 and 6

CLEO

10:30 a.m.–12:15 p.m.
CTuT • Nonlinear Effects in Nanophotonic Structures
Jesper Mørk; Danmarks Tekniske Univ., Denmark, Presider

CTuT1 • 10:30 a.m. Invited

Tunable Superluminal Pulse Propagation on a Silicon Chip, *Sasikanth Manipatruni, Po Dong, Qianfan Xu, Michal Lipson; Cornell Univ., USA.* We demonstrate superluminal pulse propagation on a silicon chip using an all-optical analog to electromagnetically induced absorption created by the coherent interaction between two micro-resonators. We show group indices tunable between –1158 and –312.

CTuT2 • 11:00 a.m.

Wavelength Conversion in a Silicon Mode-Split Micro-Ring Resonator with 1G Data Rate, *Ziyang Zhang[1], Qiang Li[2], Fangfei Liu[2], Tong Ye[2], Yikai Su[2], Min Qiu[1]; [1]Royal Inst. of Technology, Sweden, [2]Shanghai Jiaotong Univ., China.* We experimentally demonstrate the wavelength conversion based on the free carrier dispersion effect in a silicon micro-ring resonator up to 1 Gbps, where the pump and signal wavelengths are set by the split resonances.

CTuT3 • 11:15 a.m.

Ultrafast Self-Pulsation in a Silicon Microdisk, *Qiang Lin, Thomas J. Johnson, Chris P. Michael, Oskar J. Painter; Dept. of Applied Physics, Caltech, USA.* We demonstrate a novel scheme for the self-generation of ultrashot pulses inside a silicon microdisk. We report the generation of pulses as short as 96 ps, close to the cavity photon lifetime.

PhAST Room 1

PhAST

10:30 a.m.–12:30 p.m.
PTuA • Lasers and LED Displays I
Mark Gitin; Coherent, Inc., USA, Presider

PTuA1 • 10:30 a.m. Invited

Prospects and Challenges for Lasers in Display Applications, *Chris Chinnock; Insight Media, USA.* No abstract available.

PTuA2 • 11:00 a.m. Invited

The Missing Color—Recent Developments in Low-Power Green Lasers for Mobile Projection, *Ulrich Steegmueller; OSRAM Opto Semiconductors, Germany.* No abstract available.

PhAST Room 2

10:30 a.m.–12:30 p.m.
PTuB • High-Power Semiconductor Lasers I
Steve Patterson; nLIGHT Photonics, USA, Presider

PTuB1 • 10:30 a.m. Invited

Product and Technology Trends: Brighter, Better, Smaller, *Jim Harrison; Spectra-Physics, USA.* Power diode-laser sources continue to evolve through co-engineering of epitaxial design, beam conditioning and thermal management. We review examples of improvements made to key attributes including reliable power, brightness, power per unit volume and value.

PTuB2 • 11:00 a.m. Invited

Reliability and Statistical Lifetime Data of High-Power Diode Lasers, *Detlev Wolff, Petra Hennig, Jens Meusel; JENOPTIK Laserdiode GmbH, Germany.* No abstract available.

PhAST Room 3

10:30 a.m.–12:30 p.m.
PTuC • Organic LED Technology for Lighting
Ghassan Jabbour; Arizona State Univ., USA, Presider

PTuC1 • 10:30 a.m. Invited

OLED Value Chain: Industry Perspective, *Jeff Popielarczyk; GE Global Res., USA.*

PTuC2 •10:50 a.m. Invited

Technological Progress and Challenges for OLED Lighting, *Yuan-Sheng Tyan; Kodak, USA.*

PTuC3 • 11:10 a.m. Invited

Title to Be Announced, *Speaker to Be Announced.*

Ballroom A1 and A8 | Ballroom A2 and A7 | Ballroom A3 and A6 | Ballroom A4 and A5

QELS | **CLEO**

QTuD • Nanoplasmonics II—Continued

QTuD5 • 11:30 a.m.
"Nearly Zero" Modal Volume Cavities Using Localized Plasmons with Some Retardation Effects, *Eyal Feigenbaum, Meir Orenstein; Technion, Israel.* The Q-factor of a localized plasmon cavity is enhanced significantly when allowing the plasmon to very slightly propagate as an SPP. The resulting mixed plasmon-plasmon polariton resonators retain sub-100nm volume with enhanced Q-factors.

QTuD6 • 11:45 a.m.
Quasi-Coplanar Plasmonic Waveguide for Ultracompact Photonic Integrated Circuits, *Jiwon Lee, Jaeyoun Kim; Iowa State Univ., USA.* We demonstrate a novel metal-dielectric structure called quasi-coplanar waveguide for subwavelength scale confinement and guiding of surface plasmon-polaritons. 2-D/3-D simulations show that various nanoscale photonic integrated circuit elements can be implemented with the structure.

QTuD7 • 12:00 p.m.
Surface Plasmon Image Dipole Effect, *K. G. Lee, K. J. Ahn, H. W. Kihm, J. S. Ahn, D. S. Kim; Seoul Natl. Univ., Republic of Korea.* Polarization resolved detection of the scattered light by a gold nano-particle functionalized tip, off a propagating surface plasmon polariton wave enables quantitative studies of the image dipole orientation effects on flat metal surface.

QTuE • Single-Photon Sources—Continued

QTuE5 • 11:30 a.m.
Time-Bin Entanglement with Single Photons from a Quantum Dot, *Anthony J. Bennett[1], David G. Gevaux[1], Zhiliang L. Yuan[1], Paola Atkinson[2], David A. Ritchie[2], Andrew J. Shields[1]; [1]Toshiba Res. Europe Ltd., UK, [2]Cavendish Lab, Cambridge Univ., UK.* We report a Franson-type experiment where two single photons from an InGaAs/GaAs quantum dot in a pillar micro-cavity reach two different, spatially separated 2-by-2 couplers at the same time and interfere with high visibility.

QTuE6 • 11:45 a.m.
Realization of Two Independent Fourier-Limited Solid-State Single-Photon Sources, *Robert Lettow[1], Ville Ahtee[2], Robert Pfab[1], Alois Renn[1], Erkki Ikonen[2], Stephan Götzinger[1], Vahid Sandoghdar[1]; [1]Lab of Physical Chemistry and optETH, ETH Zürich, Switzerland, [2]Metrology Res. Inst., Finland.* We combined high resolution laser spectroscopy and microscopy to identify individual molecules in independent microscopes. Then the Stark effect was exploited to tune the transition frequencies of the molecules and thus obtain indistinguishable single photons.

QTuE7 • 12:00 p.m.
Hong-Ou-Mandel Interference with a LED, *Anthony J. Bennett[1], Raj B. Patel[1,2], Paola Atkinson[2], Christine A. Nicoll[2], Ken Cooper[2], David A. Ritchie[2], Andrew J. Shields[3]; [1]Toshiba Res. Europe Ltd., UK, [2]Cavendish Lab, Cambridge Univ., UK, [3]Toshiba Res. Europe Ltd., UK.* We describe the first electrically-driven single-photon source which can demonstrate Hong-Ou-Mandel type interference. Experiments were performed under both pulsed and CW excitation, and we discuss the factors limiting visibility in both cases.

CTuK • Ultrafast Photonics II—Continued

CTuK4 • 11:30 a.m.
Sagnac-Interferometer Multipass-Loop Amplifier, *Stefan Roither, Aart Verhoef, Oliver D. Mücke, Georg Reider, Audrius Pugzlys, Andrius Baltuska; Photonics Inst., Vienna Univ. of Technology, Austria.* We demonstrate an interferometrically stable pulse multiplexing-amplification-recombination scheme for direct laser amplification of picosecond pulses. Switching from single-pulse amplification to the burst mode increases extraction efficiency, gain in cw-pumped crystals and output energies.

CTuK5 • 11:45 a.m.
High Power Yb:YAG Innoslab Fs-Amplifier, *Peter H. F. Russbueldt[1], Torsten Mans[2], Dieter H. Hoffmann[1], Reinhart Poprawe[1]; [1]Fraunhofer Inst. for Laser Technology, Germany, [2]Chair of Laser Technology, RWTH Aachen, Germany.* For high throughput applications a diode-pumped Yb:YAG Innoslab fs-amplifier, scalable to several 100W, was realized. At 63.2MHz repetition rate and 77W average output power nearly transform and diffraction limited 786fs pulses are achieved so far.

CTuK6 • 12:00 p.m.
Passively Mode-Locked Yb-Doped Large-Mode-Area Microstruture Fiber Laser, *Caroline Lecaplain[1], B. Ortaç[2], Ammar Hideur[1], Gilles Martel[1], Jens Limpert[2], Andreas Tünnermann[2,3]; [1]Complexe de Recherche Interprofessionnel en Aérothermochimie, Univ. de Rouen, France, [2]Inst. of Applied Physics, Friedrich Schiller Univ., Germany, [3]Fraunhofer Inst. for Applied Optics and Precision Engineering, Germany.* We report on passively mode-locked all-normal dispersion fiber lasers based on ytterbium-doped microstructure fibers and using semiconductor saturable absorbers. Average powers as high as 3.3 W and pulse durations shorter than 500 fs are generated.

CTuL • Raman Lasers and Amplifiers—Continued

CTuL5 • 11:30 a.m.
Narrow Spectral Line, Efficient 1172nm Raman Fiber Laser, *Dmitri V. Kuksenkov[1], Ellen M. Kosik Williams[1], Anthony S. Bauco[1], Richard A. Hoyt[1], Shenping Li[1], Ji Wang[1], Jeffery A. DeMeritt[1], Anping Liu[1], Keith A. Hoover[1], Joseph E. McCarthy[1], William A. Wood[1], Sergey A. Lobanov[1], Douglas S. Goodman[1], Jaymin Amin[1], Andrey E. Korolev[2], Vladimir N. Nazarov[2]; [1]Corning Inc., USA, [2]Inst. of Information Technology, Mechanics and Optics, Russian Federation.* We report on the design and performance of an injection-seeded single-pass cascaded fiber Raman laser producing 10.5W average output power at 1172nm. The linewidth is < 0.1nm and optical to optical conversion efficiency is 35%.

CTuL6 • 11:45 a.m.
Characterization of a Passively Mode-Locked Raman Fiber Laser, *Jochen Schroeder[1], Stephane Coen[1], Thibaut Sylvestre[2], Dario Alasia[2]; [1]Physics Dept., Univ. of Auckland, New Zealand, [2]Inst. Franche-Comté Electronique Mécanique Thermique et Optique–Sciences et Technologies, Ctr. Natl. de la Recherche Scientifique, Univ. de Franche-Comté, France.* We investigate the noise characteristics of an ultra-high repetition rate Raman fiber laser mode-locked by dissipative four-wave mixing and demonstrate a significant reduction of the number of supermodes by incorporating a subcavity into the laser.

CTuL7 • 12:00 p.m.
Tapered Microstructure Fibers for Fiber Optical Parametric Oscillators, *Jeremy R. Sanborn, Jacek Jasinski; Univ. of California at Merced, USA.* We present a systematic study of microstructure fibers reduced in size in order to tailor the group-velocity dispersion (GVD). The analysis includes taper recipes, GVD measurements, SEM images, and subsequent fiber optical parametric oscillator performance.

12:30 p.m.–1:30 p.m., *PhAST* Networking and Power Lunch, *Exhibit Hall 3*

12:15 p.m.–1:00 p.m., Lunch Break *(concessions available in Exhibit Hall)*

NOTES

Room C1 and C2	Room C3 and C4	Room B1 and B2	Room J2
QELS	CLEO		

QTuF • Spectroscopy/Filamentation—Continued

QTuF5 • 11:30 a.m.
Excited State Absorption and Femtosecond Lifetime Dynamics in a New Series of Near IR Dyes, *Scott Webster[1], Lazaro A. Padilha[1], Honghua Hu[1], Olga V. Przhonska[1,2], David J. Hagan[1], Eric W. Van Stryland[1], Mikhail V. Bondar[2], Iryna G. Davydenko[3], Yuriy L. Slominsky[3], Alexei D. Kachkovski[3]; [1]CREOL, The College of Optics and Photonics, Univ. of Central Florida, USA, [2]Inst. of Physics, Natl. Acad. of Sciences, Ukraine, [3]Inst. of Organic Chemistry, Natl. Acad. of Sciences, Ukraine.* Large excited-state-absorption (ESA) spectra and lifetime dynamics for a new series of NIR cyanine-like dyes are compared to similar visible dyes. Strongly red-shifted (200-300 nm) and increased ESA are observed and explained through quantum-chemical calculations.

QTuF6 • 11:45 a.m.
Energy Transfer between Four-Wave and Six-Wave Mixing Processes in Rubidium Atoms via Atomic Coherence, *Yanpeng Zhang, Blake Anderson, Min Xiao; Univ. of Arkansas, USA.* Efficient four-wave mixing (FWM) and six-wave mixing (SWM) processes are generated simultaneously in a four-level, inverted-Y atomic system via dual-EIT windows. Energy exchange during propagation between the FWM and SWM processes was experimentally observed.

QTuF7 • 12:00 p.m.
Optical Microchip Detection of Nuclear Magnetic Resonance, *Micah P. Ledbetter[1], Igor M. Savukov[1], Dmitry Budker[1], Vishal Shah[2], Svenja Knappe[2], John Kitching[2], Shoujun Xu[3], David Michalak[3], Alexander Pines[3]; [1]Dept. of Physics, Univ. of California at Berkeley, USA, [2]Time and Frequency Div., NIST, USA, [3]Dept. of Chemistry, Univ. of California at Berkeley, USA.* We demonstrate optical detection of nuclear magnetic resonance on a microchip. A theoretical optimization indicates detection limits that are competitive with that demonstrated by microcoils in high magnetic fields, without requiring superconducting magnets.

CTuM • Novel Optical Combs and Clocks—Continued

CTuM4 • 11:30 a.m. Invited
Full Stabilization of a Frequency Comb Generated in a Monolithic Microcavity, *Pascal Del'Haye, Olivier Arcizet, Albert Schliesser, Tobias Wilken, Ronald Holzwarth, Tobias J. Kippenberg; Max-Planck-Inst. for Quantum Optics, Germany.* We demonstrate independent control and full stabilization of the offset frequency and mode spacing of a frequency comb generated in a monolithic microcavity. The comb lines relative deviation from equidistance is less than 7.3×10^{-18}.

CTuM5 • 12:00 p.m.
Generation of Broad Raman Sidebands with Zero Carrier Envelope Offset by Locking Two Pump-Laser Frequencies to a Single Optical Cavity, *Takayuki Suzuki[1,2], Masataka Hirai[1], Masayuki Katsuragawa[1,2]; [1]Univ. of Electro-Communications, Japan, [2]Precursory Res. for Embryonic Science and Technology, Japan Science and Technology Agency, Japan.* We generate broad Raman sidebands with controlled carrier-envelope-offset (CEO) by locking the pump frequencies to a cavity. The CEOs controlled to integer multiples of the cavity FSR are observed both in spectral and temporal domains.

CTuN • Terahertz Spectroscopy—Continued

CTuN5 • 11:30 a.m.
Terahertz Vibrational Modes in Non-Polar Non-Hydrogen-Bonding Crystalline Solids, *Jonathan P. Laib, Aaron T. Hallquist, Alex M. Mrozack, Daniel M. Mittleman; Rice Univ., USA.* We observe terahertz vibrational modes in crystals of n-octadecane, a non-hydrogen-bonding, non-polar molecule. These modes are not present in amorphous samples.

CTuN6 • 11:45 a.m.
Conductivity of Thin Metal Films at THz Frequencies, *Norman Laman, Daniel R. Grischkowsky; Oklahoma State Univ., USA.* The conductivity of thin metal films was measured via their transmission at THz frequencies. The conductivity of all the films, particularly the thinner films and Al films, were much smaller than the bulk DC value.

CTuN7 • 12:00 p.m.
Resonant-Enhanced Dipolar Interaction between THz-Photons and Confined Acoustic Phonons in Nanocrystals, *Tzu-Ming Liu[1], Ja-Yu Lu[1], Hung-Ping Chen[1], Chung-Chiu Kuo[1], Chih-Wei Lai[1], Meng-Ju Yang[1], Pi-Tai Chou[1], Yu-Tai Li[2], Ci-Ling Pan[2], Ming-Hao Chang[3], Hsiang-Lin Liu[3], Chi-Kuang Sun[1]; [1]Natl. Taiwan Univ., Taiwan, [2]Natl. Chiao Tung Univ., Taiwan, [3]Natl. Taiwan Normal Univ., Taiwan.* We proved the existence of resonant-enhanced dipolar interaction between THz-photons and confined acoustic phonons in nanocrystals. By a specific core-shell charge separation, the dipolar (l=1) confined acoustic modes was activated to absorb THz waves.

CTuO • Nonlinear Optics of High-Generation Harmonics—Continued

CTuO3 • 11:45 a.m. Invited
Double Optical Gating of High Harmonic Generation, *Hiroki Mashiko, Steve Gilbertson, Chengquan Li, Sabih Khan, Mahendra Shakya, Eric Moon, Zenghu Chang; Kansas State Univ., USA.* We propose a novel optical switch to control the high-order harmonic generation process so that single attosecond pulses can be generated with ~10 fs input pulses. The technique combines polarization gating and two-color gating.

12:30 p.m.–1:30 p.m., *PhAST* Networking and Power Lunch, *Exhibit Hall 3*

12:15 p.m.–1:00 p.m., Lunch Break *(concessions available in Exhibit Hall)*

NOTES

Room J3	Marriott San Jose Salon 1 and 2	Marriott San Jose Salon 3	Marriott San Jose Salon 4

CLEO

CTuP • Quantum Cascade Lasers II—Continued

CTuP5 • 11:30 a.m.
Measurement of Gain and Subband Non-Parabolicity in a λ~10μm Quantum Cascade Laser from Single-Pass Transmission Measurements, *Afusat O. Dirisu[1,2], Dmitry Revin[2], Zhijun Liu[1], Ken Kennedy[2], John Cockburn[2], Claire Gmachl[1]; [1]Princeton Univ., USA, [2]Univ. of Sheffield, UK.* Sensitive single-pass transmission measurements for probing the electron distribution of Quantum Cascade lasers under an applied bias are used to extract the intersubband nonparabolicity and single-pass gain of a λ~10μm Quantum Cascade laser.

CTuP6 • 11:45 a.m.
Reversible Switching of QCL-Modes Using a pH-Responsive Polymeric Cladding, *Bernhard Basnar[1], Stephan Schartner[1], Maximilian Austerer[1], Aaron M. Andrews[1], Thomas Roch[2], Werner Schrenk[1], Gottfried Strasser[1,3]; [1]Ctr. for Micro- and Nanostructures, Vienna Univ. of Technology, Austria, [2]Comenius Univ., Slovakia, [3]SUNY Buffalo, USA.* We present a novel method for the reversible switching between different emission wavelengths for a grating-free mid-IR QCL utilizing the absorbance changes of a pH-responsive cladding under ambient conditions.

CTuP7 • 12:00 p.m.
Femtosecond Resonant Pulse Propagation in Quantum Cascade Lasers: Evidence of Coherent Effects, *Hyunyong Choi[1], Vasileios-Marios Gkortsas[2], Franz X. Kärtner[2], Laurent Diehl[3], Christine Y. Wang[3], Federico Capasso[3], David Bour[4], Scott Corzine[4], Jintian Zhu[4], Gloria Höfler[4], Theodore B. Norris[1]; [1]Univ. of Michigan, USA, [2]MIT, USA, [3]Harvard Univ., USA, [4]Agilent Labs, USA.* Ultrafast upconversion is employed to investigate pulse propagation in quantum cascade lasers. We have observed advances of the pulse peak to early times, pulse re-shaping, and evidence of a coherent contribution to pulse propagation.

CTuQ • Single Frequency and High-Power Green Lasers—Continued

CTuQ5 • 11:30 a.m.
10W Green Output by Second Harmonic Generation of a Hybrid Bulk-Fiber MOPA System, *Ryusuke Horiuchi[1], Koichi Saiki[1], Koji Adachi[1], Kazuyoku Tei[1], Shigeru Yamaguchi[1], Makoto Yoshida[2], Kenichi Tanaka[2]; [1]Tokai Univ., Japan, [2]Seikoh Giken Co., Ltd., Japan.* We report on a pulsed bulk-fiber source producing a peak power of 100 kW at 100 kHz and an average power of 20 W. An SHG efficiency of 51% was obtained by a LBO crystal.

CTuQ6 • 11:45 a.m.
200 kHz, 73 W Highly Stable Yb:YAG Thin Disk Green Laser, *Yoshihiko Fujihira, Tomohiro Imahoko, Tetsumi Sumiyoshi, Hitoshi Sekita; Cyber-Laser Inc., Japan.* As a pump laser of a Ti:sapphire femtosecond laser, we developed high power, high repetition rate and highly stable Yb:YAG thin disk green laser. We achieved 200 kHz, 73 W operation.

CTuQ7 • 12:00 p.m.
Novel Model on Thermal Conductivity in Laser Media: Dependence on Rare-Earth Concentration, *Yoichi Sato, Jun Akiyama, Takunori Taira; Laser Res. Ctr. for Molecular Science, Inst. for Molecular Science, Japan.* Authors have proposed a novel model on thermal conductivity in various laser media. The rare-earth doping effects were also discussed by comparing the measured value in Nd^{3+} and Yb^{3+}-doped $Y_3Al_5O_{12}$, YVO_4, and $GdVO_4$.

CTuR • Optical Modulators and Switches—Continued

CTuR5 • 11:30 a.m.
Nanoelectromechanical Proximity Perturbation Switching for Transparent Wavelength Switching of Resonant Filters, *Rohit Chatterjee, Chee Wei Wong; Columbia Univ., USA.* We report an experimental demonstration of nanoelectromechanical proximity perturbation switching for transparent wavelength switching of resonator filters. Proximity perturbation enables ~5 dB switching action with ~8 μs switching speeds from bar to cross state.

CTuR6 • 11:45 a.m.
All-Optical Response of Semiconductor Ring Laser Bistable to Duo Optical Injections, *Bei Li[1], Muhammad Irfan Memon[1], Guohui Yuan[1], Zhuoran Wang[1], Siyuan Yu[1], Gabor Mezosi[2], Marc Sorel[2]; [1]Univ. of Bristol, UK, [2]Univ. of Glasgow, UK.* The all-optical response of a semiconductor ring laser to two optical injections demonstrates very digital hysteresis with externally controllable switching threshold, enabling the device to be used for all-optical pulse regeneration.

CTuR7 • 12:00 p.m.
Electro-Optic Polymer Waveguide Modulators with Refractive Index Tapers Leading to Low Coupling Loss and a High Confinement Factor, *Christopher T. DeRose[1], David Mathine[1], Yasufumi Enami[1], Robert A. Norwood[1], Jingdong Luo[2], Alex K. Y. Jen[2], Nasser Peyghambarian[1]; [1]Univ. of Arizona, USA, [2]Univ. of Washington, USA.* A new design of a hybrid electro-optic polymer waveguide modulator is demonstrated that uses grayscale lithography to create refractive index tapers by photobleaching.

CTuS • Waveguide Devices—Continued

CTuS5 • 11:30 a.m. Invited
Electro-Optical Microring Resonators in Epitaxial Crystalline Organic and Ion Sliced Inorganic Materials, *Peter Günter, Andrea Guarino, Gorazd Poberaj, Harry Figi, Daniele Rezzonico, Manuel Koechlin, Mojca Jazbinsek; Inst. of Quantum Electronics, Eidgenössische Technische Zurich, Switzerland.* Electro-optically tunable microring resonators and waveguides were fabricated in submicrometer thin ion-sliced $LiNbO_3$ films and epitaxially grown organic single crystalline materials. The organic crystalline waveguides show large electro-optical effects and superior photo and thermal stability.

CTuS6 • 12:00 p.m.
Large Kerr Nonlinearity in Ultra Low Loss High-Index Glass Waveguides, *David Duchesne[1], Marcello Ferrera[1], Luca Razzari[1], Roberto Morandotti[1], Brent Little[2], David J. Moss[3]; [1]INRS-EMT, Canada, [2]Infinera Ltd., USA, [3]CUDOS, School of Physics, Univ. of Sydney, Australia.* Using self-phase modulation measurements, we show that high-index glass waveguides are a promising nonlinear platform given their ultra-low loss and high nonlinear Kerr response, determined to be 125 times larger than that of optical fibers.

12:30 p.m.–1:30 p.m., *PhAST* Networking and Power Lunch, *Exhibit Hall 3*

12:15 p.m.–1:00 p.m., Lunch Break *(concessions available in Exhibit Hall)*

NOTES

Marriott San Jose Salon 5 and 6	*PhAST* Room 1	*PhAST* Room 2	*PhAST* Room 3
CLEO	***PhAST***		

CTuT • Nonlinear Effects in Nanophotonic Structures—Continued

CTuT4 • 11:30 a.m.
Acceleration of the Refractive Index Response in Nonlinear Photonic Crystal/Quantum Dot Waveguides via the Purcell Effect, *Ferran Salleras[1], Nobuhiko Ozaki[2], Yoshinori Kitagawa[2], Yoshiaki Takata[2], Kiyoshi Asakawa[2], Naoki Ikeda[3], Yoshimasa Sugimoto[3,2], Masanori Honma[1], Yoshiyasu Ueno[1]; [1]Univ. of Electro-Communications, Japan, [2]Ctr. for Tsukuba Advanced Res. Alliance, Univ. of Tsukuba, Japan, [3]Natl. Inst. for Materials Science, Japan.* A sixfold acceleration of the phase shift recovery time in photonic crystal/quantum dot waveguides having a Purcell enhanced spontaneous emission peak resonant to the excited state of the quantum dots is experimentally demonstrated.

CTuT5 • 11:45 a.m.
Nonlinear Optics in Silicon Nitride Waveguide Device on Silicon Chip, *Kazuhiro Ikeda, Robert Saperstein, Nikola Alic, Yeshaiahu Fainman; Univ. of California at San Diego, USA.* Silicon nitride/silicon dioxide waveguide using plasma-enhanced chemical vapor deposition is reported, which has the loss of ~4dB/cm. A ring resonator using the waveguide gives the Q of 12,900 and its nonlinear response is studied.

CTuT6 • 12:00 p.m.
Noise Figure of High-Repetition-Rate Optical Parametric Amplifiers in Silicon, *Xinzhu Sang, En-Kuang Tien, Feng Qian, Nuh S. Yuksek, Qi Song, Ozdal Boyraz; Electrical Engineering and Computer Science Dept., Univ. of California at Irvine, USA.* A numerical investigation on noise figure (NF) inside the silicon waveguides pumped with high-repetition-rate pulses is carried out. The parameters of pump pulses are important to generate net gain and <7dB NF in silicon waveguides.

