QELS

8:00 a.m.–9:30 a.m.
QFA • Light Emission in Photonic Crystals
Presider to Be Announced

QFA1 • 8:00 a.m. Invited
InAs/InP Quantum Dot Photonic Crystal Microcavities—A Scalable Route to Single and Entangled Pair Sources, *Robin L. Williams[1,2], S. Frédérick[1,2], M. E. Reimer[1,2], P. Poole[1], G. Aers[1], D. Dalacu[1], M. Korkusinski[1], J. Lefebvre[1], J. Lapointe[1], W. R. McKinnon[1], P. Hawrylak[1,2]; [1]Inst. for Microstructural Sciences, Natl. Res. Council, Canada, [2]Dept. of Physics, Univ. of Ottawa, Canada.* We propose a scalable route to single and entangled photon pair sources at telecoms wavelengths based on single InAs/InP quantum dots embedded within photonic crystal microcavities. The electrostatic gating of such dots is discussed.

QFA2 • 8:30 a.m.
Photon Gun Using a Finite-Size Photonic Crystal Waveguide, *Stephen Hughes, V. C. S. Manga Rao; Queen's Univ., Canada.* Modified spontaneous emission from a single-quantum-dot embedded in a small finite-size, photonic-crystal slab waveguide are investigated. We subsequently demonstrate very large Purcell factors that can be exploited to emit efficient single photons "on-chip."

8:00 a.m.–9:45 a.m.
QFB • Quantum Imaging and Interference
Jonathan Dowling; Louisiana State Univ., USA, Presider

QFB1 • 8:00 a.m.
Nondegenerate-Wavelength Ghost Imaging, *Kam Wai Clifford Chan, Malcolm N. O'Sullivan, Oscar D. Herrera, Robert W. Boyd; Inst. of Optics, Univ. of Rochester, USA.* We study nondegenerate-wavelength thermal ghost imaging and found that the spatial resolution of the ghost image depends strongly on the wavelength of the light illuminating the object but not on that in the reference arm.

QFB2 • 8:15 a.m.
Gaussian-State Analysis of Biphoton Imaging, *Baris I. Erkmen, Jeffrey H. Shapiro; MIT, USA.* Previous work on biphoton imaging configurations is recast in the more inclusive framework of Gaussian-state quantum fields. This formulation shows that biphoton image formation is classical, but not its image-to-background ratio.

QFB3 • 8:30 a.m.
Entangled Images from 4-Wave Mixing in Rubidium Vapor, *Alberto M. Marino, Vincent Boyer, Raphael C. Pooser, Paul D. Lett; NIST, USA.* We show that non-degenerate 4-wave mixing in an atomic vapor can produce highly multimode twin beams. The process can be used to generate arbitrarily-shaped continuous-variable entangled twin beams that contain quantum-correlations in time and space.

CLEO

8:00 a.m.–9:45 a.m.
CFA • Ultrafast Modulation and Synthesis
Jeff Nicholson; OFS Labs, USA, Presider

CFA1 • 8:00 a.m.
Ultra High Extinction-Ratio and Ultra Low Chirp Optical Intensity Modulation for Pure Two-Tone Lightwave Signal Generation, *Tetsuya Kawanishi[1], Takahide Sakamoto[1], Akito Chiba[1], Masahiro Tsuchiya[1], Hiroyuki Toda[2]; [1]Natl. Inst. of Information and Communications Technology, Japan, [2]Doshisha Univ., Japan.* Pure two-tone signal generation with spurious suppression ratio of 47 dB was demonstrated by using an optical Mach-Zehnder modulator with precisely balanced operation, where extinction ratio and chirp parameter were respectively 64 dB and 0.0099.

CFA2 • 8:15 a.m.
An Interferometric Method for Dynamic Extinction Ratio Measurement, *Ibrahim T. Ozdur, Sarper Ozharar, Dimitrios Mandridis, Peter J. Delfyett; CREOL and Florida Photonics Ctr. of Excellence, College of Optics and Photonics, Univ. of Central Florida, USA.* We introduce a novel interferometric method for dynamic extinction ratio measurement of temporally demultiplexed pulses by using a high extinction modulator. The resulting extinction ratio is 44dB. Our method has a dynamic range of ~60dB.

CFA3 • 8:30 a.m.
Flexible Millimeter-Wave Comb Synthesis Using a Novel Time-Multiplexed Optical Pulse Shaping Scheme, *Chen-Bin Huang, Daniel E. Leaird, Andrew M. Weiner; Purdue Univ., USA.* Millimeter-wave combs are synthesized using a novel time-multiplexed optical pulse shaping scheme by integrating fast wavelength switching, optical frequency comb generation, and spectral line-by-line pulse shaping.

JOINT

8:00 a.m.–9:45 a.m.
JFA • Joint CLEO/QELS Symposium on Hollow-Core Photonic-Crystal Fibers I
Michael Raymer; Univ. of Oregon, USA, Presider

JFA1 • 8:00 a.m. Invited
Frequency and Wavelength Standards Based on Gas Filled HC-PBFs, *Jan C. Petersen, Jan Hald; Danish Fundamental Metrology Ltd., Denmark.* We demonstrate the observation of saturated absorption in several molecules in HC-PBFs. Characteristics of these molecular reference lines are discussed and the locking of fiber lasers to the molecular absorption lines is demonstrated.

JFA2 • 8:30 a.m.
Optical Heterodyne Saturation Spectroscopy in Ammonia Filled Hollow-Core Photonic Bandgap Fibers, *Ana M. Cubillas[1,2], Jan Hald[1], Jan C. Petersen[1]; [1]Danish Fundamental Metrology Ltd., Denmark, [2]Photonics Engineering Group, Univ. of Cantabria, Spain.* We have applied the frequency-modulation (FM) technique in the 1.5 μm wavelength region to observe saturated absorption in ammonia in hollow-core photonic bandgap fibers (HC-PBFs). Previously blended lines have been resolved.

QELS

8:00 a.m.–9:45 a.m.
QFC • Polaritons in Confined Structures
Leonid Butov; Univ. of California at San Diego, USA, Presider

QFC1 • 8:00 a.m.
Polarization- and Spin-Dependent Ultrafast Optical Nonlinearities of Bragg-Spaced Quantum Wells, *Wesley J. Johnston[1], John P. Prineas[1], Arthur L. Smirl[1], Dan T. Nguyen[2], Nai H. Kwong[2], Rolf Binder[2], Galina Khitrova[2], Hyatt M. Gibbs[2]; [1]Lab for Photonics and Quantum Electronics and Dept. of Physics, Univ. of Iowa, USA, [2]College of Optical Sciences, Univ. of Arizona, USA.* Spin- and polarization-dependent ultrafast blue shifts, transient gain and self-wave-mixing are observed in Bragg-spaced InGaAs/GaAs quantum wells. The data are in agreement with a microscopic theory.

QFC2 • 8:15 a.m.
Electrically Injected Cavity Polaritons, *Angela Vasanelli[1], Yanko Todorov[1,2], Raffaele Colombelli[3], Cristiano Ciuti[1], Christophe Manquest[1], Luca Sapienza[1], Ulf Gennser[2], Carlo Sirtori[1]; [1]Matériaux et Phénomènes Quantiques, Univ. Paris Diderot, France, [2]Lab Photonique et Nanostructures, France, [3]Inst. d'Electronique Fondamentale, Univ. Paris Sud, France.* We have realised an electroluminescent device in which electrons are injected into intersubband polariton branches. We reproduce electroluminescence spectra by using a phenomenological model, in which a voltage dependent injection is taken into account.

QFC3 • 8:30 a.m. Invited
Coherent Zero-State and π-State in an Array of Exciton-Polariton Condensates, *C. W. Lai[1,2], N. Y. Kim[1], S. Utsunomiya[2,3], G. Roumpos[1], Yoshihisa Yamamoto[1,2,3]; [1]E. L. Ginzton Lab, Stanford Univ., USA, [2]Natl. Inst. of Informatics, Japan, [3]NTT Basic Res. Labs, Japan.* We report spontaneous buildup of inphase ("zero-state") and antiphase ("p-state") states in an exciton-polariton condensate array connected by weak periodic potential barriers. These states reflect band-structure and dynamic characteristics of exciton-polariton condensates in an array.

JOINT

8:00 a.m.–9:45 a.m.
JFB • Laser Acceleration
Michael Downer; Univ. of Texas at Austin, USA, Presider

JFB1 • 8:00 a.m.
Synchrotron Radiation from Laser-Accelerated Monoenergetic Electron Beams, *Hans-Peter Schlenvoigt[1], Kerstin Haupt[1,2], Alexander Debus[1,3], Fabian Budde[1,4], Oliver Jäckel[1], Sebastian Pfotenhauer[1], Jordan G. Gallacher[5], Enrico Brunetti[5], Dino Jaroszynski[5], Erich Rohwer[2], Heinrich Schwoerer[1,2]; [1]Inst. für Optik und Quantenelektronik, Germany, [2]Laser Res. Inst., Univ. of Stellenbosch, South Africa, [3]Forschungszentrum Dresden-Rossendorf, Germany, [4]Inst. für Laser- und Plasmaphysik, Germany, [5]Dept. of Physics, Univ. of Strathclyde, UK.* We present the production of incoherent synchrotron radiation from laser-accelerated electrons propagating through an undulator. Simultaneously recorded electron and photon spectra fit well to undulator theory. Future prospects are ultrashort laser-based synchrotron light sources.

JFB2 • 8:15 a.m.
Scalings for Narrow-Band MeV Proton Beams from Laser Plasmas, *Sebastian M. Pfotenhauer[1], Oliver Jäckel[1], Jens Polz[1], Hans-Peter Schlenvoigt[1], Malte C. Kaluza[1], Heinrich Schwoerer[2], Alex P. L. Robinson[3], Paul Gibbon[4], Roland Sauerbrey[5], Ken W. D. Ledingham[6]; [1]Inst. für Optik und Quantenelektronik, Friedrich-Schiller-Univ. Jena, Germany, [2]Laser Res. Inst., Univ. of Stellenbosch, South Africa, [3]Central Laser Facility, Rutherford Appleton Lab, UK, [4]John von Neumann Inst. for Computing, Forschungszentrum Jülich, Germany, [5]Forschungszentrum Dresden-Rossendorf, Germany, [6]Dept. of Physics, Univ. of Strathclyde, UK.* Monoenergetic proton beams were obtained from laser-plasma interactions with unprecedented reproducibility. From hundreds of spectra, we derive an empirical scaling law between proton peak position and laser energy. The results are supported PIC simulations.

JFB3 • 8:30 a.m.
High Resolution Spectral Characterization of Betatron X-Ray Radiation, *Félicie Albert, Kim Ta Phuoc, Rahul Shah, Romuald Fitour, Frédéric Burgy, Amar Tafzi, Denis Douillet, Thierry Lefrou, Antoine Rousse; Lab d'Optique Appliquée, Ecole Natl. Supérieure de Techniques Avancées, Ecole Polytechnique, France.* We present the first detailed spectral measurement of 1-3 keV Betatron X-ray radiation with two high resolution crystal spectrometers. Electron trajectories in the laser produced plasma can be determined with this measurement.

CLEO

8:00 a.m.–9:45 a.m.
CFB • Short Pulse and Pulse-Shaped Lasers
Jean-Christophe F. Chanteloup; CNRS - Ecole Polytechnique, France, Presider

CFB1 • 8:00 a.m.
Pulse Energies Exceeding 13 Microjoules from a Passively Mode-Locked Yb:YAG Thin-Disk Oscillator by Use of a Self-Imaging Active Multipass Geometry, *Joerg Neuhaus[1,2], Jochen Kleinbauer[2], Alexander Killi[2], Sascha Weiler[2], Dirk H. Sutter[2], Thomas Dekorsy[1]; [1]Dept. of Physics, Univ. of Konstanz, Germany, [2]TRUMPF-Laser GmbH + Co. KG, Germany.* We demonstrate high energy picosecond pulses obtained directly from a thin-disk laser oscillator operating in ambient atmosphere. The average output power was up to 55 W at a repetition rate of 3.8 MHz.

CFB2 • 8:15 a.m.
Passively Mode-Locked and Cavity-Dumped Yb:KY$(WO_4)_2$ Oscillator with Positive Dispersion, *Guido Palmer[1], Moritz Emons[1], Martin Siegel[1], Andy Steinmann[1], Matthias Pospiech[1], Uwe Morgner[1,2]; [1]Inst. für Quantum Optics, Leibniz Univ. Hannover, Germany, [2]Laserzentrum Hannover, Germany.* We demonstrate a passively mode-locked Yb:KYW oscillator operated in the positive dispersion regime generating pulse energies exceeding 2 μJ at 1 MHz repetition rate. The chirped pulses are externally compressed down to 400 fs.

CFB3 • 8:30 a.m.
Multimillijoule Picosecond Regenerative Differentiator-Amplifier, *Andrey V. Okishev; Univ. of Rochester, USA.* 150-ps-FWHM, 12-mJ pulses have been generated in a diode-pumped regenerative amplifier (DPRA) after differentiating a 3-ns-FWHM, SBS-steepened seeding pulse using a tunable Bragg grating filter as the DPRA resonator spectrally selective mirror.

8:00 a.m.–9:45 a.m.
CFC • Comb and Continuum Generation
Jason W. Fleischer; Princeton Univ., USA, Presider

CFC1 • 8:00 a.m.
Ultrabroadband Femtosecond Continuum Generation in Crystals of Bismuth Triborate, *Alexander Gaydardzhiev[1], Ivailo Nikolov[1], Ivan Buchvarov[1], Frank Noack[2], Valentin Petrov[2]; [1]Sofia Univ., Bulgaria, [2]Max-Born-Inst. for Nonlinear Optics and Ultrafast Spectroscopy, Germany.* Ultrabroadband generation of white-light continuum in the near-IR (~135 THz, 1.15-2.4 μm) is demonstrated in BiB_3O_6, pumped by 45 fs long pulses at 800 nm, achieving an energy of 15 μJ at 1 kHz.

CFC2 • 8:15 a.m.
Short Wavelength Extension of CW-Pumped Supercontinuum at 1 Mircon, *B. A. Cumberland, J. C. Travers, S. V. Popov, J. R. Taylor; Femtosecond Optics Group, Physics Dept., Imperial College London, UK.* We report a CW supercontinuum pumped at 1 μm which extends short of the pump wavelength to 0.6 μm. Four-wave mixing is believed to be a major process for the short wavelength generation.

CFC3 • 8:30 a.m.
Tunable High Repetition-Rate Mid-Infrared Optical Combs from a Compact Amplified Er-Doped Fiber Oscillator, *Alessio Gambetta[1], Stefano Azzini[1], Gianluca Galzerano[2], Paolo Laporta[1], Roberta Ramponi[1], Marco Marangoni[1]; [1]Politecnico di Milano, Italy, [2]Inst. di Fotonica e Nanotecnologie, Ctr. Natl. de la Recherche Scientifique, Italy.* Tunable optical combs spanning the 6.5-8.5 μm range are obtained as a result of a difference-frequency-generation process between pulse-trains emitted by an amplified 100 MHz Er-fiber oscillator with unprecedented average power of tens of microwatts.

CLEO

8:00 a.m.–9:45 a.m. CFD • Thulium-Doped Fiber Amplifiers and Lasers

Timothy Carrig; Lockheed Martin Coherent Technologies, USA, Presider

CFD1 • 8:00 a.m.
High Power Pulse Amplification in Tm-Doped Fiber, *Daniel Creeden[1], Peter A. Budni[1], Peter A. Ketteridge[1], Thomas M. Pollak[1], Evan P. Chicklis[1], Gavin Frith[2], Bryce Samson[2]; [1]BAE Systems, USA, [2]Nufern, USA.* We report >20W of average output power at 1.995µm from a pulsed Tm-doped fiber amplifier system operating at 100kHz. Pulse energies of >325µJ have been generated at 50kHz with 13ns pulses in the same amplifier.

CFD2 • 8:15 a.m.
A 4W Tunable Tm^{3+}:Ho^{3+} Silica Fibre Laser, *Alexander Hemming[1], Alexander Sabella[1], Shayne Bennetts[1], Stuart D. Jackson[2], David G. Lancaster[1]; [1]Defence Science and Technology Organisation, Australia, [2]Optical Fibre Technology Ctr., Univ. of Sydney, Australia.* A multiwatt Tm^{3+}:Ho^{3+} co-doped silica fibre laser pumped at 0.79 µm is demonstrated with an extended tuning range from 1920-2120nm, compared with 1880-2040nm obtained using a Tm^{3+} only doped fibre.

CFD3 • 8:30 a.m.
Narrow Linewidth Volume Bragg Grating Stabilized Thulium Fiber Laser, *Timothy S. McComb, Vikas Sudesh, Martin Richardson; CREOL, College of Optics and Photonics, Univ. of Central Florida, USA.* A spectrometer resolution limited 300pm linewidth is achieved in a volume Bragg grating stabilized Thulium fiber laser. Slope efficiency and output power are comparable to a similar resonator formed by a broadband high reflectivity mirror.

8:00 a.m.–9:45 a.m. CFE • High-Throughput Biosensing

Changhuei Yang; Caltech, USA, Presider

CFE1 • 8:00 a.m. Invited
High-Throughput *in vivo* Genetic and Drug Screening Using Femtosecond Laser Microsurgery and Microfluidics, *Christopher B. Rohde, Fei Zeng, Coddy Gilleland, Ricardo Gonzalez-Rubio, Matthew Angel, Mehmet F. Yanik; MIT, USA.* We developed microfluidic devices, imaging algorithms and femtosecond laser microsurgery technologies to manipulate large numbers of small-animals on a single chip for sub-cellular resolution high-throughput genetic and drug screens on neural degeneration and regeneration.

CFE2 • 8:30 a.m.
Label-Free and High-Throughput Screening of Biomolecular Interactions, *Ismail E. Ozkumur, James W. Needham, David A. Bergstein, Michael Ruane, Bennett B. Goldberg, M. Selim Unlu; Boston Univ., USA.* We present a simple label-free multi-analyte detection technique that is easily scalable for high-throughput screening. We have shown a sensitivity of 20pg/mm^2 and a minimum detectable antibody concentration of 15ng/ml for a specific antigen.

8:00 a.m.–9:45 a.m. CFF • Routing and Security in Optical Networks

Scott Hamilton; MIT Lincoln Lab, USA, Presider

CFF1 • 8:00 a.m.
Demonstration of Traffic Control and WDM Routing in All-Optical Data Vortex Node, *Hyun-Do Jung, Eduward Tangdiongga, A. M. J. Koonen; Eindhoven Univ. of Technology, Netherlands.* We demonstrate all-optical traffic control and self-routing of WDM optical packets in cascaded all-optical Data Vortex switching nodes. In the experiment, WDM optical packets are successfully routed while maintaining a BER of 10^{-10} or better.

CFF2 • 8:15 a.m.
2×2 Deflection Routing Node for Optical Packet-Switched Networks, *C. C. Lee, L. F. K. Lui, P. K. A. Wai, H. Y. Tam; Hong Kong Polytechnic Univ., Hong Kong.* We experimentally demonstrated a 2×2 deflection routing module for all-optical packet-switched networks. Output port contentions are resolved based on all-optical processing of the packet headers. Both the header and payload rates are 10 Gb/s.

CFF3 • 8:30 a.m.
Optical-Layer Multicast in Wavelength-Routing Network, *Ming Chen[1], Jihong Cao[1], Feng Zhang[1], Xi Qin[1], Yong Chen[1], Bo Lv[1], Dan Lu[1], Shuisheng Jian[1], D.S. Citrin[2,3]; [1]Key Lab of All Optical Network and Advanced Telecommunication Network of EMC, Beijing Jiaotong Univ., China, [2]School of Electrical and Computer Engineering, Georgia Tech, USA, [3]Unité Mixte Intl. Georgia Tech-Ctr. Natl. de la Recherche Scientifique, Georgia Tech Lorraine, France.* An optical-layer multicast was studied and implemented efficiently, safely, block-free, and with transparency to data rate and format in a wavelength-routing self-healing network employing chirped fiber gratings and optical circulators.

8:00 a.m.–9:45 a.m. CFG • Organic/Polymer Photonics

Warren N. Herman; Lab for Physical Sciences, USA, Presider

CFG1 • 8:00 a.m.
Luminescent Polymer Waveguide Amplifiers Operating in the Near-Infrared, *Takeyuki Kobayashi[1], Martin Djiango[1], Werner J. Blau[1], Bin Cai[2], Kyoji Komatsu[2], Toshikuni Kaino[2]; [1]Trinity College Dublin, Ireland, [2]Tohoku Univ., Japan.* Near-infrared optical gain in luminescent polymeric waveguides has been investigated by use of amplified spontaneous emission. We show that a small-signal gain of 20 dB is achievable in a 1.2-mm-long waveguide.

CFG2 • 8:15 a.m.
Temperature Dependent Properties of Novel Functionalized Anthradithiophene and Dicyanomethylenedihydrofuran Derivatives, *Andrew D. Platt[1], Jonathan Day[1], John Anthony[2], Robert Twieg[3], Oksana Ostroverkhova[1]; [1]Oregon State Univ., USA, [2]Univ. of Kentucky, USA, [3]Kent State Univ., USA.* We present optical, fluorescent and photoconductive temperature dependent properties of novel high-performance solution-processable functionalized anthradithiophene and dicyanomethylenedihydrofuran derivatives. Changes in fluorescence lifetime, fluorescence quantum yield, and photoconductivity with temperature are discussed.

CFG3 • 8:30 a.m.
Gradient Index Polymer Optics, *G. Beadie[1], E. Fleet[1], A. Rosenberg[1], P. A. Lane[1], J. S. Shirk[1], Y. Jin[2], H. Tai[2], A. Kamdar[2], A. Hiltner[2], E. Baer[2]; [1]NRL, USA, [2]Case Western Reserve Univ., USA.* We developed novel lenses from gradient index, multi-polymer sheets. The sheets were processed into lenses with spherically-symmetric index profiles. An F/2.25 GRIN singlet produced images with 4x better contrast than a commercial F/2.25 glass singlet.

8:00 a.m.–9:45 a.m.
CFH • Interconnects: Modulators and Detectors

Michal Lipson; Cornell Univ., USA, Presider

CFH1 • 8:00 a.m. Invited
Photonic Components for Short Range Optical Interconnects, *Bert J. Offrein; IBM Res. GmbH, Switzerland.* Optical interconnect technology will play an increasingly important role in servers and supercomputers as a means to keep pace with the increasing intra-system bandwidth requirements. Low-cost and high density optical packaging concepts are required.

CFH2 • 8:30 a.m.
Modeling and Characterization of Mach-Zehnder Silicon Electrooptic Modulators, *Gui-Rong Zhou[1], Michael W. Geis[2], Steven J. Spector[2], Fuwan Gan[1], Matthew E. Grein[2], Robert T. Schulein,[2], Jung U. Yoon[2], Donna M. Lennon[2], Erich P. Ippen[1], Theodore M. Lyszczarz[2], Franz X. Kaertner[1]; [1]MIT, USA, [2]MIT Lincoln Lab, USA.* We present a comprehensive study of silicon Mach-Zehnder modulators based on carrier injection. Detailed comparisons between simulation results and measurements are made and excellent agreement is obtained for DC and AC characteristics.

NOTES

QFA • Light Emission in Photonic Crystals—Continued

QFA3 • 8:45 a.m.
Fractional Decay of Quantum Dots in Photonic Crystals, *Philip T. Kristensen[1], Femius Koenderink[2], Peter Lodahl[1], Bjarne Tromborg[1], Jesper Mørk[1]; [1]COM•DTU, Technical Univ. of Denmark, Denmark, [2]FOM Inst. for Atomic and Molecular Physics, Netherlands.* We define a practical measure for the degree of fractional decay and establish conditions for the effect to be observable for quantum dots in photonic crystals exhibiting absorptive losses.

