## Rooms 318-320

### IQEC

**8:00 a.m.–9:45 a.m.**
**ITuA • Metamaterials I**
*Mikhail Noginov; Norfolk State Univ., USA, Presider*

**ITuA1 • 8:00 a.m.** Tutorial
**Phononic Metamaterials with Negative Dynamic Mass Density,** *Ping Sheng; Hong Kong Univ. of Science and Technology, Hong Kong.* Dynamic mass density of a composite can differ from its static counterpart when there are relative motions between the components. Realizations of negative dynamic mass density composites and their theoretical underpinnings will be presented.

Ping Sheng obtained his BS.c. at Caltech and his Ph.D. in physics at Princeton University in 1971. After two years of postdoc at the Institute for Advanced Study, Ping joined the RCA David Sarnoff Research Center in 1973. In 1979 he joined the Exxon Corporate Research Lab, where he served as the head of the theory group from 1982-86. In 1994 Ping joined the HKUST as a professor of physics. He had been the head of the physics department from March 1999 to July 2008.

## Rooms 321-323

### CLEO

**8:00 a.m.–9:45 a.m.**
**CTuA • Combustion Sensing**
*Sukesh Roy; Spectral Energies, LLC, USA, Presider*

**CTuA1 • 8:00 a.m.** Tutorial
**Probing Gas-Phase Collisional Energy Transfer with Picosecond Laser Spectroscopy,** *Thomas B. Settersten; Sandia Natl. Labs, USA.* Effects of gas-phase collisions on active optical sensing and use of picosecond laser spectroscopy for their characterization are reviewed. Additionally, novel time-resolved approaches to reduce collisional sensitivity and to exploit species-dependent collision rates are discussed.

Dr. Settersten's research interests include laser development, nonlinear laser-molecule interactions, and energy transfer. He currently leads the Picosecond Nonlinear Diagnostic Program at the Combustion Research Facility of Sandia National Laboratories in Livermore, California. Using custom-built picosecond lasers, his group investigates collisional energy transfer in conditions relevant to combustion and develops nonlinear detection strategies (multiphoton LIF, wave-mixing spectroscopy) for small radical species in combustion systems. Prior to joining Sandia as a staff member in 2000, Dr. Settersten received a Bachelor of Science in Applied and Engineering Physics (1988) and a Master of Engineering in Applied Physics (1990) from Cornell University. After holding positions at the Cornell High-Energy Synchrotron Source and at HY-Tech Research Corporation, a small SBIR-funded company focused on plasma diagnostics, Dr. Settersten received his Ph.D. in Engineering Systems from the Colorado School of Mines (2000).

## Rooms 324-326

### JOINT

**8:00 a.m.–9:45 a.m.**
**JTuA • Daniel Chemla Joint CLEO/IQEC Symposium I**
*Presider to Be Announced*

**JTuA1 • 8:00 a.m.** Invited
**From Molecular Nonlinear Optics to Nano-Biophotonics,** *Joseph Zyss; École Normale Supérieure de Cachan, France.* Current advances in molecular nonlinear optics will be reviewed in the light of early concepts, so as to evidence continuity and evolutions. We will concentrate on all-optical orientation, the nanoscale and applications to bio-imaging.

**JTuA2 • 8:30 a.m.** Invited
**Bioimaging and the Inspiration of Daniel Chemla,** *Charles Shank; Lawrence Berkeley Natl. Lab, Univ. of California at Berkeley, USA.* Abstract not available.

## Room 314

### CLEO

**8:00 a.m.–9:45 a.m.**
**CTuB • Limitations and Noise in Optical Metrology**
*Nathan R. Newbury; NIST, USA, Presider*

**CTuB1 • 8:00 a.m.** Tutorial
**Entanglement for Metrology with Atomic Ensembles,** *Eugene Polzik; Univ. of Copenhagen, The Niels Bohr Inst., Denmark.* This tutorial will cover the reduction of the quantum projection noise in large atomic ensembles via entanglement and its applications for clocks and metrology.

Eugene Polzik is Professor of Physics at the Niels Bohr Institute in Copenhagen. He received his Ph.D degree from St. Petersburg University in 1980. He is a member of the Royal Danish Academy and Fellow of OSA and APS. Since 2001 he leads Danish National Research Foundation Center for Quantum Optics. His research interests are focused on quantum interface between photons and atoms, in particular on using collective excitations in atomic ensembles. The topics addressed most recently include photons-to-atoms teleportation, quantum memory for light, single photon sources and measurements beyond projection noise limit.

| Room 315 | Room 316 | Room 317 |
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**CLEO**

## 8:00 a.m.–9:45 a.m.
## CTuC • Optical Interconnects
*David Plant; McGill Univ., Canada, Presider*

**CTuC1 • 8:00 a.m.**
**850-nm Polymer Waveguide Amplifier for Optical Backplanes,** *Jing Yang, Mart B. J. Diemmer, Gabriël Sengo, Markus Pollnau, Alfred Driessen; Univ. of Twente, Netherlands.* Nd-complex-doped polymer channel waveguide amplifiers for optical backplanes are fabricated. Optical gain at 840-870 nm is demonstrated. 3.1 dB/cm net gain is obtained at 850 nm for an amplifier with $3.1\times10^{19}$ $cm^{-3}$ Nd concentration.

**CTuC2 • 8:15 a.m.**
**Planar Integration of a Long Range Surface Plasmon Waveguide with an Inverted Metal-Semiconductor-Metal Photodetector on Silicon,** *Sulochana Dhar, Aloyse Degiron, David R. Smith, Nan M. Jokerst; Duke Univ., USA.* A long range surface plasmon polariton (LR-SPP) insulator-metal-insulator waveguide was integrated with a thin film $In_xGa_{1-x}As$-based photodetector (PD) on silicon for planar detection of LR-SPPs, and demonstrated coupling from the LR-SPP to the PD.

**CTuC3 • 8:30 a.m.** Invited
**Manycore Processor Networks with Monolithic Integrated CMOS Photonics,** *Vladimir Stojanovic[1], Ajay Joshi[1], Christopher Batten[1], Young-Jin Kwon[2], Krste Asanovic[2]; [1]MIT, USA, [2]Univ. of California at Berkeley, USA.* This paper presents an overview of advances in highly-integrated photonic networks for emerging manycore processors. It explores the tight interaction among logical and physical implementations of all-to-all core-to-core and core-to-DRAM networks, and underlying photonic devices.

## 8:00 a.m.–9:45 a.m.
## CTuD • Optofluidics for Biosensing and Analysis CLEO Symposium I: Novel Optical Devices and Systems
*Holger Schmidt; Univ. of California at Santa Cruz, USA, Presider*

**CTuD1 • 8:00 a.m.** Invited
**Reconfigurable Photonic Crystal Circuits and Fibers Using Microfluidics,** *Benjamin J. Eggleton; Univ. of Sydney, Australia.* I review recent progress in developing reconfigurable photonic crystal circuits based on microfluidics.

**CTuD2 • 8:30 a.m.**
**Micro-Air-Bag Actuated Tunable Optofluidic Elements,** *Wuzhou Song[1], Andreas E. Vasdekis[1], Jae-Woo Choi[1,2], Demetri Psaltis[1,2]; [1]STI, Optics Lab, Swiss Federal Inst. of Technology Lausanne, Switzerland, [2]Caltech, USA.* We introduce for the first time a tuning mechanism for optofluidic devices by embedding a Micro-Air-Bag (MAB) actuator inside a microfluidic chip. Multiple tunable optical elements controlled through the pressure of compressed air were demonstrated.

**CTuD3 • 8:45 a.m.**
**Advances in on-Chip Polymer Optics for Optofluidics,** *Jessica M. Godin, Yu-Hwa Lo; Univ. of California at San Diego, USA.* We present liquid-turned-solid lenses ($\Delta n\sim1.2$) in polymer devices replicated from cryogenically-etched silicon molds, with estimated per surface losses of .2-.4 dB. The process creates optical-quality sidewalls ($\sigma_{RMS}\sim 30$ nm) needed for sensitive optofluidic devices.

## 8:00 a.m.–9:45 a.m.
## CTuE • Microresonators
*Solomon Assefa; IBM Res., USA, Presider*

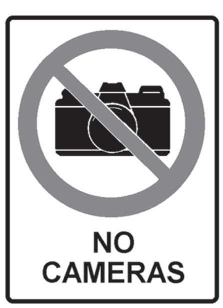
**CTuE1 • 8:00 a.m.**
**High Resolution Imaging of Optical Modes in Silicon Microdisk Cavities Based on Near-Field Perturbation,** *Ali Asghar Eftekhar, Mohammad Soltani, Siva Yegnanarayanan, Ali Adibi; Georgia Tech, USA.* We demonstrate high resolution near-field imaging of the optical modes profile in high-Q silicon microdisks. A spatial resolution of ~20nm is obtained by characterizing the perturbative effects of a scanning tip on the microdisk transmission.

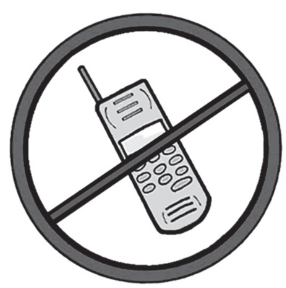
**CTuE2 • 8:15 a.m.**
**Level Crossing in Toroidal on-Chip Microcavities,** *Harald Schwefel[1], Lan Yang[2], Mark Oxborrow[3], A. Douglas Stone[4], Kerry Vahala[5], Tal Carmon[6]; [1]Univ. of Erlangen-Nuremberg, Germany, [2]Washington Univ. in St. Louis, USA, [3]Natl. Physics Lab, UK, [4]Yale Univ., USA, [5]Caltech, USA, [6]Univ. of Michigan, USA.* Level crossing between optical whispering-gallery modes is studied in toroidal microcavities. We photograph azimuthal and radial envelope patterns of crossed optical modes. We also investigate anti-crossing between modes and polarization evolution.

**CTuE3 • 8:30 a.m.**
**Resonance Spacing Tuning in Traveling-Wave Resonators,** *Amir H. Atabaki, Siva Yegnanarayanan, Ali Adibi; Georgia Tech, USA.* We propose the interferometric coupling scheme for tuning the spacing between resonances in a traveling-wave resonator. 62pm (8GHz) tuning of resonance spacing is demonstrated in SOI micro-ring resonators integrated with thin-film micro-heaters.

**CTuE4 • 8:45 a.m.**
**Observation of EIT-Like Effect in a Single High-Q Microcavity,** *Yun-Feng Xiao, Lina He, Jiangang Zhu, Lan Yang; Washington Univ. in Saint Louis, USA.* We study the coupling between a taper and two whispering-gallery modes in a single PDMS-coated silica microtoroid theoretically and experimentally. The transmission spectrum of the taper coupled two-mode resonator shows a sharp electromagnetically-induced-transparency-like window.





## Room 336

**CLEO**

### 8:00 a.m.–9:45 a.m.
### CTuF • LED Materials and III-Nitride Semiconductors
*Nelson Tansu; Lehigh Univ., USA, Presider*

**CTuF1 • 8:00 a.m.** Invited
**Low-Refractive-Index Materials: A New Class of Optical Thin-Film Materials,** *E. Fred Schubert, Jong Kyu Kim; Rensselaer Polytechnic Inst., USA.* The refractive index is the most fundamental quantity in optics. However, no optical thin-film materials have been available in the index range 1.05-1.4. A new class of low-index materials is presented including several applications.

**CTuF2 • 8:30 a.m.**
**Growths of InGaN Quantum Wells Light-Emitting Diodes on Nano-Patterned AGOG Sapphire Substrate Using Abbreviated Growth Mode,** *Yik-Khoon Ee, Jeff Biser, Wanjun Cao, Helen M. Chan, Richard P. Vinci, Nelson Tansu; Lehigh Univ., USA.*
Nanoheteroepitaxy of InGaN-based light-emitting diodes on patterned AGOG sapphire by using abbreviated growth mode, leads to significant reduction in dislocation density and 24% increase in efficiency.

**CTuF3 • 8:45 a.m.**
**Internal Quantum Efficiency and Non-Radiative Recombination Coefficient of GaInN/GaN Multiple Quantum Wells with Different Dislocation Densities,** *Qi Dai[1], Martin F. Schubert[1], Min-Ho Kim[1], Jong Kyu Kim[1], E. F. Schubert[1], Daniel D. Koleske[2], Mary H. Crawford[2], Stephen R. Lee[2], Arthur J. Fischer[2], Gerald Thaler[2], Michael A. Banas[2]; [1]Rensselaer Polytechnic Inst., USA, [2]Sandia Natl. Labs, USA.* Room-temperature photoluminescence measurements are performed on GaInN/GaN multiple quantum wells grown on GaN-on-sapphire templates with different threading-dislocation densities. The internal quantum efficiencies as a function of carrier concentration and the non-radiative coefficients are obtained.

## Room 337

**IQEC**

### 8:00 a.m.–9:45 a.m.
### ITuB • Quantum Information IV
*Presider to Be Announced*

**ITuB1 • 8:00 a.m.**
**Generation of Optical Schrödinger Cat States by Number-Resolved Squeezed Photon Subtraction,** *Thomas Gerrits[1], Scott Glancy[1], Tracy Clement[1], Brice Calkins[1], Adriana Lita[1], Aaron Miller[2], Alan Migdall[1], Sae Woo Nam[1], Richard Mirin[1], Manny Knill[1]; [1]NIST, USA, [2]Albion College, USA.* We have measured cat states, generated by squeezed photon subtraction utilizing photon-number resolving detectors and single photon detectors. We show cat states for the case when one or two photons are being subtracted.

**ITuB2 • 8:15 a.m.**
**Joint Photon Statistics of Photon-Subtracted Squeezed Light,** *Hendrik B. Coldenstrodt-Ronge[1], Brian J. Smith[1], Graciana Puentes[1], Jeff S. Lundeen[1], Alvaro Feito[2], Animesh Datta[2], Peter J. Mosley[1], Jens Eisert[2], Martin Plenio[2], Ian A. Walmsley[1]; [1]Univ. of Oxford, UK, [2]Imperial College London, UK.* We present the joint photon-number statistics of a locally photon-subtracted two-mode vacuum squeezed state of light. Comparison to the unsubtracted statistics shows a successful photon subtraction and the expected shift by one photon number.

**ITuB3 • 8:30 a.m.** Invited
**Recent Advances in Non-Gaussian Control of Optical Continuous Variables,** *Masahide Sasaki[1], H. Takahashi[1,2], K. Wakui[1], M. Takeoka[1], K. Hayasaka[1]; [1]NICT, Japan, [2]Univ. of Tokyo, Japan.* We present recent experimental progress in non-Gaussian control of optical continuous variables of traveling light, including generation and control of mesoscopic quantum superposition states and non-Gaussian entanglement control of continuous variables.

## Room 338

### 8:00 a.m.–9:45 a.m.
### ITuC • Spatial and Temporal Nonlinear Effects
*Frank Wise; Cornell Univ., USA, Presider*

**ITuC1 • 8:00 a.m.**
**Nonlinear Photon z-Pinching in Filamentary Self-Compression,** *Carsten Brée[1,2], Ayhan Demircan[1], Stefan Skupin[3], Luc Bergé[4], Günter Steinmeyer[5]; [1]Weierstrass Inst. for Applied Analysis and Stochastics, Germany, [2]Max-Born-Inst. for Nonlinear Optics and Short Pulse Spectroscopy, Germany, [3]Max-Planck-Inst. für Physik Komplexer Systeme, Germany, [4]CEA-DAM, DIF, France, [5]Max-Born-Inst. for Nonlinear Optics and Short Pulse Spectroscopy, Germany.* Self-pinching of the photon fluence of millijoule laser pulses propagating inside filaments is discussed. This effect causes local contraction of the beam diameter and is proven to lead to axial pulse self-compression.

**ITuC2 • 8:15 a.m.**
**Optical Nonlinearity of a Colloidal "Non-Ideal Gas" of Nano-Suspensions,** *Ramy El-Ganainy[1], Demetrios Christodoulides[1], Ewan M. Wright[2], Woei M. Lee[3], Kishan Dholakia[3]; [1]CREOL and FPCE, College of Optics and Photonics, Univ. of Central Florida, USA, [2]College of Optical Sciences, Univ. of Arizona, USA, [3]SUPA, School of Physics and Astronomy, Univ. of St. Andrews, UK.* We show that many-body effects in stabilized nano-suspensions can have a profound effect on their optical nonlinearity. The nonlinear properties of these colloids can range from polynomial to exponential depending on their composition and chemistry.

**ITuC3 • 8:30 a.m.**
**Accessible Light Bullets,** *Marco Peccianti[1,2], Ian B. Burgess[1], Gaetano Assanto[3], Roberto Morandotti[1]; [1]INRS Énergie, Matériaux et Télécommunications, Canada, [2]Res. Ctr. SOFT INFM-CNR, "Sapienza" Univ., Italy, [3]Nonlinear Optics and Opto-Electronics Lab, Univ. "Roma Tre", Italy.* We present a novel type of stable (3+1)D solitary self-trapped wave-packet arising from the interplay between local and nonlocal (in time and space) nonlinearities, which can be generated under experimentally feasible conditions.

**ITuC4 • 8:45 a.m.**
**Self-Filtering of Noisy Images via Stochastic Resonance,** *Dmitry V. Dylov, Jason W. Fleischer; Princeton Univ., USA.* Nonlinear self-filtering and amplification of noisy, low-level images is demonstrated in a self-focusing photorefractive medium. Signal recovery depends sensitively on the parameters of the system and represents a new dynamical type of stochastic resonance.

## Room 339

**CLEO**

### 8:00 a.m.–9:45 a.m.
### CTuG • THz Parametric Generation
*Hiromasa Ito[1,2]; [1]RIKEN, Japan, [2]Tohuku Univ., Japan, Presider*

**CTuG1 • 8:00 a.m.**
**Resonantly-Enhanced THz-Wave Generation via Multispectral Mixing inside a Ring-Cavity OPO,** *Konstantin L. Vodopyanov[1], Walter C. Hurlbut[2], Vladimir G. Kozlov[2]; [1]Stanford Univ., USA, [2]Microtech Instruments, Inc., USA.* Narrowband output at 1.5THz was produced in periodically-inverted GaAs placed inside a high-finesse ring-cavity fiber-laser-pumped degenerate PPLN OPO containing a thin Fabri-Perot etalon. Over 10-microWatt average power was generated using 2 W of laser pump.

**CTuG2 • 8:15 a.m.**
**Scaling of Average Power of Coherent Terahertz Pulses by Stacking GaAs Wafers,** *Yi Jiang[1], Yujie J. Ding[1], Ioulia B. Zotova[2]; [1]Lehigh Univ., USA, [2]ArkLight, USA.* The average terahertz output power generated from stacked GaAs wafers using two $CO_2$ lasers is scaled up by 160. The highest average output power is measured to be 29.8 µW by stacking ten wafers.

**CTuG3 • 8:30 a.m.**
**Nanosecond THz-OPO with a Novel QPM Scheme,** *Daniel Molter[1], Michael Theuer[1,2], René Beigang[1,2]; [1]Fraunhofer Inst. for Physical Measurement Techniques IPM, Germany, [2]Univ. of Kaiserslautern, Germany.* A nanosecond OPO pumped by a Q-switched Nd:$YVO_4$ laser for terahertz generation in periodically poled lithium niobate with a new pattern is presented. Characteristic properties of the OPO including cascaded processes are discussed.

**CTuG4 • 8:45 a.m.**
**High Efficiency Terahertz Generation and Detection in the Organic Nonlinear Optical Crystal OH1,** *Fabian D. J. Brunner, Arno Schneider, O-Pil Kwon, Seong-Ji Kwon, Mojca Jazbinsek, Peter Günter; Inst. for Quantum Electronics, ETH Zurich, Switzerland.* We demonstrate highly efficient generation and detection of broadband THz pulses in the organic nonlinear optical crystal OH1. We achieved a photon conversion efficiency of 11 percent through optical rectification of 45 µJ laser pulses.

Room 340 | Room 341 | Rooms 328-329

## CLEO

### 8:00 a.m.–9:45 a.m.
### CTuH • Photonic Crystal and DBR Lasers
*Judy M. Rorison; Univ. of Bristol, UK, Presider*

**CTuH1 • 8:00 a.m.** Invited
**Surface-Emitting Photonic-Crystal Laser with 35W Peak Power,** *Takui Sakaguchi[1,2], Wataru Kunishi[1,2,3], Soichiro Arimura[1], Kazuya Nagase[1], Eiji Miyai[1,2,3], Dai Ohnishi[1,2,3], Kyosuke Sakai[2,3], Susumu Noda[2,3]; [1]ROHM Co., Ltd., Japan, [2]JST, Japan, [3]Kyoto Univ., Japan.* Advances in high-efficiency, large-area, surface-emitting photonic-crystal lasers have been developed to achieve peak emission powers of 35W with a slope efficiency of 0.7W/A for a total device area of ~0.4mm$^2$.

**CTuH2 • 8:30 a.m.**
**Gain Compression and Thermal Analysis of a Sapphire-Bonded Photonic Crystal Microcavity Laser under Various Duty Cycles,** *Ling Lu, Mahmood Bagheri, Adam Mock, Jiang-Rong Cao, Sang-Jun Choi, John O'Brien, P. Daniel Dapkus; Univ. of Southern California, USA.* The gain compression factor and thermal properties of a sapphire-bonded microcavity laser are extracted by analyzing wavelength shifts under different duty cycles. High thermal resistance of 21K/mW and gain compression factor of $1.0\times10^{-16}$cm$^{-3}$ are obtained.

**CTuH3 • 8:45 a.m.**
**Tight Focal Spot and Long Depth of Focus by Radially Polarized, Narrow-Width Annular Beams from Photonic-Crystal Lasers,** *Kyoko Kitamura[1], Kyosuke Sakai[1,2], Yoshitaka Kurosaka[1], Eiji Miyai[1,3], Wataru Kunishi[1,3], Dai Ohnishi[1,3], Susumu Noda[1]; [1]Dept. of Electronic Science and Engineering, Kyoto Univ., Japan, [2]Kyoto Univ. Pioneering Res. Unit for Next Generation, Japan, [3]Photonics Res. and Development Ctr., ROHM Co., Ltd., Japan.* We found that tighter focal spots with longer depths of focus are achieved by radially polarized annular beams with controlled inner and outer radii, which could lead to high-tolerance, super-resolution applications in compact optical systems.

### 8:00 a.m.–9:45 a.m.
### CTuI • Micro-Structured Nonlinear Optics
*Robert Fisher; R. A. Fisher Associates, USA, Presider*

**CTuI1 • 8:00 a.m.**
**Periodically-Poled Silicon,** *Nick K. Hon, Kevin K. Tsia, Daniel R. Solli, Bahram Jalali; Univ. of California at Los Angeles, USA.* We propose a new class of photonic devices based on periodic stress fields in silicon. Our approach creates quasi-phase matched second-order nonlinear processes that can be used, for example, for efficient midwave-infrared generation.

**CTuI2 • 8:15 a.m.**
**2-D Photonic Crystals in Nonlinear Optical Polymers,** *Alireza Gharavi, Hamidreza Karimi-Alavijeh, Soheil Soltani, Sirus Javadpour; Shiraz Univ., Iran, Islamic Republic of.* Using cis-trans isomerization of azo polymers we can fabricate waveguides, gratings and other periodic structures. Here we have fabricated a two dimensional photonic crystal which acts as an active add/drop WDM switch.

**CTuI3 • 8:30 a.m.**
**Polarization Switching in a Quasi-Periodic Nonlinear Photonic Crystal,** *Ayelet Ganany-Padowicz[1], Irit Juwiler[2], Ofer Gayer[1], Alon Bahabad[3], Ady Arie[1]; [1]Tel-Aviv Univ., Israel, [2]Sami Shamoon College of Engineering, Israel, [3]Univ. of Colorado at Boulder and NIST, USA.* We demonstrate all-optical intensity-dependent polarization switching, based on double phase-matched cascaded processes in a quadratic nonlinear photonic quasi-crystal. The efficiency is significantly better than that of devices based on cascaded cubic nonlinearities.

**CTuI4 • 8:45 a.m.**
**4OD-Mediated Solitonic Radiations in HC-PCF Cladding,** *Fabio Biancalana[1], Fetah Benabid[2], Philip S. Light[2], Francois Couny[2], Andre Luiten[3], Peter J. Roberts[4], Jiahui Peng[5], Alexey V. Sokolov[5]; [1]Max-Planck-Inst. for the Science of Light, Germany, [2]Univ. of Bath, UK, [3]Univ. of Western Australia, Australia, [4]Technical Univ. of Denmark, Denmark, [5]Texas A&M Univ., USA.* We observe the simultaneous emission of two resonant radiation frequencies by optical solitons in a waveguiding glass-feature within the cladding of a HC-PCF, due to the unusually large 4th-order GVD coefficient of the waveguide.

### 8:00 a.m.–9:45 a.m.
### CTuJ • PON and Light Sources
*Chang-Hee Lee; KAIST, Republic of Korea, Presider*

**CTuJ1 • 8:00 a.m.**
**Performance Analysis of a Multiwavelength CW Laser Based on Supercontinuum Generation for WDM-PONs,** *Paolo Ghelfi[1], Gianluca Berrettini[2], Luca Poti[1], Antonella Bogoni[1]; [1]CNIT, Italy, [2]Scuola Superiore Sant'Anna, Italy.* A supercontinuum-based multiwavelength laser is proposed and tested in a realistic WDM-PON scenario. BER comparison with commercial multiple channel laser array confirms this multiwavelength laser as a strong candidate for WDM-PON applications.

**CTuJ2 • 8:15 a.m.**
**Broadcast Signal Transmission for WDM-PON with ASE Injection to an F-P LD,** *Hoon-Keun Lee, Sil-Gu Mun, Jung-Hyung Moon, Chang-Hee Lee; KAIST, Republic of Korea.* We propose a novel WDM source for broadcast service using a low-cost Fabry-Perot LD with broadband ASE injection. The proposed optical source provides a cost-effective WDM-PON architecture for broadcast service accommodating more than 32×622 Mb/s.

**CTuJ3 • 8:30 a.m.**
**Demonstration of Secure 2.5 Gbps, 256-ary Polarization-Multiplexed OCDM Transmission Using Single Multi-Port Encoder/Decoder,** *Nobuyuki Kataoka[1], Takahiro Kodama[2], Naoya Wada[1], Gabriella Cincotti[3], Xu Wang[4], Tetsuya Miyazaki[1], Ken-ichi Kitayama[2]; [1]NICT, Japan, [2]Osaka Univ., Japan, [3]Univ. "Roma Tre", Italy, [4]Heriot Watt Univ., UK.* Secure 2.5Gbps, 256-ary polarization-multiplexed optical code division multiplexing (OCDM) transmission using a single multi-port optical en/decoder is experimentally demonstrated for the first time.

**CTuJ4 • 8:45 a.m.**
**16 Chip, 18 Gchips/s Walsh-Code Implementation of an ECDMA Access Network Using Two Time-Shifted FIR Filters,** *Jose B. Rosas-Fernandez, Jonathan D. Ingham, Richard V. Penty, Ian H. White; Dept. of Engineering, Univ. of Cambridge, UK.* We demonstrate for the first time an electronically processed Walsh-Code with 16 chips at 18 Gchip/s. An auto-cross correlation ratio of 18.1 dB between two orthogonal codes after 10 km of SMF transmission is achieved.

## Rooms 318-320 — IQEC

### ITuA • Metamaterials I—Continued

**ITuA2 • 9:00 a.m.**
**Negative Index Metamaterials for Visible Wavelengths,** *Shumin Xiao[1], Uday K. Chettiar[1], Alexander V. Kildishev[1], Mark Thoreson[1], Vladimir P. Drachev[1], Vladimir M. Shalaev[1], Oleg D. Lavrentovich[2]; [1]Purdue Univ., USA, [2]Kent State Univ., USA.* We report on a metamaterial sample that demonstrates double-negative index behavior at the shortest wavelength to date. We also discuss the controlled resonance tuning of optical magnetism in materials by using of liquid crystals.

**ITuA3 • 9:15 a.m.**
**Stereometamaterials,** *Na Liu[1], Hui Liu[2], Shi-Ning Zhu[2], Harald Giessen[1]; [1]4th Physics Inst., Univ. of Stuttgart, Germany, [2]Dept. of Physics, Nanjing Univ., China.* We introduce a novel concept to nano-photonics, namely stereometamaterials. Specifically, we study stacked twisted split-ring resonator metamaterials and demonstrate how their optical properties depend on the particular arrangement of the individual constituents.

**ITuA4 • 9:30 a.m.**
**Enhancement of Magnetic Dipole Transitions in Lanthanide Ions for Optical Metamaterials,** *Sinan Karaveli, Alexandra E. Witthoft, Rashid Zia; Brown Univ., USA.* We present experimental evidence of optically enhanced magnetic dipole transitions from trivalent Europium ions. Spectra and lifetime data are used to highlight direct and indirect enhancement pathways, and implications for optical metamaterials are discussed.

## Rooms 321-323 — CLEO

### CTuA • Combustion Sensing—Continued

**CTuA2 • 9:00 a.m.**
**Tomographic Imaging in Practical Combustion Devices Based on Hyperspectral Absorption Spectroscopy,** *Lin Ma[1], Weiwei Cai[1], Andrew W. Caswell[2], Thilo Kraetschmer[2], Scott T. Sanders[2], Sukesh Roy[3], James R. Gord[4]; [1]Clemson Univ., USA, [2]Univ. of Wisconsin at Madison, USA, [3]Spectral Energies LLC, USA, [4]AFRL, USA.* A hyperspectral tomography sensor has been developed to measure the distribution of temperature and chemical species. The spatial and temporal resolution enabled by this sensor is expected to resolve key issues in practical combustion devices.

**CTuA3 • 9:15 a.m.**
**Fire Detection with a Compact, 2.3 µm VCSEL-Based Carbon Monoxide Sensor,** *Andreas Hangauer[1,2], Jia Chen[1,2], Rainer Strzoda[1], Max Fleischer[1], Markus C. Amann[2]; [1]Siemens AG, Germany, [2]Walter Schottky Inst., Technische Univ. München, Germany.* A novel compact sensor approach utilizing the wide current tunability of VCSELs and employing reference gas in the photodetector is tested under diverse standard conditions for fire detection.

**CTuA4 • 9:30 a.m.**
**VCSEL-Based Oxygen Sensor for Combustion Optimization in Gas/Oil Furnaces,** *Jia Chen[1,2], Andreas Hangauer[1,2], Rainer Strzoda[2], Maximilian Fleischer[2], Markus-Christian Amann[1]; [1]Technische Univ. München, Germany, [2]Siemens Corporate Technology, Germany.* The first VCSEL-based $O_2$ sensor for gas/oil furnace applications employing a diffuse reflector is presented which circumvents alignment and interference problems. Optimized data processing is used for long-term stable operation and allows for real-time measurement.

## Rooms 324-326 — JOINT

### JTuA • Daniel Chemla Joint CLEO/IQEC Symposium I—Continued

**JTuA3 • 9:00 a.m.**
**Ultrafast Spectroscopy of Multilayer Epitaxial Graphene,** *Dong Sun[1], Charles J. Divin[1], Claire Berger[2], Phil First[2], Walt de Heer[2], Theodore B. Norris[1]; [1]Univ. of Michigan, USA, [2]Georgia Tech, USA.* Nondegenerate ultrafast mid-infrared pump-probe spectroscopy is used to study multilayer epitaxial graphene. By tuning the probe wavelength, we can determine the doping profile of the layers.

**JTuA4 • 9:15 a.m.** Invited
**Quantum Wells and Nanophotonics: Physics, Applications and Limits,** *David A. B. Miller; Stanford Univ., USA.* We summarize recent work in germanium quantum well physics and devices, in nanophotonic and nanometallic structures, and in fundamental limits to optical components, for applications such as slow light and optical interconnects to silicon.

## Room 314 — CLEO

### CTuB • Limitations and Noise in Optical Metrology—Continued

**CTuB2 • 9:00 a.m.**
**Direct Evidence of Intensity Correlation of Broadband Incoherent CW Sources at Ultrashort Timescale by Second-Order Interferometry with a Two-Photon-Absorption Detector,** *Fabien Boitier[1], Antoine Godard[1], Jean Bonnet[1], Emmanuel Rosencher[1,2], Claude Fabre[3]; [1]Onera, France, [2]Physics Dept., École Polytechnique, France, [3]Univ. Pierre et Marie Curie, France.* The second-order coherence properties of highly-incoherent cw sources (true blackbody and amplified spontaneous emission) are directly evidenced at femtosecond timescales by use of an interferometric autocorrelator based on a two-photon absorption in a GaAs phototube.

**CTuB3 • 9:15 a.m.**
**Frequency Noise of a Microchip Raman Laser,** *Tao Lu, Lan Yang, Tal Carmon, Bumki Min, Kerry Vahala; Caltech, USA.* We report measurement of the fundamental component of linewidth in a micro-Raman laser fabricated on a silicon chip. A linewidth as narrow as 3-Hz is measured.

**CTuB4 • 9:30 a.m.**
**Coherence Properties of Optical Frequency Comb Generated in Large Pitch HC-PCF Filled with $H_2$,** *Yingying Wang, Francois Couny, Phil S. Light, Fetah Benabid; Univ. of Bath, UK.* We report on the coherence measurement of the optical frequency comb generated in a hydrogen-filled square-lattice HC-PCF. The visibilities of higher order Stokes and anti-Stokes lines are quantified indicating a high degree of coherence.

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

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**NOTES**

## CTuC • Optical Interconnects—Continued

**CTuC4 • 9:00 a.m.**
**Very Short Polarization Splitting/Combining Using Two Horizontally-Slotted Waveguides,** *Yang Yue[1], Lin Zhang[1], Raymond Beausoleil[2], Alan Willner[1]; [1]Univ. of Southern California, USA, [2]HP Labs, USA.* We propose a very short polarization splitter/combiner using two horizontally-slotted waveguides. A 46.7-micron conversion length is achieved with 22 dB extinction ratio. The bandwidth is 18 nm for ER>20 dB.

**CTuC5 • 9:15 a.m.**
**How Short Can an Adiabatic Mode Transformer Be in a Coupled Waveguide System?** *Xiankai Sun, Hsi-Chun Liu, Amnon Yariv; Caltech, USA.* We derive the shortest length of adiabatic mode transformers which keep the power scattered into unwanted modes below a certain level. The theory is well supported by the numerical results from a transfer matrix method.

**CTuC6 • 9:30 a.m.**
**Highly Efficient Grating Coupler between Optical Fiber and Silicon Photonic Circuit,** *Shankar Kumar Selvaraja[1], Diedrik Vermeulen[1], Marc Schaekers[2], Erik Sleeckx[2], Wim Bogaerts[1], Gunther Roelkens[1], Pieter Dumon[1], Dries Van Thourhout[1], Roel Baets[1]; [1]Dept. of Information Technology, Ghent Univ.-IMEC, Belgium, [2]IMEC, Belgium.* We report on a highly efficient grating coupler between optical fiber and silicon photonic circuit. Using layers of Si/$SiO_2$ as a Bragg mirror and amorphous Si we have measured a coupling efficiency of 69.5%.