PTuA • Lasers and LED Displays I—Continued

PTuA3 • 11:30 a.m. Invited
RGB Laser Sources for Display Applications, *Greg Niven; Novalux, Inc., USA.* No abstract available.

PTuA4 • 12:00 p.m. Invited
GaN Micro-Pixel LED Arrays: Novel Solid-State Micro-Projectors and Micro-Displays, *Martin Dawson; Univ. of Strathclyde, UK.* No abstract available.

PTuB • High-Power Semiconductor Lasers I—Continued

PTuB3 • 11:30 a.m. Invited
Recent High-Power Diode Laser Development at Coherent Semiconductor Division, *Tom Hasenberg; Coherent Semiconductor Div., USA.* We report on recent developments of high-power GaAs-based laser diodes at Coherent. The results will include CW as well as quasi-CW lasers operating at numerous wavelengths including 808nm, 880nm and in the 9XX nm range.

PTuB4 • 12:00 p.m. Invited
Laser Diode Arrays for Printing, Coding and Marking, *Stewart McDougall; Intense Ltd., UK.* High power individually addressable arrays of single mode lasers have important applications in next generation digital printing systems. Arrays consisting of over 300 elements are combined with drive electronics and optics delivering excellent system performance.

PTuC • Organic LED Technology for Lighting—Continued

PTuC4 • 11:30 a.m. Invited
Organic Semiconductor Interfaces and Devices, *Andrew Evans; Aberystwyth Univ., UK.*

PTuC5 • 11:50 a.m. Invited
Hybrid Quantum Dots for Lighting, *Andrew Wang; Ocean NanoTech, USA.*

PTuC6 • 12:10 p.m. Invited
PANEL: What Are the Key Issues for OLED Acceptance for General Purpose Illumination?

12:30 p.m.–1:30 p.m., *PhAST* Networking and Power Lunch, *Exhibit Hall 3*

12:15 p.m.–1:00 p.m., Lunch Break *(concessions available in Exhibit Hall)*

NOTES

1:00 p.m.–2:30 p.m.
JTuA • CLEO/QELS Poster Session I

JTuA1
High-Power Emission of Nd-Vanadate Thin-Disk Lasers In-Band Pumped at 0.88 µm Directly into the Emitting Level, *Nicolaie Pavel[1], Christian Kränkel[2], Rigo Peters[2], Klaus Petermann[2], Günter Huber[2]; [1]Natl. Inst. for Lasers, Plasma and Radiation Physics, Bucharest, Romania, [2]Inst. of Laser Physics, Univ. of Hamburg, Germany.* In-band pumping at 0.88-µm was used to realize Nd-vanadate thin-disk lasers with maximum output power of 14.9-W at 1.06-µm, and to generate 9.1-W power of green light at 0.53-µm. Results on deep-blue generation are discussed.

JTuA2
Phase Locking of Nanosecond Pulses of Q-Switched Microchip Lasers, *Fanting Kong[1], Liping Liu[1], Shou-Huan Zhou[2], Kotik K. Lee[3], Ying-Chih Chen[1]; [1]Dept. of Physics and Astronomy, Hunter College, CUNY, USA, [2]North China Res. Inst. of Electro-Optics, China, [3]Coherent Technologies, USA.* We demonstrate that nanosecond pulses of passively Q-switched microchip lasers can be phase locked without affecting the pulse duration by coupling to a common low-Q resonator.

JTuA3
High Power Tunable Tm^{3+}-Fiber Lasers and Its Application in Pumping Cr^{2+}:ZnSe Lasers, *Jianqiu Xu, Yulong Tang, Yong Yang, Yin Hang; Shanghai Inst. of Optics and Fine Mechanics, China.* Tuned by a variable reflective mirror, we achieve 71.2-W free-running and 30-W maximum average power in range of 1866~2107nm in Tm-doped fiber lasers. Watt-level powers are generated from single crystal and ceramic Cr^{2+}:ZnSe disk lasers.

JTuA4
Determination of Fluorescence Lifetimes of Yb^{3+} in Different Borate and Vanadate Hosts Using the Pinhole Method, *Christian Kränkel, Henning Kühn, Susanne T. Fredrich-Thornton, Christian Hirt, Rigo Peters, Klaus Petermann, Günter Huber; Inst. of Laser-Physics, Univ. of Hamburg, Germany.* The fluorescence lifetimes of the $^2F_{5/2}$ level of Yb^{3+} in $LaSc_3(BO_3)_4$, $Li_6Y(BO_3)_3$, $Ca_4YO(BO_3)_3$, $Ca_4GdO(BO_3)_3$, and YVO_4 were determined for various doping concentrations applying the pinhole method.

JTuA5
High Average Output Power, Picosecond Thin-Rod Yb:YAG Regenerative Chirped Pulse Amplifier with 200 µJ Pulse Energy, *Shinichi Matsubara, Motoharu Tanaka, Masaki Takama, Shinya Okuda, Sakae Kawato, Takao Kobayashi; Graduate School of Engineering, Univ. of Fukui, Japan.* A LD-pumped, thin-rod Yb:YAG regenerative chirped pulse amplifier was developed. An average output power of 20 W was obtained at a repetition rate of 100 kHz with an output pulse width of 2 ps.

JTuA6
High Repetition Rate, Acousto-Optic Q-Switched, Diode Pumped Tm:YLF Laser, *Jan K. Jabczynski, Jacek Kwiatkowski, Lukasz Gorajek, Waldemar Zendzian; Inst. of Optoelectronics, Military Univ. of Technology, Poland.* Compact, room-temperature, acousto-optic Q-switched, Tm:YLF laser pumped by 30-W fiber coupled diode laser delivers pulses with energies above 10 mJ, peak power above 200 kW, for 133 Hz repetition rate.

JTuA7
Efficient Solar-Pumped Laser by a Light-Guide/2-D CPC Cavity, *Rui Pereira, Dawei Liang; Univ. Nova de Lisboa, Portugal.* A simple fused silica light-guide assembly transmits 6kW concentrated solar power to a 2-D-CPC cavity. The calculated laser power of 75.8W is obtained for a 4mm diameter Nd:YAG rod, reaching the conversion efficiency of $11W/m^2$.

JTuA8
Development and Frequency-Doubling of a 756 nm 5-W Injection-Locked Ti:Sapphire Laser, *Yong-Ho Cha, Kwang-Hoon Ko, Gwon Lim, Hyun-Min Park, Taek-Soo Kim, Do-Young Jeong; Korea Atomic Energy Res. Inst., Republic of Korea.* We have developed a cw 5-W 756-nm injection-locked Ti:sapphire laser and generated 1.1-W 378-nm radiation by its frequency-doubling in an external enhancement cavity, which is useful for the selective optical pumping of Thalium isotopes.

JTuA9
Efficient Tunable Diode-Pumped Yb:YAG Ceramic Laser, *Hiroaki Yoshioka[1], Shinki Nakamura[1], Yu Matsubara[1], Takayo Ogawa[2], Satoshi Wada[2]; [1]Ibaraki Univ., Japan, [2]RIKEN, Japan.* We developed the diode-pumped 6.8-W cw Yb:YAG *ceramic* laser with the slope efficiency of 82% at 20°C and demonstrated the tunable oscillation of the laser. The tunable range was from 1021.0 to 1083.6 nm.

JTuA10
Generation of Beams with Spiral Phase Shift Using a Divided Half Waveplate in a Laser Cavity, *Hikaru Kawauchi[1], Yuichi Kozawa[1], Shunichi Sato[1], Shojiro Kawakami[2]; [1]Inst. of Multidisciplinary Res. for Advanced Materials, Tohoku Univ., Japan, [2]Photonic Lattice Inc. and Sendai Foundation of Applied Information Technology, Japan.* Beams with spiral phase shift are generated using a duodecimally divided half waveplate in a Ti:sapphire laser cavity. Either Laguerre-Gaussian or radially polarized laser beam with orbital angular momentum is obtained from the cavity.

JTuA11
High Power, Pulsed Flash-Lamp Pumped Erbium Laser Designed for Medical Applications, *Jacek Swiderski, Marek Skorczakowski, Andrzej Zajac; Inst. of Optoelectronics, Military Univ. of Technology, Poland.* A record 2,4MW peak power, actively Q-switched Er:YAG laser is presented. For 10Hz repetition rate 21mJ, 86ns pulses at the wavelength of 2940nm were achieved. The beam divergence was 2,3mrad.

JTuA12
Transient Laser Brightness Enhancement Using a Large-Stroke Bimorph Mirror, *Walter Lubeigt[1], Mike Griffith[2], Leslie Laycock[2], David Burns[1]; [1]Inst. of Photonics, Univ. of Strathclyde, UK, [2]BAE Systems Advanced Technology Ctr., UK.* A large-stroke bimorph was used to reduce the time-to-full brightness of a Nd:YLF laser by a factor of 3. The 31-element mirror has the potential to combine this transient control with steady state brightness optimisation.

JTuA13
Gas Phase Study of the Reactivity of Optical Coating Materials with Hydrocarbons Using a Compact EUV Laser, *Scott C. Heinbuch, Feng Dong, Jorge Rocca, Elliot Bernstein; Colorado State Univ., USA.* We have conducted single photon ionization mass spectroscopy studies of the chemical reactivity of $Si_m/Ti_m/Hf_m/Zr_m/Ru_mO_n$, metal oxide nanoclusters. The results are relevant to the carbon contamination of capping layers in extreme ultraviolet (EUV) reflective coatings.

JTuA14
Polarization Effect of Self-Assembled Guanosine Crystal on the Transport Properties of Metal-Semiconductor-Metal Structure, *Jianyou Li[1], Arup Neogi[1], Abhijit Sarkar[2], S. Cho[3], Hadis Morkoc[3]; [1]Univ. of North Texas, USA, [2]Michigan Molecular Inst., USA, [3]Virginia Commonwealth Univ., USA.* Guanosine molecules having strong dipole moment self-assemble forming ribbon-like structure with polarization along its axis. Single molecule current-voltage and photocurrent measurements show that polarization depends on the ribbon length and thereby effect the MSM devices.

JTuA15
Fine Twin Structure in Crystal Quartz for Quasi-Phase-Matched Deep Ultraviolet Generation, *Muneyuki Adachi[1,2], Jun Nakanishi[1,2], Sunao Kurimura[1], Ken-ichi Hayashi[2]; [1]Natl. Inst. for Materials Science, Japan, [2]Nidek Co., Ltd., Japan.* We succeeded in fabrication of the finest twins in crystal quartz with a period of 11.9µm and generation of 266 nm light with 2.2mW by 2nd-order-QPM through precise control of the temperature and pulsed stress.

JTuA16
Temperature Dependence of Blue Light-Induced Near-Infrared Absorption of Ferroelectric Crystals, *Shigehiro Nagano[1], Ryosuke Shimizu[2], Atsushi Shoji[1], Koji Suizu[3], Keiichi Edamatsu[1]; [1]Res. Inst. of Electrical Communication, Tohoku Univ., Japan, [2]Precursory Res. for Embryonic Science and Technology, Japan Science and Technology Agency, Japan, [3]Graduate School of Engineering, Nagoya Univ., Japan.* We studied blue light-induced near-infrared absorption (BLINIRA) and its temperature dependence in ferroelectric crystals, i.e., MgO-doped stoichiometric-$LiNbO_3$, congruent-$LiNbO_3$, MgO-doped stoichiometric-$LiTaO_3$, and stoichiometric-$LiTaO_3$. We found the BLINIRA decreased with the increase of temperature.

JTuA17
Fabrication of Microstructures Containing the Conjugated Polymer MEH-PPV, *Cleber R. Mendonça[1,2], Daniel S. Corrêa[1,2], Tobias Voss[2], Prakriti Tayalia[2], Eric Mazur[2]; [1]Inst. de Física de São Carlos, Univ. de São Paulo, Brazil, [2]Dept. of Physics, Harvard School of Engineering and Applied Sciences, Harvard Univ., USA.* We use two-photon polymerization to fabricate microstructures containing the conjugated polymer MEH-PPV. The microstructures preserve the characteristic emission of MEH-PPV, exhibiting waveguiding of such emission when fabricated on top of porous silica substrate.

JTuA18
Improved Band Anticrossing Using Many Impurity Anderson Model and Study of N Induced Scattering in the GaInNAs Material System, *Nikolaos Vogiatzis, Judy M. Rorison; Univ. of Bristol, UK.* Using self energy calculations we present an improved band-anti crossing model with regards to the perturbed extended and localized states, based on the many impurity Anderson model. We also derive the perturbed density of states.

JTuA19
Controlling Disclinations in Liquid Crystal Planar Bragg Gratings, *Benjamin D. Snow[1], Faisal R. M. Adikan[1], James C. Gates[1], Corin B. E. Gawith[1], Andriy Dyadyusha[2], Huw E. Major[1], Malgosia Kaczmarek[2], Peter G. R. Smith[1]; [1]Optoelectronics Res. Ctr., Univ. of Southampton, UK, [2]School of Physics and Astronomy, Univ. of Southampton, UK.* Direct-UV-written liquid crystal tunable planar Bragg Gratings exhibit complex wavelength tuning with threshold points and hysteresis. We discuss the role of disclinations in the liquid crystal and whether they may allow faster wavelength tuning.

JTuA20
Sub-10nm Nanolithography and Direct Pattern Transfer on III-V Compound Semiconductor Using Sol-Gel Derived ZrO_2, *Boyang Liu, Seng-Tiong Ho; Dept. of Electrical Engineering and Computer Science, Northwestern Univ., USA.* A new approach for direct sub-10nm pattern transfer using spin-coated ZrO_2 is presented. The sample InP compound etching selectivity to ZrO_2 is over 13:1 with highest aspect ratio of 35:1. The smallest feature is 9nm.

JTuA21
Raman Spectroscopic Study of Silicone-Based Hydrogel Polymers with Large Index Changes Induced by Femtosecond Laser Micromachining, *Li Ding[1], Luiz G. Cancado[1], Lukas Novotny[1], Wayne H. Knox[1], Richard I. Blackwell[2], Dharmendra Jani[2], Jay F. Künzler[2]; [1]Univ. of Rochester, USA, [2]Bausch & Lomb, USA.* Raman spectroscopy has been used to study the femtosecond laser micromachined regions inside silicone-based hydrogel polymers. No significant changes in the Raman spectrum are observed even when index change is as large as +0.06.

JTuA22
High-Index-Contrast AlGaAs Waveguide Scattering Loss Reduction via Oxidation Smoothing of Sidewall Roughness, *Christopher S. Seibert[1], Di Liang[1], Douglas C. Hall[1], Zane A. Shellenbarger[2]; [1]Univ. of Notre Dame, USA, [2]Sarnoff Corp., USA.* The propagation loss of single mode high index contrast AlGaAs ridge waveguides is reduced nearly three orders of magnitude (at 1 cm guide length) through application of a nonselective wet oxidation sidewall roughness smoothing technique.

JTuA23
Polymer-Based Microstructured Fiber toward Imaging Application, *Lili Wang, Jian Wang; Xi'an Inst. of Optics and Precision Mechanics, Chinese Acad. of Sciences, China.* PMMA-based MOF with 547 air holes was fabricated by extruding and stretching of an big-size preform with hole diameter of 1.5 mm and hole spacing of 1.9 mm. The high image resolution was demonstrated.

JOINT

1:00 p.m.–2:30 p.m.
JTuA • CLEO/QELS Poster Session I

JTuA24
Silver Clusters as Probes for Femtosecond Laser-Glass Interaction, *Matthieu Bellec[1], Lionel Canioni[1], Arnaud Royon[1], Bruno Bousquet[1], Thierry Cardinal[2]; [1]CPMOH, Univ. Bordeaux 1, France, [2]ICMCB, CNRS, Univ. Bordeaux 1, France.* Sub-wavelength structuration by femtosecond laser interaction in a model glass doped with silver ions is investigated. Induced silver clusters are used to probe free carriers distribution. Theoretical mechanism is discussed and compared to fluorescence imaging.

JTuA25
Ultrafast Reflectivity Dynamics in Bis (N-Butylimido) Perylene Thin Films, *Tina Shih[1], Cleber Mendonca[1,2], Maria Kandyla[1], R. F. Aroca[3], C. J. L. Constantino[4], Eric Mazur[1]; [1]Harvard Univ., USA, [2]Univ. de Sao Paulo, Brazil, [3]Univ. of Windsor, Canada, [4]UNESP, Brazil.* Using pump-probe reflectometry, we study the ultrafast excited-state dynamics in thin films of BuPTCD, an organic semiconductor, deposited on gold nanoparticles. We observe depletion of the ground state and excited state absorption after photo-excitation.

JTuA26
Photoconductivity of Ambipolar Long-Channel Carbon-Nanotube Field-Effect Transistors, *Chi-Ti Hsieh[1], D. S. Citrin[1,2], P. P. Ruden[3]; [1]School of Electrical and Computer Engineering, Georgia Tech, USA, [2]Unite Mixte Intl., Georgia Tech-CNRS, France, [3]Dept. of Electrical and Computer Engineering, Univ. of Minnesota, USA.* The photocurrents of carbon-nanotube field-effect transistors are small due to the small exciton ionization rate and large exciton nonradiative-decay rate, and the photocurrent gain is small for the long-channel devices.

JTuA27
488 nm Irradiation Induced Photodarkening Study of Yb-Doped Aluminosilicate and Phosphosilicate Fibers, *Jayanta K. Sahu, Seongwoo Yoo, Alex Boyland, Chandrajit Basu, Mridu Kalita, Andrew Webb, Collin L. Sones, Johan Nilsson, David N. Payne; Optoelectronics Res. Ctr., Univ. of Southampton, UK.* Photodarkening in highly Yb-doped aluminosilicate and phosphosilicate fibers, under 488 nm irradiation, is presented. Both irradiation-induced excess loss and post-irradiation temporal loss evaluations reveal that Yb-doped phosphosilicate fiber is highly resistant to photodarkening.

JTuA28
Advances in Single Crystal $ZnGeP_2$ Processing for High Energy Applications, *Kevin Zawilski, Peter Schunemann, Scott Setzler, Thomas Pollak; BAE Systems, USA.* Scale-up of single crystal $ZnGeP_2$ resulting in 30x30 mm^2 aperture, high-quality optical samples has been demonstrated. The combination of increased aperture and improved LIDT has resulted in material better suited to high energy applications.

JTuA29
Composition Dependence of Infrared Optical Phonon Modes in AlGaN Epilayers Grown on Sapphire Substrates, *Jun-Rong Chen, Tien-Chang Lu, Hao-Chung Kuo, Shing-Chung Wang; Dept. of Photonics, Inst. of Electro-Optical Engineering, Natl. Chiao-Tung Univ., Taiwan.* We reported the study of AlGaN films using FTIR measurements and theoretical fitting. Several absorption dips were observed when the aluminum composition is larger than 24%. These dips are induced due to strain relaxation.

JTuA30
Investigation of Optical Gain in Al_2O_3:Er Channel Waveguide Amplifiers, *Jonathan D. B. Bradley, Laura Agazzi, Dimitri Geskus, Tom Blauwendraat, Feridun Ay, Kerstin Wörhoff, Markus Pollnau; Integrated Optical MicroSystems Group, MESA+ Inst. for Nanotechnology, Univ. of Twente, Netherlands.* Reactively co-sputtered aluminum oxide layers with low background loss and varying Er concentrations have been deposited. Net optical gain of 0.76 dB/cm was obtained for an Er concentration of 0.9×10^{20} cm^{-3} in a channel waveguide.

JTuA31
Suppression of Up-Conversion Luminescence in Er^{3+}-Codoped Oxyfluoride Silicate Glass, *Jian Zhang, Shaoxiong Shen, Gin Jose, Animesh Jha; Inst. for Materials Res., Univ. of Leeds, UK.* In Yb^{3+}, Er^{3+}-codoped oxyfluoride silicate glass having composition with molar concentrations of 61 SiO_2-12Na_2O-3Al_2O_3-12LaF_3-12PbF_2, the upconversion luminescence was greatly reduced by introducing Ce^{3+} ions without significantly reducing the lifetimes of lasing level.

JTuA32
Low Loss Ring Resonator Waveguides in Self Processing Photopolymers, *Matthew W. Grabowski[1], Robert R. McLeod[2]; [1]Deptartment of Physics, Univ. of Colorado, USA, [2]Dept. of Electrical Engineering, Univ. of Colorado, USA.* We propose a method for making low loss ring resonators in self processing photopolymers via direct-write lithography. This direct-write method compensates radiation mode coupling to first order, significantly reducing bend loss.

JTuA33
Analysis and Realization of Novel Optical Fields with Elliptical Symmetry of Linear Polarization, *Gilad M. Lerman, Uriel Levy; Hebrew Univ. of Jerusalem, Israel.* We study the tight focusing properties of a novel polarization field with elliptical symmetry. The eccentricity of the incident field assists in controlling the focal field properties, allowing matching the field distribution to specific applications.

JTuA34
Nanofabrication of Sub-Wavelength Grating Using Ultra-Fine Nano-Machining Process, *Jun Nakajima, Fumio Koyama; Tokyo Inst. of Technology, Japan.* We present the nanofabrication of sub-wavelength grating using ultra-fine nano-machining process. We successfully demonstrate the nano-machining fabrication of 20 nm grating pitch for nano-structured photonic devices, which is also used for thermal nano-imprint mold.

JTuA35
Large Third and Fifth Order Optical Nonlinearity of Organic-Inorganic CdS Quantum Dots in an Optically Transparent Thin Film, *M. J. Potasek, Y. Gao, A. Tonizzo, A. Walser, R. Dorsinville; City College of New York, USA.* We report large values of two- and three-photon absorption coefficients at 532nm (252 cm/GW) and 1064nm (160 cm^3/GW^2) in surfactant-capped CdS quantum dots. The cross-sections were approximately 1e-44 cm^4s/photon (532nm) and 8e-73 cm^6s^2/photon^2 (1064nm).

JTuA36
Photoelastic Tomographic Characterization of Stress Distribution in Fibers in Dependence of Drawing Parameters, *Matteo Tacca[1], Maddalena Ferrario[2], Pierpaolo Boffi[1,2], Mario Martinelli[1,2]; [1]Dept. di Elettronica e Informazione, Politecnico di Milano, Italy, [2]CoreCom, Italy.* Residual stress distribution is experimentally analyzed in different optical fibers thanks to photoelastic tomography characterization to demonstrate the dependence by fiber drawing parameters, such as speed tension and temperature.

JTuA37
Photoluminescence Comparison Analysis of Patterned and Self-Assembled Quantum Dots by MOCVD, *Ping-Show Wong[1], Baolai Liang[1], Noppadon Nuntawong[1], Jun Tatebayashi[1], Diana Huffaker[2,1], Vitaliy Dorogan[3], Yuriy Mazur[3], Gregory J. Salamo[3]; [1]Ctr. for High Technology Materials, Univ. of New Mexico, USA, [2]Electrical Engineering Dept., Univ. of California at Los Angeles, USA, [3]Dept. of Physics, Univ. of Arkansas, USA.* Power-, temperature-dependent, time-resolving, and micro-photoluminescence studies are performed to characterize patterned and self-assembled quantum dots (QDs) to understand the band structure. Carrier filling, relaxation, recombination and lifetime are different for these two QD growth modes.

JTuA38
Properties of Hard X-Rays Generated by Femtosecond Laser Interaction with Cu in a Laminar Helium Flow in Ambient Air, *Bixue Hou, James Easter, Karl Krushelnick, John A. Nees; Ctr. for Ultrafast Optical Science, Univ. of Michigan, USA.* Hard x-rays are generated in laminar helium flow in atmosphere by tightly focused 35fs-3mJ laser pulses interacting with Cu. Spectrum, efficiency and source size are compared with those measured in vacuum and in static helium.

JTuA39
Ultrashort Pulses Generation with the Mazzler Active Spectral Broadening and the XPW Pulse Shortening Technique, *Lorenzo Canova[1], Olivier Albert[1], Rodrigo Lopez-Martens[1], Perrine Giacomini[2], Pierre-Mary Paul[2]; [1]Lab d'Optique Appliquée, Ecole Natl. Supérieure de Techniques Avancées, Ecole Polytechnique, France, [2]Amplitude Technologies, France.* We demonstrated the Mazzler with XPW filter approach to obtain ultrashort pulses with Gaussian shape at the output of the laser system. This scheme can be scaled to higher output energy and sub 10fs pulses.

JTuA40
Photoionization of Xe Clusters Under Intense XUV Irradiation, *Brendan F. Murphy, Kay Hoffmann, John Keto, Todd Ditmire; Fusion Res. Ctr., Univ. of Texas at Austin, USA.* We have undertaken the study of xenon clusters irradiated by intense, femtosecond XUV pulses. Focused 38nm high harmonic radiation irradiates clusters of ~10^3 atoms, producing energetic ions consistent with a collective cluster response.

JTuA41
Beam Slowing Down in a Laser Plasma Accelerator by Laser-Induced Betatron Oscillation, *Yuelin Li[1], Karoly Nemeth[1], John Cary[2,3]; [1]Argonne Natl. Lab, USA, [2]Ctr. for Integrated Plasma Studies and Dept. of Physics, Univ. of Colorado, USA, [3]Tech-X Corp., USA.* The beam in a laser wakefield can be slowed down by laser-induced, large-amplitude betatron oscillation, leading to potential larger dephasing length between the beam and the wake field and in turn a higher beam energy.

JTuA42
Radiation from an Electron Wave Packet Driven by a Strong Laser Field, *Michael J. Ware, Justin Peatross; Brigham Young Univ., USA.* We argue against treating driven free-electron wave packets as extended classical charge distributions for computing scattered light. We have designed an experiment to test this by measuring light scattered out the side of a focus.

JTuA43
Manipulation of Molecular Rotational Wave-Packet, *Chengyin Wu, Yunan Gao, Nan Xu, Qihuang Gong; Peking Univ., China.* We both experimentally and theoretically demonstrated that molecular rotational populations can be actively controlled in a coherent rotational wave packet by using two strong, properly delayed femtosecond laser pulses.

JTuA44
Asymptotic Pulse Shapes in Filamentary Propagation of Femtosecond Pulses and Self-Compression, *Carsten Krüger[1,2], Ayhan Demircan[1], Gero Stibenz[2], Nickolai Zhavoronkov[2], Günter Steinmeyer[2]; [1]Weierstraß-Inst. für Angewandte Analysis und Stochastik, Germany, [2]Max-Born-Inst., Germany.* We investigate asymptotic pulse shapes arising from a balance of Kerr-type and plasma-mediated self-amplitude modulations. These self-stabilizing soliton-like solutions closely resemble experimental data and constitute the major mechanism for self-compression in femtosecond filaments.

