Rooms 318-320

CLEO

8:00 a.m.–9:45 a.m.
CMA • fs Fiber Oscillators I
Jay E. Sharping; Univ. of California at Merced, USA, Presider

CMA1 • 8:00 a.m.
Passive Synchronization between Self-Similar Yb-Fiber and Stretched-Pulse Er-Fiber Mode-Locked Lasers, *Wei-Wei Hsiang[1], Chia-Hao Chang[1], Chien-Po Cheng[1], Hsin-Chia Su[2], Seth Tsau[2], Chieh Hu[2], Yinchieh Lai[3,4]; [1]Dept. of Physics, Fu Jen Catholic Univ., Taiwan, [2]Laser Application Technology Ctr., ITRI, Taiwan, [3]Dept. of Photonics & Inst. of Electro-Optical Engineering, Natl. Chiao-Tung Univ., Taiwan, [4]Res. Ctr. for Applied Sciences, Academia Sinica, Taiwan.* Passive synchronization is demonstrated between the self-similar Yb-fiber and the stretched-pulse Er-fiber mode-locked lasers. The pulse repetition rates of the two mode-locked lasers can keep locked when multiple-pulse bound states or periodic pulse collisions occur.

CMA2 • 8:15 a.m.
Normal-Dispersion Passively Mode-Locked Ytterbium-Doped Fiber Laser with a Fundamental Repetition Rate Higher than 400 MHz, *Dai Yoshitomi[1], Taisuke Kawasaki[2], Takashi Aoki[3], Yohei Kobayashi[1,2], Norio Nakamura[2], Tetsuya Homma[3], Hiroshi Kawata[4], Kenji Torizuka[1]; [1]AIST, Japan, [2]Inst. for Solid State Physics, Univ. of Tokyo, Japan, [3]Shibaura Inst. of Technology, Japan, [4]High Energy Accelerator Res. Organization (KEK), Japan.* We have developed a normal-dispersion passively mode-locked ytterbium-doped fiber laser with a fundamental repetition rate higher than 400 MHz at a wavelength of ~1085 nm by use of a short linear cavity design.

CMA3 • 8:30 a.m.
Passively Generated High Repetition Rate Pulse Bursts Using a Fiber Laser with a Polarization Maintaining Section, *Avi Zadok, Jacob Sendowski, Amnon Yariv; Caltech, USA.* Pulse bursts of sub-THz rates are passively generated in a mode locked fiber laser. Repetition rates are controlled by the differential group delay of an intra cavity polarization maintaining fiber. Simulations and experiments are reported.

CMA4 • 8:45 a.m.
All-PM Monolithic fs Yb-Fiber Laser, Dispersion-Managed with All-Solid Photonic Bandgap Fiber, *Xiaomin Liu, Jesper Lægsgaard, Dmitry Turchinovich; Technical Univ. of Denmark, Denmark.* All-in-fiber SESAM-modelocked self-starting fiber laser is demonstrated. Cavity dispersion is managed by a spliced-in PM all-solid photonic bandgap fiber. The laser directly delivers 1.25 nJ pulses of 280 fs duration.

Rooms 321-323

IQEC

8:00 a.m.–9:45 a.m.
IMA • Strongly Coupled Atomic Systems
James P. Clemens; Miami Univ., USA, Presider

IMA1 • 8:00 a.m. Tutorial
Atomic Physics and Quantum Information Processing with Superconducting Circuits, *Franco Nori[1,2]; [1]RIKEN, Japan, [2]Univ. of Michigan, USA.* Superconducting circuits using Josephson junctions can behave like atoms making transitions between discrete energy levels. Such circuits can test quantum mechanics at macroscopic scales and be used to conduct atomic-physics experiments on a silicon chip.

Franco Nori was born in Venezuela and received his Ph.D. in Physics in 1987, from the University of Illinois, USA. From 1987-89 he was at the ITP of the University of California at Santa Barbara. Later on, he became Professor at the Physics Department, University of Michigan, Ann Arbor, and team leader in RIKEN, Japan. His areas of research are: nano-science; condensed matter physics; complex systems; and quantum information. He is a Fellow of the American Association for the Advancement of Science (AAAS); Fellow of the Institute of Physics (IoP), UK; and Fellow of the American Physical Society (APS).

Rooms 324-326

CLEO

8:00 a.m.–9:45 a.m.
CMB • 10 Years of Frequency Combs CLEO Symposium I
Thomas R. Schibli; JILA, USA, Presider

CMB1 • 8:00 a.m. Tutorial
Frequency Combs—At the Frontier of Precision Measurements, *Theodor Hänsch; Univ. of Munich, Germany.* The principles and techniques for generating optical frequency combs from the THz region to the extreme ultraviolet will be reviewed. A growing list of applications includes precise spectroscopy of atoms and molecules, optical atomic clocks, and precision astronomy.

Professor Theodor W. Hänsch is a Director at the Max-Planck-Institute of Quantum Optics in Garching, and Carl Friedrich von Siemens Professor at the Department of Physics of the Ludwig-Maxmilians-University in Munich, Germany. He was born in Heidelberg, Germany, where he received his doctorate in laser physics in 1969. In 1970, he joined Arthur L. Schawlow at Stanford University as a postdoc. Two years later, he accepted a faculty appointment at the Stanford Physics Department, where he worked as a Full Professor from 1975 until he returned to his native Germany in 1986. In 2005, Theodor W. Hänsch shared half of the Physics Nobel Prize with John L. Hall *for their contributions to the development of laser-based precision spectroscopy, including the optical frequency comb technique.*

Room 314

IQEC

8:00 a.m.–9:45 a.m.
IMB • Infrared and Nonlinear Plasmonics
Gennady Shvets; Univ. of Texas at Austin, USA, Presider

IMB1 • 8:00 a.m.
Active Control and Spatial Mapping of Mid-Infrared Propagating Surface Plasmons, *Troy Ribaudo[1], Eric Shaner[2], Scott S. Howard[3], Claire Gmachl[3], Xiaojun Wang[4], Fow-Sen Choa[5], Daniel Wasserman[1]; [1]Univ. of Massachusetts at Lowell, USA, [2]Sandia Natl. Labs, USA, [3]Princeton Univ., USA, [4]Adtech Optics Inc., USA, [5]Univ. of Maryland, Baltimore County, USA.* Surface waves on metal films with subwavelength features and tunable optical resonances are excited with a quantum cascade laser. The resulting transmission through, and propagation on, the metal/dielectric interface is measured, both spectrally and spatially.

IMB2 • 8:15 a.m.
Critical Coupling to Surface Phonon-Polaritons in SiC, *Burton Neuner III[1], Dmitriy Korobkin[1], Chris Fietz[1], Davy Carole[2], Gabriel Ferro[2], Gennady Shvets[1]; [1]Univ. of Texas at Austin, USA, [2]Univ. Claude Bernard Lyon I, France.* We observe critically coupled surface phonon-polariton excitation in SiC, leading to maximum electric field enhancement. A double-scan of wavelength and incidence angle in the ATR configuration demonstrates critical coupling for two air gaps.

IMB3 • 8:30 a.m. Invited
Frequency Conversion of Spontaneously Emitted Photons in a Nonlinear Photonic Crystal Nanocavity, *Murray W. McCutcheon[1], Darrick E. Chang[2], Yinan Zhang[1], Mikhail D. Lukin[3], Marko Lončar[1]; [1]School of Engineering and Applied Sciences, Harvard Univ., USA, [2]Inst. for Quantum Information, Caltech, USA, [3]Physics Dept., Harvard Univ., USA.* We theoretically demonstrate high fidelity frequency conversion of a photon generated by a dipole-like emitter in a double mode nonlinear cavity irradiated by a classical field, and propose a realistic photonic crystal nanocavity implementation.

Room 315

IQEC

8:00 a.m.–9:45 a.m.
IMC • Nonlinear Nanophotonic and Periodic Media
Roberto Morandotti; INRS-EMT, Canada, Presider

IMC1 • 8:00 a.m. Invited
Large-Area Linear and Nonlinear Nanophotonics, *Steven R. Brueck; Univ. of New Mexico, USA.* Interferometric lithography provides a facile technique for the fabrication of large-areas of nanophotonic structures. Examples of both linear and nonlinear responses will be drawn from plasmonics, metamaterials, and photonic crystals.

IMC2 • 8:30 a.m.
Diffusion and Redistribution of Rubidium in Hollow-Core Photonic Bandgap Fibers, *Aaron D. Slepkov, Amar R. Bhagwat, Vivek Venkataraman, Pablo Londero, Alexander L. Gaeta; School of Applied and Engineering Physics, Cornell Univ., USA.* We characterize the diffusion and redistribution processes that Rb atoms undergo on the inner silica surface of hollow-core photonic bandgap fibers by investigating the dynamics of fiber-transmission and light-induced atomic desorption.

IMC3 • 8:45 a.m.
All-Optical Modulation of Four Wave Mixing in a Rb-Filled Hollow-Core Photonic Band-Gap Fiber, *Pablo S. Londero, Vivek Venkataraman, Amar R. Bhagwat, Aaron D. Slepkov, Alexander L. Gaeta; Cornell Univ., USA.* We demonstrate efficient modulation of four-wave mixing in a Rb-waveguide system via application of a weak "switching" field. We observe 3 dB attenuation of the signal field with only 3600 photons of "switching" energy.

Room 316

CLEO

8:00 a.m.–9:45 a.m.
CMC • Transmission and Optical Processing
Juerg Leuthold; Univ. of Karlsruhe (TH), Germany, Presider

CMC1 • 8:00 a.m. Invited
Forward Error Correction in Next Generation Optical Communication Systems, *Takashi Mizuochi; Mitsubishi Electric Corp., Japan.* Recent progress in advanced FECs for optical communications is reviewed. A low-density parity-check code (LDPC) is a promising candidate for 100 Gb/s class systems, potentially yielding a net coding gain of 9dB or more.

CMC2 • 8:30 a.m.
The Ultimate Cost of PDL in Fiber-Optic Systems, *Alon Nafta, Mark Shtaif; Tel Aviv Univ., Israel.* We study PDL in fiber-optic systems. The degradation in capacity is evaluated and quantified in terms of the equivalent reduction in SNR. The analysis provides guidelines for the amount of tolerable PDL in optical systems.

CMC3 • 8:45 a.m.
Scaling Rules for Optimizing 2R Regenerators, *Prashant P. Baveja[1], Drew N. Maywar[2], Govind P. Agrawal[1]; [1]Inst. of Optics, Univ. of Rochester, USA, [2]Lab of Laser Energetics, Univ. of Rochester, USA.* We show that the ratio of accumulated dispersion to maximum nonlinear phase shift can be used to predict the performance of regenerators making use of highly nonlinear fibers with different lengths, dispersions, and nonlinear parameters.

Room 317

8:00 a.m.–9:45 a.m.
CMD • Light Emission in Novel Nano-Structures and Materials
Leslie Kolodziejski; MIT, USA, Presider

CMD1 • 8:00 a.m. Invited
Lasing in Metal-Clad Nano-Cavities, *Martin T. Hill; Eindhoven Univ. of Technology, Netherlands.* Metallic nano-cavities employed in recently demonstrated metallic cavity nano-lasers are examined. An overview is given of results from devices employing metal-insulator-metal structures with sub-wavelength dimensions, and progress in further miniaturization to tens of nanometers reported.

CMD2 • 8:30 a.m.
Room Temperature Lasing from Subwavelength Metal-Insulator-Semiconductor Structures, *Maziar P. Nezhad, Aleksandar Simic, Olesya Bondarenko, Boris A. Slutsky, Amit Mizrahi, Liang Feng, Vitaliy Lomakin, Yeshaiahu Fainman; Univ. of California at San Diego, USA.* We report pulsed room temperature lasing from optically pumped sub-wavelength metal-insulator-semiconductor structures. The lasers consist of InGaAsP gain disks embedded in a SiO_2/ aluminum bi-layer. Lasing at 1520nm from a 730nm gain core is demonstrated.

CMD3 • 8:45 a.m.
All Planar Integration of High-Q, Er-Doped Silicon-Rich Silicon Nitride Microdisk with SU-8 Waveguide for On-Chip, Si-Based Light Source, *Jee Soo Chang[1], Seokchan Eom[1], Gun Yong Sung[2], Jung H. Shin[1]; [1]KAIST, Republic of Korea, [2]ETRI, Republic of Korea.* All-planar integration of a light source coupled WG on Si chip is achieved using SRN:Er microdisks and SU8 WG. High Q, sharp Er^{3+} WGM emission indicates the promise of SRN:Er for compact,Si- based light source.

Room 336 | Room 337 | Room 338 | Room 339

CLEO

8:00 a.m.–9:45 a.m.
CME • Imaging Applications
Fiorenzo Omenetto; Tufts Univ., USA, Presider

CME1 • 8:00 a.m. Invited
Multifocal, Multi-Modal, Photon Counting, Multiphoton Microscopy, *Jeffrey Squier, W. Amir, Ramon Carriles, E. Chandler, J. J. Field, Erich E. Hoover, D. Schafer, Kraig E. Sheetz; Colorado School of Mines, USA.* High-speed nonlinear imaging systems capable of dynamically imaging multiple focal planes simultaneously, in multiple modalities (two photon excitation fluorescence, second harmonic generation, and third harmonic generation), are demonstrated for the first time.