## CTuD • Optofluidics for Biosensing and Analysis CLEO Symposium I: Novel Optical Devices and Systems—Continued

**CTuD4 • 9:00 a.m.**
**A Tunable Optofluidic Microlens Based on Gradient Refractive Index,** *Xiaole Mao, Sz-Chin Steven Lin, Michael I. Lapsley, Jinjie Shi, Bala Krishna Juluri, Tony Jun Huang; Penn State Univ., USA.* A tunable optofluidic microlens configuration named Liquid Gradient Refractive Index (L-GRIN) lens is described. The variable light focusing is achieved through the diffusion based refractive index gradient within a microfluidic device.

**CTuD5 • 9:15 a.m.**
**Optofluidic Grating Spectrography on a Chip,** *Zhenyu Li, Axel Scherer; Caltech, USA.* We demonstrated liquid-metal based optical components such as mirrors and reflection gratings for building on-chip optofluidic spectrographs. We designed a Czerny-Turner spectrograph with 1.7nm resolution, 200nm *FSR* and a footprint of 3cm by 3cm.

**CTuD6 • 9:30 a.m.**
**Opto-Thermorheologically Reconfigurable Microfluidics,** *Joonsik Park, Mekala Krishnan, David Erickson; Cornell Univ., USA.* Here we present our work on opto-thermorheologically induced flow manipulation. This optofluidic technique enables both local flow manipulation through valving, as well as dynamic large scale reconfiguration of flow channels in a microfluidic device.

## CTuE • Microresonators—Continued

**CTuE5 • 9:00 a.m.**
**Thin-Ridge SOI Disk and Ring Resonators with "Magic Radius" and "Magic Width" Phenomena,** *Thach G. Nguyen[1], Ravi S. Tummidi[2], Thomas L. Koch[2], Arnan Mitchell[1]; [1]School of Electrical and Computer Engineering, RMIT Univ., Australia, [2]Ctr. for Optical Technologies, Lehigh Univ., USA.* Using the mode matching simulation, we show that the propagation losses of TM-like mode in thin-ridge SOI disk and ring resonators are significantly impacted by the radius of the disk or ring, and waveguide width.

**CTuE6 • 9:15 a.m.**
**Compensation of Thermal Effect in High-*Q* Toroidal Microresonators by PDMS Coating,** *Lina He, Yun Feng Xiao, Chunhua Dong, Jiangang Zhu, Venkat Gaddam, Lan Yang; Washington Univ. in St. Louis, USA.* We theoretically and experimentally demonstrate that thermal effect in ultra-high-*Q* silica toroidal microresonators can be compensated by applying a layer of polydimethylsiloxane (PDMS). The observed *Q* factor is $1.5\times10^6$ for coating thickness of 0.52 µm.

**CTuE7 • 9:30 a.m.**
**Ultimate Miniaturization of Single and Coupled Resonator Filters in Silicon Photonics,** *Mohammad Soltani, Qing Li, Siva Yegnanarayanan, Ali Adibi; Georgia Tech, USA.* Resonator-based filters using oxide-clad silicon microdisks scaled to ultimate miniaturization (radius~1.5-2 µm) close to radiation limit are demonstrated. High-Q (~150000) and single-mode operation in each microdisk enables low insertion-loss and large free-spectral-range filters.

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

NOTES

Room 336

CLEO

## CTuF • LED Materials and III-Nitride Semiconductors—Continued

**CTuF4 • 9:00 a.m.**
**Strong Photoluminescence from InGaN/GaN Nanorods Arrays Studies by Time-Resolved Photoluminescence,** *Chi-Chang Hong[1], Hyeyoung Ahn[1], Chen-Ying Wu[2], Shangjr Gwo[2]; [1]Dept. of Photonics, Inst. of Electro-Optical Engineering, Natl. Chiao Tung Univ., Taiwan, [2]Dept. of Physics, Natl. Tsing-Hua Univ., Taiwan.* We report more than one order of magnitude stronger green photoluminescence from InGaN/GaN nanorods arrays compare to that from InGaN epilayer and its emission mechanism studied by time-resolved and temperature-resolved photoluminescence measurement.

**CTuF5 • 9:15 a.m.**
**Pulsed Metalorganic Chemical Vapor Deposition of in-Polar and N-Polar InN Semiconductors on GaN/Sapphire for Terahertz Applications,** *Hongping Zhao, Muhammad Jamil, Guangyu Liu, G.S. Huang, Hua Tong, Guibao Xu, Yujie Ding, Nelson Tansu; Lehigh Univ., USA.* Narrow bandgap (0.77eV) In- and N-polar InN semiconductors were grown by using pulsed metalorganic chemical vapor deposition. Ultrafast laser excitation on optimized In-polar InN sample resulted in terahertz radiation (0.25-2.0THz) with output power of 2.36μW.

**CTuF6 • 9:30 a.m.**
**Stark Effect Induced by Photogenerated Carriers in Multiple GaN/AlN Asymmetric Coupled Quantum Wells,** *Guan Sun[1], Suvranta K. Tripathy[1], Yujie J. Ding[1], Guangyu Liu[1], G. S. Huang[1], Hongping Zhao[1], Nelson Tansu[1], Jacob B. Khurgin[2]; [1]Lehigh Univ., USA, [2]Johns Hopkins Univ., USA.* We have observed blue and red Stark shifts of two excitonic transition peaks in multiple GaN/AlN asymmetric coupled quantum wells due to increases in electric fields originating from spatial separation of photogenerated electrons and holes.

Room 337 / Room 338

IQEC

## ITuB • Quantum Information IV—Continued

**ITuB4 • 9:00 a.m.**
**Quantum Teleportation of Wavepackets in a Non-Gaussian State,** *Noriyuki Lee[1,2], Yuishi Takeno[1,2], Hugo Benichi[1,2], Hidehiro Yonezawa[1,2], James Webb[3], Elanor Huntington[3], Ladislav Mišta[4], Radim Filip[4], Peter Van Loock[5], Samuel L. Braunstein[6], Akira Furusawa[1,2]; [1]Dept. of Applied Physics, School of Engineering, Univ. of Tokyo, Japan, [2]CREST, Japan Science and Technology Agency, Japan, [3]Ctr. for Quantum Computer Technology, School of Information Technology and Electrical Engineering, Univ. College, Univ. of New South Wales, Australia, [4]Dept. of Optics, Palacký Univ., Czech Republic, [5]Optical Quantum Information Theory Group, Inst. of Theoretical Physics I and Max-Planck Res. Group, Inst. of Optics, Information and Photonics, Univ. of Erlangen-Nürnberg, Germany, [6]Computer Science, Univ. of York, UK.* We demonstrate quantum teleportation of wavepackets in a non-Gaussian state, so-called "Schroedinger kitten", for the first time.

**ITuB5 • 9:15 a.m.**
**A Neglected Noise Source in Quantum Optics,** *Antônio S. Coelho[1], Jônatas E. S. César[1], Katiúscia N. Cassemiro[2], Alessandro S. Villar[3], Marcelo Martinelli[1], Paulo Nussenzveig[1]; [1]Inst. de Física, Univ. de São Paulo, Brazil, [2]Max-Planck Junior Res. Group, Germany, [3]Max-Planck-Inst. for the Science of Light, Univ. of Erlangen-Nuremberg, Germany.* In the nonlinear interaction of intense beams with a crystal inside an optical cavity, phonon scattering of the central carrier into sidebands acts as a source of extra phase noise for experiments in quantum optics.

**ITuB6 • 9:30 a.m.**
**Fidelity of a Conditional Quantum Teleportation Protocol Based on Imperfect Detection of Collective Spontaneous Emission,** *Richard Wagner Jr., James P. Clemens; Miami Univ., USA.* We employ quantum trajectory theory to model temporally resolved photodetection of collective emission from a pair of atoms to investigate the performance of a conditional quantum teleportation protocol. We include effects of imperfect photodetection.

## ITuC • Spatial and Temporal Nonlinear Effects—Continued

**ITuC5 • 9:00 a.m.**
**Field-Free Unidirectional Molecular Rotation Following Excitation by Two Ultrashort Pulses,** *Sharly Fleischer, Yuri Khodorkovsky, Ilya Sh. Averbukh, Yehiam Prior; Weizmann Inst. of Science, Israel.* By varying the polarization and delay between two ultrashort laser pulses, we control the plane, speed, and sense of molecular rotation. This control may be implemented to individual components within a molecular mixture.

**ITuC6 • 9:15 a.m.**
**Sub-Diffraction Limited CARS Microscopy: A Theoretical Investigation,** *Willem P. Beeker[1], Petra Groß[2], Chris J. Lee[1], Carsten Cleff[2], Herman L. Offerhaus[1], Carsten Fallnich[2], Jennifer L. Herek[1], Klaus -J. Boller[1]; [1]Univ. of Twente, Netherlands, [2]Westfälische Wilhelms-Univ., Germany.* The possibility of obtaining sub-diffraction limited spatial resolution with label-free imaging, based on coherent anti-Stokes Raman (CARS) microscopy, is investigated numerically. Like STED, CARS emission is strongly suppressed by applying an additional light field.

**ITuC7 • 9:30 a.m.**
**Airy Beam Propagation through Unbiased Photorefractive Media,** *Joyce Lee[1], Shu Jia[1], Jason W. Fleischer[1], Demetrios N. Christodoulides[2]; [1]Princeton Univ., USA, [2]CREOL, College of Optics and Photonics, Univ. of Central Florida, USA.* We observe the propagation of 1-D airy beams through an unbiased photorefractive crystal. For ordinary polarization, the beam diffracts, while for extraordinary polarization it experiences nonlinearity through charge diffusion and has its diffraction suppressed.

Room 339

CLEO

## CTuG • THz Parametric Generation—Continued

**CTuG5 • 9:00 a.m.**
**THz Generation from InN Films Based on Interference between Optical Rectification and Photocurrent Surge,** *Guibao Xu[1], Yujie J. Ding[1], Hongping Zhao[1], Muhammad Jamil[1], Nelson Tansu[1], Ioulia B. Zotova[2], Charles E. Stutz[3], Darnell E. Diggs[3], Nils Fernelius[3], Frank K. Hopkins[3], Chad S. Gallinat[4], Gregor Koblmüller[4], James S. Speck[4]; [1]Lehigh Univ., USA, [2]ArkLight, USA, [3]AFRL, USA, [4]Univ. of California at Santa Barbara, USA.* THz average output power as high as 2.4 microwatts is generated from InN films, with the mechanism being the interference between optical rectification and photocurrent surge.

**CTuG6 • 9:15 a.m.**
**Terahertz Emission from Nonpolar Indium Nitride,** *Grace D. Metcalfe[1], Hongen Shen[1], Michael Wraback[1], Gregor Koblmüller[2], Chad S. Gallinat[2], James S. Speck[2]; [1]ARL, USA, [2]Univ. of California at Santa Barbara, USA.* We present terahertz emission from nonpolar InN due to carrier transport in stacking fault-related internal in-plane electric fields. Evidence of in-plane transport is observed as a terahertz waveform polarity flip with reversal of the *c*-axis.

**CTuG7 • 9:30 a.m.**
**High Efficiency THz Pulse Generation in New Stilbazolium Salts,** *Marcel Stillhart, Arno Schneider, Zhou Yang, Blanca Ruiz, Mojca Jazbinsek, Peter Günter; ETH Zurich, Switzerland.* The THz generation efficiency in two new stilbazolium salts pumped by laser sources at telecommunication wavelengths is increased compared to DAST, the benchmark material for this application.

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

NOTES

Room 340 | Room 341 | Rooms 328-329

## CLEO

### CTuH • Photonic Crystal and DBR Lasers—Continued

**CTuH4 • 9:00 a.m.**
**Short (~1µm) Quantum-Wire Single-Mode Photonic-Crystal Microcavity Laser,** *Kirill A. Atlasov, Milan Calic, Fredrik Karlsson, Pascal Gallo, Alok Rudra, Benjamin Dwir, Eli Kapon; École Polytechnique Fédérale de Lausanne, Switzerland.* High spontaneous-emission coupling and low-threshold lasing is achieved in semiconductor photonic-crystal cavities using short quantum wires. Lasing is established and characterized based on the linewidth narrowing and time-resolved photon dynamics.

**CTuH5 • 9:15 a.m.**
**High Optical Feedback-Tolerance of Distributed Reflector Lasers with Wire-Like Active Regions for High Speed Isolator-Free Operation,** *SeungHun Lee, Noriaki Tajima, Takahiko Shindo, Daisuke Takahashi, Nobuhiko Nishiyama, Shigehisa Arai; Tokyo Inst. of Technology, Japan.* Optical feedback-tolerance of distributed-reflector (DR) laser with a wirelike distributed-feedback section and distributed-Bragg-reflector (DBR) section was investigated. Isolator-free 2.5-Gb/s-10-km transmissions and low RIN were demonstrated under -13.5-dB optical back-reflection with a power penalty of 2-dB.

**CTuH6 • 9:30 a.m.**
**Single-Mode Q-Switched Pulse Generation from a Tapered DBR Laser,** *M. Xia[1], C. H. Kwok[1], R. V. Penty[1], I. H. White[1], K. -H. Hasler[2], B. Sumpf[2], G. Erbert[2]; [1]Univ. of Cambridge, UK, [2]Ferdinand-Braun-Inst. für Höchstfrequenztechnik, Germany.* Q-switching of a 1060 nm quantum-well tapered DBR laser is investigated. Single-mode optical pulses are generated with a peak power of 3.4W, pulse energy of 1nJ and a FWHM spectral width of <0.09 nm.

### CTuI • Micro-Structured Nonlinear Optics—Continued

**CTuI5 • 9:00 a.m.**
**Nonlinear Inter-Core Coupling in Triple-Core Photonic Crystal Fibers,** *Yan Yan[1], Jean Toulouse[1], Kristen J. Boucher[2]; [1]Dept. of Physics, Lehigh Univ., USA, [2]McGill Univ., Canada.* We model and investigate experimentally the propagation of light in a triple-core photonic crystal fiber (PCF) in the nonlinear regime. Two separate nonlinear effects are identified, giving rise to two separate nonlinear ranges.

**CTuI6 • 9:15 a.m.**
**Nonlinear Polarization Rotation in a Carbon Nanotubes-Filled Micro-Slot Fiber Device for All-Optical Wavelength Conversion,** *K. K. Chow[1], A. Martinez[1], K. Zhou[2], I. Bennion[2], S. Yamashita[1]; [1]Dept. of Electrical Engineering and Information Systems, Univ. of Tokyo, Japan, [2]Photonics Res. Group, School of Engineering and Applied Science, Aston Univ., UK.* We demonstrate wavelength conversion based on cross-phase modulation induced nonlinear polarization rotation in a carbon nanotubes-filled micro-slot fiber device. Wavelength converted signal with 3-dB power penalty for 10 Gb/s NRZ signal is obtained.

**CTuI7 • 9:30 a.m.**
**Nonlinear Diffraction in Two-Dimensional Nonlinear Photonic Structures with a Short-Range Order,** *Yan Sheng[1], Solomon M. Saltiel[2,3], Dragomir Neshev[2], Wieslaw Krolikowski[2], Kaloian Koynov[1], Yuri S. Kivshar[2]; [1]Max -Plank-Inst. for Polymer Res., Germany, [2]Nonlinear Physics Ctr. and Laser Physics Ctr., Australian Natl. Univ., Australia, [3]Dept. of Physics, Sofia Univ., Bulgaria.* We report the nonlinear diffraction and Cherenkov radiation via second-harmonic generation in two-dimensional short-range ordered nonlinear photonic structures. We discuss a model for describing this phenomenon and analyze the observed diffraction patterns and polarization properties.

### CTuJ • PON and Light Sources—Continued

**CTuJ5 • 9:00 a.m.**
**Tunable N-Fold Multicasting and Pulsewidth of 40 Gb/s Channels by Variable Periodic Slicing of a Supercontinuum,** *Omer F. Yilmaz, Scott Nuccio, Xiaoxia Wu, Alan E. Willner; Univ. of Southern California, USA.* We demonstrate tunable-fold multicasting of 40-Gb/s RZ-OOK channels via supercontinuum slicing by a polarization-based tunable periodic-filter. 2-, 4-, and 8-fold multicasting were achieved with average power penalties of 0.1, 0.26, 0.44dB, respectively, at $10^{-9}$ BER.

**CTuJ6 • 9:15 a.m.**
**OSNR Requirements for Optical Multicarrier Generator for Short Range Radio-over-Fiber Systems,** *Youngjae Kim[1], Mohammad Pasandi[2], Serge Doucet[2], Leslie Rusch[2], Sophie LaRochelle[2]; [1]Univ. Laval, Canada, [2]Ctr. d'Optique, Photonique et Lasers, Univ. Laval, Canada.* We demonstrate an optimized and compact optical multicarrier generator for radio-over-fiber (ROF) systems. We verify that the generator meets the OSNR and optical carrier power requirements for good quality OFDM signals.

**CTuJ7 • 9:30 a.m.**
**Multifunctional and Reconfigurable 10-GHz Operation of an Optical Injection-Locked VCSEL,** *Bo Zhang[1], Xiaoxue Zhao[2], Devang E. Parekh[2], Yang E. Yue[1], Werner E. Hofmann[3], Markus E. Amann[3], Connie E. Chang-Hasnain[2], Alan E. Willner[1]; [1]Univ. of Southern California, USA, [2]Univ. of California at Berkeley, USA, [3]Technical Univ. of Munich, Germany.* Using a single chirp-adjustable injection-locked 1.55-µm multi-mode VCSEL followed by a tunable interferometer, we experimentally demonstrate three unique functions, showing UWB-monocycle generation, NRZ to PRZ format conversion, and NRZ-data clock recovery.

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

NOTES

## Rooms 318-320 — IQEC

### 10:30 a.m.–12:15 p.m.
### ITuD • Metamaterials II
*Mikhail A. Noginov; Norfolk State Univ., USA, Presider*

**ITuD1 • 10:30 a.m.**
**Transient Response in Optical ENZ Nanocircuit Boards,** *Nader Engheta[1], Andrea Alù[1,2]; [1]Univ. of Pennsylvania, USA, [2]Univ. of Texas at Austin, USA.* Using analytical and numerical methods, we analyze the temporal response of optical nanocircuit boards formed by grooves in epsilon-near-zero (ENZ) metamaterial substrates. We discuss bandwidth, group velocity and signal delay in such ENZ-surrounded channels.

**ITuD2 • 10:45 a.m.**
**Electromagnetic Coupling Effects in Pairs of Split-Ring Resonators,** *Nils Feth[1], Martin Wegener[2], Stefan Linden[1], Martin Husnik[2], Michael König[3], Kai Stannigel[3], Jens Niegemann[3], Kurt Busch[3]; [1]Inst. für Nanotechnologie, Forschungszentrum Karlsruhe in der Helmholtz-Gemeinschaft, Germany, [2]Inst. für Angewandte Physik, Univ. of Karlsruhe, Germany, [3]Inst. für Theoretische Festkörperphysik, Univ.of Karlsruhe, Germany.* We measure the absolute extinction cross-section spectrum of isolated pairs of split-ring resonators by a modulation technique. The spectral position of the magnetic resonance depends on the separation of the split-ring resonators.

**ITuD3 • 11:00 a.m.**
**Polarizing Properties of Three-Dimensional Helical Metamaterials,** *Justyna K. Gansel[1], Michael Thiel[1], Martin Wegener[1], Klaus Bade[2], Volker Saile[2], Georg von Freymann[3], Stefan Linden[3]; [1]Inst. für Angewandte Physik and Ctr. for Functional Nanostructures, Univ. of Karlsruhe, Germany, [2]Inst. für Mikrostrukturtechnik, Forschungszentrum Karlsruhe, Germany, [3]Inst. für Nanotechnologie, Forschungszentrum Karlsruhe, Germany.* We investigate the polarizing properties of chiral photonic metamaterials composed of three-dimensional metal helices. The calculated spectra reveal pronounced circular dichroism. Our geometry parameters are compatible with fabrication via direct laser writing and electrodeposition.

**ITuD4 • 11:15 a.m.**
**Sub-Picosecond Optical Switching in the Near-Infrared Using Negative Index Metamaterials,** *Keshav M. Dani[1], Zahyun Ku[2], Prashanth C. Upadhya[1], Rohit P. Prasankumar[1], Steve R. J. Brueck[2], Antoinette J. Taylor[1]; [1]Ctr. for Integrated Nanotechnologies, Los Alamos Natl. Lab, USA, [2]Ctr. for High Technology Materials and Electrical and Computer Engineering Dept., Univ. of New Mexico, USA.* We study the ultrafast non-linear optical properties of a negative-index metamaterial. In particular, we achieve sub-picosecond optical switching allowing for terabits per second modulation at telecommunication wavelengths.

## Rooms 321-323 — JOINT

### 10:30 a.m.–12:15 p.m.
### JTuB • Slow/Fast Light and its Applications Joint CLEO/IQEC Symposium I: Stimulated Brillouin and Raman Scattering
*Jean Toulouse; Lehigh Univ., USA, Presider*

**JTuB1 • 10:30 a.m.** Tutorial
**Capabilities and Limitations of Slow Light Optical Buffers: Searching for the Killer Application,** *Rodney Stuart Tucker; Univ. of Melbourne, Australia.* We provide an overview of the capabilities and limitations of slow light optical buffers. A number of fundamental waveguide properties such as loss and dispersion severely limit the opportunities for practical slow light optical buffering.

Rod Tucker is a Laureate Professor at the University of Melbourne and Research Director of the Australian Research Council Special Research Centre for Ultra-Broadband Information Networks (CUBIN). He has worked at the University of California at Berkeley, Cornell University, Plessey Research (Caswell), AT&T Bell Laboratories, Hewlett Packard Laboratories and Agilent Technologies. He is a Fellow of the Australian Academy of Science, the Australian Academy of Technological Sciences and Engineering, the IEEE, and OSA. He was awarded the Australia Prize in 1977 for contributions to telecommunications and the IEEE LEOS Aron Kressel Award in 2007 for his contributions to semiconductor optoelectronics.

## Rooms 324-326 — JOINT

### 10:30 a.m.–12:15 p.m.
### JTuC • Daniel Chemla Joint CLEO/IQEC Symposium II
*Theodore Norris; Univ. of Michigan, USA, Presider*

**JTuC1 • 10:30 a.m.** Invited
**Excitons in the Family: Working with Daniel Chemla,** *Wayne H. Knox; Inst. of Optics, Univ. of Rochester, USA.* Daniel Chemla was an inspirational scientist, natural mentor and visionary leader. I share my experiences working with Daniel and others at Bell Labs from 1984 through the 1990s on "all excitons all the time".

**JTuC2 • 11:00 a.m.** Invited
**Nonlinear Terahertz Spectroscopy of Semiconductors,** *Stephan W. Koch, M. Kira, J. T. Steiner, D. Golde; Philipps Univ. Marburg, Germany.* Studies are presented that combine optical and THz excitation in the linear and nonlinear regimes. The analysis focuses on exciton formation and decay, the plasmonic response, THz gain, excitonic Rabi flopping, and quantum-state control.

## Room 314 — CLEO

### 10:30 a.m.–12:15 p.m.
### CTuK • Control of Frequency Combs
*Scott Diddams; NIST, USA, Presider*

**CTuK1 • 10:30 a.m.**
**Vibration Immune Fiber-Laser Frequency Comb Based on a Polarization-Maintaining Figure-Eight Laser,** *Fabrizio R. Giorgetta[1], Esther Baumann[1], Jeffrey W. Nicholson[2], William C. Swann[1], Ian Coddington[1], Nathan R. Newbury[1]; [1]NIST, USA, [2]OFS Labs, USA.* A frequency comb is phase-locked to a cw laser with an electro-optic-modulator providing 1.6MHz feedback bandwidth. Residual phase-noise was as low as -94dBc/Hz, and the comb remained locked under mechanical vibration of up to 1.9g.

**CTuK2 • 10:45 a.m.**
**Phase-Stabilized 167 MHz Repetition Frequency Carbon Nanotube Fiber Laser Frequency Comb,** *Jinkang Lim[1], Kevin Knabe[1], Yishan Wang[1,2], Rodrigo Amezcua-Correa[3], François Couny[3], Philip S. Light[3], Fetah Benabid[3], Jonathan C. Knight[3], Kristan L. Corwin[1], Jeffrey W. Nicholson[4], Brian R. Washburn[1]; [1]Kansas State Univ., USA, [2]Xi'an Inst. of Optics and Precision Mechanics, China, [3]Ctr. for Photonics and Photonics Materials, Univ. of Bath, UK, [4]OFS Labs, USA.* The frequency comb generated by a high repetition frequency erbium-doped fiber ring laser using carbon nanotube saturable absorber is phase-stabilized for the first time. The comb's stability is compared a photonic crystal fiber acetylene reference.

**CTuK3 • 11:00 a.m.**
**Octave-Spanning Fiber Laser Comb with 300 MHz Comb Spacing for Optical Frequency Metrology,** *Jin-Long Peng, Tze-An Liu, Ren-Huei Shu; Ctr. for Measurement Standards, Taiwan.* A passively mode-locked Er-fiber laser via nonlinear polarization rotation with fundamental repetition rate of 300 MHz is demonstrated. Frequency stabilization of the spectrum-broadened, octave-spanning laser comb and application to optical frequency measurement is reported.

**CTuK4 • 11:15 a.m.**
**Ultra-Broad Absolute-Frequency Tunable Light Source Locked to a Fiber-Based Frequency Comb,** *Hisanari Takahashi[1,2], Yoshiaki Nakajima[1,3], Hajime Inaba[1], Kaoru Minoshima[1,2]; [1]AIST, Japan, [2]Tokyo Univ. of Science, Japan, [3]Univ. of Fukui, Japan.* A phase-locked 110-GHz continuously-tunable optical-single-frequency generator is developed based on a phase-stabilized fiber-based comb. Stability of the optical frequencies at 1s are 3.0 and $31\times10^{-12}$ at scanning speeds of 0.17 and 1.0 GHz/s, respectively.

### 10:30 a.m.–12:15 p.m.
### CTuL • Communication Components and Techniques
*Shayan Mookherjea; Univ. of California at San Diego, USA, Presider*

**CTuL1 • 10:30 a.m.**
**Packet Switching Demonstrator Using an Integrated and Pigtailed Add-Drop Filter Based on Photonic Crystal Structures,** *J.J. Vegas Olmos[1], Ken-ichi Kitayama[1], Masatoshi Tokushima[2]; [1]Osaka Univ., Japan, [2]NEC Corp., Japan.* We demonstrate packet switching using an integrated-and-pigtailed add-drop filter based on photonic crystal structures at 10-Gbps. The results show a negligible power-penalty of less than 2dB for packet-based operation (and 2.5dB for static operation).

**CTuL2 • 10:45 a.m.**
**Optimized Pulse Shaping for Mitigating Optical Nonlinearity,** *Benoît Châtelain[1], Odile Liboiron-Ladouceur[1], François Gagnon[2], David V. Plant[1]; [1]McGill Univ., Canada, [2]École de Technologie Supérieure, Canada.* A new pulse shape for optical nonlinearity mitigation is proposed. Realistic simulations show that a 2.3 dB increase in launch power can be obtained at no extra cost.

**CTuL3 • 11:00 a.m.** Tutorial
**Modulation and Multiplexing in Optical Communications,** *Peter J. Winzer; Bell Labs, Alcatel-Lucent, USA.* Starting with capacity- and sensitivity-constrained transport (fiber-optic networks, satellite links), optics is steadily replacing electronics, progressing into implementation-constrained (on-chip) applications. At the same time, significant innovations are needed to continue optical transport capacity scaling.

Peter J. Winzer received his Ph.D. in electrical engineering from the Vienna University of Technology, Austria, in 1998. Supported by the European Space Agency, he investigated space-borne Doppler lidar and laser communications using high-sensitivity digital modulation and detection. In 2000 he joined Bell Labs, focusing on many aspects of fiber-optic networks from 10 to 100 Gb/s, including several 100-Gb/s transmission demonstrations. He has widely published and patented and is actively involved in technical and organizational tasks with LEOS and OSA. He is a Distinguished Member of Technical Staff at Bell Labs, a Member of OSA and a Fellow of the IEEE.

### 10:30 a.m.–12:15 p.m.
### CTuM • Optofluidics for Biosensing and Analysis CLEO Symposium II: Photonic Crystals and Bioanalysis
*David Erickson; Cornell Univ., USA, Presider*

**CTuM1 • 10:30 a.m.** Invited
**Optofluidic Fabrication of Functional Particles with Controlled Sizes, Shapes and Structures,** *Seung-Man Yang, Shin-Hyun Kim, Seung-Kon Lee, Hyo Sung Park; KAIST, Republic of Korea.* We will consider two different routes to functional nanostructures; namely, self-organization of colloids inside microfluidic devices and holographic lithography directly on pre-patterned microfluidic channels. The structures have potential applications in diagnosis, bio-imaging and biochemical identification.

**CTuM2 • 11:00 a.m.**
**Thermo-Optic Stabilization of Optofluidic Photonic Crystal Resonators,** *Christian Karnutsch[1], Cameron L. C. Smith[1], Alexandra Graham[1], Snjezana Tomljenovic-Hanic[1], Ross McPhedran[1], Benjamin J. Eggleton[1], Liam O'Faolain[2], Thomas F. Krauss[2], Sanshui Xiao[3], Niels Asger Mortensen[3]; [1]Univ. of Sydney, Australia, [2]Univ. of St. Andrews, UK, [3]Technical Univ. of Denmark, Denmark.* We investigate the temperature sensitivity of silicon-based optofluidic photonic crystal double-heterostructure resonators. We systematically study the optical properties of these resonators as function of temperature, specifically demonstrating the potential for creating temperature-insensitive photonic crystal devices.

**CTuM3 • 11:15 a.m.**
**On-Chip Single Particle Spectroscopy,** *Arthur Nitkowski, Michal Lipson; Cornell Univ., USA.* We demonstrate on-chip optical trapping of micron-sized dielectric spheres using supercontinuum light and silicon nitride waveguides. The broadband source enables scattering spectroscopy to be performed on single particles trapped by a high-confinement waveguide.

### 10:30 a.m.–12:15 p.m.
### CTuN • Silicon Nanocrystals Light Emission
*Yasuhiko Arakawa; Univ. of Tokyo, Japan, Presider*

**CTuN1 • 10:30 a.m.** Tutorial
**Light Emission from Silicon Nanostructures: Past, Present and Future Perspectives,** *Luca Dal Negro; Boston Univ., USA.* In this tutorial, I will review the main approaches developed to engineer efficient light emission from silicon-based materials and I will discuss the state of the art for on-chip optical amplifiers and silicon laser devices.

Luca Dal Negro received both the Laurea in physics, *summa cum laude*, in 1999 and the Ph.D. degree in semiconductor physics from the University of Trento, Italy, in 2003. In 2003 he joined MIT as a post doctoral associate. Since January 2006 he has been the Assistant Professor in the Department of Electrical and Computer Engineering at Boston University and a Photonics Center faculty member. He manages and conducts research projects on silicon-based photonic materials and devices, plasmon sensing, and aperiodic photonic structures. His current research focus is on materials nanofabrication, silicon photonics, semiconductor spectroscopy, optics of complex media, and nanoplasmonics. He has authored and coauthored more than 70 technical articles.

## Room 336 — CLEO

### 10:30 a.m.–12:15 p.m.
### CTuO • Waveguides and Emitters
*Sunao Kurimura; Natl. Inst. for Materials Science, Japan, Presider*

**CTuO1 • 10:30 a.m.**
**Characterization of Single-Mode Chalcogenide Glass Waveguides at 8.35 μm,** *Mark C. Phillips, Amy H. Qiao, Bruce E. Bernacki, Norman C. Anheier; Pacific Northwest Natl. Lab, USA.* Laser-written single-mode waveguides in $As_2Se_3/As_2S_3$ films were characterized at 8.35 μm using the Fabry-Perot technique. Waveguide loss and refractive index were measured as a function of writing dose and compared to modeling results.

**CTuO2 • 10:45 a.m.**
**Solution-Cast $As_2S_3$ Raised Strip Waveguides for Integrated Mid-IR Optics,** *Candice Tsay[1], Elvis Mujagic[2], Claire F. Gmachl[1], Craig B. Arnold[1]; [1]Princeton Univ., USA, [2]Vienna Univ. of Technology, Austria.* The development of planar chalcogenide glass waveguides leads the way toward integrated mid-infrared optics. $As_2S_3$ waveguides fabricated by solution casting have a transmission loss of 9.47 dB/cm at 4.8μm.

**CTuO3 • 11:00 a.m.**
**Optical Loss Reduction in HIC Chalcogenide Glass Waveguides via Thermal Reflow,** *Juejun Hu[1], Ning-Ning Feng[1], Anu Agarwal[1], Lionel C. Kimerling[1], Nathan Carlie[2], Laeticia Petit[2], Kathleen Richardson[2]; [1]MIT Microphotonics Ctr., USA, [2]School of Materials Science and Engineering, Ctr. for Optical Materials Science and Engineering Technologies, Clemson Univ., USA.* A rapid thermal reflow technique is applied to high-index-contrast, sub-micron waveguides in $As_2S_3$ chalcogenide glass to reduce sidewall roughness and associated optical scattering loss. Up to 50% optical loss reduction after reflow treatment is achieved.

**CTuO4 • 11:15 a.m.**
**Detection of Structural Defects of Extremely Low Concentrations in Commercial Synthetic Silica Glass,** *Madoka Ono[1], Akio Koike[1], Tomonori Ogawa[2], Masaaki Takata[2], Shinya Kikugawa[2]; [1]Asahi Glass Co., Japan, [2]Asahi Glass Electronics Co. Ltd., Japan.* Concentrations of intrinsic structural defects in synthetic silica glass, AQT, were measured by highly sensitive ESR and photoluminescence measurements. It was revealed that the defects, influential for 193 nm absorption, were less than $10^{13}$ pcs/cm$^3$.

## Room 337 — IQEC

### 10:30 a.m.–12:15 p.m.
### ITuE • Fiber Generation of Single and Entangled Photons
*Prem Kumar; Northwestern Univ., USA, Presider*

**ITuE1 • 10:30 a.m.**
**Narrowband All-Fibre Source of Heralded Single Photons,** *Alex R. McMillan[1], Jeremie Fulconis[2], Matthaeus Halder[2], John G. Rarity[2], William J. Wadsworth[1]; [1]Univ. of Bath, UK, [2]Univ. of Bristol, UK.* We demonstrate an all-fibre source of near time-bandwidth limited, heralded single photons at 1570nm. An output of $9.2\times10^4$ heralded photons per second was achieved with a heralding fidelity of 52%.

**ITuE2 • 10:45 a.m.**
**Photon Pair Generation via Spontaneous Four-Wave Mixing in Birefringent Optical Fibers,** *Brian J. Smith, Pierre Mahou, Offir Cohen, Jeff S. Lundeen, Ian A. Walmsley; Univ. of Oxford, UK.* We experimentally demonstrate photon pair production in standard single-mode optical fibers via spontaneous four-wave mixing. The process utilizes birefringent phase matching to control the photon-pair joint spectral structure.