JTuA45
Extreme-Contrast Front End for High-Power Laser Systems, *Christophe Dorrer, Ildar A. Begishev, Andrey V. Okishev, Jonathan D. Zuegel; Lab for Laser Energetics, Univ. of Rochester, USA.* A high-energy, high-contrast seed source for high-power lasers is directly generated using parametric amplification, with a temporal contrast better than 100 dB within 5 ps of the pulse peak and an extremely fast rising edge.

JTuA46
Single-Shot Measurements of Ultrafast Dynamics in a Dense Plasma, *Irina V. Churina, Byoungick Cho, Aaron C. Bernstein, Todd Ditmire; Texas Ctr. for High Intensity Science, Dept. of Physics, Univ. of Texas at Austin, USA.* The ultrafast dynamics in a dense plasma were studied with a single-shot measurement of the time-dependent reflectivity and phase shift at the rear surface of a free standing aluminum foil following femtosecond irradiation.

JTuA • CLEO/QELS Poster Session I—Continued

JTuA47

Electron Emission from Atomic Clusters Irradiated with Few Cycle Laser Pulses, *Yasin C. El-Taha[1], Emma Springate[2], Rob Carley[1], Firoz Rajgara[3], Delphine Darios[1], Chris Froud[2], Stefano Bonora[2], Dan Symes[2], John W. G. Tisch[1], Roland A. Smith[1], Deepak Mathur[3], Jon P. Marangos[1]; [1]Imperial College London, UK, [2]Rutherford Appleton Lab, UK, [3]Tata Inst. of Fundamental Res., India.* We present the first study of atomic clusters irradiated by ultra-short pulses. A weak prepulse has been shown to allow energetic coupling with the clusters enhancing the electron yield.

JTuA48

Probing Excited State Dynamics of Retinal Isomerization in Bacteriorhodopsin, *David M. Cardoza[1], Andrei C. Florean[2], James L. White[1], Roseanne J. Sension[2], Philip H. Bucksbaum[1,3]; [1]Stanford Univ., USA, [2]Univ. of Michigan, USA, [3]Stanford Linear Accelerator Ctr./Photon Ultrafast Science and Engineering Ctr., USA.* We study the effects of excitation pulse intensity, chirp and bandwidth on the ultrafast dynamics of retinal isomerization in bacteriorhodopsin. Variation of these parameters alters the decay times of the I and J conformations.

JTuA49

Monomorph Large Aperture Adaptive Optics for High Peak-Power Femtosecond Lasers, *Gilles Cheriaux[1], Frederic Burgy[1], Jean Christophe Sinquin[2], Jean Marie Lurçon[2], Claude Guillemard[2]; [1]Lab d'Optique Appliquée, Ecole Natl. Supérieure de Techniques Avancées, Ecole Polytechnique, France, [2]Compagnie Industrielle des Lasers, France.* Novel architecture of deformable mirror is presented. The monomorph mirror presents the advantage of avoiding high-spatial frequency on the residual wavefront enabling propagation without energy modulation. The residual wavefront at rest is 3.4 nm rms.

JTuA50

The Z-Petawatt Laser at Sandia National Laboratories, *Patrick K. Rambo, Jens Schwarz, Matthias Geissel, Erik Brambrink, Aaron Edens, Mark Kimmel, Briggs W. Atherton; Sandia Natl. Labs, USA.* Performance characteristics and rst experiments on Sandia's Z-Petawatt (ZPW) laser will be presented. This system will provide enhanced backlighting capabilities on the Z-Accelerator by achieving multi 10 keV x-rays in less than a picosecond.

JTuA51

High-Dynamic-Range, Single-Shot Cross-Correlator Using a Pulse Replicator, *Christophe Dorrer, Jake Bromage, Jonathan D. Zuegel; Lab for Laser Energetics, Univ. of Rochester, USA.* A single-shot, third-order cross-correlator is implemented using a pulse replicator that generates a sequence of spatially distinct, temporally delayed sampling pulses. A 250-ps temporal range with 60-dB dynamic range is demonstrated in single-shot operation.

JTuA52

Group Delay Measurement for Balancing Dispersion in Complex Stretcher-Compressor Systems, *John K. Crane[1], Ralph H. Page[1], Miro Y. Shverdin[1], Mike J. Messerly[1], James D. Nissen[1], Vernon Keith Kanz[1], Jay W. Dawson[1], Brian H. Shaw[2], Grace Shih[3], Craig W. Siders[1], Chris P. J. Barty[1]; [1]Lawrence Livermore Natl. Lab, USA, [2]Univ. of California at Davis, USA, [3]Univ. of Arizona, USA.* The phase-shift technique for measuring group-delay has novel applications for aligning and commissioning grating compressors and balancing dispersion in large, high-energy petawatt and other complex, chirped-pulse amplifier systems.

JTuA53

Systematic Study of the Influence of the High Orders Spectral Phase on XPW Generation, *Lorenzo Canova[1], Olivier Albert[1], Alexandre Trisorio[1], Rodrigo Lopez Martens[1], Nicolas Forget[2], Thomas Oksenhendler[2], Stoyan Kourtev[3], Nicolay Minkovsky[3], Solomon M. Saltiel[3]; [1]Lab d'Optique Appliquée, Ecole Natl. Supérieure de Techniques Avancées, Ecole Polytechnique, France, [2]Fastlite, Ecole Polytechnique, France, [3]Faculty of Physics, Univ. of Sofia, Bulgaria.* We present the first comprehensive study of the role of spectral phase on cross-polarized wave generation using sub 30 fs pulses. We derive the acceptable residual phase to define Fourier transformed ultrashort pulses.

JTuA54

Interaction of High Power Laser with Snow Nanotubes, *Tala Palchan[1], Arie Zigler[1], Zohar Henis[2], Anatoly Y. Faenov[3], Sergey A. Pikuz[3]; [1]Hebrew Univ., Israel, [2]Soreq Res. Ctr., Israel, [3]Joint Inst. for High Temperatures, Russian Acad. of Sciences, Russian Federation.* We found that snow nanotubes targets absorb more than 95% of the incident light of a high power laser. Fast ions were generated with energies up to 100*keV*.

JTuA55

High-Energy, Diode-Pumped, Cryogenically-Cooled Yb:LiYF$_4$ Chirped-Pulse Amplification System, *Makoto Aoyama[1,2], Kanade Ogawa[1,2,3], Yutaka Akahane[1,2], Koichi Tsuji[1], Akira Sugiyama[1], Junji Kawanaka[3], Hajime Nishioka[4], Masayuki Fujita[5], Koichi Yamakawa[1,2]; [1]Japan Atomic Energy Agency, Japan, [2]Core Res. for Evolutional Science and Technology, Japan Science and Technology Corp., Japan, [3]Inst. of Laser Engineering, Osaka Univ., Japan, [4]Univ. of Electro-Communications, Japan, [5]Inst. for Laser Technology, Japan.* We present a cryogenically-cooled Yb:LiYF$_4$ chirped-pulse amplification system with an energy of >100-mJ boosted by regenerative and multi-pass amplifiers for pumping multi-terawatt, few-cycle optical parametric chirped-pulse amplification.

JTuA56

Generation of High-Contrast, High-Intense Laser Pulses by Use of Nonlinear Pre-Amplifier in Ti:Sapphire Laser System, *Hiromotsu Kiriyama, Michiaki Mori, Izuru Daito, Yoshiki Nakai, Takuya Shimomura, Manabu Tanoue, Atsushi Akutsu, Shuji Kondo, Shuhei Kanazawa, Hajime Okada, Tomohiro Motomura, Hiroyuki Daido, Toyoaki Kimura, Toshiki Tajima; Japan Atomic Energy Agency, Japan.* We report the first high-contrast, high-intense Ti:Sapphire chirped-pulse amplification laser system incorporating a nonlinear pre-amplifier based on an optical parametric chirped-pulse amplification for use in experiments where relativistic effects dominate the physics.

JTuA57

Miniaturized Two-Photon Fluorescence and Second Harmonic Generation Microscope with a 24Hz Frame-Rate, *Tzu-Ming Liu[1,2], Ming-Che Chan[1,2], I-Hsiu Chen[1,2], Shih-Shuan Chia[1,2], Chi-Kuang Sun[1,2]; [1]Natl. Taiwan Univ., Taiwan, [2]Academia Sinica, Taiwan.* With miniaturized tube lenses and two-dimensional asynchronous scanning of the micro-electro-mechanical-system mirror, we demonstrated a 24Hz frame-rate miniaturized two-photon fluorescence/second-harmonic-generation microscope system. Sub-micron transverse resolution of sectioning images can be achieved.

JTuA58

Enhancement of Diffraction-Based Biosensor Sensitivity via a Bloch Surface Wave, *Marco Liscidini, John E. Sipe; Univ. of Toronto, Canada.* We propose a biosensor based on the diffraction of Bloch surface waves (BSWs) in periodic dielectric stacks. Great enhancement of diffraction efficiency by a grating of proteins is predicted when BSW is excited.

JTuA59

Combining Near-Infrared Autofluorescence and Raman Spectroscopy Improves the *in vivo* Detection of Cervical Precancer, *Zhiwei Huang[1], Jianhua Mo[1], Wei Zheng[1], Jeffrey Low[2], Joseph Ng[2], A. Ilancheran[2]; [1]Dept. of Bioengineering, Natl. Univ. of Singapore, Singapore, [2]Div. of Gynaecologic Oncology, Dept. of Obstetrics and Gynaecology, Natl. Univ. Hospital, Singapore.* The purpose of this study is to explore the feasibility of combining near-infrared (NIR) autofluorescence and Raman spectroscopy to enhance the *in vivo* detection of cervical intraepithelial neoplasia.

JTuA60

First Optical Observation of Periodic Motion of Native Human Cancer Cells, *Hao He, Siu Kai Kong, Kam Tai Chan; Chinese Univ. of Hong Kong, Hong Kong.* It is difficult to observe motions of living cells directly because of their transparency. With the aid of a highly sensitive detector, we are able to observe periodic cellular motions by measuring the scattered light.

JTuA61

Remote Sensing in Optical Coherence Tomography, *Yongwoo Park, Tae-Jung Ahn, Jose Azana; Enérgie, Matériaux et Télécommunications, Inst. Natl. de la Res. Scientifique, Canada.* We propose a remotely-sensible optical coherence tomography (OCT) system. Its probe is accessible to tens-of-meter distance off the main OCT platform. This remote sensibility facilitates sharing a single high-quality OCT utility for multiple distant applications.

JTuA62

Second Harmonic Generation Microscopy on the Polyhedral Inclusion Bodies of Nuclear Polyhedrosis Viruses, *Tzu-Ming Liu[1], Yen-Wei Lee[1], Chieh-Feng Chang[1], Shih-Chia Yeh[2], Chung-Hsiung Wang[2], Shi-Wei Chu[1], Chi-Kuang Sun[1,3]; [1]Natl. Taiwan Univ., Taiwan, [2]Natl. Central Univ., Taiwan, [3]Academia Sinica, Taiwan.* We demonstrate second-harmonic-generation (SHG) microscopic imaging on the polyhedral inclusion bodies (PIB) of nucleopolyhedrovirus in living cells. Due to a body-centered-cubic arrangement of polyhedrin trimers, these PIBs generate SHG with polarization anisotropy.

JTuA63

A Prototype Miniaturized Chip for Bio-Imaging Applications, *Qiaoqiang Gan, Yu Wang, Yaohua Sun, Svetlana Tatic-Lucic, Filbert Bartoli; Lehigh Univ., USA.* We demonstrate a prototype miniaturized chip for bio-imaging based on semiconductor LEDs. The Epi-fluorescent images under direct LED illuminations are comparable to the images captured with commercial systems employing solid-state-laser illumination through standard filter sets.

JTuA64

Near-Infrared Fluorescent Labeling of Tissue Transglutaminase Substrates for Imaging Tumor Boundaries, *Chia-Pin Pan[1], Khalid Amin[1], Yihui Shi[1], Stephanie Olson[1], Jeanne P. Haushalter[1], Charles S. Greenberg[2], Zishan Haroon[1], Gregory W. Faris[1]; [1]SRI Intl., USA, [2]Duke Univ. Medical Ctr., USA.* A novel strategy is developed to optically image tumor boundaries by cross-linking near-infrared fluorescent-labeled tissue transglutaminase substrates into tumor boundary tissue.

JTuA65

Two-Photon Imaging and Photothermal Therapy of Cancer Cells Using Biofunctional Gold Nanorods, *Jingliang Li, Daniel Day, Min Gu; Ctr. for Micro-Photonics, Faculty of Engineering and Industrial Science, Swinburne Univ. of Technology, Australia.* Transferrin-conjugated gold nanorods were used for targeting, two-photon imaging and photothermal therapy of cancer cells. The presence of nanorods significantly reduced the laser power effective for therapy.

JTuA66

Analytical Expressions and Simplified Formulas for GVD and TOD of Reflection Grism Compressors, *Steve Kane[1], Bruno Touzet[1], Charles Durfee[2], Jeff Squier[2]; [1]HORIBA Jobin Yvon, USA, [2]Colorado School of Mines, USA.* We obtain expressions for the GVD and TOD of reflection grism compressors for compensating material dispersion and provide useful approximations for practical grism designs.

JTuA67

Focus Optimization with Binary Wave-Front Coding, *Linbo Liu[1], Frédéric Diaz[2], Brigitte Loiseaux[2], Jean-Pierre Huignard[2], Nanguang Chen[1], Colin Sheppard[1]; [1]Natl. Univ. of Singapore, Singapore, [2]Thales Res. and Technology, France.* Novel schemes to optimize the focusing condition of Gaussian beam are proposed. Super-resolution is achieved along a DOF 4 times larger than the confocal parameter. The experimental results are presented by use of an OALV.

JTuA68

Raman Microspectroscopy of Melanosomes in RPE Cells: The Effect of Light Irradiation, *Anushree Saha[1], Vladislav V. Yakovlev[1], Robert J. Thomas[2], Gary Noojin[3], Michael Denton[3], Janice Burke[4]; [1]Univ. of Wisconsin at Milwaukee, USA, [2]Optical Radiation Branch, AFRL, USA, [3]Northrop Grumman Corp., USA, [4]Medical College of Wisconsin, USA.* Raman microspectroscopy is used for the first time to study chemical and structural transformations in RPE cells exposed to cw and short-pulsed high-intensity light irradiation.

JTuA • CLEO/QELS Poster Session I—Continued

JTuA69
Microscale Flexible Image Projection Device for Spatiotemporal Excitation in the Research of Visual System Development, *Heng Xu[1], Kristina M. Davitt[2], Wei Dong[3], Yoon-Kyu Song[4], William R. Patterson III[4], Carlos D. Aizenman[3], Arto V. Nurmikko[1,4]; [1]Dept. of Physics, Brown Univ., USA, [2]Ecole Normale Superieure, France, [3]Dept. of Neuroscience, Brown Univ., USA, [4]Div. of Engineering, Brown Univ., USA.* We have developed a microscale flexible image projection device, integrating a matrix addressable blue/green two-dimensional LED array to a multicore imaging fiber. Spatio-temporal patterns of illumination have been used to study amphibian visual system development.

JTuA70
Robust Fluorescent Tomography Using Likelihood Priors: Phantom Experimental Results, *Pouyan Mohajerani, Ali A. Eftekhar, Ali Adibi; Georgia Tech, USA.* A method is proposed for improving the robustness of fluorescent tomography by estimating the likelihood of non-zero concentration at any voxel. Phantom experimental results demonstrate robust reconstruction despite significant modeling mismatch due to optical heterogeneities.

JTuA71
Vacuum-Free Hard X-Rays Driven by High-Field Pulses from a Femtosecond Fiber Laser, *Bixue Hou, Matthew Rever, Almantas Galvanauskas, John A. Nees; Univ. of Michigan, USA.* A compact vacuum-free hard x-ray source based on high-field pulses from a femtosecond fiber laser interacting with nickel in gently flowing helium is demonstrated. K_α x-ray conversion efficiency is 1.7×10^{-9}.

JTuA72
Ultra-Wideband Wavelength-Tunable Actively and Harmonically Mode-Locked Fiber Ring Laser Using a Bismuth-Oxide-Based Erbium-Doped Fiber and a Bismuth-Oxide-Based Highly Nonlinear Fiber, *Yutaka Fukuchi, Joji Maeda; Tokyo Univ. of Science, Japan.* We demonstrate an actively and harmonically mode-locked laser employing a 151-cm-long bismuth-oxide-based erbium-doped fiber and a 250-cm-long bismuth-oxide-based highly nonlinear fiber. Stable 10-GHz short pulses are obtained with a 60-nm tuning range covering the CL-band.

JTuA73
Stable Gain-Switched 845 nm Pulse Generation by a Weak 1550 nm Seed Laser, *Guanshi Qin, Takenobu Suzuki, Yasutake Ohishi; Res. Ctr. for Advanced Photon Technology, Toyota Technological Inst., Japan.* We demonstrate what we believe to be the first demonstration of stable gain-switched 845-nm pulse generation by a weak modulated 1550-nm seed laser from an Er^{3+}-doped fluoride fiber pumped by a CW 974 nm LD.

JTuA74
Vector-Model Simulation of All-Normal-Dispersion Fiber Lasers, *William H. Renninger, Andy Chong, Frank W. Wise; Cornell Univ., USA.* Fiber lasers operating in the normal dispersion regime with a filter are analyzed with simulations of coupled-field equations. This model predicts new operating modes previously unrecognized by scalar simulations.

JTuA75
Waveguide Induced Spectral Bandwidth Enhancement of Slow Light Group Index Caused by Stimulated Brillouin Scattering in Optical Fiber, *Valeri I. Kovalev[1,2], Robert G. Harrison[1], Jonathan C. Knight[3], Nadezhda E. Kotova[2]; [1]Dept. of Physics, Heriot-Watt Univ., UK, [2]P. N. Lebedev Physical Inst. of the Russian Acad. of Sciences, Russian Federation, [3]Ctr. for Photonics and Photonic Materials, Univ. of Bath, UK.* We show that the spectral bandwidth of slow light systems based on stimulated Brillioun scattering in optical fibers can be massively increased by waveguide induced spectral broadening, to a telecom-scale value of ≥10 Gb/s.

JTuA76
Modeling of High Power 977 nm Yb Fiber Laser with Ring Doping in a High-Order-Mode Fiber, *Richard S. Quimby[1], Ted F. Morse[2], Roman L. Shubochkin[2], Siddharth Ramachandran[3]; [1]Worcester Polytechnic Inst., USA, [2]Boston Univ., USA, [3]OFS Labs, USA.* A 977-nm Yb fiber laser is calculated to have high efficiency when operating in the LP_{07} high-order mode of a large core diameter (43 mm) fiber, with Yb doped in a ring inside the core.

JTuA77
Power Scalable Visible Supercontinuum Generation Using Amplified Nanosecond Gain-Switched Laser Diode, *Malay Kumar[1], Chenan Xia[1], Xiuquan Ma[1], Vinay V. Alexander[1], Mohammed N. Islam[1], Fred L. Terry Jr.[1], Carl C. Aleksoff[2], Alex Klooster[2], Douglas Davidson[2]; [1]Univ. of Michigan, USA, [2]Coherix Inc., USA.* Supercontinuum covering 0.45-1.2µm is scaled from 250-740mW by varying the repetition rate of a frequency doubled telecom laser diode. Efficient SC generation requires minimal non-linearity in the amplifier and fiber dispersion matched to the pump.

JTuA78
Characterization of Raman-Assisted Fiber Optical Parametric Amplifiers Gain, *S. H. Wang[1], Lixin Xu[2], P. K. A. Wai[1], H. Y. Tam[1]; [1]Hong Kong Polytechnic Univ., Hong Kong, [2]Univ. of Science and Technology of China, China.* We reported theoretical modeling of the gain of Raman-assisted fiber optical parametric amplifiers. The model can be used to design and optimize the amplifier gain.

JTuA79
Nonlinear Effects in a Silica-Node of a Hollow-Core Photonic Crystal Fiber within the Photonic Bandgap, *Georges Humbert[1], Yingying Wang[2], Phil S. Light[2], Fetah Benabid[2], Peter John Roberts[3]; [1]XLIM, Unité Mixte de Recherche, Ctr. Natl. de la Recherche Scientifique, France, [2]Ctr. for Photonics and Photonic Materials, Dept. of Physics, Univ. of Bath, UK, [3]Dept. of Communications, Optics and Materials, Technical Univ. of Denmark, Denmark.* We report on strong nonlinear effects in a specific sub-micron scale silica-node within the cladding of a hollow-core photonic crystal fiber at frequencies lying within the air-guiding cladding photonic bandgap.

JTuA80
Numerical Investigation into Beam Propagation inside an Index Antiguided Fiber Laser, *Hyun Su Kim[1,2], Timothy McComb[2], Vikas Sudesh[2], Martin C. Richardson[2]; [1]Chosun Univ., Republic of Korea, [2]CREOL, College of Optics and Photonics, Univ. of Central Florida, USA.* We numerically investigate the beam propagation inside an index antiguided fiber laser. The results show that reflection on the air-cladding boundary of a fiber has strong influence on the guided beam profile along the core.

JTuA81
Group Velocity Dispersion in Chalcogenide As_2S_3 Glass Nanofibers, *Chitrarekha B. Chaudhari, Takenobu Suzuki, Yasutake Ohishi; Res. Ctr. for Advanced Photon Technology, Toyota Technological Inst., Japan.* Group velocity dispersions of air and borosilicate cladding chalcogenide As_2S_3 nanofibers are calculated and compared. Zero flattened dispersion can be tailored around telecommunication wavelength, 1.5 µm, by proper cladding material and the nanofiber core diameter.

JTuA82
Nonlinearity Enhancement and Dispersion Management in Bismuth Microstructured Fibers with a Filled Slot Defect, *Kunimasa Saitoh, Kuniaki Kakihara, Shailendra Varshney, Masanori Koshiba; Hokkaido Univ., Japan.* We investigate nonlinearity enhancement and dispersion management in microstructured fibers with a slotted-defect infiltrated with highly-nonlinear liquid. Using slot-defected-core bismuth microstructured fibers, γ as high as 11,000 $W^{-1}km^{-1}$ and dispersion-flattened characteristics at telecom-band is possible.

JTuA83
Passive Phase Locking of Fiber Laser Array Based on a Common Ring Cavity, *Bing Lei, Ying Feng; College of Optoelectronic Science and Engineering, Natl. Univ. of Defense Technology, China.* We report the passive phase locking of three fiber lasers based on a common ring cavity. The cavity provides the common resonating modes of the array through mutual injection locking.

JTuA84
Bound-Soliton States under a Periodic Phase Modulation, *Nhan D. Nguyen, L. N. Binh, T. L. Huynh; Dept. of Electrical and Computer System Engineering, Monash Univ., Australia.* We report experimental results of multi-solitons in an active FM mode-locked fiber laser. Periodic phase modulation in the laser plays an important role in stabilization and determination of number of solitons in the bound states.

JTuA85
Analysis of *N*+1-Core Fiber Laser Cavity, *Erik J. Bochove; Directed Energy Directorate, AFRL, USA.* Mode structure and oscillation condition of a multicore fiber laser are derived using coupled mode theory, yielding conditions for in-phase and flattened supermode operation. An inhomogeneous facet reflectivity can be used for mode control applications.

JTuA86
Design and Realization of an Inherently Gain Flattened Erbium Doped Fiber Amplifier, *B. Nagaraju[1], M. C. Pal[2], M. Pal[2], A. Pal[2], R. K. Varshney[1], B. P. Pal[1,3], S. K. Bhadra[2], G. Monnom[3], B. Dussardier[3]; [1]Indian Inst. of Technology Delhi, India, [2]Central Glass and Ceramic Res. Inst., India, [3]Lab de Physique de la Matière Condenesèe, Univ. de Nice Sophia Antipolis, Ctr. Natl. de la Recherche Scientifique, France.* We report design and realization of a highly asymmetric co-axial dual-core fiber to attain an inherently gain flattened EDFA with median gains ≥ 28 dB and gain excursion within ± 2 dB across the C-band.

JTuA87
Polarization Properties of a Long-Period Grating Written in a Pure Fused Silica Photonic Crystal Fiber, *Christophe Caucheteur[1], Andreï Fotiadi[1], Patrice Megret[1], Gilberto Brambilla[2], Stephen A. Slattery[3], David Nikogosyan[3]; [1]Faculte Polytechnique de Mons, Belgium, [2]Univ. of Southampton, UK, [3]Univ. College Cork, Ireland.* Polarization properties of a long-period grating inscribed in a single-mode photonic crystal fiber are presented. A strong modulation in the polarization-dependent loss and differential group delay spectra with periods of 2.6 and 1.3nm is reported.

JTuA88
Strain Analysis on the Interface of Double-Clad Cr^{4+}:YAG Crystal Fibers, *Chien-Chih Lai[1], Kuang-Yao Huang[2], Yen-Sheng Lin[3], Sheng-Lung Huang[1,4]; [1]Inst. of Photonics and Optoelectronics, Natl. Taiwan Univ., Taiwan, [2]Inst. of Electro-Optical Engineering, Natl. Sun Yat-Sen Univ., Taiwan, [3]Dept. of Electronic Engineering, I-Shou Univ., Taiwan, [4]Dept. of Electrical Engineering, Natl. Taiwan Univ., Taiwan.* The interface analysis of Cr^{4+}:YAG crystal fibers(DCF) was done using HRTEM. While it was pumped at 1064 nm and yields 3-dB bandwidth of over 240 nm with a maximum output power up to mW order.

JTuA89
Tunable Mode-Locked Semiconductor Fiber Laser Using a Nonlinear Optical Loop Mirror, *Juan Hernandez-Cordero[1], Lawrence R. Chen[2], Martin Rochette[2]; [1]Materials Res. Inst., Natl. Autonomous Univ. of Mexico, Mexico, [2]Dept. of Electrical and Computer Engineering, McGill Univ., Canada.* Tunable and multi-wavelength mode-locked operation of a fiber laser is demonstrated. A loop mirror with highly nonlinear fiber is used as an all-optical modulator; tuning is achieved through dispersive gratings and a tunable optical delay.

JTuA90
Waveguide Ring Resonators with Gain at the Quantum Limit, *Hsien-kai Hsiao, Kim Winick; Dept. of Electrical Engineering and Computer Science, Univ. of Michigan, USA.* An expression for the quantum-limited frequency resolution of active waveguide ring resonator spectrometers is derived, and a 1.6 cm diameter, diode-pumped, active waveguide, ring resonator is demonstrated in a neodymium-doped glass with finesse of 250.

JTuA • CLEO/QELS Poster Session I—Continued

JTuA91
Flat-Top Pulse Generation Based on the Combined Action of Active Mode Locking and Nonlinear Polarization Rotation, *Xiaohui Fang[1], P. K. A. Wai[1], Chao Lu[1], H. Y. Tam[2], S. H. Wang[1]; [1]Photonics Res. Ctr. and Dept. of Electronic and Information Engineering, Hong Kong Polytechnic Univ., Hong Kong, [2]Photonics Res. Ctr. and Dept. of Electrical Engineering, Hong Kong Polytechnic Univ., Hong Kong.* A pulsewidth tunable 10 GHz flat-top pulse train is generated based on the combined action of active mode locking and nonlinear-polarization-rotation pulse shaping. The SMSR is 65 dB and the timing jitter is 145 fs.