QFA4 • 9:00 a.m.
Manipulation of Quantum Emitters on Photonic Crystal Cavities, *Michael Barth[1], Johannes Stingl[1], Josef Kouba[2], Bernd Loechel[2], Oliver Benson[1]; [1]Humboldt-Univ. Berlin, Germany, [2]Application Ctr. for Microengineering, BESSY GmbH, Germany.* We investigate the manipulation of nanoscopic particles, which contain few or single quantum emitters, on photonic crystal cavities using scanning probe techniques, thereby aiming at the precise control of light-matter coupling in these cavities.

QFA5 • 9:15 a.m.
Visible and Telecom-Wavelength Single Quantum Dots in 1-D Photonic Bandgap Chiral Microcavities, *Svetlana G. Lukishova[1], Luke J. Bissell[1], Chris Evans[2], Megan Hahn[2], Yun Jin Choi[3], Charles John Clarkson[4], Xiao Feng Qian[3], Todd Krauss[2], C. R. Stroud, Jr[1], Robert W. Boyd[1]; [1]Inst. of Optics, Univ. of Rochester, USA, [2]Dept. of Chemistry, Univ. of Rochester, USA, [3]Dept. of Physics, Univ. of Rochester, USA, [4]Dept. of Electrical and Computer Engineering, Univ. of Rochester, USA.* CdSe/PbSe single quantum dots were doped into chiral-photonic-bandgap cholesteric microcavities for visible/telecom wavelengths. High-purity circularly polarized fluorescence of definite handedness from single quantum dots was observed for the first time because of microcavity spiral structure.

QFB • Quantum Imaging and Interference—Continued

QFB4 • 8:45 a.m.
Experimental Realization of Quantum Oblivious Transfer, *David Fattal[1], Marco Fiorentino[1], Antony Chefles[2], Raymond G. Beausoleil[1]; [1]Hewlett Packard Co., USA, [2]Hewlett Packard Co., UK.* We present an experimental demonstration of an unconditionally secure, cheat-sensitive Oblivious Transfer protocol relying on entanglement-free quantum communication. Our experiment is based on a down-conversion-based heralded photon source, commercial fiber components, and silicon single-photon detectors.

QFB5 • 9:00 a.m.
On the Practicality of Quantum Interferometry Using Photonic N00N States, *Gerald Gilbert, Michael Hamrick, Yaakov S. Weinstein; MITRE, USA.* We show that attenuated *N00N* states lead to a worse phase estimate than equally attenuated *N* separable state unless the transmittance of the medium is very high.

QFB6 • 9:15 a.m.
Two-Photon Interference behind Young's Double Slit, *Martin P. van Exter, Jelmer J. Renema, Wouter H. Peeters; Leiden Univ., Netherlands.* We observe two-photon interference behind Young's double slit with unprecedented quality and demonstrate complementarity between quantum entanglement in the two-photon field and optical coherence in the projected one-photon field for three different types of illumination.

QFB7 • 9:30 a.m.
Spin Hall Effect of Light via Weak Measurements: Sharp and Smooth Index Variations, *Onur Hosten, Paul G. Kwiat; Univ. of Illinois at Urbana-Champaign, USA.* Using "quantum weak-measurements" as a coherent enhancement technique for small signals, we have measured the recently proposed "spin Hall effect" of light at an air-glass interface, and are working on the smoothly varying refractive-index case.

CFA • Ultrafast Modulation and Synthesis—Continued

CFA4 • 8:45 a.m.
Using Difference Frequency Generation to Lock a CW Visible Laser to a Fiber Laser Frequency Comb, *A. K. Mills, Yi-Fei Chen, Jie Jiang, K. Madison, David J. Jones; Univ. of British Columbia, Canada.* We demonstrate the use of difference frequency generation to lock a visible cw Ti:sapphire laser to a femtosecond frequency comb spanning 1 to 2 μm generated by a fiber laser frequency comb.

CFA5 • 9:00 a.m.
Toward Coherent Pulse Synthesis Using Independently Tunable Femtosecond Oscillators, *Barry J. S. Gale, Jinghua Sun, Derryck T. Reid; Heriot Watt Univ., UK.* Pulses at 780 nm from a femtosecond optical parametric oscillator and its Ti:sapphire pump laser were phase-locked as a prerequisite to coherent synthesis at different wavelengths. Coherence was demonstrated using spectral interferometry and interferometric cross-correlation.

CFA6 • 9:15 a.m.
Few-Cycle Femtosecond Waveform Synthesizer, *Stefan Rausch[1], Thomas Binhammer[1], Anne Harth[1], Niels Meiser[1], Franz X. Kärtner[2], Uwe Morgner[1,3]; [1]Inst. of Quantum Optics, Leibniz Univ. Hannover, Germany, [2]Dept. of Electrical Engineering and Computer Science, MIT, USA, [3]Laserzentrum Hannover, Germany.* A waveform synthesizer consisting of an octave-spanning Ti:sapphire oscillator and a prism-based pulse shaper is presented. Combined with CEO-phase stabilization the system allows for full control of the electric field on a sub-femtosecond time-scale.

CFA7 • 9:30 a.m.
Generation of Sub-Two-Cycle Pulses in Mid-Infrared Region by Four-Wave Rectification in Air, *Takao Fuji, Toshinori Suzuki; RIKEN, Japan.* Generation of mid-infrared pulses by four-wave mixing through filamentation in air has been demonstrated. The pulse width was measured as 13 fs, which corresponds to 1.3 optical cycles. The output energy reaches 1.5 μJ.

JFA • Joint CLEO/QELS Symposium on Hollow-Core Photonic-Crystal Fibers I—Continued

JFA3 • 8:45 a.m.
Experimental Comparison of Electromagnetic Induced Transparency in Acetylene-Filled Kagomé and Triangular Lattice Hollow Core Photonic Crystal Fiber, *Natalie V. Wilding, Philip S. Light, Francois Couny, Fetah Benabid; Univ. of Bath, UK.* Experimental comparison of triangular-lattice and kagomé-lattice HC-PCF with regard to electromagnetic induced transparency is reported. The results show that the mode beating, responsible for the noisy background, is dramatically suppressed in kagomé HC-PCF.

JFA4 • 9:00 a.m.
Production of Controllable Rb-Vapor Densities in Photonic Bandgap Fibers, *Amar R. Bhagwat, Aaron D. Slepkov, Vivek Venkataraman, Pablo Londero, Alexander L. Gaeta; Cornell Univ., USA.* We generate a highly-controlled, optically-dense, and repeatable Rb vapor inside of a hollow-core photonic bandgap fiber using light-induced atomic desorption. Here we present its generation dynamics and use for nonlinear quantum optical applications.

JFA5 • 9:15 a.m.
Saturated Absorption Spectroscopy of C_2H_2 inside a Hollow, Large-Core Kagome Photonic Crystal Fiber, *Kevin Knabe[1], Andrew Jones[1], Kristan L. Corwin[1], Francois Couny[2], Philip S. Light[2], Fetah Benabid[2]; [1]Kansas State Univ., USA, [2]Univ. of Bath, UK.* Saturated absorption spectroscopy in acetylene-filled, 19-cell kagome-structured hollow core photonic crystal fiber is investigated. The large core size of ~70 μm allows for narrow sub-Doppler features, and the wavelength-insensitive transmission is suitable for frequency measurements.

JFA6 • 9:30 a.m.
Microstructured Hollow-Core Rib Waveguides, *James A. West, Ellen M. Kosik Williams, Karl W. Koch; Corning Inc., USA.* We examine the properties of a new type of hollow-core fiber with a rib-waveguide geometry. Based on photonic band-gap fibers, these new designs offer intriguing possibilities for gas and liquid sensing.

9:45 a.m.–10:15 a.m., Coffee Break, *Concourse Level*

QFC • Polaritons in Confined Structures—Continued

QFC4 • 9:00 a.m.
First and Second Order Coherence of Exciton-Polariton Condensates, *Chih-Wei Lai[1,2], Georgios Roumpos[1], Alfred Forchel[3], Yoshihisa Yamamoto[1,2]; [1]Stanford Univ., USA, [2]Natl. Inst. of Informatics, Japan, [3]Univ. of Würzburg, Germany.* We investigate the first and second order coherence of exciton-polariton condensates both in coordinate and momentum space. The measured correlations provide insights into the phase and intensity fluctuations induced by polariton interactions.

QFC5 • 9:15 a.m.
Bragg Cavity Polaritons in Disordered Planar Lattices, *Michal Grochol, Carlo Piermarocchi; Michigan State Univ., USA.* We investigate polaritons resulting from excitons localized in arrays with energy and oscillator strength fluctuations embedded in microcavities. The polariton emission shape remains robust under oscillator strength fluctuations, but is more sensitive to energy fluctuations.

QFC6 • 9:30 a.m.
Time-Resolved Optical Interferometry of Polaritonic States in Metallic Photonic Crystal Slabs, *Tobias Utikal[1], Thomas Zentgraf[2], Markus Lippitz[3], Harald Giessen[1]; 14th Physics Inst., Univ. of Stuttgart, Germany, [2]Dept. of Mechanical Engineering, Univ. of California at Berkeley, USA, [3]Max Planck Inst. for Solid State Res., Germany.* We present time-resolved nonlinear optical measurements on polaritonic states in metallic photonic crystals. The femtosecond time dynamics of the polariton are tailored by an interferometric three-pulse pump-probe technique.

JFB • Laser Acceleration—Continued

JFB4 • 8:45 a.m.
Direct Measurement of the Electron Density Driving the Laser Particle Acceleration with Thin Foils, *Oliver Jäckel[1], Sebastian M. Pfotenhauer[2], Jens Polz[2], Hans-Peter Schlenvoigt[2], Malte C. Kaluza[2], Heinrich Schwoerer[3]; [1]Inst. für Optik und Quantelektronik, Germany, [2]Inst. für Optik und Quantenelektronik, Friedrich-Schiller-Univ., Germany, [3]Laser Res. Inst., Univ. of Stellenbosch, South Africa.* A method for time resolved optical probing of laser ion acceleration using interferometry is presented. The electron density in the accelerating fields were reconstructed in a time series with 100 fs resolution.

JFB5 • 9:00 a.m.
Relativistic Photoelectron Measurements from Ionization of Argon and Xenon in Ultrahigh Fields, *Isaac Ghebregziabher, Anthony DiChiara, Sasi Palaniyappan, Rob Sauer, Rob Mitchel, Jane Waesche, Samantha White, B. C. Waker; Dept. of Physics and Astronomy, Univ. of Deleware, USA.* Photoelectron angular distributions with energies as high as 1MeV were measured and calculated with a semi-classical tunneling model at relativistic laser intensity. Measurements and theory show directional higher energy electrons and isotropic lower energy electrons.

JFB6 • 9:15 a.m. Invited
1 GeV Electron Beams from a Laser-Driven Channel-Guided Accelerator, *Csaba Toth, K. Nakamura, A. Gonsalves, D. Panasenko, N. Matlis, C. G. R. Geddes, C. B. Schroeder, E. Esarey, W. P. Leemans; Lawrence Berkeley Natl. Lab, USA.* GeV-class electron beams generated from laser wakefield accelerator with 40 TW laser pulses using a 33 mm hydrogen-based capillary discharge waveguide. Stable 0.5 GeV e-beams can produce bright radiation from THz to X-rays.

CFB • Short Pulse and Pulse-Shaped Lasers—Continued

CFB4 • 8:45 a.m.
CPA Free Sub-Picosecond Ultrafast Laser Amplifier, *Eric Mottay, Martin Delaigue, Antoine Courjaud; Amplitude Systèmes, France.* We demonstrate a diode-pumped Ytterbium ultrashort pulse laser amplifier, avoiding chirped pulse amplification, resulting in a simple and robust laser system. The average power exceeds 10 W for repetition rates between 50 and 100 kHz.

CFB5 • 9:00 a.m.
11 MW Pico-Second Pulses with >70 W Average Power from a Phase-Conjugate Nd:YVO_4 Bounce Laser System, *Kouji Nawata[1], Naoki Shiba[1], Masahito Okida[1], Takashige Omatsu[1,2]; [1]Chiba Univ., Japan, [2]Japan Science and Technology Agency, Japan.* A 78.5W pico-second master-oscillator power-amplifier system based on a Nd:YVO_4 bounce amplifier with a phase conjugator was demonstrated. The peak power of the output pulses was 8-11MW in a pulse-repetition-frequency region of 0.7-1MHz.

CFB6 • 9:15 a.m.
A Non-Interferometric Pulse-Stacker for Diagnostic and Energetic Laser Applications, *Douglas A. Dalton, Aaron C. Bernstein, James C. Sanders, Daniel Herrmann, Despina Milathianaki, Todd Ditmire; Univ. of Texas at Austin, USA.* We demonstrate a passive, robust pulse-stacker and pulse-shaper which eliminates inter-pulse interference of stacked pulses while producing a top-hat spatial beam profile.

CFB7 • 9:30 a.m.
Operation Features of Regenerative Amplifiers at High Repetition Rate, *Mikhail Grishin[1,2], Vidmantas Gulbinas[2], Andrejus Michailovas[1], Juozas Verseckas[1]; [1]EKSPLA uab, Lithuania, [2]Inst. of Physics, Lithuania.* Peculiar dynamics of high repetition rate regenerative amplifiers limits the system power efficiency. A basic model of regenerative amplifiers dynamics and experimental verification of operation efficiency are presented.

CFC • Comb and Continuum Generation—Continued

CFC4 • 8:45 a.m.
Limiting Nature of Continuum Generation in Silicon, *Prakash V. Koonath, Daniel R. Solli, Bahram Jalali; Univ. of California at Los Angeles, USA.* The generation of spectral continuum in silicon is studied experimentally and theoretically. The dynamics of the free carriers generated through two photon absorption (TPA) is found to limit the extent of the generated continuum.

CFC5 • 9:00 a.m.
Real Time Amplitude Noise and Jitter Comparison of Supercontinua Generated at Different Dispersion Regimes, *Nuh S. Yuksek, Xinzhu Sang, En-Kuang Tien, Feng Qian, Qi Song, Ozdal Boyraz; Univ. of California at Irvine, USA.* An experimental investigation on noise performances of supercontinua generated in normal and anomalous dispersion fibers is carried out. The supercontinuum in the normal dispersion fiber has lower real time amplitude noise and timing jitter.

CFC6 • 9:15 a.m.
Polarization Preservation of White-Light Supercontinuum Generation, *Leonardo De Boni, Carlos Toro, Florencio E. Hernandez; Univ. of Central Florida, USA.* We demonstrate that the supercontinuum picosecond generation (SC) preserves the polarization state, linear, elliptical and circular, of the pump source. Additionally, an analysis of the main mechanism was done based on the spectra polarization dependence.

CFC7 • 9:30 a.m.
Polarized Supercontinuum from a 1064nm Microchip Laser and Application to Tunable Visible/UV Generation in BIBO, *Chunle Xiong, William J. Wadsworth; Dept. of Physics, Univ. of Bath, UK.* We generate a 99% polarized supercontinuum from a 1064nm microchip laser by use of a highly birefringent photonic crystal fiber. We also demonstrate tunable visible/UV generation in BIBO pumped by the polarized continuum source.

9:45 a.m.–10:15 a.m., Coffee Break, *Concourse Level*

CFD • Thulium-Doped Fiber Amplifiers and Lasers—Continued

CFD4 • 8:45 a.m.
320-fs Thulium-Doped Fiber-Ring-Laser with a Pulse Energy of 3.5-nJ, *Martin Engelbrecht, Frithjof Haxsen, Axel Ruehl, Dieter Wandt, Dietmar Kracht; Laser Zentrum Hannover, Germany.* A thulium-doped double-clad femtosecond fiber laser at 1985-nm with internal dispersion compensation is presented. Based on additive pulse modelocking it generates pulses with a dechirped duration of 320-fs and an energy of 3.5-nJ.

CFD5 • 9:00 a.m.
Single-Frequency Tm-Doped Fiber Master-Oscillator Power-Amplifier with 10 W Linearly Polarized Output at 1943 nm, *Zhaowei Zhang, Alex J. Boyland, Jayanta K. Sahu, Morten Ibsen, W. Andy Clarkson; Optoelectronics Res. Ctr., Univ. of Southampton, UK.* We report efficient operation of a narrow-linewidth master-oscillator power-amplifier (MOPA), based on a Tm-doped fiber distributed-feedback laser and two amplifier stages, in-band pumped at 1565nm. The MOPA yielded 10W of linearly-polarized single-frequency output at 1943nm.

CFD6 • 9:15 a.m.
High-Power Widely Tunable Thulium-Doped Fiber Master-Oscillator Power-Amplifier around 2 μm, *Lee Pearson, Deyuan Shen, Jayanta K. Sahu, William Andrew Clarkson; Optoelectronics Res. Ctr., Univ. of Southampton, UK.* We report a high power, widely-tunable Tm-doped fiber master-oscillator power amplifier system generating over 100W of linearly-polarized output with a >190nm tuning range. The output power is limited only by the available pump power.

CFD7 • 9:30 a.m.
Actively Q-Switched Tm^{3+}-Doped and Tm^{3+}, Ho^{3+}-Codoped Silica Fiber Lasers, *Marc Eichhorn[1], Stuart D. Jackson[2]; [1]French-German Res. Inst. of Saint-Louis, France, [2]Optical Fibre Technology Ctr., Univ. of Sydney, Australia.* We report on the Q-switched operation of Tm^{3+}-doped and Tm^{3+}, Ho^{3+}-co-doped silica fiber lasers. Short pulses at high repetition rates and high average power could be achieved with the Tm^{3+}-doped silica fiber.

CFE • High-Throughput Biosensing—Continued

CFE3 • 8:45 a.m.
High-Throughput Protein Binding End-Points and Kinetics in Microarrays Using Label-Free OI-RD Microscopes, *James P. Landry, Yung-Shin Sun, Yi-yan Fei, Kit S. Lam, Xiangdong Zhu; Univ. of California at Davis, USA.* The potential of biomolecular microarrays on glass for high-throughput kinetics assays has not previously been fully exploited. We demonstrate real-time label-free optical detection of antibodies binding to drug-antigen microarrays using oblique-incidence reflectivity difference (OI-RD) microscopes.

CFE4 • 9:00 a.m.
High-Throughput Microscope for Label-Free Detection of Protein and Small-Molecule Chemical Microarrays, *Yiyan Fei[1], James P. Landry[1], Yun-Shin Sun[1], Juntao Luo[2], Xiaobing Wang[2], Kit S. Lam[2], Xiangdong Zhu[1]; [1]Dept. of Physics, Univ. of California at Davis, USA, [2]Div. of Hematology and Oncology, Dept. of Internal Medicine, Univ. of California at Davis, USA.* We describe a novel scanning optical microscope that enables high-throughput label-free detection of end-points and kinetics of multiple biomolecular reactions on microarrays with more than 10,000 protein or small-molecule targets.

CFE5 • 9:15 a.m.
Distance Dependent Amplification of Molecular Fluorescence via Photonic Crystal Slabs, *Nikhil Ganesh, Patrick C. Mathias, Wei Zhang, Brian T. Cunningham; Univ. of Illinois at Urbana-Champaign, USA.* Theoretical and experimental verification of near-field fluorescence amplification from PC slabs is performed. Key results indicate absence of quenching at small resonator-molecule separations and ability to tune the interaction volume to accommodate various fluorescent assays.

CFE6 • 9:30 a.m.
Development of SPR Sensor Array Based on Optoelectronic Platform for High Throughput System, *Hyungseok Pang[1], Patrick L. Likamwa[1], Hyoung J. Cho[2]; [1]CREOL and Florida Photonics Ctr. of Excellence, College of Optics and Photonics, Univ. of Central Florida, USA, [2]Dept. of Mechanical, Materials and Aerospace Engineering, Univ. of Central Florida, USA.* A SPR biosensor array based on optoelectronic platform has been developed. Using integrated photodetector, the SPR signal has been directly converted into electrical signal and the device has the potential of high throughput measurement capabilities.

CFF • Routing and Security in Optical Networks—Continued

CFF4 • 8:45 a.m.
Ultra High-Rate Optical Key Distribution, *Oren Buskila, Mark Shtaif, Avishay Eyal; School of Electrical Engineering, Tel Aviv Univ., Israel.* We describe a scheme for physical layer encryption allowing key establishment at standard optical communications rates. Thereby ultimate security can be achieved using the one-time pad protocol.

CFF5 • 9:00 a.m.
Steganographic Fiber-Optic Transmission Using Coherent Spectral-Phase-Encoded Optical CDMA, *Bernard Wu[1], Anjali Agarwal[2], Ivan Glesk[1], Evgenii Narimanov[1], Shahab Etemad[2], Paul R. Prucnal[1]; [1]Princeton Univ., USA, [2]Telcordia Technologies, USA.* Stealth communication using coherent SPE-OCDMA is demonstrated. The coherent approach can provide higher spectral efficiency than incoherent optical CDMA.

CFF6 • 9:15 a.m.
Running-Code O-CDMA Based on AOM Pulse Shapers, *Shawn X. Wang[1], Gregory S. Kanter[2], Prem Kumar[1]; [1]Northwestern Univ., USA, [2]NuCrypt LLC, USA.* We report on a successful demonstration of a continuously-running-code O-CDMA system. The system utilizes double-pass acousto-optic-modulator pulse shapers as the encoding/decoding devices which are capable of microsecond-scale code-sequence refresh rate.

CFF7 • 9:30 a.m.
Transmission of a Chaos-Masked Signal with In-Line All-Optical Wavelength Conversion, *Paolo Minzioni, Mauro Benedetti, Giuseppe Aromataris, Ilaria Cristiani, Sabina Merlo, Valerio Annovazzi-Lodi; Electronics Dept., Univ. of Pavia, Italy.* In this paper we demonstrate wavelength-conversion, of a message masked by additive chaos, along a transmission line. This result shows that chaos-based communications are compatible with channel-switching and wavelength-conversion as required in reconfigurable networks.

CFG • Organic/Polymer Photonics—Continued

CFG4 • 8:45 a.m. **Tutorial**
Organic Photonics, *Stephen Forrest; Dept. of Electrical Engineering and Computer Science, Univ. of Michigan, USA.* We will review the materials, devices and underlying physics of organic semiconductors which have opportunities for use in new optoelectronic appliances, such as displays, focal plane arrays, and solar cells.

Steven Forrest received his B.A. Physics in 1972 from the University of California, and his MSc and Ph.D. Physics in 1974 and 1979 from the University of Michigan. First at Bell Labs, he investigated photodetectors for optical communications. In 1985, Prof. Forrest joined the Electrical Engineering and Materials Science Departments at USC where he worked on optoelectronic integrated circuits, and organic semiconductors. In 1992, Prof. Forrest became the James S. McDonnell Distinguished University Professor of Electrical Engineering at Princeton University. He served as director of the National Center for Integrated Photonic Techology, and as Director of Princeton's Center for Photonics and Optoelectronic Materials (POEM). From 1997-2001, he served as the Chair of the Princeton's Electrical Engineering Department. In 2006, he rejoined the University of Michigan as Vice President for Research, and as the William Gould Dow Collegiate Professor in Electrical Engineering, Materials Science and Engineering, and Physics. A Fellow of the IEEE and OSA and a member of the National Academy of Engineering, he received the IEEE/LEOS Distinguished Lecturer Award in 1996-1997, and in 1998 he was co-recipient of the IPO National Distinguished Inventor Award as well as the Thomas Alva Edison Award for innovations in organic LEDs. In 1999, Prof. Forrest received the MRS Medal for work on organic thin films. In 2001, he was awarded the IEEE/LEOS William Streifer Scientific Achievement Award for advances made on photodetectors for optical communications systems. In 2006 he received the Jan Rajchman Prize from the Society for Information Display for invention of phosphorescent OLEDs, and is the recipient of the 2007 IEEE Daniel E. Nobel Award for innovations in OLEDs. Prof. Forrest has authored ~425 papers in refereed journals, and has 173 patents. He is co-founder or founding participant in several companies, including Sensors Unlimited, Epitaxx, Inc., Global Photonic Energy Corp., Universal Display Corp. (NASDAQ: PANL) and ASIP, Inc.