**ITuE3 • 11:00 a.m.**
**Fibre Source of Intrinsically Time Bandwidth Limited Photon Pairs,** *Jeremie Fulconis[1], Matthaeus M. Halder[1], Alex Clark[1], Ben Cemlyn[1], Jeremy O'Brien[1], John G. Rarity[1], Chunle Xiong[2], William J. Wadsworth[2]; [1]Dept. of Electrical and Electronic Engineering, Univ. of Bristol, UK, [2]Dept. of Physics, Univ. of Bath, UK.* We investigate a new phase-matching scheme for pure state photon pair generation in birefringent photonic crystal fibres. We demonstrate 80% visibility non-classical interference between unfiltered photons coming from non-degenerate pairs and created in separate sources.

**ITuE4 • 11:15 a.m.**
**PCF Photon Pair Source Bridging the Visible and NIR,** *Christoph Söller, Benjamin Brecht, Peter J. Mosley, Leyun Zang, Alexander Podlipensky, Philip St. J. Russell, Christine Silberhorn; Max-Planck Res. Group, Germany.* We present a PCF photon pair source with signal and idler emission in the visible and near-infrared wavelength regions. Our joint spectral coincidence measurements indicate that the generation of spectrally decorrelated photon pairs is possible.

## Room 338 — IQEC

### 10:30 a.m.–12:15 p.m.
### ITuF • Novel Phenomena
*Hui Cao; Yale Univ., USA, Presider*

**ITuF1 • 10:30 a.m.**
**Nonlinear Generation and Manipulation of Airy Beams,** *Tal Ellenbogen, Noa Voloch, Ayelet Ganany-Padowicz, Ady Arie; Tel-Aviv Univ., Israel.* We demonstrate a quadratic nonlinear photonic structure that converts a fundamental Gaussian beam to an accelerating airy beam at the second harmonic. The nonlinear response enables all-optical switching of the beam's acceleration direction.

**ITuF2 • 10:45 a.m.**
**Experimental Demonstration of Optical Wave Propagation in *PT*-Symmetric Potentials,** *Christian E. Rüter[1], Detlef Kip[1], Konstantinos G. Makris[2], Demetrios N. Christodoulides[2], Or Peleg[3], Mordechai Segev[3]; [1]Clausthal Univ. of Technology, Germany, [2]CREOL, College of Optics and Photonics, Univ. of Central Florida, USA, [3]Technion-Israel Inst. of Technology, Israel.* Wave propagation in parity-time symmetric potentials is studied for the first time in systems involving a complex refractive index distribution with gain/loss. We demonstrate experimental results for an optically-pumped directional coupler in photorefractive $LiNbO_3$.

**ITuF3 • 11:00 a.m.**
**Parametric Optical Magnetism and the Complex Mathieu Equation,** *William M. Fisher, Stephen C. Rand; Univ. of Michigan, USA.* Motion of a bound electron driven by moderately intense light is shown experimentally to generate intense parametric magnetism and theoretically undergoes ultrafast growth of nonlinear magnetic susceptibility governed by a complex Mathieu equation.

**ITuF4 • 11:15 a.m.**
**Autoresonant Optics and Many-Body Random-Phase Autoresonance,** *Assaf Barak[1], Mordechai Segev[1], Lazar Friedland[2]; [1]Technion-Israel Inst. of Technology, Israel, [2]Hebrew Univ. of Jerusalem, Israel.* We study autoresonant dynamics of light, unraveling a new effect: many-body autoresonance. The phenomenon involves multi-component mutually-uncorrelated waves passing adiabatically through resonance, and a sharp common-threshold transition to nonlinear phase-locking and amplification to predetermined amplitudes.

## Room 339 — CLEO

### 10:30 a.m.–12:15 p.m.
### CTuP • Nd Lasers
*Eric Honea; Lockheed Martin Aculight, USA, Presider*

**CTuP1 • 10:30 a.m.**
**946nm Single-Frequency Operation in a Non-Planar Ring Cavity with Corner Cube,** *Ke Gong, Keying Wu, Shufang He, Yujing Huo; Dept. of Electronic Engineering, Tsinghua Univ., China.* 946nm single-frequency operation is demonstrated in a non-planar ring cavity consisted of corner cube and thermally bonded Porro prism. Pumped by optical fiber coupled LD, maximum continuous output power of 160mW is generated.

**CTuP2 • 10:45 a.m.**
**Investigation of the Self-Injection Locked Behaviour of a Continuous Wave Nd:YAG Ring Laser,** *Tobias Meier[1,2], Benno Willke[1,2], Marina Dehne[1,2], Karsten Danzmann[1,2]; [1]Albert Einstein Inst., Max-Planck-Inst. for Gravitational Physics, Germany, [2]Inst. für Gravitationsphysik, Leibniz Univ. Hannover, Germany.* External redirection of light from one propagation direction of a ring laser back into the opposite direction forces uni-directional operation. We investigated this so-called self-injection locking effect and achieved single-frequency operation.

**CTuP3 • 11:00 a.m.**
**Narrow-Line, Continuous-Wave Orange 593.5-nm Generation in Diode-Pumped $Nd:YVO_4$ Laser Using Volume Bragg Gratings,** *Wei-Wen Chen, Yen-Liang Chen, Wei-Kuan Chang, Te-Yuan Chung, Yen-Hung Chen; Dept. of Optics and Photonics, Natl. Central Univ., Taiwan.* We report the demonstration of a single-longitudinal-mode 593.5-nm laser achieved via intracavity sum-frequency generation of a dual-wavelength cw $Nd:YVO_4$ laser using two volume-Bragg-grating reflectors. >2.5-mW 593.5-nm orange light was obtained with this compact laser system.

**CTuP4 • 11:15 a.m.**
**24 W 888nm Pumped $Nd:YVO_4$ 1342 nm Oscillator Operating in the $TEM_{00}$ Mode,** *Florian Lenhardt[1], Martin Nittmann[2], Thorsten Bauer[2], Jürgen Bartschke[2], Johannes Albert L'huillier[1]; [1]Technische Univ. Kaiserslautern, Germany, [2]Xiton Photonics GmbH, Germany.* We report on a 888nm diode pumped $Nd:YVO_4$ cw-laser at 1342 nm, which provides an output power of 24 W into a diffraction limited beam. An optical conversion efficiency of 29% was obtained.

Room 340

# CLEO

## 10:30 a.m.–12:15 p.m.
## CTuQ • Mode-Locking and Dynamics of Semiconductor Lasers
*Luke F. Lester; Ctr. For High Technology Materials, Univ. of New Mexico, USA, Presider*

**CTuQ1 • 10:30 a.m.**
**Ultrafast Pulse Characterization of Semiconductor Single-Section Fabry-Parot Mode-Locked Lasers,** *Weiguo Yang[1], Christophe Dorrer[2]; [1]Western Carolina Univ., USA, [2]Univ. of Rochester, USA.* We used a time-domain modulation based technique to characterize the ultrafast pulse of the semiconductor single-section Fabry-Perot lasers. The pulse spectral phase is found time invariant and hence positively confirms the mode-locking operation.

**CTuQ2 • 10:45 a.m.**
**Sub-200-fs Passively Mode-Locked Semiconductor Disk Laser,** *Peter Klopp[1], Uwe Griebner[1], Martin Zorn[2], Markus Weyers[2]; [1]Max-Born-Inst., Germany, [2]Ferdinand-Braun-Inst., Germany.* The femtosecond laser performance of an optically pumped InGaAs-AlGaAs disk laser emitting around 1.04 µm was studied. Using a saturable absorber with a surface-near quantum well, 190-fs-pulses were generated.

**CTuQ3 • 11:00 a.m.**
**RF Linewidth Narrowing in Quantum-Dash-Based Passive Mode-Locked Lasers Using Optical Feedback,** *Kamel Merghem[1], Sheherazade Azouigui[1], Akram Akrout[1], Anthony Martinez[1], Francois Lelarge[2], Alexandre Shen[2], Guang-Hua Duan[2], Guy Aubin[1], Abderrahim Ramdane[1]; [1]CNRS LPN, France, [2]Bell Labs, Alcatel-Lucent, France.* We report on the effect of external optical feedback on a quantum-dash-based passive mode-locked laser. We demonstrate a RF linewidth narrowing from 5.5 kHz to 800 Hz at a 10 GHz frequency.

**CTuQ4 • 11:15 a.m.**
**Methods for Improved 3dB Bandwidth in an Injection-Locked QDash Fabry Perot Laser @ 1550nm,** *Michael C. Pochet[1], Nader A. Naderi[1], Frederic Grillot[1], Nathan Terry[2], Vassilios Kovanis[2], Luke F. Lester[1]; [1]Ctr. for High Technology Materials, Univ. of New Mexico, USA, [2]AFRL, USA.* The alpha parameter's impact on an injection-locked Fabry-Perot QDash laser's bandwidth is analyzed. A large α is a primary approach to suppress the sag in the response and increase the bandwidth under positive frequency detuning.

Room 341

## 10:30 a.m.–12:15 p.m.
## CTuR • SHG
*Andrew Schober; Lockheed Martin Coherent Technologies, USA, Presider*

**CTuR1 • 10:30 a.m.**
**Characterization of the Second Harmonic of a Nd:$YVO_4$ Laser with Frequency-Shifted Feedback,** *Cheikh Ndiaye, Takefumi Hara, Hiromasa Ito; Tohoku Univ., Japan.* Spectral studies of the second harmonic (SH) of a Nd:$YVO_4$ frequency-shifted feedback laser using a KTP crystal revealed that the SH signal also consists of a frequency comb but chirping twice faster than the fundamental.

**CTuR2 • 10:45 a.m.**
**Compact Narrow-Linewidth 589 nm Laser Source,** *Yushi Kaneda[1], Mahmoud Fallahi[1], Jörg Hader[1,2], Jerome V. Moloney[1,2], Stephan W. Koch[3], Bernardette Kunert[3], Wolfgang Stolz[3]; [1]Univ. of Arizona, USA, [2]Nonlinear Control Strategies, USA, [3]Univ. Marburg, Germany.* 2 W of single-frequency output at 589 nm was demonstrated using second-harmonic generation of a highly-strained InGaAs quantum well optically-pumped semiconductor laser. The linewidth measurement was limited by the 5-MHz resolution of the equipment.

**CTuR3 • 11:00 a.m.**
**Continuous-Wave Frequency Doubling of Near-Infrared Light Using $Al_xGa_{1-x}As$ Bragg Reflection Waveguides,** *Payam Abolghasem, Bhavin J. Bijlani, Amr S. Helmy; Edward S. Rogers Sr. Dept. of Electrical and Computer Engineering, Univ. of Toronto, Canada.* Continuous-wave second harmonic generation in type-I phase-matched $Al_xGa_{1-x}As$ Bragg reflection waveguides is reported. Peak second harmonic power of 3.10 nW was measured for a pump at 1563.5 nm with an internal power of 174 uW.

**CTuR4 • 11:15 a.m.**
**620 mW Single-Frequency Nd:$YVO_4$/$BiB_3O_6$ Red Laser,** *Fabiola Camargo[1], Thomas Zanon-Willette[2], Thomas Badr[2], Niklaus U. Wetter[1], Jean-Jacques Zondy[2]; [1]Inst. de Pesquisas Energéticas e Nucleares, Brazil, [2]Inst. Natl. de Métrologie, Conservatoire Natl. des Arts et Métiers, France.* Using a type-I phase-matched bismuth borate crystal, a record 620 mW single-frequency red laser at 671 nm is achieved from intra-cavity SHG of a π-polarized single-end pumped Nd:$YVO_4$ ring laser oscillating on the λ~1342nm transition.

Rooms 328-329

# PhAST

## 10:30 a.m.–12:30 p.m.
## PTuA • UV LEDs for Health and Safety
*Michael Wraback; ARL, USA, Presider*

**PTuA1 • 10:30 a.m.** Invited
**III-Nitride Based Deep UV LEDs and Applications,** *Remis Gaska; Sensor Electronic Technology, Inc, USA.* Abstract not available.

**PTuA2 • 11:00 a.m.** Invited
**Prospects and Challenges for Disinfection Using UV Light Emitting Diodes,** *D. G. Knight; Trojan Technologies, Canada.* The challenges and prospects for use of UV LEDs in the water disinfection industry, which treats water flows ranging from milliliters per minute to multiple millions of cubic meters per day, will be discussed.

Rooms 318-320 | Rooms 321-323 | Rooms 324-326 | Room 314

IQEC | JOINT | CLEO

## ITuD • Metamaterials II—Continued

**ITuD5 • 11:30 a.m.**
**Ultrafast Modulation of Optical Metamaterials,** *David J. Cho[1], Wei Wu[2], Ekaterina Ponizovskaya[2], Pratik Chaturvedi[2], Alexander M. Bratkovsky[2], Shih-Yuan Wang[2], Xiang Zhang[1], Feng Wang[1], Y. Ron Shen[1,3]; [1]Univ. of California at Berkeley, USA, [2]HP Labs, USA, [3]Materials Science Div., Lawrence Berkeley Natl. Lab, USA.* The optical response of fishnet metamaterial can be modulated in femtosecond time scale. This modulation dynamics is mainly determined by the constituting dielectric medium, but the modulation magnitude is greatly enhanced through the plasmon resonance.

**ITuD6 • 11:45 a.m.**
**High-Frequency Active Metamaterials,** *Ekaterina Poutrina, David R. Smith; Duke Univ., USA.* We present a systematic numerical study of metamaterials integrated with gain media to achieve composite low-loss metamaterials at terahertz and infrared wavelengths. The impact of spatial dispersion on the effective permeability resonance restoration is emphasized.

**ITuD7 • 12:00 p.m.**
**Electromagnetically Induced Transparency in Metamaterials,** *Philippe Tassin[1], Lei Zhang[2], Thomas Koschny[2,3], E. N. Economou[3], C. M. Soukoulis[2,3]; [1]Vrije Univ. Brussel, Belgium, [2]Iowa State Univ., USA, [3]Univ. of Crete, Greece.* We present two metamaterial designs exhibiting spectral features similar to electromagnetically induced transparency in their electric and magnetic response, respectively. These metamaterials combine low absorption with the high group velocity required for slow-light applications.

## JTuB • Slow/Fast Light and its Applications Joint CLEO/IQEC Symposium I: Stimulated Brillouin and Raman Scattering—Continued

**JTuB2 • 11:30 a.m.**
**Polarization Evolution of Stimulated Brillouin Scattering Amplified Signals in Standard Fibers,** *Avi Zadok[1], Elad Zilka[2], Avishay Eyal[2], Luc Thevenaz[3], Moshe Tur[2]; [1]Caltech, USA, [2]Tel-Aviv Univ., Israel, [3]École Polytechnique Fédérale de Lausanne, Switzerland.* The polarization evolution of stimulated Brillouin scattering amplified signals in the presence of fiber birefringence is examined in analysis, simulation and experiment. The signal polarization is drawn towards the conjugate of the pump polarization.

**JTuB3 • 11:45 a.m.**
**Measurement and Modeling of Brillouin Scattering in a Multifilament Core Fiber,** *Guillaume Canat[1], Laurent Lombard[1], Pierre Bourdon[1], Véronique Jolivet[1], Olivier Vasseur[1], Sylvia Jetschke[2], Sonja Unger[2], Johannes Kirchhof[2]; [1]ONERA/DOTA, France, [2]Inst. of Photonic Technology, Germany.* The Brillouin gain efficiency was measured in an Erbium-Ytterbium multifilament-core fiber. The corresponding Brillouin gain is 4dB smaller than for standard doped fibers. Measurement and modeling show the presence of 2 classes of acoustic modes.

**JTuB4 • 12:00 p.m.**
**Modal and Spectral Evolution of Raman Lines in a $H_2$-Filled Hollow Core PCF Taper,** *Francois Couny[1], Benoit Beaudou[2], Phil S. Light[1], Yingying Y. Wang[1], Natalie V. Wheeler[1], Frederic Gerome[2], Fetah Benabid[1]; [1]Univ. of Bath, UK, [2]Xlim, UMR CNRS, France.* The spatial mode evolution of spectral Raman components generated in and propagated through a tapered hollow-core PCF reveals adiabatic transition from core modes to surface mode. Its effect on the Raman converter is discussed.

## JTuC • Daniel Chemla Joint CLEO/IQEC Symposium II—Continued

**JTuC3 • 11:30 a.m.**
**Ultrafast Coherent Electron Spin Flip in a 2-D Electron Gas ,** *Carey E. Phelps, Timothy Sweeney, Hailin Wang; Dept. of Physics and Oregon Ctr. for Optics, Univ. of Oregon, USA.* Spin flip in a 2-D electron gas is realized with a 2 ps, off-resonant laser pulse. Complete spin flip leads to spin precessions that are symmetric with respect to the arrival time of the pi-pulse.

**JTuC4 • 11:45 a.m.** Invited
**Coherence Control of Spin and Charge Currents,** *Henry M. van Driel; Univ. of Toronto, Canada.* We review how quantum interference in absorption pathways can be used to generate spin and charge currents in materials from silicon to carbon nanotubes and also permit the generation and detection of a spin-Hall effect.

## CTuK • Control of Frequency Combs—Continued

**CTuK5 • 11:30 a.m.**
**Self-Referencing of Optical Frequency Combs,** *Christian Grebing, Sebastian Koke, Günter Steinmeyer; Max-Born-Inst., Germany.* We propose and demonstrate a novel technique that allows for intrinsic stabilization of an optical frequency comb to zero offset. This method greatly simplifies carrier-envelope phase control and experiments in extreme nonlinear optics.

**CTuK6 • 11:45 a.m.**
**Efficient Carrier Envelope Offset Locking for a Frequency Comb by Modifying a Collinear *f*-to-2*f* Interferometer,** *Atsushi Ishizawa[1], Tadashi Nishikawa[1], Shinichi Aozasa[2], Atsushi Mori[3], Yousuke Hiraki[4], Osamu Tadanaga[3], Masaki Asobe[3], Hidetoshi Nakano[1]; [1]NTT Basic Res. Labs, NTT Corp., Japan, [2]NTT Access Network Service Systems Labs, NTT Corp., Japan, [3]NTT Photonics Labs, NTT Corp., Japan, [4]NTT Electronics Techno Corp., Japan.* We demonstrate a carrier-envelope-offset-locked frequency comb with 500-pJ pulse energy, with increased coupling efficiency into a tellurite PCF by using angled-V-groove splicing. Carrier-envelope-offset stabilization at telecommunications wavelengths is achieved at the lowest pulse energy.

**CTuK7 • 12:00 p.m.**
**Isochronic Control of the Carrier-Envelope Phase-Shift,** *Mihaly Görbe[1], Christian Grebing[2], Karoly Osvay[2,1], Günter Steinmeyer[2]; [1]Dept. of Optics and Quantum Electronics, Univ. of Szeged, Hungary, [2]Max-Born-Inst., Germany.* A concept for orthogonal intracavity control of phase and group delay by a specially designed compensator assembly is investigated theoretically and experimentally. This assembly greatly simplifies carrier-envelope phase control and experiments in extreme nonlinear optics.

**10:30 a.m.–12:30 p.m.** ***PhAST* Market Focus Session: New Laser Sources and Processes in Photovoltaic Manufacturing,** *Exhibit Hall*

**12:15 p.m.–1:00 p.m. Lunch Break** *(concessions available on the exhibit floor)*

**12:30 p.m.–1:30 p.m.** ***PhAST* Power Lunch (Lunch begins at 12:30 p.m.),** *Exhibit Hall*

## CLEO

### CTuL • Communication Components and Techniques—Continued

**CTuL4 • 12:00 p.m.**
**Temporal Differentiation of Optical Signals Based on Polarization Coupling and Filtering,** *Zhengyong Li, Chongqing Wu, Shuangshou Yang, Changyong Tian; Beijing Jiaotong Univ., China.* We propose an all-optical differentiation scheme based on polarization coupling and filtering while performing it well at 12.5 Gb/s with error ~0.07, which is applicable to high-speed optical signal processing at 40 Gb/s and above.

### CTuM • Optofluidics for Biosensing and Analysis CLEO Symposium II: Photonic Crystals and Bioanalysis—Continued

**CTuM4 • 11:30 a.m.**
**Active Trapping of Individual Particles on an Optofluidic Analysis Platform,** *Sergei Kühn[1], Philip Measor[1], Evan J. Lunt[2], Brian S. Phillips[2], David W. Deamer[1], Aaron R. Hawkins[2], Holger Schmidt[1]; [1]School of Engineering, Univ. of California at Santa Cruz, USA, [2]Dept. of Electrical and Computer Engineering, Brigham Young Univ., USA.* A feedback-based opto-electrical trap is demonstrated on a fully planar optofluidic analysis platform. The trap permits the prolonged observation of single fluorescent objects ranging from bacteria to nanoparticles in an optofluidic setting.

**CTuM5 • 11:45 a.m.**
**Fluorescence Monitoring of Microchip Capillary Electrophoresis Separation with Monolithically Integrated Optical Waveguides,** *Chaitanya Dongre[1], Ronald Dekker[1,2], Hugo J. W. M. Hoekstra[1], Rebeca Martinez-Vazquez[3], Roberto Osellame[3], Roberta Ramponi[3], Giulio Cerullo[3], Rob van Weeghel[4], Geert A. J. Besselink[2], Hans H. van den Vlekkert[2], Markus Pollnau[1]; [1]Integrated Optical MicroSystems, MESA+ Inst. for Nanotechnology, Univ. of Twente, Netherlands, [2]LioniX BV, Netherlands, [3]Inst. di Fotonica e Nanotecnologie del CNR, Dept. di Fisica, Politecnico di Milano, Italy, [4]Zebra Bioscience BV, Netherlands.* Femtosecond-laser-written waveguides were integrated with fluidic microchannels in a commercial lab-on-a-chip. High-spatial-resolution monitoring of fluorescently labeled DNA molecules during capillary electrophoresis separation is demonstrated, as an intermediate step toward point-of-care diagnostic bioassays for DNA analysis.

**CTuM6 • 12:00 p.m.**
**Optofluidic Circular Grating Distributed Feedback Dye Laser,** *Yan Chen, Zhenyu Li, David Henry, Axel Scherer; Caltech, USA.* We demonstrate a surface emitting optofluidic dye laser using a second order circular grating distributed feedback resonator. The optofluidic dye laser offers a low-cost and integrated coherent light source for lab-on-a-chip spectroscopy systems.

### CTuN • Silicon Nanocrystals Light Emission—Continued

**CTuN2 • 11:30 a.m.**
**Design of Active Photonic Devices for Enhanced Emission from Si Nanocrystals,** *Brandon F. Redding, Shouyuan Shi, Timothy Creazzo, Elton Marchena, Dennis Prather; Univ. of Delaware, USA.* Si-nc light emission, overcoming limitations of c-Si, is described by a rate equation formalism within the ADE-FDTD scheme. Following this scheme, we design a series of resonant devices which tune and enhance the Si-nc luminescence.

**CTuN3 • 11:45 a.m.**
**Fabrication and Characterization of Active Devices for Enhanced Luminescence from Silicon Nanocrystals,** *Timothy A. Creazzo, Brandon Redding, Elton Marchena, Shouyuan Shi, Dennis W. Prather; Univ. of Delaware, USA.* We demonstrate enhanced photoluminescence from silicon nanocrystals using a DBR microcavity. We also show a candidate electroluminescent device which can be embedded into a similar DBR cavity for enhancement.

**CTuN4 • 12:00 p.m.**
**Pump-Probe Measurements in Silicon-Rich Nitride Waveguides and Resonators Doped with Erbium,** *Debo Olaosebikan[1], Alexander Gondarenko[1], Kyle Preston[1], Michal Lipson[1], Selcuk Yerci[2], Rui Li[2], Luca Dal Negro[2]; [1]Cornell Univ., USA, [2]Boston Univ., USA.* We report a suppression, attributed to erbium stimulated emission, of the photoinduced absorption of a 1.53µm probe in erbium doped silicon rich nitride waveguides. Resonators with record high quality factors >14,000 are achieved.

**10:30 a.m.–12:30 p.m. *PhAST* Market Focus Session: New Laser Sources and Processes in Photovoltaic Manufacturing,** *Exhibit Hall*

**12:15 p.m.–1:00 p.m. Lunch Break** *(concessions available on the exhibit floor)*

**12:30 p.m.–1:30 p.m. *PhAST* Power Lunch (Lunch begins at 12:30 p.m.),** *Exhibit Hall*

## Room 336 — CLEO

### CTuO • Waveguides and Emitters—Continued

**CTuO5 • 11:30 a.m.**
**Er:LiCAF as Potential Vacuum Ultraviolet Laser Material at 163 nm,** *Toshihiko Shimizu[1], Marilou Cadatal[1], Kouhei Yamanoi[1], Satoru Takatori[1], Minh Pham[1], Elmer Estacio[1], Tomoharu Nakazato[1], Nobuhiko Sarukura[1], Kentaro Fukuda[2,3], Toshihisa Suyama[2], Takayuki Yanagida[2,3], Akira Yoshikawa[3], Fumio Saito[3]; [1]Inst. of Laser Engineering, Osaka Univ., Japan, [2]Tokuyama Corp., Japan, [3]Inst. of Multidisciplinary Res. for Advanced Materials, Tohoku Univ., Japan.* Vacuum ultraviolet fluorescence from micro-pulling down method-grown Er:LiCAF is found to have 163-nm peak emission with 1.3-µs lifetime, making it one of the shortest emission wavelengths from solid-state materials reported.

**CTuO6 • 11:45 a.m.**
**Effects of Rapid Thermal Annealing on CdTe Nanoparticles: A Raman Spectroscopic Study Using Hollow Core Photonic Crystal Fiber,** *Steven Rutledge[1], Jordan Dinglasan[2], Darren Anderson[2], Anjan Das[2], Jane Goh[3], Cynthia Goh[3], Amr Helmy[1]; [1]Edward S. Rogers Sr. Dept. of Electrical and Computer Engineering, Univ. of Toronto, Canada, [2]Vive Nano Inc., Canada, [3]Dept. of Chemistry, Univ. of Toronto, Canada.* Evidence of defect reduction in CdTe nanoparticles upon rapid thermal processing is observed using Raman spectroscopy performed in hollow-core photonic crystal fiber. The Raman spectra indicates the reduction of Te-Te defects in the annealed nanoparticles.

**CTuO7 • 12:00 p.m.**
**Surface-Plasmon Enhanced Fluorescence in CdSe/ZnS Semiconductor Quantum Dots,** *Li Wang[1], Damian Ancukiewicz[2], Jiayu Chen[1], Ravi K. Jain[1]; [1]Ctr. for High Technology Materials, Univ. of New Mexico, USA, [2]Applied Physics, Columbia Univ., USA.* We report surface-plasmon enhanced fluorescence in CdSe/ZnS semiconductor quantum dots via linear and nonlinear excitations. 2x and 10x fluorescence enhancements have been achieved for linear and nonlinear excitations, respectively.

## Room 337 — IQEC

### ITuE • Fiber Generation of Single and Entangled Photons—Continued

**ITuE5 • 11:30 a.m.**
**Generation of O-Band Polarization Entanglement in SMF-28,** *Matthew A. Hall, Joseph B. Altepeter, Prem Kumar; Northwestern Univ., USA.* We demonstrate the generation of high-quality entangled photon pairs in the 1310 nm O-band. Using an ultra-stable source design, we produce polarization entanglement with 97.5% fidelity as characterized via coincidence basis tomography.

**ITuE6 • 11:45 a.m.**
**Fiber Based Source of Frequency Entangled Photon Pairs in the Telecom Band,** *Xiaoying Li[1], Lei Yang[1], Liang Cui[1], Xiaoxin Ma[1], Zhe Yu Ou[2]; [1]Tianjin Univ., China, [2]Indiana Univ.-Purdue Univ., USA.* Frequency entangled photon pairs generated by using four wave mixing in a Sagnac fiber loop are presented. Coincidence detection shows the quantum interference in the form of spatial beating with a visibility of 95%.

**ITuE7 • 12:00 p.m.**
**A Fiber-Based Source of Degenerate Polarization-Entangled Photons in the Telecom Band,** *Milja Medic, Joseph Altepeter, Matthew Hall, Monika Patel, Prem Kumar; Northwestern Univ., USA.* We present a high quality degenerate source of polarization-entangled photons 0.96±0.01 fidelity with a maximally entangled state. Reverse Hong-Ou-Mandel interference in an optical-fiber Sagnac loop deterministically separates the indistinguishable photons.

## Room 338 — IQEC

### ITuF • Novel Phenomena—Continued

**ITuF5 • 11:30 a.m.**
**Experimental Observation of a Microscopic Cascaded Contribution to the Fifth-Order Nonlinear Susceptibility,** *Ksenia Dolgaleva[1], Heedeuk Shin[1], Robert W. Boyd[1], John E. Sipe[2]; [1]Inst. of Optics, Univ. of Rochester, USA, [2]Dept. of Physics, Univ. of Toronto, Canada.* We report the first, to the best of our knowledge, experiment on the separation of the microscopic cascaded contribution to the fifth-order nonlinear susceptibility, which comes from the third-order microscopic hyperpolarizability.

**ITuF6 • 11:45 a.m.**
**Measuring Photon Direction in High-Index-Contrast Waveguides,** *Jacob T. Robinson, Michal Lipson; Cornell Univ., USA.* We demonstrate that within high-index-contrast waveguides, photons traveling in different directions can follow slightly different trajectories. Using near-field microscopy we distinguish between forward and backward propagating photons.

**ITuF7 • 12:00 p.m.**
**Bound States in the Continuum, and Nonlinear Phenomena Associated with Them,** *Or Peleg[1], Shachar Klainman[1], Alexander Szameit[2], Nimrod Moiseyev[1], Moti Segev[1]; [1]Technion-Israel Inst. of Technology, Israel, [2]Friedrich-Schiller-Univ., Germany.* We study the existence of very long lived states (effectively bound states) in longitudinally-modulated coupled waveguides, demonstrate nonlinear means to excite and control them, and their nonlinear collapse into ordinary guided modes of a single waveguide.

## Room 339 — CLEO

### CTuP • Nd Lasers—Continued

**CTuP5 • 11:30 a.m.**
**888nm Pumped Nd:$YVO_4$ Regenerative Amplifier with Long Pico-Second Pulses, 20 kHz Repetition Rate and Efficient Second Harmonic Generation,** *Markus Lührmann, Christian Theobald, Richard Wallenstein, Johannes L'huillier; Technische Univ. Kaiserslautern, Germany.* We report on a 888nm diode-pumped Nd:$YVO_4$ regenerative amplifier with 33.8W output-power with a repetition-rate of 20kHz and hundreds of picoseconds pulse duration. Moreover a high conversion efficiency of 74% for second harmonic was reached.

**CTuP6 • 11:45 a.m.**
**Tunable and Passively Q-Switched Nd:$YVO_4$ Laser Using a Chirped Volume Bragg Grating,** *Kai Seger, Pär Jelger, Björn Jacobsson, Valdas Pasiskevicius, Fredrik Laurell; Royal Inst. of Technology, Sweden.* A Nd:$YVO_4$ laser was locked with a chirped volume Bragg grating. Tuning was performed from 1063nm to 1065nm by grating translation with 4W maximum output power with Cr:YAG, Q-switched pulses with 17ns, 8µJ were achieved.

**CTuP7 • 12:00 p.m.**
**Low Threshold Channel Waveguide Laser in a Monocrystalline Nd:(Gd, Lu)$_2O_3$ Film,** *Andreas Kahn[1], Henning Kühn[1], Sebastian Heinrich[1], Klaus Petermann[1], Günter Huber[1], Jonathan D. B. Bradley[2], Kerstin Wörhoff[2], Markus Pollnau[2]; [1]Inst. für Laser-Physik, Univ. Hamburg, Germany, [2]Integrated Optical MicroSystems Group, MESA+ Inst. for Nanotechnology, Univ. of Twente, Netherlands.* We report the first waveguide laser based on rare-earth sesquioxides. A structured Nd(0.5%):(Gd,Lu)$_2O_3$ film pumped at 820nm showed lasing at 1.08 µm. The laser-threshold was 0.8mW, the preliminary slope-efficiency 0.5% and the maximum output power 1.8mW.

**10:30 a.m.–12:30 p.m.** ***PhAST* Market Focus Session: New Laser Sources and Processes in Photovoltaic Manufacturing,** *Exhibit Hall*

**12:15 p.m.–1:00 p.m. Lunch Break** *(concessions available on the exhibit floor)*

**12:30 p.m.–1:30 p.m. *PhAST* Power Lunch (Lunch begins at 12:30 p.m.),** *Exhibit Hall*

| Room 340 | Room 341 | Rooms 328-329 |
|---|---|---|

**CLEO** | **PhAST**

## CTuQ • Mode-Locking and Dynamics of Semiconductor Lasers—Continued

**CTuQ5 • 11:30 a.m.**
**Dynamic SMSR Measurement of Fast SG-DBR Laser Wavelength Switching,** *Jan Peter Engelstaedter[1], Brendan Roycroft[1], Frank H. Peters[1,2], Brian Corbett[1]; [1]Tyndall Natl. Inst. and Ctr. for Telecommunication Value-Chain Driven Res., Ireland, [2]Univ. College Cork, Ireland.* We present for the first time measurement of the dynamic SMSR during fast laser channel transitions. A highly sensitive heterodyne method is employed in order to achieve signal to noise ratios in excess of 60dB.

**CTuQ6 • 11:45 a.m.**
**Error-Free Operation of Monolithic All-Optical Set-Reset Flip-Flop Based on Semiconductor Ring Laser,** *Marco Zanola[1], Gabor Mezosi[2], Maria J. Latorre Vidal[1], Andrea Trita[1], Marc Sorel[2], Guido Giuliani[1]; [1]Univ. di Pavia, Italy, [2]Univ. of Glasgow, UK.* A monolithic semiconductor ring laser is operated as an all-optical flip-flop with a response time of 100 ps. Bit-Error-Rate measurements of repeated set-reset switchings show error-free operation.

**CTuQ7 • 12:00 p.m.**
**Large Signal Dynamics of Slow and Fast Light Propagation in Semiconductor Optical Amplifiers,** *Seán P. Ó Dúill, Evgeny Shumakher, Gadi Eisenstein; Technion–Israel Inst. of Technology, Israel.* A full model for the phase of detected sinusoidal signals with large modulation indices after propagation through a semiconductor optical amplifier is presented with a comparison to a small signal model and an experimental confirmation.

## CTuR • SHG—Continued

**CTuR5 • 11:30 a.m.**
**Single Mode Tunable All Solid-State UV Laser at the 281.6 nm Clock Transition of $^{199}Hg^+$,** *Thorsten Schmitt[1], Thomas A. Puppe[1], Andreas Nendel[1], Frank Lison[1], Wilhelm G. Kaenders[1], Marc Le Flohic[2]; [1]Toptica Photonics AG, Germany, [2]Keopsys SA, France.* A frequency-quadrupled fiber-amplified semiconductor master oscillator provides 32mW tunable CW power at the 281.6 nm clock transition of $^{119}Hg^+$. Master-line width and tuneability are maintained for the UV light while amplifier added background is suppressed.