CME2 • 8:30 a.m.
Ultrafast Optical Wide Field Microscopy, *Rohit P. Prasankumar[1], Zahyun Ku[2], Aaron A. Gin[3], Prashanth C. Upadhya[1], Steven R. J. Brueck[2], Antoinette J. Taylor[1]; [1]Ctr. for Integrated Nanotechnologies, Los Alamos Natl. Lab, USA, [2]Ctr. for High Technology Materials, Univ. of New Mexico, USA, [3]Sandia Natl. Labs, USA.* An ultrafast optical microscope capable of rapidly and sensitively acquiring wide field optical images with sub-100 femtosecond temporal resolution and micrometer spatial resolution is demonstrated for the first time.

CME3 • 8:45 a.m.
Ultrafast Confocal Microscope for Functional Imaging of Organic Thin Films, *Dario Polli, Jenny Clark, Michele Celebrano, Giulia Grancini, Guglielmo Lanzani, Giulio Cerullo; Politecnico di Milano, Italy.* We introduce a novel instrument combining femtosecond pump-probe spectroscopy with broadband detection and confocal microscopy. The system has 200-fs temporal resolution and 300-nm spatial resolution. We present spatio-temporal maps of excited-state dynamics in polyfluorene-polymethylethacrylate blends.

8:00 a.m.–9:45 a.m.
CMF • Biomedical Tomography
James Tunnell; Univ. of Texas at Austin, USA, Presider

CMF1 • 8:00 a.m.
Imaging Fluorescence Resonance Energy Transfer in Scattering Media Using Optical Diffusion Tomography, *Vaibhav Gaind, Kevin J. Webb, Sumith Kularatne, Charles A. Bouman; Purdue Univ., USA.* We present experiments and simulations that show the microscopic fluorescence resonance energy transfer (FRET) donor-acceptor distance can be determined using a diffusion model. The approach could lead to deep tissue *in vivo* FRET imaging.

CMF2 • 8:15 a.m.
A Multi-Resolution Approach toward Robust Fluorescent Molecular Tomography: Experimental Phantom Results, *Pouyan Mohajerani, Ali Behrooz, Ali Adibi; Georgia Tech, USA.* We propose a method to improve depth resolution and accuracy of fluorescent molecular tomography (FMT) by applying a spatial constraint to obtain a low-resolution fluorophore presence map. Results are verified using a CW FMT system.

CMF3 • 8:30 a.m.
Concurrent Optical Coherence Tomography and Line-Scanning Laminar Optical Tomography, *Shuai Yuan[1], Qian Li[1], James Jiang[2], Alex Cable[2], Yu Chen[1]; [1]Univ. of Maryland, USA, [2]Thorlabs Inc., USA.* We have developed a hybrid optical tomography system combing optical coherence tomography (OCT) and line-scanning fluorescence laminar optical tomography (FLOT). This system could be used for concurrent depth-resolved tissue-structural and molecular imaging.

CMF4 • 8:45 a.m.
Multimodality Optical Imaging of Atherosclerotic Plaques Combining Optical Coherence Tomography and Fluorescence Lifetime Imaging, *Javier A. Jo, Brian E. Applegate, Chintan A. Trivedi, Patrick Thomas, Desmond Jacob, Ryan Shelton, Fred Clubb, Brandis Keller; Texas A&M Univ., USA.* We demonstrate the advantage of combining high-resolution Fourier domain optical coherence tomography (OCT) with wide-field time-gated fluorescence lifetime imaging microscopy (FLIM) for a comprehensive morphological and biochemical characterization of atherosclerotic vulnerable plaques (VP).

8:00 a.m.–9:45 a.m.
CMG • Compact Sensors
Douglas J. Bamford; Physical Sciences Inc., USA, Presider

CMG1 • 8:00 a.m.
Polarization-Noise Suppression by Twice 90º Polarization-Axis Rotated Splicing in Resonator Fiber Optic Gyroscope, *Xijing Wang, Zuyuan He, Kazuo Hotate; Dept. of Electrical Engineering and Information Systems, The Univ. of Tokyo, Japan.* 5-order enhancement in system sensitivity of resonator fiber optic gyroscope by polarization-noise suppression using twice 90º polarization-axis rotated splicing is numerically demonstrated. The optimal condition to suppress polarization-noise is demonstrated experimentally by temperature control.

CMG2 • 8:15 a.m.
Self-Mixing Interferometry in VCSELs for Nanomechanical Cantilever Sensing, *David Larsson[1], Anders Greve[2], Jørn M. Hvam[1], Anja Boisen[2], Kresten Yvind[1]; [1] Dept. of Photonics Engineering, DTU Fotonik, Denmark, [2] Dept. of Nano- and Microtechnology, DTU Nanotech, Denmark.* We have investigated optical read-out of uncoated polymer micrometer-sized cantilever sensors by self-mixing interference in VCSELs for single-molecule gas sensing. A resolution of ~0.2 nm is measured, which is much better than current methods.

CMG3 • 8:30 a.m.
Single Nanoparticle Detection by Mode Splitting in Ultra-High-Q Microtoroid, *Jiangang Zhu, Yun-Feng Xiao, Lin Li, Lina He, Lan Yang, Da-Ren Chen; Washington Univ. in St Louis, USA.* We experimentally demonstrate that a single nanoparticle can induce mode splitting of MHz in an ultra-high-Q microtoroid resonator, which can be used to extract information of the nanoparticle. Analytical model matches well with the experiments.

CMG4 • 8:45 a.m.
Plasmonic Sensors Based on Semiconductor Laser Diode Packages, *Qiaoqiang Gan, Filbert J. Bartoli; Lehigh Univ., USA.* We combine Plasmonic grating structures with commercially available semiconductor laser diode packages to realize a prototype miniaturized chemical/bio-sensor.

8:00 a.m.–9:45 a.m.
CMH • Nanostructured and Organic LEDs
Hao-Chung Kuo; IEO/Natl. Chiao-Tung Univ., Taiwan, Presider

CMH1 • 8:00 a.m.
Making a Direct Electrical Contact to InGaN/GaN Nanorod LEDs: High Output Power Density, *Ya-Ju Lee[1], Shawn-Yu Lin[2], Ching-Hua Chiu[3], Tien-Chang Lu[3], Hao-Chung Kuo[3], Shing-Chung Wang[3]; [1]Inst. of Electro-Optical Science and Technology, Natl. Taiwan Normal Univ., Taiwan, [2]Future Chips Constellation and Dept. of Physics, Applied Physics and Astronomy, Rensselaer Polytechnic Inst., USA, [3]Dept. of Photonics and Inst. of Electro-Optical Engineering, Natl. Chiao-Tung Univ., Taiwan.* We realize a new scheme for making a direct contact to a two-dimensional (2-D) nanorod LED array using the oblique-angle deposition. More importantly, we demonstrate highly efficient carrier injection into the nanorods.

CMH2 • 8:15 a.m.
Colloidal Nanocrystal-Based Light-Emitting Diodes Fabricated on Plastic—Towards Flexible Quantum Dot Optoelectronics, *Jian Xu[1], Zhanao Tan[1], Chunfeng Zhang[1], Fan Zhang[1], Shawn Pickering[1], Andrew Wang[2]; [1]Penn State Univ., USA, [2]Ocean NanoTech LLC, USA.* We report the first demonstration of mechanically flexible quantum dot light-emitting-diodes (QD-LEDs) of all three RGB primary colors. The efficiencies of the flexible devices are high, suggesting the intrinsic flexibility of the QD-based optoelectronic devices.

CMH3 • 8:30 a.m.
Microcontact Printing of Multicolor Quantum Dots Light Emitting Diode on Silicon, *Ashwini Gopal, Kazunori Hoshino, Sunmin Kim, Xiaojing Zhang; Univ. of Texas at Austin, USA.* A novel inorganic quantum dot based light emitting diode is fabricated by microcontact printing of a well defined-geometry of CdSe/ZnS nanoparticles films onto p-type silicon substrate that acts as the hole transporting layer.

CMH4 • 8:45 a.m.
White Light Generating Nonradiative Energy Transfer Directly from Epitaxial Quantum Wells to Colloidal Nanocrystal Quantum Dots, *Sedat Nizamoglu[1], Emre Sari[1], Jong-Hyeob Baek[2], In-Hwan Lee[3], Hilmi Volkan Demir[1]; [1]Dept. of Electrical and Electronics Engineering, Dept. of Physics, Nanotechnology Res. Ctr., and Inst. of Materials Science and Nanotechnology, Bilkent Univ., Turkey, [2]Korea Photonics Technology Inst., Republic of Korea, [3]School of Advanced Materials Engineering, Res. Ctr. of Industrial Technology, Chonbuk Natl. Univ., Republic of Korea.* We present white light generating nonradiative Förster resonance energy transfer at a rate of $(2ns)^{-1}$ directly from epitaxial InGaN/GaN quantum wells to CdSe/ZnS heteronanocrystals in their close proximity at chromaticity-coordinates (x,y)=(0.42,0.39) and correlated-color-temperature CCT=3135K.

Room 340 | Room 341 | Rooms 328-329

CLEO

8:00 a.m.–9:45 a.m.
CMI • THz Instrumentation and Techniques
Chiko Otani; RIKEN, Japan, Presider

CMI1 • 8:00 a.m.
Amplitude Modulation of Terahertz Quantum Cascade Lasers by External Interband-Excitation Light, *Norihiko Sekine, Iwao Hosako; NICT, Japan.* We have investigated light-current characteristics of terahertz quantum cascade lasers under external light injection. The light injection induces the modulation of the output power that is explained by the characteristic properties of the laser.

CMI2 • 8:15 a.m.
Inverse-Quantum-Engineering: A New Methodology for Designing THz QCLs for Basic and Applied Research, *Inès Waldmueller, Michael C. Wanke, Maytee Lerttamrab, Dan G. Allen, Weng W. Chow; Sandia Natl. Labs, USA.* We demonstrate the general capabilities of the developed methodology by tuning the emission frequency of a GaAs/$Al_xGa_{1-x}As$ THz QCL over a frequency range of 2.9 THz, and the Al fraction over a range of 0.17.

CMI3 • 8:30 a.m.
Spatiotemporal Control of THz Pulses by Shaping the Laser Beam Transverse Profile in a Non Linear Rectifying Crystal, *Ciro D'Amico, Marc Tondusson, Jerome Degert, Eric Freysz; Univ. de Bordeaux1, France.* We demonstrate that spatiotemporal properties of Terahertz (THz) pulses generated in a ZnTe crystal are controlled in the intermediate field by shaping the transverse spatial profile of the near infrared (NIR) femtosecond (fs) optical pump.

CMI4 • 8:45 a.m.
Terahertz-Wave Detection Using an Organic DAST Crystal Covering Ultra-Wide Frequency-Range at Room Temperature, *Hiroaki Minamide[1], Jun Zhang[1], Ruixiang Guo[1], Seigo Ohno[1], Katsuhiko Miyamoto[1], Hiromasa Ito[1,2]; [1]RIKEN Sendai, Japan, [2]Tohoku Univ., Japan.* Rapidly responding, high-sensitivity terahertz (THz)-wave detection with an organic DAST crystal was demonstrated using nonlinear frequency up-conversion to near-infrared light. Detection of THz-wave signals from 16.4-THz to 26.3-THz was achieved at room temperature.

8:00 a.m.–9:45 a.m.
CMJ • Nonlinear Optical Materials
David Hagan; CREOL, Univ. of Central Florida, USA, Presider

CMJ1 • 8:00 a.m. Invited
Ultra-Wide THz-Wave Generation by DAST and BNA, *Hiromasa Ito[1,2]; [1]RIKEN Sendai, Japan, [2]Tohoku Univ., Japan.* Organic crystals are most promising materials for efficient THz-wave generation. 4-dimethylamino-N-methyl-4-stilbazolium tosylate (DAST) and N-benzyl-2-methyl-4-nitroaniline (BNA) are investigated for ultra-wide THz-wave generation. New THz applications will be presented using frequency-agile THz sources.

CMJ2 • 8:30 a.m.
Multilayer Walk-off Corrected Nonlinear Optical Devices - Engineering of Quasi-Noncritical Phase-Matching to All Wavelengths, *Xiaodong Mu, Helmuth E. Meissner, Huai-Chuan Lee; Onyx Optics, Inc., USA.* Multilayer walk-off corrected nonlinear crystal composites not only can correct the spatial walk-off, but also can compensate the phase-mismatching caused by incident angle deviation. The noncritical phase-matching-like properties can be engineered to all wavelengths.