9:45 a.m.–10:15 a.m., Coffee Break, *Concourse Level*

CFH • Interconnects: Modulators and Detectors—Continued

CFH3 • 8:45 a.m.
Hybrid Silicon Evanescent Phase Modulator Based on Carrier Depletion in Offset Multiple-Quantum-Well, *Hui-wen Chen, Ying-hao Kuo, John E. Bowers; Univ. of California at Santa Barbara, USA.* We demonstrate a phase modulator based on carrier depletion on the hybrid silicon evanescent platform. The device has a modulation efficiency of 4Vmm, along with a bandwidth of 100nm and power capability up to 20mW.

CFH4 • 9:00 a.m.
High-Speed Silicon Electro-Optical Modulator that Can Be Operated in Carrier Depletion or Carrier Injection Mode, *Steven J. Spector[1], Michael W. Geis[1], Matthew E. Grein[1], Robert T. Schulein[1], Jung U. Yoon[1], Donna M. Lennon[1], Fuwan Gan[2], Gui-Rong Zhou[2], Franz X. Kaertner[2], Theodore M. Lyszczarz[1]; [1]MIT Lincoln Lab, USA, [2]MIT, USA.* A silicon optical modulator has been demonstrated which is capable of operating in a forward bias mode for low power (<10 mW), or in a reverse bias mode for large bandwidth.

CFH5 • 9:15 a.m.
Planar and Vertical Si Nanowire Photodetectors, *Arthur Zhang, Sifang You, Cesare Soci, Deli Wang, Yu-Hwa Lo; Univ. of California at San Diego, USA.* We demonstrate scalable Si nanowire photodetectors that function as phototransistors. Etched planar and vertical Si nanowire photodetectors have been fabricated and characterized, showing high (>35,000) internal gain under UV illumination.

CFH6 • 9:30 a.m.
Nanophotodetector Array for Nano-Imaging, *Boyang Liu, Yingyan Huang, Seng-Tiong Ho; Dept. of Electrical Engineering and Computer Science, Northwestern Univ., USA.* A novel near-field nano-imager based on nanophotodetector (NPD) array is presented. Simulation shows λ/10 resolution could be obtained by NPD array. The initially realized NPD devices at 1.5μm wavelength have the smallest pixel size of 50nm.

9:45 a.m.–10:15 a.m.
Coffee Break, *Concourse Level*

NOTES

Ballroom A1 and A8	Ballroom A2 and A7	Ballroom A3 and A6	Ballroom A4 and A5
QELS		CLEO	JOINT

10:15 a.m.–12:00 p.m.
QFD • Random Lasers
Hui Cao; Northwestern Univ., USA, Presider

QFD1 • 10:15 a.m. Invited
Random Lasers, *Allard P. Mosk; Univ. of Twente, Netherlands.* Random lasing is a unique tool to investigate the longest-lived light modes in a disordered material. The behavior of very strongly scattering random lasers in our experiments is well understood in terms of these modes.

QFD2 • 10:45 a.m.
Middle-IR Random Lasing of Cr:ZnS Nanocrystalline Powder: From Diffusion to Photon Localization Regimes, *Dmitri V. Martyshkin, Changsu Kim, Igor S. Moskalev, Vladimir V. Fedorov, Sergey S. Mirov; Univ. of Alabama at Birmingham, USA.* First room temperature mid-IR random lasing in the doped 27nm Cr:ZnS nanocrystals (NC) is studied and compared with micron grain size random laser.

QFD3 • 11:00 a.m.
Random Laser Emission from ZnO Nanocomposite Hybrids, *Andreas Stassinopoulos[1,2], Evangelos D. Tsagarakis[3], Rabindra N. Das[3], Spiros H. Anastasiadis[1,4], Emmanuel P. Giannelis[3], Dimitris G. Papazoglou[1,5], Demetrios Anglos[1]; [1]Inst. of Electronic Structure and Laser, Foundation for Res. and Technology, Hellas, Greece, [2]Dept. of Physics, Univ. of Crete, Greece, [3]Dept. of Materials Science and Engineering, Cornell Univ., USA, [4]Dept. of Chemical Engineering, Aristotle Univ. of Thessaloniki, Greece, [5]Materials Science and Technology Dept., Univ. of Crete, Greece.* Highly scattering ZnO-hybrid nanostructures are produced exhibiting random laser action upon optical excitation. Studies that investigate the influence of pump pulse duration on the random laser efficiency are presented along with coherence length measurements.

10:15 a.m.–12:00 p.m.
QFE • Entangled Photon Sources I
Matthew Eisaman; Natl. Inst. of Standards and Technology, USA, Presider

QFE1 • 10:15 a.m.
Hong-Ou-Mandel Dip Using Photon Pairs from a PPLN Waveguide, *Qiang Zhang[1], Hiroki Takesue[2], Carsten Langrock[1], Xiuping Xie[1], Martin M. Fejer[1], Yoshihisa Yamamoto[1]; [1]Stanford Univ., USA, [2]NTT Basic Res. Labs, Japan.* We experimentally observed a Hong-Ou-Mandle dip with 1.5-μm photon pairs generated in a periodically poled lithium niobate waveguide with integrated mode demultiplexer. The visibility of the dip was 78% without subtraction of any noise.

QFE2 • 10:30 a.m.
High Quality Telecom-Band Polarization-Entangled Photon-Pairs from a Stable, Pulse-Pumped, Short PPLN Waveguide, *Han Chuen Lim[1,2], Akio Yoshizawa[2,3], Hidemi Tsuchida[2,3], Kazuro Kikuchi[1]; [1]Graduate School of Frontier Sciences, Univ. of Tokyo, Japan, [2]Natl. Inst. of Advanced Industrial Science and Technology (AIST), Japan, [3]CREST, Japan Science and Technology Agency (JST), Japan.* We demonstrate an ultra-stable, pulse-pumped source of telecom-band polarization-entangled photon-pairs using 1-mm-long PPLN waveguide placed in a polarization-diversity fiber-loop without temperature control. Full tomographic characterization confirms a purity higher than 0.94 and fidelity exceeding 0.96.

QFE3 • 10:45 a.m.
Generation of 1.5-μm Band Polarization Entanglement Using Silicon Wire Waveguide, *Hiroki Takesue[1,2], Hiroshi Fukuda[3], Tai Tsuchizawa[3], Toshifumi Watanabe[3], Koji Yamada[3], Yasuhiro Tokura[1,2], Sei-ichi Itabashi[3]; [1]NTT Basic Res. Labs, NTT Corp., Japan, [2]CREST, Japan Science and Technology Agency, Japan, [3]NTT Microsystem Integration Labs, NTT Corp., Japan.* We present the first experimental generation of 1.5-μm band polarization entanglement based on spontaneous four-wave mixing in a silicon wire waveguide. Two-photon interference fringes with >83% visibilities were successfully obtained.

QFE4 • 11:00 a.m.
Experimental Test of Non-Local Realism Using a Fiber-Based Source of Polarization-Entangled Photon Pairs, *Matthew D. Eisaman, Elizabeth Goldschmidt, Jingyun Fan, Alan Migdall; NIST, USA.* We test local realistic and non-local realistic theories using a fiber-based source of polarization-entangled photons. Our measurements violate local (certain non-local) hidden-variable theories by 15 (3) standard deviations.

10:15 a.m.–12:00 p.m.
CFI • Ultrafast Oscillators I
Sterling Backus; Kapteyn-Murnane Labs, USA, Presider

CFI1 • 10:15 a.m.
Efficient High Power Passively Mode-Locked Yb:Lu_2O_3 Thin Disk Laser, *Cyrill R. E. Baer[1], Sergio V. Marchese[1], Anna G. Engqvist[1], Matthias Golling[1], Deran J. H. Maas[1], Thomas Südmeyer[1], Ursula Keller[1], Rigo Peters[2], Christian Kränkel[2], Klaus Petermann[2], Günter Huber[2]; [1]Dept. of Physics/ETH Zurich, Switzerland, [2]Inst. für Laser-Physik, Univ. of Hamburg, Germany.* The first passively mode-locked Yb:Lu_2O_3 thin disk laser generates 370-fs pulses with 20.5 W average power. Yb:Lu_2O_3 is an excellent alternative to femtosecond Yb:YAG thin disk lasers, achieving higher optical-to-optical efficiencies and shorter pulse durations.

CFI2 • 10:30 a.m.
High-Power, Diode-Pumped Modelocked Cr^{3+}:LiCAF Laser, *Umit Demirbas[1], Alphan Sennaroglu[2,1], Franz X. Kärtner[1], James G. Fujimoto[1]; [1]MIT, USA, [2]Koc Univ., Turkey.* We describe a diode-pumped Cr^{3+}:LiCAF laser which produces 590 mW of continuous-wave output power using two pump diodes. Passive mode locking with a semiconductor saturable absorber mirror produces 97-fs, 2.8-nJ pulses near 800 nm wavelength.

CFI3 • 10:45 a.m.
Self-Starting Kerr-Mode-Locked Polycrystalline Cr^{2+}:ZnSe Laser, *Igor S. Moskalev, Vladimir V. Fedorov, Sergey B. Mirov; Univ. of Alabama at Birmingham, USA.* We demonstrate a middle-infrared self-starting Kerr-mode-locked Cr:ZnSe laser operating at 103 MHz repetition-rate with estimated lower limit of the pulse width of 300 fs and output power of 50 mW at 2.4 μm wavelength.

CFI4 • 11:00 a.m. Invited
Attosecond-Resolution Timing Jitter Characterization of Free-Running Mode-Locked Lasers, *Jungwon Kim, Jeff Chen, Jonathan Cox, Franz X. Kärtner; MIT, USA.* Timing jitter characterization of free-running mode-locked lasers is demonstrated using balanced optical cross-correlation in the timing detector and the timing delay configurations. The limitation set by shot noise is 470 attoseconds in 10-MHz bandwidth.

10:15 a.m.–12:00 p.m.
JFC • Joint CLEO/QELS Symposium on Hollow-Core Photonic-Crystal Fibers II
Karl Koch; Corning, Inc., USA, Presider

JFC1 • 10:15 a.m. Invited
Nonlinear Optics in Gas-Filled Photonic Band-Gap Fibers, *Alexander Gaeta; Cornell Univ., USA.* Hollow-core photonic band-gap fibers offer the potential of extreme enhancement of both resonant and non-resonant nonlinear interactions with gases.

JFC2 • 10:45 a.m.
Generation of Multi-Octave Optical-Frequency Combs in a Kagome Lattice Hollow Core Photonic Crystal Fiber, *Francois Couny[1], Fetah Benabid[1], Peter J. Roberts[2], Phil S. Light[1], Michael G. Raymer[3]; [1]Ctr. for Photonics and Photonic Materials, Dept. of Physics, Univ. of Bath, UK, [2]COM, Technical Univ. of Denmark, Denmark, [3]Oregon Ctr. for Optics and Dept. of Physics, Univ. of Oregon, USA.* A 3-octave spectral comb is generated in a hydrogen-filled hollow-core photonic-crystal-fiber. The spectrum consists of up to 45 high-order Stokes and anti-Stokes lines generated by coherent stimulated Raman scattering in the transient regime of amplification.

JFC3 • 11:00 a.m.
Dispersive Pulse Compression in Hollow-Core Photonic Bandgap Fibers, *Jesper Laegsgaard, Peter J. Roberts; Dept. of Communications, Optics and Materials, Technical Univ. of Denmark, Denmark.* Dispersive pulse compression in a hollow-core photonic bandgap fiber is studied numerically. The limits to peak power for high pulse quality arising from fiber nonlinearities are investigated, along with the validity of approximate scaling relations.

10:15 a.m.–12:00 p.m.
QFF • Coherent Control and Novel Lasers
Chih-Wei Lai; Michigan State Univ., USA, Presider

QFF1 • 10:15 a.m.
Ultrafast Carrier-Envelope-Offset Phase Control of Optical Rectification in Resonantly Excited Semiconductors, *Cole P. Van Vlack, Stephen Hughes; Queen's Univ., Canada.* Ultrashort pulse light-matter interactions in a semiconductor are theoretically investigated within the regime of resonant optical rectification. Using 5 fs pulse envelope areas of around 1.5-3 π, a single-shot dependence on carrier-envelope-offset phase.

QFF2 • 10:30 a.m.
Adaptive Control of Transient Vibrational Wave-Packet Motion by Using Chirped Pulse Sequences, *Kengo Horikoshi[1,2], Kazuhiko Misawa[1,2]; [1]Tokyo Univ. of Agriculture and Technology, Japan, [2]CREST, Japan Science and Technology Agency, Japan.* We applied adaptive pulse-shaping for real-time observation of coherently controlled wave-packet motions. Individual excitation of twisting and bending modes was successful in a cyanine dye molecule by using a chirped pulse sequence.

QFF3 • 10:45 a.m. Invited
Factoring Numbers with Interfering Random Waves, *Sébastien Weber, Beatrice Chatel, Bertrand Girard; Lab Collisions, Agrégats, Réactivité, CNRS, France.* We report on the successful operation of an analogue computer designed to factor numbers. A sequence of shaped femtosecond pulses is used to implement a Gauss sum. N = 1'340'333'404'807 has been successfully factorized.

10:15 a.m.–12:00 p.m.
JFD • High Harmonic Generation and Attosecond Physics I
Henry Kapteyn; Univ. of Colorado Boulder, USA, Presider

JFD1 • 10:15 a.m. Tutorial
The Physics of High-Order Harmonic Generation, *Anne L'Huillier; Lund Univ., Sweden.* This tutorial will describe the field of high-order harmonics in gases, including attosecond pulse generation.

Biography and photo not available.

10:15 a.m.–12:00 p.m.
CFJ • Nd Lasers
Timothy Carrig; Lockheed Martin Coherent Technologies, USA, Presider

CFJ1 • 10:15 a.m.
Quasi-Flat-Top - Frequency-Doubled Nd:Glass Laser for Pumping of High-Power Ti:Sapphire Amplifiers at 0.1 Hz Repetition Rate, *Victor P. Yanovsky[1], Galina Kalinchenko[1], Pascal Rousseau[1], Vladimir Chvykov[1], Gerard Mourou[2], Karl Krushelnik[1]; [1]Univ. of Michigan, USA, [2]Lab d'Optique Appliquée, Ecole Natl. Supérieure de Techniques Avancées, Ecole Polytechnique, France.* Nd:glass laser delivers up to 120 J-energy with flat-top profile at 0.1 Hz. The output is frequency doubled with 50% efficiency and used to pump Ti:sapphire. The developed design is perspective for ultra-high-intensity-laser development.

CFJ2 • 10:30 a.m.
High Energy Amplification of a Continuous Wave Mode-Locked Picosecond Nd:YVO_4 Laser by a Pulsed Grazing-Incidence Slab Amplifier, *Luca Carrà, Antonio Agnesi, Paolo Dallocchio, Federico Pirzio, Giancarlo Reali, Alessandra Tomaselli, Daniele Scarpa, Carla Vacchi; Univ. of Pavia, Italy.* A single pass, side pumped grazing incidence Nd:YVO_4 amplifier, optimized for minimum ASE noise, was used to increase the energy of 10-ps mode-locking seed pulses from 1 nJ to 210 μJ, with M^2=1.3.

CFJ3 • 10:45 a.m.
Watt-Level Single-Longitudinal-Mode, Tunable Dual-Wavelength, CW Nd:YVO_4 Laser, *Yen-Yin Lin[1], R. Y. Tu[1], T. D. Wang[1], S. T. Lin[1], A. C. Chiang[2], Y. H. Chen[3], Y. C. Huang[1]; [1]Inst. of Photonics Technologies, Natl. Tsinghua Univ., Taiwan, [2]Nuclear Science and Technology Development Ctr., Natl. Tsinghua Univ., Taiwan, [3]Inst. of Optical Sciences, Natl.Central Univ., Taiwan.* We report a watt-level, single-longitudinal-mode, tunable dual-wavelength, CW Nd:YVO_4 laser. The measured spectral widths and average power were 450 MHz, 1.2 W at 1064 nm and 400 MHz, 0.9 W at 1342 nm.

CFJ4 • 11:00 a.m.
Compact, High Peak Power, Passively Q-Switched Micro-Laser for Ignition of Engines, *Masaki Tsunekane[1], Takayuki Inohara[2], Akihiro Ando[2], Kenji Kanehara[2], Takunori Taira[3]; [1]Japan Science and Technology Agency, Japan, [2]Nippon Soken Inc., Japan, [3]Inst. for Moleculer Science, Japan.* Spark plug-size, passively Q-switched Cr:YAG/Nd:YAG micro-laser was developed for ignition of engines. Optical power intensity of >5TW/cm^2 was obtained at the focal point and the enhanced combustion for leaner gas mixture was realized.

10:15 a.m.–12:00 p.m.
CFK • QPM Devices
Takunori Taira; Laser Res. Ctr. for Molecular Science, Japan, Presider

CFK1 • 10:15 a.m.
Ultra-Broadband, High Gain, Polarization-Independent Optical Parametric Amplification in Type-II Quasi-Phase-Matched AlGaAs Waveguides, *Stevan S. Djordjevic, Nicolas K. Fontaine, S. J. B. Yoo; Univ. of California at Davis, USA.* We discuss a dispersion-managed non-birefringent type-II quasi-phase-matched (QPM) aluminum-gallium-arsenide (AlGaAs) waveguide, achieving 22.4 dB gain with ±0.5 dB uniformity across 334 nm-band centered at 1550 nm with 17 mW pump power.

CFK2 • 10:30 a.m.
Over 10W Single-Pass Second Harmonic Green Light Generation with Periodically Poled MgO Doped Congruent $LiNbO_3$, *Yasuhiro Satoh[1], Yasuhiro Higashi[1], Masaki Hiroi[1], Tsuyoshi Suzudo[1], Hideki Ishizuki[2], Takunori Taira[2]; [1]Ricoh Co. Ltd., Japan, [2]Inst. for Molecular Science, Japan.* 10.2W green light was generated by single pass SHG from quasi CW operated 33W microchip Nd:YVO_4 laser with periodically poled MgO-doped congruent lithium niobate (PPMgLN). PPMgLN length and thickness were 20mm and 1mm, respectively.

CFK3 • 10:45 a.m.
Development of Dual-Phase-Modulators Integrated QPM-SHG Waveguide—Equilateral/Inequilateral-Scheme, *Yuji Oki, Hirofumi Watanabe, Tatsuo Okada; Graduate School of Information Science and Electrical Engineering, Kyushu Univ., Japan.* Novel waveguided PPLN-SHG device was demonstrated. Two types of dual-phase modulated PPLN device were fabricated and investigated. Inequilateral-type was similar to previously reported. Equilateral-type was newly proposed and demonstrated for first time.

CFK4 • 11:00 a.m.
Monolithically Integrated Laser Bragg Q-Switch and Wavelength Converter in a PPLN Crystal, *Shoutai Lin[1], Guwywu Chang[1], YenYin Lin[1], Yenchieh Huang[1], A. C. Chian[1], Y. H. Chen[2]; [1]Natl. Tsing Hua Univ., Taiwan, [2]Natl. Central Univ., Taiwan.* We report a PPLN crystal with a built-in electro-optic Bragg grating for both temperature-insensitive laser Q-switching and temperature-tuned wavelength conversion with 35% parametric efficiency from 1064 nm to mid-infrared wavelengths between 1440 and 2750 nm.

Room J3

CLEO

10:15 a.m.–12:00 p.m.
CFL • Bismuth-Based Fiber Devices
Robert Jopson; Alcatel-Lucent, USA, Presider

CFL1 • 10:15 a.m.
Narrowband and Tunable Parametric Amplification in Bismuth-Oxide-Based Highly Nonlinear Fiber, *Kyota Seki, Shinji Yamashita; Univ. of Tokyo, Japan.* We have experimentally, for the first time, demonstrated one-pump optical fiber parametric amplification (OPA) in Bismuth-Oxide-based highly nonlinear fiber (Bi-HNLF), and realized narrowband (0.75nm) and tunable gain spectrum as high as 58dB.

CFL2 • 10:30 a.m.
Bi_2O_3-Based Erbium Doped Fiber Laser with over 130 nm Tunable Range, *Seiki Ohara, Tomoharu Hasegawa, Naoki Sugimoto; Asahi Glass Co. Ltd., Japan.* We have demonstrated Bi_2O_3-based Erbium doped fiber ring laser. Only 0.2-m of BIEDF as a gain media shows 134 nm tunable range and high signal-to-noise ration over 70 dB for 120 nm tunable range.

CFL3 • 10:45 a.m. Invited
Bi_2O_3-Based Fiber for Highly Nonlinear Applications, *Naoki Sugimoto, Tatsuo Nagashima, Tomoharu Hasegawa, Seiki Ohara; Asahi Glass Co. Ltd., Japan.* We have fabricated Bi_2O_3-based microstructured fiber using a novel method. It was experimentally revealed that this fiber shows nonlinearlity ~ 780 $W^{-1}km^{-1}$ and GVD ~ -25 ps/nm/km simultaneously.

Marriott San Jose Salon 1 and 2

CLEO

10:15 a.m.–12:00 p.m.
CFM • Optical Coherence Tomography
Brian E. Applegate; Texas A&M Univ., USA, Presider

CFM1 • 10:15 a.m.
Noninvasive Assessment of Optical Clearing of Epithelial Tissues with OCT, *Mohamad G. Ghosn[1], Esteban F. Carbajal[1], Natasha A. Befrui[1], Valery V. Tuchin[2], Kirill V. Larin[1,2]; [1]Univ. of Houston, USA, [2]Saratov State Univ., Russian Federation.* Selective translucence of epithelial tissues is key technique for imaging in highly scattering media. Here we demonstrate capability of OCT for noninvasive and depth-resolved quantification of tissue optical clearing by application of various hyperosmotic agents.

CFM2 • 10:30 a.m.
Optical Coherence Tomography Imaging with k-Space Linear Fourier Domain Mode Locked Lasers, *Christoph M. Eigenwillig, Benjamin R. Biedermann, Robert Huber; Ludwig-Maximilians-Univ. München, Germany.* We report on a Fourier Domain Mode Locked wavelength swept laser source with a highly linear time-frequency sweep characteristic and demonstrate OCT imaging without k-space resampling prior to Fourier transformation with this source.

CFM3 • 10:45 a.m.
Characterization of Wavelength Swept Laser for Optical Coherence Tomography Imaging, *Min Yong Jeon[1,2], Jun Zhang[1], Qiang Wang[1], Zhongping Chen[1,3]; [1]Beckman Laser Inst., Univ. of California at Irvine, USA, [2]Chung Nam Natl. Univ., Republic of Korea, [3]Dept. of Biomedical Engineering, Univ. of California at Irvine, USA.* We report the characteristics of wavelength swept laser with scanning fiber Fabry-Perot filter in the 1300 nm. We investigate the dependence of the scanning frequencies of the conventional and Fourier domain mode-locked wavelength swept laser.

CFM4 • 11:00 a.m.
Real-Time Optical Coherence Tomography Based on Linearly Stretched Pulse Interference, *Tae-Jung Ahn, Yongwoo Park, Jean-Claude Kieffer, José Azaña; Enérgie, Matériaux et Télécommunications, Inst. Natl. de la Res. Scientifique, Canada.* We demonstrate ultrahigh-speed optical coherence tomography (OCT) imaging (at 5,000,000 A-lines/s) of biological samples using a recently introduced stretched-pulse interference technique with significantly improved performances in terms of sensitivity (-82dB) and resolution (42-μm).

Marriott San Jose Salon 3

QELS

10:15 a.m.–12:00 p.m.
QFG • Photonic Crystals: Waveguides and Cavities
Presider to Be Announced

QFG1 • 10:15 a.m.
One-Way Waveguides in Photonic Crystals and Back-Scattering Suppression, *Zheng Wang, Yidong Chong, John Joannopoulos, Marin Soljačić; MIT, USA.* A broadband one-way waveguide is numerically demonstrated at the surface of a 2-D magneto-optical photonic crystal containing Yttrium-Iron-Garnet. The strong time-reversal breaking results in the absence of backward-propagating modes and scattering-immune transmission across strong scatters.