**CTuR6 • 11:45 a.m.**
**Efficient Frequency Doubling of a Femtosecond Er-Fiber Laser Using $BiB_3O_6$,** *Kentaro Miyata[1,2], Fabian Rotermund[1,3], Valentin Petrov[1]; [1]Max Born Inst., Germany, [2]Chitose Inst. of Science and Technology, Japan, [3]Ajou Univ., Republic of Korea.* $BiB_3O_6$ has been used for second-harmonic generation of a femtosecond Er-fiber laser-amplifier at 56 MHz. An internal conversion efficiency of 23% was obtained for second-harmonic pulses with a duration of 64 fs at 782 nm.

**CTuR7 • 12:00 p.m.**
**400nm Blue-Violet Light Production by Type-I Noncritical Phase-Matching Second-Harmonic Generation in $Gd_{1-x}R_xCa_4O(BO_3)_3$ (R = Lu, Sc): Crystal Growth and Nonlinear Characterization,** *Lucian Gheorghe[1], Pascal Loiseau[2], Julien Lejay[2], Patrick Aschehoug[2], Gérard Aka[2]; [1]Natl. Inst. for Laser, Plasma and Radiation Physics, ECS Lab, Romania, [2]École Natl. Supérieure de Chimie de Paris, LCMCP, CNRS-UMR, France.* Nonlinear crystals of $Gd_{0.882}Lu_{0.118}Ca_4O(BO_3)_3$ and $Gd_{0.872}Sc_{0.128}Ca_4O(BO_3)_3$ with large size and good quality have been grown by Czochralski method. Theoretical and experimental investigations demonstrated that both crystals generate 400nm laser radiation by type-I NCPM SHG processes.

## PTuA • UV LEDs for Health and Safety—Continued

**PTuA3 • 11:30 a.m.** Invited
**Shedding Light on Nutrition,** *Steve Britz[1], Roman Mirecki[1], Joe Sullivan[2]; [1]Food Components and Health Lab, USDA, USA, [2]Dept. of Plant Science and Landscape Architecture, Univ. of Maryland, USA.* Supplemental ultraviolet-B radiation (280-320 nm) can increase phenolic compounds in plants and help to preserve them during storage after harvest. The nutritional significance of these compounds and the use of UV-LEDs will be discussed.

**PTuA4 • 12:00 p.m.** Invited
**Application of UV LEDs to the Design of Low Cost Biological Aerosol Detectors,** *Peter Hairston; Northrop Grumman Corp., USA.* Measuring UV-excited fluorescence from individual airborne particles is a leading technique for fast, non-specific detection of biological threat aerosols. UV-LEDs, available at several wavelengths, enable cost reduction of these detectors while presenting additional design challenges.

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**10:30 a.m.–12:30 p.m.** ***PhAST* Market Focus Session: New Laser Sources and Processes in Photovoltaic Manufacturing,** *Exhibit Hall*

**12:15 p.m.–1:00 p.m.** **Lunch Break** *(concessions available on the exhibit floor)*

**12:30 p.m.–1:30 p.m.** ***PhAST* Power Lunch (Lunch begins at 12:30 p.m.),** *Exhibit Hall*

**JOINT**

## 1:00 p.m.–2:30 p.m.
## JTuD • Joint CLEO/IQEC Poster Session I

**JTuD1**
**Terahertz Generation Using a Two-Frequency Highly-Doped Ceramic Nd:YAG Microchip Laser,** *Aaron M. McKay, Judith M. Dawes; Macquarie Univ., Australia.* Stable, continuously tunable, beat-frequency generation of microwave frequencies up to 150 GHz, with narrow linewidth, is demonstrated from a dual-frequency ceramic Nd:YAG microchip laser, using optical and radio-frequency spectra.

**JTuD2**
**Glass Hybrid OPCPA Scale Test Bed Laser,** *Samuel H. Feldman, Greg Hays, Alexia Belolipetski, Daniel Herrmann, Jurgen Schmidt, Hernan J. Quevedo, Aaron C. Bernstein, Todd Ditmire; Univ. of Texas at Austin, USA.* The Glass Hybrid OPCPA Scale Test bed (GHOST) Laser combines OPCPA with two types of Glass amplifiers to reduce of gain narrowing and allowing compression of a glass amplified pulse to almost 100 fs.

**JTuD3**
**Pulse-Pumped CW Tunable Ti:Sapphire Laser,** *Hsiao-hua Liu; Kapteyn-Murnane Labs, Inc., USA.* A cryogenically-cooled CW tunable Ti:sapphire laser, pumped by a frequency-doubled pulsed fiber laser, was demonstrated. Output power >8 W with an $M^2$ value <1.05 and a 160-nm tuning range with <0.07 nm linewidth were demonstrated.

**JTuD4**
**Tunable Ho:YAG Laser Pumped by Tm:Fiber Laser,** *Jacek Kwiatkowski[1], Lukasz Gorajek[1], Jan Karol Jabczynski[1], Waldemar Zendzian[1], Helena Jelinkova[2], Jan Sulc[2], Michal Nemec[2], Petr Koranda[2]; [1]Inst. of Optoelectronics, Military Univ. of Technology, Poland, [2]Czech Technical Univ. in Prague, Czech Republic.* Tm:fiber laser was used for pumping of tunable Ho:YAG laser. Tunability in 2070 - 2130 nm wavelength range was obtained. 1130 mW was reached at 2132.8 nm with 53% slope efficiency.

**JTuD5**
**Frequency Stabilized and Doubled Nd:YLF Laser: An All-Solid-State Local Oscillator for a Calcium Optical Atomic Clock,** *Joseph D. Topomondzo, Mayerlin N. Portela, Flavio C. Cruz; Univ. of Campinas - UNICAMP, Brazil.* We describe a frequency-doubled, stabilized, diode-pumped solid-state Nd:YLF laser at 657 nm, proposed as a candidate for a local oscillator in optical atomic clocks based on neutral calcium atoms.

**JTuD6**
**Spectroscopic Properties and Gain Cross Section of Er, Yb Doped $Y_2O_3$ Transparent Ceramic for Eye-Safe Laser,** *Marine Reynaud[1], Nicolas Luiselli[1], Lucian Gheorghe[1], Pascal Loiseau[1], Gerard Aka[1], Christian Larat[2], Eric Lallier[2], Akio Ikesue[3]; [1]École Nat. Superieure de Chimie de Paris, France, [2]Thales Res. & Technology France, France, [3]World Labo Co. Ltd, Japan.* We present the spectroscopic characteristics and gain cross section of Er, Yb doped $Y_2O_3$ transparent ceramic which is a potential material for eyes-safe laser.

**JTuD7**
**CTF3 Photo-Injector Laser,** *Massimo Petrarca[1], Valentine Fedosseev[1], Konrad Elsener[1], Nathalie Lebas[1], Roberto Losito[1], Alessandro Masi[1], Marta Divall[2], Gram Hirst[2], Ian Ross[2], Carlo Vicario[3], Ilario Boscolo[4], Simone Cialdi[4], Daniele Cipriani[4]; [1]CERN, Switzerland, [2]Rutherford Appleton Lab, UK, [3]Laboratori Nazionali di Frascati, Inst. Nazionale di Fisica Nucleare, Italy, [4]Inst. Nazionale di Fisica Nucleare, Sez. Milano and Dip. Fisica, Univ. Milano, Italy.* Nd:YLF laser system has been developed to drive an electron photo-injector. A chain of mode-locked 1.5GHz oscillator, preamplifier, and two powerful diode-pumped amplifiers deliver 6.4kW long IR bunches which are converted to 262nm.

**JTuD8**
**Temperature and Polarization Dependences of Cr:YAG Transmission for Passive Q-Switching,** *Masaki Tsunekane[1], Takunori Taira[2]; [1]Japan Science and Technology Agency, Japan, [2]Inst. for Molecular Science, Japan.* Temperature and polarization dependences of Cr:YAG transmission at 1064nm were measured as functions of the incident beam intensity. 5% increase of the initial transmission at 150°C was observed but the saturated transmission was the same.

**JTuD9**
**Compact, 1W, 10 kHz, Q-Switched, Diode-Pumped Yb:YAG Laser with Volume Bragg Grating for LIDAR Applications,** *Viktor A. Fromzel[1], Mikhail A. Yakshin[1], Coorg R. Prasad[1], Geary Schwemmer[1], Vadim Smirnov[2], Leonid B. Glebov[3]; [1]Science and Engineering Services, Inc., USA, [2]OptiGrate, USA, [3]CREOL, College of Optics and Photonics, Univ. of Central Florida, USA.* We developed a compact, narrow-linewidth diode-pumped Yb:YAG laser with volume Bragg grating delivering stable $TEM_{00}$- mode Q-switched pulses at 1030 nm with average output of 1W at 10 kHz and linewidth of < 0.08 nm.

**JTuD10**
**Cesium Laser with Transverse Diode Laser Pumping,** *Michael K. Shaffer, Boris V. Zhdanov, Jerry Sell, Randy J. Knize; United States Air Force Acad., USA.* A transversely pumped Cs vapor laser has been demonstrated using fifteen laser diode arrays to pump the gain medium, yielding 14% optical to optical efficiency and 15% slope efficiency.

**JTuD11**
**Flight Qualification of the High Output Maximum Efficiency Resonator (HOMER) Laser for Space-Based Remote Sensing Applications,** *Barry Coyle[1], Paul Stysley[2], Peter Rossini[1], Robert Frederickson[3], Cheryl Salerno[1], Richard Kay[2], Demetrios Poulios[2], Bryan Blair[1], Ken Cory[4]; [1]NASA Goddard Space Flight Ctr., USA, [2]American Univ., USA, [3]ATK Space Inc., USA, [4]Science Systems Applications Inc., USA.* A diode-pumped Nd:YAG oscillator has been developed with advanced packaging hardware, employing an unstable resonator cavity with a gaussian reflective output coupler, produces aperture-free $TEM_{00}$ beams, and has completed space flight qualification testing.

**JTuD12**
**Enhancement in Microwave Modulation Efficiency of Vertical Cavity Surface-Emitting Laser by Optical Feedback,** *Nemi Gavra, V. Ruseva, M. Rosenbluh; Bar Ilan Univ., Israel.* Feedback greatly enhances the high frequency modulation efficiency of VCSELs and provides a means of obtaining high contrast coherent population trapping signals with low rf modulation power.

**JTuD13**
**Coherent Coupling in Ring Defect Photonic Crystal Vertical Cavity Surface Emitting Laser,** *Anjin Liu, Hongwei Qu, Wei Chen, Mingxin Xing, Wenjun Zhou, Wanhua Zheng; CAS, China.* Selectively oxidized ring defect photonic crystal vertical cavity surface emitting laser (RD-PCVCSEL) is first demonstrated. The device achieves coherent coupling over the entire continuous-wave current range.

**JTuD14**
**Actively Controlled Tuning of an External Cavity Diode Laser by Polarization Spectroscopy,** *Thorsten Führer, Denise Stang, Thomas Walther; Technische Univ. Darmstadt, Germany.* Using polarization spectroscopy to control the shape of the diode current ramp while tuning an external cavity diode laser we achieved mode-hop free tuning of up to 105 GHz with an uncoated, off-the-shelf laser diode.

**JTuD15**
**Fast Wavelength Tuning of External Cavity Quantum Cascade Lasers,** *Tracy R. Tsai, Gerard Wysocki; Princeton Univ., USA.* We present a fast wavelength tuning of a Littrow-type EC-QCL. This configuration allows for coarse broadband and high resolution mode-hop-free wavelength scanning at >1kHz rates. Example EC-QCL measurements of mid-infrared ammonia spectra are demonstrated.

**JTuD16**
**Failure Mode Investigation of High Power Multi-Mode InGaAs-AlGaAs Strained Quantum Well Lasers Using Time-Resolved EL and EBIC Techniques,** *Yongkun Sin, Neil Ives, Nathan Presser, Steven C. Moss; Aerospace Corp., USA.* We report our failure mode investigation of high power multi-mode InGaAs-AlGaAs strained quantum well (QW) lasers using time-resolved electroluminescence (EL) and electron beam induced current (EBIC) techniques.

**JTuD17**
**1.55-µm VCSEL Arrays for Optical Multiple-Input Multiple-Output (MIMO),** *Werner H. Hofmann[1], Ning Hua Zhu[2], Markus Görblich[1], Liang Xie[2], Gerhard Böhm[1], Markus Ortsiefer[3], Markus-Christian Amann[1]; [1]Walter Schottky Inst., Technische Univ. München, Germany, [2]Natl. Res. Ctr. for Optoelectronic Technology, China, [3]VERTILAS GmbH, Germany.* VCSEL arrays of five lasers, emitting at 1.55-µm with a per-channel modulation bandwidth in excess of 10-GHz are presented. Being especially designed for optical MIMO, they can be coupled into the core of a MMF.

**JTuD18**
**Tunable External-Cavity Quantum Cascade Laser Sources for Gas Sensing and Spectroscopy,** *David R. Scherer, Juan Montoya, Joel M. Hensley, Mark G. Allen; Physical Sciences Inc., USA.* Developments in tunable external-cavity quantum cascade lasers will be presented, along with results on broadly tunable lasers for spectroscopic applications.

**JTuD19**
**Polarization Switching in 1.3-µm Quantum Dot Vertical Cavity Surface Emitting Lasers,** *Fang-Ming Wu[1], Ruei-Long Lan[2], Peng-Chun Peng[3], Chung-Ching Huang[1], Rong-Yu Peng[2], Jye-Hong Chen[1], Chun-Ting Lin[1], Gray Lin[4], Hao-Chung Kuo[1], Jim-Y Chi[5], Sien Chi[1]; [1]Inst. of Electro-Optical Engineering, Natl. Chiao Tung Univ., Taiwan, [2]Dept. of Electrical Engineering, Natl. Chi Nan Univ., Taiwan, [3]Dept. of Electro-Optical Engineering, Natl. Taipei Univ. of Technology, Taiwan, [4]Dept. of Electronics Engineering, Natl. Chiao Tung Univ., Taiwan, [5]Inst. of Opto-Electronic Engineering, Natl. Dong Hwa Univ., Taiwan.* This work for the first time, experimentally demonstrates the polarization switching in 1.3-µm quantum dot VCSEL. The polarization switching in quantum dot VCSEL is achieved by adjusting the optical injection power.

**JTuD20**
**Towards a Monolithic Cavity Soliton Laser,** *Tiffany Elsass, Sylvain Barbay, Karine Gauthron, Grégoire Beaudoin, Isabelle Sagnes, Robert Kuszelewicz; Lab de Photonique et de Nanotructures, France.* We propose an original design of a monolithic and integrated vertical cavity laser with saturable absorber and discuss experimental results showing the formation and fast writing/erasure of bistable laser spots.

**JTuD21**
**Mid-Infrared GaInSb/AlGaInSb Quantum Well Laser Diodes,** *Geoff R. Nash[1,2], Suzie J. B. Przeslak[2], Stuart J. Smith[1], Guilhem de Valicourt[3], Aleksey D. Andreev[4], Peter J. Carrington[5], Min Yin[5], Anthony Krier[5], Stuart D. Coomber[1], Louise Buckle[1], Martin T. Emeny[1], Tim Ashley[1]; [1]QinetiQ, UK, [2]Univ. of Bristol, UK, [3]Univ. of Essex, UK, [4]Univ. of Surrey, UK, [5]Lancaster Univ., UK.* Electroluminescence from GaInSb/AlGaInSb quantum well (QW) diode lasers, grown on GaAs, has been investigated as a function of strain in the QWs, with lasing occurring at ~3.3microns at 200K with 1.1% strain in the QW.

**JTuD22**
**GaAs-Based Transverse Junction Superluminescent Diode at 1.1µm Wavelength Region,** *Shi-Hao Guol[1], Ming-Ge Chou[2], Jr-Hung Wang[2], Ying-Jay Yang[1], Chi-Kuang Sun[1], Jin-Wei Shi[2]; [1]Natl. Taiwan Univ., Taiwan, [2]Natl. Central Univ., Taiwan.* We report GaAs-based transverse-junction-superluminescent-diodes, characterized as transverse-carrier-flow spread in quantum wells horizontally instead of vertical well-by-well injection. These devices overcome the problem of non-uniform-carrier-distribution and operate at a bio-optical window of 1.1-µm wavelength regime.

## JTuD • Joint CLEO/IQEC Poster Session I—Continued

**JTuD23**
**Intersubband Absorption Loss in High-Performance Mid-Infrared Quantum Cascade Lasers,** *Yamac Dikmelik[1], Jacob B. Khurgin[1], Matthew D. Escarra[2], Peter Q. Liu[2], Anthony J. Hoffman[2], Kale J. Franz[2], Claire F. Gmachl[2], Jenyu Fan[3], Xiaojun Wang[3]; [1]Johns Hopkins Univ., USA, [2]Princeton Univ., USA, [3]AdTech Optics, USA.* We calculate intersubband absorption loss and report measured waveguide loss for two high-performance mid-infrared quantum cascade laser designs. Intersubband absorption loss accounts for a major component of waveguide loss for these structures.

**JTuD24**
**Directly Photoinscribed Thick Bragg Gratings in Ohara WMS-15 Glass-Ceramic,** *Peter A. Krug, Rodica Matei Rogojan, Jacques Albert; Carleton Univ., Canada.* Volume gratings were UV inscribed in WMS-15 glass-ceramic at 193 and 248nm without additional processing. Weak, easily bleached gratings resulted from fluences below 0.3kJ/cm$^2$. Stable gratings with $\Delta n \sim 6\times10^{-5}$ were formed at higher fluences.

**JTuD25**
**Fabrication of Three-Dimensional Photonic Crystal Template Using Two-Layer Integrated Phase Mask,** *Di Xu[1], Kevin P. Chen[1], Ahmad Harb[2], Daniel Rodriguez[2], Karen Lozano[2], Yuankun Lin[2]; [1]Dept. of Electrical and Computer Engineering, Univ. of Pittsburgh, USA, [2]College of Science and Engineering, Univ. of Texas-Pan American, USA.* In this paper, we report a new design and fabrication of an integrated two-layer phase mask for five-beam holographic fabrication of three-dimensional photonic crystal templates.

**JTuD26**
**Fabrication of High-Q PDMS Optical Microspheres with Applications Towards Thermal Sensing,** *Chun-Hua Dong, Li-Na He, Yun-Feng Xiao, Venkat Gaddam, Sahin Ozdemir, Lan Yang; Micro/Nano Photonics and Photonic Materials Lab, Dept. of Electrical and Systems Engineering, Washington Univ. in St. Louis, USA.* We report an efficient fabrication method for PDMS-based optical microspheres. Resonance wavelength shift of the high-Q Whispering gallery mode as a function of temperature is obtained, 0.245 nm/°C, which agrees well with the theoretical prediction.

**JTuD27**
**Effect of Nano-Crystalline Structures in the Interface on Double-Clad $Cr^{4+}$: YAG Crystal Fiber,** *Chien-Chih Lai[1], Yen-Sheng Lin[2], Kuang-Yao Huang[3], Chao-Wen Ting[2], Sheng-Lung Huang[1]; [1]Graduate Inst. of Electro-Optical Engineering, Natl. Taiwan Univ., Taiwan, [2]Dept. of Electronic Engineering, I-Shou Univ., Taiwan, [3]Inst. of Electro-Optical Engineering, Natl. Sun Yat-Sen Univ., Taiwan.* The microstructure of the YAG/$SiO_2$ interface in double-clad $Cr^{4+}$: YAG crystal fibers were investigated by HRTEM. These nano-domains have a little angle about 2° title from the core YAG structures at the original interface.

**JTuD28**
**1.3μm Electroabsorption Modulator with InAs/InGaAs/GaAs Quantum Dots,** *C. Y. Ngo[1], S. F. Yoon[1], W. K. Loke[1], Q. Cao[1], D. R. Lim[1], Vincent Wong[1], Y. K. Sim[1], S. J. Chua[2]; [1]Nanyang Technological Univ., Singapore, [2]Inst. of Materials Res. and Engineering, Singapore.* Electroabsorption properties of 1.3μm InAs/InGaAs/GaAs quantum dot electroabsorption modulator (EAM) are investigated. Onset of absorption to higher electric field suggests the potential to achieve higher optical power handling capability than conventional EAM.

**JTuD29**
**Intradot Dynamics of InAs/GaAs Quantum Dot Based Electro-Absorbers,** *Tomasz Piwonski[1,2], Jaroslaw Pulka[2], Gillian Madden[2], John Houlihan[1,3], Guillaume Huyet[1,2], Evgeny Viktorov[4], Thomas Erneux[4], Paul Mandel[4]; [1]Tyndall Natl. Inst., Ireland, [2]Cork Inst. of Technology, Ireland, [3]Waterford Inst. of Technology, Ireland, [4]Univ. Libre de Bruxelles, Belgium.* The carrier relaxation dynamics of an InAs/GaAs QD absorber is studied using pump-probe measurements. Under reverse bias conditions, we reveal fundamental differences in intradot relaxation dynamics depending on the initial population of the energy states.

**JTuD30**
**Observation of Carrier Localization in Well-Aligned Gallium Nitride Nanorods,** *Shou-Yi Kuo[1], Fang-I Lai[2], Woei-Tyng Lin[2], Wei-Chun Chen[3], Chien-Nan Hsiao[3]; [1]Dept. of Electronic Engineering, Chang Gung Univ., Taiwan, [2]Dept. of Electrical Engineering, Yuan-Ze Univ., Taiwan, [3]Instrument Technology Res. Ctr., Natl. Applied Res. Labs, Taiwan.* Well-aligned GaN nanorods were formed on (0001) $Al_2O_3$ substrate by chemical beam epitaxy. The "S-shape" behavior with localization observed in the temperature-dependent photoluminescence might be ascribed to the fluctuation in crystallographic defects and composition.

**JTuD31**
**Laser Wakefield Electron Beam Characterization by Cross-Correlation in an IFEL,** *Christopher M. S. Sears, Alexander Buck, Daniel Hermann, Ferenc Krausz, Karl Schmid, Raphael Tautz, Laszlo Veisz; Max-Planck-Inst. für Quantenoptik, Germany.* We propose an experiment to measure laser wakefield produced electron beam pulse duration using the inverse Free-Electron-Laser (IFEL) process in combination with a few optical cycle laser pulse as a cross-correlator for the electron beam.

**JTuD32**
**Laser Induced Fusion in Deuterium Clusters Irradiated by Softly Focused, Petawatt Pulses,** *Gilliss Dyer, Erhard Gaul, Mikael Martinez, Aaron Bernstein, Hernan Quevedo, Woosuk Bang, Teddy Borger, Brendan Murphy, Matthew McCormick, Donghoon Kuk, Johannes Rougk, Douglas Hammond, Ramiro Escamilla, Martin Ringuette, Franki Aymond, Todd Ditmire; Univ. of Texas at Austin, USA.* We present the results of the first target shots on the Texas Petawatt Laser. Petawatt pulses are softly focused into a deuterium cluster gas plume to produce a large volume plasma and high neutron yield.

**JTuD33**
**Origin of the Spectral Minimum in the High Harmonics of $N_2$,** *Joseph P. Farrell, Brian K. McFarland, Markus Gühr, Phil H. Bucksbaum; Stanford Univ., USA.* High harmonics of $N_2$ exhibit a spectral minimum consistent with either geometrical interference or HOMO-1 contributions. Angle- and intensity-dependent HHG measurements are compared to simulations. The purely geometrical model is ruled out.

**JTuD34**
**Coherent TeraHertz and X-Ray Spectroscopy of a Laser-Driven Plasma in a Copper Target,** *Zhiyuan Chen, Yuan Gao, Matthew DeCamp; Univ. of Delaware, USA.* Coherent TeraHertz emission and hard x-ray emission from a laser-driven plasma in a solid target are measured simultaneously revealing a complementary picture of the ultrafast plasma.

**JTuD35**
**Contrast Challenge for Ultrahigh-Intensity Experiments on High-Density Targets,** *Victor Yanovsky, Vladimir Chvykov, Galina Kalinchenko, Takeshi Matsuoka, Anatoly Maksimchuk, Karl Krushelnick; Univ. of Michigan, USA.* Current contrast-control-technology is inadequate for solid targets with the next generation of high-intensity lasers. We apply a spatiotemporal-contrast-concept (STC) to demonstrate that intensity~$10^{25}$ W/cm$^2$ is feasible for transparent solids at STC ~$10^{14}$.

**JTuD36**
**Spectral Cleaning of Few-Cycle Pulses via Cross-Polarized Wave (XPW) Generation,** *Aurelie Jullien[1], Charles G. Durfee[2], Alexandre Trisorio[1], Lorenzo Canova[1], Jean-Philippe Rousseau[1], Brigitte Mercier[1], Laura Antonucci[1], Olivier Albert[1], Rodrigo Lopez-Martens[1]; [1]ENSTA ParisTech, École Polytechnique, CNRS, France, [2]Colorado School of Mines, USA.* The nonlinear contrast filtering technique XPW is applied to sub-10 fs pulses. The process can dramatically improve the spectral quality of the seed pulses, opening the way to the production of high-temporal quality few-cycle pulses.

**JTuD37**
**Polarization Dependent Pulse Compression through Hollow Fiber for mJ-Level, Sub-5fs Pulse Generation,** *Xiaowei Chen[1,2], Arnaud Malvache[1], Aurelie Jullien[1], Lorenzo Canova[1], Antonin Borot[1], Alexandre Trisorio[1], Olivier Albert[1], Charles Durfee[3], Rodrigo Lopez-Martens[1]; [1]CNRS, France, [2]CAS, China, [3]Colorado School of Mines, USA.* 4.3fs, 1mJ pulses at 1 kHz are generated through hollow fiber seeded with circularly polarized laser beam. This technique provides an effective energy upscaling approach for hollow fiber compression technique.

**JTuD38**
**Closed-Loop Optimization of the Temporal Duration of a 21fs, 4 mJ CPA Laser System with High B-Integral,** *Lorenzo Canova[1], Alexandre Trisorio[1], Xiaowei Chen[1], Brigitte Mercier[1], Olivier Albert[1], Rodrigo Lopez Martens[1], Nicolas Forget[2], Thomas Oksenhendler[2]; [1]Lab d'Optique Appliquée, Ensta-Paritech, École Polytechnique, Ctr. Natl. de la Recherche Scientifique, France, [2]Fastlite, France.* We present automated optimization of the temporal duration of femtosecond pulses generated in a CPA laser system with high B-integral. Both phase measurement and correction were done by a single AOPDF within the CPA system.

**JTuD39**
**Preservation of the Carrier Envelope Phase in Generation of Cross Polarized Wave,** *Karoly Osvay[1,2], Lorenzo Canova[3], Charles Durfee[4], Attila P. Kovács[1], Ádam Börzsönyi[1], Olivier Albert[3], Rodrigo Lopez-Martens[3]; [1]Dept. of Optics, Univ. of Szeged, Hungary, [2]Max-Born-Inst., Germany, [3]Lab d'Optique Appliquée, École Polytechnique, CNRS, France, [4]Colorado School of Mines, USA.* We demonstrate the preservation of the CEP in the XPW process with two independent methods, both relying on the spatially and spectrally resolved interference fringes formed by the XPW beam and its fundamental.

**JTuD40**
**Nanometer-Scale Machining by Laser Ablation with a Focused Extreme Ultraviolet Laser Beam,** *Herman Bravo[1], Benito Szapiro[1,2], Przemyslaw Wachulak[1], Mario C. Marconi[1], Weilun Chao[3], Erik Anderson[3], David T. Attwood[3], Carmen S. Menoni[1], Jorge J. Rocca[1]; [1]Colorado State Univ., USA, [2]Univ. of the South, USA, [3]Lawrence Berkeley Natl. Lab, USA.* We report the ablation of 200 nm-top wide (130 nm FWHM) trenches on PMMA photoresist by focusing the extreme ultraviolet output from a table-top capillary discharge laser with a Fresnel zone plate lens.

**JTuD41**
**Liquid Crystal Spatial Light Modulator for Arbitrary Amplitude Modulation from Ultraviolet to Near-Infrared,** *Jiangfeng Zhu, Takashi Tanigawa, Yu Sakakibara, Shaobo Fang, Taro Sekikawa, Mikio Yamashita; Dept. of Applied Physics, Hokkaido Univ., Japan.* We fabricated a new liquid-crystal spatial light modulator for amplitude modulation of 315-1100 nm spectrum. Applied voltage and pulse width dependent transmission was characterized, which paves the way for monocycle-pulse shaping and attosecond pulse measurement.

**JTuD42**
**Statistical Light-Mode Dynamics of Passive Mode-Locking with Slow Saturable Absorber,** *Michael Katz, Omri Gat, Baruch Fischer; Technion-Israel Inst. of Technology, Israel.* A novel dynamical approach to slow absorber modelocking with noise yields explicit expressions for the conditions of pulse existence and continuum stability, the pulse power and minimal width, and provides guidelines for optimal system configuration.

**JTuD43**
**Space-Time Distortion Elimination for Shaped Ultrafast Laser Pulses,** *Bingwei Xu[1,2], Vadim V. Lozovoy[1], Haowen Li[2], Marcos Dantus[1,2]; [1]Michigan State Univ., USA, [2]Biophotonic Solutions Inc., USA.* We report design parameters to eliminate or minimize the spatial distortion for shaped femtosecond pulses after a Fourier-transform pulse shaper, theoretically and experimentally. We conclude that all distortions are avoided with correct pulse shaper setup.

**JTuD44**
**MEMS Based Speckle Reduction Obtained by Angle Diversity for Fast Imaging,** *Itay Peled[1,2], Michael Zenou[1], Boris Greenberg[1], Zvi Kotler[1]; [1]Orbotech Ltd., Israel, [2]Jerusalem College of Technology, Israel.* We propose a cheap, compact and generic approach for suppressing speckle effect, allowing laser illumination for fast imaging. The speckle reduction is obtained by angular diversity using MEMS.

## JTuD • Joint CLEO/IQEC Poster Session I—Continued

**JTuD45**
**Ultra-Short Pulse Compression for Mode-Locked Ti:Sapphire Laser by Using a Tapered Fiber,** *Kuei-Chu Hsu[1,2], Ja-Hon Lin[3], Chih-Chieh Taso[3], Nan-Kuang Chen[4,5], Yinchieh Lai[1]; [1]Dept. of Photonics and Inst. of Electro-Optical Engineering, Natl. Chiao-Tung Univ., Taiwan, [2]Graduate Inst. of Electro-Optical Engineering, Chang Gung Univ., Taiwan, [3]Dept. of Electro-Optical Engineering and Inst. of Electro-Optical Engineering, Natl. Taipei Univ. of Technology, Taiwan, [4]Dept. of Electro-Optical Engineering, Natl. United Univ., Taiwan, [5]Optoelectronics Res. Ctr., Natl. United Univ., Taiwan.* For Ti:sapphire lasers 100 fs input pulses at the 880-nm, after passing through the 1-cm long tapered fiber and grating pairs with 1.6 cm separation, the final pulse width is compressed down to 33 fs.

**JTuD46**
**Condensation of Light in Actively Mode-Locked Lasers,** *Rafi Weill[1], Omri Gat[2], Baruch Fischer[1]; [1]Technion-Israel Inst. of Technology, Israel, [2]Racah Inst. of Physics, Hebrew Univ., Israel.* We present a new approach to active mode-locking (AML) that predicts, under certain conditions, pulse "condensation", analogous to BEC. In the condensate state, the first AML eigenmode is dominant over all other modes.

**JTuD47**
**Complimentary Ultrashort Laser Pulse Characterization Using SHG FROG and MOSAIC,** *Daniel A. Bender[1], Mansoor Sheik-Bahae[2]; [1]Sandia Natl. Labs, USA, [2]Univ. of New Mexico, USA.* A method for generating the MOSAIC trace from the SHG FROG dataset is shown. Examples will be presented illustrating enhanced visual sensitivity, applicability and complimentary qualitative pulse characterization using SHG FROG.

**JTuD48**
**Wavelength Selective Switch Using GaInAs/InP MQW Variable Index Arrayed Waveguides,** *Yu Shimizu, Hiroya Iwasaki, Takayuki Sugio, Yosuke Murakami, Kazuhiko Shimomura; Sophia Univ., Japan.* Wavelength selective switch using GaInAs/InP MQW variable index arrayed waveguides have successfully demonstrated. The demultiplexed wavelength light could be exchanged the output ports by changing the refractive index of arrayed waveguides by using thermo-optic effect.

**JTuD49**
**Silicon Microring Based Elastic Polarization Converter,** *Yunhong Ding, Xiaobei Zhang, Xinliang Zhang, Dexiu Huang; Wuhan Natl. Lab for Optoelectronics, Huazhong Univ. of Science and Technology, China.* We designed a silicon microring based elastic polarization converter, which can realize arbitrary polarization conversion between any two of linear, circular, and elliptic polarization states. Simulation results show good polarization converting characteristics at resonance condition.

**JTuD50**
**Period Adapted Bragg Mirror Multimode Interference Device,** *Christopher Holmes, Huw E. Major, James C. Gates, Corin B. E. Gawith, Peter G. R. Smith; Optoelectronics Res. Ctr., Univ. of Southampton, UK.* A direct UV-written multimode interference device is constructed with a pair of Bragg mirrors that have adaptively manipulated period to minimise excess loss. Excess loss achieved is comparable to that of a regular MMI device.

**JTuD51**
**Conformal P-N Junctions for Low Energy Electro-Optic Switching,** *Sean P. Anderson, Philippe M. Fauchet; Univ. of Rochester, USA.* We show that a conformal pn junction can reduce the switching energy of resonant devices to below 100 aJ.

**JTuD52**
**Digital Reconstruction of Axially Thick Potentials,** *Christopher Barsi, Jason W. Fleischer; Princeton Univ., USA.* The holographic reconstruction of objects typically assumes that the object is axially thin. Here, we demonstrate a simple approach that works for axially-thick potentials which evolve dynamically. Results are verified by reconstructing linear scattering experiments.

**JTuD53**
**Metal-Free Integrated Elliptical Reflector for High-Efficiency Waveguide Crossing and Turn,** *Xiangyu Li, Zhenyu Hou, Yingyan Huang, Seng-Tiong Ho; Northwestern Univ., USA.* A novel on-chip waveguide crossing and turn based on elliptical reflector is proposed. Our simulation demonstrates that it can achieve high transmission efficiency, low crosstalk, and compact size. Several crossings with good performances are shown.

**JTuD54**
**Tuning of an Optofluidic Micro Ring Resonator by Electrowetting,** *Uriel Levy, Romi Shamai; Hebrew Univ. of Jerusalem, Israel.* We demonstrate the tuning of an on chip Micro Ring Resonator (MRR) using water based droplet driven by electrowetting. The results show that optofluidic devices can be controlled by electrical signal.