CMJ3 • 8:45 a.m.
Nonlinear Optical Transformation of the Polarization State with Holographic Cut Cubic Crystals, *Stoyan Kourtev[1], Lorenzo Canova[2], Nikolay Minkovski[1], Aurelie Jullien[2], Olivier Albert[2], Rodrigo Lopez-Martens[2], Solomon M. Saltiel[1]; [1]Faculty of Physics, Sofia Univ., Bulgaria, [2]Lab d'Optique Appliquée, École Natl.e Supérieure de Techniques Avances, École Polytechnique, CNRS, France.* We demonstrate very efficient (~30%) nonlinear optical polarization switch between two linearly cross-polarized states with holographic cut BaF_2 crystal. The same cut can be used for nonlinear optical transformation of circularly polarized light.

8:00 a.m.–9:45 a.m.
CMK • Quantum Dots and Mode-Locked Lasers
A. Catrina Bryce; Univ. of Glasgow, UK, Presider

CMK1 • 8:00 a.m. Tutorial
Commercialization of QD Lasers, *Mitsuru Sugawara; Fujitsu Labs Ltd., Japan.* This talk will overview developments and commercialization of quantum-dot optical devices, i.e., lasers and amplifiers, from the epoch-making finding of InAs self-assembled quantum dots emitting at 1.3 µm to the launch of QD Laser Inc and its activity.

Dr. Sugawara joined Fujitsu Laboratories Ltd., Japan, in 1984, and studied physics of semiconductor optical devices like lasers, detectors, amplifiers, and switches. Since the finding of self-assembled quantum dots emitting at 1.3 micron by his group in 1995, he has been working on physics of quantum-dot lasers and amplifiers and their application to optical communications. He worked as a professor of University of Tokyo in 2001-2005 to develop quantum-dot optical devices under the academic-industrial collaboration project. In 2006, he launched QD Laser, Inc. to commercialize quantum-dot optical devices as President and CEO. He is the recipient of the JAPAN Prime Minister's Award 2007 and the Runner-Up Award in the Semiconductor category of The Wall Street Journal Technology Innovation Awards 2006. He is the editor and the author of the book entitled Self-Assembled InGaAs/GaAs Quantum Dots.

Rooms 318-320

CLEO

CMA • fs Fiber Oscillators I—Continued

CMA5 • 9:00 a.m.
Femtosecond Pulses with 1.1 GHz Repetition Rate Generated from a CW Laser without Mode-Locking, *Yitang Dai, Chris Xu; Cornell Univ., USA.* 471-fs pulses are generated by injecting a 33-ps pulse train, obtained from pulse carving a 1.55-µm CW DFB laser, into a time-lens loop. High repetition rate of 1.1 GHz is demonstrated.

CMA6 • 9:15 a.m.
Giant-Chirp Oscillators for Short-Pulse Fiber Amplifiers, *William H. Renninger, Andy Chong, Frank W. Wise; Cornell Univ., USA.* A dissipative-soliton oscillator can replace the oscillator, stretcher, pulse-picker, and pre-amplifier in a chirped-pulse fiber amplifier. 150-ps pulses at 3-MHz repetition rate are amplified to 1-uJ energy with pulse duration as short as 670 fs.

CMA7 • 9:30 a.m.
High Energy Femtosecond Chirped-Pulse Oscillator, *Caroline Lecaplain[1], Bulend Ortaç[2], Ammar Hideur[1], Jens Limpert[2], Andreas Tünnermann[2]; [1]Univ. de Rouen, France, [2]Inst. of Applied Physics, Friedrich-Schiller-Univ. Jena, Germany.* We report on the generation of high-energy femtosecond pulses in a chirped-pulse oscillator based on an ytterbium-doped photonic crystal fiber. Output pulses with 800 fs duration and more than 90 nJ energy are generated.

Rooms 321-323

IQEC

IMA • Strongly Coupled Atomic Systems—Continued

IMA2 • 9:00 a.m.
Photon Correlations in Systems with Strong Light-Matter Coupling, *Lukas Schneebeli, Mackillo Kira, Stephan W. Koch; Dept. of Physics and Material Sciences Ctr., Philipps-Univ., Germany.* The appearance of the two-photon strong-coupling states is analyzed in atomic vs. semiconductor quantum-dot microcavities. An identical excitation mechanism explains phenomena observed in photon-correlation measurements.

IMA3 • 9:15 a.m.
Conditional Dynamics in Two-Mode Cavity QED, *David G. Norris[1], Eric J. Cahoon[1], Pablo Barberis[2], Howard J. Carmichael[3], Luis A. Orozco[1]; [1]Univ. of Maryland, USA, [2]Univ. Nacional Autonoma de Mexico, Mexico, [3]Univ. of Auckland, New Zealand.* The conditional dynamics of ^{85}Rb atoms in a driven two-mode optical cavity shows quantum beats from ground state Larmor precession. We study the manipulation and control of their fringe visibility.

IMA4 • 9:30 a.m.
A Cavity QED System Coupling Nitrogen Vacancy Centers in a Diamond Nanopillar to a Silica Microsphere, *Khodadad N. Dinyari, Mats Larsson, Hailin Wang; Univ. of Oregon, USA.* A composite cavity QED system, which couples nitrogen vacancy centers in a diamond nanopillar to whispering gallery modes in a silica microsphere and overcomes limitations of earlier diamond nanocrystal based systems, is demonstrated.

Rooms 324-326

CLEO

CMB • 10 Years of Frequency Combs CLEO Symposium I—Continued

CMB2 • 9:00 a.m.
Frequency Measurement of a Sr Optical Lattice Clock Using a Coherent Optical Link over a 120-km Fiber, *Feng-Lei Hong[1,2], Mitsuru Musha[3], Masao Takamoto[2,4], Hajime Inaba[1,2], Shinya Yanagimachi[1], Akifumi Takamizawa[1], Ken-ichi Watabe[1], Takeshi Ikegami[1], Michito Imae[1,2], Yasuhisa Fujii[1,2], Masaki Amemiya[1,2], Ken'ichi Nakagawa[3], Ken-ichi Ueda[3], Hidetoshi Katori[2,4]; [1]AIST, Japan, [2]CREST, Japan Science and Technology Agency, Japan, [3]Univ. of Electro-Communications, Japan, [4]Univ. of Tokyo, Japan.* We demonstrate a precision frequency measurement using a phase-stabilized 120-km optical fiber link over a physical distance of 50 km. The absolute frequency of the ^{87}Sr optical lattice clock is measured to be 429228004229874.1(2.4) Hz.

CMB3 • 9:15 a.m.
Absolute Ranging Using Frequency Combs, *William C. Swann, Ian Coddington, Nathan R. Newbury; NIST, USA.* We present a technique for measuring absolute range that uses two mismatched frequency combs to measure distance over 1.5 m range with 10 nm level statistical uncertainty.

CMB4 • 9:30 a.m.
New Mechanism of All-Optical Poling for Carrier-Envelope Phase Measurement Using Dye-Grafted Polymer, *Takayoshi Kobayashi[1,2,3,4], Kotaro Okamura[1,2]; [1]Univ. of Electro-Communications, Japan, [2]JST, Japan, [3]Natl. Chiao Tung Univ., Taiwan, [4]Osaka Univ., Japan.* All-optical poling efficiency was measured using dye-grafted polymer to determine the carrier-envelope phase. Increased chromophore density lead to tenfold reduction in signal detection time and presence of restoring force to zero poling was observed.

Room 314

IQEC

IMB • Infrared and Nonlinear Plasmonics—Continued

IMB4 • 9:00 a.m.
IR Index Sensing Based on Surface Phonon-Polaritons in SiC, *Dmitriy Korobkin[1], Burton Neuner III[1], Chris Fietz[1], Davy Carole[2], Gabriel Ferro[2], Gennady Shvets[1]; [1]Dept. of Physics, Univ. of Texas, USA, [2]Univ. Claude Bernard Lyon 1, France.* We present results demonstrating the excitation of surface phonon-polaritons at the interface between SiC and different materials. The resonant nature of the excitation can be used to sense minute substance amounts or distinguish between substances.

IMB5 • 9:15 a.m.
Weak Coupling of Monolayer Lead Sulfide Quantum Dots to Silicon Photonic Crystal Cavities at Near-Infrared Wavelengths, *Ranojoy Bose, Jie Gao, Fang Wen Sun, James F. McMillan, Xiaodong Yang, Charlton J. Chen, Chee Wei Wong; Columbia Univ., USA.* We present experimental analysis of weak coupling for monolayer lead sulfide quantum dots coupled to silicon photonic crystal cavities between 4K and room temperature, as well as power-saturation measurements of dots at 4K.

IMB6 • 9:30 a.m.
Enhancement of Nonlinearity in Random Metal-Dielectric Films, *Uday K. Chettiar, Piotr Nyga, Alexander V. Kildishev, Vladimir P. Drachev, Vladimir M. Shalaev; Purdue Univ., USA.* Metal-dielectric composites are studied experimentally and through fullwave simulations using FDTD. Simulations show excellent agreement with experiments. The local fields obtained from the simulations give insight into the enhancement of the nonlinear processes.

9:45 a.m.–10:15 a.m. Coffee Break, *300 Level Foyer*

NOTES

Room 315 | Room 316 | Room 317

IQEC

IMC • Nonlinear Nanophotonic and Periodic Media—Continued

IMC4 • 9:00 a.m.
Dynamic Localization in Curved Coupled Optical Waveguide Arrays, *Arash Joushaghani[1], Rajiv Iyer[1], Julius Wan[2], Joyce K. S. Poon[1], Martijn C. de Sterke[3], Marc M. Dignam[2], J. Stewart Aitchison[1]; [1]Univ. of Toronto, Canada, [2]Queen's Univ., Canada, [3]Univ. of Sydney, Australia.* We present the experimental observation of three different optical localization schemes in curved coupled optical waveguide arrays. Exact and approximate dynamic localization are compared and a new type of localization, quasi-Bloch oscillations, is demonstrated.

IMC5 • 9:15 a.m.
From Type II Upconversion to SPDC: A Path to Broadband Polarization Entanglement in Poled Fibers, *Eric Y. Zhu[1], Lukas G. Helt[2], Marco Liscidini[2], Li Qian[1], John E. Sipe[2], Albert Canagasabey[3], Costantino Corbari[3], Morten Ibsen[3], Peter G. Kazansky[3]; [1]Dept. of Electrical and Computer Engineering, Univ. of Toronto, Canada, [2]Dept. of Physics, Univ. of Toronto, Canada, [3]Optoelectronics Res. Ctr., Univ. of Southampton, UK.* We report type-II sum-frequency and second-harmonic generation in a 24-cm-long periodically-poled silica fiber. Quasi-phase matching is achieved for orthogonally-polarized signal and idler over 1520-1575 nm, demonstrating the path to in-fiber broadband polarization-entangled photon pair generation.

IMC6 • 9:30 a.m.
Ultrafast All-Optical Modulation in GaAs Photonic Crystal Cavities, *Chad Husko[1,2], Alfredo De Rossi[2], Sylvain Combrié[2], Quynh Tran[2], Fabrice Raineri[3,4], Chee Wei Wong[1]; [1]Columbia Univ., USA, [2]Thales Res. and Technology, France, [3]Lab de Photonique et de Nanostructures, CNRS, France, [4]Univ. D. Diderot, France.* We demonstrate all-optical modulation via ultrafast optical carrier injection in a GaAs photonic crystal cavity using a degenerate pump-probe technique. The low switching(absorption) energy~120fJ(10fJ),and fast response(~15ps),limited only by carrier lifetime, suggest practical all-optical switching applications.

CLEO

CMC • Transmission and Optical Processing—Continued

CMC4 • 9:00 a.m.
Highly Alignment Tolerant 10 Gb/s Links Using Very Large Core Plastic Optical Fiber, *Arup Polley, Stephen E. Ralph; Georgia Tech, USA.* We experimentally demonstrate error-free 10Gb/s transmission over the largest core size fiber ever reported. A tolerance of ±30micron is demonstrated for both the VCSEL source and PIN diode receiver.

CMC5 • 9:15 a.m.
1-µm Waveband, 12.5-Gbps Transmission with a Wavelength Tunable Single-Mode Selected Quantum-Dot Optical Frequency Comb Laser, *Naokatsu Yamamoto[1], Redouane Katouf[1], Kouichi Akahane[1], Tetsuya Kawanishi[1], Hideyuki Sotobayashi[2]; [1]NICT, Japan, [2]Aoyama Gakuin Univ., Japan.* 1-µm waveband, 12.5-Gbps transmission over a 1.5-km single-mode holey-fiber is demonstrated with clear eye-openings. A wavelength tunable single-mode selected quantum-dot optical frequency-comb laser is used as the optical-source potentially capable of wavelength division multiplexing (WDM).

CMC6 • 9:30 a.m.
Optimum Filter for Wavelength Conversion with QD-SOA, *Rene Bonk[1], Stelios Sygletos[1], Romain Brenot[2], Thomas Vallaitis[1], Andrej Marculescu[1], Philipp Vorreau[1], Jingshi Li[1], Wolfgang Freude[1], Francois Lelarge[2], Guang-Hua Duan[2], Juerg Leuthold[1]; [1]Univ. of Karlsruhe, Germany, [2]Alcatel-Thalès III-V Labs, Joint Lab of Bell Labs and Thales Res. and Technology, France.* High-quality all-optical wavelength conversion is demonstrated with a single QD-SOA followed by a filter. The operation regimes of QD-SOA are identified. It is shown that different filter schemes are needed for the respective regimes.