QFG2 • 10:30 a.m.
A Hydrogen Sensor Based on Metallic Photonic Crystal Slabs, *Dietmar Nau[1,2], Regina B. Orzekowsky[1,3], Andreas Seidel[1,3], Todd P. Meyrath[1], Harald Giessen[1]; [1]Univ. Stuttgart, Germany, [2]Univ. of Bonn, Germany, [3]Max-Planck-Inst. für Festkörperforschung, Germany.* A hydrogen sensor based on a metallic photonic crystal using gold and WO_3 is presented. Hydrogen exposure influences the optical properties of this device by gasochromic mechanisms with a theoretical limit in the sub-1000-ppm-range.

QFG3 • 10:45 a.m.
Trench Waveguide in Photonic Crystal Slab, *Alexey G. Yamilov, Mark Herrera; Missouri Univ. of Science and Technology, USA.* We show that trench defect in a photonic crystal slab leads to efficient wave-guiding. Based on trench-waveguide geometry, slow-light devices and coupled-cavity micro-resonator arrays can be fabricated with scalable (holographic) photolithography avoiding electron-beam lithography.

QFG4 • 11:00 a.m.
Experimental Observation of Rabi Oscillations in a One-Dimensional Photonic Lattice, *Ksenia Shandarova[1], Christian E. Rüter[1], Rong Dong[1], Detlef Kip[1], Konstantinos G. Makris[2], Demetrios N. Christodoulides[2], Or Peleg[3], Moti Segev[3]; [1]Clausthal Univ. of Technology, Germany, [2]CREOL, School of Optics, Univ. of Central Florida, USA, [3]Technion - Israel Inst. of Technology, Israel.* We observe Rabi oscillations in one-dimensional waveguide arrays. Adiabatic transitions, both direct and indirect (phonon-assisted), between extended Floquet-Bloch modes associated with different bands are stimulated by index-gratings inducing periodic modulations along the propagation direction.

Marriott San Jose Salon 4

CLEO

10:15 a.m.–12:00 p.m.
CFN • Optofluidics
David D. Nolte; Purdue Univ., USA, Presider

CFN1 • 10:15 a.m. Invited
Photonic Crystal Optofluidics for High Throughput Biosensing, *Charles J. Choi, Brian T. Cunningham; Univ. of Illinois at Urbana-Champaign, USA.* Photonic crystal reflectance filters are co-fabricated/integrated with microfluidic channels that enable selective tuning of resonant reflectance spectra on flexible, transparent plastic substrates. Label-free biodetection within the fluid network is demonstrated as an exemplary application.

CFN2 • 10:45 a.m.
Polymer Photonic Crystal Band Edge Lasers for Evanescent Wave Sensing, *Mads B. Christiansen, Felipe Bernal Arango, Morten Gersborg-Hansen, Anders Kristensen; MIC-Dept. of Micro and Nanotechnology, Technical Univ. of Denmark, Denmark.* Two effects of optofluidic tuning of polymer photonic crystal bandedge lasers are demonstrated. Symmetry modification alters emission directions, and the intensities of these signals depend on cladding index. The wavelength also depends on cladding index.

CFN3 • 11:00 a.m.
UV Written Evanescent Devices Fabricated in Micro-Structured Substrates for Optofluidics, *James C. Gates, Christopher Holmes, Benjamin D. Snow, Corin B. E. Gawith, Peter G. R. Smith; Optoelectronics Res. Ctr., Univ. of Southampton, UK.* We report our recent developments in micro-structured evanescent devices. Micro-machining prior to direct UV writing of channel waveguides provides additional flexibility to fabricate evanescent interacting devices such as modulators and sensors, which allow adiabatic operation.

10:15 a.m.–12:00 p.m.
CFO • Nano Fabrication Techniques and Novel Material

Siegfried Janz; Natl. Res. Council Canada, Canada, Presider

CFO1 • 10:15 a.m.
Fabrication and Investigation of Photonic Crystal Device with MEMS Activated Defects Insertion, *Monica A. Taysing-Lara, Gerard Dang, Stefan Svensson, Weimin Zhou; ARL, USA.* A GaAs/AlGaAs-based photonic-crystal device with MEMS activated insertion/removal of defect posts into/from sub-micron photonic-crystal holes has been fabricated and investigated. This allows the device to actively create/remove point resonators or waveguides in the photonic-crystal membrane.

CFO2 • 10:30 a.m.
Fabrication of Nanophotonic Circuit Components by Thermal Nano Imprint Lithography, *Stijn Scheerlinck[1], Rasmus H. Pedersen[2], Pieter Dumon[1], Wim Bogaerts[1], Ulrich Plachetka[3], Dries Van Thourhout[1], Roel Baets[1], Anders Kristensen[2]; [1]IMEC-Ghent Univ., Belgium, [2]MIC-Dept. of Micro and Nanotechnology, Technical Univ. of Denmark, Denmark, [3]Advanced Microelectronic Ctr. Aachen, Germany.* Nanophotonic components are fabricated using thermal nano imprint lithography (NIL). A silicon-on-insulator Mach-Zehnder interferometer with 20 dB extinction ratio is demonstrated. Grating couplers fabricated by a two-step imprint process demonstrate over 14% coupling efficiency.

CFO3 • 10:45 a.m.
Transmission Properties of Selectively Gold-Filled Polarization-Maintaining PCF, *Howard W. Lee, Markus A. Schmidt, Hemant Tyagi, Luis Prill Sempere, Philip St.J. Russell; Max Planck Res. Group, Univ. of Erlangen-Nuremberg, Germany.* We report on the optical properties of a polarization-preserving PCF in which two enlarged hollow channels on opposite sides of the core are filled with gold. Surface plasmon resonances and intriguing polarisation effects are observed.

CFO4 • 11:00 a.m.
Polarization Properties of PCF with Ge-Nanowire, *Markus A. Schmidt, Hemant Tyagi, Luis Prill Sempere, Philip St. J. Russell; Max Planck Res. Group, Univ. of Erlanger-Nuremberg, Germany.* A broad-band in-fiber polarizer with suppression >25dB over 300nm bandwidth is reported. It is made by introducing a high quality Ge nanowire into one of the hollow channels of a photonic crystal fiber.

NOTES

Ballroom A1 and A8	Ballroom A2 and A7	Ballroom A3 and A6	Ballroom A4 and A5
QELS		CLEO	JOINT

QFD • Random Lasers—Continued

QFD4 • 11:15 a.m.
Experimental Study of Instability in Random Lasers, *G. Zhu, W. L. Lundy, M. A. Noginov; Norfolk State Univ., USA.* We have experimentally studied the pulse-to-pulse instability in $Nd:Sc_3(BO_3)_4$ random laser. The increase of the instability at the threshold and its reduction at further increase of pumping is in line with the theoretical predictions.

QFD5 • 11:30 a.m.
Random Laser with Ultra-High Concentration of Dye, *J. K. Kitur, G. Zhu, M. Bahoura, M. A. Noginov; Norfolk State Univ., USA.* We have studied stimulated emission in rhodamine 6G-TiO_2 random laser. The minimal threshold has been found at ultra-high concentrations of both dye and TiO_2 nanoparticles.

QFD6 • 11:45 a.m.
Information with Light in Random Media from Spatial Speckle Correlations over Excitation Position, *Zhenyu Wang, Kevin J. Webb; Purdue Univ., USA.* We demonstrate that the spatial correlation of speckle intensity patterns over the source excitation position is sensitive to polarization, scatter, and source arrangement. This should prove important for sensing in the presence of scatter.

QFE • Entangled Photon Sources I—Continued

QFE5 • 11:15 a.m.
Microstructure-Fiber-Based Source of High-Flux Hyperentangled Photon-Pairs, *Jun Chen[1,2], Jingyun Fan[1,2], Matthew D. Eisaman[1,2], Alan Migdall[1,2]; [1]Natl. Inst. of Standards and Technology, USA, [2]Joint Quantum Inst., Univ. of Maryland, USA.* We generate hyperentangled (time-bin and polarization) photon-pairs using a microstructure-fiber Sagnac interferometer. Two-photon interference visibilities in both degrees of freedom are > 84%, and Bell's inequality is violated by 27 σ at 1-kHz coincidence rate.

QFE6 • 11:30 a.m.
Absolute Emission Rates of Spontaneous Parametric Down Conversion into a Single Transverse Gaussian Mode, *Alexander Ling, Antia Lamas-Linares, Christian Kurtsiefer; Natl. Univ. of Singapore, Singapore.* We provide expressions that give the maximum observable emission rate of photon pairs produced in SPDC when all interacting fields are in a single transverse Gaussian mode.

QFE7 • 11:45 a.m.
Single Crystal Source of Polarization Entangled Photons at Non-Degenerate Wavelengths, *Sebastien Sauge, Marcin Swillo, Guilherme Xavier, Maria Tengner, Anders Karlsson; KTH, Royal Inst. of Technology, Sweden.* We demonstrate a bright, narrowband, compact single-crystal source of polarization entangled photon pairs at non-degenerate wavelength. This work is instrumental for quantum key distribution and entanglement transfer from photonic to atomic qubits.

CFI • Ultrafast Oscillators I—Continued

CFI5 • 11:30 a.m.
Low-Repetition-Rate Femtosecond Operation in Long Cavity Modelocked Yb:CALGO Laser, *Justine Boudeile[1], Dimitris Papadopoulos[1], Frédéric Druon[1], Marc Hanna[1], Patrick Georges[1], Pierre-Olivier Petit[2], Philippe Goldner[2], Bruno Viana[2]; [1]Lab Charles Fabry de l'Inst. d'Optique, France, [2]Lab de Chimie de la Matière Condensée de Paris, France.* We report on long-cavity modelocked laser with Yb:CALGO crystal, with, first, a 27-MHz, sub 100-fs single-pulse regime and, second, a very atypical double-pulse dual-wavelength femtosecond regime.

CFI6 • 11:45 a.m.
Low Timing-Jitter High Repetition-Rate Femtosecond Pulse Trains via Locking to External Fabry-Perot Cavities, *Jian Chen, Jason W. Sickler, Erich P. Ippen, Franz X. Käertner; MIT, USA.* Generation of low timing-jitter 150-fs pulse trains at 1560 nm with 2 GHz repetition rate is demonstrated by locking a fundamentally mode-locked 200 MHz fiber laser to a high finesse (F=2000) external Fabry-Perot cavity.

JFC • Joint CLEO/QELS Symposium on Hollow-Core Photonic-Crystal Fibers II—Continued

JFC4 • 11:15 a.m.
Compression of Picosecond Optical Pulses in Tapered Hollow-Core Photonic Bandgap Fiber, *Kevin Cook, Mathew G. Welch, Frederic Gérôme, Alan K. George, William J. Wadsworth, Jonathan C. Knight; Univ. of Bath, UK.* We demonstrate nonlinear compression of 2.5ps and 1.2ps laser pulses at 800nm wavelength using a 35m tapered hollow-core photonic bandgap fiber with continuously decreasing dispersion.

JFC5 • 11:30 a.m.
Tapered Hollow-Core Photonic Crystal Fiber for Cascaded Stimulated-Raman-Scattering, *Benoît Beaudou[1,2], François Couny[1], Ying Ying Wang[1], Philip Stephen Light[1], Fetah Benabid[1]; [1]Univ. of Bath, UK, [2]XLIM, Unite Mixte de Recherche, Ctr. Natl. de la Recherche Scientifique, Univ. de Limoges, France.* We report on the fabrication of a tapered hollow-core photonic crystal fiber with a transition-length as long as 40m for cascaded Stimulated-Raman-Scattering applications. The structural and optical characterization demonstrates the linearity of the taper.

JFC6 • 11:45 a.m.
Large Pitch Hollow Core Honeycomb Fiber, *Benoît Beaudou[1,2], François Couny[1], Fetah Benabid[1], Peter John Roberts[3]; [1]Univ. of Bath, UK, [2]XLIM, Unite Mixte de Recherche, Ctr. Natl. de la Recherche Scientifique, Univ. de Limoges, France, [3]Dept. of Communications, Optics and Materials, Technical Univ. of Denmark, Denmark.* A new kind of hollow core photonic crystal fiber (HC-PCF) for broadband guidance is introduced. Structural and optical properties of a fabricated example are detailed.

12:00 p.m.–1:30 p.m., Lunch Break *(on your own)*

QFF • Coherent Control and Novel Lasers—Continued

QFF4 • 11:15 a.m.
Coherence Properties and Photon Statistics of Quantum-Dot Based Microcavity Lasers, *Jan Wiersig, Christopher Gies, Sandra Ritter, Frank Jahnke; Inst. for Theoretical Physics, Univ. of Bremen, Germany.* We present results of a microscopic theory for the photon correlation functions $g^{(1)}(\tau)$ and $g^{(2)}(\tau)$ describing the first-order coherence and the photon statistics of quantum-dot-based microcavity lasers with large spontaneous emission coupling.

QFF5 • 11:30 a.m.
Two-/Three-Photon Pumped Ultraviolet Nanorod Lasers, *Chunfeng Zhang, Fan Zhang, Jian Xu; Dept. of Engineering Science and Mechanics, Penn State Univ., USA.* With femtosecond-pulse excitation, two- and three-photon absorption induced ultraviolet lasing with spectral linewidth 0.2-1 nm have been realized under very low excitation threshold from ZnO nanorod arrays at both room and liquid nitrogen temperatures.

QFF6 • 11:45 a.m.
An Organic Laser in the Monomolecular Regime, *Francesco Quochi[1], Michele Saba[1], Fabrizio Cordella[1], Agnieszka Gocalinska[1], R. Corpino[1], M. Marceddu[1], A. Anedda[1], A. Andreev[2], H. Sitter[3], N. S. Sariciftci[4], Andrea Mura[1], Giovanni Bongiovanni[1]; [1]Dept. di Fisica, Univ. di Cagliari, Italy, [2]Inst. of Physics, Univ. Leoben, Austria, [3]Inst. for Semiconductor and Solid State Physics, Univ. Linz, Austria, [4]Linz Inst. for Organic Solar Cells, Univ. Linz, Austria.* We demonstrated laser action in the regime of linear recombination of singlet excitons in para-sexiphenyl crystalline films in the form of nanofibers under optical excitation with femto- and nanosecond pulses.

JFD • High Harmonic Generation and Attosecond Physics I—Continued

JFD2 • 11:15 a.m.
All-Optical Quasi-Phase Matching and Quantum Path Selection of High-Order Harmonic Generation at 140 eV Using Counterpropagating Light, *Amy L. Lytle, Xiaoshi Zhang, Paul Arpin, Oren Cohen, Margaret M. Murnane, Henry C. Kapteyn; JILA and Dept. of Physics, Univ. of Colorado, USA.* We extend all-optical quasi-phase matching of high harmonic generation to 140-150 eV, where conventional phase matching is not possible. We also demonstrate, and present a model for, selective enhancement of a single quantum trajectory.

JFD3 • 11:30 a.m.
Interferometric Measurement of High-Order Harmonic Fields with Attosecond Temporal Resolution, *Toshihiko Shimizu, Yasuo Nabekawa, Eiji J. Takahashi, Katsumi Midorikawa; RIKEN, Japan.* We demonstrate interferometric spectroscopy of high-order harmonic fields with a resolution of the XUV optical period. In addition, we obtain an interferometric fringe of an attosecond pulse train by reconstruction from these harmonic fields.

JFD4 • 11:45 a.m.
Complete Characterization of High Harmonic Pulses by Photoelectron Spectral Shearing Interferometry, *Eisuke Haraguchi, Tatsuya Okamoto, Takashi Tanigawa, Mikio Yamashita, Taro Sekikawa; Dept. of Applied Physics, Hokkaido Univ., Japan.* The complete characterization of the 19th harmonic of Ti:sapphire laser was demonstrated using the photoelectron spectral shearing interferometry for the first time. The frequency chirp of a harmonic pulse was sensitively detected by this method.

CFJ • Nd Lasers—Continued

CFJ5 • 11:15 a.m.
Passively Q-Switched Nd:YLF Laser in a D-Rod Configuration, *Bhabana Pati, Kevin F. Wall, Yelena Isyanova, Peter F. Moulton; Q Peak, Inc., USA.* We have developed a compact, efficient, passively Q-switched, solid-state-laser, producing 7-mJ, < 10 ns pulses, and a near TEM_{00} beam. The cross section of the laser crystal was D-shaped and it was side pumped.

CFJ6 • 11:30 a.m. Invited
Low Wavelength Emissions with Nd Doped Lasers, *Marc Castaing[1,2], Emilie Herault[1], François Balembois[1], Patrick Georges[1]; [1]Lab Charles Fabry de l'Inst. d'Optique, Ctr. Natl. de la Recherche Scientifique, Univ. Paris-Sud, France, [2]Oxxius SA, France.* We report the first demonstration of true three level laser emission in diode-pumped Nd doped vanadate and YAG crystals. Wavelengths ranging from 900 to 869 nm open new doors to deeper blue emissions by SHG.

CFK • QPM Devices—Continued

CFK5 • 11:15 a.m.
Group Velocity Mismatch and Third-Order Nonlinearities in Domain-Disordered Quasi-Phase Matching Waveguides, *Ahmed Al Muhairi, Sean J. Wagner, J. Stewart Aitchison, A. S. Helmy; Univ. of Toronto, Canada.* Simulations show that group-velocity-mismatch and third-order effects reduce second harmonic generation efficiency by 23% and 33%, respectively, in GaAs/AlAs superlattice waveguide. Also, optimal waveguide lengths were found to be longer than the walkoff length.

CFK6 • 11:30 a.m.
Efficient Second-Harmonic Generator and Electro-Optic Polarization-Mode Converter in Single Aperiodically Poled Lithium Niobate, *Cheng-Liang Chang, Wei-Wen Chen, Chao-Hung Lin, Yen-Hung Chen; Dept. of Optics and Photonics, Natl. Central Univ., Taiwan.* We report the first attempt on constructing an *aperiodically* poled $LiNbO_3$ for optimally integrating dual nonlinear-optical devices. >50% second-harmonic-generation conversion efficiency enhancement over a conventional cascaded *periodically* poled $LiNbO_3$ is obtained with such a device.

CFK7 • 11:45 a.m.
Angular Quasi-Phase-Matching in MgO:PPLN, *Yannick Petit[1], Benoit Boulanger[1], Patricia Segonds[1], Pierre Brand[1], Corinne Felix[1], Bertrand Menaert[1], Hideki Ishizuki[2], Takunori Taira[2]; [1]Inst. Néel, Ctr. Natl. de la Recherche Scientifique, Univ. J. Fourier, France, [2]Inst. for Molecular Science, Japan.* We show that quasi-phase-matching corresponding to a propagation in a periodically poled non linear medium at any angle with the grating vector provide wider wavelength tuneability and spectral acceptance. The case of MgO:PPLN is studied.

12:00 p.m.–1:30 p.m., Lunch Break *(on your own)*

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

CFL • Bismuth-Based Fiber Devices—Continued

CFL4 • 11:15 a.m.
Bismuth-Doped Fiber Laser at 1.16 µm, *Seongwoo Yoo, Mridu P. Kalita, Jayanta K. Sahu, Johan Nilsson, David Payne; Optoelectronic Res. Ctr., Univ. of Southampton, UK.* We used a bismuth-doped fiber with high pump absorption, 1.2 dB/m, to make a short (25 m) Bi-fiber laser at 1.16 µm with 10% efficiency. We discuss the influence of host glass and unsaturable absorption.

CFL5 • 11:30 a.m.
Singlemode Crystalline Fibers for the Middle Infrared, *Leonid Butvina, Olesya V. Sereda, Andrey G. Okhrimchuk, Alexey L. Butvina, Eugeny M. Dianov, Ninel V. Lichkova, Vladimir N. Zagorodnev; Fiber Optics Res. Ctr., Russian Acad. of Sciences, Russian Federation.* Microstructured and step-index fibers from silver halides singlemode at 10.6 µm and 5.5 µm are demonstrated. Experimental and theoretical evidences are presented to establish that the fibers are singlemode at 10.6 µm.

CFL6 • 11:45 a.m.
Pulsed Raman Conversion to 2.14 µm by Means of a Thulium-Doped Fiber Laser and a GeO_2 Fiber, *Delphine Gruppi[1], Antoine Hirth[1], Pierre Pfeiffer[2]; [1]French-German Res. Inst. of Saint-Louis ISL, France, [2]Lab des Systèmes Photoniques, Univ. Louis Pasteur Strasbourg, Ecole Natl. Supérieure de Physique, France.* Pulsed Raman conversion to 2.14 µm is reported. Peak Stokes power of 210 W (400 mW average) at 30 kHz with a slope efficiency of 62 % in a GeO_2-doped fiber is demonstrated.

CFM • Optical Coherence Tomography—Continued

CFM5 • 11:15 a.m.
Time-Gated Infrared Fourier-Domain Optical Coherence Tomography, *Matthew S. Muller, James M. Fraser; Queen's Univ., Canada.* By combining incoherent time gating (sum-frequency mixing) with coherent gating (optical coherence tomography), we process light backscattered from a sample in the optical domain to improve imaging contrast by 29 dB.

CFM6 • 11:30 a.m.
***In situ* Frog Retina Imaging Using Common-Path OCT with a Gold-Coated Bare Fiber Probe,** *Jae-Ho Han, Scott Hendrickson, Jin U. Kang; Johns Hopkins Univ., USA.* We have demonstrated *in situ* imaging of a frog retina and the surrounding tissue using common-path optical coherence tomography with a gold-coated bare fiber probe which shows no image degradation when operating in vitreous humor/saline solution.

CFM7 • 11:45 a.m.
Measurement of the Oxygenation Level of Hemoglobin with Spectroscopic Spectral-Domain Optical Coherence Tomography, *Cheng-Kuang Lee, Chih-Wei Lu, Meng-Tsan Tsai, Yih-Ming Wang, C. C. Yang; Natl. Taiwan Univ., Taiwan.* We report the measurement of hemoglobin oxygen saturation level in human blood with a spectroscopic spectral-domain optical coherence tomography system based on the cross-over behavior of Hb and HbO_2 absorption coefficients around 800 nm.

QFG • Photonic Crystals: Waveguides and Cavities—Continued

QFG5 • 11:15 a.m.
Maximum Scaling of Second-Harmonic Generation in One-Dimensional Photonic Crystals, *Marco Liscidini[1,2], Andrea Locatelli[3], Costantino De Angelis[3], Lucio Claudio Andreani[2]; [1]Univ. of Toronto, Canada, [2]Univ. of Pavia, Italy, [3]Univ. of Brescia, Italy.* We demonstrate maximum scaling of second-harmonic generation as the eighth power of the photonic crystal length without phase matching (PM). This result challenges a commonly held view regarding the necessity of PM for large scaling.

QFG6 • 11:30 a.m.
Coupled Resonant Modes of Dual L3-Defect Planar Photonic Crystal Cavities, *Sang Lam[1], Alexander R. A. Chalcraft[1], Dominik Szymanski[1], Ruth Oulton[1], Ben D. Jones[1], Daniele Sanvitto[1], David M. Whittaker[1], Mark Fox[1], Maurice S. Skolnick[1], David O'Brien[2], Thomas F. Krauss[2], Hui-yun Liu[1], Paul W. Fry[1], Mark Hopkinson[1]; [1]Univ. of Sheffield, UK, [2]Univ. of St. Andrews, UK.* We present the realization of 2-D photonic crystal cavities with a dual L3-defect geometry. The experimental results show consistent and predictable splitting of the fundamental modes and reveal clear evidence for strong cavity-cavity coupling.