JTuA92
Ultra-Narrow Dual-Channel Filter Based on Sampled Fiber Bragg Gratings, *Xueming Liu[1,2], Guoyong Sun[1], Dae Seung Moon[1], Dusun Hwang[1], Aoxinag Lin[1], Youngjoo Chung[1]; [1]Gwangju Inst. of Science and Technology, Republic of Korea, [2]State Key Lab of Transient Optics and Photonics, Xi'an Inst. of Optics and Precision Mechanics, China.* We have proposed a new ultra-narrow dual-bandpass FBG. Based on the proposed grating, an ultra-narrow dual-channel filter is designed. Our filter has the same bandwidth, the even strength, and the ultra-narrow bandwidth (<1pm).

JTuA93
Near-Infrared QEPAS Sensor for Trace Ethylene Monitoring at Atmospheric Pressure, *Stéphane Schilt[1,2], Anatoliy A. Kosterev[2], Frank K. Tittel[2]; [1]IR Microsystems SA, Switzerland, [2]Electrical and Computer Engineering Dept., Rice Univ., USA.* A sensor based on quartz enhanced photoacoustic spectroscopy was evaluated for the detection of trace levels of ethylene at atmospheric pressure using a fiber coupled DFB diode laser probing an absorption peak at 6177.15 cm^{-1}.

JTuA94
Development of Laser Based Spectroscopic Trace-Gas Sensors for Environmental Sensor Networks and Medical Exposure Monitors, *Stephen G. So, Daniel Chang, Omar Al'Rifai, Gerard Wysocki, Anatoliy A. Kosterev, Frank K. Tittel; Rice Univ., USA.* We report wavelength modulated TDLAS/QEPAS trace gas sensors with reduced size, efficiency, and cost for use in environmental sensor networks and medical exposure monitors. CO_2 measurements with a 2μm diode laser dissipate <1W.

JTuA95
Enhanced Spontaneous Raman Scattering Using a Photonic Crystal Fiber, *Michael P. Buric[1,2], Joel Falk[1,2], Kevin P. Chen[1,2], Steven Woodruff[1]; [1]Natl. Energy Technology Lab, USA, [2]Univ. of Pittsburgh, USA.* The output power from spontaneous gas-phase Raman scattering is enhanced using a hollow-core photonic crystal fiber for the gas cell and Stokes light collector, yielding >100 times enhancement over a free-space configuration.

JTuA96
Measuring Orthogonal Components of Electric Field via Optical Second Harmonic Generation in $KTiOPO_4$, *Nilesh J. Vasa, R. Sarathi; Indian Inst. of Technology-Madras, India.* DC to impulse electric field measurements are performed by combining an electro-optic effect with the second harmonic generation in $KTiOPO_4$ crystals. The technique is extended to measure orthogonal components of the electric field.

JTuA97
Quartz-Enhanced Photoacoustic Spectroscopy of HCN from 6433 to 6613 cm^{-1}, *Weixiong Zhao[1], Xiaoming Gao[1], Kun Liu[1], Frans J. M. Harren[2], Weidong Chen[3], Frank K. Tittel[4]; [1]Anhui Inst. of Optics and Fine Mechanics, Chinese Acad. of Sciences, China, [2]Dept. of Molecular and Laser Physics, Radboud Univ., Netherlands, [3]Lab de Physicochimie de l'Atmosphère, Unite Mixte de Recherche, Ctr. Natl. de la Recherche Scientifique, France, [4]Rice Quantum Inst., Rice Univ., USA.* The HCN absorption spectrum from 6433 to 6613 cm^{-1} was acquired at room temperature by means of a tunable external cavity diode laser based quartz-enhanced photoacoustic spectroscopy (QEPAS) technique.

JTuA98
Compact Diode Laser Trace Gas System with an Optical Fiber Coupled High-Finesse External Cavity Based on Cavity Ringdown Spectroscopy, *Jun-ichi Sato, Kana Nemoto, Shigeru Yamaguchi, Masamori Endo, Kenzo Nanri, Tomoo Fujioka; Tokai Univ., Japan.* A fiber coupled high-finesse external cavity diode laser for cavity ringdown spectroscopy was successfully demonstrated. The sensitivity of 1x 10^{-7} cm^{-1} was achieved in a 1 cm^3 remotely located ringdown cavity as a sensor head.

JTuA99
Identification of Weak Inversion and Inversion-Rotational Transitions within Excited Vibrational State of Ammonia, *Hongqian Sun[1], Yujie J. Ding[1], Ioulia B. Zotova[2]; [1]Lehigh Univ., USA, [2]ArkLight, USA.* We demonstrate that a widely-tunable far-IR source developed by us recently can be used to identify weak inversion and inversion-rotational transitions within the ν_2=1 excited state of NH_3 molecule. Seven transition peaks have been observed.

JTuA100
Surface Enhanced Raman Spectroscopy of Aromatic Compounds on Silver Nanoclusters, *Yafit Fleger, D. H. Dressler, Yitzhak Mastai, Michael Rosenbluh; Bar-Ilan Univ., Israel.* Surface enhanced Raman spectroscopy is used to characterize monolayers of different aromatic compounds in the proximity of silver nanoclusters. Based on theory and experiment we determine the origin of specific spectral shifts of Raman lines.

JTuA101
Single Photon Spectrometer for High Speed Detection of Multi-Color Fluorescence Radiation, *Ivan Tovkach, A. Tsupryk, D. Gavrilov, O. Kosobokova, G. Gudkov, G. Tyshko, B. Gorbovitski; Stony Brook Univ., USA.* This paper describes design of the new sensor system for fluorescence detection applications. Based on single photon detection technique proposed system has unique combination of characteristics —high detection speed and wide linearity dynamic range.

JTuA102
High-Speed Quantum Random Number Generation, *Michael A. Wayne, Evan R. Jeffrey, Gleb M. Akelsrod, Paul G. Kwiat; Univ. of Illinois at Urbana-Champaign, USA.* We present a quantum random number generator based on randomness in photon emission and detection. Using a single-photon counter and FPGA-based data processing allows for a convenient implementation that outputs data at 40 Mbit/s.

JTuA103
Generation of Squeezed Vacuum Light Pulse at Non-Soliton Wavelength of 800 nm with a Sagnac Loop Fiber Interferometer, *Yuji Fujiwara, Kenichi Hirosawa, Fumihiko Kannari; Dept. of Electronics and Electrical Engineering, Keio Univ., Japan.* Production of squeezed vacuum laser pulses at 800 nm is studied with a Sagnac fiber interferometer using a Ti:sapphire femtosecond laser. Excessive noise can be suppressed with shorter fiber lengths even with sub-picosecond laser pulses.

JTuA104
Weak-Pulse Implementation of SARG04 Quantum Cryptography Protocol in Free Space, *Youn-Chang Jeong, Kwan-Young Hong, Yong-Su Kim, Yoon-Ho Kim; Pohang Univ. of Science and Technology (POSTECH), Republic of Korea.* We report a weak-pulse implementation of SARG04 quantum cryptography protocol in free-space. The sifted key generation rate of 22k bit per second and quantum bit error rate of 4% have been demonstrated.

JTuA105
Experimental Implementation of 1310-nm Differential Phase Shift QKD System with Up-Conversion Detectors, *Lijun Ma, Hai Xu, Tiejun Chang, Oliver Slattery, Xiao Tang; NIST, USA.* We have experimentally implemented a differential phase shift quantum-key distribution system with up-conversion detectors operating at a 2.5 Gbps clock rate. A Michelson interferometer with Faraday mirrors is used to increase the system stability.

JTuA106
Fidelity of a Conditional Quantum Teleportation Protocol Based on Collective Spontaneous Emission, *Richard Wagner Jr., James P. Clemens; Miami Univ., USA.* We employ quantum trajectory theory to model temporally and spatially resolved photodetection of collective emission to investigate the performance of a conditional quantum teleportation protocol. The fidelity approaches unity with a success probability of 0.25.

JTuA107
Time-Bin Encoding for Narrow-Band Single Photons, *Matthias Scholz, Nils Neubauer, Oliver Benson; Humboldt-Univ. of Berlin, Germany.* Quantum networks require the reliable encoding of quantum information in narrow-band single photons which couple efficiently to atomic ensembles. We demonstrate such encoding using Michelson interferometers and apply our scheme to quantum key distribution.

JTuA108
Design of Bright, Fiber-Coupled and Fully Factorable Photon Pair Sources for Quantum Information Processing, *Luis Edgar Vicent[1], Alfred B. U'Ren[1], Lijian Zhang[2], Ian A. Walmsley[2]; [1]Ctr. de Investigacion Cientifica y Educacion Superior de Ensenada (CICESE), Mexico, [2]Clarendon Lab, Univ. of Oxford, UK.* We derive conditions for full spatio-temporal factorability in non-collinear type-I spontaneous parametric downconversion. We show that fulfilment of these conditions leads to a higher single-mode fiber-coupled brightness, compared to sources rendered factorable through spectral filtering.

JTuA109
Optimum Detection of Quantum Entangled Fiber Solitons, *Yinchieh Lai[1,2], Ray-Kuang Lee[3]; [1]Dept. of Photonics, Natl. Chiao-Tung Univ., Taiwan, [2]Res. Ctr. for Applied Sciences, Academia Sinica, Taiwan, [3]Inst. of Photonics Technologies, Natl. Tsing-Hua Univ., Taiwan.* Multi-partie time-multiplexed fiber solitons after nonlinear interaction are rigorously proved to be quantum entangled in the sense that their quadrature internal modes satisfy EPR criterion. The optimum homedyne local oscillator for entanglement detection is determined.

JTuA110
Simultaneous Teleportation of the Spectral and Polarization States of a Photon, *Travis S. Humble, Ryan S. Bennink, Warren P. Grice; Oak Ridge Natl. Lab, USA.* We describe how spectrally multimode, polarization-entangled photons simultaneously teleport quantum information encoded into the spectral and polarization degrees of freedom of a single photon using sum frequency generation to implement a Bell-state measurement.

JTuA111
Quantum Computation with Donor-Based Qubits in Silicon Photonic Cavities, *Ruynet L. Matos Filho[1], Miguel Abanto[2], Belita Koiller[1], Luiz Davidovich[1]; [1]Inst. de Física, Univ. Federal do Rio de Janeiro, Brazil, [2]Univ. Federal do Acre, Brazil.* We propose quantum computation in a silicon donor quantum computing architecture. Initialization, manipulation, and detection are accomplished via optical processes.The errors in the implementation of logic gates are bellow the threshold for scalable quantum computation.

JTuA112
Improving Squeezing Purity from a $KNbO_3$ Crystal by Temperature Tuning, *Thomas Gerrits, Tracy S. Clement, Scott C. Glancy, Richard Mirin, Sae Woo Nam, Emanuel Knill; NIST, USA.* We show a method to increase the purity of a squeezed state. The method relies on temperature tuning the nonlinear crystals, which changes the output mode of the squeezed mode to match the local oscillator.

JTuA113
"Backward Heisenberg Picture" Approach for Spontaneous Parametric Down-Conversion, *Zhenshan Yang, Marco Liscidini, John E. Sipe; Univ. of Toronto, Canada.* We develop a fully quantum-mechanical approach for describing spontaneous parametric down-conversion, which allows us to write an expression for the quantum state easily, even when multiple photon pairs are generated in the process.

JTuA114
Weak Coherent State Homodyne Detection with Sequential I-Q Measurements, *Qing Xu[1], Marcia Betania Costa e Silva[1], Philippe Gallion[1], Artur Arvizu[2], Francisco Javier Mendieta[2]; [1]Ecole Natl. Supérieure de Télécommunications, France, [2]Ctr. de Investigacion Cientifica y de Educacion Superior de Ensenada (CICESE), Mexico.* We design and implement an optical phase estimator for carrier synchronization of a homodyne receiver for weak coherent states, based on sequential I-Q measurements. We report experimental results on performance in BER and phase-number uncertainty.

JTuA • CLEO/QELS Poster Session I—Continued

JTuA115
Proposed Method for Quantum Correlation (Bell) Measurement of Two Electrons in a Single Quantum Dot Based on Faraday/Kerr Rotation, *Toshihide Takagahara[1,2]; [1]Kyoto Inst. of Technology, Japan, [2]CREST, Japan Science and Technology Agency, Japan.* An optical non-destructive method is proposed based on the Faraday/Kerr rotation for quantum correlation(Bell) measurement of two electrons in a single quantum dot which is essential in the quantum repeater and its feasibility is investigated.

JTuA116
Interference Pattern Formation in the Second-Order Intensity Correlation with Beams Orthogonally Polarized, *Itamar Vidal, Dilson Caetano, Caio Olindo, Eduardo J. S. Fonseca, Jandir M. Hickmann; Inst. de Física, Univ. Federal de Alagoas, Brazil.* Considering the polarization state of the pseudothermal light beams, we demonstrate that the nonlocal second-order interference pattern formation does not depend on the polarization of the beams crossing the different parts of a distributed double-slit.

JTuA117
A Deterministic Single-Photon Source, *Kevin T. McCusker[1], Nicholas A. Peters[1,2], Aaron P. VanDevender[1,3], Paul G. Kwiat[1]; [1]Univ. of Illinois, USA, [2]Telcordia Technologies, Inc., USA, [3]NIST, USA.* We are developing an experimental setup to deterministically create single photons using spontaneous downconversion. We expect our source to output a single photon with a probability of 70%, and two photons with less than 3%.

JTuA118
Temporal Shaping of a Heralded Single-Photon Wave Packet, *So-Young Baek, Osung Kwon, Yoon-Ho Kim; Pohang Univ. of Science and Technology (POSTECH), Republic of Korea.* We report the temporal shaping and nonlocal control of a heralded single-photon wave packet, conditionally prepared by detecting the idler trigger photon of the signal-idler photon pair born in the process of spontaneous parametric down-conversion.

JTuA119
Anisotropic Metamaterials for Purely 2-D Optics, *Justin L. Elser, Viktor A. Podolskiy; Physics Dept., Oregon State Univ., USA.* We develop an approach to utilize anisotropic metamaterials to solve the fundamental problem of parasitic scattering of surface waves into free-space modes, paving the way for purely 2-D optics.

JTuA120
Optical Properties of Metamaterials Composed from Organic Molecules and Silver Nanostructures, *Alexander V. Gavrilenko, Starre N. Williams, Mikhail A. Noginov, Vladimir I. Gavrilenko; Norfolk State Univ., USA.* First principle calculations of Ag nanoslab optical functions indicate strong contributions of the surface states to light absorption. Imaginary part of dielectric function responsible for losses is substantially modified due to adsorption of organic molecules.

JTuA121
The Imbert-Fedorov and Goos-Hänchen Shift at Metamaterial Interfaces, *Thomas Paul, Christoph Menzel, Carsten Rockstuhl, Falk Lederer; Inst. of Condensed Matter Theory and Solid State Optics, Friedrich Schiller Univ. Jena, Germany.* We analyze beam displacements that occur upon reflection at interfaces between homogeneous media and metamaterials. Emphasis is put on system requirements, the techniques to predict the shift and the peculiarities in the presence of metamaterials.

JTuA122
Angle-Dependent Effective Properties of Metamaterials: Material vs. Wave Parameters, *Christoph Menzel[1], Thomas Paul[1], Carsten Rockstuhl[1], Falk Lederer[1], Thomas Pertsch[2]; [1]Inst. of Condensed Matter Theory and Solid State Optics, Friedrich-Schiller-Univ. Jena, Germany, [2]Inst. of Applied Physics, Friedrich-Schiller-Univ. Jena, Germany.* We introduce a procedure to retrieve angle- and polarization-dependent effective parameters of metamaterials based on reflection and transmission at a finite slab. Their meaning in the presence of strong spatial dispersion and anisotropy is discussed.

JTuA123
Light Propagation and Effective Parameters of Nanowire Based Metamaterials: An Analytical Approach, *Joerg Petschulat[1], Christoph Menzel[2], A. Chipouline[1], C. Rockstuhl[2], T. Pertsch[1], F. Lederer[1]; [1]Inst. of Applied Physics, Friedrich-Schiller-Univ. Jena, Germany, [2]Inst. for Condensed Matter Theory and Solid State Optics, Friedrich-Schiller-Univ. Jena, Germany.* We introduce a model to determine the effective material parameters of composite metamaterials.The approach combines the electric and magnetic multipole expansion of a single structure to describe the propagation properties of the respective effective medium.

JTuA124
Optical Shockley-Like Surface States in Light-Induced Superlattices, *Xiaosheng Wang[1], Natalia Malkova[2,3], Ivan Hromada[1], Garnett Bryant[2], Zhigang Chen[1,4]; [1]San Francisco State Univ., USA, [2]Atomic Physics Div., NIST, USA, [3]Joint Quantum Inst., NIST, Univ. of Maryland, USA, [4]TEDA Applied Physics School, Nankai Univ., China.* We provide the first demonstration of linear Shockley-like surface states in optically-induced semi-infinite photonic lattices with alternating strong/weak couplings. Such surface states appear in superlattices only when the surface termination is specially designed.

JTuA125
High-Q Cavity Design in Photonic Crystal Heterostructures, *Snjezana Tomljenovic-Hanic, C. Martijn de Sterke; ARC Ctr. of Excellence for Ultrahigh Bandwidth Devices for Optical Systems (CUDOS), School of Physics, Univ. of Sydney, Australia.* We introduce a simple procedure for high-*Q* cavity design in photonic crystal heterostructures. The key parameter in the optimization process is the relative position of the resonant frequency within the mode-gap.

JTuA126
Experimental Verification of Zero-*n* Bandgap in Photonic Crystal Superlattices at the Near-Infrared, *Serdar Kocaman[1], Rohit Chatterjee[1], Nicolae C. Panoiu[2], Mingbin Yu[3], Dim L. Kwong[3], Richard M. Osgood[2], Chee W. Wong[1]; [1]Optical Nanostructures Lab., Columbia Univ., USA, [2]Dept. of Applied Physics and Applied Mathematics, Columbia Univ., USA, [3]Inst. of Microelectronics, Singapore.* Zero-*n* bandgap has been observed in photonic superlattices consisting of layered stack of materials with positive index of refraction and photonic crystal slab. An experimental verification of FDTD simulations is reported here.

JTuA127
Impedance of Photonic Crystals, *Felix Lawrence[1], Lindsay C. Botten[2], Kokou B. Dossou[2], C. Martijn de Sterke[1]; [1]Univ. of Sydney, Australia, [2]Univ. of Technology, Sydney, Australia.* We show how the concept of impedance can be defined rigorously in terms of Bloch modes for photonic crystal applications, and then exploit this to accurately and efficiently design multilayer anti-reflection coatings for photonic crystals.

JTuA128
Analytical Solution and Design Guideline for Highly Reflective Subwavelength Gratings, *Vadim Karagodsky, Michael C. Y. Huang, Connie J. Chang-Hasnain; Univ. of California at Berkeley, USA.* We present an analytical solution for the reflectivity of a sub-wavelength grating in the case of a transverse plane-wave incidence and propose a design guideline for maximal reflectivity based on this solution.

JTuA129
Evolution of Defect States in 2-D Photonic Crystals, *Kokou B. Dossou[1], Lindsay C. Botten[1], Christopher G. Poulton[1], Ross C. McPhedran[2], Ara A. Asatryan[1], C. Martijn de Sterke[2]; [1]Dept. of Mathematical Sciences, Ctr. for Ultrahigh Bandwidth Devices for Optical Systems (CUDOS), Univ. of Technology, Sydney, Australia, [2]School of Physics, Ctr. for Ultrahigh Bandwidth Devices for Optical Systems (CUDOS), Univ. of Sydney, Australia.* We study the evolution of defect states from the band-edges of a 2-D photonic crystal. A simple exponential relation is derived for the dispersion of the state, and we investigate the connection with Bloch modes.

JTuA130
Tunable Ferroelectric Photonic Crystals, *Oleg Aktsipetrov, Tatiana Murzina, Fedor Sychev, Irina Kolmychek; Moscow State Univ., Russian Federation.* Spectral tuning of photonic band gap in photonic crystals is attained by infiltration of sodium nitrite into nanoporous silicon template. Tuning up to 15 nm is achieved in the temperature interval from 50°C to 200°C.

JTuA131
Dielectric Microcavities for THz Radiation: Identical Mode Spectrum and Coupling in Polyethylene Disks, *Sascha Preu, Harald G. L. Schwefel, Stefan Malzer, Gottfried H. Döhler, Lijun Wang; Max Planck Res. Group, Information and Photonics, Univ. of Erlangen, Germany.* We report the fabrication and characterization of identical dielectric whispering gallery microcavites for teraherz (THz) radiation. The THz radiation is coupled via a tapered waveguide into the coupled cavities. Mode splitting is observed.

JTuA132
Optimization of Coupling between a Metal Nanocavity and a Free-Space Gaussian Mode, *Muthiah Annamalai, Sarath C. Samudrala, Michael Vasilyev; Univ. of Texas at Arlington, USA.* We minimize scattering losses and maximize coupling to a given free-space mode from sub-wavelength metal aperture surrounded by periodic corrugations via optimum choice of parameters of the structure.

JTuA133
Forerunners and Turbulent Propagation in Plasmonic Waveguides, *Gilad Rosenblatt, Eyal Feigenbaum, Meir Orenstein; Technion, Israel.* Abrupt near IR optical pulses launched over metal-dielectric interface are exhibiting wavefronts moving almost at the speed of light in vacuum (much faster than plasmonic wavepackets) and comprised of much lower frequencies (tens of THz).

Ballroom A1 and A8 | Ballroom A2 and A7 | Ballroom A3 and A6 | Ballroom A4 and A5

QELS | **CLEO**

2:30 p.m.–4:15 p.m.
QTuG • Nanoplasmonics III
Mark Brongersma; Stanford Univ., USA, Presider

QTuG1 • 2:30 p.m.
Resonantly Enhanced Near-Field Lithography, *Mankei Tsang[1], Demetri Psaltis[1,2]; [1]Caltech, USA, [2]Ecole Polytechnique Fédérale de Lausanne, Switzerland.* We propose the combination of a planar optical resonator and a solid immersion lens for resonantly enhanced non-contact near-field lithography. Subwavelength small spots can be produced by exciting the Bessel modes of the resonator.

QTuG2 • 2:45 p.m.
Quasi-Periodicity Probes the Origin of Transmission Resonances in Nanoapertures, *Thomas Zentgraf[1], Harald Giessen[1], Carsten Rockstuhl[2], Falk Lederer[2]; [1]Univ. of Stuttgart, Germany, [2]Friedrich Schiller Univ. Jena, Germany.* We report on experimental and theoretical studies of enhanced transmission through 1-D and 2-D nanoapertures. We show that this transmission possesses vertical resonances and is therefore independent of the spatial aperture arrangement.

QTuG3 • 3:00 p.m. Invited
The Strength of Surface Plasmons, *Maurizio Righin[1], Giovanni Volpe[1], Dmitri Petrov[1,2], Romain Quidant[1,2]; [1]Inst. de Ciencies Fotoniques (ICFO), Spain, [2]Inst. Catalana de Recerca i Estudis Avançat (ICREA), Spain.* We measure the femto-Newton forces produced by 2-D surface plasmon optical traps able to trap micro-colloids at a patterned metal surface under low laser intensity.

2:30 p.m.–4:15 p.m.
QTuH • QELS Symposium on Quantum Light-Matter Interfaces I
Presider to Be Announced

QTuH1 • 2:30 p.m. Invited
Trapped Ion Quantum Networks, *Christopher Monroe[1,2], L.-M. Duan[1,2], D. Matsukevich[1,2], P. Maunz[1,2], D. L. Moehring[1,2], S. Olmschenk[1,2]; [1]Joint Quantum Inst., USA, [2]Dept. of Physics, Univ. of Maryland, USA.* We describe the use of a photonic coupling between remote trapped ions for applications in quantum communication and quantum computing.

QTuH2 • 3:00 p.m.
Tunable Light-Matter Interactions with Cold Ensembles, *Marcin Kubasik[1], Sebastian R. de Echaniz[1], Marco Koschorreck[1], Mario Napolitano[1], E. S. Polzik[1,2], Morgan W. Mitchell[1]; [1]ICFO, Inst. of Photonic Sciences, Spain, [2]Niels Bohr Inst., Copenhagen Univ., Denmark.* Effective interactions between a cold atomic ensemble and probe light can take the "QND," "beam-splitter," and "two-mode squeezing" forms, useful for quantum cloning and memory. We describe experiments with dipole-trapped ^{87}Rb using these interactions.

QTuH3 • 3:15 p.m.
Generation and Distribution of Heralded Entanglement between Atomic Ensembles for Scalable Quantum Networks, *Kyung S. Choi, Julien Laurat, Hui Deng, Chin-Wen Chou, Hugues de Riedmatten, Daniel Felinto, H. Jeff Kimble; Caltech, USA.* Entanglement is generated by detection of single photon emitted indistinguishably by atomic ensembles. We characterize relationship of degree of entanglement to local dephasing. Parallel pairs of entanglement are distributed to polarization entanglement via conditional control.

2:30 p.m.–4:15 p.m.
CTuU • Ultrafast Photonics III
Peter J. Delfyett; CREOL/School of Optics, Univ. of Central Florida, USA, Presider

CTuU1 • 2:30 p.m.
Effect of Jitter on Linear Self-Referencing Pulse Characterization Techniques, *Christophe Dorrer; Lab for Laser Energetics, Univ. of Rochester, USA.* The accuracy of modulator-based linear implementations of spectral shearing interferometry, simplified chronocyclic tomography, and spectrography when jitter is present on the electric modulator drive is studied analytically and simulated.

CTuU2 • 2:45 p.m.
Point-By-Point Inscription of Sub-Micrometer Period Fiber Bragg Gratings, *Yicheng Lai, K. Zhou, K. Sugden, I. Bennion; Aston Univ., UK.* Point-by-point inscription of sub-µm period fiber Bragg gratings with good spectral quality, first order Bragg resonances within the C-band is achieved. Distinct polarization characteristics are further observed in these fiber gratings.

CTuU3 • 3:00 p.m.
Femtosecond-Laser Pulse Shaping with Microoptical Retroreflector Arrays, *Ruediger Grunwald[1], Martin Bock[1], Jürgen Jahns[2]; [1]Max-Born-Inst. for Nonlinear Optics and Short-Pulse Spectroscopy, Germany, [2]FernUniv. Hagen, Optische Nachrichtentechnik, Germany.* An effective method to control the temporal structure of femtosecond pulses by microoptical retroreflector arrays is presented. Multipulses of variable delay or variable pulse duration were generated and detected by second order autocorrelation.