CMD • Light Emission in Novel Nano-Structures and Materials—Continued

CMD4 • 9:00 a.m.
Modulation of Uniform Light Pattern with Light Extraction Enhancement by GaN Microlens Arrays of LEDs, *YunChih Lee, Chien-Chi Hsu, Shih-Pu Yang, Po-Shen Lee, Jenq-Yang Chang, Mount-Learn Wu; Dept. of Optics and Photonics, Natl. Central Univ., Taiwan.* The uniform light pattern with light extraction enhancement 250% of LEDs with GaN microlens arrays are demonstrated numerically and experimentally. It makes LED light source as a device of spatial-intensity uniformity integrated with GaN-LEDs structure.

CMD5 • 9:15 a.m.
Paper Withdrawn.

CMD6 • 9:30 a.m.
Emission Enhancement and Redistribution via Bloch Surface Waves, *Molu Shi[1], Matteo Galli[2], Daniele Bajoni[2], Marco Liscidini[1], John Sipe[1]; [1]Univ. of Toronto, Canada, [2]Univ. of Pavia, Italy.* We demonstrate a strong enhancement and intensity redistribution of dipole emission by a Bloch Surface Wave at the surface of a periodic silicon nitrite multi-layer.

9:45 a.m.–10:15 a.m. Coffee Break, *300 Level Foyer*

NOTES

Room 336 | Room 337 | Room 338 | Room 339

CLEO

CME • Imaging Applications—Continued

CME4 • 9:00 a.m.
Ultrashort-Pulsed Nondiffracting Images, *Martin Bock, Susanta K. Das, Rüdiger Grunwald; Max-Born-Inst. for Nonlinear Optics and Short-Pulse Spectroscopy, Germany.* Saari's concept of "flying images" was realized with ultrashort-pulsed needle beam arrays. By applying reflective phase-only spatial light modulators, two-dimensional image information was programmed in pseudo-nondiffracting sub-beams of extremely high aspect ratio and propagation stability.

CME5 • 9:15 a.m.
Tabletop Coherent Diffractive Microscopy with Soft X-Rays from High Harmonic Generation at 13.5 nm, *Daisy A. Raymondson[1], Richard Sandberg[1], Ethan Townsend[1], Matt Seaberg[1], Chan La-o-vorakiat[1], Margaret Murnane[1], Henry Kapteyn[1], Kevin Raines[2], Jianwei Miao[2], William Schlotter[3,4]; [1]JILA, Univ. of Colorado and NIST, USA, [2]Dept. of Physics and Astronomy, Univ. of California at Los Angeles, USA, [3]Inst. fur Experimentalphysik, Univ. Hamburg, Germany, [4]FLASH at DESY, Germany.* We demonstrate lensless diffractive microscopy with 92nm resolution using 13.5nm light from high harmonic generation. Fast image retrieval with Fourier transform holography is shown, and we present paths to refining the images to higher resolution.

CME6 • 9:30 a.m.
Measurement of Two-Photon Excitation Spectrum of Various Fluorophores with Fourier Transform Nonlinear Spectroscopy, *Hiroshi Hashimoto[1,2], Keisuke Isobe[1], Akira Suda[1], Fumihiko Kannari[2], Hiroyuki Kawano[3], Hideaki Mizuno[3], Atsushi Miyawaki[3], Katsumi Midorikawa[1]; [1]RIKEN Advanced Science Inst., Japan, [2]Keio Univ., Japan, [3]RIKEN Brain Science Inst., Japan.* We show a technique to measure the two-photon excitation spectrum of various fluorophores, based on Fourier transform nonlinear spectroscopy with the use of ultrabroadband laser (670-1100 nm).

CMF • Biomedical Tomography—Continued

CMF5 • 9:00 a.m. Invited
Mesoscopic Imaging Using Multi Spectral Optoacoustic Tomography (MSOT), *Vasilis Ntziachristos, Daniel Razansky; Technische Univ. München, Germany.* The talk describes next generation high-resolution photonic tissue imaging that goes beyond the penetration limit of optical microscopy.

CMF6 • 9:30 a.m.
High-Resolution Photoacoustic Imaging, *Fanting Kong[1], Ying-Chih Chen[1], Harriet O. Lloyd[2], Ronald H. Silverman[2,3], Hyung Kim[4], Jonathan M. Cannata[4], K. Kirk Shung[4]; [1]Dept. of Physics and Astronomy, Hunter College and the Graduate School, CUNY, USA, [2]Dept. of Ophthalmology, Weill Cornell Medical College, USA, [3]F.L. Lizzi Ctr. for Biomedical Engineering, Riverside Res. Inst., USA, [4]Dept. of Biomedical Engineering, Univ. of Southern California, USA.* We report a high-resolution photoacoustic imaging apparatus based on a ring transducer which allows focused laser and ultrasonic beams to be launched collinearly from a monolithic device.

CMG • Compact Sensors—Continued

CMG5 • 9:00 a.m.
Contrast Enhancement of UV Absorption and Improved Biochip Imaging, *Kristelle Robin[1], Jean-Luc Reverchon[1], Arnaud Brignon[1], Laurent Mugherli[2], Michel Fromant[2], Pierre Plateau[2], Henri Benisty[3]; [1]Thales Res. & Technology, France, [2]Lab de Biochimie, CNRS, France, [3]Lab Charles Fabry de l'Inst. d'Optique, France.* Biochip using UV absorption for selective DNA or proteins imaging may take advantage of sensitivity enhancement thanks to either multilayer structures or grating structures. We discuss the interest of coupled angular and spectral illumination.

CMG6 • 9:15 a.m.
Highly-Sensitive Intracavity Detection Using Polarization Mode Beating Techniques, *Andrea Rosales-García[1], Theodore F. Morse[1], Juan Hernández-Cordero[2]; [1]Boston Univ., USA, [2]Inst. de Investigaciones en Materiales, Univ. Nacional Autónoma de México, Mexico.* We propose a highly-sensitive fiber optic sensor based on polarization mode beating techniques for measuring nanometric changes in optical pathlength. The high sensitivity and narrow laser linewidth show a potential application for ultra-sensitive biological measurements.

CMG7 • 9:30 a.m.
Gratings on Porous Silicon Structures for Sensing Applications, *Marco Liscidini[1], Xing Wei[2], Chris Kang[2], Guoguang Rong[2], Scott Retterer[3], Maddalena Patrini[4], John Sipe[1], Sharon Weiss[2]; [1]Univ. of Toronto, Canada, [2]Vanderbilt Univ., USA, [3]Oak Ridge Natl. Lab, USA, [4]Dept. of Physics, Univ. of Pavia, Italy.* We investigate the use of gratings on porous silicon (PSi) structures for sensing applications. Examples of two classes of systems are studied: grating-coupled waveguide biosensors and diffraction-based biosensors.

CMH • Nanostructured and Organic LEDs—Continued

CMH5 • 9:00 a.m.
Beam Shaping of GaN/InGaN Vertical-Injection Light Emitting Diodes via High-Aspect-Ratio Nanorod Arrays, *Min-An Tsai[1], Peichen Yu[1], C. L. Chao[1], C. H. Chiu[1], H. C. Kuo[1], T. C. Lu[1], S. C. Wang[1], J. J. Huang[2]; [1]Natl. Chiao Tung Univ., Taiwan, [2]Natl. Taiwan Univ., Taiwan.* The enhanced light extraction and collimated output beam profile from GaN/InGaN vertical-injection light emitting diodes are demonstrated utilizing high-aspect-ratio nanorod arrays. The nanorod arrays are patterned by self-assembled silica spheres, followed by inductively-coupled-plasma reactive-ion-etching.

CMH6 • 9:15 a.m.
Enhancement in Electron Injection and Transport of Organic Light Emitting Diodes Using MnO, *Jiaxiu Luo, Lixin Xiao, Zhijian Chen, Qihuang Gong; State Key Lab for Artificial Microstructures and Mesoscopic Physics, Dept. of Physics, Peking Univ., China.* An insulator MnO as an electron injecting and transporting material introduced into organic light-emitting diodes to increase electroluminescence efficiency also can eliminate the problem of the oxidation of reactive dopants to improve stability of devices.

CMH7 • 9:30 a.m.
Enhancement on Top Emission of Organic Light-Emitting Diode via Scattering Surface Plasmons by Nano-Aggregated Outcoupling Layer, *Zhijian Chen, Ziyao Wang, Lixin Xiao, Qihuang Gong; State Key Lab for Artificial Microstructures and Mesoscopic Physics, Dept. of Physics, Peking Univ., China.* A stable self nano-aggregated bathocuproine film was fabricated and introduced atop of conventional organic light emitting diode for enhancing top emission, leading to 2.7 times enhancement on top emission due to scattering surface plasmon energy.

9:45 a.m.–10:15 a.m. Coffee Break, *300 Level Foyer*

NOTES

CMI • THz Instrumentation and Techniques—Continued

CMI5 • 9:00 a.m. Invited

Terahertz-Comb-Referenced Spectrum Analyzer, *Takeshi Yasui; Osaka Univ., Japan.* Precise frequency measurement of CW-THz wave is proposed by using a THz frequency comb of photocurrent in a photoconductive antenna. Precision of the frequency measurement was 2.2×10^{-11} within the range of 75-110 GHz.

CMI6 • 9:30 a.m.

Ferroelectric PVDF-Based Surface Plasmon Resonance-Like Integrated Sensor at Terahertz Frequencies for Gaseous Analytes, *Alireza Hassani, Maksim Skorobogatiy; École Polytechnique de Montréal, Canada.* Plasmon-like excitation at the interface between fully polymeric fiber sensor and gaseous analyte is demonstrated theoretically in terahertz regime. Sensor sensitivity of 1.3e-4RIU to the changes in the gaseous analyte refractive index is predicted.

CMJ • Nonlinear Optical Materials—Continued

CMJ4 • 9:00 a.m.

Temporal Pulse Compression in High-Index Doped Silica Glass Integrated Waveguides, *Marco Peccianti[1,2], Ian B. Burgess[1], Marcello Ferrera[1], David Duchesne[1], Luca Razzari[1,3], Roberto Morandotti[1], Brent E. Little[4], Sai T. Chu[4], David J. Moss[5]; [1]INRS Énergie, Matériaux et Télécommunications, Canada, [2]Ctr. SOFT INFM-CNR, Sapienza Univ., Italy, [3]Dept. di Elettronica, Univ. di Pavia, Italy, [4]Infinera Ltd, USA, [5]CUDOS, School of Physics, Univ. of Sydney, Australia.* By exploiting the excellent nonlinear properties of a novel silica based low-loss high index glass (Hydex ®), we demonstrated low peak power, efficient ps pulse compression in a 45cm spiral waveguide.

CMJ5 • 9:15 a.m.

Light-Induced Reversible Shift and Control of the Bandgap of Bulk CdZnTe:V Crystals, *K. V. Adarsh, Sharon Shwartz, Mordechai Segev, Emil Zolotoyabko, Uri El Hanany; Technion-Israel Inst. of Technology, Israel.* We present the experimental observation of very large, light-induced, reversible change in the bandgap (up to 70meV) of CdZnTe:V crystals. Above a specific threshold, the bandgap shift persists when illumination is turned off.

CMJ6 • 9:30 a.m.

Mode-Selective Single-Beam Coherent Anti-Stokes Raman Scattering Spectroscopy of Gas Phase Molecules, *Paul J. Wrzesinski[1], Bingwei Xu[2], Dmitry Pestov[1], Marcos Dantus[1,2]; [1]Michigan State Univ., USA, [2]BioPhotonic Solutions Inc., USA.* Binary phase shaping is applied to single-beam CARS spectroscopy of gas mixtures, such as ambient air, and is shown to provide mode-selectivity and enhanced non-resonant background suppression capability when compared with the original technique.

CMK • Quantum Dots and Mode-Locked Lasers—Continued

CMK2 • 9:00 a.m.

Sub-kHz RF Electrical Linewidth from a 10GHz Passively Mode-Locked Quantum-Dot Laser Diode, *Guillermo Carpintero[1], Mark G. Thompson[2], Richard V. Penty[2], Ian H. White[2]; [1]Univ. Carlos III de Madrid, Spain, [2]Univ. of Cambridge, UK.* A packaged 10GHz monolithic two-section quantum-dot mode-locked laser is presented, with record narrow 500Hz RF electrical linewidth for passive mode-locking. Single sideband noise spectra show 147fs integrated timing jitter over the 4MHz-80MHz frequency range.

CMK3 • 9:15 a.m.