QFG7 • 11:45 a.m.
Observation of Broadband Self-Collimation in fs Laser-Written Waveguide Arrays, *Alexander Szameit[1], Ivan L. Garanovich[2], Matthias Heinrich[1], Andrey A. Sukhorukov[2], Felix Dreisow[1], Thomas Pertsch[1], Stefan Nolte[1], Andreas Tünnermann[1], Yuri S. Kivshar[2]; [1]Inst. of Applied Physics, Friedrich-Schiller-Univ. Jena, Germany, [2]Nonlinear Physics Ctr. and Ctr. for Ultra-High Bandwidth Devices for Optical Systems (CUDOS), Australia.* We report on the first experimental observation of self-collimation of white-light beams in specially designed fs laser-written curved waveguide arrays, where discrete diffraction was suppressed over the spectral range extending from blue to infrared wavelengths.

CFN • Optofluidics—Continued

CFN4 • 11:15 a.m.
Side-Detection of Out-Coupled Core Light from a Microfluidic Fiber Microslit, *Yicheng Lai[1], J. Petrovic[1], T. Butler[2], K. Sugden[1], I. Bennion[1]; [1]Aston Univ., UK, [2]Fiberlogix Ltd, UK.* The interactions of the core-propagating light with an intersecting microslit within a conventional single-mode fiber are investigated. Orientation-dependent out-coupling of core light was utilized to create side-detection, miniature fiber rotation sensors.

CFN5 • 11:30 a.m.
Fluid-Filled Tunable Mold for Polymer Lenses, *Sung Hwan Cho[1], Frank S. Tsai[2], Robert Vasko[3], Jeff Vasko[3], Yu-Hwa Lo[2]; [1]Materials Science and Engineering Program, Jacobs School of Engineering, Univ. of California at San Diego, USA, [2]Electrical and Computer Engineering Dept., Jacobs School of Engineering, Univ. of California at San Diego, USA, [3]Rhevision Technology, Inc., USA.* Polymer lenses were fabricated using a fluid-filled tunable molding process providing a simple and cost-effective way to control lens curvature and shape. This approach enables fast prototyping and shortens the design cycle for optical systems.

CFN6 • 11:45 a.m.
Micro-Concentrator for Vanadium Nanorods by Efficient Light-Induced Convective Flow, *Benjamin K. Wilson, Xiaoyu Miao, Lih Y. Lin; Univ. of Washington, USA.* Avalanche concentration, a long-range accumulation of particles around a laser spot in a liquid sample, is demonstrated and characterized for VO_2 nanorods. The effect is found to be caused by efficient heating of VO_2 nanorods.

12:00 p.m.–1:30 p.m., Lunch Break *(on your own)*

CFO • Nano Fabrication Techniques and Novel Material—Continued

CFO5 • 11:15 a.m.
Electro-Optic Polymer Microring Resonators Based on Charon Coupler Design, *Daniele Rezzonico, Mojca Jazbinsek, Andrea Guarino, Peter Gunter; ETH Zurich, Switzerland.* We propose and demonstrate a new type of electro-optic microresonators, where the shape of the transmission spectrum is controlled by losses and phase-shifts induced at the asymmetric coupler between the cavity and the bus waveguide.

CFO6 • 11:30 a.m.
Coherent Control of Thermal Emission from SiC due to Coupled Resonant Cavity Structure, *Nir Dahan, Avi Niv, Gabriel Biener, Yuri Gorodetski, Vladimir Kleiner, Erez Hasman; Technion-Israel Inst. of Technology, Israel.* Coherent thermal emission from an anisotropic microstructure upon SiC is presented. The enhanced coherency is due to coupled resonant cavities supported by surface phonon-polaritons. A quality-factor 600 and an angular divergence of 1.4mrad are obtained.

CFO7 • 11:45 a.m.
Fiber Taper Coupling to Chalcogenide Microsphere Modes, *Christian Grillet, Eric Magi, Benjamin E. Eggleton; Ctr. for Ultrahigh-Bandwidth for Optical Sciences, School of Physics, Univ. of Sydney, Australia.* We report the manufacturing and optical characterization of microspheres in chalcogenide. We show that high-Q modes of a 9.2 μm diameter chalcogenide glass can be efficiently excited using a silica tapered fiber.

12:00 p.m.–1:30 p.m.
Lunch Break *(on your own)*

NOTES

Ballroom A1 and A8	Ballroom A2 and A7	Ballroom A3 and A6	Ballroom A4 and A5
QELS		CLEO	JOINT

1:30 p.m.–3:15 p.m.
QFH • Photonic Crystals: Control
Jelena Vuckovic; Stanford Univ., USA, Presider

QFH1 • 1:30 p.m.
Catch and Release of Optical Pulses by Dynamic Q Control of a Photonic Crystal Nanocavity, *Jeremy Upham, Yoshinori Tanaka, Takashi Asano, Susumu Noda; Kyoto Univ., Japan.* We demonstrate catching and releasing of optical pulses by dynamic Q factor control of a photonic crystal nanocavity. Optical pulses are caught and released on demand within the photon lifetime.

QFH2 • 1:45 p.m.
Tuning Coherent Radiative Thermal Conductance in Multilayer Photonic Crystals, *Wah Tung Lau, Jung-Tsung Shen, Georgios Veronis, Shanhui Fan; Stanford Univ., USA.* Photonic crystals can be used to drastically influence coherent radiative thermal conductance. In a multilayer crystal, radiative thermal conductance can transit from above to below vacuum value when temperature increases, due to photonic band effects.

QFH3 • 2:00 p.m.
Coherent Control of Ultra-High Frequency Acoustic Resonances in Photonic Crystal Fibers, *Gustavo S. Wiederhecker[1,2], Andre Brenn[2], Hugo L. Fragnito[1], Philip St. J. Russell[2]; [1]Inst. de Fisica, Univ. Estadual de Campinas, Brazil, [2]Max-Planck Res. Group, Inst. of Optics, Information and Photonics, Univ. of Erlangen-Nuremberg, Germany.* Acoustic resonances trapped within the core (1 μm diameter) of a photonic crystal fibre are excited electrostrictively using laser pulses. Using pulse sequences we achieve coherent control leading to a 100-fold increase in their amplitude.

QFH4 • 2:15 p.m.
Experimental Demonstration of Photonic Bandgap Tuning in Mixed Photonic Crystals, *Hee J. Kim[1], Dong-Uk Kim[1], Jaejun Yu[1], Heonsu Jeon[1], Q-Han Park[2]; [1]Seoul Natl. Univ., Republic of Korea, [2]Korea Univ., Republic of Korea.* We experimentally demonstrated that the photonic bandedges of a mixed photonic crystal system shift monotonically as the mixing composition ratio is varied. Results are in excellent agreement with the virtual crystal approximation.

1:30 p.m.–3:15 p.m.
QFI • Entangled Photon Sources II
Franco N. Wong; MIT, USA, Presider

QFI1 • 1:30 p.m.
Generation of Uncorrelated Photon-Pairs in an Optical Fiber, *Offir Cohen, Jeff S. Lundeen, Graciana Puentes, Brian J. Smith, Peter J. Mosley, Ian A. Walmsley; Univ. of Oxford, UK.* We demonstrate experimentally the realization of heralded pure photons generation in a birefringent optical fiber.

QFI2 • 1:45 p.m.
All-Fibre Source of Heralded Single Photons at 1550nm, *Chunle Xiong[1], Alex R. McMillan[1], Olivier Alibart[2], Jeremie Fulconis[3], John G. Rarity[3], William J. Wadsworth[1]; [1]Univ. of Bath, UK, [2]Univ. of Nice Sophia Antipolis, France, [3]Univ. of Bristol, UK.* We demonstrate a bright fibre source of heralded single photons at 1550nm with detected rates greater than 10 kilocounts per second. Photon generation and separation is performed in spliced fibre components.

QFI3 • 2:00 p.m.
Paper Withdrawn

QFI4 • 2:15 p.m. Invited
Fiber-Based Two-Photon Sources for Quantum Information, *Alan Migdall[1,2], Jingyun Fan[1,2]; [1]NIST, USA, [2]Joint Quantum Inst., Univ. of Maryland, USA.* We review the merits of using fiber as a nonlinear media for production of correlated and entangled photon pairs for quantum information applications and we present history, status and fruits of efforts in this area.

1:30 p.m.–3:15 p.m.
CFP • Ultrafast Oscillators II
Presider to Be Announced

CFP1 • 1:30 p.m.
Femtosecond Thin Disk Lasers with >10 μJ Pulse Energy, *Thomas Südmeyer, Sergio V. Marchese, Cyrill R. Baer, Shigeki Hashimoto, Anna G. Engqvist, Matthias Golling, Deran J. H. C. Maas, Ursula Keller; ETH Zurich, Switzerland.* We present a SESAM-modelocked Yb:YAG laser generating nearly transform-limited femtosecond pulses with 11 μJ energy at 4-MHz repetition rate and excellent beam quality. We discuss the key challenges for further increase of the pulse energy.

CFP2 • 1:45 p.m.
Passive Mode-Locking of Diode-Pumped Yb:KYF_4 Laser, *Gianluca Galzerano[1], Nicola Coluccelli[1], Lucia Bonelli[2], Alberto Di Lieto[2], Alessandra Toncelli[2], Mauro Tonelli[2], Paolo Laporta[1], Orazio Svelto[1]; [1]Inst. di Fotonica e Nanotecnologie-CNR, Dept. di Fisica, Politecnico di Milano, Italy, [2]Inst. di Fotonica e Nanotecnologie-CNR, Dept. di Fisica, Univ. di Pisa, Italy.* We report on the first demonstration of passive mode-locked operation of a diode-pumped Yb:KYF_4 crystal. Transform-limited pulses with duration of 170 fs, average power of 60 mW, and repetition rate of 55 MHz are obtained.

CFP3 • 2:00 p.m.
Single-Walled Carbon Nanotube Saturable Absorbers for Mode-Locked Laser Operation Near 1 μm, *Andreas Schmidt[1], Simon Rivier[1], Günter Steinmeyer[1], Valentin Petrov[1], Uwe Griebner[1], Jong Hyuk Yim[2], Won Bae Cho[2], Soonil Lee[2], Fabian Rotermund[2]; [1]Max-Born-Inst., Germany, [2]Ajou Univ., Republic of Korea.* Single-walled carbon nanotube saturable absorbers were designed for passive mode-locking near 1 μm. Using Yb:KYW and Yb:KLuW, nearly transform-limited sub-150 fs pulses were generated at 1037 nm and 1048 nm, respectively.

CFP4 • 2:15 p.m.
Bistable Mode-Locking in a Semiconductor Disk Laser, *Esa J. Saarinen, Jari Lyytikäinen, Oleg G. Okhotnikov; Optoelectronics Res. Ctr., Tampere Univ. of Technology, Finland.* We present the first demonstration of hysteresis in a semiconductor disk laser mode-locked with semiconductor saturable absorber. It is shown that the size of the hysteresis loop can be controlled by varying the unsaturated gain.

1:30 p.m.–3:15 p.m.
JFE • Joint CLEO/QELS Symposium on Hollow-Core Photonic-Crystal Fibers III
Robert Jopson; Alcatel-Lucent, USA, Presider

JFE1 • 1:30 p.m. Invited
Quantum Coherent Effects with Hollow-Core Photonic Crystal Fibers, *Fetah Benabid, P. S. Light, F. Couny; Univ. of Bath, UK.* We review the results of the work done on coherent effects in hollow-core photonic crystal fibers. These include generation of electromagnetically induced transparency and saturable absorption spectroscopy in molecular gases and atomic vapours.

JFE2 • 2:00 p.m.
Core-Surround Shaping of Hollow Core Photonic Crystal Fiber via Fiber Etching, *Yingying Wang, Philip S. Light, Fetah Benabid; Ctr. for Photonics and Photonic Materials, Dept. of Physics, Univ. of Bath, UK.* We report on a technique to pattern the shape of the core surround of hollow-core PCF. Different shapes were fabricated and a relationship between surface mode positions and core surround thickness is experimentally observed.

JFE3 • 2:15 p.m. Invited
Optical Guiding of Atoms through a Hollow-Core Photonic Band-Gap Fiber, *Randall J. Knize, T. Takekoshi; Laser and Optics Res. Ctr., Dept. of Physics, US Air Force Acad., USA.* We have demonstrated guiding of rubidium atom through a hollow core photonic bandgap fiber. Rb atoms from a thermal oven travel down 6 cm fiber with an efficiency that is greater than 70%.

1:30 p.m.–3:15 p.m.
QFJ • Coherent Control of Spin in Semiconductors

Jigang Wang; Lawrence Berkeley Natl. Lab, USA, Presider

QFJ1 • 1:30 p.m.
Ultrafast Raman Spin Rotations of Electrons in Quantum Wells, *Samuel G. Carter, Zhigang Chen, Steven T. Cundiff; JILA, Univ. of Colorado and NIST, USA.* Short pulses detuned below the absorption edge of GaAs quantum wells are used to rotate electron spins through a Raman process. Faraday rotation measurements demonstrate significant rotations with negligible excitation of electrons and holes.

QFJ2 • 1:45 p.m.
Manipulating Nonlinear Optical Response from Electron Spins in a 2-D Electron Gas via Exciton Injection, *Shannon O'Leary, Hailin Wang; Univ. of Oregon, USA.* Using a two-color, three-pulse differential transmission technique, we manipulate nonlinear optical processes of electron spins in a modulation-doped CdTe quantum well through exciton injection. The spin manipulation takes place without optical spin rotation.

QFJ3 • 2:00 p.m.
All-Optical Injection, Control and Detection of Ballistic Charge Transport in Semiconductors, *Arthur L. Smirl[1], Hui Zhao[1], Eric J. Loren[1], Henry M. van Driel[2]; [1]Lab for Photonics and Quantum Electronics, Univ. of Iowa, USA, [2]Dept. of Physics and Inst. for Optical Sciences, Univ. of Toronto, Canada.* Ballistic pure charge currents are injected into GaAs quantum wells using quantum interference techniques and are spatially and temporally resolved for the first time. The dynamics are dominated by momentum relaxation and space charge effects.

QFJ4 • 2:15 p.m.
Optical Birefringence Effects of Pure Spin Currents in Semiconductors, *Ren-Bao Liu[1], Jing Wang[1,2], Bang-Fen Zhu[2]; [1]Dept. of Physics, The Chinese Univ. of Hong Kong, Hong Kong, [2]Dept. of Physics, Tsinghua Univ., China.* We predict that a pure spin current in a semiconductor, even without net magnetization, presents the Voigt and Faraday birefringence, which may be exploited for a direct, non-demolition measurement of the pure spin current.

1:30 p.m.–3:15 p.m.
JFF • High Harmonic Generation and Attosecond Physics II

Tsuneto Kanai; RIKEN, Japan, Presider

JFF1 • 1:30 p.m.
Angular-Dependence of Molecular Photoionization Cross-Sections Studied by Time-Resolved EUV Spectroscopy, *Isabell Thomann, Robynne Lock, Etienne Gagnon, Arvinder Sandhu, Henry C. Kapteyn, Margaret M. Murnane, Wen Li; JILA and Dept. of Physics, Univ. of Colorado, USA.* We obtain angular data on molecular EUV photoionization. We impulsively align N_2 and CO_2 and then ionize using high-harmonic pulses. By measuring the ion yield versus delay we extract angle-dependent cross-sections.

JFF2 • 1:45 p.m.
Attosecond Excitation of Electron Wavepackets, *Giuseppe Sansone[1], E. Benedetti[1], M. Nisoli[1], F. Kelkensberg[2], W. K. Siu[2], O. Ghafur[2], P. Johnsson[2], M. J. J. Vrakking[2], I. Znakovskaya[3], T. Uphues[3], S. Zherebtsov[3], M. F. Kling[3], F. Lépine[4], K. J. Schafer[5], T. Remetter[6], J. Mauritsson[6], M. Swoboda[6], A. L'Huillier[6]; [1]Natl. Lab for Ultraintense Optical Science, Consiglio Natl. delle Ricerche, Inst. Natl. per La Fisica della Materia, Dept. di Fisica, Politecnico di Milano, Italy, [2]Inst. for Atomic and Molecular Physics, Foundation for Fundamental Res. on Matter, Netherlands, [3]Max-Planck Inst. für Quantenoptik, Germany, [4]Lab for Ionic and Molecular Spectrometry, Ctr. Natl. de la Recherche Scientifique, Univ. Lyon [1], France, [5]Dept. of Physics and Astronomy, Louisiana State Univ., USA, [6]Dept. of Physics, Lund Univ., Sweden.* We present experiments, supported by time-dependent Schrödinger simulations, on the dynamics of Helium bound states after an attosecond excitation in the presence of a strong infrared laser field.

JFF3 • 2:00 p.m. Invited
Ultrafast Atomic and Molecular Dynamics with High-Order Harmonic Probes, *Stephen R. Leone; Univ. of California at Berkeley, USA.* High-order harmonics are used for atomic molecular dynamics studies by core-level transient absorption spectroscopy and photoelectron spectroscopy. High field ionization of Xe atoms, strong field coupling effects and dissociative ionization are investigated.

1:30 p.m.–3:15 p.m.
CFQ • High-Power and High-Energy Solid-State Lasers

Hagop Injeyan; Northrop Grumman Corp, USA, Presider

CFQ1 • 1:30 p.m.
The National Ignition Facility: Status and Performance of the World's Largest Laser System for the High Energy Density and Inertial Confinement Fusion, *Christopher A. Haynam, Paul J. Wegner, Glenn M. Heestand, Edward Moses, Richard A. Sacks, M. W. Bowers, S. N. Dixit, G. V. Erbert, M. A. Henesian, M. R. Hermann, K. S. Jancaitis, K. Knittel, T. Kohut, K. R. Manes, C. D. Marshall, N. C. Mehta, J. Menapace, J. R. Murray, M. C. Nostrand, C. D. Orth, R. Patterson, R. Saunders, Michael J. Shaw, M. Spaeth, S. B. Sutton; Lawrence Livermore Natl. Lab, USA.* The National Ignition Facility will support high energy density science experiments, including the demonstration of inertial fusion ignition. We discuss the status of NIF commissioning, and the results of various system performance validation measurements.

CFQ2 • 1:45 p.m.
Amplified Spontaneous Emission in Large Size, High Gain Yb^{3+}:YAG Amplifiers: Numerical Modeling and Experimental Test Bench for Foreseen KJ-Range Diode Pumped Solid State Laser Facilities, *Daniel Albach, Jean-Christophe Chanteloup, Geoffroy Le Touzé; Lab pour l'Utilisation des Lasers Intenses, Ecole Polytechnique, France.* We will present a three-dimensional Monte-Carlo model calculating the impact of amplified spontaneous emission on large size, high gain quasi-three level laser materials, especially Yb^{3+}:YAG and compared it to experimental results, currently under progress.

CFQ3 • 2:00 p.m.
Gain and Thermal Distorsion Investigation on the Yb:YAG Diode Pumped LUCIA Oscillator, *Sofiane Bahbah, Daniel Albach, Jean Christophe Chanteloup, Philippe Hollander, Bernard Vincent; LULI, Ecole Polytechnique, France.* We present the latest investigations performed on the LUCIA Yb:YAG diode pumped oscillator (260 mJ, 49 ns, 2 Hz). Thermal distortions as well gain measurements have been explored.

CFQ4 • 2:15 p.m.
Thin-Disk Laser Operation with Single-Pass Pumping, *Simon Rivier[1], Uwe Griebner[1], Valentin Petrov[1], Xavier Mateos[2], Oscar Silvestre[2], Maria Cinta Pujol[2], Magdalena Aguilo[2], Francesc Diaz[2], Sophie Vernay[3], Daniel Rytz[3]; [1]Max-Born-Inst., Germany, [2]Univ. Rovira i Virgili, Spain, [3]FEE GmbH, Germany.* Single-pass pumping of a thin disk consisting of a 50 µm epitaxial layer of 32% Yb-doped $KLu(WO_4)_2$ deposited on a $KLu(WO_4)_2$ substrate produced 9 W of output power near 1030 nm at 77% slope efficiency.

1:30 p.m.–3:15 p.m.
CFR • Nonlinear Waveguides

Vladimir V. Shkunov; Raytheon Corporation, USA, Presider

CFR1 • 1:30 p.m.
Nonlinear Effects in PPLN Waveguide Resonators, *Reinhard Geiss[1], Roland Schiek[2], Thomas Pertsch[1], Arkadi Chipouline[1], O. Egorov[1], F. Lederer[1], Wolfgang Sohler[3], Andreas Tuennermann[4]; [1]Inst. of Applied Physics, Friedrich-Schiller-Univ. Jena, Germany, [2]Univ. of Applied Sciences Regensburg, Germany, [3]Univ. Paderborn, Germany, [4]Fraunhofer Inst. for Applied Optics and Precision Engineering, Germany.* Resonator bistability in Ti:PPLN waveguide was tested experimentally. Spectrum changes were measured at different input powers and compared with theory. Parameters necessary for bistable operation are accessible via temperature and wavelength tuning.

CFR2 • 1:45 p.m. Invited
Nonlinear Optical Limits to Power in Fiber Amplifiers, *A. V. Smith[1], G. R. Hadley[1], R. L. Farrow[1], B. T. Do[2]; [1]Sandia Natl. Labs, USA, [2]Ball Aerospace, USA.* Stimulated Brillouin scattering, stimulated Raman scattering, four-wave mixing, self phase modulation, self focusing and optical dielectric breakdown limit the power obtainable from fiber amplifiers. We explore the limits on nanosecond pulse amplification in LMA fibers.

CFR3 • 2:15 p.m.
Pump/Signal Induced Refractive Index Changes in Yb-Doped Fiber Amplifier: The Origin and Properties, *Andrei Fotiadi[1,2], Oleg L. Antipov[3], Patrice Mégret[1]; [1]Faculté Polytechnique de Mons, Belgium, [2]Ioffe Physico-Technical Inst. of Russian Acad. of Sciences, Russian Federation, [3]Inst. of Applied Physics of Russian Acad. of Science, Russian Federation.* Refractive index changes induced by pump-signal operation in commercial Yb-doped fibers are shown to be of electronic origin with a strong contribution of UV-transitions to the polarizability difference explored for testing wavelength of 1460-1620 nm.

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

1:30 p.m.–3:15 p.m.
CFS • Yb-Doped Fiber Lasers and Amplifiers
Adrian Carter; Nufern, USA, Presider

CFS1 • 1:30 p.m.
10-Watt, Single-Mode, Single-Frequency, 1.03 µm Yb^{3+}-Doped Phosphate Fiber Amplifier, *Yin-Wen Lee[1], Supriyo Sinha[1], Michel J. F. Digonnet[1], Robert L. Byer[1], Shibin Jiang[2]; [1]Stanford Univ., USA, [2]NP Photonics Inc., USA.* We describe the first 10-W single-mode, single-frequency Yb^{3+}-doped phosphate fiber amplifier. The fiber is doped with 12 wt% Yb_2O_3 and only 47.5-cm long. A 25-W phosphate fiber laser with 52.7% slope efficiency is also reported.

CFS2 • 1:45 p.m.
Materials Optimization for Ytterbium-Doped High Power Fiber Lasers, *Magnus Engholm[1,2], Lars Norin[2]; [1]Dept. of Information, Technology and Media, Physical Electronics and Photonics, Mid-Sweden Univ., Sweden, [2]Acreo FiberLab AB, Sweden.* In this paper we will present paths to reduce the extent of photodarkening in ytterbium-doped fiber lasers based on the aluminosilicate glass matrix. This will enable higher powers and longer operating lifetimes.

CFS3 • 2:00 p.m.
Experimental Verification of Spatial Distribution of Photodarkening in Large Mode Area Ytterbium-Doped Fibers, *Mircea Hotoleanu, Joona Koponen, Teemu Kokki, Marko Laurila; Liekki Corp., Finland.* We experimentally demonstrated that photodarkening is not uniformly distributed in the cross-section of bent LMA fibers. Photodarkening distribution depends on coiling diameter, and affects the use of fibers in applications and their photodarkening propensity measurement.