CTuU4 • 3:15 p.m.
Control of Femtosecond Laser Pulses by Deterministically Aperiodic Photonic Structures, *Liudmila Makarava[1], M. M. Nazarov[2], I. A. Ozheredov[2], A. P. Shkurinov[2], A. G. Smirnov[3], S. V. Zhukovsky[3,4]; [1]Belarusian State Agricultural Technical Univ., Belarus, [2]Moscow State Univ., Russian Federation, [3]Natl. Acad. of Sciences, Belarus, [4]Univ. Bonn, Germany.* Control of femtosecond laser pulses by deterministically aperiodic photonic multilayer structures is studied both experimentally and theoretically. We demonstrate that quasiperiodic structure with only 2.8 µm thickness varies duration of phase-modulated pulses up to 30%.

2:30 p.m.–4:15 p.m.
CTuV • Ultrafast Fiber Lasers I
Jeff Nicholson; OFS Labs, USA, Presider

CTuV1 • 2:30 p.m.
Ultra-Short Pulse Mode-Locked Rod-Type Fiber Laser, *Bülend Ortac[1], Olivier Schmidt[1], Thomas Schreiber[2], Ammar Hideur[3], Jens Limpert[1], Andreas Tünnermann[1,2]; [1]Inst. of Applied Physics, Friedrich-Schiller-Univ. Jena, Germany, [2]Fraunhofer Inst. for Applied Optics and Precision Engineering, Germany, [3]Complexe de Recherche Interprofessionnel en Aérothermochimie, Unité Mixte de Recherche, Univ. de Rouen, France.* We report on the generation of ultra-short pulses with energies above 250 nJ from a self-starting mode-locked Ytterbium-doped large-mode-area rod-type fiber laser operating in the dispersion-compensation-free regime and discuss scaling possibilities beyond the µJ barrier.

CTuV2 • 2:45 p.m.
Tunable High Energy Femtosecond Soliton Fiber Laser Based on Hollow-Core Photonic Bandgap Fiber, *Pascal Dupriez[1], Frédéric Gérôme[2], Jonathan C. Knight[2], John Clowes[1], William J. Wadsworth[2]; [1]Fianium Ltd., UK, [2]Ctr. for Photonics and Photonic Materials, Univ. of Bath, UK.* A tunable femtosecond fiber laser source based on pulse compression and soliton formation in hollow-core photonic bandgap fiber is presented. Efficient frequency-doubling produced 166 nJ pulse energy with 14 nm tuneability at green wavelengths.

CTuV3 • 3:00 p.m.
Passively Mode-Locked Ytterbium Fiber Laser with Integrated Hollow-Core Photonic Bandgap Fiber, *Julia Fekete[1], András Cserteg[2], Zoltán Várallyay[2], Péter Antal[1], Robert Szipőcs[1,3]; [1]Res. Inst. for Solid State Physics and Optics, Hungary, [2]Furukawa Electric Inst. of Technology Ltd., Hungary, [3]R&D Ultrafast Lasers Ltd., Hungary.* An ytterbium fiber oscillator is demonstrated comprising a hollow-core photonic bandgap fiber fusion spliced to single-mode fibers in the cavity generating pulses of 4.1 nJ energy and pulse width of 210 fs.

CTuV4 • 3:15 p.m.
Fiber Optical Trap Deposition of Carbon Nanotubes on Fiber End-Faces in a Modelocked Laser, *Hua Ji[1], Leif Katsuo Oxenløwe[1], Michael Galili[1], Karsten Rottwitt[1], Palle Jeppesen[1], Lars Grüner-Nielsen[2]; [1]Dept. of Communications, Optics & Materials, Technical Univ. of Denmark, Denmark, [2]D&E Dept., OFS Denmark, Denmark.* The fiber optical trap technique for depositing carbon nanotubes on fiber end-faces in modelocked lasers is experimentally characterized. Precise control of optical power and the temperature of carbon nanotubes solution are important in this technique.

Room C1 and C2 — **CLEO**

2:30 p.m.–4:15 p.m.
CTuW • Light Emission I: Quantum Dots
Presider to Be Announced

CTuW1 • 2:30 p.m.
Single Photon Emission from Spatially Controlled Periodic Arrays of II-VI Quantum Dots, *Qiang Zhang[1], Cuong Dang[2], Hayato Urabe[1], Shouheng Sun[3], Arto Nurmikko[1,2]; [1]Div. of Engineering, Brown Univ., USA, [2]Dept. of Physics, Brown Univ., USA, [3]Dept. of Chemistry, Brown Univ., USA.* We have developed a means of spatially organizing II-VI colloidal quantum dots into periodically patterned templates with high accuracy. Individual quantum dots are readily accessible by photoexcitation and show single photon emission with antibunching characteristics.

CTuW2 • 2:45 p.m.
Efficient Excitation and Emission of Single Quantum Dot by Simultaneous Coupling to Two Different Photonic Crystal Nanocavity Modes, *Yasutomo Ota[1], Masahiro Nomura[2], Naoto Kumagai[2], Katsuyuki Watanabe[2], Satomi Ishida[1], Satoshi Iwamoto[1,2,3], Yasuhiko Arakawa[1,2,3], Masayuki Shirane[2,4], Shunsuke Kono[2,4], Shinichi Yorozu[2,4]; [1]Res. Ctr. for Advanced Science and Technology, Univ. of Tokyo, Japan, [2]Inst. for Nano Quantum Information Electronics, Univ. of Tokyo, Japan, [3]Inst. of Industrial Science, Univ. of Tokyo, Japan, [4]NEC, Japan.* We utilized simultaneous coupling of higher and ground states of a single QD with two different resonant modes of a PhC nanocavity for efficient excitation and emission. Enhanced emission with strongly suppressed background was demonstrated.

CTuW3 • 3:00 p.m.
Achievement of Ultra-Low Threshold Excitation Power (8 nW) in a Nearly Single Quantum Dot Nanocavity Laser, *Masahiro Nomura, Yasutomo Ota, Naoto Kumagai, Satoshi Iwamoto, Yasuhiko Arakawa; Univ. of Tokyo, Japan.* We demonstrate photonic crystal nanocavity laser with nearly-single quantum dot gain. Continuous-wave lasing was achieved at photocarrier generation rate of 5 x 10^9/s, corresponding to several carrier injection into nearly-single quantum dot.

CTuW4 • 3:15 p.m.
Towards Single Time-Bin Entangled Photons Using Quantum Dots, *Christophe Couteau, Gregor Weihs; Inst. for Quantum Computing, Canada.* We present our results on fluorescence and photon statistics of quantum dots. We show evidence for photon cross-correlation and discuss directions towards proofs of time-bin entangled photons from a single dot.

Room C3 and C4 — **QELS**

2:30 p.m.–4:15 p.m.
QTuI • Spatial Effects and Instabilities
Presider to Be Announced

QTuI1 • 2:30 p.m.
Suppressing Noise-Induced Intensity Pulsations in Semiconductor Lasers by Means of Time-Delayed Feedback, *Valentin Flunkert, Eckehard Schöll; Inst. für Theoretische Physik, Technische Univ. Berlin, Germany.* We show by analytical and numerical results that coupling an external Fabry-Perot resonator to a semiconductor laser can efficiently suppress noise-induced intensity pulsations (relaxation oscillations). This constitutes a realization of time-delayed feedback control.

QTuI2 • 2:45 p.m.
Resonance Effects Governing Modulation Instability of Incoherent Light, *Eyal Ben Bassat, Tal Schwartz, Ofer Manela, Mordechai Segev; Technion Israel Inst. of Technology, Israel.* We demonstrate, theoretically and experimentally, resonance effects associated with modulation instability of incoherent light. The resonance is exemplified in a sharp transition of the spatial-frequency of maximum-gain, and in the absence of threshold.

QTuI3 • 3:00 p.m.
Self-Induced Transparency in Nano-Dispersions: Formation and Instabilities, *Georgios A. Siviloglou[1], Ramy A. El-Ganainy[1], Demetrios N. Christodoulides[1], Carmel Rotschild[2], Mordechai Segev[2]; [1]College of Optics and Photonics, CREOL, Univ. of Central Florida, USA, [2]Physics Dept., Technion-Israel Inst. of Technology, Israel.* We show that light scattering from a cloud of nano-particles dispersed in a host medium can lead to the formation of self-induced transparent waveguides. The stability properties of these nonlinear propagation channels are examined.

QTuI4 • 3:15 p.m.
Observation of Accelerating Airy Beam Ballistics, *Georgios A. Siviloglou, John Broky, Aristide Dogariu, Demetrios N. Christodoulides; CREOL, College of Optics, Univ. of Central Florida, USA.* We demonstrate experimentally that Airy beams can perform ballistic dynamics in a way totally analogous to that of projectiles moving under the action of gravity. The possibility of circumventing opaque obstacles is discussed.

Room B1 and B2 — **CLEO**

2:30 p.m.–4:15 p.m.
CTuX • Semiconductor THz Detectors and Emitters
Amit K. Agrawal; Univ. of Utah, USA, Presider

CTuX1 • 2:30 p.m. Invited
Terahertz Detectors and Emitters Based on Plasma Wave Oscillations in Nanometer Gate Length Transistors, *Wojciech Knap[1,2]; [1]Tohoku Univ., Japan, [2]Ctr. Natl. de la Recherche Scientifique, Univ. Montpellier, France.* The plasma frequency of High Electron Mobility Transistor can reach Terahertz range for nanometre size gate lengths. This work presents an overview of the results on THz detection and emission by transistors and multi-grating structures.

CTuX2 • 3:00 p.m.
Room Temperature Terahertz Emission from Two-Dimensional Plasmons in Doubly Interdigitated Grating Gate Heterostructure Transistors, *Yahya M. Meziani[1], Hiroyuki Handa[1], Wojciech Knap[1,2], Taiichi Otsuji[1], Eiichi Sano[3], Vyacheslav V. Popov[4]; [1]Res. Inst. of Electrical Communication, Tohoku Univ., Japan, [2]Group d'Etude des Semiconducteur, Montpellier Univ., France, [3]Res. Ctr. for Integrated Quantum Electronics, Hokkaido Univ., Japan, [4]Inst. of Radio Engineering and Electronics, Russian Acad. of Sciences ul. Zelyonaya, Russian Federation.* We observed intensive room temperature broadband terahertz emission from two-dimensional plasmons in dual grating-gate high electron-mobility transistors. Experiments were performed using infrared spectroscopy with a Silicon bolometer. Simulation reveals the thermal excitation of the plasmons.

CTuX3 • 3:15 p.m.
Room Temperature Terahertz Detection Based on Electron Plasma Resonance in an Antenna-Coupled GaAs MESFET, *Sangwoo Kim[1], Mark S. Sherwin[1], Jeramy D. Zimmerman[2], Arthur C. Gossard[2], Paolo Focardi[3], Dong Ho Wu[4]; [1]Physics Dept., Univ. of California at Santa Barbara, USA, [2]Materials Dept., Univ. of California at Santa Barbara, USA, [3]JPL, USA, [4]NRL, USA.* Plasma resonance of electrons was observed in an Antenna-Coupled GaAs Metal-Semiconductor-Field-Effect-Transistor (MESFET) by sweeping bias voltages. This resonant absorption was used to realize a room temperature terahertz detector.

Room J2

2:30 p.m.–4:15 p.m.
CTuY • OPOs I
Narasimha S. Prasad; NASA Langley Res. Ctr., USA, Presider

CTuY1 • 2:30 p.m.
Synchronously Pumped Near-Degenerate Doubly Resonant Optical Parametric Oscillator, *Jason S. Pelc, Joe E. Schaar, Konstantin L. Vodopyanov, Martin M. Fejer; Stanford Univ., USA.* We study the characteristics of a low-loss type-II phasematched synchronously pumped DRO. Numerical simulations using a split-step Fourier method agree well with experimental results.

CTuY2 • 2:45 p.m.
Performance Enhancement of Continuous-Wave, Singly Resonant Optical Parametric Oscillators Using Signal Coupling, *Goutam K. Samanta[1], Majid Ebrahim-Zadeh[1,2]; [1]Inst. de Ciències Fotòniques, Spain, [2]Inst. Catalana de Recera i Estudis Avancats, Spain.* Major improvements in performance of continuous-wave singly-resonant optical parametric oscillators are reported by exploiting signal output coupling. Substantial enhancements in output power, extraction efficiency, and practical tuning range are obtained at minimum cost to threshold.

CTuY3 • 3:00 p.m.
Tunable Optical Parametric Oscillator Controlled by a Transversely Chirped Bragg Grating, *Björn Jacobsson[1], Valdas Pasiskevicius[1], Fredrik Laurell[1], Vadim Smirnov[2], Leonid Glebov[2]; [1]Laser Physics, KTH, Royal Inst. of Technology, Sweden, [2]OptiGrate, USA.* We demonstrate a novel technique for locking and tuning of a near-degenerate OPO using a transversely chirped Bragg grating. The signal tuning range was 997-1016 nm and the maximum signal energy was 0.7 mJ.

CTuY4 • 3:15 p.m.
Longitudinal Mode Structure of Degenerate OPO with Volume Bragg Grating Output Coupler, *Markus Henriksson[1,2], Lars Sjöqvist[1], Valdas Pasiskevicius[2], Fredrik Laurell[2]; [1]FOI–Swedish Defence Res. Agency, Sweden, [2]KTH, Royal Inst. of Technology, Sweden.* Optical parametric oscillators using volume Bragg gratings as cavity mirrors provide narrow bandwidth signals. The longitudinal mode spectrum of a 1.06 µm pumped degenerate OPO is measured with Fabry-Perot etalon and compared to simulations.

CLEO

Room J3

2:30 p.m.–4:15 p.m.
CTuZ • Mid-IR Semiconductor Lasers
Igor Vurgaftman; NRL, USA, Presider

CTuZ1 • 2:30 p.m.
Room Temperature Operated 3.1-µm Type-I GaSb-based Diode Lasers with 80mW Continuous Wave Output Power, *Leon Shterengas, Gela Kipshidze, Takashi Hosoda, Dmitry Donetsky, Gregory Belenky; SUNY at Stony Brook, USA.* High-power diode lasers with heavily-strained In(Al)GaAsSb type-I quantum-well active region emitting at 3.1µm at room temperature are reported. Devices operate in continuous-wave regime with output power above 200mW and 80mW at 250K and 285K, correspondingly.

CTuZ2 • 2:45 p.m.
Electrically Pumped GaSb-Based VCSEL with Buried Tunnel Junction, *Alexander Bachmann, Taek Lim, Kaveh Kashani-Shirazi, Oliver Dier, Christian Lauer, Markus-Christian Amann; Walter Schottky Inst., Technische Univ. München, Germany.* We present the concept and first results of a continuous wave room temperature operating electrically pumped GaSb-based VCSEL with buried tunnel junction as current aperture. Laser emission has been achieved at 2.3 µm.

CTuZ3 • 3:00 p.m.
Mid-Infrared Interband Cascade Lasers Operating CW at Thermoelectric-Cooler Temperatures, *William W. Bewley, Chadwick L. Canedy, Chulsoo Kim, Mijin Kim, Jill A. Nolde, Diane C. Larrabee, J. R. Lindle, Igor Vurgaftman, Jerry R. Meyer; NRL, USA.* Mid-infrared interband cascade lasers with 11-µm-wide ridge width and Au electroplating operated cw to 288 K, where the emission wavelength was 4.1 µm. Another device emitted at 5.1 µm and operated cw to 229 K.

CTuZ4 • 3:15 p.m.
Dual-Wavelength Interband Cascade Lasers in Mid-Infrared Spectral Region, *Kamjou Mansour[1], Cory J. Hill[1], Yueming Qiu[1], Rui Q. Yang[2]; [1]JPL, Caltech, USA, [2]Univ. of Oklahoma, USA.* We report the world-first successful demonstration of widely spaced dual wavelength interband cascade lasers operating simultaneously in continuous wave near 3.5 and 4.5 microns.

Marriott San Jose Salon 1 and 2

2:30 p.m.–4:15 p.m.
CTuAA • Eye-Safe Lasers
Norman P. Barnes; NASA Langley Res. Ctr., USA, Presider

CTuAA1 • 2:30 p.m.
In-Band Pumping of High-Power Ho:YAG Lasers by Laser Diodes at 1.9µm, *Karsten Scholle, Peter Fuhrberg; LISA Laser Products OHG, Germany.* High-power laser diodes at 1.9µm allow direct in-band pumping of Ho:YAG. In an endpumped rod configuration 40W cw output with 57% slope efficiency were achieved in a most compact system.

CTuAA2 • 2:45 p.m.
Conductively Cooled Ho:Tm:LuLiF Laser Amplifier, *Yingxin Bai[1], Jirong Yu[2], Bo Trieu[2], Mulugeta Petros[3], Paul Petzar[4], Hyung Lee[4], Upendra Singh[2]; [1]Science Systems & Applications, Inc., USA, [2]NASA Langley Res. Ctr., USA, [3]Science and Technology Corp., USA, [4]Natl. Inst. of Aerospace, USA.* A conductively-cooled Ho:Tm:LuLiF laser head can amplify 80mJ/340ns probe pulses into 400mJ when the pump pulse energy is close to amplified spontaneous emission (ASE) threshold, 5.6J. For a small signal, the double-pass amplification exceeds 25.

CTuAA3 • 3:00 p.m.
Efficient in-Band-Pumped $Er:Sc_2O_3$-Laser at 1.58 µm, *Matthias Fechner, Rigo Peters, Andreas Kahn, Klaus Petermann, Ernst Heumann, Guenter Huber; Inst. of Laser-Physics, Univ. of Hamburg, Germany.* We present an efficient in-band-pumped Er(0.2 at.%):Sc_2O_3-laser at 1581 nm with a maximum output power of 0.95 W and a maximum slope efficiency of 31%.

CTuAA4 • 3:15 p.m.
Efficient Single-Axial-Mode Operation of an Er:YAG Ring Laser at 1645 nm, *Ji Won Kim, J. K. Sahu, W. A. Clarkson; Optoelectronics Res. Ctr., Univ. of Southampton, UK.* We report an Er:YAG ring laser employing an acousto-optic modulator to enforce unidirectional operation. The laser yields 4.7W of single-frequency output at 1645nm in a beam with M^2~1.03 for 14W of pump power at 1532nm.

Marriott San Jose Salon 3

2:30 p.m.–4:15 p.m.
CTuBB • Photonic Integrated Circuits
Shayan Mookherjea; Univ. of California at San Diego, USA, Presider

CTuBB1 • 2:30 p.m. Tutorial
InP-Based Photonic Integrated Circuits, *Larry Coldren; Univ. of California at Santa Barbara, USA.* The integration of a number of photonic components on a single InP chip for increased functionality and reliability as well as decreased power dissipation and cost is reviewed. Integration approaches, emphasizing UCSB work, is presented.

Larry A. Coldren is the Fred Kavli Professor of Optoelectronics and Sensors at the University of California at Santa Barbara. After receiving his Ph.D. from Stanford, he spent 13 years in the research area at Bell Laboratories, where he worked on SAW devices and tunable coupled-cavity lasers using novel RIE techniques. He joined UCSB in 1984 where he is now Director of the Optoelectronics Technology Center. He has co-founded a VCSEL and a widely-tunable transmitter company that were both successfully acquired. His group continues to develop leading results on efficient VCSELs and widely-tunable lasers and Photonic ICs. Prof. Coldren has authored or co-authored numerous papers and patents. He is a Fellow of the IEEE, OSA and IEE, a recipient of the John Tyndall Award, and a member of the National Academy of Engineering.

Marriott San Jose Salon 4

2:30 p.m.–4:15 p.m.
CTuCC • Nanowires, Whiskers and Needles
David D. Nolte; Purdue Univ., USA, Presider

CTuCC1 • 2:30 p.m.
Bright Photoluminescence from GaAs and InGaAs Nanoneedles Grown on Si Substrates, *Michael Moewe, Linus C. Chuang, Shanna Crankshaw, Connie Chang-Hasnain; Univ. of California at Berkeley, USA.* We report novel single-crystalline (In)GaAs nanoneedles with 2~5 nm tips, smooth 6-9° taper angles and lengths up to 3-4 µm, grown aligned to [111] orientation on Si substrates. Bright photoluminescence is obtained from quantum-well nanoneedles.

CTuCC2 • 2:45 p.m.
Self-Aligned Planar GaAs Nanowires Grown by MOCVD on GaAs (100) Substrates, *Seth A. Fortuna, Xi Zeng, Xiuling Li; Univ. of Illinois at Urbana-Champaign, USA.* The growth of self-aligned planar GaAs nanowires on GaAs (100) substrates is demonstrated using Au-catalyzed metalorganic chemical vapor deposition (MOCVD). The effect of growth temperature on nanowire orientation and the growth mechanism are discussed.

CTuCC3 • 3:00 p.m.
Growth of GaAs Whiskers by MBE on LPCVD Si(111) Nanowire Trunks, *Aaron M. Andrews, Pavel Klang, Alois Lugstein, Matthias Schramboeck, Matthias Steinmair, Youn-Joo Hyun, Emmerich Bertagnolli, Christoph Zauner, Karl Unterrainer, Werner Schrenk, Gottfried Strasser; Vienna Univ. of Technology, Austria.* We present the heteroepitaxial growth of wurtzite GaAs nanowhiskers on Si(111)-nanowire trunks forming hierarchical star-like structures with a six-fold symmetry, grown in the [0001] direction perpendicular to the Si-NW {112} facets.

CTuCC4 • 3:15 p.m.
Broad Angular and Spectral Anti-Reflection Employing GaN Nano-Pillar Structures, *ChingHua Chiu[1], Peichen Yu[1], C. C. Chen[1], H. C. Kuo[1], T. C. Lu[1], S. C. Wang[1], S. S. Hsu[2], Y.J. Cheng[2], Y.C. Chang[2]; [1]Dept. of Photonics and Inst. of Electro-Optical Engineering, Natl. Chiao Tung Univ., Taiwan, [2]Res. Ctr. for Applied Sciences, Academia Sinica, Taiwan.* Angular and spectral reflectivities of GaN nano-pillar structures are investigated for heights of 350nm, 550nm and 720 nm. Calculations based on rigorous coupled-wave analysis show excellent agreement with the measured reflectivities for s- and p-polarizations.

Marriott San Jose Salon 5 and 6

CLEO

2:30 p.m.–4:15 p.m.
CTuDD • Resonators and Dispersion Engineering
Chee Wei Wong; Columbia Univ., USA, Presider

CTuDD1 • 2:30 p.m.
1.5-µm-Radius High-Q Silicon Microring Resonators, *Qianfan Xu, David Fattal, Raymond G. Beausoleil; Hewlett-Packard Labs, USA.* We show cascaded silicon microring resonators with 1.5-µm radius critically coupled to a narrower waveguide. A coupled Q of 9,000 is achieved. Devices are fabricated with the widely-available SEM-based lithography system using a stitching-free design.

CTuDD2 • 2:45 p.m.
Compact Bandwidth Tunable Microring Resonators, *Long Chen, Nicolás Sherwood-Droz, Michal Lipson; School of Electrical and Computer Engineering, Cornell Univ., USA.* We demonstrate microring resonators on silicon-on-insulator with bandwidth tunable from 0.1 nm to 0.7 nm, an extinction ratio of 23 dB and a footprint of less than 0.001 mm^2 using interferometric couplers and thermal tuning.

CTuDD3 • 3:00 p.m.
Characterization of the Effect of Small Perturbations on the Optical Modes in High Q Microdisk Cavities, *Ali Asghar Eftekhar, Ali Adibi, Mohammad Soltani, Siva Yegnanarayanan; Georgia Tech, USA.* We have investigated the effect of small perturbations on the optical modes in a silicon microdisk using a NSOM system. The scattering loss and mode coupling due to NSOM tip and cavity interactions are studied.

CTuDD4 • 3:15 p.m.
Dynamic Tuning of Birefringence in Silicon Waveguides, *Kevin K. Tsia, Sasan Fathpour, Bahram Jalali; Univ. of California at Los Angeles, USA.* Integrated piezoelectric transducers are used to electrically vary the dispersion in a silicon optical waveguide.

PhAST

PhAST Room 1

2:15 p.m.–4:15 p.m.
PTuD • Lasers and LED Displays II
Mark Gitin; Coherent, Inc., USA, Presider

PTuD1 • 2:15 p.m. Invited
Green Lasers for Micro-Projectors, *James Grochocinski; Corning Inc., USA.* An emerging photonics market is micro-projectors for mobile devices. Compact and efficient solid-state light sources are essential for micro-projectors. We present a green laser architecture demonstrating the attributes required for this high-volume consumer electronics market.

PTuD2 • 2:45 p.m. Invited
Linear Light Modulator Arrays for Laser Projection Display Systems, *David Bloom; ALCES Technology, Inc., USA.* No abstract available.

PTuD3 • 3:15 p.m. Invited
Recent Advances in Optically Pumped Semiconductor Lasers, *Juan Chilla; Coherent Inc., USA.* Optically pumped semiconductor lasers offer significant advantages with respect to all traditional diode-pumped solid state lasers. We will describe our recent progress in the lab and applying this technology to commercial systems.

PhAST Room 2

2:15 p.m.–3:45 p.m.
PTuE • High-Power Semiconductor Lasers II
Steve Patterson; nLIGHT Photonics, USA, Presider

PTuE1 • 2:15 p.m. Invited
Advances in High-Power Diode Lasers and Fiber-Based Solutions at nLIGHT, *Steve Patterson; nLight Photonics, USA.* Advances in power, efficiency, reliability and package technology at nLIGHT will be reported and described to include the expected technology advances in high power diode laser systems.

PTuE2 • 2:45 p.m. Invited
Wavelength-Stabilized and Linewidth-Narrowed High-Power and High-Efficiency 800-975 nm Diode Lasers, *Manoj Kanskar; Alfalight Inc., USA.* High-power 800-975 nm diode laser pumps have been monolithically wavelength-stabilized and emission bandwidth narrowed using DFB grating. These diodes are attractive sources for pumping micro-chip lasers, DPSSL's and fiber lasers without active-cooling.

PTuE3 • 3:15 p.m. Invited
Vertical-Cavity Surface-Emitting Laser Arrays for High-Power Pumping Applications, *Jean-François Seurin, Chuni L. Ghosh, Viktor Khalfin, Aleksandr Miglo, Guoyang Xu, James D. Wynn, Prachi Pradhan, L. Arthur D'Asaro; Princeton Optronics, USA.* We present record output power levels (>200W) in continuous-wave operation from high-efficiency 2-D VCSEL arrays. These arrays emit around 975nm with narrow spectral width (<1nm) and excellent wavelength stability (<0.07nm/K), in a circular, low-diverging beam.