Single and Dual-Mode Injection Locked Quantum-Dot Mode-Locked Lasers, *Tatiana Habruseva[1], Shane O'Donoghue[1], Natalia Rebrova[1], Stephen P. Hegarty[1], Dmitrii Rachinskii[2], Guillaume Huyet[1,3]; [1]Tyndall Natl. Inst., Ireland, [2]Univ. College Cork, Ireland, [3]Cork Inst. of Technology, Ireland.* Quantum-dot mode-locked lasers are injection locked by single and two-tone master sources. Narrow linewidth, improved time-bandwidth product and wavelength control are demonstrated.

CMK4 • 9:30 a.m.

Picosecond Pulse Generation in Narrow Stripe Mode-Locked Quantum Dot Master Oscillator Power Amplifier, *Vojtech F. Olle, Mark G. Thompson, Kevin A. Williams, Richard V. Penty, Ian H. White; Ctr. for Photonic Systems, Univ. of Cambridge, UK.* This paper reports a monolithically integrated mode-locked narrow stripe QD MOPA operating at 1300nm generating a stable 20GHz pulse train with an average power of 46.4mW and a pulse duration of 8.3ps.

9:45 a.m.–10:15 a.m. Coffee Break, *300 Level Foyer*

NOTES

Rooms 318-320 | **Rooms 321-323** | **Rooms 324-326** — **CLEO**

Room 314 — **IQEC**

10:15 a.m.–12:00 p.m.
CML • fs Fiber Oscillators II
Jeff Nicholson; OFS Labs, USA, Presider

CML1 • 10:15 a.m.
High Repetition Rate, High Average Power, Femtosecond Erbium Fiber Ring Laser, *Jonathan L. Morse[1], Jason W. Sickler[1,2], Jian Chen[1], Franz X. Kärtner[1], Erich P. Ippen[1]; [1]MIT, USA, [2]SiOnyx, Inc., USA.* A 301 MHz fundamentally mode-locked erbium fiber ring laser generating 108 fs pulses is demonstrated. Novel combination of gain fiber with anomalous group-velocity dispersion and intra-cavity silicon with normal group-velocity dispersion yields a stretched-pulse operation.

CML2 • 10:30 a.m.
Polarization Maintaining Passively Mode-Locked Er-Doped Ultrashort Soliton Fiber Laser Using Single Wall Carbon Nanotube Polyimide Film, *Yumiko Seno[1], Norihiko Nishizawa[1], Yoichi Sakakibara[2], Kazuhiko Sumimura[1], Emiko Itoga[2], Hiromichi Kataura[2], Kazuyoshi Itoh[1]; [1]Osaka Univ., Japan, [2]AIST, Japan.* All-polarization maintaining Er-doped ultrashort soliton fiber laser using single wall carbon nanotube polyimide film and variable output coupler is constructed and investigated. A 580 pJ and 46 fs ultrashort pulse is generated after compression.

CML3 • 10:45 a.m.
Self-Similar and Stretched-Pulse Operation of Erbium-Doped Fiber Lasers with Carbon Nanotubes Saturable Absorber, *Khanh Kieu, Frank W. Wise; Cornell Univ., USA.* We report self-similar and stretched pulse operations in an all-fiber erbium-doped laser using carbon nanotube saturable absorber, for the first time. Pulses as short as 115fs are achieved in the stretched-pulse regime.

CML4 • 11:00 a.m.
A Passively Mode-Locked Femtosecond Soliton Fiber Laser at 1.5 µm with a CNT-Doped Polycarbonate Saturable Absorber, *Fumio Shohda[1], Takafumi Shirato[1], Masataka Nakazawa[1], Kyoji Komatsu[2], Toshikuni Kaino[2]; [1]Res. Inst. of Electrical Communication, Tohoku Univ., Japan, [2]Inst. of Multidisciplinary Res. for Advanced Materials, Tohoku Univ., Japan.* We report a new 1.5 µm passively mode-locked fiber laser incorporating a CNT-doped polycarbonate as a polymer saturable absorber. A 115-fs, 39-MHz soliton pulse was successfully generated with an average output power of 3.4 mW.

10:15 a.m.–12:00 p.m.
CMM • Polarization Effects in Nitride LEDs
Michael Wraback; ARL, USA, Presider

CMM1 • 10:15 a.m. Tutorial
Progress in the Growth, Characterization and Device Performance for Nonpolar and Semipolar GaN-Based Materials, *James Speck; Univ. of California at Santa Barbara, USA.* In this talk, we highlight UCSB work on growth of state-of-the-art nonpolar and semipolar GaN materials and devices to avoid deleterious effects due to discontinuities in spontaneous and piezoelectric polarization.

James S. Speck received his B.S.M.E from the University of Michigan in 1983. He received his S.M. and Sc.D. at MIT in 1985 and 1989 respectively in Materials Science. After a brief post-doctoral stay at MIT, he joined the faculty in the Materials Department at the Univ. of California at Santa Barbara in 1990 where he is now Professor and Department Chair. Speck's research focuses on the relationship between epitaxial growth, microstructural and morphological evolution, relationship to growth and devices. Nearly all of his current work is on GaN-related materials and devices.

10:15 a.m.–12:00 p.m.
CMN • 10 Years of Frequency Combs CLEO Symposium II
Kaoru Minoshima; AIST, Japan, Presider

CMN1 • 10:15 a.m.
GHz Yb-Femtosecond-Fiber Laser Frequency Comb, *I. Hartl, Hugh A. McKay, R. Thapa, B. K. Thomas, L. Dong, M. E. Fermann; IMRA America, Inc., USA.* We deomonstrate a Fabry-Pérot cavity, passively saturable-absorber-modelocked Yb-fiber femtosecond oscillator with up to 1.04 GHz fundamental repetition rate, enabling octave spanning continuum generation and self-referenced fCEO stabilization.

CMN2 • 10:30 a.m.
A Low-Noise, Octave-Spanning Optical Frequency Comb Generated by a Mode-Locked Fiber Laser with an Intracavity Electro-Optic Modulator, *Yoshiaki Nakajima[1,2,3], Hajime Inaba[2,3], Kazumoto Hosaka[2,3], Atsushi Ihara[2], Ken-Ichi Watabe[2], Atsushi Onae[2], Kaoru Minoshima[2], Sakae Kawato[1], Takao Kobayashi[1], Toshio Katsuyama[1], Feng-Lei Hong[2,3]; [1]Univ. of Fukui, Japan, [2]Natl. Metrology Inst. of Japan, Japan, [3]CREST, Japan Science and Technology Agency, Japan.* We demonstrate a fast control of an octave-spanning fiber-based frequency comb with an intracavity electro-optic modulator. The servo bandwidth of both repetition and carrier-envelope offset frequency is greater than 200 kHz.

CMN3 • 10:45 a.m.
Frequency Comb Generation in the XUV Regime Using a Yb-Fiber Laser and Amplifier System, *Birgitta Bernhardt[1], Akira Ozawa[1], Ronald Holzwarth[1], Thomas Udem[1], Ioachim Pupeza[1], Jens Rauschenberger[1], Ferenc Krausz[1], Theodor W. Hänsch[1], Yohei Kobayashi[2], Diana Höfling[3]; [1]Max-Planck-Inst. for Quantumoptics, Germany, [2]Inst. for Solid State Physics, Univ. of Tokyo, Japan, [3]Menlo Systems GmbH, Germany.* An Yb-doped fiber laser and amplifier system is used together with an enhancement cavity for high harmonic generation for precision spectroscopy. Higher order harmonics can be produced in comparison to systems with Ti:sapphire lasers.

CMN4 • 11:00 a.m.
Carrier-Envelope Phase Dynamics of Octave-Spanning Titanium:Sapphire Lasers, *Michelle Y. Sander, Franz X. Kärtner; MIT, USA.* The carrier-envelope phase dynamics of octave-spanning Ti:sapphire lasers are analyzed based on a one-dimensional laser. It is found that self-steepening is the major contributor to the energy dependent carrier-envelope phase and that center-frequency-shifts are negligible.

10:15 a.m.–12:00 p.m.
IMD • Plasmonic Antennas and Devices
Nader Engheta; Univ. of Pennsylvania, USA, Presider

IMD1 • 10:15 a.m.
Semiconductor Lasers with Integrated Plasmonic Polarizers, *Nanfang Yu[1], Qi Jie Wang[1], Christian Pflügl[1], Laurent Diehl[1], Tadataka Edamura[2], Sninichi Furuta[2], Masamichi Yamanishi[2], Hirofumi Kan[2], Federico Capasso[1]; [1]Harvard Univ., USA, [2]Central Res. Lab, Hamamatsu Photonics K.K., Japan.* We report control of semiconductor laser polarization by patterning plasmonic structures on the laser facet. Linearly-polarized laser emission along an arbitrary polarization direction and a combination of linearly- and circularly-polarized laser emission are demonstrated.

IMD2 • 10:30 a.m.
Direct UV Near-Field Optical Imaging of a Metallic Nano Bowtie Antenna, *Liangcheng Zhou, Qiaoqiang Gan, Filbert Bartoli, Volkmar Dierolf; Lehigh Univ., USA.* Direct near-field optical imaging of a bowtie nano-antenna was observed using a UV near field scanning optical microscope. A strong localized UV light spot was observed at the tip of the bowtie structure.

IMD3 • 10:45 a.m.
Optical Antennas for Vector Near-Field Imaging, *Robert L. Olmon[1], Laxmikant Saraf[2], Peter M. Krenz[3], Glenn D. Boreman[3], Markus B. Raschke[1]; [1]Univ. of Washington, USA, [2]Pacific Northwest Natl. Lab, USA, [3]CREOL, Univ. of Central Florida, USA.* A new method for nano-engineering the optical antenna properties of scanning probe tips by combining focused ion beam milling with nano-CVD is presented. We demonstrate the capabilities by probing specific vector-field components of plasmonic nanostructures.

IMD4 • 11:00 a.m.
Translation of Nanoantenna Field Enhancement by a Metal-Dielectric Composite Superlens, *Zhengtong Liu, Mark Thoreson, Alexander V. Kildishev, Vladimir P. Drachev, Vladimir M. Shalaev; Purdue Univ., USA.* Our simulations show that highly localized field enhancement produced by a periodic array of silver nanoantennas can be translated to the far side of a metal-dielectric composite superlens composed of silver and silica components.

Room 315

IQEC

10:15 a.m.–12:00 p.m.
IME • Solitons and Nonlinear Wave Propagation
Demetrios Christodoulides; CREOL, Univ. of Central Florida, USA, Presider

IME1 • 10:15 a.m.
Incoherent Surface-Solitons in Effectively-Instantaneous Nonlinear Media, *Barak Alfassi, Carmel Rotschild, Mordechai Segev; Technion-Israel Inst. of Technology, Israel.* We study, theoretically and experimentally, random-phase surface-solitons in instantaneous nonlocal nonlinear media, where the key mechanism for self-trapping is played by the nonlocal nature of the nonlinearity.

IME2 • 10:30 a.m.
Area Theorem and Energy Quantization for Dissipative Optical Solitons, *William H. Renninger, Andy Chong, Frank W. Wise; Cornell Univ., USA.* We derive a dissipative soliton area theorem that contrasts with other area theorems: the energy scales directly with the pulse duration, and the energy has an upper bound. Predictions are verified in a fiber oscillator.

IME3 • 10:45 a.m.
Soliton Interaction in Dispersion-Managed Fibers: Formation of the Soliton Molecule, *Alexander Hause, Haldor Hartwig, Christoph Mahnke, Michael Böhm, Fedor Mitschke; Univ. of Rostock, Germany.* We present a perturbation theory explaining the interaction of adjacent dispersion managed solitons. A stable equilibrium separation and oscillations around it are found. The model is validated by comparison to experimental and numerical results.

IME4 • 11:00 a.m.
Solitons in Semiconductor Microcavities Operating in the Strong Coupling Regime, *Oleg A. Egorov[1], Dmitry V. Skryabin[2], Alexey V. Yulin[2], Falk Lederer[1]; [1]Inst. of Condensed Matter Theory and Solid State Optics, Friedrich-Schiller-Univ. Jena, Germany, [2]Ctr. for Photonics and Photonic Materials, Dept. of Physics, Univ. of Bath, UK.* We demonstrate theoretically the existence of *polariton-solitons* in semiconductor microcavity in the strong-coupling regime. Their relaxation time and required pump powers are at least one order less than those of their weakly coupled light-only counterparts.

Room 316

CLEO

10:15 a.m.–12:00 p.m.
CMO • Free Space Optical and Quantum Communications
Curtis Menyuk; Univ. of Maryland, Baltimore County, USA, Presider

CMO1 • 10:15 a.m.
Non-Line-of-Sight Cloud-Scatter Communication, *Rex Moncur, Paul Edwards, Le N. Binh; Monash Univ., Australia.* We report novel low bit rate non-line-of-sight optical free space communication over 200 km employing forward scattering from clouds with 134 dB link loss and mid-path scatter gain of 10 dBi.