**JTuD55**
**A Lamp-Type LED-Based Illumination Subsystem Prototype for Miniature Fluorescence Sensor,** *Yu Wang, Susan Perry, Filbert Bartoli; Lehigh Univ., USA.* A miniature illumination subsystem with proximal stacking of a LED with a mini-lens, excitation filter and cell sample worked as well as a typical Xe lamp in a prototype of miniature fluorescence sensor.

**JTuD56**
**Development of a Closed Feedback Controlled System for Automated Laser Soldering of Skin,** *Mohamamd Sadegh Nourbakhsh[1,2], Mohamamd E. Khosroshahi[1], Sohrab Saremi[1], Shahram Rabbani[3], Amir Hooshyar[1], Farhad Tabatabaee[1]; [1]Amirkabir Univ. of Technology, Iran, Islamic Republic of, [2]Materials Engineering Dept.,Semnan Univ., Iran, Islamic Republic of, [3]Tehran Heart Ctr., Iran, Islamic Republic of.* We have developed an automated soldering system based on diode laser, IR detector, photodiode, digital thermocouple and camera. The true temperature of the heated tissue was determined by using an improved calibration soft ware method.

**JTuD57**
**Optofluidic Bragg Grating Sensor for Monolayer Detection,** *Richard M. Parker, James C. Gates, Peter G. R. Smith, Martin C. Grossel; Optoelectronics Res. Ctr., Univ. of Southampton, UK.* An exposed Bragg grating incorporated into a planar waveguide was used to form a refractive index sensor. The high sensitivity to subtle changes allowed the study of surface functionalisation and binding within a microfluidic system.

**JTuD58**
**Photon-Counting Photobleaching Measurements and the Effect of Dispersion in Two-Photon Microscopy,** *Jeffrey J. Field, Ramón Carriles, Jeff Squier; Colorado School of Mines, USA.* The effect of dispersion of excitation pulses in two-photon microscopy is examined with a photon-counting microscope in stationary and scanning modalitites. It is demonstrated that transform-limited pulses provide the best signal despite increased bleaching rates.

**JTuD59**
**Self-Adaptive Common-Path Fourier-Domain Optical Coherence Tomography with Real-Time Surface Recognition and Feedback Control,** *Kang Zhang, Jin U. Kang; Johns Hopkins Univ., USA.* We demonstrated a self-adaptive common-path Fourier-domain OCT system with real-time surface recognition and feedback control. The scanning probe tracks the sample surface variance and effective imaging depth was largely extended to the probe's free-moving range.

**JTuD60**
**3-D Optical Force Field of Inclined Duel-Fiber Tweezers,** *Yuxiang Liu, Miao Yu; Univ. of Maryland, USA.* The trapping efficiency of an inclined dual-fiber optical tweezers setup is calibrated along one dimension, and the 3-D trapping forces are investigated numerically. The results indicate its ability to perform force sensing in optofluidic systems.

**JTuD61**
**Slow and Superluminal Light Pulses via EIT in a 20-Metre Acetylene-Filled Photonic Microcell,** *Natalie V. Wheeler, Philip S. Light, Francois Couny, Fetah Benabid; Univ. of Bath, UK.* Electromagnetically induced transparencies are recorded in a 20 metre acetylene-filled photonic microcell and used to observe pulses of probe light delayed (advanced) by up to 5 ns (1 ns). Suggested applications include interferometry.

**JTuD62**
**Widely Tunable All Erbium-Doped Fiber Laser Based on Multimode Interference Effects,** *Arturo A. Castillo-Guzman[1], J. E. Antonio-Lopez[2], Romeo Selvas-Aguilar[1], D. A. May-Arrioja[2], Julián Estudillo-Ayala[3]; [1]Facultad de Ciencias Físico Matemáticas, Univ. Autónoma de Nuevo León, Mexico, [2]Inst. Nacional de Astrofísica, Óptica y Electrónica, Mexico, [3]Facultad de Ingeniería Mecánica, Eléctrica y Electrónica Univ. de Guanajuato Campus Salamanca, Mexico.* A 60nm wide tunable all erbium-doped fiber ring laser based on the multimode interference effect (MMI) is presented. The tuning range goes from 1549nm to 1609nm with better than 40dB signal to noise ratio.

**JTuD63**
**Array Size Scalability of Passively Coherently Phased Fiber Laser Arrays,** *Wei-Zung Chang, Tsai-Wei Wu, Herbert Winful, Almantas Galvanauskas; Univ. of Michigan, USA.* We explore theoretically and experimentally efficiency of coherent phasing of 2,4,6,8,10,12,14,16-channel fiber-laser arrays built using fused 50:50 single-mode couplers. Experimental and theoretical results agree well and provide the relationship between array size and combining efficiency.

**JTuD64**
**Photonic Band-Gap Mode Due to a Topological Defect within a Photonic Crystal Fiber Cladding,** *Georges Humbert[1], Fetah Benabid[2], Peter John Roberts[3]; [1]UMR CNRS, France, [2]Univ. of Bath, UK, [3]Technical Univ. of Denmark, Denmark.* We report on properties of a photonic band-gap mode due to a topological defect within a photonic crystal fiber cladding which allows band-gap guidance below the air-line, yielding an unusual dispersion curve.

**JTuD65**
**Low-Noise High-Power Ultrafast Yb-Fiber Amplifier System with Integrated Pump Delivery,** *Pranab Mukhopadhyay, Hamit Kalaycioğlu, Kivanc Özgören, Levent Budunoğlu, F. Ömer Ilday; Bilkent Univ., Turkey.* We report the first high-power, low-noise fiber amplifier seeded by an all-normal-dispersion Yb- fiber laser with completely fiber-integrated pump delivery. 16W is obtained with $M^2$<1.1. Dechirped pulse duration is 200fs. Laser intensity noise is <0.2%.

**JTuD66**
**Group Velocity Dispersion in Composite Tellurite-Fluorophosphate Fiber,** *Chitrarekha B. Chaudhari, Meisong Liao, Takenobu Suzuki, Yasutake Ohishi; Res. Ctr. for Advanced Photon Technology, Toyota Technological Inst., Japan.* We design composite tellurite and fluorophosphate glass fiber and calculate the group velocity dispersion. Either anomalous or zero flattened dispersion can be tailored for nonlinear applications, in telecommunication band, with proper core and cladding dimensions.

**JTuD67**
**Ytterbium-Doped Mode-Locked Fiber Laser at Hundreds of kHz Repetition Rate,** *Chun Zhou, Lingling Chen, Yue Cai, Meng Zhang, Ling Ren, Peng Li, Zhigang Zhang; Univ. of Beijing, China.* A long ring-cavity, low repetition rate Yb-doped fiber laser was demonstrated. Pulses with repetition rate of about 381.3 kHz and single pulse energy above 300 nJ were obtained.

**JTuD68**
**Optofluidically Tunable MMI Filter,** *Jose E. Antonio-Lopez[1], Jose G. Aguilar-Soto[1], Daniel A. May-Arrioja[1], Patrick LiKamWa[2], Jose J. Sanchez-Mondragon[1]; [1]INAOE, Mexico, [2]CREOL, Univ. of Central Florida, USA.* An optofluidically tunable multimode interference (MMI) bandpass filter is demonstrated. This scheme allows for a tuning range of almost 40 nm, by simple changing the liquid refractive index around the multimode fiber of the filter.

**JTuD69**
**Spectral Characterization of Heicoidal Long-Period Gratings in Photonic Crystal Fibers,** *Woojin Shin[1], Kyunghwan Oh[2], Bong-Ahn Yu[1], Yeung Lak Lee[1], Do-Kyeong Ko[1]; [1]Advanced Photonics Res. Inst., Gwangju Inst. of Science and Technology, Republic of Korea, [2]Yonsei Univ., Republic of Korea.* We report helicoidal long-period grating by twisting photonic crystal fiber under $CO_2$ laser irradiation and investigated its novel characteristics. The fabricated PCF-LPG endows unique resonance tuning capability with low polarization-dependent loss and thermal shift.

## JTuD • Joint CLEO/IQEC Poster Session I—Continued

**JTuD70**
**Tunable All-Normal-Dispersion Yb-Doped Mode-Locked Fiber Lasers,** *Lingjie Kong, Xiaosheng Xiao, Changxi Yang; Tsinghua Univ., China.* Continuous wavelength tunablity is demonstrated in all-normal-dispersion Yb-doped mode-locked fiber laser with a briefringent filter. The mode-locking is self-started and stable. The center wavelength can be tuned from 1024.5 nm to 1070.8 nm.

**JTuD71**
**Fiber Laser with Enhanced Modelocking Using a Carbon Nanotube-Filled Micro-Slot Saturable Absorber,** *Amos Martinez[1], Kaiming Zhou[2], Ian Bennion[2], Shinji Yamashita[1]; [1]Univ. of Tokyo, Japan, [2]Aston Univ., UK.* We propose a robust, compact, low-loss saturable absorber consisting of a liquid core waveguide, engraved in an optical fiber and filled with carbon nanotubes. Enhanced modelocking in an all-fiber configuration is achieved.

**JTuD72**
**Characterization of the Large Index Modification Caused by Electrical Discharge in Optical Fibers,** *Benoit Sévigny[1], Mikaël Leduc[2], Mathieu Faucher[1], Nicolas Godbout[2], Suzanne Lacroix[2]; [1]ITF Labs, Canada, [2]École Polytechnique de Montréal, Canada.* The large index perturbation observed in Long Period Gratings made by electric discharge is measured and explained in terms of modification of the fiber stress and strain state.

**JTuD73**
**Silicon Avalanche Photodiodes for Low Cost, High Loss Short Wavelength Radio over Fiber Links,** *Fan Yang, Michael J. Crisp, Ke Fang, Richard V. Penty, Ian H. White; Cambridge Univ., UK.* An APD is shown to improve the noise figure of a lossy optical link compared to a PIN-TIA combination of equivalent gain. Transmission of IEEE 802.11g WLAN signals is demonstrated with 18dB optical link loss.

**JTuD74**
**Using Gain-Clamping to Mitigate Gain Transients in Fibre Optical Parametric Amplifiers,** *Nikolaos Gryspolakis, Lawrence R. Chen; McGill Univ., Canada.* We demonstrate using all-optical-gain-clamping to mitigate gain transients induced by channel add/drop in FOPAs. In a 4 channel system, we obtain error-free transmission for the surviving channel, compared to a BER = $10^{-3}$ without gain-clamping.

**JTuD75**
**Distortion Free, High Delay-Bandwidth Product Data Buffer Using Fast-Light Based White Light Cavities,** *Ho Nam Yum[1,2], Mary Salit[1], M. Selim Shahriar[1]; [1]Northwestern Univ., USA, [2]Texas A&M Univ., USA.* We propose a distortion-free data buffering system using a fast-light based white light cavity. This system offers a breakthrough in overcoming the delay-bandwidth product constraint in dispersion-based buffers, and can be realized using optical fibers.

**JTuD76**
**Optimization of Focal Plane Detectors for Mitigation of Atmospheric Turbulence Effects in Deep Space Optical Communication,** *Ali J. Hashmi[1], Ali A. Eftekhar[1], Ali Adibi[1], Farid Amoozegar[2]; [1]Georgia Tech, USA, [2]JPL, USA.* Atmospheric turbulence is a major limiting factor in a deep space optical communication link. To mitigate these effects, we present optimization of focal plane detectors which results in considerable improvement in performance of optical receivers.

**JTuD77**
**Simulation of All-Optical Packet Switching with All-Optical Header Processing Using Fabry-Perot Laser Diodes at 10 Gb/s,** *Liqing Gan[1], Feng Li[1], L. F. K. Lui[1], C. C. Lee[2], P. K. A. Wai[1]; [1]Photonics Res. Ctr. and Dept. of Electronic and Information Engineering, Hong Kong, [2]Hong Kong Polytechnic Univ., Hong Kong.* All-optical packet switching with all optical heading processing using one and two Fabry-Perot laser diodes are studied numerically. Both the header and data rates are at 10 Gb/s.

**JTuD78**
**Modulation Squeezing of a 10 Gb/s RZ and NRZ Signal with a Single SOA,** *Mirco Scaffardi[1], Gianluca Berrettini[2], Irfan Fazal[3], Luca Potì[1], Alan E. Willner[3], Antonella Bogoni[1]; [1]Consorzio Nationale Interuniversitario per le Telecomunicazioni, Italy, [2]Scuola Superiore Sant'Anna, Italy, [3]Univ. of Southern California, USA.* A characterisation of a SOA-based modulation suppressor for 10Gb/s RZ and NRZ signals is performed. Its effectiveness in colourless WDM PON is demonstrated obtaining error-free operation in a 20km-long link.

**JTuD79**
**Stacked Optical Code Label and Its Decoder with Cyclic Postfix in Optical Multicasting Networks,** *Ming Xin, Minghua Chen, Hongwei Chen, Shizhong Xie; Dept. of Electronics Engineering, Tsinghua Univ., China.* A cyclic postfix is introduced in the stacked optical code (OC) labels decoder implemented by Fiber Bragg Gratings. Then multicasting to a large number of nodes can be realized with a single stacked OC label.

**JTuD80**
**Differentiation of Three Isotopic Variants of Nitrous Oxide Based on Spectra of Rotational Transitions,** *Hongqian Sun[1], Yujie J. Ding[1], Ioulia B. Zotova[2]; [1]Lehigh Univ., USA, [2]ArkLight, USA.* We have identified 68 rotational transitions from three isotopic variants of nitrous oxide, among which 29 were never observed previously. By deducing and comparing the rotational constants, we have reliably differentiated among three isotopic variants.

**JTuD81**
**A Stabilized Fiber Laser for Low Frequency, High Resolution Sensing,** *Timothy T-Y Lam, Conor M. Mow-Lowry, Jong H. Chow, David E. McClelland, Ian C. M. Littler; Australian Natl. Univ., Australia.* A stabilized fiber laser is presented for low frequency, sensing applications. Suppression of noise to 15 fε/√Hz (2Hz/√Hz) is demonstrated at 60 Hz. For a 20 mm sensor, displacement sensitivity of 0.3 fm/√Hz is expected.

**JTuD82**
**Wavelength Modulation in Tunable Diode Laser Photoacoustic Spectroscopy,** *Jaakko Saarela, Juha Toivonen, Albert Manninen, Tapio Sorvajärvi, Rolf Hernberg; Tampere Univ. of Technology, Finland.* Wavelength modulation waveforms were studied in tunable diode laser photoacoustic spectroscopy by way of simulations and experiments. The modulation waveforms were sinusoidal, triangular, shaped, and quasi-square waves. The quasi-square waveform gave the largest signal-to-noise ratio.

**JTuD83**
**Atmospheric Trace Gases Concentration Measurements Using Open Path FTIR,** *Daniela V. Vladutescu, Maung Lwin, Barry Gross, Fred Moshary, Samir Ahmed; New York City College of Technology, USA.* In this paper we present results of atmospheric greenhouse gases concentrations measurements based on open path FTIR techniques and propose a quantum cascade laser approach for simultaneous measurements for ammonium and ozone.

**JTuD84**
**Ethylene Trace Detection by Quartz Enhanced Photoacoustic Spectroscopy,** *Kun Liu[1], Tao Wu[1], Xiaoming Gao[1], Weijun Zhang[1], Eric Fertein[2], Weidong Chen[2]; [1]CAS, China, [2]CNRS, France.* $C_2H_4$ absorption line intensity at 6172.95 $cm^{-1}$ was determined for trace detection. $C_2H_4$ trace concentration measurements were performed using quartz enhanced photoacoustic spectroscopy (QEPAS) with a sensitivity of 1.3 ppmv (1σ) for τ=1s time constant.

**JTuD85**
**Kramers-Kronig Imaging of Diffuse Media and Embedded Objects,** *Tzachi Tal, Yossi Ben-Aderet, Er'el Granot, Shmuel Sternklar; Ariel Univ. Ctr. of Samaria, Israel.* The Kramers-Kronig technique is used to reconstruct the impulse-response of a diffusive media with picosecond resolution. We demonstrate the ability to image an object within clothing at a distance of 3m from the detection system.

**JTuD86**
**Accounting for System Affects in Depolarization Lidar,** *Matthew M. Hayman, Jeffrey P. Thayer; Univ. of Colorado, USA.* When using lidar to measure small depolarization values, coupling of polarization planes in the system is of significant concern. We employ hardware polarization compensation to reduce system polarization cross-talk, improving depolarization estimates.

**JTuD87**
**Experimental Demonstration of a Bottle Microresonator,** *Ganapathy Senthil Murugan, James S. Wilkinson, Michalis N. Zervas; Optoelectronics Res. Ctr., Univ. of Southampton, UK.* We demonstrate a very simple technique to fabricate robust microbottle resonators. Spheroidal WGMs and bottle modes were excited preferentially using a tapered fiber coupled at specific locations along the bottle, and characteristic resonance spectra obtained.

**JTuD88**
**Optical Monitoring of a Wavelength-Scale Mechanical Resonator via Cavity Scattering,** *Akobuije Chijioke, John Lawall; NIST, USA.* We demonstrate sensitive optical readout of the motion of a wavelength-scale mechanical resonator via its scattering within a high-finesse optical cavity. Static calibration, dynamic monitoring and feedback cooling are presented.

**JTuD89**
**Silicon Photonic Evanescent Field Molecular Sensor Using Resonant Grating Interrogation,** *Bill Sinclair, Jens H. Schmid, Philip Waldron, Daniel Poitras, Siegfried Janz, Trevor Mischki, Gregory Lopinski, Adam Densmore, Dan-Xia Xu, Jean Lapointe, Andre Delâge; Natl. Res. Council Canada, Canada.* A 220 nm thick silicon waveguide molecular sensor is interrogated through the back of an SOI wafer, using reflection from a silicon dioxide grating. Adsorption of a protein monolayer induces 60% change in reflected power.

**JTuD90**
**Near-IR Emission from Metal-Insulator-Metal Tunnel Junctions Based on Surface Plasmon Interactions,** *Jiayu Chen[1], Li Wang[1], Damian Ancukiewicz[2], Ravinder K. Jain[1]; [1]Univ. of New Mexico, USA, [2]Columbia Univ., USA.* We report the observation of near-IR emission from Al-$AlO_x$-Au tunnel junctions and a blurred-up peak at high applied voltage. We argue that it results from an interaction with near-IR surface plasmons.

**JTuD91**
**Optical Sum-Frequency Generation and Ferroelectric-Like Switching in Si-O Polar Structures,** *Jia-Min Shieh[1,2], Wen-Chien Yu[1], Jung Y. Huang[2], Yi-Chao Wang[2], Ching-Wei Chen[2], Chao-Kei Wang[1], Hao-Chung Kuo[2], Bau-Tong Dai[1], Ci-Ling Pan[2]; [1]Natl. Nano Device Labs, Taiwan, [2]Inst. of Electro-Optical Engineering, Natl. Chiao Tung Univ., Taiwan.* Optical sum-frequency generation and ferroelectric-like switching in Si-O polar structures comprised of Si nanocrystals (*nc*-Si) in mesoporous silica was reported and attributed to polar layers lying at the interfaces between one-side bonded *nc*-Si and host.

**JTuD92**
**Parallel-Coupled Dual Racetrack Ring Silicon Modulator for Advanced Modulation Formats,** *Wei Jiang[1], Zhong Shi[2]; [1]Rutgers Univ., USA, [2]Luna Innovations Inc., USA.* We propose and analyze a parallel-coupled dual racetrack-ring silicon modulator. Our simulations show that a wide variety of advanced modulation formats such as QPSK and 16-QAM can be achieved in such a structure.

**JTuD93**
**Near Field Imaging with Assembled Nanoparticles,** *Misha Sumetsky; OFS Labs, USA.* It is shown theoretically that a near field probe composed of several nanoparticles with optimized positions can perform much faster and with the better contrast and resolution than a probe composed of a single nanoparticle.

## JTuD • Joint CLEO/IQEC Poster Session I—Continued

**JTuD94**
**Emission Characteristics of 2-D Photonic Crystal Band Edge Organic Blue Lasers Designed at Three Surface-Emitting Emission Band Edges,** *Sidney S. Yang, Chong-Jie Haung, Shih-I Chen; Inst. of Photonics Technologies, Natl. Tsing Hua Univ., Taiwan.* Two-dimensional photonic crystal band-edge lasers at different emission band locations (MII, Γ, KII) are designed based on photonic band diagrams. The emission characteristics are presented. The lasing phenomenon is occurred only at MII point.

**JTuD95**
**Threshold and Dynamic Characteristics of Photonic Crystal Nanolasers,** *Richard Hostein, Remy Braive, Audrey Miard, Sylvain Barbay, Noelle Gogneau, Anne Talneau, Luc LeGratiet, Isabelle Robert-Philip, Isabelle Sagnes, Alexios Beveratos; Lab de Photonique et Nanostructures, CNRS, France.* We analyze the chirp dynamics of quantum dot based photonic crystal nanolasers and demonstrate room temperature lasing at 1550nm. We demonstrate a discrepancy between the classical threshold definition and transition from thermal to coherent light.

**JTuD96**
**Spectral Properties of Entangled Photons Generated via Type-I Frequency-Nondegenerate Spontaneous Parametric Down-Conversion,** *So-Young Baek, Yoon-Ho Kim; Pohang Univ. of Science and Technology (POSTECH), Republic of Korea.* We report experimental and theoretical studies on the spectral properties of entangled photons of cw-pumped type-I frequency-nondegenerate SPDC. We find that the entangled-photon pair exhibits spectral and temporal features commonly associated with type-II SPDC.

**JTuD97**
**Quantum Random Number Generator Using Photon-Number Path Entanglement,** *Young-Wook Cho, Osung Kwon, Yoon-Ho Kim; Dept. of Physics, Pohang Univ. of Science and Technology (POSTECH), Republic of Korea.* We report a novel quantum random number generator based on the photon-number–path entangled state. The randomness in our scheme is of truly quantum mechanical origin. The generated bit sequences satisfy the standard randomness test.

**JTuD98**
**Extraction of Correlated 2-Photons with near Unit Efficiency,** *Alexander Ling[1,2], Jun Chen[1,2], Jingyun Fan[1,2], Alan Migdall[1,2]; [1]Joint Quantum Inst., Univ. of Maryland, USA, [2]NIST, USA.* We demonstrate the extraction of high purity correlated 2-photons ($g^{(2)}(0)$=0.0055) from a microstructure-fiber source with near unit efficiency. Such a source may help many quantum information applications including loop-hole free Bell-type tests.

**JTuD99**
**Ghost Imaging with Entangled Light–Comparison of Theory and Experiment,** *Claudio G. Parazzoli[1], Barbara A. Capron[1], Jeff Adams[2], Kam W. Chan[3], Malcolm N. O'Sullivan[3], Robert W. Boyd[3], Jeffrey H. Hunt[1]; [1]Boeing Phantom Works, USA, [2]SpectraNet, Inc., USA, [3]Inst. of Optics, Univ. of Rochester, USA.* We compare results of a ghost imaging experiment using entangled photons with numerically computed images. We find excellent agreement for double slit masks in both transmission and reflection modes for different magnifications.

**JTuD100**
**High-Order Thermal Ghost Imaging,** *Kam Wai Clifford Chan, Malcolm N. O'Sullivan, Robert W. Boyd; Inst. of Optics, Univ. of Rochester, USA.* We show that high-order ghost imaging has higher visibility and contrast-to-noise ratio as compared to conventional thermal ghost imaging. We also obtain the optimal polynomial order that gives the best contrast-to-noise ratio.

**JTuD101**
**Sub Shot Noise Spatial Correlation Measurement for Quantum Imaging of Weak Objects,** *Giorgio Brida, Marco Genovese, Alice Meda, Ivano Ruo-Berchera; Inst. Nazionale di Ricerca Metrologica, Italy.* We report an experiment on sub-shot-noise spatial correlations measurement without any subtraction of background; this result is a crucial point for the realization of sub shot-noise imaging of weak objects.

**JTuD102**
**Modeling Asymmetric Reflectance in Semicontinuous Metal Films Using Generalized Ohm's Law,** *Nicholas A. Kuhta[1], Aiqing Chen[2], Keisuke Hasegawa[2], Miriam Deutsch[2], Viktor Podolskiy[1]; [1]Oregon State Univ., USA, [2]Univ. of Oregon, USA.* Generalized Ohm's Law is used to model the phenomenon of broadband asymmetric reflectance recently observed in semicontinuous metal-dielectric films in the proximity of the percolation threshold. Qualitative agreement with experiment is achieved.

**JTuD103**
**Self-Consistent Description of Time-Resolved Raman and Fluorescence Emission of Semiconductor Quantum Dots,** *Julia Kabuss, Andreas Knorr, Marten Richter; Inst. für Theoretische Physik, Technische Univ. Berlin, Germany.* We calculate the dynamic emission spectrum of a coupled phonon-quantum dot system after stationary and pulsed excitation using density matrix formalism. Fluorescence and Raman emission can be distinguished by their different temporal dynamics.

**JTuD104**
**Polarization Proximity Effect in Isolator Crystal Pairs,** *Yoav Linzon, M. Ferrera, L. Razzari, A. Pignolet, R. Morandotti; INRS-Énergie et Matériaux, Université du Québec, Canada.* We experimentally study the polarization dynamics of near infrared light transmitted through magneto-optic Yttrium Iron Garnet isolator crystal pairs using a modified balanced detection scheme. In the sub-millimeter separations, we observed a magnetostatic proximity effect.

**JTuD105**
**Ultrafast Relaxation Dynamics in GaN Nanowires,** *Prashanth C. Upadhya[1], Qiming Li[2], George T. Wang[2], Arthur J. Fischer[2], Antoinette J. Taylor[1], Rohit P. Prasankumar[1]; [1]Ctr. for Integrated Nanotechnologies, Los Alamos Natl. Lab, USA, [2]Sandia Natl. Labs, USA.* Time-resolved optical measurements on GaN nanowires give insight into carrier relaxation dynamics on a femtosecond timescale, allowing us to understand the nature of defect states present in the nanostructure.

**JTuD106**
**Bright Photoluminescence from Non-Tapered InN Nanowires Grown on Si by Molecular Beam Epitaxy,** *Yi-Lu Chang, Arya Fatehi, Zetian Mi; McGill Univ., Canada.* We have achieved superior quality non-tapered InN nanowires on Si(111) by molecular beam epitaxy, which are free of dislocations and exhibit bright photoluminescence at room-temperature and significantly reduced spectral broadening (linewidth~18.5 meV at 77K).

**JTuD107**
**Coherent Optical Phonons in Multiferroic $LuMnO_3$,** *Kyeong-Jin Jang[1], Jongseok Lim[1], Jihee Kim[2], Ki-Ju Yee[2], Jai Seok Ahn[3], Jaewook Ahn[1]; [1]KAIST, Republic of Korea, [2]Chungnam Natl. Univ., Republic of Korea, [3]Pusan Natl. Univ., Republic of Korea.* We observe coherent phonons of 4.0 THz and 45 GHz oscillation frequencies in the magnetically disordered phase ($T>T_N$) of multiferroic $LuMnO_3$ using femtosecond IR spectroscopy. We attribute the phonons to the displacement of polyhedron $MnO_5$.

**JTuD108**
**Coupled Carrier-Phonon Dynamics in Light Emitting Quantum-Dot Heterostructures: Switch on Dynamics and Carrier Heating,** *Janik Wolters, Matthias-René Dachner, Marten Richter, Andreas Knorr, Ulrike Woggon; Technische Univ. Berlin, Germany.* Microscopic calculations of the dynamics of electrically injected carriers, coupled to LO-phonons in Stranski-Krastanov-grown quantum-dot-emitters are presented. Even though the phonon distribution remains in equilibrium, a substantial carrier heating occurs.

**JTuD109**
**Uniaxial Stress Dependence of Yellow Series np Excitons in $Cu_2O$,** *Eunmi Chae[1,2], Kosuke Yoshioka[1,2], Makoto Kuwata-Gonokami[1,2]; [1]Solution Oriented Res. for Science and Technology-JST, Univ. of Tokyo, Japan, [2]CREST-JST, Japan.* We observed stress dependence of the energy of np excitons in $Cu_2O$ by linear absorption spectroscopy. The energy shift of np states agrees well with calculations using modified coefficients under symmetry considerations.

**JTuD110**
**All Optical Waveguiding in a Coherent Atomic Rubidium Vapor,** *Praveen K. Vudyasetu, David J. Starling, John C. Howell; Univ. of Rochester, USA.* We demonstrate an all optical waveguide imprinted by a low power Laguerre Gaussian control laser beam using a coherent Raman process in warm atomic rubidium vapor.

**JTuD111**
**Experimental Generation of 1.6-THz Repetition-Rate Pulse-Trains in a Passive Optical Fiber Resonator,** *François Leo[1], Pascal Kockaert[1], Philippe Emplit[1], Marc Haelterman[1], Arnaud Mussot[2], Eric Louvergneaux[2], Majid Taki[2]; [1]OPERA-Photonique, Univ. Libre de Bruxelles, Belgium, [2]PhLAM, Univ. de Lille, France.* Using an optical fiber ring cavity with a GVD coefficient as low as $-0.02$ $ps^2$/km, we experimentally generated pulse-trains with a repetition-rate in the THz range. We achieved the spectral and temporal characterization of this train.

**JTuD112**
**Beam Interaction in Self-Defocusing Nonlinear Media with Nonlocal Response,** *Can Sun, Jason W. Fleischer; Princeton Univ., USA.* We study, theoretically and experimentally, beam dynamics and interaction in a self-defocusing medium with spatial nonlocality. By varying the beam separation and distance to boundaries, we demonstrate an effective method of controlling beam trajectories.

**JTuD113**
**Frequency up-Converted Lasing of Nanocrystal Quantum-Dots in Microbeads,** *Chunfeng Zhang[1], Fan Zhang[1], Jian Xu[1], Y. A. Wang[2]; [1]Dept. of Engineering Science and Mechanics, Penn State Univ., USA, [2]Ocean NanoTech LLC, USA.* Frequency up-converted lasing emission at visible wavelengths was observed from nanocrystal-infiltrated silica microbeads, which has been explained by the coupling of the two-photon pumped biexciton gain to the whispering gallery mode in a spherical microcavity.

**JTuD114**
**Multi-Filamentation and Temporal Compression of an Elliptical Beam in the Anomalous Dispersion Regime,** *Bonggu Shim, Samuel E. Schrauth, Alexander L. Gaeta; School of Applied and Engineering Physics, Cornell Univ., USA.* We investigate spatio-temporal focusing of an elliptically-shaped beam in a bulk medium with a Kerr nonlinearity and anomalous dispersion. Strong spatio-temporal localization of the mode is observed via multi-filamentation and temporal compression.

**JTuD115**
**Absolute Probes of Surface Chirality Based on Second-Harmonic Generation,** *Mikko J. Huttunen, Miro Erkintalo, Martti Kauranen; Tampere Univ. of Technology, Finland.* We propose new second-harmonic-generation probes of surface chirality, based on circular polarizations or handed superpositions of radial and azimuthal polarizations. Because of normal incidence focusing, the techniques are not sensitive to anisotropy.

**JTuD116**
**Temporal, Spectral, and Spatial Effects of Cross-Phase Modulation with Intense Single-Cycle Terahertz Pulses,** *Yuzhen Shen, G. L. Carr, James B. Murphy, Thomas Y. Tsang, Xijie Wang, Xi Yang; Brookhaven Natl. Lab, USA.* We demonstrate that the intense electric field of a subpicosecond single-cycle terahertz pulse can control and manipulate the temporal, spectral, and spatial characteristics of a copropagating ultrashort laser pulse through cross-phase modulation.

**JTuD117**
**Near-Field Imaging of Coupled Surface-Wave Layers,** *Akram Ahmadi, Hossein Mosallaei; Northeastern Univ., USA.* Coupled Multi-layered surfaces are presented to manipulate evanescent fields and offer subwavelength near-field imaging. Positive and negative interfaces alternation will successfully tailor the poles of surface waves, resulting in superior electromagnetic-optical characteristics.

## JTuD • Joint CLEO/IQEC Poster Session I—Continued

**JTuD118**
**Effects of Molecular Adsorption on Optical Losses of Silver Surfaces,** *Alexander V. Gavrilenko, Carla S. McKinney, Mikhail A. Noginov, Vladimir I. Gavrilenko; Norfolk State Univ., USA.* Optical losses of organic molecues adsorbed on the Ag(111) surface are studied by first-principles. Substantial modifications of Im(ε) in the near infrared and visible spectral regions are predicted, discussed, and compared to experimental results.

**JTuD119**
**Effect of Low Temperature on Surface Plasmon Polaritons in Silver Films,** *Mohammad Mayy[1], Guhoua Zhu[1], Ehab Mayy[2], Andrey V. Yakim[1], Amanda D. Webb[1], John E. Livenere[1], Heng Li[1], Dwanye Bobb[1], Mikhail A. Noginov[1]; [1]Norfolk State Univ., USA, [2]Central Piedmont Community College, USA.* We have studied the effect of low temperature on the surface plasmon polariton loss and DC resistivity in silver films. We infer that a sizable loss reduction can be obtained in films of higher quality.

**JTuD120**
**Colloidal Semiconductor Quantum Dot Whispering-Gallery Microlaser: A Comparative Study of Two Approaches,** *Razvan I. Stoian, Elijah Dale, Deepak Ganta, Albert T. Rosenberger; Oklahoma State Univ., USA.* The microlaser consists of a tapered-fiber-coupled fused-silica microsphere, with HgTe nanocrystals deposited on one tapered fiber. Compared to a microlaser having a coated microsphere, the lasing signal is cleaner and the cavity *Q* remains high.

**JTuD121**
**Paper Withdrawn**.

**JTuD122**
**Long-Range Surface Plasmon Polariton Waveguides for Visible Light Applications,** *Malte C. Gather, Kristjan Leosson; Science Inst., Univ. of Iceland, Iceland.* We report long-range plasmonic waveguides with a dye-compatible cladding material, exhibiting visible-light propagation lengths up to 0.5 mm. Experimentally determined propagation lengths are compared to simulations and a strategy for further improvements is identified.

**JTuD123**
**Linear and Nonlinear Optical Response of Aligned Gold Nanorods,** *Lazaro A. Padilha[1], Jake Fontana[2], Dana Kohlgraf-Owens[1], Michele F. Moreira[2], Scott Webster[1], Peter Palffy-Muhoray[2], Pieter G. Kik[1], David J. Hagan[1], Eric W. Van Stryland[1]; [1]CREOL and FPCE, College of Optics and Photonics, Univ. of Central Florida, USA, [2]Liquid Crystal Inst., USA.* The optical properties of gold nanorods suspended in toluene are studied as a function of orientation by aligning them with a low-frequency electric field. The nonlinear optical response is consistent with a 2-level saturation model.

**JTuD124**
**Spatial Filtering by Using Cascading Plamonic Gratings,** *Chih Ming Wang[1], Yia Chung Chang[2], Din Ping Tsai[2,3]; [1]Inst. of Optoelectronic Engineering, Natl. Dong Hwa Univ., Taiwan, [2]Res. Ctr. for Applied Sciences, Academia Sinica, Taiwan, [3]Dept. of Physics, Natl. Taiwan Univ., Taiwan.* In this paper, cascading plamonic gratings were investigated. The angle dependent reflection spectrum of the proposed structure displays a resonance peak at a specific angle. The FWHM of the resonant peak is smaller than 2°.