PhAST Room 3

2:15 p.m.–4:15 p.m.
PTuF • Business Growth for OLED Lighting
Ghassan Jabbour; Arizona State Univ., USA, Presider

PTuF1 • 2:15 p.m. Invited
Printed OLEDs for Lighting, *Devin MacKenzie; Add-Vision Inc., USA.*

PTuF2 • 2:35 p.m. Invited
Inkjet Printing Technology for OLED Display and Lighting, *Martin Schoeppler; FUJIFILM Dimatix, USA.*

PTuF3 • 2:55 p.m. Invited
Encapsulation Requirements, *Robert Jan Visser; Vitex Systems, USA.*

PTuF4 • 3:15 p.m. Invited
OLED Lighting Market Dynamics, *Phil Wright; OIDA, USA.*

Ballroom A1 and A8 | Ballroom A2 and A7 | Ballroom A3 and A6 | Ballroom A4 and A5

QELS | CLEO

QTuG • Nanoplasmonics III—Continued

QTuG4 • 3:30 p.m.
Nano-Optical and Terahertz Near-Field Studies of Surface Plasmon Generation, *D. S. Kim[1], K. G. Lee[1], M. A. Seo[1], K. J. Ahn[1], A. J. L. Adam[2], J. H. Kang[3], H. W. Kihm[1], Q. H. Park[3], P. C. M. Planken[2]; [1]Seoul Natl. Univ., Republic of Korea, [2]Delft Univ. of Technology, Netherlands, [3]Korea Univ., Republic of Korea.* We investigate sub-wavelength diffraction by a single slit, both in nano-optical and in terahertz regimes. The wave-front in optical regime separates itself into forward propagating beam and surface-bound 90-degree diffracted wave, i.e., surface plasmon polaritons.

QTuG5 • 3:45 p.m.
Secure Signal Transfer by Optical Near-Field Interactions, *Makoto Naruse[1,2], Hirokazu Hori[3], Kiyoshi Kobayashi[4], Motoichi Ohtsu[2]; [1]Natl. Inst. of Information and Communications Technology, Japan, [2]Univ. of Tokyo, Japan, [3]Univ. of Yamanashi, Japan, [4]Tokyo Inst. of Technology, Japan.* We theoretically demonstrate secure signal transfer by optical excitations involving optical near-field interactions. The energy dissipation processes, occurred locally in the nanometer-scale associated with exciton-phonon interactions, guarantees higher tamper resistance than conventional wired devices.

QTuG6 • 4:00 p.m.
Simulations of a Compact Integrated Plasmonic Attenuator Operating at Telecom Wavelengths, *Petur G. Hermannsson[1], Tiberiu Rosenzveig[1], Kristjan Leosson[1], Alexandra Boltasseva[2]; [1]Science Inst., Univ. of Iceland, Iceland, [2]COM.DTU, Technical Univ. of Denmark, Denmark.* We present finite-element simulations of a 1-mm long variable optical attenuator based on a long-range surface plasmon polariton waveguide, exhibiting <1dB insertion loss, 20dB extinction ratio, low power consumption and response times around 1 ms.

QTuH • QELS Symposium on Quantum Light-Matter Interfaces I—Continued

QTuH4 • 3:30 p.m.
Mapping Entanglement in and out of Quantum Memories, *Hui Deng, Kyung S. Choi, Julien Laurat, Jeff H. Kimble; Caltech, USA.* We report entanglement generation in atomic quantum memories via deterministic mapping of photonic entanglement. The atomic entanglement is retrieved back into photon modes after a programmable storage time, with an overall efficiency of 17%.

QTuH5 • 3:45 p.m.
Preservation of Entanglement in a Slow Light Medium, *Curtis J. Broadbent, Ryan M. Camacho, Ran Xin, John C. Howell; Univ. of Rochester, USA.* We demonstrate the preservation of entanglement of an energy-time entangled biphoton through a slow light medium. After delay of one photon by ~1.3 correlation lengths, the 1.3 THz biphoton still violates a Bell inequality.

QTuH6 • 4:00 p.m.
Multimode Memories with Longitudinally Broadened Ensembles, *Joshua A. S. Nunn, Karl Surmacz, Felix C. Waldermann, Ka Chung Lee, Klaus Reim, Virginia O. Lorenz, Zhongyang Wang, Dieter Jaksch, Ian A. Walmsley; Oxford Univ., UK.* Quantum storage of multiple optical modes affords improved performance for quantum repeaters. We present new analytic and numerical results unifying the scaling of the multimode storage capacity for various memory protocols in artificially broadened ensembles.

CTuU • Ultrafast Photonics III—Continued

CTuU5 • 3:30 p.m.
Ultrafast Electroabsorption Dynamics in a GaInNAs Quantum Well Waveguide at 1.3μm, *David B. Malins[1], Alvaro Gomez-Iglesias[1], Alan Miller[1], Mircea Guina[2]; [1]Univ. of St. Andrews, UK, [2]Optoelectronic Res. Ctr., Tampere Univ. of Technology, Finland.* Time-resolved electro-absorption is reported for the first time in a GaInNAs quantum well p-i-n waveguide at 1.3μm. A recovery of 55ps demonstrates the potential for optical modulator devices.

CTuU6 • 3:45 p.m.
Optical Pulse Compression of a Pulse Trapped in an Optical Microcavity, *Po Dong, Long Chen, Arthur Nitkowski, Michal Lipson; School of Electrical and Computer Engineering, Cornell Univ., USA.* We demonstrate that optical pulse compression can be realized by tuning the quality factor of an optical microcavity from a high value to a low value, with tuning time shorter than the photon lifetime.

CTuU7 • 4:00 p.m.
33MHz Repetition Rate Semiconductor Mode-Locked Laser Using eXtreme Chirped Pulse Oscillator, *Shinwook Lee, Dimitrios Mandridis, Peter J. Delfyett Jr.; CREOL and Florida Photonics Ctr. of Excellence, College of Optics and Photonics, Univ. of Central Florida, USA.* An XCPO generates stretched pulses > 10 ns at a 33MHz repetition rate from semiconductor mode-locked laser. The spectral bandwidth is scalable depending on the group delay of CFBG and the pulse repetition rate.

CTuV • Ultrafast Fiber Lasers I—Continued

CTuV5 • 3:30 p.m.
Fabrication and Characterization of Carbon Nanotube-Polymer Saturable Absorbers for Mode-Locked Lasers, *Sho Uchida[1], Amos Martinez[2], Yong-Won Song[3], Takaaki Ishigure[1], Shinji Yamashita[2]; [1]Dept. of Applied Physics and Physico-Informatics, Faculty of Science and Technology, Keio Univ., Japan, [2]Dept. of Electronic Engineering, Univ. of Tokyo, Japan, [3]Ctr. for Energy Materials Res., Korea Inst. of Science and Technology, Republic of Korea.* A method to fabricate Carbon Nanotube-doped Polymer composites is proposed and the merits of adding dopants to the material are analyzed. Passive mode-locked lasing is demonstrated using a thin-film CNT-based saturable absorber.

CTuV6 • 3:45 p.m.
Passively Synchronized Two-Color Polarization Additive Pulse Mode-Locked Fiber Lasers, *Wei-Wei Hsiang[1], Chien-Po Cheng[1], Chia-Hao Chang[1], Chieh-Yu Fang[1], Lien-Bee Chang[1], Yinchieh Lai[2,3]; [1]Dept. of Physics, Fu Jen Catholic Univ., Taiwan, [2]Dept. of Photonics and Inst. of Electro-Optical Engineering, Natl. Chiao-Tung Univ., Taiwan, [3]Res. Ctr. for Applied Sciences, Academia Sinica, Taiwan.* Passive synchronization and polarization additive pulse mode-locking techniques are combined to generate simultaneously the 1.03 μm and 1.53 μm ultrashort pulses at the same pulse repetition rates from synchronized Yb-fiber and Er-fiber mode-locked lasers.

CTuV7 • 4:00 p.m.
Laser Dynamics of Asynchronously Modelocked Fiber Soliton Lasers, *Wei-Wei Hsiang[1], Ye-Chen Chen[2], Hon-Chieh Chang[2], Jye-Hong Chen[2], Yinchieh Lai[2,3]; [1]Dept. of Physics, Fu Jen Catholic Univ., Taiwan, [2]Dept. of Photonics and Inst. of Electro-Optical Engineering, Natl. Chiao-Tung Univ., Taiwan, [3]Res. Ctr. for Applied Sciences, Academia Sinica, Taiwan.* Laser dynamics of asynchronously modelocked Er-fiber soliton lasers is investigated theoretically and experimentally. The pulse parameters are found to exhibit complicated slow periodic variations and can be examined experimentally by analyzing the RF spectra.

4:15 p.m.–4:45 p.m., Coffee Break, *Exhibit Hall*

NOTES

Room C1 and C2

CLEO

CTuW • Light Emission I: Quantum Dots—Continued

CTuW5 • 3:30 p.m.
Silicon Based Colloidal Quantum Dot Photonic Crystal Light Emitters at Telecom Wavelengths, *Bryan C. Ellis[1], Ludovico Cademartiri[2], Ilya Fushman[1], Geoff A. Ozin[2], Jelena Vuckovic[1]; [1]Stanford Univ., USA, [2]Univ. of Toronto, Canada.* A high-density colloidal quantum dot film emitting at telecom wavelengths is evanescently coupled to a Si photonic crystal cavity, and the possibility of making a laser from the structure is discussed.

CTuW6 • 3:45 p.m.
Integration of Site-Controlled Pyramidal Quantum Dots and Photonic Crystal Membrane Cavities, *Pascal Gallo[1], M. Felici[1], B. Dwir[1], K. Atlasov[1], K. F. Karlsson[1], A. Rudra[1], A. Mohan[1], E. Kapon[1], G. Biasiol[2], L. Sorba[2]; [1]Ecole Polytechnique Federale de Lausanne, Switzerland, [2]TACS-INFM Natl. Lab, Italy.* Deterministic integration of site-controlled InGaAs/GaAs quantum dots (QDs) with photonic crystal cavities is demonstrated. Fine adjustment of QD position (within ~10nm) and emission energy (few meV) allows construction of coupled QD systems.

CTuW7 • 4:00 p.m.
Whispering Gallery Modes in Quantum Dot Micropillar Cavities, *Ben Jones[1], Vasily Astratov[2], Ruth Oulton[1], Sang Lam[1], Daniele Sanvitto[1], David Whittaker[1], Mark Fox[1], Maurice Skolnick[1], Paul Fry[3], Mark Hopkinson[3]; [1]Dept. of Physics and Astronomy, Univ. of Sheffield, UK, [2]Dept. of Physics and Optical Science, Univ. of North Carolina at Charlotte, USA, [3]Dept. of Electronic and Electrical Engineering, Univ. of Sheffield, UK.* High Q-factor (~60,000) Whispering Gallery Modes are observed from GaAs based micropillar cavities with embedded InAs quantum dots. Low threshold lasing is observed in WGMs near to the peak of the QD ensemble.

Room C3 and C4

QELS

QTuI • Spatial Effects and Instabilities—Continued

QTuI5 • 3:30 p.m.
Spatial-Dispersion-Free Ultrashort Optical-Vortex-Pulse Generation Using Polarization Singularity, *Yu Tokizane, Taisuke Ogoshi, Atsushi Taniguchi, Kazuhiko Oka, Ryuji Morita; Dept. of Applied Physics, Hokkaido Univ., Japan.* The generation method of spatial-dispersion-free optical vortices using polarization singularity due to an axially-symmetric polarizer was proposed and demonstrated with an ultrabroad-band light(~350 to ~1000nm) and an ultrashort optical pulse (~50fs).

QTuI6 • 3:45 p.m.
Self-Trapping of Optical Vortices in Photonic Lattices Optically Induced with Self-Defocusing Nonlinearity, *Daohong Song[1], Liqin Tang[1], Cibo Lou[1], Xiaosheng Wang[2], Jingjun Xu[1], Zhigang Chen[1,2], H. Susanto[3], K. Law[3], P. G. Kevrekidis[3]; [1]Nankai Univ., China, [2]San Francisco State Univ., USA, [3]Univ. of Massachusetts, USA.* We demonstrate self-trapping of singly- and doubly-charged vortices in a self-defocusing "backbone" photonic lattice. While the singly-charged vortex can evolve into a gap vortex soliton, the doubly-charged tends to turn into quasi-vortex or quadrupole structure.

QTuI7 • 4:00 p.m.
Direct Determination of Light Beams' Topological Charges Using Diffraction, *Willamys C. Soares[1], Dilson P. Caetano[1], Eduardo J. S. Fonseca[1], Sabino Chávez-Cerda[2], Jandir M. Hickmann[1]; [1]Inst. de Física, Univ. Federal de Alagoas, Brazil, [2]Inst. Nacional de Astrofisica, Optica y Electronica, Mexico.* We demonstrate a new method to measure the phase singularity of light beams with orbital angular momentum, based on the diffraction by a triangular aperture. We have applied our method to Bessel and Laguerre-Gauss beams.

Room B1 and B2

CLEO

CTuX • Semiconductor THz Detectors and Emitters—Continued

CTuX4 • 3:30 p.m.
Observation of Enhanced THz Emission from InGaN/GaN Multiple Quantum Wells, *Xiaodong Mu, Yujie J. Ding, Ronald A. Arif, Muhammad Jamil, Nelson Tansu; Lehigh Univ., USA.* Broadband THz pulses have been generated from InGaN/GaN multiple quantum wells pumped by a frequency-doubled sub-picosecond laser amplifier at 395 nm. Enhanced THz emissions are strongly correlated with reduced photoluminescence intensities.

CTuX5 • 3:45 p.m.
Terahertz Emission from Nonpolar Gallium Nitride, *Grace D. Metcalfe[1], Eric D. Readinger[1], Hongen Shen[1], Michael Wraback[1], Asako Hirai[2], Erin Young[2], James S. Speck[2]; [1]US ARL, USA, [2]Materials Dept., Univ. of California at Santa Barbara, USA.* We observe polarized terahertz emission from nonpolar gallium nitride due to an in-plane polarization terminated by stacking faults. A measured flip of the THz waveform polarity agrees with carrier transport in an in-plane electric field.

CTuX6 • 4:00 p.m.
Ultrabroadband THz Field Detection beyond 170THz with a Photoconductive Antenna, *Masaaki Ashida[1,2], Ryota Akai[1], Hiroshi Shimosato[1], Ikufumi Katayama[1], Tadashi Itoh[1], Katsuhiko Miyamoto[3,4], Hiromasa Ito[3,4]; [1]Osaka Univ., Japan, [2]Japan Science and Technology Agency, Japan, [3]Tohoku Univ., Japan, [4]RIKEN, Japan.* We demonstrate ultrabroadband THz field detection with a photoconductive antenna using a combination of ultrashort laser pulses of 6fs duration and a DAST crystal. We successfully observed ultra-high frequency component beyond 170THz in near-infrared region.

Room J2

CLEO

CTuY • OPOs I—Continued

CTuY5 • 3:30 p.m.
A Coherent Tunable Source of High-Power Nanosecond Pulses at ~840 nm, Near the Fourier Limit of Optical Bandwidth, *Kenneth G. H. Baldwin[1], Mitsuhiko Kono[1], Richard T. White[2], Yabai He[2], Brian J. Orr[2]; [1]Australian Natl. Univ., Australia, [2]Macquarie Univ., Australia.* A chirp-controlled nanosecond-pulsed tunable optical parametric oscillator and twostage Ti:sapphire amplifier generate high-power coherent light at ~840 nm, with frequency stability and narrow optical bandwidth as needed for high-resolution ultraviolet spectroscopy.

CTuY6 • 3:45 p.m.
An Injection-Seeded Pulsed Optical Parametric Oscillator with a Self-Adaptive Cavity for High-Resolution Spectroscopy, *Brian J. Orr, Yabai He; Macquarie Univ., Australia.* An injection-seeded, self-adaptive optical parametric oscillator cavity with a photorefractive phase-conjugate reflector generates tunable nanosecond-pulsed output. Its narrow, single-longitudinal-mode optical bandwidth is verified by high-resolution spectroscopic measurements.

CTuY7 • 4:00 p.m.
Application of Mid-Infrared Attenuated Total Reflectance Spectroscopy Using Broadly Tunable OPOs, *A. F. Nieuwenhuis[1], Chris J. Lee[1], Peter J. M. van der Slot[1], Ian D. Lindsay[2], Petra Groß[3], K.-J. Boller[1]; [1]Univ. of Twente, Netherlands, [2]Univ. of Bristol, UK, [3]Westfälische Wilhelms-Univ. of Münster, Germany.* A singly resonant optical parametric oscillator based on MgO:PPLN is used as a tunable light source for attenuated total reflectance spectroscopy. Because of high emitted power spectral densities, diluting the sample can be avoided.

4:15 p.m.–4:45 p.m., Coffee Break, *Exhibit Hall*

NOTES

CLEO

CTuZ • Mid-IR Semiconductor Lasers—Continued

CTuZ5 • 3:30 p.m.
Large Tunability of an Optically Pumped Mid-IR Laser with Chirped Distributed-Feedback Grating, *Liang Xue[1], S.R.J. Brueck[1], Ron Kaspi[2]; [1]Univ. of New Mexico, USA, [2]AFRL, USA.* A CW, single-longitudinal-mode, optically pumped, type-II distributed-feedback laser at 4.3 µm is reported. Tunability of 27 nm (14 cm^{-1}) is obtained with the novel chirped grating design at a fixed temperature of 77 K.

CTuZ6 • 3:45 p.m.
Room Temperature, Sb-Based Monolithic EP-VCSEL at 2.3 µm Including 2 n-Type DBR, *Arnaud Ducanchez, Laurent Cerutti, Arnaud Garnache, Frédéric Genty; Inst. d'electronique du Sud, Univ. of Montpellier II, France.* We demonstrate a 2.3 µm emission at RT under quasi-CW operation from a Sb-based monolithic VCSEL. The structure is composed of 2 n-doped AlAsSb/GaSb DBR, a type-I GaInAsSb/AlGaAsSb QWs active region and a tunnel junction.

CTuZ7 • 4:00 p.m.
Intersubband Electroluminescence from a ZnCdSe/ZnCdMgSe Quantum Cascade Structure, *Kale J. Franz[1], William O. Charles[2], Aidong Shen[2], Anthony J. Hoffman[1], Maria C. Tamargo[2], Claire Gmachl[1]; [1]Princeton Univ., USA, [2]City College of New York, USA.* We show electrically-pumped transverse magnetic polarized intersubband emission from a ZnCdSe/ZnCdMgSe quantum cascade structure grown lattice-matched on InP. Electroluminescence centered near 4.8 µm was observed, in good agreement with calculations.

CTuAA • Eye-Safe Lasers—Continued

CTuAA5 • 3:30 p.m.
Cryogenically Cooled Laser Based on Resonantly Pumped Er^{3+}:Y_2O_3 Ceramic, *Nikolay Ter-Gabrielyan, Larry D. Merkle, G. Alex Newburgh, Mark Dubinskii; US ARL, USA.* Laser performance of Er^{3+}-doped Y_2O_3 ceramic is reported for the first time. Resonantly-pumped, eyesafe, 1.6-µm Er:Y_2O_3 cryo-laser slope efficiency of ~48% and output power ~ 7 W have been achieved in this first experiment.

CTuAA6 • 3:45 p.m.
Tunable Laser Operation of Tm:NaY(WO_4)$_2$, *Mauricio Rico[1], Jose M. Cano-Torres[1], Concepcion Cascales[1], Maria D. Serrano[1], Carlos Zaldo[1], Uwe Griebner[2], Valentin Petrov[2]; [1]Inst. de Ciencia de Materials de Madrid, Consejo Superior de Investigaciones Cientificas, Spain, [2]Max-Born-Inst., Germany.* CW laser operation of Tm^{3+} in Czochralski-grown disordered NaY(WO_4)$_2$ crystals is demonstrated. The tunability extends from 1847 to 2069 nm. The maximum slope efficiency and output power amount to ≈43% and ≈400 mW, respectively.

CTuAA7 • 4:00 p.m.
Widely Tunable Tm:YAG, Tm:YAP, Tm:LuAG, Tm:GdVO_4, Tm,Ho:GdVO_4 and Tm, Ho:YLF Lasers, *Yu-feng Li, Yue-zhu Wang, Bao-quan Yao, You-Lun Ju; Natl. Key Lab of Tunable Laser Technology, China.* Diode-pumped Tm:YAG, Tm:LuAG, Tm:YAP, Tm:GdVO_4, Tm,Ho:GdVO_4 and Tm,Ho:YLF lasers tuned by birefringent filters(BF) are demonstrated and compared. Tuning range of 1.8-2.1 micron is obtained from these six lasers with several watts power output.

CTuBB • Photonic Integrated Circuits—Continued

CTuBB2 • 3:30 p.m. Invited
Large-Scale High-Index-Contrast Planar Lightwave Circuits, *Brent Little, Sai Chu, Wei Chen, John Hryniewicz, Fred Johnson, Wenlu Chen, Dave Gill, Oliver King, Roy Davidson, Kevin Donovan, John Gibson; Infinera Corp., USA.* Large-scale optical integration is enabled by high-index contrast materials and building blocks. We highlight recent advances in the miniaturization of optical elements and of dense integration of planar lightwave circuits for Telecommunications and RF-Photonic applications.

CTuBB3 • 4:00 p.m.
Demonstration of an Electronic Photonic Integrated Circuit in a Commercial Scaled Bulk CMOS Process, *Jason S. Orcutt[1], Anatol Khilo[1], Milos A. Popovic[1], Charles W. Holzwarth[1], Benjamin Moss[1], Hanqing Li[1], Marcus S. Dahlem[1], Thomas D. Bonifield[2], Franz X. Kaertner[1], Erich P. Ippen[1], Judy L. Hoyt[1], Rajeev J. Ram[1], Vladimir Stojanovic[1]; [1]MIT, USA, [2]Texas Instruments Inc., USA.* We demonstrate the first photonic chip designed in a commercial bulk CMOS process (65 nm node) using standard process layers combined with scalable post-processing, enabling dense photonic integration with high-performance microprocessor electronics.

CTuCC • Nanowires, Whiskers and Needles—Continued

CTuCC5 • 3:30 p.m.
Micro-Photoluminescence from a Single InGaN-Based Nano-Pillar Fabricated by Focus Ion Beam Milling, *H. H. Yen[1], ChingHua Chiu[1], Peichen Yu[1], C. C. Kao[1], ChiaHung Lin[1], H. C. Kuo[1], T. C. Lu[1], S. C. Wang[1], W.Y. Yeh[2]; [1]Dept. of Photonics and Inst. of Electro-Optical Engineering, Natl. Chiao Tung Univ., Taiwan, [2]Electronics and Optoelectronics Res. Labs, Industrial Technology Res. Inst., Taiwan.* Micro-photoluminescence from GaN/InGAN multiple quantum wells embedded in a nano-pillar structure with a diameter of 300nm is characterized. The emission spectrum shows a blue shift of 68.3 meV in energy due to strain relaxation.

CTuCC6 • 3:45 p.m.
Enhanced Fluorescence via Photonic Crystal Slabs Incorporating Nanorod Structures, *Wei Zhang, Nikhil Ganesh, Patrick C. Mathias, Brian T. Cunningham; Univ. of Illinois at Urbana-Champaign, USA.* The emission intensity of a fluorescent dye is increased by 104 times through the combined effects of enhanced near-fields produced by a 1-dimensional photonic crystal and enhanced surface area provided by a nanorod coating.

CTuCC7 • 4:00 p.m.
Photophysics of Si Nanostructures: Ensembles and Single Particles, *Alex R. Guichard, Rohan D. Kekatpure, Mark L. Brongersma; Stanford Univ., USA.* Optical properties of various Si nanostructures are discussed. The Auger coefficient of $TiSi_2$-catalyzed Si nanowires is 2x10^{-13} cm^3/s. To avoid ensemble artifacts, fabrication and optical analysis of single nanowires and nanoparticles is presented.

4:15 p.m.–4:45 p.m., Coffee Break, *Exhibit Hall*

NOTES

Marriott San Jose Salon 5 and 6 | PhAST Room 1 | PhAST Room 2 | PhAST Room 3

CLEO

CTuDD • Resonators and Dispersion Engineering—Continued

CTuDD5 • 3:30 p.m.
Dispersion Engineering of Silicon Nanophotonic Wires Using Thin Film Over-Claddings, *William M. J. Green[1], Xiaoping Liu[2], Xiaogang Chen[2], Solomon Assefa[1], Richard M. Osgood, Jr.[2], Yurii A. Vlasov[1]; [1]IBM Res., USA, [2]Columbia Univ., USA.* Numerical simulations and experiments are performed to investigate the use of thin conformal silicon nitride cladding layers to engineer the dispersion properties of silicon nanophotonic waveguides.

CTuDD6 • 3:45 p.m.
Measurement of a Flat Lens Focusing in a 2-D Photonic Crystal at Optical Wavelength, *Nathalie Fabre[1], Loic Lalouat[2], Benoit Cluzel[2], Xavier Mélique[1], Didier Lippens[1], Frédérique de Fornel[2], Olivier Vanbésien[1]; [1]Inst. of Electronic Micro and Nanotechnology, France, [2]Inst. Carnot de Bourgogne, France.* Using Scanning Near field Optical Microscopy (SNOM), we observed the focusing effect provided by negative refraction in a 2-D photonic crystal. Experimental observations are analyzed in light of FDTD 3-D simulations.

CTuDD7 • 4:00 p.m.
Supercollimation in Photonic Crystals Composed of Nano-Scale Silicon Rods, *Ta-Ming Shih[1], Marcus Dahlem[1], Andre Kurs[1], Gale Petrich[1], Marin Soljacic[1], Erich Ippen[1], Leslie Kolodziejski[1], Katherine Hall[2], Morris Kesler[2]; [1]MIT, USA, [2]Wide Net Technologies, USA.* Supercollimation is the diffraction-less propagation of light using the dispersion properties of specially-designed photonic crystals. We have measured supercollimation in photonic crystals composed of nano-scale rods over distances of up to one thousand lattice periods.

PhAST

PTuD • Lasers and LED Displays II—Continued

PTuD4 • 3:45 p.m. Invited
532 nm from Frequency-Doubled, Monolithic Master-Oscillator-Power-Amplifier Laser Diode, *Paul Rudy; QPC Lasers, Inc., USA.* We have frequency-doubled high power single mode laser diodes using a simple design suitable for cost effective, efficient, compact visible light engines. Initial doubling experiments produce over 100 mW CW power at 532 nm from ~1 W CW at 1064 nm based on an extra-cavity design using a bulk SHG crystal. We also demonstrate up to 9 W CW at 1064 nm from a monolithic single chip with single spatial mode and single frequency operation and recently demonstrated substantially higher power visible laser operation.