CMO2 • 10:30 a.m.
Integrated Angle-of-Arrival Sensing and Simultaneous Bidirectional Communication Using a Cat's Eye Modulating Retroreflector, *David J. Klotzkin[1,2], Peter G. Goetz[2], William S. Rabinovich[2], Mike S. Ferraro[2], Rita Mahon[2], Steven C. Binari[2]; [1]Binghamton Univ., USA, [2]NRL, USA.* A bidirectional single-aperture modulating retroreflector is realized by superimposing a small low-frequency signal on the interrogating beam. Transmitted and received data are frequency-separated, enabling full-duplex operation and autodetection of illumination.

CMO3 • 10:45 a.m.
Power Penalty from Amplified Spontaneous Emission in Spatial Diversity Links, *Todd G. Ulmer, Scott R. Henion, Frederick G. Walther; MIT Lincoln Lab, USA.* We investigate the power penalty caused by excess amplified spontaneous emission in an optically preamplified receiver for use with a multi-wavelength spatial diversity transmitter to mitigate atmospheric fading.

CMO4 • 11:00 a.m. Tutorial
Quantum Communication: Real-World Applications and Academic Research, *Nicolas Gisin; Univ. de Genève, Switzerland.* The field of quantum communication is mature enough to divided into an applied side, around Quantum Key Distribution, and a fundamental research program. This tutorial gives an intuitive perspective on some recent advances.

Room 317

10:15 a.m.–12:00 p.m.
CMP • Resonant and Photonic Crystal Structures Emission
Martin T. Hill; Eindhoven Univ. of Technology, Netherlands, Presider

CMP1 • 10:15 a.m. Invited
Photonic Crystal Nanocavity Laser with Single Quantum Dot Gain, *Masahiro Nomura, Naoto Kumagai, Satoshi Iwamoto, Yasutomo Ota, Yasuhiko Arakawa; Univ. of Tokyo, Japan.* We demonstrate a photonic crystal nanocavity laser essentially driven by single quantum dot gain. A diluted quantum dot density (~0.4/cavity) resulted in clear single quantum dot feature and distinct phase transition in photon correlation measurements.

CMP2 • 10:45 a.m.
Directive Emission from High-Q Photonic Crystal Cavities through Band Folding, *Sylvain Combrié, Nguyen Vi Quynh Tran, Alfredo De Rossi; Thales Res. and Technology, France.* A new design is proposed for tailoring the farfield of high-Q Photonic Crystal nanocavities. We achieved experimentally a six-fold improvement of the collection efficiency. This will improve single photon sources based on photonic crystals considerably.

CMP3 • 11:00 a.m.
InP 2-D Photonic Crystal Lasers Integrated onto SOI Waveguides, *Yacine Halioua[1,2], Timothy Karle[1], Isabelle Sagnes[1], Gunther Roelkens[2], Dries Van Thourhout[2], Rama Raj[1], Fabrice Raineri[1,3]; [1]LPN, CNRS, France, [2]Photonics Res. Group (INTEC), Ghent Univ.–IMEC, Belgium, [3]Univ. Paris-Diderot, France.* We report the fabrication of InP photonic crystal lasers operating around 1.55µm at room temperature, integrated and evanescently coupled to SOI waveguides. Laser operation is obtained from a line-defect accurately aligned above the SOI circuitry.

Room 336 | Room 337 | Room 338 | Room 339

CLEO | IQEC

10:15 a.m.–12:00 p.m.
CMQ • Ultrafast Optics Applications
Stefan Nolte; Friedrich Schiller Univ. Jena, Germany, Presider

CMQ1 • 10:15 a.m.
Optical Bandwidth and Focusing Dynamics Effects on an Underwater Laser Acoustic Source, *Melissa Hornstein, Theodore G. Jones, Antonio Ting, Dennis Lindwall; NRL, USA.* Both femtosecond and nanosecond laser pulses can produce nonlinear effects in water, including filamentation and laser-induced breakdown resulting in acoustic generation. We examine the effects of GVD, varying wavelength, bandwidth, energy, and focusing configurations.

CMQ2 • 10:30 a.m.
Remote Detection of Aluminum and Trace Methane Using Mobile Femtosecond Laser System of T&T Lab, *Yousef Kamali[1], Jean-François Daigle[1], Patrick Tremblay Simard[1], Francis Théberge[2], Marc Châteauneuf[2], Huailiang Xu[1], Ali Azarm[1], Yanping Chen[1], Claude Marceau[1], Zhen-Dong Sun[1], Jens Bernhardt[1], Sophie Chagnon-Lessard[1], François Lessard[1], Gilles Roy[2], Jacques Dubois[2], See Leang Chin[1]; [1]Ctr. d'Optique, Photonique et Lasers (COPL), Laval Univ., Canada, [2]Defence Res. and Development (DRDC)-Valcartier, Canada.* We report two remote sensing experiments of aluminum in the winter time and trace methane in the summer time using the mobile femtosecond laser facility T&T (Terawatt & Terahertz) designed by the Defence R&D Canada-Valcartier.

CMQ3 • 10:45 a.m.
Picosecond Ultrasonics Using an Optical Cavity, *Yanqiu Li, Qian Miao, Arto Nurmikko, Humphrey Maris; Brown Univ., USA.* We have implemented a new means of measuring very high frequency ultrasound in nanostructured materials (known as picosecond ultrasonics) by using a high-Q optical resonator that enables significant enhancement and detailed characterization of ultrasound signals.

CMQ4 • 11:00 a.m.
New Concept for Ultra-Broadband Photonic Integrator with Fundamentally Unlimited Operation Time Window, *Mohammad Hossein Asghari[1], Yongwoo Park[1], Yitang Dai[2], Jianping Yao[2], José Azaña[1]; [1]INRS, Canada, [2]Univ. of Ottawa, Canada.* We propose and demonstrate a concept for temporal integration of optical waveforms with no fundamental limitation on the device's operation time window and frequency bandwidth using a pulse multiplier concatenated with a fiber Bragg grating.

10:15 a.m.–12:00 p.m.
CMR • Optical Coherence Tomography
David Erickson; Cornell Univ., USA, Presider

CMR1 • 10:15 a.m. Tutorial
Advances in Optical Coherence Tomography for Biological Imaging, *Johannes F. de Boer; VU Univ. Amsterdam, Netherlands.* Advances in Optical Coherence Tomography will be discussed. Sensitivity advantages of Spectral or Fourier Domain and Optical Frequency Domain Imaging or Swept Source OCT will be explained, and examples of clinical applications will be presented.

Prof. J.F. de Boer is a full professor at the VU University, Amsterdam. He was an associate professor at Harvard Medical School until 2008. He is a pioneer of OCT technologies and application in Medicine. He developed the first video rate Spectral Domain OCT. His current interests include endoscopy and microscopy.

10:15 a.m.–12:00 p.m.
CMS • Pollutant and Emission Sensing
Terrence Meyer; Iowa State Univ., USA, Presider

CMS1 • 10:15 a.m. Invited
Characterizing Particulate and Droplet Size Distributions: Exhaust Emissions to Cloud Research, *William D. Bachalo; Artium Technologies, Inc., USA.* Phase Doppler interferometry applied to spray research has improved combustion efficiency with emissions reductions and led to insights in atmospheric and meteorological research. Laser-induced incandescence is demonstrated as a means for monitoring combustion particulate emissions.

CMS2 • 10:45 a.m.
Ultra-Compact Multipass Laser Absorption Spectroscopy Platform for Distributed Sensor Networks, *Stephen G. So[1], Ardalan Amiri Sani[2], Frank K. Tittel[2], Gerard Wysocki[1]; [1]Princeton Univ., USA, [2]Rice Univ., USA.* A prototype three-node wireless sensor network of portable, battery-powered spectroscopic trace-gas sensors equipped with custom 24-pass Herriott cells has been developed. Individual sensor performance and sensor network localization of a gas plume will be reported.

CMS3 • 11:00 a.m.
Design and Deployment of a Quantum Cascade Laser Absorption Spectrometer in an Open-Path Sensor System For Trace Gas Analysis, *Anna P. M. Michel[1], Peter Q. Liu[1], June K. Yeung[1], Paul Corrigan[2], Mary Lynn Baeck[1], Xiaole Pan[3], Huabin Dong[3], Zifa Wang[3], Timothy Day[4], James A. Smith[1], Fred Moshary[2], Claire F. Gmachl[1]; [1]Princeton Univ., USA, [2]CUNY, USA, [3]CAS, China, [4]Daylight Solutions, USA.* A widely tunable, external cavity quantum cascade laser was used in the deployment of an open-path sensor for the measurement of water vapor, ozone, ammonia, and carbon dioxide in the urban atmosphere of Beijing, China.

10:15 a.m.–12:00 p.m.
IMF • Quantum Information I
Paul E. Barclay; Hewlett-Packard Labs, USA, Presider

IMF1 • 10:15 a.m. Invited
Efficient Routing of Single Photons with One Atom and a Microtoroidal Cavity, *Takao Aoki[1], A. S. Parkins[2], D. J. Alton[3], C. A. Regal[3], Barak Dayan[4], E. Ostby[3], K. J. Vahala[3], H. J. Kimble[3]; [1]Kyoto Univ., Japan, [2]Univ. of Auckland, New Zealand, [3]Caltech, USA, [4]Weizmann Inst. of Science, Israel.* We demonstrate robust and efficient routing of photons using a microtoroidal cavity QED system. Single photons from a coherent input are sorted to one output of the fiber with excess photons redirected to the other.

IMF2 • 10:45 a.m. Invited
Quantum State Preparation with Waveguides and Photon Counting, *Christine Silberhorn; Max-Planck-Inst. für Optik, Germany.* Recent progress in quantum communication highlights the need of advanced non-Gaussian states exhibiting high purity and spatio-spectral single-mode characteristics. We employ tailored waveguides and photon counting to implement efficient state preparation suitable for quantum networks.

10:15 a.m.–12:00 p.m.
CMT • THz Spectroscopy and Dynamics
Richard Averitt; Boston Univ., USA, Presider

CMT1 • 10:15 a.m. Invited
Terahertz Electrical Measurement of Single-Walled Carbon Nanotube Transistors, *Zhaohui Zhong[1], Nathaniel M. Gabor[2], Jay E. Sharping[3], Alexander L. Gaeta[2], Paul McEuen[2]; [1]Univ. of Michigan, USA, [2]Cornell Univ., USA, [3]Univ. of California at Merced, USA.* We describe the first terahertz electrical measurements of single-walled carbon nanotube transistors. A picosecond ballistic electron resonance is directly observed in the time-domain. These results demonstrate a powerful new tool for directly probing picosecond electron motion in nanostructures.

CMT2 • 10:45 a.m.
THz Carrier Dynamics in Epitaxial Graphene, *Charles J. Divin[1], Dong Sun[1], Claire Berger[2], Walt de Heer[2], P. N. First[2], Theodore B. Norris[1]; [1]Univ. of Michigan, USA, [2]Georgia Tech, USA.* Ultrafast optical pump/THz-probe spectroscopy is used to measure the conductivity recovery dynamics in epitaxial graphene. The observed dynamics are insensitive to probe frequency, with recovery rates consistent with mid-IR measurements of carrier cooling.

CMT3 • 11:00 a.m. Invited
THz Studies of Charge and Exciton Dynamics in Semiconductor Nanostructures, *Mischa Bonn; FOM-Inst. for Atomic and Molecular Physics, Netherlands.* We have used Terahertz time-domain spectroscopy to investigate carrier dynamics in a wide range of semiconductors. It allows to discriminate between free charges and excitons and is suitable to study carrier-carrier interactions in nanostructured materials.

10:15 a.m.–12:00 p.m.
CMU • Nonlinear Optics in Gases
Jean-Claude Diels; Univ. of New Mexico, USA, Presider

CMU1 • 10:15 a.m.
Above-Millijoule Continuum Generation Using Polarisation Dependent Filamentation in Atoms and Molecules, *Oscar Varela[1], Amelle Zaïr[1], Julio San Roman[1], Iñigo J. Sola[1], Benjamin Alonso[1], Camilo Prieto[1], Luis Roso[1,2]; [1]Univ. de Salamanca, Spain, [2]Ctr. de Laseres Pulsados y Ultraintensos, Spain.* We experimentally demonstrate that input polarization control inducing one single filament is a very robust technique to achieve multi-millijoule output energies. We highlight a supercontinuum generation above one-millijoule limit consistent with sub-10fs laser pulse generation.

CMU2 • 10:30 a.m.
Femtosecond Laser Induced Plasma Diffraction Gratings in Air, *Sergiy Suntsov[1], Daryoush Abdollahpour[1], Dimitrios G. Papazoglou[1,2], Stelios Tzortzakis[1]; [1]Inst. of Electronic Structure and Laser, Foundation for Res. and Technology Hellas, Greece, [2]Univ. of Crete, Greece.* The creation of a volume plasma density grating in air by two intersecting high-intensity IR femtosecond laser pulses is demonstrated experimentally. The detailed characterization of the grating is conducted based on its diffraction properties.