CFS4 • 2:15 p.m.
12 x 12 Image Amplifier Based on Yb^{3+}-Doped Multi-Core Phosphate Optical Fiber, *Arturo Chavez-Pirson, Wenyan Tian, Shigeru Suzuki, Shibin Jiang; NP Photonics Inc., USA.* We demonstrate image amplification in a 12x12 pixel optical image amplifier array based on high gain per unit length Yb^{3+}-doped phosphate glass optical fiber. We achieve 12dB of pump-induced pixel gain from a 10cm-long fiber.

1:30 p.m.–3:15 p.m.
CFT • Superresolution Imaging
Alberto Bilenca; Harvard Medical School, USA, Presider

CFT1 • 1:30 p.m. Invited
Dual-Color Superresolution Imaging Using Genetically Expressed Probes, *Hari Shroff[1], Catherine G. Galbraith[2], James A. Galbraith[2], Helen White[1], Jennifer Gillette[2], Scott Olenych[3], Michael W. Davidson[3], Eric Betzig[1]; [1]Howard Hughes Medical Inst., USA, [2]NIH, USA, [3]Florida State Univ., USA.* We report dual-color superresolution imaging using endogenously expressed fluorescent proteins. An imaging resolution of 20-30 nm facilitates study of the ultrastructural relationship between proteins present in adhesion complexes at the surfaces of whole, fixed cells.

CFT2 • 2:00 p.m.
Superresolution Imaging in Live Bacterial Cells by Single-Molecule Active-Control Microscopy, *Julie S. Biteen, Michael A. Thompson, Nicole K. Tselentis, Lucy Shapiro, W. E. Moerner; Stanford Univ., USA.* Imaging of a nanoscale emitter naturally provides position information beyond the diffraction limit. We use active control to switch single fluorophores on and off to image structures with 40-nm resolution in a living cell.

CFT3 • 2:15 p.m.
Phase, Amplitude and Polarization Microscope Using a Robust and Compact Interferometer, *Remy Tumbar; Cornell Univ., USA.* We coupled a compact and robust phase-shifting and shearing interferometer (sampling field sensor) to the imaging port of a standard, infinity corrected, transmission microscope to obtain phase, amplitude and polarization images of unstained biological samples.

1:30 p.m.–3:15 p.m.
QFK • Plasmonic Nanoantennas
Marc M. Dignam; Queen's Univ., Canada, Presider

QFK1 • 1:30 p.m.
Two Distinct Types of Resonances in Optical Bowtie Slot Nanoantennas, *Hongcang Guo, Thomas Zentgraf, Todd P. Meyrath, Na Liu, Liwei Fu, Stefan Kaiser, Heinz Schweizer, Harald Giessen; Univ. of Stuttgart, Germany.* We study the resonance properties of optical bowtie slot antennas in experiment and numerical simulations. The dependence of the plasmonic and Fabry-Perot-like resonances on the antenna geometry and metal properties is investigated.

QFK2 • 1:45 p.m.
Spectroscopy of Individual V-Shaped Silver Nanoantennas, *Nina Meinzer[1], Martin Wegener[1], Michael F. G. Klein[2], Peter-Jürgen Jakobs[2], Herbert Hein[2], Michael König[3], Jens Niegemann[3], Kurt Busch[3], Nils Feth[4], Stefan Linden[4]; [1]Inst. für Angewandte Physik, Univ. Karlsruhe (TH), Germany, [2]Inst. für Mikrostrukturtechnik, Forschungszentrum Karlsruhe in der Helmholtz-Gemeinschaft, Germany, [3]Inst. für Theoretische Festkörperphysik, Univ. Karlsruhe (TH), Germany, [4]Inst. für Nanotechnologie, Forschungszentrum Karlsruhe in der Helmholtz-Gemeinschaft, Germany.* Following the suggestion of Stockman et al., we have fabricated individual V-shaped silver nanoantennas with 20-nm minimum feature size. Measured attenuated total internal reflection spectra are compared with numerical solutions of the vector Maxwell equations.

QFK3 • 2:00 p.m. Invited
Near-Field Mapping of Infrared Optical Antennas, *Robert L. Olmon[1], Andrew C. Jones[1], Peter M. Krenz[2], Glenn Boreman[2], Markus B. Raschke[1]; [1]Univ. of Washington, USA, [2]CREOL, Univ. of Central Florida, USA.* The near-field distribution of linear optical antennas is measured with phase-contrast scattering-type near-field microscopy (s-SNOM). A distinct scaling behavior with antenna length is observed for different structures with and without gap.

1:30 p.m.–3:15 p.m.
CFU • Ultrafast Dynamics
Presider to Be Announced

CFU1 • 1:30 p.m.
Characterization of Ce:$LuLiF_4$ as Fast Scintillator Using Storage Ring Free-Electron Lasers, *Tomoharu Nakazato[1], Yusuke Furukawa[1], Marilou Cadatal[2], Minh Pham[2], Toshihiro Tatsumi[1], Ayumi Saiki[1], Yasunobu Arikawa[1], Nobuhiko Sarukura[1,2], Hiroaki Nishimura[1], Hiroshi Azechi[1], Kunioki Mima[1], Tsuguo Fukuda[3], Masahito Hosaka[4], Masahiro Katoh[4], Nobuhiro Kosugi[4]; [1]Inst. of Laser Engineering, Osaka Univ., Japan, [2]Graduate Univ. for Advanced Studies, Japan, [3]Inst. of Multidisciplinary Res. for Advanced Materials, Tohoku Univ., Japan, [4]UVSOR Facility Inst. for Molecular Science (IMS), Japan.* Ce:$LuLiF_4$ as fast scintillator is evaluated using a storage ring free-electron laser operated in deep ultraviolet region. The response time is found to be varied for the excitation of the different absorption band.

CFU2 • 1:45 p.m.
UV Fluorscence of Hydrothermal Method Grown ZnO for a Fast Scintillators, *Yusuke Furukawa[1], Momoko Tanaka[2], Masaharu Nishikino[2], Hiroshi Yamatani[2], Tomoharu Nakazato[1], Toshihiro Tatsumi[1], Shigeki Saito[1], Hidetoshi Murakami[1], Nobuhiko Sarukura[1], Hiroaki Nishimura[1], Kunioki Mima[1], Keisuke Nagashima[2], Toyoaki Kimura[2], Yuji Kagamitani[3], Tsuguo Fukuda[3]; [1]Inst. of Laser Engineering, Osaka Univ., Japan, [2]Advanced Photon Res. Ctr., Japan Atomic Energy Agency, Japan, [3]Inst. of Multidisciplinary Res. for Advanced Materials, Tohoku Univ., Japan.* The scintillation properties of a hydrothermal method grown ZnO crystal are evaluated for EUV laser excitation. The excitonic emission decay at 380-nm is determined to be 1.3-ns, almost identical to ultraviolet laser excitation cases.

CFU3 • 2:00 p.m.
Ultrafast Carrier Dynamics in PbS Quantum Dots, *Gero Nootz[1], Lazaro A. Padilha[1], David J. Hagan[1], Eric W. Van Stryland[1], Sjoerd Hoogland[2], Edward H. Sargent[2]; [1]CREOL, College of Optics and Photonics, Univ. of Central Florida, USA, [2]Edward S Rogers Sr., Dept. of Electrical and Computer Engineering, Univ. of Toronto, Canada.* We report studies of multi-carrier dynamics in PbS quantum dots. Nanosecond recombination times are observed for the $1S_{el}$-$1S_{3/2}$ transition and evidence of direct radiative recombination from $1P_{el}$-$1P_{3/2}$ is observed on picoseconds time scales.

CFU4 • 2:15 p.m.
Recombination Dynamics in Quantum Dot Semiconductor Saturable Absorber Mirrors (QD-SESAMs), *Deran J. H. C. Maas, Aude-Reine Bellancourt, Martin Hoffmann, Benjamin Rudin, Matthias Golling, Thomas Südmeyer, Ursula Keller; ETH Zurich, Switzerland.* We present the first systematic study of recombination dynamics in InAs QD-SESAMs. Decreasing growth temperature and increasing indium coverage reduces the recovery time from 1500 to 24 ps, leading to shorter pulses in modelocked VECSELs.

CLEO

1:30 p.m.–3:15 p.m.
CFV • Novel THz Generation Schemes

Richard D. Averitt; Boston Univ., USA, Presider

CFV1 • 1:30 p.m.
Polarization Analysis of THz Generated by Four Wave Mixing in Air, *Aurélien Houard, Yi Liu, Bernard Prade, André Mysyrowicz; Lab d'Optique Appliquée, Ecole Natl. Supérieure des Techniques Avancées, Ecole Polytechnique, Ctr. Natl. de la Recherche Scientifique, France.* We examine the generation of terahertz by optical rectification of fundamental infrared beam with its second harmonic in ionized air. From polarization measurements we identify an important, yet so far unreported cross term $\chi^{(3)}_{xyxy}$.

CFV2 • 1:45 p.m.
Terahertz Radiation from Biased Femtosecond Laser Filament in Air, *Yi Liu, Aurélien Houard, Bernard Prade, André Mysyrowicz; Lab d'Optique Appliquée, ENSTA, Ecole Polytechnique, France.* Terahertz radiations of laser filament biased by an AC Terahertz field or a DC electric field are studied. Similar physical properties of the two THz radiations are observed. Efficiency of both methods is compared.

CFV3 • 2:00 p.m. Invited
Intense THz Supercontinuum Generation in Femtosecond Laser-Gas Interactions, *Ki-Yong Kim, Antoinette J. Taylor, George Rodriguez; Los Alamos Natl. Lab, USA.* Intense coherent THz radiation from two-color laser interactions with various gas species is examined. Peak THz energy of >4.5 μJ per pulse with a bandwidth in excess of 70 THz is routinely produced.

NOTES

QFH • Photonic Crystals: Control—Continued

QFH5 • 2:30 p.m.
Transverse Photo Voltage Induced by Circularly Polarized Light in Metallic Photonic Crystal Slabs, *Takafumi Hatano, Baku Nishikawa, Hiroyuki Kurosawa, Teruya Ishihara; Tohoku Univ., Japan.* We discovered transverse photo-induced voltage in two-dimensional metallic photonic crystal slabs for oblique incident circularly polarized light. Signal sign is reversed by changing the sense of polarization or sign of incident angle.

QFH6 • 2:45 p.m.
Polarization Changes in Diffraction from Planar Periodic Patterns with Pure Structural and Molecular Chirality, *Ksenia Dolgaleva[1], Robert W. Boyd[1], S. N. Volkov[2,3], Konstantins Jefimovs[4], Jari Turunen[4], Yuri Svirko[4], Brian K. Canfield[5], Martti Kauranen[5]; [1]Inst. of Optics, Univ. of Rochester, USA, [2]Dept. of Physics and Astronomy, Univ. of Rochester, USA, [3]Dept. of Electrical and Computer Engineering, Johns Hopkins Univ., USA, [4]Dept. of Physics and Mathematics, Univ. of Joensuu, Finland, [5]Inst. of Physics, Tampere Univ. of Technology, Finland.* We prepare diffractive arrays of metal nanoparticles that possess molecular and structural chirality. Both cases lead to comparative chiral polarization effects, which must be interpreted as arising from chirality of the experimental setup.

QFH7 • 3:00 p.m.
Disorder-Induced Resonance Shifts in Photonic Crystal Nanocavities, *Lora Ramunno[1], Stephen Hughes[2]; [1]Univ. of Ottawa, Canada, [2]Queen's Univ., Canada.* An optical scattering theory is introduced that predicts significant disorder-induced resonance shifts in photonic-crystal nanocavities. Even for nm-scale imperfections, we calculate blue shifts of several meV, two orders of magnitude larger than the cavity linewidth.

QFI • Entangled Photon Sources II—Continued

QFI5 • 2:45 p.m.
Heralded Generation of Two-Photon NOON States for Precision Quantum Metrology, *Brian J. Smith, Peter J. Mosley, Jeff S. Lundeen, Ian A. Walmsley; Clarendon Lab, Univ. of Oxford, UK.* We experimentally demonstrate a heralded source of high-purity two-photon NOON states derived from heralded single-photon sources.

QFI6 • 3:00 p.m.
Preparation and Characterization of Arbitrary States of Four-Dimensional Qudits Based on Biphotons, *So-Young Baek[1], Stanislav S. Straupe[2], Alexander P. Shurupov[2], Sergei P. Kulik[2], Yoon-Ho Kim[1]; [1]Pohang Univ. of Science and Technology (POSTECH), Republic of Korea, [2]Moscow State Univ., Russian Federation.* We report an experiment on preparation and characterization of general four-dimensional quantum states using ultrafast-pumped frequency-nondegenerate SPDC. We also discuss two additional experimental schemes which offer more complete control of the state purity and entropy.

CFP • Ultrafast Oscillators II—Continued

CFP5 • 2:30 p.m.
Femtosecond Pulse Generation at 1530nm Using a GaInNAsSb SESAM, *Christopher G. Leburn[1], Nikolaus K. Metzger[1], Christian T. A. Brown[1], Wilson Sibbett[1], Stephane Calvez[2], David Burns[2], Handong D. Sun[2], Martin D. Dawson[2], Melanie Le Dû[3], Jean-Christophe Harmand[3]; [1]Univ. of St. Andrews, UK, [2]Inst. of Photonics, Univ. of Strathclyde, UK, [3]Lab de Photonique et de Nanostructure, Ctr. Natl. de la Recherche Scientifique, France.* We describe the operation of a femtosecond Cr4+:YAG laser that has been mode locked using a novel GaInNAsSb SESAM. 230fs pulses were generated at an average output power of 280mW.

CFP6 • 2:45 p.m.
Diode-Pumped Sub 60-fs Kerr-Lens Mode-Locked Yb-Doped Sesquioxide Combined Ceramic Laser, *Masaki Tokurakawa[1], Akira Shirakawa[1], Ken-ichi Ueda[1], Hideki Yagi[2], Takagimi Yanagitani[2], Alexsander A. Kaminskii[3]; [1]Univ. of Electro-Communications, Japan, [2]Takuma Works, Konoshima Chemical Co. Ltd., Japan, [3]Inst. of Crystallography, Russian Acad. of Sciences, Crystal Laser Physics, Russian Federation.* Diode-pumped Kerr-lens mode-locked laser operation of Yb^{3+}:Sc_2O_3 and Yb^{3+}:Y_2O_3 combined ceramics has been achieved. Sub-60 fs pulses with the average power of 380 mW were obtained at the center wavelength of 1042 nm.

CFP7 • 3:00 p.m.
Generation of Sub-30 fs Pulses from a Mode-Locked Ytterbium Fiber Laser Oscillator with Phase Compensation, *Xiangyu Zhou[1,2], Dai Yoshitomi[1,2], Yohei Kobayashi[1,2], Shuichi Tani[3], Hideki Yokoi[3], Kenji Torizuka[1,2,3]; [1]Natl. Inst. of Advanced Industrial Science and Technology (AIST), Japan, [2]Core Res. for Evolutional Science and Technology, Japan Science and Technology Agency, Japan, [3]Shibaura Inst. of Technology, Japan.* An ultrashort-pulses mode-locked ytterbium-doped fiber laser has been developed with 28.3 fs duration at 80 MHz. The dispersion was compensated by a grating pair inside the cavity and a prism pair outside the cavity.

JFE • Joint CLEO/QELS Symposium on Hollow-Core Photonic-Crystal Fibers III—Continued

JFE4 • 2:45 p.m. Invited
Raman Amplification of Continuous-Wave Laser Emission in Hydrogen-Filled Hollow-Core Photonic Crystal Fiber, *Kazuki Ihara, Shin-ichi Zaitsu, Totaro Imasaka; Kyushu Univ., Japan.* A continuous-wave laser is amplified in a hollow-core photonic crystal fiber containing molecular hydrogen. The laser power was amplified 1.3-fold, and the effect of beam polarization for pump and probe lasers is investigated.

3:15 p.m.–3:45 p.m., Coffee Break, *Concourse Level*

QFJ • Coherent Control of Spin in Semiconductors—Continued

QFJ5 • 2:30 p.m. Invited
Imaging Spin Injection and Spin Transport in Semiconductors, *Scott A. Crooker[1], Darryl L. Smith[2], Chris J. Palmstrom[3], Paul A. Crowell[4]; [1]Natl. High Magnetic Field Lab, USA, [2]Los Alamos Natl. Lab, USA, [3]Dept. of Chemical Engineering and Materials Science, Univ. of Minnesota, USA, [4]School of Physics and Astronomy, Univ. of Minnesota, USA.* Using scanning Kerr-rotation microscopy, we directly image the injection and subsequent transport of spin-polarized electrons in semiconductors. We discuss optical spin injection as well as electrical spin injection in hybrid Fe/GaAs spin transport devices.

QFJ6 • 3:00 p.m.
Ultrafast Spin Dynamics in Colloidal ZnO Quantum Dots, *Nils Janßen[1], Tobias Hanke[1], Florian Sotier[1], Tim Thomay[1], Rudolf Bratschitsch[1], Kelly M. Whitaker[2], Daniel R. Gamelin[2]; [1]Univ. of Konstanz, Germany, [2]Univ. of Washington, USA.* We perform time-resolved Faraday rotation measurements on colloidal ZnO quantum dots. A biexponential decay of the dephasing time T_2^* of the electron spins governed by competing recombination processes is observed.

JFF • High Harmonic Generation and Attosecond Physics II—Continued

JFF4 • 2:30 p.m.
Novel Gas Targets for Efficient High-Harmonic Generation and More Energetic Attosecond Pulse Generation, *Christoph P. Hauri[1], Giuseppe Sansone[2], Enrico Benedetti[2], Mauro Nisoli[2]; [1]Paul Scherrer Inst., Switzerland, [2]Ctr. for Ultrafast Science and Biomedical Optics, Dept. di Fisica, Politecnico di Milano, Italy.* We demonstrate a 10-fold increase in high-order harmonic generation in argon and neon for long (25 fs) and short (5 fs) pulses by optimizing the gas distribution in the laser interaction zone.

JFF5 • 2:45 p.m.
Quantum Path Interference in the Wavelength Dependence of High-Harmonic Generation, *Kenichi L. Ishikawa[1,2], Klaus Schiessl[3], Emil Persson[3], Joachim Burgdörfer[3]; [1]Univ. of Tokyo, Japan, [2]Japan Science and Technology Agency, Japan, [3]Vienna Univ. of Technology, Austria.* We investigate the fundamental-wavelength dependence of high-harmonic generation yield. Superimposed on a smooth power-law dependence, we find surprisingly strong and rapid fluctuations on a fine wavelength scale, due to quantum-path interferences.

JFF6 • 3:00 p.m.
Extreme-Ultraviolet Polarimetry with Laser-Generated High-Order Harmonics, *Nicole Brimhall, Nicholas Herrick, Matthew Turner, David D. Allred, R. Steven Turley, Michael Ware, Justin B. Peatross; Dept. of Physics and Astronomy, Brigham Young Univ., USA.* We developed an extreme ultraviolet polarimeter, employing laser-generated high-order harmonics as the light source. Reflection scans made with this instrument show agreement over three orders of magnitude with data obtained at the Advanced Light Source.

CFQ • High-Power and High-Energy Solid-State Lasers—Continued

CFQ5 • 2:30 p.m.
Thermally Induced Local-Depolarization in Thin YAG Ceramics for High-Power Lasers, *Yu Oishi[1,2], Traian Dascalu[1], Katsumi Midorikawa[2], Takunori Taira[1]; [1]Inst. for Molecular Science, Japan, [2]RIKEN, Japan.* We investigate a spatially-distributed local-depolarization induced by thermal-birefringence for the power scaling in Nd:YAG ceramics. We found the variation of local-depolarization was dramatically increased when the thickness of ceramics becomes comparable to the grain size.

CFQ6 • 2:45 p.m.
Faraday Isolators for High Average Power: State of the Art, *Efim A. Khazanov, Ivan B. Mukhin, Oleg V. Palashov, Alexander V. Voytovich, Dmitry S. Zheleznov; Inst. of Applied Physics, Russian Federation.* We review all known approaches to suppress thermal effects in Faraday isolator: design with two TGG crystals, cooling to nitrogen temperature, disc geometry, non-traditional magneto-optics material, advanced permanent magnet design, and superconductive solenoid.

CFQ7 • 3:00 p.m.
Evidence for Optically Induced Heating of the GLAS/ICESAT Doubler Crystal, *Graham R. Allan; NASA GSFC, USA.* Numerical modeling results of optically induced heating of the GLAS doubler explain the performance degradation in output energy of laser-I and II and partially laser-III and are consistent with the on-orbit telemetry.

CFR • Nonlinear Waveguides—Continued

CFR4 • 2:30 p.m.
Diffraction-Managed Solitons and Nonlinear Beam Diffusion in Modulated Waveguide Arrays, *Alexander Szameit[1], Ivan L. Garanovich[2], Matthias Heinrich[1], Alexander Minovich[2], Felix Dreisow[1], Andrey A. Sukhorukov[2], Thomas Pertsch[1], Dragomir N. Neshev[2], Stefan Nolte[1], Wieslaw Krolikowski[2], Andreas Tunnermann[1], Arnan Mitchell[3], Yuri S. Kivshar[2]; [1]Inst. of Applied Physics, Friedrich-Schiller-Univ. Jena, Germany, [2]Ctr. for Ultrahigh Bandwith Devices for Optical Systems, Nonlinear Physics Ctr. and Laser Physics Ctr., Res. School of Physical Sciences and Engineering, Australian Natl. Univ., Australia, [3]School of Electrical and Computer Engineering, RMIT Univ., Australia.* We present the first experimental observation of nonlinear beam diffusion and formation of diffraction-managed solitons in periodically-curved arrays of coupled optical waveguides created using femtosecond laser writing in glass, and titanium indiffusion in $LiNbO_3$ crystals.

CFR5 • 2:45 p.m.
Wavelength Conversion Module with +4 dB Gain Using Direct-Bonded QPM-Zn: $LiNbO_3$ Ridge Waveguide, *Takeshi Umeki, Osamu Tadanaga, Masaki Asobe; NTT Photonics Labs, NTT Corp., Japan.* We fabricate a fiber-coupled module using a highly damage resistant $LiNbO_3$ ridge waveguide. A low insertion loss (-4dB) and sufficient parametric conversion gain (+8dB) enable us to achieve a wavelength converter with +4dB fiber-to-fiber gain.

CFR6 • 3:00 p.m.
Phase Matching Using Ridge Bragg Reflection Waveguides, *Bhavin J. Bijlani, Payam Abolghasem, Amr S. Helmy; Univ. of Toronto, Canada.* Ridge Bragg Reflection Waveguides are used to phase-match second harmonic generation at 1600 nm. Exact phase-matching bandwidth of 4.5 nm with an internal conversion efficiency of 8.6 %/W is obtained.

3:15 p.m.–3:45 p.m., Coffee Break, *Concourse Level*

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

CFS • Yb-Doped Fiber Lasers and Amplifiers—Continued

CFS5 • 2:30 p.m.
Three-Core Tellurite Fiber with Multiple Rare Earth Emission, *Henry T. Bookey[1], Robert R. Thomson[1], Nicholas D. Psaila[1], Ajoy K. Kar[1], Joris Lousteau[2], Animesh Jha[2], Nicolas Gayraud[3], Hongxia Li[3], William N. MacPherson[3], James S. Barton[3]; [1]School of Engineering and Physical Sciences, Heriot Watt Univ., UK, [2]Inst. for Materials Res., Univ. of Leeds, UK, [3]Applied Optics and Photonics, Heriot Watt Univ., UK.* We have fabricated a three core tellurite glass fiber having a different rare earth system in each of its cores. Three distinct sets of emission characteristics are observed with a single pump wavelength.