**JTuD125**
**Effective in Plane Launching and Focusing Surface Plasmons by a Plasmonic Lens,** *Jiayuan Wang, Jiasen Zhang, Qihuang Gong; State Key Lab for Mesoscopic Physics and Dept. of Physics, Peking Univ., China.* We implement in plane launching and focusing surface plasmons by fabricating Fresnel zone-plate like grating on a thin gold film. A subwavelength focal spot, with transverse FWHM=712nm, is observed at 830nm vacuum wavelength.

**JTuD126**
**B-Dot Probe Study of Two-Color Laser-Produced Elongated Air Filaments,** *Ki-Yong Kim, Sanjay Varma, Matt Aubuchon, Yu-Hsin Chen, Howard Milchberg; Univ. of Maryland, USA.* The generation of transient electrical current and terahertz radiation in two-color laser-produced plasma filaments is studied with a B-dot probe. The diagnostic can monitor transient electrical currents induced by two-color photoionization.

NOTES

**Rooms 318-320**

**IQEC**

## 2:30 p.m.–4:15 p.m.
## ITuG • Novel Optical Phenomena
*Hakan E. Türeci; ETH Zurich, Switzerland, Presider*

**ITuG1 • 2:30 p.m.** Invited

**Routing Light with Nematicons: Light Localization and Steering in Liquid Crystals,** *Gaetano Assanto[1], Marco Peccianti[2], Alessandro Alberucci[1], Armando Piccardi[1]; [1]Univ. of Rome, Italy, [2]Univ. of Quebec, Canada.* Liquid crystals in the nematic phase support light self-confinement via reorientational nonlinearity and nonlocality, yielding robust spatial solitons which can trap, switch, and route optical signals. We review the major achievements in the field.

**ITuG2 • 3:00 p.m.**

**Optical Activity in Achiral Metamaterials,** *Eric Plum[1], Xing-Xiang Liu[1,2], Vassili A. Fedotov[1], Yifang Chen[3], Din P. Tsai[2], Nikolay I. Zheludev[1]; [1]Optoelectronics Res. Ctr., Univ. of Southampton, UK, [2]Natl. Taiwan Univ., Taiwan, [3]Rutherford Appleton Lab, UK.* We demonstrate strong optical activity (and circular dichroism) for both microwave and photonic achiral planar metamaterials. The effect arises from extrinsic chirality resulting from oblique incidence of light onto the metamaterial structures.

**ITuG3 • 3:15 p.m.**

**Soliton Transport in Random Potential,** *Barak Alfassi, Tal Schwartz, Mordechai Segev; Technion-Israel Inst. of Technology, Israel.* We study soliton dynamics in random propagation-invariant potentials, and find that transport varies from classical-particle transport when correlation distance is large, to the short-range correlation regime, where these particle-like entities experience the transport of waves.

**Rooms 321-323**

**JOINT**

## 2:30 p.m.–4:15 p.m.
## JTuE • Slow/Fast Light and its Applications Joint CLEO/IQEC Symposium II
*Jean Toulouse; Lehigh Univ., USA, Presider*

**JTuE1 • 2:30 p.m.** Invited

**Slow and Fast Light in Optical Fibers: Review and Perspectives,** *Luc Thévenaz; Swiss Federal Inst. of Technology, École Polytechnique Fédérale de Lausanne, Switzerland.* Fiber slow light systems are at a turning point moving from a laboratory research to real applications. The possibility to shape the spectral resonance in Brillouin slow light leads to optimized configurations and innovative solutions.

**JTuE2 • 3:00 p.m.**

**Demonstration of Boolean Logic Gates Using Ultraslow Light,** *Byoung S. Ham, J. Hahn; Inha Univ., Republic of Korea.* Photon logic gates are observed using ultraslow light. The building block of the photon logic gate is photon routing phenomenon, where the routing is based on atomic coherence enhanced by ultraslow light.

**JTuE3 • 3:15 p.m.**

**A 10 GHz Optoelectronic Oscillator Continuously Tunable by an Intra Cavity SOA Based Slow Light Element,** *Evgeny M. Shumakher, Seán O. Dúill, Gadi Eisenstein; Technion-Israel Inst. of Technology, Israel.* We describe the use of a semiconductor optical amplifier as an intra cavity, continuous phase tuning element in an optoelectronic oscillator. A tuning range larger than 3 MHz is demonstrated in a 10 GHz oscillator.

**Rooms 324-326**

**IQEC**

## 2:30 p.m.–4:15 p.m.
## ITuH • Excitons
*Makoto Kuwata-Gonokami; Univ. of Tokyo, Japan, Presider*

**ITuH1 • 2:30 p.m.** Tutorial

**Four-Wave Mixing and Many-Particle Effects in Semiconductors,** *Rolf Binder; Univ. of Arizona, USA.* Four-wave mixing in semiconductor quantum wells has long been used to investigate many-particle effects. We introduce the theoretical concepts and illustrate some developments of the field, which D.S. Chemla helped to shape.

Rolf Binder received his Ph.D. in physics from the University of Dortmund, Germany, in 1988. Since 1989 he has been with the University of Arizona, where he is currently professor in the College of Optical Sciences and the Department of Physics. He is also a fellow of The Optical Society. Using non-equilibrium many-particle theories, he studies mainly optical properties of semiconductors. Recent examples of research projects include slow light effects in semiconductor heterostructures, optical refrigeration of semiconductors, and optical four-wave mixing instabilities.

**Room 314**

**CLEO**

## 2:30 p.m.–4:15 p.m.
## CTuS • Clock Dissemination and Distance/Displacement Metrology
*Kristan L. Corwin; Kansas State Univ., USA, Presider*

**CTuS1 • 2:30 p.m.**

**Long-Term Stable Timing Distribution of an Ultrafast Optical Pulse Train over Multiple Fiber Links with Polarization Maintaining Output,** *Jonathan A. Cox, Jungwon Kim, Jeff Chen, Franz X. Kaertner; MIT, USA.* The distribution of an ultrafast optical pulse train over multiple fiber links with long-term stable timing precision within 2 femtoseconds rms is accomplished by integrating a polarization maintaining output with 300 meter long fiber links.

**CTuS2 • 2:45 p.m.**

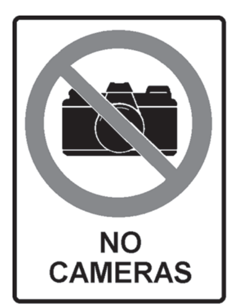
**Ultra Precise Frequency Dissemination across Germany—Towards a 900 km Optical Fiber Link from PTB to MPQ,** *Katharina Predehl[1], Ronald Holzwarth[1], Thomas Udem[1], Theodor W. Hänsch[1], Osama Terra[2], Gesine Grosche[2], Burghard Lipphardt[2], Harald Schnatz[2]; [1]Max-Planck-Inst. of Quantum Optics, Germany, [2]Physikalisch-Technische Bundesanstalt, Germany.* In order to compare optical frequency standards over large distances PTB and MPQ are establishing an optical fiber link of more than 900 km length. We report the intermediate results of this project.

**CTuS3 • 3:00 p.m.**

**Delivery of an Ultrastable Cs Optical Atomic Clock Using a JGN II Optical Test Bed,** *Masato Yoshida, Ikuo Kashiwamura, Toshihiko Hirooka, Masataka Nakazawa; Res. Inst. of Electrical Communication, Tohoku Univ., Japan.* We demonstrate Cs optical atomic clock delivery using a 200 km installed fiber link. PMD in the fiber link was found to be a major factor degrading the frequency stability of the delivered clock signal.

**CTuS4 • 3:15 p.m.**

***In situ* Calibration of a Translation Stage by Low-Coherence Tandem Interferometer,** *Akiko Hirai[1], Jun-ichiro Kitta[2], Hirokazu Matsmoto[3]; [1]AIST, Japan, [2]Japan Quality Assurance Organization, Japan, [3]Univ. of Tokyo, Japan.* For remote and *in situ* calibration of translation stage, system comparing optical-path-differences of two distantly-located low-coherence-interferometers through a single-mode-optical-fiber has been developed. Results of 52 nm-deviation and 30 nm-standard deviation for 39 mm-displacement is achieved.

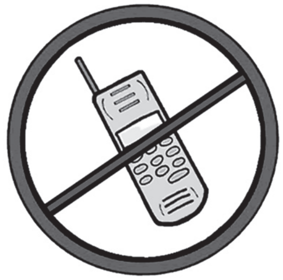


## 2:30 p.m.–4:15 p.m.
## CTuT • Microwave Photonics
*Paul Matthews; Northrop Grumman Corp., USA, Presider*

**CTuT1 • 2:30 p.m.**
**Wide-Bandwidth, High-Resolution ADC Scalable to Continuous-Time Operation,** *George A. Sefler, Josh A. Conway, George C. Valley; Aerospace Corp., USA.* A photonic front-end is used with a commercial digital oscilloscope to create a 2-channel, 7-effective bit, 10-GHz input bandwidth ADC that can be scaled to continuous-time operation by adding commercial components for 10 more channels.

**CTuT2 • 2:45 p.m.**
**Optical Sampling of Several Bandwidth-Limited Signals,** *Alfred Feldster, Yuval P. Shapira, Moshe Horowitz; Israel Inst. of Technology, Israel.* We experimentally demonstrate an optical system for multirate undersampling of several bandwidth limited signals with unknown carrier frequencies within a very broad frequency range. The amplitudes and the phases of the signals were accurately reconstructed.

**CTuT3 • 3:00 p.m.** Invited
**Optical Processing to Enhance UWB Transmission and Reception,** *Leslie A. Rusch, Mohammad Abtahi; Univ. Laval, Canada.* The range and/or bit rates of impulse radio UWB systems can be improved by employing the optical processing. We consider optical pulse shaping at the transmitter and precise receiver synchronization and windowing using optical techniques.



## 2:30 p.m.–4:15 p.m.
## CTuU • Optofluidics for Biosensing and Analysis
## CLEO Symposium III: Optical Manipulation
*Peter Domachuk; Tufts Univ., USA, Presider*

**CTuU1 • 2:30 p.m.** Invited
**Functional Measurement of Biological Parts,** *Matthew Lang; MIT, USA.* We present a parts perspective using biological components to form complex systems and discuss: connectivity, network formation, and motility. Challenges associated with characterization and assembly are discussed relative to assay development and instrumentation advances.

**CTuU2 • 3:00 p.m.**
**Optofluidic Platform Advancements for Optical Particle Manipulation,** *Philip Measor[1], Segei Kühn[1], Evan J. Lunt[2], Brian S. Phillips[2], Aaron R. Hawkins[2], Holger Schmidt[1]; [1]Univ. of California at Santa Cruz, USA, [2]Brigham Young Univ., USA.* A new design mitigates multimode waveguide behavior in an optofluidic platform and increases fundamental mode coupling to 95%. Experimental results yield excellent agreement with simulations and demonstrate a suitable device for optical particle manipulation.

**CTuU3 • 3:15 p.m.**
**Optofluidic Method for Revolving a Trapped Spherical Particle,** *Ethan Schonbrun[1], Joyce Wong[2], Kenneth B. Crozier[1]; [1]Harvard Univ., USA, [2]Schlumberger-Doll Res., USA.* We demonstrate a method for revolving a spherical particle on a 100 nm orbit using the interplay between an applied fluid force and an anisotropic optical trapping potential.

## 2:30 p.m.–4:15 p.m.
## CTuV • Photodetectors and Modulators
*Steven Spector; MIT, USA, Presider*

**CTuV1 • 2:30 p.m.** Invited
**CMOS-Integrated High-Speed Germanium Waveguide Photodetector for Optical Interconnects,** *Solomon Assefa[1], Fengnian Xia[1], Stephen W. Bedell[1], Ying Zhang[1], Teya Topuria[2], Philip M. Rice[2], Yurii A. Vlasov[1]; [1]IBM T.J. Watson Res. Ctr., USA, [2]IBM Almaden Res. Ctr., USA.* Compact germanium waveguide photodetector with 38fF capacitance, 40Gbps bandwidth and 0.4A/W responsivity is demonstrated. High-quality Ge-on-insulator single-crystalline layer was monolithically integrated into front-end CMOS process by lateral seeded crystallization.

**CTuV2 • 3:00 p.m.**
**Monolithic Integration of Germanium Photodetectors and Silicon Wire Waveguides with Carrier Injection Structures,** *Tai Tsuchizawa[1], Koji Yamada[1], Toshifumi Watanabe[1], Hiroyuki Shinojima[1], Hidetaka Nishi[1], Seiichi Itabashi[1], Sungbong Park[2], Yasuhiko Ishikawa[2], Kazumi Wada[2]; [1]NTT Corp., Japan, [2]Univ. of Tokyo, Japan.* We integrated monolithically vertical p-i-n Ge photodetectors with variable optical attenuators (VOAs) based on Si wire rib waveguides. The Ge photodetector accurately detected the change in light power due to the Si-VOA.

**CTuV3 • 3:15 p.m.**
**Compact Wavelength-Selective Resonant Photodetector Based on III-V/Silicon-on-Insulator Heterogeneous Integration,** *Liu Liu, Joost Brouckaert, Günther Roelkens, Dries Van Thourhout, Roel Baets; INTEC Dept., IMEC, Ghent Univ., Belgium.* We introduce a compact, resonant photodetector based on III-V/silicon-on-insulator heterogeneous integration. Wavelength-selective detection is demonstrated. >10dB extinction ratio is obtained. The responsivity of the detector is ~1.0A/W at the resonance wavelengths.

## Room 336

### CLEO

### 2:30 p.m.–4:15 p.m.
### CTuW • Random Lasers and Light Emission
*A. H. Kung; Academia Sinica, Taiwan, Presider*

**CTuW1 • 2:30 p.m.** Invited
**Chaotic Microcavity Laser with High Quality and Unidirectional Output,** *Hui Cao[1], Qinghai Song[1], Boyang Liu[2], Seng T. Ho[2], Wei Fang[3], Glenn S. Solomon[3]; [1]Yale Univ., USA, [2]Northwestern Univ., USA, [3]NIST, USA.* We demonstrate a chaotic microcavity laser which not only produces unidirectional emission but also has a quality factor of 22000. The output beam has a divergence angle less than 40 degree for all lasing modes.

**CTuW2 • 3:00 p.m.**
**Degree of Mode Localization in Random Lasing from ZnO Nanoparticles,** *Johannes Fallert, Janos Sartor, Roman J. B. Dietz, Daniel Schneider, Victor Zalamai, Claus Klingshirn, Heinz Kalt; Inst. für Angewandte Physik, Univ. Karlsruhe, Germany.* We present an experimental procedure to directly extract the degree of localization of random laser modes in ZnO powders. Strongly localized and extended modes are found to coexist within the same ensemble area.

**CTuW3 • 3:15 p.m.**
**RT Mid-IR Random Lasing of $Cr^{2+}$ Doped ZnS, ZnSe, CdSe Powders, Polymer Liquid and Polymer Films,** *Changsu Kim, Dmitri V. Martyshkin, Vladimir V. Fedorov, Sergey B. Mirov; Univ. of Alabama at Birmingham, USA.* We demonstrate room temperature (RT) middle-infrared (Mid-IR) random lasing of chromium- (Cr) doped ZnSe, ZnS, and CdSe powders, the powders imbedded in perfluorocarbon liquid polymer solutions, and fluorocarbon polymer films.

## Room 337

### IQEC

### 2:30 p.m.–4:15 p.m.
### ITuI • Quantum-Optical Communication Technologies
*Mankei Tsang; MIT, USA, Presider*

**ITuI1 • 2:30 p.m.**
**Megabits Secure Key Rate Quantum Key Distribution,** *Qiang Zhang[1,2], Hiroki Takesue[3], Toshimori Honjo[3], Kai Wen[1], Toru Hirohata[4], Motohiro Suyama[5], Yoshihiro Takiguchi[4], Hidehiko Kamada[3], Yasuhiro Tokura[3], Osamu Tadanaga[3], Yoshiki Nishida[3], Masaki Asobe[3], Yoshihisa Yamamoto[1,2]; [1]Stanford Univ., USA, [2]Natl. Inst. of Informatics, Japan, [3]NTT Basic Res. Labs, NTT Corp., Japan, [4]Central Res. Lab, Japan, [5]Electron Tube Div., Japan.* Imperfect practical conditions limit communication speed of Quantum cryptography. Here we implement differential phase shift quantum key distribution with up-conversion assisted hybrid photon detector to achieve 1.3M bits/s secure key rate over a 10 km fiber.

**ITuI2 • 2:45 p.m.** Invited
**Megabit per Second Quantum Key Distribution Using Practical InGaAs APDs,** *Alexander R. Dixon[1,2], Zhiliang L. Yuan[2], James F. Dynes[2], Andrew W. Sharpe[2], Andrew J. Shields[2]; [1]Univ. of Cambridge, UK, [2]Toshiba Res. Europe Ltd, UK.* We report the first gigahertz clocked decoy-protocol quantum key distribution (QKD) system, with a record secure key rate of 1.02 Mbit/s over a fiber distance of 20 km and 10.1 kbit/s over 100 km.

**ITuI3 • 3:15 p.m.**
**Quantum Key Distribution with an Untrusted Source,** *Yi Zhao, Bing Qi, Hoi-Kwong Lo; Univ. of Toronto, Canada.* The "plug & play" quantum cryptography scheme has significant advantage in real-life applications over other schemes and is adopted in most commercial quantum cryptosystems. Here, we present a rigorous security proof of it.

## Room 338

### 2:30 p.m.–4:15 p.m.
### ITuJ • Quantum Dots, Quantum Wells, and Cavities
*Presider to Be Announced*

**ITuJ1 • 2:30 p.m.**
**Electrically Controlled Single Quantum Dot Switching in Photonic Crystal Resonators,** *Andrei Faraon, Arka Majumdar, Jelena Vuckovic; Stanford Univ., USA.* The reflectivity of a photonic crystal cavity is modified using a single coupled quantum dot. We demonstrate electrical modulation by controlling the state of the quantum dot using a lateral electric field.

**ITuJ2 • 2:45 p.m.**
**Two-Photon Excitation and Emission in Quantum Dots Coupled to Photonic Crystal Nanocavities,** *Ziliang Lin, Jelena Vuckovic; Stanford Univ., USA.* We present calculations and proposals for two-photon transition rate enhancement in quantum dots coupled to photonic crystal cavities. Cavity-assisted absorption and emission are efficient methods to coherently excite quantum dots and generate indistinguishable single photons.

**ITuJ3 • 3:00 p.m.**
**Unusual Quantum Correlations and Photon Antibunching in an off-Resonant Quantum Dot Photonic-Crystal Cavity System,** *Emy Illes, Peijun Yao, Stephen Hughes; Queen's Univ., Canada.* We introduce a medium-dependent master equation formalism to study the off-resonant coupling behavior between a single quantum dot and a photonic-crystal cavity. Several surprising effects are found that help explain recent experiments.

**ITuJ4 • 3:15 p.m.**
**Cavity-QED Assisted "Attraction" between an Exciton and a Cavity Mode in a Planar Photonic-Crystal Cavity,** *Takehiko Tawara[1], Stephen Hughes[2], Hidehiko Kamada[1], Peijun Yao[2], Hirosi Okamoto[3], Takasumi Tanabe[1], Tetsuomi Sogawa[1]; [1]NTT Basic Res. Labs, Japan, [2]Queen's Univ., Canada, [3]NTT Photonics Labs, Japan.* We introduce a new regime of light-matter interaction, whereby a single exciton and photonic-crystal cavity mode are mutually "attracted" as they are tuned through resonance. This phenomenon is successfully explained by a quantized medium-dependent theory.

## Room 339

### CLEO

### 2:30 p.m.–4:15 p.m.
### CTuX • Application Driven Lasers
*Joe Alford; Lockheed Martin Coherent Technologies, USA, Presider*

**CTuX1 • 2:30 p.m.** Tutorial
**Space Qualification of Solid State Lasers,** *Anne-Marie d. Novo-Gradac[1], John F. Cavanaugh[2]; [1]NASA Headquarters, USA, [2]NASA Goddard Space Flight Ctr., USA.* General design principles for developing space based diode pumped solid state laser systems will be presented. Major issues affecting the design, development, system engineering, ground testing, operational simplicity and long term reliability will be discussed.

Anne-Marie Novo-Gradac has worked for NASA since 2001. She led the laser design teams for the Mercury Laser Altimeter (MLA) on board the MESSENGER spacecraft, and the Lunar Orbiter Laser Altimeter (LOLA) on the Lunar Reconnaissance Orbiter. She now serves as a Program Executive in the Astrophysics Division at NASA Headquarters.

John Cavanaugh has worked for NASA since 1983 on instruments for environments ranging from Antarctica to Mars. He has worked on several space-based laser instruments, including the Mars Orbiter Laser Altimeter (MOLA), the Shuttle Laser Altimeter (SLA) and MLA. He is currently the system engineer for the LOLA instrument.

## 2:30 p.m.–4:15 p.m.
## CTuY • Novel Materials
*Peter Smowton; Cardiff Univ., UK, Presider*

**CTuY1 • 2:30 p.m.**
**A Ge-on-Si Laser for Electronic-Photonic Integration,** *Xiaochen Sun, Jifeng Liu, Lionel C. Kimerling, Jurgen Michel; MIT, USA.* We demonstrate room temperature photoluminescence and optical gain from the direct band gap transition of tensile strained n-type Ge-on-Si around 1600 nm, which can be applied to a Si-based laser for optical interconnects and communications.

**CTuY2 • 2:45 p.m.**
**Lasing in Optically Pumped Ga(NAsP)/(BGa)(AsP) Heterostructures on Silicon,** *Christoph Lange[1], Niko S. Köster[1], Daniel J. Franzbach[1], Sangam Chatterjee[1], Wolfgang W. Rühle[1], Steffen Zinnkann[1], Sven Liebich[1], Igor Németh[1], Rafael Fritz[1], Kerstin Volz[1], Wolfgang Stolz[1], Bernardette Kunert[2], Nils C. Gerhardt[3], Nektarios Koukourakis[3], Martin Hofmann[3]; [1]Faculty of Physics and Material Sciences Ctr., Philipps-Univ. Marburg, Germany, [2]NAsP III/V GmbH, Germany, [3]Photonics and Terahertz Technology, Ruhr-Univ. Bochum, Germany.* We report lasing of optically pumped Ga(NAsP)/(BGa)(AsP) heterostructures grown lattice-matched on Si. Modal gain of up to 80cm$^{-1}$ is determined at 300K and a distinct threshold behavior and mode spectrum is observed up to 100K.

**CTuY3 • 3:00 p.m.**
**Origin of Non Radiative Recombination in GaInNAsSb/GaNAs Quantum Well Lasers,** *James Ferguson[1], Peter M. Smowton[1], Peter Blood[1], Hopil P. Bae[2], Tomas Sarmiento[2], James S. Harris Jr.[2]; [1]Cardiff Univ., UK, [2]Stanford Univ., USA.* We quantify contributions to threshold-current in state-of-the-art 1.55 µm GaInNAsSb lasers and the affect of layer design and nitrogen level. Non-radiative current is independent of nitrogen content (3.0-3.3%) but linked to the GaNAs barriers.

**CTuY4 • 3:15 p.m.**
**1528 nm GaInNAsSb/GaAs Vertical Cavity Surface Emitting Lasers,** *Tomas Sarmiento, Hopil Bae, Thomas D. O'Sullivan, James S. Harris Jr.; Stanford Univ., USA.* We present the operation of electrically-injected 1528 nm GaInNAsSb vertical cavity surface emitting lasers grown on GaAs. Pulsed lasing at room temperature and continuous wave lasing at low temperatures are reported for the first time.

## 2:30 p.m.–4:15 p.m.
## CTuZ • Nonlinear Optics for Imaging and Metrology
*Jason Fleischer; Princeton Univ., USA, Presider*

**CTuZ1 • 2:30 p.m.**
**Application of Nonlinear Optical Mixing to Microwave Photonic Instantaneous Frequency Measurement,** *Lam A. Bui[1], Mark Pelusi[2], Trung Vo[2], Niusha Sarkhosh[1], Hossein Emami[1], Arnan Mitchell[1], Benjamin J. Eggleton[2]; [1]Royal Melbourne Inst. of Technology Univ., Australia, [2]CUDOS, Univ. of Sydney, Australia.* We demonstrate use of all optical mixing in a highly nonlinear fiber to achieve microwave photonic frequency measurement. The system is simple, compact, predictable and stable with potential applications in next generation radar warning receivers.

**CTuZ2 • 2:45 p.m.**
**Differential Mode-Locked Cavity for Measurements of Minute Displacements,** *Xuan Luo, Alexander Braga, Ladan Arissian, Jean-Claude Diels; Univ. of New Mexico, USA.* A laser cavity with interwoven pulse trains provides a unique environment for intracavity interferometry. In a linear configuration 3 nm displacement is converted to 1 kHz shift in beat frequency.

**CTuZ3 • 3:00 p.m.**
**Measuring Particle Size Distributions via the Polarization Dependence of Second Harmonic Generation,** *Willem P. Beeker[1], Chris J. Lee[1], Clare J. Strachan[2,3], Klaus -J. Boller[1]; [1]Univ. of Twente, Netherlands, [2]Univ. of Otago, New Zealand, [3]Univ. of Helsinki, Finland.* We present a method to determine particle size distributions in powders, based on the polarization dependent second harmonic generation (SHG). Unlike existing methods, dilution is not required and is largely insensitive to the optical alignment.

**CTuZ4 • 3:15 p.m.**
**Photonic MEMS Vibrating at X-Band Rates (11 GHz),** *Matthew Tomes, Tal Carmon; Univ. of Michigan, USA.* We experimentally observe an opto-mechanical whispering-gallery [WG] resonator vibrating at 11 GHz. We use optical electrostriction to drive mechanical vibration at frequencies which scale inversely with optical wavelength, irrespective of micro-resonator size.

## 2:15 p.m.–4:15 p.m.
## PTuB • Applications of Solid-State Lighting
*Leo J. Schowalter; Crystal IS, Inc, USA, Presider*

**PTuB1 • 2:15 p.m.** Invited
**LED Lighting Systems,** *Neal Hunter; Cree, Inc., USA.* Abstract not available.

**PTuB2 • 2:45 p.m.** Invited
**The Use of Visible and Infrared LED and Advanced Hybrid Lighting Technologies in Tactical Illumination System Applications,** *Mark Schmidt; Cyberlux Corp., USA.* Advanced LED and hybrid solid-state lighting technologies provide previously unavailable lighting solutions for tactical situations ranging from establishing Forward Base Operations to First Responder disaster relief efforts, where hightly portable, reliable, energy-efficient lighting is critical.

**PTuB3 • 3:15 p.m.** Invited
**Roadblocks to High Efficiency Solid-State Lighting: Bridging the "Green-Yellow Gap",** *Mary Crawford, D. D. Koleske, J. Y. Tsao, A. M. Armstrong, G. T. Wang, A. J. Fischer, J. J. Wierer, M. E. Coltrin, L. E. Shea-Rohwe; Sandia Natl. Labs, USA.* Lighting applications are presently limited by the lack of efficient LEDs across the visible spectrum. We review materials challenges that underlie the "green-yellow gap" in LED efficiency and describe emerging approaches for bridging that gap.

## Rooms 318-320 — IQEC

### ITuG • Novel Optical Phenomena—Continued

**ITuG4 • 3:30 p.m.**
**Local Anisotropic Polarizability in Mesoscopic Structures,** *David P. Haefner, Sergey Sukhov, Aristide Dogariu; CREOL and FPCE, College of Optics and Photonics, Univ. of Central Florida, USA.* We present a method for describing optical properties of inhomogeneous media at mesoscopic scales. When the volume of interaction varies, the effective polarizability tensor introduces a new length scale characterizing the structural morphology.

**ITuG5 • 3:45 p.m.**
**Nonlinear Light Propagation in Fractal Waveguide Arrays,** *Shu Jia, Jason W. Fleischer; Princeton Univ., USA.* We study nonlinear beam propagation in a fractal waveguide array, created by optically-inducing nested periodic arrays in a self-defocusing photorefractive crystal. Nonlinear mode coupling and energy transport between the folded bands is demonstrated.

**ITuG6 • 4:00 p.m.**
**The Dirac Point of Photonic Graphene,** *Michiel J. de Dood; Leiden Univ., Netherlands.* Photonic graphene is an optical analogue to electronic graphene. We introduce Dirac maps to design a structure of alumina rods and experimentally demonstrate the existence of an Dirac point at 17 GHz in transmission measurements.

## Rooms 321-323 — JOINT

### JTuE • Slow/Fast Light and its Applications Joint CLEO/IQEC Symposium II—Continued

**JTuE4 • 3:30 p.m.** Invited
**Slow and Stopped Images,** *John Howell; Univ. of Rochester, USA.* We report on the slowing and stopping of transverse images in a hot atomic vapor. The images are shown to be robust to decohering mechanisms. The hot vapor is also shown to preserve quantum fields.

**JTuE5 • 4:00 p.m.**
**Brillouin Cross-Gain Modulation and $10^{-4}c$ Slow-Light,** *Shmuel Sternklar, Eyal Sarid, Tal Arditi, Er'el Granot; Ariel Univ. Ctr. of Samaria, Israel.* We introduce a new method of achieving cross-gain modulation and slow light using the Brillouin nonlinearity in an optical fiber. We demonstrate approx. $10^{-4}c$ group velocity using this technique with milliwatts of optical power.

## Rooms 324-326 — IQEC

### ITuH • Excitons—Continued

**ITuH2 • 3:30 p.m.**
**Quantitative Analysis of Coulomb-Induced Nonlinearities in Semiconductor Quantum Wells,** *Ryan P. Smith[1], Andrew C. Funk[1], Jared K. Wahlstrand[1], Steven Cundiff[1], Martin Schafer[2], Mackillo Kira[2], Stephan W. Koch[2]; [1]JILA, Univ. of Colorado, and NIST, USA, [2]Dept. of Physics and Material Sciences Ctr., Philipps-Univ., Germany.* We report quantitative spectrally-resolved transient absorption in GaAs quantum wells for varying pump intensity. Comparison to microscopic modeling yields quantitative information about the Coulomb-induced nonlinearities and radiative coupling.

**ITuH3 • 3:45 p.m.**
**Berry Phase Effect on Exciton Transport and Bose Einstein Condensate,** *Wang Yao[1], Qian Niu[2]; [1]Univ. of Hong Kong, Hong Kong, [2]Univ. of Texas at Austin, USA.* For excitons in semiconductors, a gauge structure intrinsic to the wavefunction leads to spin-dependent topological transport. When sufficiently large number of excitons have condensed, a non-rotating Bose-Einstein condensate may become unstable against vortex formation.

**ITuH4 • 4:00 p.m.**
**Properties of the Exciton Inner Ring at Ultra-Low Temperatures and High Magnetic Fields,** *Aaron T. Hammack[1], Sen Yang[1], Leonid V. Butov[1], Arthur C. Gossard[2]; [1]Univ. of California at San Diego, USA, [2]Univ. of California at Santa Barbara, USA.* We report on the properties of the exciton inner ring in coupled quantum wells at ultra-low temperatures ($T_{bath}$ = 175 mK) and in high magnetic fields.

## Room 314 — CLEO

### CTuS • Clock Dissemination and Distance/Displacement Metrology—Continued

**CTuS5 • 3:30 p.m.**
**A Simple Optical-Zooming Positioning System Using a Femtosecond Frequency Comb,** *Mariko Kajima, Kaoru Minoshima; AIST, Japan.* A precisely controllable positioning stage based on an optical-zooming interferometer using two diode lasers locked to a fs-comb was developed. The nonlinearity error of positioning was 0.6 nm and control resolution was 20 pm.

**CTuS6 • 3:45 p.m.**
**Direct Comparison of Absolute Distance Meter Using an Optical Comb and Integrated Optical Interferometer with an Optical Sub-Wavelength Accuracy,** *Kaoru Minoshima[1,2], Yasuhiro Sakai[1,3], Hisanari Takahashi[1,2], Hajime Inaba[1], Sakae Kawato[3]; [1]AIST, Japan, [2]Tokyo Univ. of Science, Japan, [3]Univ. of Fukui, Japan.* Distance measurements using the 821st harmonic of the intermode beat frequency in an optical comb with optical-sub-wavelength accuracy are demonstrated. Direct comparison with a laser interferometer for the same optical setup reveals good agreement to 20nm.

**CTuS7 • 4:00 p.m.**
**Semiconductor Laser Tracking Frequency Distance Gauge,** *James D. Phillips[1], Greg M. Huffman[2], Robert D. Reasenberg[1]; [1]Smithsonian Astrophysical Observatory, USA, [2]GMH Engineering, Inc., USA.* Space-based astronomical instruments and gravitational experiments require dramatically improved distance measurement accuracy. The tracking frequency laser distance gauge measures to picometer accuracy. We discuss the design of the semiconductor laser version and its controller.

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**2:30 p.m.–4:30 p.m.** ***PhAST* Market Focus Session: Renewable Energy and Energy Efficiency,** *Exhibit Hall*

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

NOTES

## Room 315 | Room 316 | Room 317

## CLEO

### CTuT • Microwave Photonics—Continued

**CTuT4 • 3:30 p.m.**
**Wireless/Photonics Interfaces Based on Resonant Tunneling Diode Optoelectronic Oscillators,** *Bruno Romeira[1], José Figueiredo[1], Thomas Slight[2], Liquan Wang[2], Edward Wasige[2], Charles Ironside[2]; [1]Ctr. de Electrónica, Optoelectrónica e Telecomunicações, Univ. do Algarve, Portugal, [2]Dept. of Electronics and Electrical Engineering, Univ. of Glasgow, UK.* We employ phase synchronization for converting low power wireless signals to the optical domain and optical injection locking for converting optical sub-carrier signals to the electric domain by using resonant tunneling diode oscillator circuits.

**CTuT5 • 3:45 p.m.**
**Electro-Optic Modulator Using Patch Antenna-Coupled Resonant Electrodes and Polarization-Reversed Structure for Radio-on-Fiber Systems,** *Hiroshi Murata, Noriyoshi Suda, Yasuyuki Okamura; Osaka Univ., Japan.* A newly-developed EO modulator with patch antenna-coupled resonator electrodes for converting wireless microwave signals to optical signals is presented. The directivity control using the polarization reversal technique with improved microwave-lightwave conversion efficiency is experimentally demonstrated.

**CTuT6 • 4:00 p.m.**
**Arbitrary Radio-Frequency Waveform Generation with a Silicon Chip-Based Spectral Shaper,** *Hao Shen, Maroof H. Khan, Yi Xuan, Lin Zhao, Daniel E. Leaird, Andrew M. Weiner, Minghao Qi; Purdue Univ., USA.* We demonstrate ultra-compact spectral shaping via thermo-optically tunable multiple-channel microring resonators on a silicon chip, and combine it with frequency-time mapping to achieve photonic radio-frequency arbitrary waveform generation (RFAWG).