CMU3 • 10:45 a.m.
Reconciling Two Views of IR Filamentation in Air: Bessel Beams or Plasma-Confined Beams? *Daniel Mirell, Jeremy Yeak, Jean-Claude Diels; Univ. of New Mexico, USA.* Filaments prepared by letting a beam collapse, or by launching a < 200µm beam from vacuum to atmosphere, are compared. The two types of filaments show different properties, characteristics of different theories about their nature.

CMU4 • 11:00 a.m.
Long Time Revival of Femtosecond Laser Plasma Filaments in Air, *Bing Zhou[1], Selcuk Akturk[1], Bernard Prade[1], Yves-Bernard Andre[1], Aurelien Houard[1], Yi Liu[1], Michel Franco[1], Ciro D'Amico[1], Estelle Salmon[2], Zuo-Qiang Hao[2], Noelle Lascoux[2], Andre Mysyrowicz[1]; [1]Lab d'Optique Appliquée, Ecole Natl. Supérieure de Techniques Avances, Ecole Polytechnique, Ctr. Natl. de la Recherche, France, [2]Univ. de Lyon, France.* We experimentally demonstrate the revival of femtosecond laser plasma channels in air up to several milliseconds after plasma recombination. the revived plasma channel is generated over 50 cm using a Bessel-like nanosecond laser beam.

10:15 a.m.–12:00 p.m.
CMV • Quantum Dot Lasers II
Mitsuru Sugawara; Fujitsu Labs Ltd., Japan, Presider

CMV1 • 10:15 a.m. Invited
Studies on the Relative Advantages of Quantum-Dot and Quantum-Well Gain Media in Lasers and Amplifiers, *Weng Chow; Sandia Natl. Labs, USA.* The merit of quantum-dot versus quantum-well lasers is much debated. This paper describes an attempt at an answer by examining intrinsic behavior and underlying physics, using a microscopic theory with a rigorous treatment of scattering.

CMV2 • 10:45 a.m.
InP/AlGaInP 730nm Emission Quantum Dot Lasers, *Mohammed S. Al-Ghamdi[1], Peter M. Smowton[1], Samuel Shutts[1], Matthew Hutchings[1], Peter Blood[1], Andrey Krysa[2]; [1]Cardiff Univ., UK, [2]EPSRC Natl. Ctr. for III-V Technologies, Univ. of Sheffield, UK.* We describe growth and wafer design improvements to reduce 300K threshold current density to 165Acm^{-2} for 2mm long laser with uncoated facets and, using sophisticated optical and electrical characterisation, we demonstrate how this is achieved.

CMV3 • 11:00 a.m.
Tunneling-Injection High-Power 1060-nm Quantum Dot Laser with Improved Temperature Stability, *E-M. Pavelescu[1], Christian Gilfert[1], J. P. Reithmaier[1], A. A. Martín-Mínguez[2], I. Esquivias[2]; [1]Univ. of Kassel, Germany, [2]Univ. Politécnica de Madrid, Spain.* High-power 1060 nm quantum dot lasers was developed with tunnel injection quantum wells. The laser showed an improved internal efficiency (94%) and high output powers (4.4 W) with a high characteristic temperature (197 K).

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

CLEO | IQEC

CML • fs Fiber Oscillators II—Continued

CML5 • 11:15 a.m.
Ultrafast Erbium-Doped Fiber Laser Mode-Locked by a Carbon Nanotube Saturable Absorber, *Zhipei Sun, Alex G. Rozhin, Fengqiu Wang, William Milne, Richard V. Penty, Ian H. White, Andrea C. Ferrari; Univ. of Cambridge, UK.* We demonstrate an ultrafast stretched-pulse fiber laser mode-locked by a carbon nanotube based saturable absorber. 123 fs pulses at 1.56 µm are generated with an output spectral width of 32 nm.

CML6 • 11:30 a.m.
147 fs, 51 MHz Soliton Fiber Laser at 1.56 µm with a Fiber-Connector-Type SWNT/P3HT Saturable Absorber, *Fumio Shohda[1], Takafumi Shirato[1], Masataka Nakazawa[1], Junji Mata[2], Jun Tsukamoto[2]; [1]Res. Inst. of Electrical Communication, Tohoku Univ., Japan, [2]Toray Industries Inc., Japan.* We fabricated a fiber-connector-type saturable absorber in which SWNTs and P3HT (poly-3-hexylthiophene) were coated on the connector end. The pulse width was 147 fs and the repetition rate reached as high as 51 MHz.

CML7 • 11:45 a.m.
Mode-Locked Thulium-Doped Fiber Laser with Carbon Nanotube Saturable Absorber, *Khanh Kieu, Frank W. Wise; Cornell Univ., USA.* We report mode-locking of an all-fiber thulium/holmium (Tm/Ho) co-doped laser with a saturable absorber based on a fiber taper embedded in carbon nanotube/polymer composite (FTCNTPC). 750fs soliton pulses are generated at wavelength around 1890nm.

CMM • Polarization Effects in Nitride LEDs—Continued

CMM2 • 11:15 a.m.
Light Emission Polarization Properties of A-Plane InGaN/GaN Quantum Wells Light Emitting Diodes, *Hung-Hsun Huang, Yuh-Renn Wu; Inst. of Photonics and Optoelectronics and Dept. of Electrical Engineering, Natl. Taiwan Univ., Taiwan.* We study the optical characteristics of nonpolar a-plane InGaN/GaN quantum wells. The larger indium composition and the smaller well width enhance the light polarization ratio. However, the polarization ratio decreases as the carrier injection increases.

CMM3 • 11:30 a.m.
Electro-Optical Properties of *n*-InGaN/*p*-GaN LED with *p*-Side Down with Varying Indium Composition, *Meredith L. Reed[1], H. Shen[1], Michael Wraback[1], Alexander Syrkin[2], Alexander Usikov[2]; [1]ARL, USA, [2]Technologies and Devices Intl., Inc., USA.* The negative polarization charge at the *n*-InGaN/*p*-GaN interface of single heterojunction LEDs with *p*-side down is investigated for various In-compositions. We demonstrate peak emission wavelength blue-shift and intensity dependence on In-composition with increasing current density.

CMM4 • 11:45 a.m.
Polarization-Enhanced Mg Doping in InGaN/GaN Superlattice for Green Light-Emitting Diodes, *Hung Cheng Lin[1], Geng Yen Lee[1], Hsueh Hsing Liu[1], Nai Wei Hsu[1], Chin Chi Wu[1], Jen Inn Chyi[1,2,3]; [1]Dept. of Electrical Engineering, Natl. Central Univ., Taiwan, [2]Dept. of Optics and Photonics, Natl. Central Univ., Taiwan, [3]Res. Ctr. for Applied Sciences, Academia Sinica, Taiwan.* Electrical properties of low-temperature grown Mg-modulation-doped InGaN/GaN superlattice (MD-SLS) for green light-emitting diodes (LEDs) are investigated. The light output intensity of green LEDs with the p-InGaN/GaN MD-SLS is approximately doubled.

CMN • 10 Years of Frequency Combs CLEO Symposium II—Continued

CMN5 • 11:15 a.m.
Quantum-Limited Comb Lineshape and Frequency Uncertainty, *Jared K. Wahlstrand[1], John T. Willits[1,2], Curtis R. Menyuk[1,3], Steven T. Cundiff[1]; [1]JILA, USA, [2]Univ. of Colorado, USA, [3]Univ. of Maryland, Baltimore County, USA.* We calculate the noise properties of a femtosecond frequency comb from experimentally-derived parameters. Using a simple model for a feedback system, we calculate the phase noise spectrum for comb lines across the laser spectrum.

CMN6 • 11:30 a.m.
Octave-Spanning Raman Comb Stabilized to an Optical Frequency Standard, *Masayuki Katsuragawa[1,2], F. L. Hong[3,4], T. Suzuki[1,2], M. Arakawa[1]; [1]Univ. of Electro-Communications, Japan, [2]PRESTO, Japan, [3]AIST, Japan, [4]CREST, Japan.* It is shown that adiabatic manipulation of a Raman process allows us to produce an optical-frequency-comb from single-frequency lasers. The carrier-envelope-offset frequency of the generated octave-spanning Raman comb is stabilized to an optical-frequency-standard.

CMN7 • 11:45 a.m.
Optical Frequency Comb Generated by Four-Wave Mixing in Highly Nonlinear Fibers, *Jose M. Chavez Boggio, Slaven Moro, Joshua Windmiller, Sanja Zlatanovic, Evgueny Myslivets, Nikola Alic, Stojan Radic; Univ. of California at San Diego, USA.* Efficient generation of a cascade of four-wave mixing products using a low-dispersion highly nonlinear fiber is demonstrated. The measured optical frequency comb (with a spacing of 100 GHz) spans over more than 350 nm.

IMD • Plasmonic Antennas and Devices—Continued

IMD5 • 11:15 a.m.
Directing Optical Emission Using a Yagi-Uda Antenna Composed of a Finite Linear Array of Gold Nanorods, *Terukazu Kosako, Holger F. Hofmann, Yutaka Kadoya; Hiroshima Univ., Japan.* We present the realization of a Yagi-Uda antenna array for the optical frequency regime made of gold nanorods. The results suggest that the optical antenna can be used to direct the emission of light.

IMD6 • 11:30 a.m.
Nanoscale Optical Field Localization by Resonantly Focused Plasmons, *Liang Feng, Derek Van Orden, Maxim Abashin, Vitaliy Lomakin, Yeshaiahu Fainman; Univ. of California at San Diego, USA.* A plasmonic resonant nano-focusing-antenna has been experimentally integrated with a Si waveguide to effectively convert an incoming waveguide mode to a localized plasmon mode and focus light in an ultra small volume in all 3 dimensions.

IMD7 • 11:45 a.m.
Generation of Vectorial Light Beams Using Space-Variant Subwavelength Gratings at 1064 nm, *Gilad Lerman, Avner Yanai, Uriel Levy; Hebrew Univ. of Jerusalem, Israel.* The generation of vectorial beams at 1064 nm by the use of polarization transformer devices consisting of space-variant subwavelength gratings (SGs) is demonstrated experimentally. We discuss using such beams for plasmonic nanofocusing applications.

12:00 p.m.–1:30 p.m. Lunch Break

NOTES

Room 315 | Room 316 | Room 317

IQEC

IME • Solitons and Nonlinear Wave Propagation—Continued

IME5 • 11:15 a.m.
Soliton Emission from a Trapping Potential, *Marco Peccianti[1,2], Gaetano Assanto[2]; [1]Res. Ctr. SOFT INFM-CNR, "Sapienza" Univ., Italy, [2]Nonlinear Optics and OptoElectronics Lab (NooEL), Univ. "Roma Tre", Italy.* Spatial solitons trapped in a confining potential can undergo power dependent scattering. As the potential depends on the nonlinearity, solitons can accumulate transverse acceleration and eventually escape. We demonstrated this phenomenon in a reorientational medium.

IME6 • 11:30 a.m.
Nonlinear Self-Focusing of Partially-Coherent Spatial Beams, *Can Sun, Dmitry V. Dylov, Jason W. Fleischer; Princeton Univ., USA.* We consider the propagation of a partially-coherent spatial beam in both self-focusing and self-defocusing nonlinear media. Measurements of beam widths for both nonlinearities confirm theoretical predictions based on a nonlinear Gaussian-Schell model.

IME7 • 11:45 a.m.
Observation of Two-Dimensional Quasi-Localized Solitons with Saddle-Shaped Diffraction and Hybrid Nonlinearity, *Yi Hu[1], Cibo Lou[1], Peng Zhang[1,2,3], Sheng Liu[2], Jianlin Zhao[2], Jingjun Xu[1], Jianke Yang[4], Zhigang Chen[1,3]; [1]Nankai Univ., China, [2]Northwestern Polytechnical Univ., China, [3]San Francisco State Univ., USA, [4]Univ. of Vermont, USA.* We report the first demonstration of 2-D quasi-localized solitons near a saddle point of diffraction surfaces. These solitons arise from a balance between saddle-shaped diffraction and hybrid nonlinearity in optically-induced ionic-type photonic lattices.

CLEO

CMO • Free Space Optical and Quantum Communications—Continued

Prof. Nicolas Gisin was born in 1952 in Geneva, Switzerland were he studied physics and mathematics. He received his Ph.D. in Physics from the University of Geneva in 1981. The "Fondation Louis de Broglie" recognised his dissertation with an award. After a post-doc at the University of Rochester, NY, he worked for a start-up company dedicated to fibre instrumentation. In 1988 he joined the Group of Applied Physics at the University of Geneva as head of the optics section. Under his leadership the optics section developed three research directions: telecom, optical sensors and quantum optics. The telecom and the sensing activities led to many patents and technological transfers to Swiss and international industries, with several commercial successes. The quantum optics activities are orientated towards fundamental research. Quantum cryptography and long distance quantum entanglement received a lot of attention from the international scientific community as well as from the mass media. In 2003, this was recognised as one of the 10 technologies that should "change the world "!