PTuF • Business Growth for OLED Lighting—Continued

PTuF5 • 3:35 p.m.
PANEL: What Is the Roadmap for Market Penetration of OLEDs into GPL by Segment?

4:15 p.m.–4:45 p.m., Coffee Break, *Exhibit Hall*

NOTES

4:45 p.m.–6:30 p.m.
QTuJ • Nanoplasmonics IV
Romain Quidant; Inst. de Sciences Fotoniques, Spain, Presider

QTuJ1 • 4:45 p.m.
Perfect 90º Bending and 4-Ways Memoryless Splitting of Plasmons in a Nano-Junction, *Eyal Feigenbaum, Meir Orenstein; Israel Inst. of Technology, Israel.* Plasmonic wave is perfectly split to 4 identical waves when encountering nano intersection. This is substantially different from photonic waveguides exhibiting negligible coupling to vertical segments. Larger plasmonic junction is exhibiting retardation and memory effects.

QTuJ2 • 5:00 p.m.
Electro-Plasmonics: Dynamical Plasmonic Circuits with Minimized Parasitic Scattering, *Viktor A. Podolskiy, Justin Elser; Oregon State Univ., USA.* We demonstrate that enhanced electro-optical effect in plasmonic microstructures is accompanied by dramatically reduced parasitic scattering of surface waves. Analytical description of relevant physics and implications for creation of high-performance dynamical plasmonic circuits are discussed.

QTuJ3 • 5:15 p.m.
Plasmonic Filters with IR Windows of Transparency, *Vashista C. de Silva, Piotr Nyga, Mark D. Thoreson, Vladimir P. Drachev, Vladimir M. Shalaev; Purdue Univ., USA.* Plasmonic filters were fabricated based on gold fractal nanostructures grown on silica microspheres. The fractal nanostructures were modified using laser irradiation, resulting in decreased extinction in the mid-infrared range.

QTuJ4 • 5:30 p.m.
From Slowing Down to Stopping of Electromagnetic Waves Within Ultrawide Bandwidth Based on Plasmonic Graded Metallic Gratings: A Novel Scheme for "Trapped Rainbow," *Qiaoqiang Gan, Zhan Fu, Yujie J. Ding, Filbert J. Bartoli; Lehigh Univ., USA.* We demonstrate that since the group velocity of spoof surface plasmon polariton modes at the cutoff frequency is extremely low, electromagnetic waves with different frequencies can be slowed down or even stopped at different positions.

4:45 p.m.–6:30 p.m.
QTuK • QELS Symposium on Quantum Light-Matter Interfaces II
Presider to Be Announced

QTuK1 • 4:45 p.m. Invited
Quantum Interface between Light and Matter: New Approaches and Applications, *A. Akimov, M. Bajscy, D. Chang, E. Togan, J. Maze, A. S. Zibrov, Mikhail D. Lukin; Harvard Univ., USA.* We will describe experimental realization of two novel approaches to quantum interface between single photons and spins in atomic and solid-state systems. Progress towards implementation of potential applications of these techniques will be discussed.

QTuK2 • 5:15 p.m.
Coherent Transfer of Light Polarization to Electron Spins in a Semiconductor: Toward Quantum Media Conversion, *Hideo Kosaka[1,2], Hideki Shigyou[1], Yasuyoshi Mitsumori[1,2], Yoshiaki Rikitake[2,3], Hiroshi Imamura[2,3], Takeshi Kutsuwa[2], Keiichi Edamatsu[1]; [1]Tohoku Univ., Japan, [2]CREST-JST, Japan, [3]Nanotechnology Res. Inst., AIST, Japan.* We demonstrate that the superposition of light polarization states is coherently transferred to electron spins in a semiconductor quantum well via the light-hole excitons under in-plane magnetic field by using time-resolved Kerr rotation.

QTuK3 • 5:30 p.m.
A Practical Protocol for Quantum Networking with Semiconductor Quantum Dots, *Edo Waks, Deepak Sridharan; Univ. of Maryland at College Park, USA.* A protocol is presented for generating entanglement between spatially separated quantum dots with different emission wavelengths and radiative lifetimes. This protocol can be practically implemented in semiconductor systems where emitters suffer from large inhomogeneous broadening.

4:45 p.m.–6:30 p.m.
CTuEE • Optical Parametric Chirped Pulse Amplifiers
Franz X. Kaertner; MIT, USA, Presider

CTuEE1 • 4:45 p.m.
5-fs Multi-mJ CEP-Locked OPCPA System at 1 kHz, *Shunsuke Adachi[1,2], Nobuhisa Ishii[1,2], Hiroki Ishii[1,2], Teruto Kanai[1,2], Atsushi Kosuge[1,2], Shuntaro Watanabe[1,2], Yohei Kobayashi[2,3], Dai Yoshitomi[2,3], Kenji Torizuka[2,3]; [1]Inst. for Solid State Physics, Univ. of Tokyo, Japan, [2]Core Res. for Evolutional Science and Technology, Japan Science and Technology Agency, Japan, [3]Natl. Inst. of Advanced Industrial Science and Technology (AIST), Japan.* We report an optical parametric chirped-pulse amplification (OPCPA) system with the pulse duration of 5.5 fs at a 1-kHz repetition rate, pumped by a 450-nm pulse from a frequency-doubled Ti:Sapphire laser.

CTuEE2 • 5:00 p.m.
Two-Micron Optical Parametric Chirped Pulse Amplifier for Long-Wavelength Driven High Harmonic Generation, *Jeffrey Moses, Oliver D. Muecke, Andrew Benedick, Edilson L. Falcao-Filho, Shu-Wei Huang, Kyung-Han Hong, Aleem M. Siddiqui, Jonathan R. Birge, F. Omer Ilday, Franz X. Kaertner; MIT, USA.* An optical parametric chirped pulse amplification system producing high-energy, few-cycle pulses at 2.0-µm wavelength with low superfluorescence noise background for high harmonic generation in gas jets is demonstrated.

CTuEE3 • 5:15 p.m.
Near-Infrared Non-Collinear Optical Parametric Amplification in Bulk Potassium-Titanyl Phosphate with >2500 cm^{-1} Bandwidth, *Oleksandr Isaienko, Eric Borguet; Temple Univ., USA.* We report non-collinear optical parametric amplification in a bulk $KTiOPO_4$ (KTP) crystal generating ultra-broadband near-IR pulses, that cover simultaneously the wavelength region ~1050-1450 nm with a bandwidth >2500 cm^{-1}.

CTuEE4 • 5:30 p.m.
Nearly Octave Broadband High-Powered Optical Parametric Amplification toward Monocycle Regime, *Keisaku Yamane[1,2], Takashi Tanigawa[1,2], Taro Sekikawa[1,2], Mikio Yamashita[1,2]; [1]Hokkaido Univ., Japan, [2]Core Res. for Evolutional Science and Technology, Japan Science and Technology Agency, Japan.* We demonstrated the generation of 34-µJ 14-fs optical pulses with an ultrabroad bandwidth (540-1000 nm) by the use of one angularly-dispersed non-collinear optical parametric amplifier.

4:45 p.m.–6:30 p.m.
CTuFF • Ultrafast Fiber Lasers II
Martin Fermann; IMRA America, Inc, USA, Presider

CTuFF1 • 4:45 p.m.
Pulse Dynamic in a Passively Mode-Locked Chirped-Pulse Fiber Laser, *Bülend Ortac[1], Marco Plotner[1], Thomas Schreiber[2], Jens Limpert[1], Andreas Tünnermann[1]; [1]Inst. of Applied Physics, Friedrich-Schiller-Univ. Jena, Germany, [2]Fraunhofer Inst. for Applied Optics and Precision Engineering, Germany.* We report experimental and numerical results on the pulse dynamic of passively mode-locked Yb-doped fiber laser operating in the chirped-pulse regime. A newly design cavity with a CFBG provides positive dispersion with negligible nonlinearity.

CTuFF2 • 5:00 p.m.
Fourier Domain Mode Locking Theory, *Christian Jirauschek[1], Christoph Eigenwillig[2], Benjamin Biedermann[2], Robert Huber[2]; [1]Technische Univ. München, Germany, [2]Ludwig-Maximilians-Univ. München, Germany.* We present a theoretical model for the recently developed Fourier domain mode locked (FDML) lasers. The good agreement with experiment provides valuable insights into the mechanism of FDML operation.

CTuFF3 • 5:15 p.m.
Spectrally Breathing Femtosecond Pulses from an Er-Doped Fiber Laser, *Bulent Oktem, Coskun Ulgudur, F. Oemer Ilday; Bilkent Univ., Turkey.* We report order-of-magnitude spectral breathing in a dispersion-managed Er-fiber laser with an intra-cavity bandpass filter. This is to our knowledge the highest of any laser reported. Pulse energy is 1.7 nJ, width is 110 fs.

CTuFF4 • 5:30 p.m.
Highly Normal Dispersion Er-Doped Fiber Laser Mode-Locked with a SESAM, *Amelie Cabasse[1], Bülend Ortac[2], Gilles Martel[1], Ammar Hideur[1], Jens Limpert[2]; [1]Complexe de Recherche Interprofessionnel en Aérothermochimie, Unité Mixte de Recherche, Univ. de Rouen, France, [2]Inst. of Applied Physics, Friedrich-Schiller-Univ., Germany.* We report on a passively mode-locked erbium fiber laser operating in a highly-positive dispersion regime. Highly-chirped pulses with 5.4 ps duration and 8 nm spectral bandwidth are generated. They are compressed down to 757 fs.

Room C1 and C2

CLEO

4:45 p.m.–6:30 p.m.
CTuGG • Light Emission II
Minghao Qi; Purdue Univ., USA, Presider

CTuGG1 • 4:45 p.m.
Prospects for Epitaxial c-Er_2O_3 as a CMOS-Compatible Lasing Material, *Christopher P. Michael[1], Oskar Painter[1], Homan B. Yuen[2], Vijit A. Sabnis[2], Aleta Jamora[2], Scott Semans[2], Peter B. Atanackovic[2]; [1]Caltech, USA, [2]Translucent, Inc., USA.* The emission of high-Q c-Er_2O_3 resonators displays little inhomogeneous broadening, robust vacuum-Rabi splitting, and strong upconversion. Considering these effects and a rate-equation model, we analyze the prospects for optically pumped on-chip lasing using c-Er_2O_3.

CTuGG2 • 5:00 p.m.
Enhanced Erbium Emission in Photonic Crystal Nanocavities, *Maria Makarova[1], Vanessa Sih[1], Joe Warga[2], Luca Dal Negro[2], Jelena Vuckovic[1]; [1]Stanford Univ., USA, [2]Boston Univ., USA.* We fabricated photonic crystal nanocavities to enhance erbium (Er) emission in silicon-rich nitride nanocrystals. We observed experimental quality factors of ~6000 and 20-fold enhancement, in agreement with numerical calculations of the Purcell effect.

CTuGG3 • 5:15 p.m.
An On-Chip Erbium Doped Three-Photon Upconversion Silica Microlaser Emitting at Green Wavelengths, *Tao Lu[1], Lan Yang[2], Rob V. A. van Loon[3], Albert Polman[3], Kerry Vahala[1]; [1]Caltech, USA, [2]Washington Univ. in St. Louis, USA, [3]Inst. for Atomic and Molecular Physics, Foundation for Fundamental Res. on Matter, Netherlands.* We report an on-chip Erbium doped silica upconversion toroid laser. Pumped at Infrared wavelengths (1450 nm) with threshold power as low as 689 µW, the laser emits green light via continuously absorbing three pump photons.

CTuGG4 • 5:30 p.m.
Microdisk Laser Linewidth and Spontaneous Emission Rate Enhancement, *Mahmood Bagheri, Min Hsiung Shih, Ling Lu, Raymond Sarkissian, William K. Marshall, Seung June Choi, John D. O'Brien, P. Daniel Dapkus; Univ. of Southern California, USA.* An increase in the spectral width of microdisk laser spectra biased slightly above threshold is experimentally observed, and an increase in spontaneous emission rate in devices with small optical mode volume is demonstrated.

Room C3 and C4

QELS

4:45 p.m.–6:30 p.m.
QTuL • Third Order Effects/ Chalcogenides
Ady Arie; Tel-Aviv Univ., Israel, Presider

QTuL1 • 4:45 p.m.
Enhancement of Laser-Induced Gratings Diffraction Efficiency by Forcing Molecular Rotation, *Dimitrii N. Kozlov[1], Johannes Kiefer[2], Markus C. Weikl[2], Thomas Seeger[2], Alfred Leipertz[2]; [1]A.M. Prokhorov General Physics Inst., Russian Acad. of Sciences, Russian Federation, [2]Lehrstuhl für Technische Thermodynamik and Erlangen Graduate School in Advanced Optical Technologies, Friedrich-Alexander-Univ. Erlangen-Nürnberg, Germany.* For the first time to our knowledge, thermal laser-induced gratings (LIGs) are generated via two-photon stimulated Raman excitation of pure rotational transitions in molecules employing a single broadband pump laser.

QTuL2 • 5:00 p.m.
Hot and Cold Phonons Induced by Electric Field and Resonant Raman Scattering in GaN/AlN Triangular Quantum Well, *Guibao Xu[1], Suvranta K. Tripathy[1], Xiaodong Mu[1], Yujie J. Ding[1], Kejia Wang[2], Cao Yu[2], Debdeep Jena[2], Jacob B. Khurgin[3]; [1]Lehigh Univ., USA, [2]Univ. of Notre Dame, USA, [3]Johns Hopkins Univ., USA.* We have evidenced hot and cold longitudinal-optical (LO) phonons induced by electric field and resonant Raman scattering in GaN/AlN triangular quantum well, probed by first-order and second-order resonant Raman scattering of 3-ps light pulses.

QTuL3 • 5:15 p.m.
Control of the Third-Order Nonlinearities in a GaAs/AlGaAs Superlattice by Ion Implantation Quantum Well Intermixing, *Sean J. Wagner[1], Amr S. Helmy[1], J. Stewart Aitchison[1], Usman Younis[2], Barry M. Holmes[2], David C. Hutchings[2]; [1]Univ. of Toronto, Canada, [2]Univ. of Glasgow, UK.* Self-phase modulation was observed in GaAs/AlGaAs superlattice-core waveguides that were quantum well intermixed by ion implantation. The band gap was blue-shifted by 68 nm and the Kerr effect was suppressed by 67% after intermixing.

QTuL4 • 5:30 p.m.
Nonlinear Long-Period Gratings in As_2Se_3 Chalcogenide Fiber for All-Optical Switching, *Hong C. Nguyen, Dong -I. Yeom, C. M. de Sterke, Klaus Finsterbusch, Eric C. Magi, Libin B. Fu, Boris T. Kuhlmey, Benjamin J. Eggleton; Ctr. for Ultrahigh Bandwidth Devices for Optical Sciences, Univ. of Sydney, Australia.* We experimentally demonstrate all-optical switching using an acoustically generated long-period grating in highly nonlinear As_2Se_3 chalcogenide fiber. The results, with numerical simulations, demonstrate switching at optical powers two orders of magnitude lower than in silica.

Room B1 and B2

CLEO

4:45 p.m.–6:30 p.m.
CTuHH • THz Parametric Generation
Weili Zhang; Oklahoma State Univ., USA, Presider

CTuHH1 • 4:45 p.m.
Generation of 260-µW Fourier-Transform-Limited Nanosecond THz Pulses by Frequency-Mixing Two CO_2 Lasers, *Yi Jiang, Yujie J. Ding; Lehigh Univ., USA.* Coherent THz pulses at 328.2 µm were generated by mixing two CO_2 laser frequencies based on collinear phase-matched difference-frequency generation in GaSe crystals. The highest average output power was measured to be 260 µW.

CTuHH2 • 5:00 p.m.
Phase-Matched THz-Wave Generation in a Planar GaAs Waveguide, *Konstantin L. Vodopyanov[1], Yuri H. Avetisyan[2]; [1]Stanford Univ., USA, [2]Radiophysics Faculty, Yerevan State Univ., Armenia.* Using near-degenerate optical parametric oscillator operating at ~2 microns as a dual-wavelength pump source, we generated tunable THz radiation near 2THz, at a microwatt power level, with TM_0 propagation mode of a planar GaAs waveguide.

CTuHH3 • 5:15 p.m.
Tunable THz Source Based on Intracavity Parametric Down-Conversion in Quasi-Phase-Matched GaAs, *Joseph Schaar[1], Konstantin Vodopyanov[1], Paulina Kuo[1], Martin Fejer[1], Angie Lin[1], Xiaojun Yu[1], James Harris[1], David Bliss[2], Candace Lynch[2], Vladimir Kozlov[3], Walter Hurlbut[3]; [1]Stanford Univ., USA, [2]AFRL, USA, [3]Microtech Instruments, Inc., USA.* We developed an efficient frequency-tunable THz source using intracavity mixing between the two resonant waves of a synchronously pumped doubly resonant OPO. Three types of quasi-phase-matched GaAs were utilized: optically contacted, orientation-patterned, and diffusion-bonded GaAs.

CTuHH4 • 5:30 p.m.
Generation of THz Pulses in Teflon Bonded Periodically Inverted GaAs Structures, *Sergei Tochitsky, Sarah Trubnick, Chan Joshi; Dept. of Electrical Engineering, Univ. of California at Los Angeles, USA.* A novel technique for low-temperature bonding of GaAs wafers using an interboundary Teflon film is developed. A 2x2 cm^2 quasi-phase matched structure of 5 wafers pumped by CO_2 laser lines generated the narrow-band THz radiation.

Room J2

4:45 p.m.–6:30 p.m.
CTuII • OPOs II
Narasimha S. Prasad; NASA Langley Res. Ctr., USA, Presider

CTuII1 • 4:45 p.m.
20-50 kHz Mid-Infrared OP-GaAs OPO, *Christelle Kieleck[1], Marc Eichhorn[1], Antoine Hirth[1], David Faye[2], Eric Lallier[2]; [1]French-German Res. Inst. of Saint-Louis, France, [2]Thales Res. and Technology France, France.* An efficient OP-GaAs OPO pumped by a high repetition rate (20-50 kHz) Q-switched Ho:YAG laser is presented. The slope efficiency is 53% at 20 kHz. Influence of pump polarization on OPO performance is tested.

CTuII2 • 5:00 p.m.
Multi-Watt Mid-IR Fiber-Pumped OPO, *Daniel Creeden, Peter A. Ketteridge, Peter A. Budni, Kevin Zawilski, Peter G. Schunemann, Thomas M. Pollak, Evan P. Chicklis; BAE Systems, USA.* We have demonstrated a multi-watt mid-IR ZGP OPO pumped by a pulsed Tm-doped fiber laser operating at 1.995um. 2W of total mid-IR output power has been generated in the 3.4-3.9µm and 4.0-4.7µm spectral regions simultaneously.

CTuII3 • 5:15 p.m.
Electro-Optically Q-Switched Tm:YAG Laser Pumped ZGP Optical-Parametric Oscillator, *Marc Eichhorn, Antoine Hirth; French-German Res. Inst. of St. Louis, France.* We present what is believed to be the first Tm:YAG laser pumped ZGP-OPO. Pump energies of 4 mJ and OPO 3-5 µm output energies of 1 mJ were achieved at 100 Hz repetition rate.

CTuII4 • 5:30 p.m.
Narrow-Bandwidth Mid-IR Generation Based on a Large Aperture Periodically Poled Mg-Doped $LiNbO_3$ Optical Parametric Pump System, *Jiro Saikawa[1], Mitsuhiko Miyazaki[1], Masaaki Fujii[1], Hideki Ishizuki[2], Takunori Taira[2]; [1]Tokyo Inst. of Technology, Japan, [2]Inst. for Molecular Science, Japan.* We have developed a narrow-bandwidth (<$2cm^{-1}$) Mid-IR optical parametric system with a large-aperture PPMgLN based 2µm pump system. The system tuned from 4.7 to 10.6µm, and the maximum output energy of 1.7mJ was obtained.

Room J3	Marriott San Jose Salon 1 and 2	Marriott San Jose Salon 3	Marriott San Jose Salon 4

CLEO

4:45 p.m.–6:30 p.m.
CTuJJ • Novel Semiconductor Emitters
Cun-Zheng Ning; Arizona State Univ., USA, Presider

CTuJJ1 • 4:45 p.m. Invited

Room Temperature Polariton Lasing and BEC in Semiconductor Microcavities, *Jeremy J. Baumberg[1], S. Christopoulos[1], G. Baldassarri Höger von Högersthal[2], A. Grundy[2], P. G. Lagoudakis[2], A. Kavokin[2], G. Christmann[3], R. Butté[3], E. Feltin[3], J. F. Carlin[3], N. Grandjean[3], Dmitry Solnyshkov[4], G. Malpuech[4]; [1]Dept. of Physics, Univ. of Cambridge, UK, [2]Dept. of Physics and Astronomy, Univ. of Southampton, UK, [3]Ecole Polytechnique Fédérale de Lausanne, Inst. for Quantum Electronics and Photonics, Switzerland, [4]Lab des Sciences et Matériaux pour l'Electronique, et d'Automatique, Ctr. Natl. de la Recherche Scientifique, Univ. Blaise Pascal, France.* Strongly-coupled GaN semiconductor microcavities exhibit polariton effects at room temperature. We show sub-mW thresholds for coherent polariton lasing at 300K, and discuss polarization evidence for the formation of Bose-Einstein polariton condensates.

CTuJJ2 • 5:15 p.m.

Room-Temperature Spin-Controlled Optoelectronic Devices, *Stephan Hoevel[1], Nils C. Gerhardt[1], Martin R. Hofmann[1], Fang-Yuh Lo[1], Dirk Reuter[1], Andreas D. Wieck[1], Ellen Schuster[2], Werner Keune[2]; [1]Ruhr-Univ., Germany, [2]Univ. Duisburg-Essen, Germany.* Spin-dependent optoelectronic devices for room temperature spin-controlled photonics are presented containing remanent spin injection in LEDs, spin amplification and emission by VCSELs and spin detection.

CTuJJ3 • 5:30 p.m.

Photonic Crystal Single-Mode DFB Laser Array with Precise Frequency Spacing, *Alexandre Larrue, Olivier Bouchard, Laurent Jalabert, Alexandre Arnoult, Antoine Monmayrant, Olivier Gauthier-Lafaye, Sophie Bonnefont, Françoise Lozes-Dupuy; LAAS-CNRS, Univ. de Toulouse, France.* We have developed integrated DFB laser arrays using photonic crystal waveguide on membrane. They exhibit stable and controlled single-mode emissions with wavelength spacings as small as 0.3 nm.

4:45 p.m.–6:30 p.m.
CTuKK • Novel Solid-State Lasers and Materials
Iain T. McKinnie; Kapteyn Murnane Labs, USA, Presider

CTuKK1 • 4:45 p.m.

First Report of Absorption and Fluorescence Singularities in the Nd:YCOB Monoclinic Crystal, *Yannick Petit[1], Benoit Boulanger[1], Patricia Segonds[1], Corinne Felix[1], Bertrand Menaert[1], Julien Zaccaro[1], Gérard Aka[2]; [1]Inst. NEEL, France, [2]Ecole Nat. Supérieure de Chimie de Paris, France.* We report measurements in polarized light of angular distribution of absorption and fluorescence of a monoclinic crystal. Patterns are close to the biaxial index surface topology but main values are not in the dielectric frame.

CTuKK2 • 5:00 p.m.

Efficient Q-Switched $Yb:YAl_3(BO_3)_4/Cr^{4+}:YAG$ Lasers, *Junhai Liu[1], Uwe Griebner[2], Valentin Petrov[2], Huaijin Zhang[3], Jing Li[3], Jiyang Wang[3]; [1]Qingdao Univ., China, [2]Max-Born-Inst., Germany, [3]Shandong Univ., China.* Q-switched diode-pumped $Yb:YAl_3(BO_3)_4$ lasers provide an average output power of 4.15 W, pulse energy of 139 µJ, pulse duration of 18 ns, and a slope efficiency of 59% operating near 1040 nm at room temperature.

CTuKK3 • 5:15 p.m. Invited

Dy^{3+} and Pr^{3+} Doped Crystals for Mid-IR Lasers, *Andrey G. Okhrimchuk; Fiber Optics Res. Ctr., Russian Acad. of Sciences, Russian Federation.* Here is presented a review of rare-earth doped crystals wherein mid-IR oscillation is demonstrated. Advantages and disadvantages of low phonon matrixes are examined.

4:45 p.m.–6:30 p.m.
CTuLL • Optical Access
Ping Kong Wai; Hong Kong Polytechnic Univ., Hong Kong, Presider

CTuLL1 • 4:45 p.m. Tutorial

A Physical Layer Perspective on Current and Next-Generation Passive Optical Networks, *Kenneth C. Reichmann, Patrick P. Iannone; AT&T Labs-Res., USA.* This tutorial will focus on physical layer issues associated with passive optical networks. Corresponding technologies of present and future deployments will also be discussed.

Ken Reichmann, B.S. Physics '79, M.S. Elec. Eng. '98, is a Principal Member of Technical Staff in the Optical Systems Research dept. at AT&T Labs-Research, concentrating on passive optical network technologies for metro, business and residential access. He is a Senior Member of the IEEE.

4:45 p.m.–6:30 p.m.
CTuMM • Novel Fiber Structures
Presider to Be Announced

CTuMM1 • 4:45 p.m.

Chemical Fluid Deposition of Semiconductors inside a Microstructured Optical Fiber for Optoelectronic Applications, *Mahesh Krishnamurthi[1], Dong J. Won[1], Neil Baril[1], Rongrei He[1], Chris E. Finlayson[2], Adrian A. Correa[2], Pier Sazio[2], John Badding[1], Venkatraman Gopalan[1]; [1]Pennsylvania State Univ., USA, [2]Univ. of Southampton, UK.* A technique to fill semiconductors inside a microstructured optical fiber is developed. The structural, electrical and optical properties are investigated. All-optical modulation of light and an in-fiber field effect transistor are demonstrated using this device.

CTuMM2 • 5:00 p.m.

"Colorful" Solid-Core Bragg Fibers Guiding in the Visible, *Alexandre Dupuis, Ning Guo, Bertrand Gauvreau, Alireza Hassani, Elio Pone, Francis Boismenu, Maksim Skorobogatiy; Ecole Polytechnique de Montreal, Canada.* We report on the fabrication and characterization of intensely colored solid core all-polymer Bragg fibers. By modifying the reflector layer thickness we illustrate that bandgap position can be adjusted at will in the visible.

CTuMM3 • 5:15 p.m.