### CTuU • Optofluidics for Biosensing and Analysis CLEO Symposium III: Optical Manipulation—Continued

**CTuU4 • 3:30 p.m.**
**Direct Manipulation of Nanoparticles and DNA in Sub-Wavelength Optical Nanochannels,** *Allen H. J. Yang, Sean D. Moore, Bradley S. Schmidt, Matt Klug, Michal Lipson, David Erickson; Cornell Univ., USA.* Here we demonstrate two novel approaches to on-chip optofluidic transport. We show the trapping of polystyrene microspheres using SU-8 waveguides down to 75nm polystyrene nanoparticles and linear λ-DNA using silicon slotted waveguides.

**CTuU5 • 3:45 p.m.**
**Optofluidic Assembly of Red/Blue/Green Semiconductor Nanowires,** *Steven L. Neale[1], Zhiyong Fan[1], A. T. Ohta[2], Arash Jamshidi[1], Justin K. Valley[1], Hsan Y. Hsu[1], Ali Javey[1], Ming C. Wu[1]; [1]Univ. of California at Berkeley, USA, [2]Dept. of Electrical Engineering, Univ. of Hawai'i at Manoa, USA.* A full-color pixel consisting of CdSe, ZnO, and CdS nanowires has been heterogeneously integrated on a substrate with lithographic accuracy using lateral optoelectronic tweezers (LOET).

**CTuU6 • 4:00 p.m.**
**Bacteria Manipulation with Optically Controlled Fluidic Valves,** *Jae-Woo Choi[1,2], James R. Adleman[1,2], Demetri Psaltis[1,2]; [1]École Polytechnique Fédérale de Lausanne, Switzerland, [2]Caltech, USA.* Optically controlled fluidic valves are utilized to concentrate and detect bacteria, selectively switch the pathway of the bacteria, and demonstrate bidirectional fluidic flow within a microfluidic channel.

### CTuV • Photodetectors and Modulators—Continued

**CTuV4 • 3:30 p.m.**
**GaAs Nanoneedle Photodetector Monolithically Grown on a (111) Si Substrate by MOCVD,** *Linus C. Chuang, Chris Chase, Michael Moewe, Kar Wei Ng, Shanna Crankshaw, Connie Chang-Hasnain; Dept. of Electrical Engineering and Computer Sciences, and Applied Science and Technology Group, Univ. of California at Berkeley, USA.* P-n junction GaAs nanoneedle photodetectors are monolithically grown on a (111) Si substrate by MOCVD with CMOS compatibility. A linear response of the photocurrent to the irradiance can be obtained under room temperature operation.

**CTuV5 • 3:45 p.m.**
**Enhanced Electro-Optic Effects in Suspended Waveguides,** *Todd H. Stievater[1], Doewon Park[1], William S. Rabinovich[1], Subramaniam Kanakaraju[2], Christopher J. K. Richardson[2], Jacob B. Khurgin[3]; [1]NRL, USA, [2]Lab for Physical Sciences, USA, [3]Johns Hopkins Univ., USA.* We demonstrate enhanced electro-optic phase shifts in suspended InGaAs/InGaAsP quantum well waveguides compared to attached waveguides. The enhancement stems from tightened mode confinement between the electrodes, and should improve further with thinner waveguides.

**CTuV6 • 4:00 p.m.**
**Optimally Efficient Resonance-Tuned Optical Modulators,** *Miloš A. Popović; MIT, USA.* Based on a first-principles, physically-intuitive design approach, I propose novel resonance-tuned intensity modulators with optimal modulation efficiency and extinction, even for lossy modulation mechanisms, including higher-order designs cascadable on wavelength-division multiplexed (WDM) signal waveguides.

**2:30 p.m.–4:30 p.m.** ***PhAST* Market Focus Session: Renewable Energy and Energy Efficiency,** *Exhibit Hall*

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

NOTES

## Room 336

### CLEO

### CTuW • Random Lasers and Light Emission—Continued

**CTuW4 • 3:30 p.m.**
**Three-Photon Lasing from ZnSe Excited by a Kilojoule-Class Nd:Glass Laser,** *Yusuke Furukawa, Tomoharu Nakazato, Toshihiro Shimizu, Marilou Cadatal, Elmer Estacio, Nobuhiko Sarukura, Akiyuki Shiroshita, Kazuto Otani, Toshihiko Kadono, Keisuke Shigemori, Hiroshi Azechi; Inst. of Laser Engineering, Osaka Univ., Japan.* Three-photon fluorescence and lasing from ZnSe was observed for a kilojoule-class, 100 picosecond pulse, Nd:glass laser excitation. In this work, the emission properties and its excitation energy dependence were investigated for low and high-energy excitation.

**CTuW5 • 3:45 p.m.**
**Room-Temperature Photoluminescence in Er-Doped Deuterated Amorphous Carbon,** *Raymond Y. C. Tsai, Li Qian, Nazir P. Kherani; Univ. of Toronto, Canada.* We report strong room-temperature photoluminescence at ~1.5µm in erbium-doped deuterated amorphous carbon for the first time. Deuteration, instead of hydrogenation, of amorphous carbon eliminates C-H and O-H bonds, significantly reducing the quenching of erbium emission.

**CTuW6 • 4:00 p.m.**
**Performance Comparison of Bottom and Top Emitting LWIR (8 µm) LED Devices,** *Naresh C. Das, Wayne Chang; ARL, USA.* For similar substrate thickness, flip-chip mount bottom emitting LWIR LED device has higher light intensity than top emitting device. Enhanced emission is attributed to better cooling and light reflection from anode metal of the device.

## Room 337

### IQEC

### ITuI • Quantum-Optical Communication Technologies—Continued

**ITuI4 • 3:30 p.m.**
**Differential-Quadrature-Phase-Shift (DQPS) Quantum Key Distribution,** *Kyo Inoue[1,2,3], Yuuki Iwai[1,3], Tetsuya Kukita[1,3], Toshimori Honjo[2,3]; [1]Osaka Univ., Japan, [2]NTT Basic Res. Labs, Japan, [3]JST-CREST, Japan.* A quantum key distribution (QKD) scheme named differential-quadrature-phase-shift (DQPS) QKD is proposed, that uses a weak coherent pulse train in which each pulse is randomly phase modulated by $\{0, \pi\}\{\pi/2. 3\pi/2\}$.

**ITuI5 • 3:45 p.m.**
**Multi Letter Phase Shift Keying Quantum Key Distribution Using Direct and Reverse Reconciliation,** *Denis Sych, Gerd Leuchs; Univ. of Erlangen-Nuremberg, Germany.* We analyze a CV QKD protocol with multi letter phase shift keying. We show the key rate can be essentially increased by use of multi letter alphabet with reverse reconciliation and optimal postselection.

**ITuI6 • 4:00 p.m.**
**Quantum Optical Temporal Phase Estimation by Homodyne Phase-Locked Loops,** *Mankei Tsang, Jeffrey H. Shapiro, Seth Lloyd; MIT, USA.* Using classical estimation techniques, we design homodyne phase-locked loops for optical temporal phase and instantaneous frequency measurements at the quantum limit.

## Room 338

### ITuJ • Quantum Dots, Quantum Wells, and Cavities—Continued

**ITuJ5 • 3:30 p.m.**
**Polarized Single Photons from Colloidal Quantum Dots in Chiral Microcavities at Room Temperature,** *Luke J. Bissell[1], Svetlana G. Lukishova[1], Roger A. Smith[1], Mayukh Lahiri[2], Carlos R. Stroud, Jr.[1], Robert W. Boyd[1]; [1]Inst. of Optics, Univ. of Rochester, USA, [2]Dept. of Physics and Astronomy, Univ. of Rochester, USA.* We report elliptically-polarized fluorescence from colloidal semiconductor quantum dots in a chiral 1-D photonic bandgap microcavity composed of a planar-aligned cholesteric liquid crystal. Antibunched fluorescence proves a polarized single photon source operating at room temperature.

**ITuJ6 • 3:45 p.m.**
**Nanophotonic Energy up-Conversion Using ZnO Nanorod Double-Quantum-Well Structures,** *Takashi Yatsui[1], Suguru Sangu[2], Kiyoshi Kobayashi[1], Tadashi Kawazoe[1], Motoichi Ohtsu[1], JinKyoung Yoo[3], Jee Hae Chae[3], Gyu-Chul Yi[3]; [1]Univ. of Tokyo, Japan, [2]Ricoh Co., Ltd., Japan, [3]POSTECH, Republic of Korea.* We report nanophotonic energy up-conversion operation in ZnO nanorod double-quantum-well structures assisted by the optical absorption of phonons via an optical near-field.

**ITuJ7 • 4:00 p.m.**
**Band-Gap Tuning with Mechanical Heterostructures,** *Jan D. Makowski[1], Brady D. Anderson[1], Wing S. Chan[1], Mika J. Saarinen[2], Christopher J. Palstrøm[3], Joseph J. Talghader[1]; [1]Univ. of Minnesota, USA, [2]Tampere Univ. of Technology, Finland, [3]Univ. of California at Santa Barbara, USA.* Two surface quantum wells in a collapsed heterostructure couple across an air gap of variable width. Experiments demonstrate a tuning range of 22 nm with the potential for up to 225 nm.

## Room 339

### CLEO

### CTuX • Application Driven Lasers—Continued

**CTuX2 • 3:30 p.m.**
**Injection Seeded High Precision Frequency Stabilization for Q-Switched Solid-State Oscillators in LIDAR-Applications,** *Martin Ostermeyer, Thomas Waltinger, Markus Gregor, Robert Elsner; Univ. of Potsdam, Germany.* A Pound-Drever-Hall technique modified by a sample and hold circuit is presented and applied to an Nd:YAG ring oscillator emitting 8W average power at 400Hz yielding frequency stability of better 285kHz.

**CTuX3 • 3:45 p.m.**
**A High-Power Passively Q-Switched Monolithic Solid-State Laser,** *Xin Gao, Hiroyuki Ohashi, Masayuki Saito, Hiroshi Okamoto, Kazunori Shinoda, Katsumi Shibayama, Yoshihisa Warashina, Koei Yamamoto; Hamamatsu Photonics K.K., Japan.* A passively Q-switched monolithic solid-state laser with a crystal of Nd:YAG+Cr:YAG bonded at room temperature and a fiber-coupled LD stack was developed. 12 mJ output with 50 Hz and 2.3 ns pulse width was achieved.

**CTuX4 • 4:00 p.m.**
**Large Enhancement in $TEM_{00}$ Solar Laser Power by a Light Guide Assembly-Ellyptical Cavity,** *Dawei Liang, Rui P. Pereira; Dept. de Física, FCT, Univ. Nova de Lisboa, Portugal.* Through a fused silica light guide assembly, the concentrated solar radiation is efficiently focused into a small diameter Nd:YAG rod by a sharp elliptical cavity. $TEM_{00}$ laser power is triple that of the 2-D-DCPC cavity.

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**2:30 p.m.–4:30 p.m.** ***PhAST* Market Focus Session: Renewable Energy and Energy Efficiency,** *Exhibit Hall*

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

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**NOTES**

Room 340 | Room 341 | Rooms 328-329

CLEO | PhAST

## CTuY • Novel Materials—Continued

**CTuY5 • 3:30 p.m.**
**GaN-Based Laser Diodes Including a Lattice-Matched $Al_{0.83}In_{0.17}N$ Cladding Layer,** *Eric Feltin, Antonino Castiglia, Gatien Consendey, Jean-François Carlin, Raphael Butté, Nicolas Grandjean; École Polytechnique Fédérale de Lausanne, Inst. of Quantum Electronics and Photonics, Switzerland.* Nitride blue lasers including an AlInN cladding lattice matched to GaN were fabricated. Lasing at 415nm is observed at 300K with a threshold current density of 7.5kA/cm$^2$ and a peak power of 140mW at 1.2A.

**CTuY6 • 3:45 p.m.**
**Novel Multiwavelength Emitter for WDM Transmission Utilizing Broadband Quantum-Dash Laser Diode,** *Chee-Loon Tan[1], Hery S. Djie[2], Boon S. Ooi[1]; [1]Lehigh Univ., USA, [2]JDS Uniphase Corp., USA.* We demonstrate a novel idea of potentially-compact and cost-effective multiwavelength emitter using a single broadband semiconductor quantum-dash laser device coupled with an arrayed waveguide grating structure, that is suitable for wavelength-division-multiplexing transmission.

**CTuY7 • 4:00 p.m.**
**Super-Broadly Wavelength-Tunable Semiconductor Nanowire Lasers on a Single Substrate,** *An Lian Pan[1], Weichang Zhou[1,2], Eunice Leong[1], Rui Bin Liu[1], Alan Chin[1], Bingsuo Zou[2], Cun-Zheng Ning[1]; [1]Arizona State Univ., USA, [2]Hunan Univ., China.* We demonstrate lasing from semiconductor nanowires with wavelength continuously tunable from 500 to 700 nm on single substrate. This widest ever tuning range of any semiconductor lasers is achieved through spatial composition-grading of alloy semiconductors.

## CTuZ • Nonlinear Optics for Imaging and Metrology—Continued

**CTuZ5 • 3:30 p.m.** Invited
**Imaging with Ultrashort Shaped Pulses,** *Yair Andegeko[1], Dmitry Pestov[1], Yves Coello[1], Vadim V. Lozovoy[1], Marcos Dantus[1,2]; [1]Michigan State Univ., USA, [2]BioPhotonic Solutions, Inc., USA.* Ultrashort shaped pulses are becoming available and their use for biomedical imaging will permit signal enhancements, selective excitation, and reduced photobleaching. These pulses are also enabling new imaging modalities which provide greater chemical information.

**CTuZ6 • 4:00 p.m.**
**Phase-Sensitive Three-Wave Mixing for Imaging Resolution Improvement,** *Douglas French, Zun Huang, Igor Jovanovic; Purdue Univ., USA.* Phase-sensitive three-wave mixing operated in the deamplification mode can produce angular phase amplification for multimode beams. A detailed analysis of this scheme indicates that super-Rayleigh imaging resolution is expected.

## PTuB • Applications of Solid-State Lighting—Continued

**PTuB4 • 3:45 p.m.** Invited
**HVPE InGaN for LEDs: State of the Art and Horizons,** *Alexander Syrkin; Technologies and Devices Intl., Inc., Oxford Instruments, USA.* We will discuss results of InGaN material and device growth by HVPE. Application of new device concepts for LEDs arising from new HVPE capabilities will be discussed, including all-HVPE InGaN based LEDs for SSL.

**2:30 p.m.–4:30 p.m.** ***PhAST* Market Focus Session: Renewable Energy and Energy Efficiency,** *Exhibit Hall*

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

NOTES

## Rooms 318-320

### IQEC

**4:45 p.m.–6:30 p.m.**
**ITuK • Ultrafast Plasmonics**
*Nikolay Zheludev; Univ. of Southampton, UK, Presider*

**ITuK1 • 4:45 p.m.** Tutorial
**Recent Theoretical Progress in Nanoplasmonics,** *Mark I. Stockman; Georgia State Univ., USA.* We consider fundamentals and latest theoretical developments in the theoretical nanoplasmonics. Both fundamentals and recent developments such as SPASER and active nanoplasmonics are within the scope. We will also briefly review recent experimental data.

Mark I. Stockman, Ph. D., D. Sc., is a Professor of Physics and Astronomy at Georgia State University in Atlanta, GA. He has presented numerous invited, plenary and keynote talks and lectures at major Conferences in the field of optics and nanoplasmonics. He was the chairman of Metal Nanoplasmonics Conference at 2005-2009 SPIE Meetings at San Diego, and the co-Chair of Nanoplasmonics and Metamaterials Conference at OSA 2008 Frontiers in Optics Meeting. He was the Distinguished Visiting Professor at École Normale Supérieure de Cachan (France) (March, 2006 and July, 2008); Invited Professor at École Supérieur de Physique et de Chimie Industrielle, Paris, France, May-June, 2008; Guest Professor at the University of Stuttgart (September-November, 2008) and Ludwig Maximilian University at Munich, Germany and Max-Plank-Institute for Quantum Optics (Garching at Munich, Germany) (December 2008 – June 2009). His expertise is in theoretical condensed matter and optical physics, nanoplasmonics; theory of ultrafast, coherent, and nonlinear photoprocesses in nanosystems, and strong field nanoplasmonics.

## Rooms 321-323

### JOINT

**4:45 p.m.–6:30 p.m.**
**JTuF • Slow/Fast Light and its Applications Joint CLEO/IQEC Symposium III**
*Alexander Gaeta; Cornell Univ., USA, Presider*

**JTuF1 • 4:45 p.m.** Invited
**Slow Light in Dispersion-Engineered Photonic Crystal Waveguides,** *Thomas Krauss; Univ. of St. Andrews, UK.* Slow light photonic crystal waveguides can be dispersion-engineered with an unprecedented degree of control over the group index, propagation loss and injection efficiency. Ultrasmall optical switches and substantial enhancement of nonlinear effects are demonstrated.

**JTuF2 • 5:15 p.m.**
**Digital Deterministic Control of Slow Light in Photonic Crystal Waveguide Membranes through Atomic Layer Deposition,** *Charlton Chen[1], Chad Husko[1], Inanc Meric[1], Ken Shepard[1], Chee Wei Wong[1], William M. J. Green[2], Yurii A. Vlasov[2], Solomon Assefa[2]; [1]Columbia Univ., USA, [2]IBM T.J. Watson Res. Ctr., USA.* Control of slow-light and higher-order dispersion in air-bridged silicon photonic-crystal waveguides using atomic layer deposition is investigated. Slow light modal coupling is also examined. Results are compared with ab initio numerical simulations.

**JTuF3 • 5:30 p.m.**
**Disorder-Induced Coherent Scattering in Slow-Light Photonic Crystal Waveguides,** *Mark Patterson[1], Stephen Hughes[1], Sylvain Combrié[2], N.-V.-Quynh Tran[2], Alfredo De Rossi[2], Renaud Gabet[3], Yves Jaouën[3]; [1]Dept. of Physics, Queen's Univ., Canada, [2]Thales Res. and Technology, France, [3]Telecom Paris Tech, France.* A new scattering theory for describing disorder-induced multiple scattering events in photonic crystal waveguides is presented with matching experiments on GaAs samples. Our self-consistent 3-D model successfully reproduces the rich experimental features including band-edge resonances.

## Rooms 324-326

### IQEC

**4:45 p.m.–6:30 p.m.**
**ITuL • Spin and Quantum Dots**
*Steven Cundiff; JILA, Univ. of Colorado and NIST, USA, Presider*

**ITuL1 • 4:45 p.m.**
**Monitoring Electron Spin Decoherence in Correlations of Sequential Weak Measurement by Faraday Rotation,** *Ren-Bao Liu[1], Shu-Hong Fung[1], Hok-Kin Fung[1], A. N. Korotkov[2], L. J. Sham[3]; [1]Dept. of Physics, Chinese Univ. of Hong Kong, Hong Kong, [2]Dept. of Electrical Engineering, Univ. of California at Riverside, USA, [3]Dept. of Physics, Univ. of California at San Diego, USA.* We show in theory that the electron spin decoherence, excluding the inhomogeneous broadening effect, can be seen in the third-order correlation function of sequential weak quantum measurement by Faraday rotation.

**ITuL2 • 5:00 p.m.**
**Spin State Transfer and Tomography in a Semiconductor,** *Hideo Kosaka[1,2], Hideki Shigyou[1], Takahiro Inagaki[1], Yoshiaki Rikitake[3,2], Hiroshi Imamura[4,2], Yasuyoshi Mitsumori[1,2], Keiichi Edamatsu[1]; [1]Res. Inst. of Electrical Communication, Tohoku Univ., Japan, [2]CREST-JST, Japan, [3]Dept. of Information Engineering, Sendai Natl. College of Technology, Japan, [4]Nanotechnology Res. Inst., AIST, Japan.* We demonstrate that the coherence of the electron spin state, transferred from the light polarization state, is tomographically measured in a semiconductor quantum well via the light-hole excitons by the developed tomographic Kerr rotation method.

**ITuL3 • 5:15 p.m.**
**Two-Photon Spectroscopy of InAs Quantum Dot Molecules,** *Michael Scheibner, Allan S. Bracker, Danny Kim, Ilya V. Ponomarev, Dan Gammon; NRL, USA.* Optical spectra of InAs quantum dot molecules show clear signatures of 2-photon absorption through sequential and simultaneous transitions. Biexcitons can be spatially direct or indirect, producing 2-photon transitions that are unique to molecules.

**ITuL4 • 5:30 p.m.**
**Evidence of Symmetry Breaking and Carrier Dynamics in Lead Salt Quantum Dots,** *Gero Nootz[1,2], Lazaro A. Padilha[1], Scott Webster[1], David J. Hagan[1,2], Eric W. Van Stryland[1,2], Larissa Levina[3], Vlad Sukhovatkin[3], Edward H. Sargent[3]; [1]CREOL and FPCE, College of Optics and Photonics, Univ. of Central Florida, USA, [2]Dept. of Physics, Univ. of Central Florida, USA, [3]Edward S. Rogers Sr. Dept. of Electrical and Computer Engineering, Univ. of Toronto, Canada.* We report multi-carrier dynamics and two-photon absorption in lead-salt quantum dots. Inter and intra-band relaxation as well as Auger recombination is observed, along with breaking of the one and two-photon transition selection rules.

## Room 314

### CLEO

**4:45 p.m.–6:30 p.m.**
**CTuAA • Novel 2-D and 3-D Microscopy**
*Evgeni Sorokin; Photonics Inst., Technische Univ. Vienna, Austria, Presider*

**CTuAA1 • 4:45 p.m.**
**High-Precision Contouring of Rapidly Oscillating Optical Surfaces with Two-Wavelength Single-Shot Digital Holography,** *Thomas Hansel, Günter Steinmeyer, Klaus Reimann, Ruediger Grunwald, Uwe Griebner; Max-Born-Inst., Germany.* A novel method for contouring of optical surfaces with unprecedented dynamic range is presented. At an object depth >50 µm, surface deformations of a MEMS of some 10 nm are still unambiguously detectable.

**CTuAA2 • 5:00 p.m.**
**New Concepts for Depth Resolved Holographic Imaging Based on Spectrally Tunable Diode Lasers,** *Nektarios Koukourakis[1], Christoph Kasseck[1], Nils C. Gerhardt[1], Martin R. Hofmann[1], Daniel Rytz[2], Sebastian Koeber[3], Michael Salvador[3], Klaus Meerholz[3]; [1]Photonics and Terahertz Technology, Ruhr-Univ. Bochum, Germany, [2]FEE GmbH, Germany, [3]Inst. of Physical Chemistry, Univ. of Cologne, Germany.* We present two new depth resolved holographic imaging concepts with spectrally tunable diode lasers. Variable depth resolution is achieved by changing the tuning width and a concept for single-shot recording of a 3-D-image is introduced.

**CTuAA3 • 5:15 p.m.**
**Serial Time Encoded Amplified Microscopy,** *Keisuke Goda, Kevin K. Tsia, Bahram Jalali; Univ. of California at Los Angeles, USA.* We present an imaging method that maps a 2-D image into a serial time-domain waveform and simultaneously amplifies it optically. Continuous real-time images at a record frame rate of 6.1MHz are captured using an oscilloscope.

**CTuAA4 • 5:30 p.m.**
**Dual Femtosecond Laser Based Multiheterodyne Low Coherence Interferometry,** *Stefan Kray, Felix Spöler, Michael Först, Heinrich Kurz; Inst. of Semiconductor Electronics, RWTH Aachen Univ., Germany.* We present a high-speed, high-resolution, non-mechanical time-domain method for low coherence interferometry, utilizing multiheterodyne detection via two mode-locked femtosecond lasers. Tomographic depth sensing over 150mm with 5.9kHz scanning rates and 8µm depth resolution is demonstrated.

## Room 315

### 4:45 p.m.–6:30 p.m.
### CTuBB • Modulators and Switches
*Olav Solgaard; Stanford Univ., USA, Presider*

**CTuBB1 • 4:45 p.m.**
**2.5 Gbps Electro-Optic Modulator in Deposited Silicon,** *Kyle Preston, Sasikanth Manipatruni, Carl B. Poitras, Michal Lipson; Cornell Univ., USA.* We demonstrate GHz-speed electro-optic modulation using microring resonators in a deposited layer of polycrystalline silicon. Active optical devices in a deposited microelectronic material can enable monolithic large-scale integration of photonic networks on a microelectronic chip.

**CTuBB2 • 5:00 p.m.**
**Silicon-Nitride Surface Passivation of Sub-Micron Silicon Waveguides for Low-Power Optical Switches,** *Joris Van Campenhout[1], William M. J. Green[1], Solomon Assefa[1], Yurii A. Vlasov[1], Xiaoping Liu[2], Richard M. Osgood, Jr.[2]; [1]IBM T.J. Watson Res. Ctr., USA, [2]Columbia Univ., USA.* We achieved a two-orders-of-magnitude improvement of free carrier lifetimes in sub-micron silicon-on-insulator waveguides by applying a stoichiometric $Si_3N_4$ coating. Such surface passivation is critical for low-power operation of carrier-injected optical switches.

**CTuBB3 • 5:15 p.m.**
**Towards Athermal Slotted Silicon Microring Resonators with UV-Trimmable PMMA upper-Cladding,** *Linjie Zhou, Katsunari Okamoto, S. J. Ben Yoo; Univ. of California at Davis, USA.* We demonstrate that PMMA upper cladding on the slotted silicon micoring resonators can reduce the resonance thermal dependence from 91 pm/° to 27 pm/°C. UV trimming can shift the resonance wavelength 0.5 nm.

**CTuBB4 • 5:30 p.m.**
**Designing High-Speed, Low-Chirp, Low-Distortion Microring Modulators,** *Wesley D. Sacher, Joyce K. S. Poon; Univ. of Toronto, Canada.* We show that microring modulators with variable coupling strengths can have low distortion, zero chirp, high extinction ratios, and large modulation rates only limited by the coupler or the free spectral range of the resonator.

## Room 316

### 4:45 p.m.–6:30 p.m.
### CTuCC • Optofluidics and Biosensors
*Holger Schmidt; Univ. of California at Santa Cruz, USA, Presider*

**CTuCC1 • 4:45 p.m.**
**On-Chip Cytometry Using Lensless Digital Holography,** *Sungkyu Seo, Ting-Wei Su, Anthony Erlinger, Derek Tseng, Aydogan Ozcan; Univ. of California at Los Angeles, USA.* We illustrate a high-throughput on-chip cytometry platform that records the holographic diffraction pattern of cells/bacteria without using any lenses. These digital-holograms contain finger-print information of each cell/bacteria enabling unambiguous recognition of different micro-objects using pattern-recognition.

**CTuCC2 • 5:00 p.m.**
**Polymer Photonic Crystal Dye Lasers as Optofluidic Cell Sensors,** *Mads B. Christiansen[1], Joanna M. Lopacinska[1], Mogens H. Jakobsen[1], Niels Asger Mortensen[2], Gabriela Blagoi[1], Martin Dufva[1], Anders Kristensen[1]; [1]DTU Nanotech, Dept. of Micro and Nanotechnology, Technical Univ. of Denmark, Denmark, [2]DTU Fotonik, Dept. of Photonics Engineering, Technical Univ. of Denmark, Denmark.* Hybrid polymer photonic crystal band-edge lasers are chemically activated to covalently bind biomolecules or for HeLa cell attachment using an anthraquinone (AQ) UV activated photolinker. The lasers change emission wavelength linearly with inhomogeneous cell coverage.

**CTuCC3 • 5:15 p.m.**
**Highly Multiplexed Antibody-Antigen Detection Using Nanoscale Optofluidic Resonators,** *Sudeep Mandal, Julie Goddard, David Erickson; Cornell Univ., USA.* We demonstrate a highly multiplexable optofluidic biosensor consisting of arrays of evanescently coupled photonic crystal resonators. We show the ability to monitor binding kinetics of Anti-Streptavidin in real-time and investigate the limit-of-detection of the sensor.

**CTuCC4 • 5:30 p.m.**
**Complementary Silk-Siloxane Hybrid Optofluidics,** *Konstantinos Tsioris, Peter Domachuk, Graham Tilburey, Jason Amsden, David Kaplan, Fiorenzo Omenetto; Tufts Univ., USA.* Optofluidics combines principles from microfluidics and photonics. In such an approach we are proposing a hybrid polymer device fabricated from PDMS and silk fibroin to create a pH sensor.

## Room 317

### 4:45 p.m.–6:30 p.m.
### CTuDD • Photonic Crystal Waveguides
*Chee Wei Wong; Columbia Univ., USA, Presider*

**CTuDD1 • 4:45 p.m.**
**Observation of Polarization Singularities at the Nanoscale,** *Matteo Burresi[1], Rob Engelen[1], Aron Opheij[1], Dries van Oosten[1], L. Kuipers[1], Daisuke Mori[2], Toshihiko Baba[2]; [1]FOM Inst. for Atomic and Molecular Physics, Netherlands, [2]Yokohama Natl. Univ., Japan.* We measure the in-plane electric field above a photonic crystal waveguide with a polarization- and phase-sensitive near-field microscope. We find polarization singularities and study the topology of the surrounding electric field at the nanoscale.

**CTuDD2 • 5:00 p.m.**
**Decimated Cavity Photonic Crystal Membrane Lasers,** *Christopher M. Long, Antonios Giannopoulos, Kent Choquette; Univ. of Illinois, USA.* We report photonic crystal membrane nanolasers which employ a decimated photonic crystal cavity. Optically pumped lasing is achieved in decimated linear and star cavities showing that nonperiodic yet symmetric lattice structures provide sufficient optical confinement.

**CTuDD3 • 5:15 p.m.**
**Optical Wave Transport and Localization in Disordered Photonic Crystal Waveguides,** *Juraj Topolancik[1,2], Frank Vollmer[2], Rob B. Ilic[3], Michael Crescimanno[4]; [1]Northeastern Univ., USA, [2]Rowland Inst. at Harvard, Harvard Univ., USA, [3]Cornell Univ., USA, [4]Youngstown State Univ., USA.* Effects of disorder on linear wave propagation in photonic crystal waveguides are investigated. In-plane translational and vertical symmetry of the crystal are broken by disorder. High-Q cavity excitation mechanism based on polarization mixing is introduced.

**CTuDD4 • 5:30 p.m.**
**High-Q Photonic Crystal Hetero-Slab-Edge Microcavity Laser for Index Sensing,** *Yi-Hua Hsiao, Tsan-Wen Lu, Wei-De Ho, Po-Tsung Lee; Dept. of Photonics and Inst. of Electro-Optical Engineering, Natl. Chiao Tung Univ., Taiwan.* We design a photonic crystal hetero-slab-edge microcavity sustaining surface mode with high quality factor $\sim 5.4\times 10^5$ and index sensitivity of 591 nm/refractive index unit by mode-gap effect. Lasing actions from real devices are also observed.

Room 336

CLEO

### 4:45 p.m.–6:30 p.m.
### CTuEE • Advanced Film Technology
*Takashi Kondo; Univ. of Tokyo, Japan, Presider*

**CTuEE1 • 4:45 p.m.**
**High Quality Synthetic Single Crystal Diamond for Novel Optical Applications,** *Peter Santini[1], Ian Friel[2], Daniel Twitchen[2], Geoffrey Scarsbrook[2]; [1]Harris Intl., USA, [2]Element Six Ltd., UK.* Recent breakthroughs in single crystal diamond synthesis by chemical vapor deposition have lead to reproducible material of exceptionally high quality and of practical size, for a range of novel laser and photonics applications.

**CTuEE2 • 5:00 p.m.**
**Novel Ce:BiIG Epitaxial Thin Films for Magneto-Optical Applications,** *Marcello Ferrera, Manda Chandra Sekhar, Jaeyeol Y. Hwang, Luca Razzari, Catalin Harnagea, Michael Zaezjev, Yoav Linzon, Alain Pignolet, Roberto Morandotti; INRS Énergie, Matériaux et Télécommunications, Canada.* We report on the growth and characterization of novel $Ce_{2.2}Bi_{0.8}Fe_5O_{12}$-(Ce:BiIG) epitaxial thin films fabricated via Pulsed Laser Deposition. Our results suggest the highest Faraday rotation ever obtained in magneto-optical garnet thin films (0.55degrees/µm, @1550 nm).

**CTuEE3 • 5:15 p.m.**
**Low Loss Stoichiometric $TeO_2$ Thin Films and Waveguides,** *Khu T. Vu, Steve J. Madden, Barry Luther-Davies; Australian Natl. Univ., Australia.* Stoichiometric low loss Tellurium dioxide, $TeO_2$, films have been produced and fabricated into low loss waveguides. As-deposited $TeO_2$ films and waveguides with propagation loss around or below 0.1dB/cm at 1550nm have been achieved.

**CTuEE4 • 5:30 p.m.**
**Refractive Index Engineering of a Tunable Channel Waveguide Array by the $He^+$ Implantation in an Electrooptic KLTN Substrate,** *Alexander Gumennik, Galina Perepelitsa, Abraham Israel, Aharon J. Agranat; Hebrew Univ., Israel.* Measurements of an electro-optic tunability of a channel array waveguide, fabricated by ion implantations through a comb-like stopping mask, revealed that the implantation through the active volume of the device didn't diminish its electro-optic properties.

Room 337

IQEC

### 4:45 p.m.–6:30 p.m.
### ITuM • Single Photon Quantum Technologies
*Sergey V. Polyakov; Univ. of Maryland and NIST, USA, Presider*

**ITuM1 • 4:45 p.m.**
**High Efficiency Single Photon Source: The Photonic Wire Geometry,** *Julien Claudon[1], Maela Bazin[1], Nitin S. Malik[1], Joel Bleuse[1], Jean-Michel Gérard[1], Inbal Friedler[2], Philippe Lalanne[2], Jean-Paul Hugonin[2], Niels Gregersen[3], Torben R. Nielsen[3], Jesper Mørk[3]; [1]CEA-CNRS, France, [2]Lab Charles Fabry de l'Inst. d'Optique, CNRS, Univ. Paris-Sud, France, [3]Dept. of Photonics Engineering, DTU Fotonik, Technical Univ. of Denmark, Denmark.* We present a single-photon-source design based on the emission of a quantum dot embedded in a semiconductor (GaAs) nanowire. Its ends are engineered to reach a record-high collection efficiency of 90% with a realistic design.

**ITuM2 • 5:00 p.m.**
**Using Surface Plasmons to Enhance the Speed and Efficiency of Superconducting Nanowire Single-Photon Detectors,** *Xiaolong Hu[1], Eric A. Dauler[1,2], Andrew J. Kerman[2], Joel K. W. Yang[1], James E. White[1], Charles H. Herder[1], Karl K. Berggren[1]; [1]Res. Lab of Electronics, MIT, USA, [2]MIT Lincoln Lab, USA.* We report our design and fabrication of superconducting nanowire single-photon detectors integrated with gold plasmonic nanostructures, which can enhance the absorption of TM-polarized light, and can enlarge the effective area without sacrificing detector speed.