CFS6 • 2:45 p.m.
Energy Transfer and Gain Analysis for Tb^{3+}-Yb^{3+} Co-Doped Silicate Glasses under the 0.98 µm Excitation, *Tatsuya Yamashita[1,2], Yasutake Ohishi[1]; [1]Toyota Technological Inst., Japan, [2]Toyota Central R&D Labs Inc., Japan.* The energy transfer coefficients for Tb^{3+}-Yb^{3+}-codoped silicate glasses was obtained by a rate equation model. The proposed model can be used to understand the amplification properties in the 0.54µm band under the 0.98µm pumping.

CFS7 • 3:00 p.m.
Analysis of Spectroscopy and Amplification at 1.3 µm in Nd/Tm/Yb Doped Tellurite Glass Fibres, *Shaoxiong Shen, Billy Richards, Animesh Jha; Univ. of Leeds, UK.* Emission branching ratio at 1.3 µm and 1.06 µm has been studied in Nd/Tm/Yb doped tellurite glass fiber. 1.3 µm fluorescence intensity has been increased significantly. 3-4 dB signal gain has been observed in fiber.

CFT • Superresolution Imaging—Continued

CFT4 • 2:30 p.m.
Depletion Dynamics for Stimulated Emission Depletion (STED) Microscopy, *Margaret C. Chiang, Juan C. Garcia, Jia-Ming Liu; Univ. of California at Los Angeles, USA.* We present preliminary experimental data revealing depletion dynamics for stimulated emission depletion (STED) microscopy as a function of excitation intensity, depletion intensity, time delay, and fluorophore damage. FluoSpheres 350/440 (Invitrogen) is used.

CFT5 • 2:45 p.m.
FRET Detection in the Plasma Membrane Using Total Internal Reflection Fluorescence Lifetime Imaging Microscopy, *Pierre Blandin[1], Sandrine Lévêque-Fort[2,3], Sandrine Lecart[3], Frederic Druon[1,3], Patrick Georges[1,3], Jack C. Cossec[4], Marie-Claude Potier[4], Zsolt Lenkei[4]; [1]Lab Charles Fabry de l'Inst. d'Optique, Ctr. Natl. de la Recherche Scientifique, Univ. Paris-Sud, France, [2]Lab de Photophysique Moléculaire, Ctr. Natl. de la Recherche Scientifique, Univ. Paris-Sud, France, [3]Ctr. de Photonique Biomédicale, Univ. Paris-Sud, France, [4]Ecole Supérieure de Physique et de Chimie Industrielles, Ctr. Natl. de la Recherche Scientifique, France.* We developed a Total Internal Reflection Fluorescence Lifetime Imaging Microscope to perform functional imaging of living cells membranes labeled with FRET couples. Förster Resonance Energy Transfer efficiency can thus be followed with subwavelength axial resolution.

CFT6 • 3:00 p.m.
Probing Bacterial Surfaces Using 4Pi Spectral Self-Interference Fluorescence Microscopy, *Mehmet Dogan[1], Bennett B. Goldberg[1], Sumita Jain[2,3], Marcia B. Goldberg[3], Anna K. Swan[1], M. Selim Unlu[1]; [1]Boston Univ., USA, [2]Univ. of Washington, USA, [3]Harvard Univ. Medical School, USA.* We present nanometer scale axial localization of fluorescent markers to probe subcellular structures using self-interference based fluorescence microscopy. We show probing the membrane topography of a gram-negative bacterium, *Shigella flexneri*, and discuss further applications.

QFK • Plasmonic Nanoantennas—Continued

QFK4 • 2:30 p.m.
Single Particle Plasmon Spectroscopy of Silver Nanowires, *Moussa Ngom[1], Jan Ringnalda[2], John F. Mansfield[1], Nicholas Kotov[1], Ashish Agrawal[1], Nestor Zaluzec[3], Theodore B. Norris[1]; [1]Univ. of Michigan at Ann Arbor, USA, [2]FEI Co., USA, [3]Argonne Natl. Lab, USA.* The excitation of surface plasmons on individual nanowires is studied by high-resolution electron energy loss spectroscopy, and the results are compared to ensemble optical spectra. The transverse and longitudinal modes of these nanostructures were resolved.

QFK5 • 2:45 p.m.
Why Asymmetrical Nanoscale Plasmonic Waveguides Are Guiding Plasmons, *Nikolai Berkovitch, Meir Orenstein, Stephen G. Lipson; Israel Inst. of Technology, Israel.* Highly asymmetrical plasmonic waveguides exhibit guiding in dimensions below the expected cutoff. A new family of discrete guided modes of asymmetrical waveguides with losses is found, which assists in nano plasmonic guiding.

QFK6 • 3:00 p.m.
Long-Range Trapping and Rotation of Single Nanorods Using Plasmonic Tweezers, *Xiaoyu Miao, Benjamin Wilson, Lih Y. Lin; Univ. of Washington, USA.* We present plasmonic tweezers that makes use of localized surface plasmons from a close-packed Au nanoparticle array. This device can realize long-range trapping and orientation control of single nanorods with a low optical intensity requirement.

CFU • Ultrafast Dynamics—Continued

CFU5 • 2:30 p.m.
Resonant Raman Scattering of Coherent Picosecond Pulses by One and Two Longitudinal-Optical Phonons in GaN Film Grown on Silicon (111) Substrate, *Suvranta K. Tripathy, Guibao Xu, Xiaodong Mu, Yujie J. Ding, Muhammad Jamil, Ronald A. Arif, Nelson Tansu; Lehigh Univ., USA.* We have observed resonance-enhanced Stokes and anti-Stokes Raman scattering of coherent picosecond pulses by one as well as two longitudinal-optical phonons in GaN film grown on Si (111) substrate.

CFU6 • 2:45 p.m.
Two-Photon Absorption Induced Photoluminescence and the Ultrafast Dynamics of Para-Sexiphenyl Nano-Needles, *Kangjun Liu[1], Chunfeng Zhang[1], Zhiwei Dong[1], Shixiong Qian[1], G. Hernandez-Sosa[2], H. Sitter[2]; [1]Physics Dept., Fudan Univ., China, [2]Inst. of Semiconductor and Solid State Physics, Johannes Kepler Univ. Linz, Austria.* Two-photon absorption induced photoluminescence of para-sexiphenyl nano-needles with high polarization and directional property was observed. The time-resolved measurement shows a very fast photoresponse and the absorption polarization selectivity of ground state.

CFU7 • 3:00 p.m.
Probing Ultrafast Dynamics of Electrons and Holes in Graphene, *Jahan M. Dawlaty, Shriram Shivaraman, Mvs Chandrashekhar, Farhan Rana, Michael Spencer; Cornell Univ., USA.* Using pump-probe techniques, we study the ultrafast relaxation dynamics of photoexcited carriers in graphene. We relate the measured time scales to carrier-carrier and carrier-phonon intraband/interband scattering processes and also to crystal disorder in the material.

3:15 p.m.–3:45 p.m., Coffee Break, *Concourse Level*

CFV • Novel THz Generation Schemes—Continued

CFV4 • 2:30 p.m.
Enhanced Terahertz Pulses Emission from InAs Surface by Femtosecond Laser Pulses with Tilted Intensity Front, *Yuri H. Avetisyan[1], Karo Khachatryan[1], Rene Beigang[2]; [1]Yerevan State Univ., Armenia, [2]Kaiserslautern Univ., Germany.* It is shown that using femtosecond laser pulses with tilted intensity front allows controlling the direction of terahertz emission from InAs surface and by that way achieving significant increase in the generated power.

CFV5 • 2:45 p.m.
Backward THz-Wave Generation from Collinearly Phase-Matched Difference-Frequency Mixing in Periodically Poled Lithium Niobate, *Tsong-Dong Wang, H. L. Chang, S. T. Lin, Y. Y. Lin, A. C. Chiang, Yen-Chieh Huang; Inst. of Photonics Technologies, Dept. of Electrical Engineering, Natl. Tsinghua Univ., Taiwan.* We demonstrate difference frequency generation of backward THz waves from collinearly phase-matched, periodically poled lithium niobate. Coherent THz waves between 510~575 μm were generated by using kW pump power at a kHz repetition rate.

CFV6 • 3:00 p.m.
All-Optically Generated Ultrashort Voltage Pulses on Planar Transmission Lines, *Gabriel C. Loata, Christian Jansen, Mark Bieler, Günther Hein, Uwe Siegner; Physikalisch-Technische Bundesanstalt, Germany.* We show that shift currents generated by all-optical excitation of (110)-oriented bulk GaAs can be employed to launch ultrashort voltage pulses with frequency components exceeding 1 THz on planar transmission lines.

3:15 p.m.–3:45 p.m.
Coffee Break, *Concourse Level*

NOTES

QELS

3:45 p.m.–5:30 p.m.
QFL • Meta-Devices
Presider to Be Announced

QFL1 • 3:45 p.m.
Tight Focusing of Light in Aberration-Compensated Photonic Crystal Negative Refractive Lens, *Tomohiko Asatsuma[1,2], Toshihiko Baba[1,2]; [1]Dept. of Electrical and Computer Engineering, Yokohama Natl. Univ., Japan, [2]CREST, Japan Science and Technology Agancy, Japan.* We propose a composite photonic crystal for compensating an aberration in negative refractive lens. We experimentally observed that the focused spot size was clearly narrowed, compared with the case of single photonic crystal.

QFL2 • 4:00 p.m.
Super-Resolution Spatial Spectroscopy for Mid-IR and THz, *Leonid Alekseyev[1], Evgenii Narimanov[2], Jacob Khurgin[3]; [1]Princeton Univ., USA, [2]Purdue Univ., USA, [3]Johns Hopkins Univ., USA.* We propose a novel scheme for subwavelength-resolved spatial spectroscopy in the mid-IR and THz bands. Our approach relies on scattering from an acoustic grating and allows far-field detection of high spatial frequency Fourier components.

QFL3 • 4:15 p.m.
Compensation of Focus Blurring of Ag Slab Superlens with Intrinsic Loss of Absorption, *Kwangchil Lee, Haesung Park, Jaehoon Kim, Gumin Kang, Kyoungsik Kim; Yonsei Univ., Republic of Korea.* Using non-impedance matching condition, we improved image quality of Ag slab superlens with ~69% enhanced visibility and ~138% increased depth of field of contrast 0.5 through our FDTD calculation.

QFL4 • 4:30 p.m.
Impedance Matched Hyperlens, *Zubin Jacob, Alexander V. Kildishev, Evgenii E. Narimanov; Purdue Univ., USA.* We develop an imaging system capable of magnification, subwavelength-resolution and impedance matching, which minimizes reflection losses. We propose a practical design of the system based on available materials and existing fabrication technologies.

3:45 p.m.–5:30 p.m.
QFM • Quantum Nonlinear Optics
Presider toBe Announced

QFM1 • 3:45 p.m.
Quantum Theory of Spontaneous Emission in Multilayer Dielectric Structures, *Celestino Creatore[1,2], Lucio C. Andreani[2]; [1]Physics Dept., Politecnico di Torino, Italy, [2]Physics Dept., Univ. degli Studi di Pavia, Italy.* A full quantum-mechanical formalism has been developed in order to evaluate the spontaneous emission rate of dipoles embedded in multilayer dielectric structures. A realistic example of an antisymmetric Silicon waveguide is shown and discussed.

QFM2 • 4:00 p.m.
Quasimode-Projection Approach to Quantum-Dot-Photon Interactions in Photonic Crystal Slab Coupled-Cavity Systems, *David Fussell, Marc M. Dignam; Dept. of Physics, Queen's Univ., Canada.* We treat multiple-quantum-dot–multiple-photon dynamics in coupled-cavity photonic crystal slab systems by projecting the Hamiltonian onto a discrete basis of quasimodes. We apply this approach to spontaneous emission into two coupled cavities.

QFM3 • 4:15 p.m.
Tunneling Times through Dielectric Stacks, *Natalia B. Rutter[1,2], Sergey V. Polyakov[1,3], Paul Lett[3,4], Alan L. Migdall[1,3]; [1]Optical Technology Div., NIST, USA, [2]Physics Dept., Georgetown Univ., USA, [3]Joint Quantum Inst., Univ. of Maryland, USA, [4]Atomic Physics Div., NIST, USA.* We measure the photon tunneling time through bandgaps of dielectric layer stacks with alternating refractive indices. We observe subtle structural changes in dielectric stacks drastically affecting photon traversal times, allowing for sub- and superluminal effects.

QFM4 • 4:30 p.m.
Polariton Spectroscopy of Three-Level Atoms inside an Optical Cavity, *Julio Gea-Banacloche, Haibin Wu, Min Xiao; Univ. of Arkansas, USA.* Distinct peaks associated with atom-cavity polaritons are observed in the transmission spectrum of three-level rubidium atoms in an optically-dense vapor cell inside an optical ring cavity.

CLEO

JOINT

3:45 p.m.–5:15 p.m.
JFG • Joint CLEO/QELS Symposium on Hollow-Core Photonic-Crystal Fibers IV
Karl Koch; Corning, Inc., USA, Presider

JFG1 • 3:45 p.m.
Extremely High Coupling and Transmission of High-Powered-Femtosecond Pulses in Hollow-Core Photonic Band-Gap Fiber, *Christopher J. Hensley, Mark A. Foster, Bonggu Shim, Alexander L. Gaeta; Cornell Univ., USA.* Amplified femtosecond laser pulses are coupled through a hollow-core photonic band-gap fiber with efficiencies greater than 98%. Peak power intensities greater than 10^{14} W/cm^2 are achieved inside the fiber core.

JFG2 • 4:00 p.m.
Dispersion Properties of "Kagome" Hollow-Core Fibers, *Peter J. Roberts[1], Fetah Benabid[2], François Couny[2], Philip S. Light[2]; [1]Dept. of Communications, Optics and Materials, Technical Univ. of Denmark, Denmark, [2]Ctr. for Photonics and Photonic Materials, Univ. of Bath, UK.* The dispersion of a broadband-guiding hollow core photonic crystal fiber, possessing a Kagome cladding structure, can be adversely influenced by weak residual mode interactions. The impact on pulse propagation is explored.

JFG3 • 4:15 p.m. Invited
Control of Surface Modes in Low Loss Hollow-Core Photonic Bandgap Fibers, *Rodrigo Amezcua Correa[1], Frederic Gerome[1], Sergio G. Leon-Saval[1], Neil G. R. Broderick[2], Tim A. Birks[1], Jonathan C. Knight[1]; [1]Ctr. for Photonics and Photonics Materials, Univ. of Bath, UK, [2]Optoelectronics Res. Ctr., Univ. of Southampton, UK.* We report low-loss hollow-core photonic bandgap fibers free from surface modes. They have low attenuation over the full spectral width of the bandgap, and approximately halved dispersion and dispersion slope compared to previous fibers.

3:45 p.m.–5:30 p.m. QFN • Ultrafast Phonon Dynamics

Junichiro Kono; Rice Univ., USA, Presider

QFN1 • 3:45 p.m.
Direct Measurement of Core-Level Relaxation Dynamics on a Surface-Adsorbate System Using Ultrafast X-Rays, *Luis Miaja-Avila[1], Guido Saathoff[1], Stefan Mathias[2], Jing Yin[1], Chan La-o-vorakiat[1], Michael Bauer[3], Martin Aeschlimann[2], Margaret Murnane[1], Henry Kapteyn[1]; [1]JILA, Univ. of Colorado, USA, [2]Dept. of Physics, Univ. of Kaiserslautern, Germany, [3]Inst. für Experimentelle und Angewandte Physik, Christian-Albrechts-Univ. zu Kiel, Germany.* We present the first direct measurement of inner shell relaxation dynamics on complex systems, in this case an adsorbate on a surface. We measured a lifetime of 7fs for N-shell vacancies of Xe on Pt(111).

QFN2 • 4:00 p.m.
Piezoelectricity Induced Terahertz Photon Absorption by Confined Acoustic Phonons in Wurtzite CdSe Nanocrystals, *Tzu-Ming Liu[1], Meng-Ju Yang[1], Chih-Wei Lai[1], Pi-Tai Chou[1], Ming-Hao Chang[2], Hsiang-Lin Liu[2], Chi-Kuang Sun[1]; [1]Natl. Taiwan Univ., Taiwan, [2]Natl. Taiwan Normal Univ., Taiwan.* We observed the first piezoelectricity induced terahertz (THz) photon absorption related to the confined acoustic phonons in nanoparticles. It provides a new mechanism for THz photon-phonon conversion in low dimensional systems.

QFN3 • 4:15 p.m.
Cascaded Exciton Relaxation Resonantly Enhanced by LO Phonons in Vertically Stacked InAs Quantum Dots on InP, *Xiaodong Mu, Yujie J. Ding, Boon S. Ooi; Lehigh Univ., USA.* We have evidenced the relaxation of excitons cascading down from the highest energy state to the ground level in vertically-stacked InAs quantum dots grown on an InP substrate, which is resonantly enhanced by LO phonons.

QFN4 • 4:30 p.m.
GaAs under Intense Photoexcitation: Ultrafast Carrier and Phonon Dynamics, *Amlan Basak[1], Muneaki Hase[2], Masahiro Kitajima[3], Hrvoje Petek[1]; [1]Dept. of Physics and Astronomy, Univ. of Pittsburgh, USA, [2]Inst. of Applied Physics, Univ. of Tsukuba, Japan, [3]Natl. Inst. of Materials Science, Tsukuba, Japan.* Ultrafast eletro-optic sampling is used to observe the response of n-doped GaAs with varying photoexcitation. Photocarrier density dependent coherent LO phonon-plasmon dynamics are observed. Time-resolved analysis reveals complex spectral evolution.

3:45 p.m.–5:30 p.m. JFH • High Harmonic Generation and Attosecond Physics III

Stephen R. Leone; Dept. of Chemistry and Physics, Univ. of California at Berkeley, USA, Presider

JFH1 • 3:45 p.m.
Attosecond Control of Electron Localization in One- and Two-Color Dissociative Ionization of H_2 and D_2, *M. F. Kling[1], S. Zherebtsov[1], I. Znakovskaya[1], T. Uphues[1], G. Sansone[2], E. Benedetti[2], F. Ferrari[2], M. Nisoli[2], F. Lepine[3], M. Swoboda[4], T. Remetter[4], A. L'Huillier[4], F. Kelkensberg[5], W. K. Siu[5], O. Ghafur[5], P. Johnsson[5], M. J. J. Vrakking[5]; [1]Max-Planck Inst. für Quantenoptik, Germany, [2]Natl. Lab for Ultraintense Optical Science, Consiglio Natl. delle Ricerche, Inst. Natl. per La Fisica della Materia, Dept. di Fisica, Politecnico di Milano, Italy, [3]Univ. Lyon [1], CNRS, LASIM, France, [4]Dept. of Physics, Lund Univ., Sweden, [5]Inst. for Atomic and Molecular Physics, Foundation for Fundamental Res. on Matter, Netherlands.* We present one-color (IR) and two-color (single attosecond XUV pulse + IR) experiments where the sub-cycle evolution of the electric field of light is used to control the dissociative ionization of hydrogen and deuterium molecules.

JFH2 • 4:00 p.m.
Generation of TW-Class Two-Cycle Pulses Using a Pressure-Gradient Hollow Fiber, *Samuel Bohman[1,2], Akira Suda[1], Masanori Kaku[1,3], Takuya Kanai[2], Shigeru Yamaguchi[2], Katsumi Midorikawa[1]; [1]RIKEN, Japan, [2]Tokai Univ., Japan, [3]Miyazaki Univ., Japan.* We demonstrate generation of intense 5 fs pulses using a pressure gradient hollow fiber. The beam after pulse compression could be focused to a diffraction-limited spot with an intensity of 3×10^{18} W/cm^2.

JFH3 • 4:15 p.m.
Heterodyne Interferometry Using High Harmonic Generation in Mixed Gases, *Tsuneto Kanai, Eiji J. Takahashi, Yasuo Nabekawa, Katsumi Midorikawa; Laser Technology Lab, RIKEN, Japan.* We develop a heterodyne interferometry using high harmonic generation in mixed gases. The structure of CO_2 was encoded in the interference modulation of harmonics generated in mixed gases of aligned CO_2 and its reference atom.

JFH4 • 4:30 p.m.
Molecular Recollision Interferometry in High Harmonic Generation, *Robynne Lock, Xibin Zhou, Nick Wagner, Wen Li, Henry C. Kapteyn, Margaret M. Murnane; JILA and Dept. of Physics, Univ. of Colorado, USA.* Using extreme-ultraviolet interferometry, we measure π phase shifts in high harmonics generated from transiently aligned molecules. This data directly reflects the quantum interferences in the electron wavepacket due to the two-center molecular structure.

3:45 p.m.–5:30 p.m. CFW • Advanced Solid-State Laser Materials

Mark Dubinskii; US Army Res. Lab, USA, Presider

CFW1 • 3:45 p.m. Invited
Recent Advances in Cr^{2+} and Fe^{2+} Doped Mid-IR Laser Materials, *Sergey B. Mirov; Univ. of Alabama at Birmingham, USA.* Recent advances in Cr^{2+} and Fe^{2+} doped mid-IR polycrystalline, hot-pressed ceramic, and quantum dot laser materials fabrication and lasing under optical excitation are presented. First steps toward achieving a direct electrical excitation are demonstrated.

CFW2 • 4:15 p.m.
Semiconductor Disk Laser Pumped Cr^{2+}:Chalcogenide Lasers, *Nils Hempler[1], John-Mark Hopkins[1], Benno Rösener[2], Nicola Schulz[2], Marcel Rattunde[2], Joachim Wagner[2], Utpal N. Roy[3], Arnold Burger[3], David Burns[1]; [1]Inst. of Photonics, Univ. of Strathclyde, UK, [2]Inst. for Applied Solid State Physics, Germany, [3]Dept. of Physics, Fisk Univ., USA.* The optically pumped semiconductor disk laser is shown to be a practical low-noise pump source for Cr^{2+}:chalcogenide lasers. Results on cw-pumping of a Cr^{2+}:ZnSe and quasi-cw-pumping of a Cr^{2+}:CdZnTe laser are presented.

CFW3 • 4:30 p.m.
Diode-Pumped, Actively Internal-Q-Switched Nd:MgO:PPLN Laser, *Yen-Hung Chen, Yu-Chen Chang, Chao-Hung Lin, Te-Yuan Chung; Dept. of Optics and Photonics, Natl. Central Univ., Taiwan.* We demonstrated a diode-pumped, electro-optically internal-Q-switched laser system fabricated using a Nd:MgO:PPLN. We obtained laser pulses of pulse energy >2.45 μJ and pulse width ~28 ns from this internal-Q-switched laser system with 2% output coupling.

3:45 p.m.–5:30 p.m. CFX • Nonlinear Optical Materials

Robert Fisher; RA Fisher Associates, USA, Presider

CFX1 • 3:45 p.m.
Temperature and Wavelength Dependence of the Nonlinear Optical Parameters of InP, *Joel Murray[1], Vincent Cowan[2], Leonel P. Gonzalez[1], Shekhar Guha[3]; [1]General Dynamics Information Technology, USA, [2]Univ. of Dayton, USA, [3]AFRL, USA.* Values of the nonlinear absorption and nonlinear refraction coefficients of InP were measured at different temperatures using picosecond and nanosecond durations lasers operating at 1064 nm and 1570 nm.

CFX2 • 4:00 p.m.
Spectral Behavior of Three-Photon Absorption in Zinc-Blende Semiconductors, *Claudiu M. Cirloganu, Peter D. Olszak, Lazaro A. Padilha, Scott Webster, David J. Hagan, Eric W. Van Stryland; CREOL, College of Optics and Photonics, Univ. of Central Florida, USA.* The three-photon absorption (3PA) spectrum of ZnSe was measured using femtosecond Z-scans and theoretically verified using a Kane 4-band model including nonparabolicity and nonzone-center wave functions. Several other semiconductors with various bandgap energies are presented.