All-Solid Photonic Bandgap Fiber with Large Mode Area and High Order Modes Suppression, *Olga N. Egorova[1], Dmitriy A. Gaponov[1], Nasar A. Harchenko[1], Aleksey F. Kosolapov[1], Sergey A. Letunov[1], Andrey D. Pryamikov[1], Sergey L. Semjonov[1], Evgenii M. Dianov[1], Vladimir F. Khopin[2], Mikhail Y. Salganskii[2], Aleksey N. Guryanov[2], Dmitrii V. Kuksenkov[3]; [1]Fiber Optics Res. Ctr., Russian Federation, [2]Inst. of Chemistry of High Purity Substances, Russian Federation, [3]Corning Inc., USA.* We present all-solid bandgap fiber design with the small ratio of cladding elements diameter to pitch (0.24), with MFD of 36µm at 1µm wavelength and higher order mode suppression caused by the propagation loss difference.

CTuMM4 • 5:30 p.m.

Mass-Fabrication of Air-Core Microstructured Polymer Optical Fiber, *Lijun Kang, Lili Wang, Xinghua Yang, Jian Wang; Xi'an Inst. of Optics and Precision Mechanics, Chinese Acad. of Sciences, China.* An air-core, 252 holes cladding, 51% air-occupied fraction PMMA-based MPOF as successfully fabricated by drawing an extruded 253 holes preform. With the extrusion technique, air-core MPOF preform could be produced on a large scale.

Marriott San Jose
Salon 5 and 6

CLEO

4:45 p.m.–6:30 p.m.
CTuNN • Wavelength Selective Elements
Bert J. Offrein; IBM Res., Switzerland, Presider

CTuNN1 • 4:45 p.m.
Design and Fabrication of an Ultra-Compact Silicon on Insulator Demultiplexer Based on Arrayed Waveguide Gratings, *Xiaoping Liu[1], I-Wei Hsieh[1], Xiaogang Chen[1], Mitsuhide Takekoshi[1], Jerry I. Dadap[1], Nicolae C. Panoiu[1], Richard M. Osgood Jr.[1], William M. Green[2], Fengnian Xia[2], Yurii A. Vlasov[2]; [1]Columbia Univ., USA, [2]IBM T. J. Watson Lab, USA.* We present the design and fabrication of a SOI ultra-compact wavelength-demultiplexer based on arrayed-waveguide-gratings. The size of device is <0.1mm^2 and the simulation shows that crosstalk is >30dB between channels and insertion loss is ~1dB.

CTuNN2 • 5:00 p.m.
Silicon Self-Suspended Resonant Grating Filters at Telecommunication Wavelength, *Jia-Sheng Ye, Naoki Matsuyama, Yoshiaki Kanamori, Kazuhiro Hane; Dept. of Nanomechanics, Tohoku Univ., Japan.* A silicon self-suspended grating was fabricated using nanolithography technology. Experimental results showed that it served as an optical filter through guide mode resonance, which agreed with theoretical simulations by rigorous coupled wave method.

CTuNN3 • 5:15 p.m.
Experimental Demonstration of Loop-Coupled Microring Resonators for Optimally Sharp Optical Filters, *Milos A. Popovic, Tymon Barwicz, Peter T. Rakich, Marcus S. Dahlem, Charles W. Holzwarth, Fuwan Gan, Luciano Socci, Michael R. Watts, Henry I. Smith, Franz X. Kärtner, Erich P. Ippen; MIT, USA.* We present the first experimental demonstration of recently proposed loop-coupled resonator device concepts, with characteristic transmission zeros, enabling optimally sharp passbands for channel add-drop filter applications. Fourth-order SiN-core and Si-core strong-confinement microring-resonator designs are described.

CTuNN4 • 5:30 p.m.
2-D Resonant Grating Optical Filters for 850 nm Wavelength, in Normal and Oblique Incidence, *Stephan Hernandez[1], Olivier Gauthier-Lafaye[1], Anne-Laure Fehrembach[2], Anne Sentenac[2], Sophie Bonnefont[1], Philippe Arguel[1], Françoise Lozes-Dupuy[1]; [1]LAAS CNRS, Univ. de Toulouse, France, [2]Inst. Fresnel, France.* Performances of narrow-band 2-D resonant grating filters working for normal or high oblique incidence at 850 nm are investigated. Maximum reflectivity of 54% with 0.4 nm FHWM, and quasi-polarization independence are achieved.

NOTES

QTuJ • Nanoplasmonics IV—Continued

QTuJ5 • 5:45 p.m.
Plasmonic Nano-Laser Based on Metallic Bowtie Cavity, *Shu-Wei Chang, Shun Lien Chuang; Dept. of Electrical and Computer Engineering, Univ. of Illinois at Urbana-Champaign, USA.* We propose a nano-laser utilizing a cylindrical bowtie cavity. The low threshold current and nanometer-scale confinement of the lasing mode are achievable due to the field enhancement from plasmonic and curvature effects of bowtie tips.

QTuJ6 • 6:00 p.m.
Stimulated Emission of Surface Plasmon Polaritons, *M. A. Noginov[1], G. Zhu[1], M. Mayy[1], B. A. Ritzo[1], N. Noginova[1], V. A. Podolskiy[2]; [1]Norfolk State Univ., USA, [2]Oregon State Univ., USA.* We have observed stimulated emission of surface plasmon polaritons (SPPs) propagating at the interface between a silver film and a film of optically pumped polymethyl methacrylate (PMMA) doped with rhodamine 6G (R6G) dye.

QTuJ7 • 6:15 p.m.
High Accuracy Numerical Method for Index of Refraction Estimation with Surface Plasmon Bandgap Structures, *Colin Alleyne[1], Andrew G. Kirk[1], Paul G. Charette[2]; [1]McGill Univ., Canada, [2]Univ. de Sherbrooke, Canada.* Eigenvector analysis on 2-D surface plasmon photonic bandgap images is used for refractive index estimation. High precision (*rms* error of 3.8×10^{-8}RIU) and large dynamic range (n=1.305 to 1.375) are achieved with noisy data.

QTuK • QELS Symposium on Quantum Light-Matter Interfaces II—Continued

QTuK4 • 5:45 p.m. Invited
Cavity QED with Single Atomic and Photonic Qubits, *Gerhard Rempe; Max-Planck-Inst. for Quantum Optics, Germany.* Recent experiments towards deterministic quantum information processing with single atoms and single photons in a high-finesse optical cavity are discussed, including a single-photon server and an atom-photon interface.

QTuK5 • 6:15 p.m.
Preparation and Reconstruction of Non-Classical Field States in a Cavity QED Experiment, *Igor Dotsenko[1], Julien Bernu[1], Samuel Deléglise[1], Clément Sayrin[1], Michel Brune[1], Jean-Michel Raimond[1], Serge Haroche[1,2]; [1]Ecole Normale Supérieure, France, [2]Collège de France, France.* We prepare Schrödinger cats and other non-classical photonic states in a high-Q cavity. We reconstruct them using maximum entropy principle from an incomplete set of quantum non-demolition measurements performed with Rydberg atoms crossing the cavity.

CTuEE • Optical Parametric Chirped Pulse Amplifiers—Continued

CTuEE5 • 5:45 p.m.
Multimillijoule Optically Synchronized and CEP-Stabilized Chirped Parametric Amplification at 1.5 µm, *Oliver D. Mücke[1], Dmitry Sidorov[1], Peter Dombi[1], Audrius Pugzlys[1], Andrius Baltuska[1], Skirmantas Alisauskas[2], Jonas Pocius[3], Linas Giniunas[3], Romualdas Danielis[3]; [1]Vienna Univ. of Technology, Austria, [2]Laser Res. Ctr., Vilnius Univ., Lithuania, [3]Light Conversion Ltd., Lithuania.* Efficient infrared 35-THz-wide parametric amplification with energies >3 mJ is obtained in a 3-stage OPCPA using a combination of a 1030-nm 200-fs Yb- and a 1064-nm 60-ps Nd amplifier seeded with a common Yb oscillator.

CTuEE6 • 6:00 p.m.
Sub-Two-Cycle Light Pulses at 1.6 µm from an Optical Parametric Amplifier, *Daniele Brida[1], Stefano Bonora[2], Giovanni Cirmi[1], Cristian Manzoni[1], Sandro De Silvestri[1], Giulio Cerullo[1], Paolo Villoresi[2]; [1]Politecnico di Milano, Italy, [2]Univ. di Padova, Italy.* We generate 8.5 fs pulses at 1.6 µm from an 800-nm-pumped optical parametric amplifier working at degeneracy, employing a deformable mirror compressor. These are the shortest light pulses in this wavelength range.

CTuEE7 • 6:15 p.m.
Generation of Broadband Mid-Infrared Pulses from an Optical Parametric Amplifier, *Cristian Manzoni, Daniele Brida, Giovanni Cirmi, Marco Marangoni, Sandro De Silvetri, Giulio Cerullo; Politecnico di Milano, Italy.* We generate broadband mid-IR pulses from an 800-nm-driven optical parametric amplifier in $LiIO_3$. Exploiting its broad phase-matching bandwidth around 1 µm, we produced 2-µJ idler pulses in the 3-4 µm range supporting 30-fs transform-limited duration.

CTuFF • Ultrafast Fiber Lasers II—Continued

CTuFF5 • 5:45 p.m.
10 nJ-Normal Dispersion Erbium-Doped Fiber Laser Exhibiting Spectral Filtering, *Axel Ruehl, Vincent Kuhn, Dieter Wandt, Dietmar Kracht; Laser Zentrum Hannover e.V., Germany.* We report on an ultrafast normal dispersion erbium fiber laser generating 10 nJ pulses externally compressed to < 75 fs. The impact of spectral filtering on the mode-locking is discussed via phase noise measurements.

CTuFF6 • 6:00 p.m.
Highly Chirped Dissipative Solitons in Anomalous-Dispersion Fiber Lasers, *William H. Renninger, Andy Chong, Frank W. Wise; Cornell Univ., USA.* A new modelocking regime governed by the Ginzburg-Landau equation is demonstrated in an anomalous dispersion fiber laser. Output pulses are long, flat-topped, and highly-down-chirped, with energies above 150 nJ and repetition rates below 300 kHz.

CTuFF7 • 6:15 p.m.
Femtosecond Erbium-Doped Fiber Lasers with Large Normal Cavity Dispersion, *Andy Chong, Hui Liu, William H. Renninger, Frank W. Wise; Cornell Univ., USA.* Femtosecond pulse generation by spectral filtering of a chirped pulse is demonstrated at 1550 nm. An erbium fiber laser with large normal dispersion and a spectral filter generates 200-fs and 1-nJ pulses.

6:30 p.m.–8:00 p.m., Welcome Reception, *Concourse Level*

Room C1 and C2 — CLEO

CTuGG • Light Emission II—Continued

CTuGG5 • 5:45 p.m.
Effect of Damping and Gain Compression in Purcell-Enhanced Nanocavity Lasers, *Erwin K. Lau[1], Rodney S. Tucker[2], Ming C. Wu[1]; [1]Univ. of California at Berkeley, USA, [2]Univ. of Melbourne, Australia.* We simulate the rate equations of nanocavity lasers, introducing gain compression of both the stimulated and spontaneous emission. The resonance frequency and damping are simultaneously enhanced by the Purcell effect, greatly limiting the modulation bandwidth.

CTuGG6 • 6:00 p.m.
Low-Power Light Control with Light in High Q/V Silicon Microring Resonators, *Shijun Xiao, Hao Shen, Maroof Khan, Minghao Qi; Birck Nanotechnology Ctr., Purdue Univ., USA.* We demonstrate critically coupled silicon microring resonators with intrinsic Q close to 300,000 and mode volume $V \approx 20\times(\lambda/n_e)^3$. For sub-mW optical power, large pump induced resonance shifts were observed for applications in all-optical switching.

CTuGG7 • 6:15 p.m.
Gain Competition and Mode Shifts in ZnO Nanorod Lasers, *Johannes Fallert[1], Roman Dietz[1], Felix Stelzl[1], Huijuan Zhou[1], Claus Klingshirn[1], Heinz Kalt[1], Anton Reiser[2], Klaus Thonke[2], Rolf Sauer[2]; [1]Inst. für Angewandte Physik, Univ. Karlsruhe, Germany, [2]Inst. für Halbleiterphysik, Univ. Ulm, Germany.* We study the lasing of individual ZnO nanorod resonators. We focus on the dynamics of the laser modes in terms of gain competition and shifts. Furthermore the influence of temperature on lasing thresholds is discussed.

Room C3 and C4 — QELS

QTuL • Third Order Effects/ Chalcogenides—Continued

QTuL5 • 5:45 p.m. Invited
Nonlinearity in Chalcogenide Glasses and Fibers, and Their Applications, *J. S. Sanghera, L. B. Shaw, C. M. Florea, P. Pureza, V. Q. Nguyen, D. Gibson, F. Kung, I. D. Aggarwal; NRL, USA.* High nonlinearity and large IR transparency make chalcogenide fibers well suited for compact Raman amplifiers, supercontinuum generation and other mid-IR sources. As_2S_3 fiber has record high theoretical gain compared with silica fiber for slow-light applications.

QTuL6 • 6:15 p.m.
Modulation Instability and Bragg Soliton Formation in a Highly Nonlinear As_2S_3 Waveguide Bragg Grating, *Neil J. Baker[1], Michaël Roelens[1], Steve Madden[2], Barry Luther-Davies[2], C. Martijn de Sterke[1], Benjamin J. Eggleton[1]; [1]Ctr. for Ultrahigh Bandwidth Devices for Optical Systems, Univ. of Sydney, Australia, [2]Ctr. for Ultrahigh Bandwidth Devices for Optical Systems, Natl. Univ., Australia.* We observe modulational instability and pulse train generation in an integrated waveguide Bragg grating written in highly nonlinear chalcogenide glass. This Bragg soliton effect occurs at pulse energies 10,000 times lower than any previous reports.

Room B1 and B2 — CLEO

CTuHH • THz Parametric Generation—Continued

CTuHH5 • 5:45 p.m.
Power Scaling by Removal of Negative Differential Conversion Efficiencies for THz Generation in InP, *Xiaodong Mu[1], Yujie J. Ding[1], Ioulia B. Zotova[2]; [1]Lehigh Univ., USA, [2]ArkLight, USA.* By removing negative differential conversion efficiencies for THz generation, observed on InP, we have increased the THz output power by one order of magnitude, making InP comparable to ZnTe and InAs as highly efficient emitter.

CTuHH6 • 6:00 p.m.
0.1-15THz Generation Using BNA (N-Benzyl-2-Methyl-4-Nitroaniline) Crystal, *Katsuhiko Miyamoto[1], Hiroaki Minamide[1], Masazumi Fujiwara[2], Hideki Hashimoto[2], Hiromasa Ito[1,3]; [1]RIKEN Sendai, Japan, [2]Graduate School of Science, Osaka City Univ., Japan, [3]Graduate School of Engineering, Tohoku Univ., Japan.* We demonstrate widely tunable terahertz-wave generation using difference frequency generation (DFG) in an organic N-benzyl-2-methyl-4-nitroaniline (BNA) crystal. The frequency tuning of the BNA-DFG was obtained between 0.1 and 15 THz.

CTuHH7 • 6:15 p.m.
Palmtop Terahertz-Wave Parametric Generator with Wide Tunability, *Shin'ichiro Hayashi[1,2], Takayuki Shibuya[1,3], Hiroshi Sakai[4], Takunori Taira[5], Chiko Otani[1], Yuichi Ogawa[2], Kodo Kawase[1,2,3]; [1]RIKEN, Japan, [2]Tohoku Univ., Japan, [3]Nagoya Univ., Japan, [4]Hamamatsu Photonics K. K., Japan, [5]Inst. for Molecular Science, Japan.* We have realized palmtop and tunable THz-wave parametric generator and observed output THz-wave with tuning range of 1 - 3 THz, with power of more than 100 mW (peak), linewidth of less than 10 GHz.

Room J2 — CLEO

CTuII • OPOs II—Continued

CTuII5 • 5:45 p.m.
Fine Frequency Tuning and ±3 MHz Frequency Stabilisation of a Nanosecond Mid-Infrared Doubly Resonant Optical Parametric Oscillator, *Antoine Berrou, Myriam Raybaut, Antoine Godard, Michel Lefebvre; Office Natl. d'Etudes et de Recherches Aérospatiales, France.* We demonstrate 100 GHz continuous tuning and ±3 MHz frequency stabilization of the signal radiation delivered by an entangled cavity nanosecond OPO while the frequency fluctuation of the pump radiation is larger than 500 MHz.

CTuII6 • 6:00 p.m.
Mid-IR Photoacoustic Spectroscopy by Use of an Entangled-Cavity Doubly Resonant OPO, *Antoine Berrou[1], Fabien Marnas[2], Myriam Raybaut[1], Antoine Godard[1], Michel Lefebvre[1]; [1]Office Natl. d'Etudes et de Recherches Aérospatiales, France, [2]Inst. Pierre Simon Laplace, Lab de Météorologie Dynamique, Ecole Polytechnique, France.* An entangled cavity optical parametric oscillator is applied for photoacoustic spectroscopy in the wavelength range of 3.8-4.3 µm. High resolution spectra of N_2O are reported around 3.8 and 4 µm.

CTuII7 • 6:15 p.m.
3-µm Continuous-Wave Singly Resonant OPO, *Shoutai Lin, Yenyin Lin, R. Y. Tu, Yenchieh Huang, A. C. Chiang, J. T. Shy; Natl. Tsing Hua Univ., Taiwan.* We report a continuous-wave, single-longitudinal-mode, singly resonant OPO oscillating at 3.3 µm with 60% pump depletion. We observed optical bistability, thermal guiding, and clamped pump depletion for this OPO.

6:30 p.m.–8:00 p.m., Welcome Reception, *Concourse Level*

Room J3	Marriott San Jose Salon 1 and 2	Marriott San Jose Salon 3	Marriott San Jose Salon 4

CLEO

CTuJJ • Novel Semiconductor Emitters—Continued

CTuJJ4 • 5:45 p.m.
Quantum Cascade Microlasers with Highly Deformed Spiral-Resonators, *Dongxia Qu[1], Richard Cendejas[1], Zhijun Liu[1], Claire Gmachl[1], Fred Towner[2]; [1]Princeton Univ., USA, [2]Maxion Technologies, Inc., USA.* We study the spectral characteristics of spiral-shaped micro-cylindrical quantum cascade lasers with various spiral geometries. With medium deformations and notch angles, our lasers can achieve single-mode emission with a side-mode suppression ratio over 30 dB.

CTuJJ5 • 6:00 p.m.
High Small-Signal Modulation Bandwidth and Narrow Linewidth Microdisk Lasers, *Mahmood Bagheri, Min Hsiung Shih, William K. Marshall, Seung June Choi, John D. O'Brien, P. Daniel Dapkus; Univ. of Southern California, USA.* In this report, microdisk lasers with -3dB small-signal modulation bandwidths in excess of 17 GHz are demonstrated. Linewidth of these lasers are also measured and a minimum linewidth of 85 MHz is achieved.

CTuJJ6 • 6:15 p.m.
Quantum Dot Microdrop Laser, *Jan Schäfer, Jessica P. Mondia, Rachit Sharma, Z. H. Lu; Inst. of Optics, Information and Photonics Div. II, Germany.* We report room-temperature, low threshold, multi- and single mode lasing in levitated microdrops doped with low concentrations of CdSe/ZnS core/shell quantum dots.

CTuKK • Novel Solid-State Lasers and Materials—Continued

CTuKK4 • 5:45 p.m.
High Power Laser Operation of Sesquioxides $Yb:Lu_2O_3$ and $Yb:Sc_2O_3$, *Rigo Peters, Christian Kränkel, Klaus Petermann, Günter Huber; Inst. of Laser-Physics, Germany.* A comparative study of highly-efficient laser operation of high-purity $Yb:Lu_2O_3$ and $Yb:Sc_2O_3$ is reported. In thin-disk laser geometry an output-power of 36.3W at 1034nm with a slope-efficiency of 80% was obtained from a 5at.%-doped Lu_2O_3-disk.

CTuKK5 • 6:00 p.m.
Ultra-High-Power Optical Vortex Output from a Side-Pumped $Nd:GdVO_4$ Bounce Laser, *Masahito Okida[1], Yasushi Hayashi[1], Takashige Omatsu[1,2]; [1]Chiba Univ., Japan, [2]PRESTO Japan Science and Technology Agency, Japan.* We produced directly an ultra-high-power 1.06 um vortex mode from a diode-pumped $Nd:GdVO_4$ bounce amplifier. A maximum vortex output of 17.8 W was achieved at a pump power of 55 W.

CTuKK6 • 6:15 p.m.
Spectroscopic Properties of Er:YAG at Elevated Temperatures and Their Influence on the $^4I_{13/2}$ Laser Emission, *Marc Eichhorn[1], Susanne T. Fredrich-Thornton[2]; [1]French-German Res. Inst. of Saint-Louis, France, [2]Inst. für Laser-Physik, Germany.* We present spectroscopic results on Er:YAG at 300 K-550 K with respect to resonant pump absorption at 1.53 µm and laser emission at 1.61 µm and 1.64 µm and numerical results on laser performance.

CTuLL • Optical Access—Continued

CTuLL2 • 5:45 p.m.
Non-Reciprocal Optical Phase Modulation for Integrated NRZ/DPSK Data Re-Modulation in Optical Access Networks, *Lin Xu, Hon Ki Tsang; Chinese Univ. of Hong Kong, Hong Kong.* We show that the non-reciprocity of traveling-wave electrodes can efficiently impress phase modulation onto the reflected upstream signals only. Monolithically integrated transceivers may thus remodulate downstream signals for upstream data transmission without needing optical circulators.

CTuLL3 • 6:00 p.m.
10 Gb/s, 850nm VCSEL Based Large Core POF Links, *Arup Polley, Patrick J. Decker, Stephen E. Ralph; Georgia Tech, USA.* We demonstrate 10 Gb/s VCSEL-based transmission over 100 m of larger core (120-µm) graded-index perfluorinated plastic optical fiber thus establishing that multi-transverse-mode VCSELs are compatible with highly alignment tolerant plastic optical fiber.

CTuLL4 • 6:15 p.m.
1-µm Waveband 10-Gbit/s Transmission over a 7-km Single-Mode Hole Assisted Fiber Using a Harmonically Mode-Locked Semiconductor Laser, *Naokatsu Yamamoto[1], Hideyuki Sotobayashi[1], Kouichi Akahane[1], Masahiro Tsuchiya[1], Keijiro Takashima[2,3], Hiroyuki Yokoyama[2]; [1]Natl. Inst. of Information and Communications Technology, Japan, [2]New Industry Creation Hatchery Ctr., Tohoku Univ., Japan, [3]Japan Science and Technology Agency, Japan.* For developing a 1-µm waveband photonic-transport system, we fabricated a harmonically mode-locked semiconductor laser (MLL) RZ-signal source. We successfully demonstrated a 10-Gbit/s error-free transmission over a 7-km single-mode hole assisted fiber (HAF) at 1035-nm.

CTuMM • Novel Fiber Structures—Continued

CTuMM5 • 5:45 p.m.
Prospects for "Green" Microstuctured Optical Fibers, *Alexandre Dupuis, Ning Guo, Yan Gao, Bertrand Gauvreau, Charles Dubois, Maksim Skorobogatiy; Ecole Polytechnique de Montreal, Canada.* A powder-filling technique was used to fabricate a variety of biodegradable micro-structured polymer optical fibers using poly (epsilon-caprolactone) and cellulose derivatives. These fibers hold potential for light delivery and sensing.

CTuMM6 • 6:00 p.m.
Study of the Side Deposition Enhanced Cr^{4+} Concentration in Cr^{4+}: YAG Crystal Fiber as an Ultra Broadband Amplified Spontaneous Emitter, *Cheng-Nan Tsai[1], Yen-Sheng Lin[2], Kuang-Yao Huang[1], Yen-Sheng Lin[3], Chien-Chih Lai[2], Sheng-Lung Huang[2,4]; [1]Inst. of Electro-Optical Engineering, Natl. Sun Yat-Sen Univ., Taiwan, [2]Graduate Inst. of Photonics and Optoelectronics, Natl. Taiwan Univ., Taiwan, [3]Dept. of Electronic Engineering, I-Shou Univ., Taiwan, [4]Dept. of Electrical Engineering, Natl. Taiwan Univ., Taiwan.* Using laser heated pedestal method to grow CaO or MgO side deposited Cr^{4+}:YAG crystal fiber, Cr^{4+} concentration was raised by a factor of 110% after re-growth and annealing at 1350°C in Ca,Cr:YAG crystal fiber.

CTuMM7 • 6:15 p.m.
Raman Spectroscopy of Nanoparticles in Photonic Crystal Fibers, *J. Irizar[1], J. Dinglasan[2], J. Goh[1], A. Khetani[3], H. Anis[3], D. Anderson[2], C. Goh[1], Amr S. Helmy[1]; [1]Univ. of Toronto, Canada, [2]Northern Nanotechnologies Inc., Canada, [3]School of Information Technology and Engineering, Univ. of Toronto, Canada.* Photonic crystal fibers were demonstrated as an optimal platform for enhancing the Raman signals to study nanoparticles properties in liquids. Raman was used to analyze stages of low concentrations of ZnO nanoparticles growth in solution.

6:30 p.m.–8:00 p.m., Welcome Reception, *Concourse Level*

CTuNN • Wavelength Selective Elements—Continued

CTuNN5 • 5:45 p.m.
Cascaded Over- and Under-Coupled Resonators (COUR): Reducing Group Delay Dispersion and Overcoming the Sensitivity-Bandwidth Trade-Off, *Greeshma Gupta, William Steier; Univ. of Southern California, USA*. Cascaded over- and under-coupled resonators (COUR) result in slow light followed by fast light. COUR can be used as a notch filter and phase modulator that overcomes the trade-offs of extinction-ratio-group-delay and sensitivity-bandwidth.

CTuNN6 • 6:00 p.m.
Eight-Channel Microring Resonator Array with Accurately Controlled Channel Spacing, *Maroof H. Khan, Hao Shen, Yi Xuan, Shijun Xiao, Minghao Qi; Purdue Univ., USA*. We demonstrate accurately spaced 8-channel micro-ring resonators on a silicon-on-insulator platform via thermal tuning. The thermal cross talk between adjacent micro heaters is small.

CTuNN7 • 6:15 p.m.
Double-Notch-Shaped Microdisk Resonator-Based Devices in Silicon-on-Insulator, *Xianshu Luo[1], Chao Li[2], Andrew W. Poon[1]; [1]Hong Kong Univ. of Science and Technology, China, [2]Chinese Univ. of Hong Kong, China.* We demonstrate double-notch-shaped microdisk resonator-based filters with waveguide butt-coupling in silicon-on-insulator. Our filter demonstrates whispering-gallery-like modes with Q exceeding 10^4. We also propose and fabricate electro-optic modulators using this structure integrated with a metal-oxide-semiconductor capacitor.

6:30 p.m.–8:00 p.m.
Welcome Reception,
Concourse Level

NOTES

Tuesday, May 6