**ITuM3 • 5:15 p.m.**
**Detection Speeds for Single-Photon Detectors Based on Photoconductive Gain,** *Mary Rowe[1], G. Mackay Salley[1], Eric J. Gansen[2], Shelley M. Etzel[1], Sae Woo Nam[1], Richard P. Mirin[1]; [1]NIST, USA, [2]Univ. of Wisconsin-La Crosse, USA.* We investigate the limits on detection speed for single-photon detectors based on photoconductive gain. We outline how to apply this approach to a quantum dot, optically gated, field-effect transistor photodetector.

**ITuM4 • 5:30 p.m.**
**Improved Multiplexed Infrared Detectors for High-Rate Single-Photon Detection,** *Sergey V. Polyakov[1,2], Valentina Schettini[3], Ivo Pietro Degiovanni[3], Fabrizio Piacentini[3], Giorgio Brida[3], Alan Migdall[1,2]; [1]Optical Technology Div., NIST, USA, [2]Joint Quantum Inst., Univ. of Maryland, USA, [3]Inst. Nazionale di Ricerca Metrologica, Italy.* We present an actively-switched multiplexed infrared photon-counting system that increases counting rates at telecom wavelengths via deadtime, afterpulsing, and background-count reduction. We report a factor of 5 count-rate increase with just two multiplexed detectors.

Room 338

### 4:45 p.m.–6:30 p.m.
### ITuN • Nanophotonic Cavities and Devices
*Lev I. Deych; Dept. of Physics, CUNY-Queens College, USA, Presider*

**ITuN1 • 4:45 p.m.**
**Probing High-Q Photonic Crystal Resonances with Fluorescent Molecules,** *Kelley Rivoire[1], Anika Kinkhabwala[1], W.E. Moerner[1], Jelena Vučković[1], Fariba Hatami[2], W. Ted Masselink[2], Yuri Avlasevich[3], Klaus Müllen[3]; [1]Stanford Univ., USA, [2]Humboldt Univ., Germany, [3]Max-Planck-Inst. for Polymer Res., Germany.* Photonic crystal nanocavities with resonances in the visible and near-IR couple easily to nearby fluorescent molecules. Photoluminescence spectra demonstrate that the cavities, fabricated in a gallium phosphide membrane, have quality factors up to 11,000.

**ITuN2 • 5:00 p.m.**
**Exact Theory of Interaction between Whispering Gallery Modes in Microspheres and a Dipole Scatterer,** *Lev I. Deych, Joel Rubin; Dept. of Physics, CUNY-Queens College, USA.* Interaction of whispering gallery modes in a microsphere with a dipole scatterer is described exactly. The theory disproves the traditional understanding of this phenomenon and explains a real origin of doublets in spectra of microspheres.

**ITuN3 • 5:15 p.m.**
**Aperture-Coupled Plasmonic Ring Resonators with Submicron Bending Radii,** *Zhanghua Han[1], Vien Van[1], W. N. Herman[2], Ping-Tong Ho[2]; [1]Dept. of Electrical and Computer Engineering, Univ. of Alberta, Canada, [2]Lab for Physical Sciences and Dept. of Electrical and Computer Engineering, Univ. of Maryland, USA.* We propose and investigate ultracompact aperture-coupled metallic ring resonators with submicron radii based on strongly-confined plasmonic waveguides. Simulations showed 500nm-radius ring resonators can be obtained with low insertion loss and modal volume of only $0.085(\lambda_0/n_{eff})^3$.

**ITuN4 • 5:30 p.m.**
**High-Q Surface-Plasmon Whispering-Gallery Microcavity,** *Bumki Min[1,2], Eric Ostby[1], Volker Sorger[2], Erick Ulin-Avila[2], Lan Yang[1], Xiang Zhang[2], Kerry Vahala[1]; [1]Caltech, USA, [2]Univ. of California at Berkeley, USA.* We demonstrate a high-Q surface-plasmon-polariton (SPP) whispering-gallery microcavity with SPP Q factors up to 1,376 ± 65 in the near infrared. The SPP eigenmodes are accessed evanescently using a tapered optical waveguide.

Room 339

CLEO

### 4:45 p.m.–6:30 p.m.
### CTuFF • Laser Materials and Spectroscopy
*Hajime Nishioka; Inst. for Laser Science, Japan, Presider*

**CTuFF1 • 4:45 p.m.**
**Lasing in Cs at 894 nm Pumped by the Dissociation of CsAr and CsKr Excimers,** *Jason D. Readle[1], Clark J. Wagner[1], Joseph T. Verdeyen[2], David L. Carroll[2], J. Gary Eden[1]; [1]Univ. of Illinois at Urbana-Champaign, USA, [2]CU Aerospace, USA.* We describe the first demonstration of an atomic laser (Cs) pumped by photoexciting CsKr or CsAr excimers which subsequently dissociate. Photopumping atomic gas lasers with broadband diode lasers is now possible.

**CTuFF2 • 5:00 p.m.**
**Influence of Crystal Orientation on Coupling between Orthogonal Modes in a Nd:YAG Laser,** *Sylvain Schwartz[1], Gilles Feugnet[1], Fabien Bretenaker[2], Jean-Paul Pocholle[1]; [1]Thales Res. and Technology, France, [2]Lab Aimé Cotton, CNRS, France.* We report drastic coupling reduction between orthogonal modes of a Nd:YAG laser when the gain crystal is cut along the <100> axis instead of <111>. Our measurements are accurately described by a simple theoretical model.

**CTuFF3 • 5:15 p.m.**
**Laser Action with $Nd^{3+}$ Doped Electro-Optic Lead Lanthanum Zirconate Titanate Ceramics,** *Jingwen W. Zhang[1], Yingyin K. Zou[1], Kewen K. Li[1], Qiushui Chen[1], Hua Jiang[1], Xuesheng Chen[2], Piling Huang[2]; [1]Boston Applied Technologies, Inc., USA, [2]Wheaton College, USA.* Using $Nd^{3+}$ doped lanthanum-modified lead zirconate titanate (PLZT) ceramic gain media which possess excellent electro-optic effects and wide optical transmission window, ceramic lasers of revolutionary nature have been implemented without any extra foreign active components.

**CTuFF4 • 5:30 p.m.**
**Thermo-Optic Coefficients of Monoclinic $KLu(WO_4)_2$,** *Sergei Vatnik[1], Maria Cinta Pujol[2], Joan Josep Carvajal[2], Xavier Mateos[2], Magdalena Aguiló[2], Francesc Díaz[2], Valentin Petrov[3]; [1]Inst. of Laser Physics, RAS, Russian Federation, [2]Departament de Química Física i Inorgànica, Univ. Rovira i Virgili, Spain, [3]Max-Born-Inst. for Nonlinear Optics and Short Pulse Spectroscopy, Germany.* The three thermo-optic coefficients of the biaxial laser host $KLu(WO_4)_2$ are measured at 633 nm by a deflection method and nearly athermal propagation directions are found for polarizations along the $N_m$ and $N_p$ principal axes.

### 4:45 p.m.–6:30 p.m.
### CTuGG • Mid-Infrared Semiconductor Lasers
*Jerry Meyer; NRL, USA, Presider*

**CTuGG1 • 4:45 p.m.** Invited
**GaSb-Based Laser Diodes Operating within Spectral Range of 2 - 3.5 µm,** *Gregory Belenky[1], Leon Shterengas[1], Gela Kipshidze[1], Takashi Hosoda[1], Jianfeng Chen[1], Sergej Suchalkin[1,2]; [1]SUNY Stony Brook, USA, [2]Power Photonic Corp., USA.* We present the performance parameters of GaSb-based diode lasers operating in spectral region from 2 to 3.36µm. CW output power levels of 120mW at 3µm, 60mW at 3.1µm, and 15mW at 3.36µm (285K) are reported.

**CTuGG2 • 5:15 p.m.**
**A Widely Tunable Chirped-Grating Distributed-Feedback Laser for Spectroscopic Applications,** *Liang Xue[1], S. R. J. Brueck[1], Ron Kaspi[2]; [1]Univ. of New Mexico, USA, [2]AFRL, USA.* A 65-nm quasi-continuous tuning range is reported for a 3.5-mm-wide optically pumped type-II chirped-grating distributed-feedback laser at 3.2 µm. Methane absorption spectra demonstrate the utility of this source for atmospheric-pressure molecular spectroscopy.

**CTuGG3 • 5:30 p.m.**
**Fabrication of GaSb-Based DFB Lasers for Gas Sensing,** *Pedro J. Barrios, James A. Gupta, Jean Lapointe, Geof C. Aers, Craig Storey; Natl. Res. Council Canada, Canada.* Regrowth-free gain-coupled GaSb-based DFB lasers suitable for gas sensing were fabricated. Threshold currents for 2.4µm emission of 400µm-long DFB devices were 45mA with a total output power of nearly 11mW in CW operation at 20°C.

### 4:45 p.m.–6:30 p.m.
### CTuHH • Nonlinear Optical Physics
*Vladimir V. Shkunov; Raytheon Corp., USA, Presider*

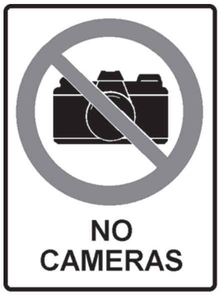
**CTuHH1 • 4:45 p.m.**
**Cavity Solitons in a Vertical Cavity Semiconductor Optical Amplifier: From Single to Cluster States,** *Sylvain Barbay, Tiffany Elsass, Xavier Hachair, Isabelle Sagnes, Robert Kuszelewicz; Lab de Photonique et de Nanotructures, CNRS, France.* We present experimental results on the formation and control of single and cluster states of cavity solitons in a vertical cavity semiconductor optical amplifier. A parameter region where cluster states are inhibited is demonstrated.

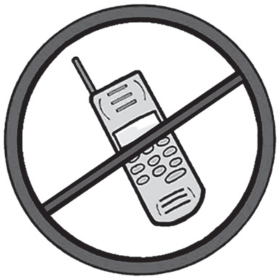
**CTuHH2 • 5:00 p.m.**
**Wave Tunneling and Hysteresis in Nonlinear Junctions,** *Wenjie Wan, Stefan Munzel, Jason W. Fleischer; Princeton Univ., USA.* We consider, theoretically and experimentally, the tunneling of a plane wave through a refractive index barrier in a self-defocusing medium. We demonstrate nonlinear modifications to the transmission rate and observe distinctive, kinetic-energy-dependent hysteresis effects.

**CTuHH3 • 5:15 p.m.** Tutorial
**Discreteness in Optics: Spatial Solitons,** *George Stegeman, Demetrios Christodoulides; Univ. of Central Florida, USA.* Discrete optics opens up new opportunities in manipulating light flow. We provide an overview of recent experimental and theoretical developments in this area. The effects of discreteness on linear and nonlinear optical interactions are discussed.

Demetri Christodoulides is a Provost's Distinguished Research Professor at CREOL-the College of Optics and Photonics of the University of Central Florida. He received his Ph.D. degree from Johns Hopkins University in 1986 and he subsequently joined Bellcore as a post-doctoral fellow. Between 1988 and 2002 he was with the faculty of the Department of Electrical Engineering at Lehigh University. His research interests include nonlinear optical interactions in bulk and synthetic materials like array structures, optical solitons, and spatio-temporal effects. He has authored and co-authored more than 180 papers. He is a Fellow of OSA and APS.

Thank you for attending CLEO/IQEC. Look for your post-conference survey via email and let us know your thoughts on the program.



## Rooms 318-320 — IQEC

### ITuK • Ultrafast Plasmonics—Continued

**ITuK2 • 5:45 p.m.**
**Femtosecond Nonlinear Optics with a Single Nanoantenna,** *Tobias Hanke, Daniel Träutlein, Barbara Wild, Alfred Leitenstorfer, Rudolf Bratschitsch; Univ. of Konstanz, Germany.* Second and third harmonic emission from a single optical antenna is observed when excited with 8-fs laser pulses. Nonlinear emission mapping and direct measurements of the plasmon dephasing time of single nanoantennas are performed.

**ITuK3 • 6:00 p.m.**
**Ultrafast Optical Nonlinearities in Hybrid Metal-J-Aggregate Nanostructures,** *Parinda Vasa[1], Robert Pomraenke[1], Stephan Schwieger[2], Erich Runge[2], Christoph Lienau[1]; [1]Carl von Ossietzky Univ. Oldenburg, Germany, [2]Technische Univ. Ilmenau, Germany.* We study for the first time, the ultrafast optical nonlinearities of hybrid, metal-J-aggregate nanostructures using angle-resolved pump-probe-spectroscopy. Our results demonstrate that the strong coupling between surface plasmon polaritons and excitons drastically alters the polariton dynamics.

**ITuK4 • 6:15 p.m.**
**Ultrafast Switching of Light into Surface Plasmons: An Active Grating Coupler,** *Nir Rotenberg, Markus Betz, Jan N. Caspers, Henry M. van Driel; Dept. of Physics and Inst. for Optical Sciences, Univ. of Toronto, Canada.* Near-infrared pump/visible probe measurements on gold gratings demonstrate picosecond control of grating assisted coupling to surface plasmon polaritons. On-off switching ratios as large as 5.3 dB are possible.

## Rooms 321-323 — JOINT

### JTuF • Slow/Fast Light and its Applications Joint CLEO/IQEC Symposium III—Continued

**JTuF4 • 5:45 p.m.** Invited
**Controlling the Speed of Light in Semiconductor Waveguides: Physics and Applications,** *Jesper Mørk[1], Weiqi Xue[1], Yaohui Chen[1], Søren Blaaberg[1], Salvador Sales[2], José Capmany[2]; [1]Technical Univ. of Denmark, Denmark, [2]Univ. Politécnica de Valencia, Spain.* We review the physics of slow and fast light in semiconductor optical waveguides. Recent experimental and theoretical results on enhancing the phase shift using optical filtering are presented and applications in microwave photonics are discussed.

**JTuF5 • 6:15 p.m.**
**Green Light Emission in Silicon through Slow Light Enhanced Third-Harmonic Generation in Photonic Crystal Waveguides,** *Christelle Monat[1], Bill Corcoran[1], Christian Grillet[1], David J. Moss[1], Benjamin J. Eggleton[1], Thomas P. White[2], Liam O'Faolain[2], Thomas F. Krauss[2]; [1]Inst. of Photonics and Optical Science, CUDOS, Univ. of Sydney, Australia, [2]School of Physics and Astronomy, Univ. of St Andrews, UK.* We report visible (green) third-harmonic generation in silicon by launching near-infrared picosecond pulses into highly confined photonic crystal waveguides. We demonstrate slow light enhancement of this nonlinear process.

## Rooms 324-326 — IQEC

### ITuL • Spin and Quantum Dots—Continued

**ITuL5 • 5:45 p.m.**
**Dynamic Light-Matter Coupling across Multiple Spatial Dimensions in a Quantum Dots-in-a-Well Heterostructure,** *Rohit P. Prasankumar[1], Weng W. Chow[2], Ram S. Attaluri[3], Rajeev V. Shenoi[3], Sanjay Krishna[3], Antoinette J. Taylor[1]; [1]Ctr. for Integrated Nanotechnologies, Los Alamos Natl. Lab, USA, [2]Sandia Natl. Labs, USA, [3]Ctr. for High Technology Materials, Univ. of New Mexico, USA.* Ultrafast density-dependent optical spectroscopic measurements on a quantum dots-in-a-well heterostructure reveal several distinctive phenomena, most notably a strong coupling between the quantum well population and light absorption at the quantum dot excited state.

**ITuL6 • 6:00 p.m.**
**Exciton Dynamics in InAs/GaAs Nanostructures: Evolution from Quantum Dot to Quantum Ring,** *Kien Wen Sun; Dept. of Applied Chemistry, Natl. Chiao Tung Univ., Taiwan.* We present detailed experimental results of the temperature dependence of time-resolved photoluminescence spectroscopy in self-assembled InAs/GaAs nanostructures as the shape of quantum structures evolved from dot to ring.

**ITuL7 • 6:15 p.m.**
**Lossless Negative Dielectric Constant Optical Material from a Semiconductor Quantum Dot Mixture,** *Kevin J. Webb, Alon Ludwig; Purdue Univ., USA.* We show that with sufficient gain, a mixture of two semiconductor quantum dots can produce an isotropic effective dielectric constant that is lossless and negative. This permits small-scale optical mode volume and lossless waveguides.

## Room 314 — CLEO

### CTuAA • Novel 2-D and 3-D Microscopy—Continued

**CTuAA5 • 5:45 p.m.**
**Imaging Interferometric Nanoscopy to the Limit of Available Frequency Space,** *Yuliya V. Kuznetsova, Alexander Neumann, S.R.J. Brueck; Univ. of New Mexico, USA.* Imaging interferometric microscopy resolution to $\lambda/2(nsub+1)$ ($nsub$ = substrate refractive index) is demonstrated using evanescent-wave illumination. Resolution to 150 nm ($\lambda/4.2$) is achieved using a 633 nm source and a 0.4 NA lens.

**CTuAA6 • 6:00 p.m.**
**Nanometer Metrology Using Ultrafast Optoacoustics,** *Thomas J. Grimsley, Fan Yan, Cuong H. Dang, Shan Che, Andrew Antonelli, Humphrey J. Maris, Qiang Zhang, Arto V. Nurmikko; Brown Univ., USA.* We present a method for accessing nanoscale dimensions in semiconductor wafer metrology, using ultrafast optoacoustic ranging. One illustrative example is the measurement of dimensions and profile of nanometer scale deep trenches in silicon-wafer based structures.

**CTuAA7 • 6:15 p.m.**
**3-D Fluorescent Particle Tracking with Nanometer Scale Accuracies Using a Double-Helix Point Spread Function,** *Sri Rama Prasanna Pavani, Rafael Piestun; Univ. of Colorado at Boulder, USA.* We demonstrate parallel three-dimensional (3-D) tracking of multiple fluorescent microspheres with nanometer scale accuracies by engineering the 3-D point spread function of a wide-field microscope to present a double-helix along the optical axis.

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**6:30 p.m.–8:00 p.m. Conference Reception,** *Ballrooms III/IV*

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**NOTES**

Room 315 | Room 316 | Room 317

**CLEO**

## CTuBB • Modulators and Switches—Continued

**CTuBB5 • 5:45 p.m.**
**Optimized Si Microdisk with High Sensitivity for Label-Free Lab-on-a-Chip Sensing Applications,** *Siva Yegnanarayanan, Mohammad Soltani, Qing Li, Ali Adibi; Georgia Tech, USA.* Ultimate miniaturized Si microdisk resonators are demonstrated with high Q (Q>100,000) and radius of 1.5 micron. Bulk index sensitivity of 27 nm/RIU is experimentally demonstrated and a mass sensitivity of ~ 16 attograms is predicted.

**CTuBB6 • 6:00 p.m.**
**Variable Ratio Power Splitters Using Computer-Generated Planar Holograms on 2×2 Multimode Interference Couplers,** *Shuo-Yen Tseng[1], Seung-keun Choi[2], Bernard Kippelen[2]; [1]Natl. Cheng Kung Univ., Taiwan, [2]Georgia Tech, USA.* Variable ratio power splitters using computer-generated planar holograms on 2×2 multimode interference (MMI) couplers are fabricated on the silicon-on-insulator platform. We demonstrate different splitting ratios by changing the hologram etch depth and the hologram length.

**CTuBB7 • 6:15 p.m.**
**All-Optical Characterization of Large-Signal Modulation Bandwidth of a Monolithically Integrated DFB-EA,** *Søren Blaaberg[1], H.C. Hansen Mulvad[1], Leif Oxenløwe[1], Marek Chacinski[2], Urban Westergren[2], Björn Stoltz[3]; [1]Technical Univ. of Denmark, Denmark, [2]Kista Photonic Res. Ctr., Royal Insitute of Technology, Sweden, [3]Syntune AB, Sweden.* We use an all-optical method to characterize the modulation bandwidth of a DFB-EA designed for 100 Gb/s Ethernet. In a large-signal wavelength conversion set-up, we show the device has an all-optical bandwidth of 83 GHz.

## CTuCC • Optofluidics and Biosensors—Continued

**CTuCC5 • 5:45 p.m.**
**High Sensitivity Local Evanescent Array Coupled Biosensors with Nanometer BSA Film,** *Rongjin Yan, Santano P. Mestas, Guangwei Yuan, Kevin L. Lear; Colorado State Univ., USA.* A LEAC biosensor on a CMOS chip with integrated buried detector array demonstrated 50% photocurrent modulation in response to a patterned nanoscale 2.5 nm thick bovine serum albumin (BSA) film.

**CTuCC6 • 6:00 p.m.**
**Real-Time, Label-Free Protein Binding Detection with a One Dimensional Photonic Crystal Sensor,** *Yunbo Guo[1,2], Thommey P. Thomas[2], Jing Y. Ye[1,2], Andrzej Myc[2], James R. Baker Jr.[2], Theodore B. Norris[1,2]; [1]Ctr. for Ultrafast Optical Science, Univ. of Michigan, USA, [2]Michigan Nanotechnology Inst. for Medicine and Biological Sciences, Univ. of Michigan, USA.* A one-dimensional photonic crystal structure in a total-internal-reflection geometry has been developed for real-time, label-free specific protein binding detection. With the streptavidin-biotin system, an ultra low mass density detection limit 24 fg/mm$^2$ was achieved.

**CTuCC7 • 6:15 p.m.**
**Integration of 780 and 850 nm Vertical-Cavity Surface-Emitting Lasers into a Micro-Fluidic Microsystem,** *Ansas M. Kasten, Joshua D. Tice, Varun B. Verma, Paul J. A. Kenis, Kent D. Choquette; Univ. of Illinois, USA.* We demonstrate compact integration of 780 and 850 nm vertical-cavity surface-emitting lasers into a micro-fluidic microsystem. Absorption at 850 nm and fluorescence pumping at 780 nm of near-infrared fluorescent molecules are presented.

## CTuDD • Photonic Crystal Waveguides—Continued

**CTuDD5 • 5:45 p.m.**
**An Expanded *k*-Space Evanescent Coupling Technique for Characterizing Photonic Crystal Waveguides,** *Michael W. Lee[1], Christian Grillet[1], Christopher G. Poulton[2], Christelle Monat[1], Cameron L. C. Smith[1], Eric Mägi[1], Darren Freeman[3], Steve Madden[3], Barry Luther-Davies[3], Benjamin J. Eggleton[1]; [1]CUDOS, School of Physics, Univ. of Sydney, Australia, [2]CUDOS, and Dept. of Mathematical Sciences, Univ. of Technology, Sydney, Australia, [3]CUDOS, Laser Physics Ctr., Australian Natl. Univ., Australia.* We demonstrate an expanded *k*-space evanescent coupling technique for characterizing the dispersion and loss of photonic crystal waveguides (PCWG) by measuring the Fabry-Pérot spectrum of a closed waveguide using a highly curved taper.

**CTuDD6 • 6:00 p.m.**
**Optical Resonances Created by Photonic Transitions,** *Zongfu Yu, Shanhui Fan; Stanford Univ., USA.* A high-Q optical resonance can be created dynamically, by inducing photonic transition between a localized state and a one-dimensional continuum through refractive index modulation. This mechanism allows for complete control of an optical micro-resonance.

**CTuDD7 • 6:15 p.m.**
**Silicon Photonic Crystal Fiber,** *Fatih Yaman, Hyungseok Pang, Xiaobo Xie, Patrick LiKamWa, Guifang Li; CREOL and FPCE, College of Optics and Photonics, Univ. of Central Florida, USA.* A hollow-core photonic crystal fiber (PCF) made of silicon is reported for the first time. The fiber is obtained by converting silica fiber to porous silicon using magnesiothermic reduction.

**6:30 p.m.–8:00 p.m. Conference Reception,** *Ballrooms III/IV*

NOTES

Room 336

**CLEO**

## CTuEE • Advanced Film Technology—Continued

**CTuEE5 • 5:45 p.m.**
**The Role of Native and Transient Laser-Induced Defects in the Femtosecond Breakdown of Dielectric Films,** *Luke A. Emmert[1], Duy Nguyen[1], Mark Mero[1], Wolfgang Rudolph[1], Dinesh Patel[2], Eric Krous[2], Carmen S. Menoni[2]; [1]Univ. of New Mexico, USA, [2]Colorado State Univ., USA.* Experiments and modeling reveal that the dielectric breakdown of hafnia films is controlled by laser induced and native defects under multiple femtosecond pulse exposure. Transient processes occur on a 100 ps and 10 ms timescale.

**CTuEE6 • 6:00 p.m.**
**Determination of Reabsorption-Free Emission Cross Sections of Ionic Transitions by the Pinhole Method,** *Henning Kühn, Klaus Petermann, Günter Huber; Inst. für Laser-Physik, Univ. of Hamburg, Germany.* The determination of emission cross sections requires an emission spectrum and the radiative lifetime. In highly ion-doped materials reabsorption can significantly affect these parameters. The pinhole method is a measurement technique providing reabsorption-free spectroscopic parameters.

**CTuEE7 • 6:15 p.m.**
**Characteristics of Carbon Nanotube Saturable Absorbers for Solid-State Laser Mode-Locking near 1.25 µm,** *Won Bae Cho[1], Sun Young Choi[1], Jong Hyuk Yim[1], Soonil Lee[1], Dong-Il Yeom[1], Fabian Rotermund[1], Günter Steinmeyer[2], Valentin Petrov[2], Uwe Griebner[2]; [1]Ajou Univ., Republic of Korea, [2]Max-Born-Inst. for Nonlinear Optics and Short-Pulse Spectroscopy, Germany.* Different types of carbon nanotube saturable absorbers were fabricated and characterized. Their application for solid-state laser mode-locking enabled the generation of sub-100-fs pulses near 1.25 µm with powers up to 280 mW at 79 MHz.

Room 337 / Room 338

**IQEC**

## ITuM • Single Photon Quantum Technologies—Continued

**ITuM5 • 5:45 p.m.** Invited
**Third- and Fourth-Order Coherences Measured with a Multi-Element Superconducting Nanowire Single-Photon Detector,** *Martin J. Stevens[1], Burm Baek[1], Eric A. Dauler[2,3], Andrew J. Kerman[3], Richard J. Molnar[3], Scott A. Hamilton[3], Karl K. Berggren[2], Richard P. Mirin[1], Sae Woo Nam[1]; [1]NIST, USA, [2]MIT, USA, [3]MIT Lincoln Lab, USA.* We demonstrate a technique for measuring third- and fourth-order coherences using a multi-element detector consisting of four independent, interleaved superconducting nanowire single-photon detectors, and observe strong bunching from a chaotic light source.

**ITuM6 • 6:15 p.m.**
**A 52 Megabits/s, Post-Processing Free, Quantum Random Number Generator,** *James F. Dynes, Zhiliang L. Yuan, Andrew W. Sharpe, Andrew J. Shields; Toshiba Res. Europe Ltd., Cambridge Res. Lab, UK.* A quantum random number generator (QRNG) based on photon arrival at a gigahertz clocked avalanche photodiode is demonstrated. The random bit rate of 52Mbps is the highest bit rate achieved so far for a QRNG.

## ITuN • Nanophotonic Cavities and Devices—Continued

**ITuN5 • 5:45 p.m.**
**Plasmonic Nano-Cavity with High *Q*-Factors,** *Volker J. Sorger[1,2], Rupert F. Oulton[1,2], Jie Yao[1,2], Guy Bartal[1,2], Xiang Zhang[1,2,3]; [1]Univ. of California at Berkeley, USA, [2]NSF Nano-Scale Science and Engineering Ctr., USA, [3]Materials Sciences Div., Lawrence Berkeley Natl. Lab, USA.* We report plasmonic Fabry-Perot nano-cavities formed by high aspect ratio metal mirrors on a metal surface. Quality factors from 100-200 were obtained, limited by plasmonic losses and fin scattering at short and long wavelengths respectively.

**ITuN6 • 6:00 p.m.**
**Plasmonic Coupling of Ag Nanoparticle Arrays with Sub-10 nm Gaps: Near-Field Origins,** *Bang-Yan Lin[1], Hei-Chen Hsu[2], Chun-Hao Teng[3], Hung-Chun Chang[1], Yuh-Lin Wang[2,4], Juen-Kai Wang[5,2]; [1]Graduate Inst. of Communication Engineering, Natl. Taiwan Univ., Taiwan, [2]Inst. of Atomic and Molecular Sciences, Academia Sinica, Taiwan, [3]Dept. of Mathematics, Natl. Cheng Kung Univ., Taiwan, [4]Dept. of Physics, Natl. Taiwan Univ., Taiwan, [5]Ctr. for Condensed Matter Sciences, Natl. Taiwan Univ., Taiwan.* Investigating with pseudo-spectral time-domain method, we show that resonant scattering characteristics of Ag nanoparticle arrays are attributed to near-field surface magnetic field, instead of enhanced electric field induced by plasmonic coupling.

**ITuN7 • 6:15 p.m.**
**Femtosecond Pulse Shaping by Ag Nanoparticle Arrays: Plasmon-Enhanced Absorption Saturation,** *Tian-You Cheng[1], Kun-Tung Tsai[1], Jiun-Haw Lee[1], Jr-Hau He[1], Yuh-Lin Wang[2,3], Juen-Kai Wang[4,2]; [1]Graduate Inst. of Photonics and Optoelectronics, Natl. Taiwan Univ., Taiwan, [2]Inst. of Atomic and Molecular Sciences, Academia Sinica, Taiwan, [3]Dept. of Physics, Natl. Taiwan Univ., Taiwan, [4]Ctr. for Condensed Matter Sciences, Natl. Taiwan Univ., Taiwan.* We have examined a femtosecond pulse shaping phenomenon induced by self-organized Ag nanoparticle arrays. Significant pulse shortening was observed as plasmon resonance occurs between the array and femtosecond pulses.

Room 339

**CLEO**

## CTuFF • Laser Materials and Spectroscopy—Continued

**CTuFF5 • 5:45 p.m.**
**Spectroscopic Characteristics of $Nd^{3+}$-Doped Photo-Thermo-Refractive Glass,** *Yoichi Sato[1], Takunori Taira[1], Vadim Smirnov[2], Larissa Glebova[2], Leonid Glebov[3]; [1]Laser Res. Ctr. for Molecular Science, Inst. for Molecular Science, Japan, [2]OptiGrate Inc., USA, [3]School of Optics, CREOL, Univ. of Central Florida, USA.* The spectroscopic properties of $Nd^{3+}$-doped photo-thermo-refractive glass (Nd:PTR) were evaluated for the first time. Authors assures that Nd:PTR is the promised laser medium due to optical qualities and designability of Nd:PTR.

**CTuFF6 • 6:00 p.m.**
**Influence of Minute Self-Absorption of Volume Bragg Grating Working as Laser Mirrors,** *Tanant Waritanant[1], Te-yuan Chung[2]; [1]Intl. School of Engineering, Chulalongkorn Univ., Thailand, [2]Dept. of Optics and Photonics, Natl. Central Univ., Taiwan.* A series of simulations and experiments were performed and confirmed minute self-absorption of volume Bragg grating (VBG) will influence the VBG reflection spectrum as it works as a laser mirror even for low power laser.

**CTuFF7 • 6:15 p.m.**
**Laser Performance at Room-Temperature of Diode-Pumped $Yb^{3+}$:YLF and $Yb^{3+}$:$CaF_2$ Crystals,** *Angela Pirri[1], D. Alderighi[1], G. Toci[1], Matteo Vannini[1], M. Tonelli[2], Martin Nikl[3]; [1]Inst. di Fisica Applicata, Italy, [2]Univ. di Pisa, Italy, [3]Inst. of Physics, Acad. of Sciences of the Czech Republic, Czech Republic.* We report the laser performance of diode-pumped $Yb^{3+}$:YLF and $Yb^{3+}$:$CaF_2$ crystals operating in Continuous Wave (CW) and quasi-CW lasing at room temperature with high efficiency power. Furthermore we probed thermal effects on the materials.

**6:30 p.m.–8:00 p.m. Conference Reception,** *Ballrooms III/IV*

NOTES

| Room 340 | Room 341 |
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**CLEO**

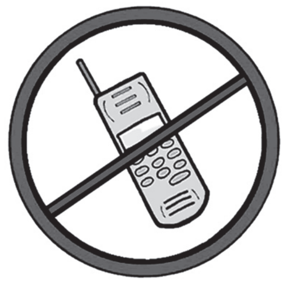
## CTuGG • Mid-Infrared Semiconductor Lasers—Continued

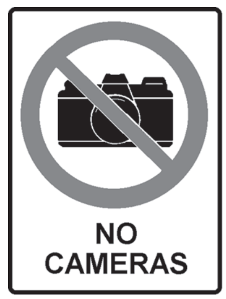
**CTuGG4 • 5:45 p.m.**
**Room Temperature, Continuous Wave Operation of an Sb-Based Laser Grown on GaAs Substrate,** *Laurent Cerutti, Jean Baptiste Rodriguez, Pierre Grech, Eric Tournié; Univ. Montpellier 2, France.* We demonstrate an Sb-based type-I laser grown on GaAs emitting at 2.2 µm in continuous wave up to 50°C.

**CTuGG5 • 6:00 p.m.**
**Ultra-Low-Threshold GaSb-Based Laser Diodes at 2.65 µm,** *Kaveh Kashani-Shirazi, Alexander Bachmann, Shamsul Arafin, Kristijonas Vizbaras, Markus-Christian Amann; Walter Schottky Inst., Technische Univ. München, Germany.* We present the design and results of a continuous wave room temperature operating GaSb-based edge emitter at 2.65 µm with threshold current densities as low as 50 A/cm² ($L \to \infty$).

**CTuGG6 • 6:15 p.m.**
**$InAs_yP_{1-y}$ Metamorphic Buffer Layers (MBLs) on InP Substrates for Mid-IR Diode Lasers,** *Jeremy Kirch[1], Toby Garrod[1], Sangho Kim[1], Joo Park[1], Jae Shin[1], Luke Mawst[1], Thomas Kuech[1], Xueyan Song[2], Susan Babcock[1], Igor Vurgaftman[3], Jerry Meyer[3]; [1]Univ. of Wisconsin-Madison, USA, [2]West Virginia Univ., USA, [3]NRL, USA.* InAs QWs grown with $InAs_yP_{1-y}$ metamorphic buffer layers on InP substrates demonstrate mid-IR emission. A novel Al-free InAsP/InGaAs SCH design provides improved carrier confinement, allowing InAs QW laser emission near λ~2.5µm @77K.

## CTuHH • Nonlinear Optical Physics—Continued






**CTuHH4 • 6:15 p.m.**
**Rayleigh-Taylor Instability in Nonlinear Optics,** *Shu Jia, Jason W. Fleischer; Princeton Univ., USA.* We demonstrate, theoretically and experimentally, an all-optical Rayleigh-Taylor instability. Observations of the characteristic spatial period as a function of intensity difference, nonlinearity, and refractive index gradient show excellent agreement with analytical calculations from perturbation theory.

NOTES

**6:30 p.m.–8:00 p.m. Conference Reception,** *Ballrooms III/IV*

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