CFX3 • 4:15 p.m.
Spatial Modulation Instability Driven by Light-Enhanced Nonlinearities in Semiconductor CdZnTe:V Crystals, *Sharon Shwartz[1], Mordechai Segev[1], Emil Zolotoyabko[1], Uri El-Hanany[2]; [1]Technion - Israel Inst. of Technology, Israel, [2]Orbotech Medical Solutions, Israel.* We present the observation of spatial-modulation-instability in CdZeTe:V, where the nonlinearities are greatly enhanced by light. We find that the index-change is composed of a huge (~0.01) uniform component and a 20-times smaller periodic component.

CFX4 • 4:30 p.m.
Multi-Pass Frequency Conversion of the CW Optical Pumped Semiconductor Laser in the UV Range, *Viktor A. Fromzel, Coorg R. Prasad, Mikhail A. Yakshin; Science and Engineering Services Inc., USA.* Multi-pass external cavity doubling of OPSL for 244 nm in BBO crystal is demonstrated. Conversion efficiency increases in 18 and 7 times with narrow and broad linewidths, respectively for 4-pass resonant-doubling compared to one-pass conversion.

Room J3

Marriott San Jose
Salon 1 and 2

CLEO

Marriott San Jose
Salon 3

QELS

3:45 p.m.–5:30 p.m.
QFO • Micro- and Nanocavities
Christoph Lienau; Carl von Ossietzky Univ., Oldenburg Inst., Germany, Presider

QFO1 • 3:45 p.m.
High-*Q* Photonic Nanocavity with a 2-ns Photon Lifetime, *Yasushi Takahashi[1], Hiroyuki Hagino[1], Yoshinori Tanaka[1], Takashi Asano[1], Susumu Noda[1,2]; [1]Dept. of Electronic Science and Engineering, Kyoto Univ., Japan, [2]Photonics and Electronics Science and Engineering Ctr., Kyoto Univ., Japan.* We have developed a photonic crystal nanocavity with a quality factor of 2.5×10^6 and a photon lifetime over 2 ns. This lifetime is the longest recorded thus far in photonic crystal cavities.

QFO2 • 4:00 p.m.
Disorder Induced Localized Photonic Modes in Planar Microcavities, *Y. Kodriano[1], D. Gershoni[1], B. Shapiro[1], M. E. Raikh[2], S. Reitzenstein[3], J. P. Reithmaier[3], A. Forchel[3]; [1]Technion, Israel, [2]Univ. of Utah, USA, [3]Univ. Würzburg, Germany.* We detect localized modes in a planar microcavity containing a layer of quantum dots and measure their spatial intensity distribution. Theory based on disorder induced most probable fluctuation in the dielectric constant explains our findings.

QFO3 • 4:15 p.m.
"Pick-and-Place" Positioning of Diamond Nanocrystals on Microcavities, *Paul E. Barclay[1], Oskar Painter[1], Charles Santori[2], Kai-Mei Fu[2], Raymond G. Beausoleil[2]; [1]Caltech, USA, [2]Hewlett Packard Labs, USA.* Diamond nanocrystals are deterministically positioned on high-*Q* SiO_2 microdisks using a fiber taper. The fiber taper is then used to collect cavity modified NV^- nanocrystal emission.

QFO4 • 4:30 p.m.
Nanocrystals in Photonic Crystal Cavities for Quantum Information Processing, *Yun-Feng Xiao[1,2], Jie Gao[1], Xiaodong Yang[1], Ranojoy Bose[1], Guang-Can Guo[2], Chee Wei Wong[1]; [1]Columbia Univ., USA, [2]Univ. of Science and Technology of China, China.* By virtue of a silicon high-*Q* photonic crystal nanocavity, we propose and examine theoretically interactions between a stationary electron spin qubit of a semiconductor nanocrystal and a flying photon qubit.

Marriott San Jose
Salon 4

CLEO

3:45 p.m.–5:30 p.m.
CFY • Subwavelength Structuring of Optical Materials
Presider to Be Announced

CFY1 • 3:45 p.m.
Large Simultaneous Band Gaps for Photonic and Phononic Crystal Slabs, *Saeed Mohammadi, Ali Asghar Eftekhar, Ali Adibi; Georgia Tech, USA.* We show the existence of simultaneous frequency band gaps for both photons and phonons in a slab of silicon with a periodic arrangement of cylindrical holes perpendicular to the slab surface with different lattice geometries.

CFY2 • 4:00 p.m.
Opening Hybrid Band Gaps in Two-Dimensional Photonic Crystals of $Pb(Mg_{1/3}Nb_{1/3})O_3$-$PbTiO_3$ Having Very Low Refractive Index Contrast, *Ratnanjali Khandwal[1], Xiaoyuan Qi[1], Bethanie J. H. Stadler[1], Kevin Zou[2]; [1]Univ. of Minnesota at Twin Cities, USA, [2]Boston Applied Technologies Inc., USA.* The effect of anisotropy on photonic crystals of $Pb(Mg_{1/3}Nb_{1/3})O_3$-$PbTiO_3$ rods in air matrices was analyzed. Despite a low refractive index contrast (n=1.47), hybrid photonic bandgaps were achieved after optimization of the structure and the anisotropy.

CFY3 • 4:15 p.m. Invited
Templated Self-Assembly and Nano-Plasmonics of Nano-Void Surfaces, *Bruno F. Soares[1], Robin M. Cole[1], Jeremy J. Baumberg[1], F. J. Garcia de Abajo[2], Sumeet Mahajan[3], Philip N. Bartlett[3]; [1]NanoPhotonics Ctr., Cambridge Univ., UK, [2]Inst. de Optica, CSIC, Spain, [3]School of Chemistry, Univ. of Southampton, UK.* Three-dimensionally nanostructured metal surfaces containing nano-scale voids produce strong localised plasmons. We show here the correlation between physical structure and photonic and electronic properties for several significant applications.

3:45 p.m.–5:30 p.m.
CFZ • High-Field THz Generation and Applications

Jason Deibel; Wright State Univ., USA, Presider

CFZ1 • 3:45 p.m. Invited

Terahertz-Field-Induced Carrier-Wave Rabi Oscillations in n-Type GaAs, *Peter Gaal[1], Wilhelm Kuehn[1], Klaus Reimann[1], Michael Woerner[1], Thomas Elsaesser[1], Rudolf Hey[2]; [1]Max-Born-Inst. für Nichtlineare Optik und Kurzzeitspektroskopie, Germany, [2]Paul-Drude-Inst. für Festkörperelektronik, Germany.* Carrier-wave Rabi oscillations between bound impurity levels in n-type GaAs are demonstrated by ultrafast THz propagation experiments for driving fields up to 5 kV/cm. For stronger fields the two-level approach breaks down.

CFZ2 • 4:15 p.m.

Nonlinear THz-Pump/THz-Probe Measurements of Semiconductor Carrier Dynamics, *Aaron M. Lindenberg[1,2], Haidan Wen[1], Erszi Szilagyi[1,2]; [1]Stanford Linear Accelerator Ctr., USA, [2]Stanford Univ., USA.* A table-top THz source has been employed to study the nonlinear response of semiconductors to near-half-cycle femtosecond pulses. We report nonlinear field-induced changes in the far infrared absorption coefficient, associated with impact ionization processes.

CFZ3 • 4:30 p.m.

Optical Detection of THz-Induced Strong Field Effects in Ensembles of Neutral Donors, *Dan G. Allen, Sangwoo Kim, Mark S. Sherwin; Univ. of California at Santa Barbara, USA.* Narrowband THz radiation drives transitions between bound electron states in GaAs neutral donors. Elastic light scattering from a donor bound exciton resonance allows time-resolved measurements of the excited state lifetime and THz-induced AC stark effect.

NOTES

QFL • Meta-Devices—Continued

QFL5 • 4:45 p.m.
Magnifying Metamaterial Lens Design by Coordinate Transformation, *Mankei Tsang[1], Demetri Psaltis[1,2]; [1]Caltech, USA, [2]Ecole Polytechnique Fédérale de Lausanne (EPFL), Switzerland.* We use the coordinate transformation technique to design metamaterial lenses that can magnify a two dimensional planar image beyond the diffraction limit.

QFL6 • 5:00 p.m.
Designs of Optical Cloak with Nonlinear Transformations, *Wenshan Cai, Vladimir M. Shalaev; Purdue Univ., USA.* Two novel designs for optical cloaking based on nonlinear transformations for TM and TE polarizations are presented. This critical development builds upon our previous work on nonmagnetic cloak designs and high-order transformations.

QFL7 • 5:15 p.m.
Ideal Cylindrical Cloak and Influence of Tiny Perturbation, *Wei Yan, Zhichao Ruan, Min Yan, Min Qiu; Royal Inst. of Technology (KTH), Sweden.* The invisibility of arbitrary radially transformed cylindrical cloaks is confirmed. The influence of a tiny perturbation at cloak's inner boundary is investigated. The methods to overcome the influence of perturbation are proposed.

QFM • Quantum Nonlinear Optics—Continued

QFM5 • 4:45 p.m. Invited
Correlations in Two-Mode Cavity QED, *David G. Norris[1], Jietai Jing[1], Rebecca Olson Knell[1], Luis A. Orozco[1], Arturo Fernandez[2], James P. Clemens[3], Perry R. Rice[3]; [1]Joint Quantum Inst., Dept. of Physics, Univ. of Maryland, USA, [2]Ctr. de Optica e Informacion Cuantica, Dept. de Fisica, Univ. de Concepcion, Chile, [3]Dept. of Physics, Miami Univ., USA.* The vertical and horizontal polarization modes of a cavity QED system become correlated through a single atom. Their auto-correlation and cross-correlations show an avenue for the study of the steady state entanglement in this system.

QFM6 • 5:15 p.m.
Modified Optical Cavity Transmission by an Intracavity Dispersive Medium, *Haibin Wu, Min Xiao; Univ. of Arkansas, USA.* By balancing the sharp linear and nonlinear dispersions of an intracavity electromagnetically induced transparency medium, the cavity transmission linewidth can be significantly modified and controlled. Cavity linewidth narrowing, broadening, and white-light cavity are experimentally demonstrated.

JFG • Joint CLEO/QELS Symposium on Hollow-Core Photonic-Crystal Fibers IV—Continued

JFG4 • 4:45 p.m. Invited
Realization of Low Loss and Polarization Maintaining Hollow Core Photonic Crystal Fibers, *Brian Mangan[1], Jens K. Lyngsø[1], Peter J. Robert[2]; [1]Crystal Fibre A/S, Denmark, [2]Dept. of Communications, Optics and Materials, Technical Univ. of Denmark, Denmark.* Antiresonant core walls in 7-cell hollow core fibers are used to reduce the attenuation to 9.3dB/km and create an intentionally highly birefringent fiber with a beatlength as low as 0.2mm.

QFN • Ultrafast Phonon Dynamics—Continued

QFN5 • 4:45 p.m.
Observation of Coherent G-Mode Oscillations in Single-Walled Carbon Nanotubes via the Spectrum-Resolved Detection, *J. H. Kim[1], K. J. Yee[1], Y. S. Lim[2], E. Haroz[3], J. Kono[3]; [1]Chungnam Natl. Univ., Republic of Korea, [2]Konkuk Univ., Republic of Korea, [3]Rice Univ., USA.* Coherent G-mode vibrations of single-walled carbon nanotubes are observed in the spectrum-resolved pump-probe measurements. The G-mode oscillation is relatively strong in the edge side of the laser spectrum while being weak for the central region.

QFN6 • 5:00 p.m.
Dynamics of the Dielectric Function in Fs-Laser Excited Bismuth, *Andrei V. Rode[1], Davide Boschetto[2], Thomas Garl[2], Antoine Rousse[2]; [1]Australian Natl. Univ., Australia, [2]Lab d'Optique Appliquée, ENSTA, Ecole Polytechnique, France.* Time-resolved study of the dielectric function of femtosecond laser excited bismuth demonstrates that excitation of coherent phonons leads to a solid-plasma phase transition, and into a quasi-stable excited state lasting up to 4 ns.

QFN7 • 5:15 p.m.
Sub-Picosecond Time-Dependent Mobility in Low-Band-Gap Polyphenylene:Fullerene Blend Probed by Terahertz Spectroscopy, *Hynek Němec[1], Han-Kwang Nienhuys[2], Erik Perzon[3], Fengling Zhang[4], Olle Inganäs[4], Petr Kužel[5], Villy Sundström[1]; [1]Lund Univ., Sweden, [2]FOM Inst. for Atomic and Molecular Physics, Netherlands, [3]Chalmers Univ., Sweden, [4]Linköping Univ., Sweden, [5]Inst. of Physics, ASCR, Czech Republic.* Time-resolved terahertz spectroscopy is used to investigate photo-induced dynamics of charge carriers in a polymer heterojunction. We directly observe instantaneous generation of highly mobile charge carriers followed by a rapid drop in their mobility.

JFH • High Harmonic Generation and Attosecond Physics III—Continued

JFH5 • 4:45 p.m.
Large Amplitude Modulation of High Order Harmonic Generation from Vibrationally Excited Molecules, *Wen Li[1,2], Xibin Zhou[1,2], Robynne Lock[1,2], Nick L. Wagner[1,2], Henry C. Kapteyn[1,2], Margaret M. Murnane[1,2], Serguei Patchkovskii[3], Albert A. Stolow[3]; [1]JILA and Dept. of Physics, Univ. of Colorado, USA, [2]NIST, USA, [3]Steacie Inst. of Molecular Science, Natl. Res. Council of Canada, Canada.* We observe large vibrationally-induced modulations in high harmonic conversion in N_2O_4. We explain this result as due to the changing electronic structure induced by the vibration, leading to preferential emission at the outer turning point.

JFH6 • 5:00 p.m.
High-Order Harmonic Generation with a 1.5 µm Self-Phase-Stabilized Parametric Source, *Caterina Vozzi[1], Francesca Calegari[1], Enrico Benedetti[1], Mauro Nisoli[1], Giuseppe Sansone[1], Sandro De Silvestri[1], Salvatore Satgira[1], Fabio Frassetto[2], Luca Poletto[2], Paolo Villoresi[2]; [1]Natl. Lab for Ultrafast and Ultraintense Optical Science, Inst. Natl. per la Fisica della Materia, Consiglio Natl. delle Res., Politecnico di Milano, Italy, [2]Lab for Ultraviolet and X-Ray Optical Res., Dept. of Information Engineering, Inst. Natl. per la Fisica della Materia, Consiglio Natl. delle Res., DEI, Univ. di Padova, Italy.* We generated high-order harmonics with self-phase-stabilized near-IR pulses produced by a parametric source. We observed a significant cutoff extension whit respect to 800-nm driving pulses at comparable peak intensity.

JFH7 • 5:15 p.m.
Ionization Gating for Tunable Isolated Attosecond Pulse Generation, *Aurelie Jullien[1,2], Thomas Pfeifer[1,2], Mark J. Abel[1,2], Phillip M. Nagel[1,2], Justine Bell[1,2], Daniel M. Neumark[1,2], Stephen R. Leone[1,2]; [1]Univ. of California at Berkeley, USA, [2]Lawrence Berkeley Natl. Lab, USA.* Ionization gating confines high-harmonic generation to the leading edge of the driver pulse. Experimentally produced soft-X-ray continuous radiation is spectrally broad and tunable. The method suggests isolated attosecond-pulse production with long driver pulses.

CFW • Advanced Solid-State Laser Materials—Continued

CFW4 • 4:45 p.m.
Laser Action in Bulk Nd^{3+}-Doped Telluride Glass, *Hamit Kalaycioglu[1], Huseyin Cankaya[1], Gonul Ozen[2], Lutfu Ovecoglu[2], Alphan Sennaroglu[1]; [1]Koc Univ., Turkey, [2]Istanbul Technical Univ., Turkey.* We report on the first observation of lasing in bulk Nd^{3+}-doped $(0.8)TeO_2$-$(0.2)WO_3$ glass at 1065 nm. Gain-switched operation was obtained with a slope efficiency of 12% at a pulse repetition rate of 1 kHz.

CFW5 • 5:00 p.m.
Developments toward a Reliable Diode-Pumped Hydrocarbon-Free 795-nm Rubidium Laser, *Sheldon S. Q. Wu[1,2], Thomas F. Soules[1], Ralph H. Page[1], Scott C. Mitchell[1], V. Keith Kanz[1], Raymond J. Beach[1]; [1]Lawrence Livermore Natl. Lab, USA, [2]Univ. of California at San Diego, USA.* We report a 795-nm diode-pumpable Rb laser using a buffer gas of pure ^3He. ^3He gas enhances mixing of the Rb fine-structure levels. This enables efficient lasing at reduced He pressures and improved thermal management.

CFW6 • 5:15 p.m.
17 Watts Continuous Wave Rubidium Laser, *Boris Zhdanov, A. Stooke, A. Boyadijian, A. Voci, Randall J. Knize; US Air Force Acad., USA.* A laser diode array pumped continuous wave Rubidium laser with slope efficiency of 53%, total optical efficiency of 46% and output power of 17 Watts has been demonstrated.

CFX • Nonlinear Optical Materials—Continued

CFX5 • 4:45 p.m.
Enhanced Electro-Optic Effect in InAs/GaAs Quantum Dots, *Brandon F. Redding, Xi Long, Nikolai Faleev, Shouyuan Shi, Dennis Prather; Univ. of Delaware, USA.* The electro-optic properties of InAs/GaAs quantum dots are studied in an external Mach-Zehnder Interferometer setup. The InAs/GaAs quantum dots are found to increase modulation relative to bulk GaAs and exhibit an electro-optic coefficient of 26pm/V.

CFX6 • 5:00 p.m.
Third-Harmonic Generation in Organic Thin Films as an Alternative to Degenerate Four-Wave Mixing Ultrafast Optical Image Processing, *Canek Fuentes-Hernandez, Shuo-Yen Tseng, San-Hui Chi, Joel M. Hales, Joseph W. Perry, Seth R. Marder, Bernard Kippelen; Georgia Tech, USA.* We report on the use of noncollinear third-harmonic generation in thin organic films for ultrafast optical image processing using 80 fs pulses at 1550nm and compare it with the traditional degenerate four-wave mixing approach.

CFX7 • 5:15 p.m.
New Mid-IR Nonlinear Optical Crystal: $CdSiP_2$, *Peter G. Schunemann[1], Kevin T. Zawilski[1], Thomas M. Pollak[1], David E. Zelmon[2], Nils C. Fernelius[2], F. Kenneth Hopkins[2]; [1]BAE Systems, USA, [2]AFRL, USA.* We report for the first time the phase matching properties of a new negative uniaxial crystal, $CdSiP_2$, which can be pumped at 1 or 1.5 microns to generate mid-IR output in the 2-9µm spectral range.

Room J3

Marriott San Jose
Salon 1 and 2

CLEO

Marriott San Jose
Salon 3

QELS

QFO • Micro- and Nanocavities—Continued

QFO5 • 4:45 p.m.
Coupled Quantum Electrodynamics in Photonic Crystal Nanocavities, *Yunfeng Xiao[1], Jie Gao[1], Xu-Bo Zou[2], James F. McMillan[1], Xiaodong Yang[1], Y.-l. Chen[2], Zheng-Fu Han[2], Guang-Can Guo[2], Chee Wei Wong[1]; [1]Columbia Univ., USA, [2]Univ. of Science and Technology of China, China.* We describe a scalable nanocavity array, with single quantum dots, for universal single-operation *N*-qubit quantum gate. A single two-level system controls the lineshapes, departing from optical-analog of electromagnetically-induced-transparency, with high fidelity and low photon loss.

QFO6 • 5:00 p.m.
Optical Cavity Modes in Micro-Pyramids, *Matthias Karl, Torsten Beck, Frank M. Weber, Jaime Lupaca-Schomber, Shunfeng Li, Dongzhi Hu, Daniel M. Schaadt, Heinz Kalt, Michael Hetterich; Inst. für Angewandte Physik, Univ. Karlsruhe (TH), Germany.* We report on the fabrication and investigation of pyramidal GaAs micro-cavities on top of a Bragg mirror. A finite-difference time-domain simulation supports the experimentally found optical mode structure for such a cavity shape.

QFO7 • 5:15 p.m.
Lasing in Sub-Micron Semiconductor Disk, *Qinghai Song[1], Jonathan Andreasen[1], Hui Cao[1], Seng Ho[1], Glenn Solomon[2]; [1]Northwestern Univ., USA, [2]NIST, USA.* Lasing was realized a sub-micron GaAs disk, which was fabricated by standard optical lithography and wet-etching method. As the disk thickness is comparable to the disk radius, 3-D–FDTD was used to simulate the resonant modes.

Marriott San Jose
Salon 4

CLEO

CFY • Subwavelength Structuring of Optical Materials—Continued

CFY4 • 4:45 p.m.
Flexible, Large-Area Metamaterials Fabricated on Thin Silicon Nitride Membranes, *Xomalin G. Peralta[1], Christian L. Arrington[1], Michael C. Wanke[1], Igal Brener[2], John D. Williams[1], Evgenya Smirnova[3], Antoinette J. Taylor[4], John F. O'Hara[4], Andrew Strikwerda[5], Richard D. Averitt[5], Willie J. Padilla[6]; [1]Sandia Natl. Labs, USA, [2]CINT Sandia Natl. Labs, USA, [3]ISR-[6], Los Alamos Natl. Lab, USA, [4]MPA-CINT, Los Alamos Natl. Lab, USA, [5]Dept. of Physics, Boston Univ., USA, [6]Dept. of Physics, Boston College, USA.* We present terahertz metamaterials fabricated on large-area, free-standing thin (≤1 μm) silicon nitride membranes with the aim of reducing dielectric losses, enhancing metamaterial sensing capabilities, and enabling flexible and conformable designs.

CFY5 • 5:00 p.m.
Interface Quality Control of Monolithic Photonic Crystals by Hydrogen Annealing, *Sora Kim[1], Rishi Kant[1], Sanja Hadzialic[2], Roger T. Howe[1], Olav Solgaard[1]; [1]Stanford Univ., USA, [2]Univ. of Olso, Norway.* We demonstrate that the optical characteristics of silicon photonic crystals can be modified by hydrogen annealing. Hydrogen annealed PCs show reduced surface roughness and improved structural uniformity, leading to increased reflectivity and sharper resonance peaks.

CFY6 • 5:15 p.m.
Longitudinally Single Mode Laser-Diode Fabricated with Nanoimprint Lithography, *Jukka P. Viheriälä, Juha Tommila, Tuomo Rytkönen, Lauri Toikkanen, Mihail Dumitrescu, Tapio Niemi, Markus Pessa; Optoelectronics Res. Ctr., Tampere Univ. of Technology, Finland.* We demonstrate diode lasers with integrated feedback gratings using Nanoimprint Lithography. Our process is developed for epitaxially grown semiconductors. Due to the feedback from the grating longitudinally single mode lasing is achieved.

CFZ • High-Field THz Generation and Applications—Continued

CFZ4 • 4:45 p.m. Invited
High-Power THz Generation, THz Nonlinear Optics and THz Nonlinear Spectroscopy, *János Hebling[1,2], Ka-Lo Yeh[1], Matthias C. Hoffmann[1], Keith A. Nelson[1]; [1]MIT, USA, [2]Dept. of Experimental Physics, Univ. of Pécs, Hungary.* A review of generation of high-power terahertz single-cycle and shaped pulses by tilted pulse front excitation with up to 200 MW/cm^2 intensity is given. Recent demonstrations of terahertz nonlinear optics and spectroscopy are then presented.

CFZ5 • 5:15 p.m.
Terahertz Emission from a Tilted-Front Laser Pulse: Phase-Matching versus Cherenkov Radiation, *Michael I. Bakunov[1,2], Sergey B. Bodrov[2,1], Maxim V. Tsarev[1,2]; [1]Univ. of Nizhny Novgorod, Russian Federation, [2]Inst. of Applied Physics, Russian Acad. of Sciences, Russian Federation.* We developed a theory to explain record experimental efficiencies of terahertz emission from tilted-front femtosecond laser pulses propagating through electro-optic crystals. This theory predicts optimal pulse parameters and crystal size maximizing the terahertz yield.

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