CMP • Resonant and Photonic Crystal Structures Emission—Continued

CMP4 • 11:15 a.m.
High Efficient and Tunable Edge Emitting Microlaser on Photonic Crystal Slab, *Wanhua Zheng, Mingxin Xing, Wei Chen, Wenjun Zhou, Anjin Liu, Hailing Wang, Lianghui Chen; Inst. of Semiconductors, CAS, China.* Tunable edge emitting microlaser was realized with a line defect waveguide, in which the radii of holes adjacent to the defect was varied gradually. A tunable range of 17 nm was obtained experimentally.

CMP5 • 11:30 a.m.
Stable Circularly-Polarized Emission from Vertical-Cavity Surface-Emitting Lasers, *Fan Zhang, Chunfeng Zhang, Jian Xu, Akhlesh Lakhtakia; Penn State Univ., USA.* A vertical cavity surface emitting laser (VCSEL) comprising a polarization-selective chiral reflector was designed, fabricated, and tested. Stable, single-mode, circularly-polarized (CP) lasing oscillation was achieved, for the first time, in a VCSEL cavity.

CMP6 • 11:45 a.m.
High Frequency Polarization Switching VCSEL Clock Using Subwavelength Quarter-Wave Plate, *Clinton J. Smith, Wendi Li, Shufeng Bai, Stephen Y. Chou; Princeton Univ., USA.* We demonstrated an external cavity vertical-cavity-surface-emitting-laser (VCSEL) clock using a subwavelength quarter-wave plate and achieved a polarization self-switching frequency as high as 7.2 GHz with an oscillation frequency FWHM of 6 MHz.

12:00 p.m.–1:30 p.m. Lunch Break

NOTES

Room 336 | Room 337 | Room 338 | Room 339

CLEO | IQEC

CMQ • Ultrafast Optics Applications—Continued

CMQ5 • 11:15 a.m.
Laser-Assisted Photoemission from Surfaces Driven by Long-Wavelength Infrared Light, *Jing Yin[1], Luis Miaja-Avlia[1], Sterling Backus[2], Guido Saathoff[3], Martin Aeschlimann[4], Margaret Murnane[1], Henry Kapteyn[1]; [1]JILA, Univ. of Colorado at Boulder, USA, [2]KMLabs Inc., USA, [3]Max-Planck-Inst. of Quantum Optics, Germany, [4]Dept. of Physics, Univ. of Kaiserslautern, Germany.* We demonstrate experimentally the advantages of driving laser-assisted photoemission from surfaces with long-wavelength-IR light. We show that applications in probing surface dynamics benefit from using longer-wavelengths since many side effects of strong fields are suppressed.

CMQ6 • 11:30 a.m.
Heterodyne Optical Sampling for Picosecond Ultrasonics and Nanoscale Heat Transfer, *Eric Mottay[1], Pierre Rigail[1], Christophe Pierre[2], Sebastien Ermeneux[2], Clement Rossignol[3], Jean-Michel Rampnoux[3], Stefan Dilhaire[3]; [1]Amplitude Systems, France, [2]Alphanov, France, [3]Univ. of Bordeaux, France.* We present a novel ultrafast pump-probe system, allowing for a drastic reduction in acquisition time, typically a few tens of minutes for 20,000 frames. We present acoustic waves and heat transfert measurements in nanometric layers.

CMQ7 • 11:45 a.m.
Novel 2-D High-Contrast Grating Hollow-Core Waveguide, *Bala Pesala[1], Vadim Karagodsky[1], Fumio Koyama[2], Connie Chang-Hasnain[1]; [1]Univ. of California at Berkeley, USA, [2]Tokyo Inst. of Technology, Japan.* Hollow-core waveguides based on high contrast gratings are analyzed using exact analytical formulation. We obtain dispersion diagrams and propose heterostructure geometry to confine the light two dimensionally in these waveguide structures.

CMR • Optical Coherence Tomography—Continued

CMR2 • 11:15 a.m.
Effective Indicators for Oral Cancer Diagnosis Based on Optical Coherence Tomography, *Meng-Tsan Tsai, Cheng-Kuang Lee, Hsiang-Chieh Lee, Yih-Ming Wang, C. C. Yang, Chun-Pin Chiang; Natl. Taiwan Univ., Taiwan.* A swept-source optical coherence tomography system is used to clinically scan oral precancer and cancer patients for statistically analyzing the effective indicators of diagnosis including the signal standard deviation, spatial-frequency spectral shape, and epithelium thickness.

CMR3 • 11:30 a.m.
Fourier Domain Pump-Probe Optical Coherence Tomography Imaging of Melanin, *Desmond Jacob, Ryan Lynn Shelton, Brian E. Applegate; Texas A&M Univ., USA.* We report the first molecular image of melanin using a novel extension of OCT, pump-probe OCT. Melanin, an abundant endogenous chromophore, could provide general contrast in OCT imaging and means to diagnose and/or monitor melanomas.

CMR4 • 11:45 a.m.
***In vivo* Measurement of the Retinal Movements Using Fourier Domain Low Coherence Interferometry,** *Kanwarpal Singh[1], Carolyne Dion[1,2], Santiago Costantino[2,3], Marcelo Wajszilber[2], Mark R. Lesk[2,3], Tsuneyuki Ozaki[1]; [1]INRS- EMT, Univ. du Québec, Canada, [2]Ctr. de Recherche de l'Hopital Maisonneuve-Rosemont, Canada, [3]Univ. de Montréal, Canada.* We describe an instrument for the study and diagnosis of glaucoma based on Fourier domain low coherence interferometry for the measurement of the retinal movements, to assess in real-time the biomechanical properties of the eye.

CMS • Pollutant and Emission Sensing—Continued

CMS4 • 11:15 a.m.
Characterization of Soot Aggregates Based on Polarization Modulated Scattering, *Weiwei Cai[1], Laura Kranendonk[2], David J. Ewing[1], Lin Ma[1]; [1]Clemson Univ., USA, [2]Fuels, Engines, and Emissions Res. Ctr., Oak Ridge Natl. Lab at NTRC, USA.* A sensor is demonstrated to characterize soot aggregates based on polarization modulated scattering. Comparison with other techniques shows promising agreement, and extension of the sensor to 1- or 2-dimensional soot imaging is discussed.

CMS5 • 11:30 a.m.
Multiple Gas Sensor Based on Super-Luminescent Diode for Combustion Monitoring, *Nilesh J. Vasa; Indian Inst. of Technology Madras, India.* Fiber-coupled super-luminescent diode (SLD) based source for the detection of various gases is proposed. SLDs with wavelengths of 760 nm and 1530 nm are used for sensing of O_2 and NH_3, respectively.

CMS6 • 11:45 a.m.
Real Time Ammonia Detection in Exhaled Human Breath with a Quantum Cascade Laser Based Sensor, *Rafał Lewicki[1], Anatoliy A. Kosterev[1], Yury A. Bakhirkin[1], David M. Thomazy[1], Jim Doty[1], Lei Dong[1], Frank K. Tittel[1], Terence H. Risby[2], Steven Solga[3,4], Deborah Kane[3], Timothy Day[5]; [1]Rice Univ., USA, [2]Johns Hopkins Univ., USA, [3]St. Luke's Hospital, USA, [4]Johns Hopkins Univ. School of Medicine, USA, [5]Daylight Solutions, USA.* Quantum cascade laser based breath sensor platform for medical applications employing a quartz-enhanced photoacoustic spectroscopy technique is reported. The detection sensitivity for exhaled ammonia is at <10 ppbv level with 1 s time resolution.

IMF • Quantum Information I—Continued

IMF3 • 11:15 a.m.
Microcavities for Cavity-QED in Single-Crystal Diamond, *Paul E. Barclay, Charles Santori, Kai-Mei C. Fu, Raymond G. Beausoleil; Hewlett-Packard Labs, USA.* Optical microcavites fabricated by etching whispering gallery mode and photonic crystal structures in a high-index gallium phosphide layer and an underlying single-crystal diamond substrate are studied experimentally and theoretically.

IMF4 • 11:30 a.m. Invited
Demonstration of Two-Qubit Quantum Algorithms with a Solid-State Electronic Processor, *Leonardo DiCarlo[1], Jerry Chow[1], Jay Gambetta[2], Lev Bishop[1], Johannes Majer[3], Alexandre Blais[4], Luigi Frunzio[1], Steven Girvin[1], Robert J. Schoelkopf[1]; [1]Yale Univ., USA, [2]Univ. of Waterloo, Canada, [3]Technische Univ. Wien, Austria, [4]Univ. de Sherbrooke, Canada.* We present the experimental implementation of two-qubit quantum algorithms in a superconducting circuit. Entanglement on demand, Grover searching and the Deutsch-Jozsa algorithm are demonstrated. Algorithmic performance is quantified via quantum state tomography.

12:00 p.m.–1:30 p.m. Lunch Break

NOTES

CMT • THz Spectroscopy and Dynamics—Continued

CMT4 • 11:30 a.m.
Terahertz Absorption in Non-Polar, Non-Hydrogen-Bonding Liquids, *Jonathan P. Laib, Daniel M. Mittleman; Rice Univ., USA.* We present results from our investigation into the liquid-lattice structures of *n*-pentane (C_5H_{12}) through *n*-hexadecane ($C_{16}H_{34}$). We observe alternating absorption values, at single frequencies, which are surprising and provide information about long-range correlations in liquids.

CMT5 • 11:45 a.m.
Ultrafast Carrier Dynamics in InGaN/GaN Multiple Quantum Wells, Measured by Time-Resolved Terahertz Spectroscopy, *Hendrik P. Porte, David G. Cooke, Peter Uhd Jepsen, Dmitry Turchinovich; DTU Fotonik, Technical Univ. of Denmark, Denmark.* Terahertz conductivity of InGaN/GaN MQWs was studied by time-resolved terahertz spectroscopy. Descreening of the built-in piezoelectric field leads to a nonexponential carrier density decay. Terahertz conductivity spectrum demonstrates a nonmetallic behavior of carriers.

CMU • Nonlinear Optics in Gases—Continued

CMU5 • 11:15 a.m.
Measurements and Calculations of Two-Beam Coupling in Air, *Aaron Bernstein, Matthew W. McCormick, Gilliss M. Dyer, James C. Sanders, Todd Ditmire; Univ. of Texas at Austin, USA.* We performed experiments demonstrated an effective energy-exchange between filament-forming beams intersecting in air. Theory considering the impulsive stimulated Raman response as the relevant nonlinear mechanism reproduces data well and points toward techniques for optimization.

CMU6 • 11:30 a.m.
Efficient Third-Harmonic Generation through Tailored IR Femtosecond Laser Pulse Filamentation in Air, *Sergiy Suntsov[1], Daryoush Abdollahpour[1], Dimitrios G. Papazoglou[1,2], Stelios Tzortzakis[1]; [1]Inst. of Electronic Structure and Laser, Foundation for Res. and Technology Hellas, Greece, [2]Materials Science and Technology Dept., Univ. of Crete, Greece.* Third-harmonic generation during filamentation of IR femtosecond laser pulses in air experiences strong spatial reshaping and conversion enhancement when a thin plasma string created by another femtosecond pulse is introduced perpendicularly to the filament's path.

CMU7 • 11:45 a.m.
Measurement of Pressure Dependent Nonlinear Refractive Index of Inert Gases, *Karoly Osvay[1,2], Adam Börzsönyi[1], Zsuzsanna Heiner[1,3], Attila P. Kovács[1], Mikhail P. Kalashnikov[2]; [1]Dept. of Optics, Univ. of Szeged, Hungary, [2]Max Born Inst., Germany, [3]Inst. of Biophysics, Biological Res. Ctr., Hungary.* Nonlinear refractive index of Ar, Kr, N_2 Ne, Xe, and air has been determined from the spatially dependent nonlinear spectral phase of weak femtosecond pulses propagating in sample gases under pressure between 0.05mbar and 1bar.

CMV • Quantum Dot Lasers II—Continued

CMV4 • 11:15 a.m.
Random Population of InAs/GaAs Quantum Dots, *Ian O'Driscoll, Matt Hutchings, Peter M. Smowton, Peter Blood; Cardiff Univ., UK.* We experimentally observe truly random to non-thermal to thermal distribution of population of InAs quantum dots with temperature using unamplified spontaneous emission and measure the impact on laser operation.

CMV5 • 11:30 a.m.
Threshold and Temperature Dependence of Quantum Dot Laser Diodes Approaching Ideal Performance, *Abdullah Demir, Gokhan Ozgur, K. Shavitranuruk, Sabine Freisem, Dennis G. Deppe; CREOL, College of Optics and Photonics, Univ. of Central Florida, USA.* Low threshold QD laser with threshold current density <10 A/cm^2 is experimentally shown and threshold current temperature dependence of a QD laser with an ideal delta function density of electronic states is analyzed.

CMV6 • 11:45 a.m.
The Differential Efficiency of InP Quantum Dot Lasers, *Gareth T. Edwards, Peter M. Smowton; Cardiff Univ., UK.* We demonstrate the origin of, and quantify the contributions to, the poor external differential efficiency we observe in InP quantum dot lasers. Injection efficiency limits the internal differential quantum efficiency to 50%.

12:00 p.m.–1:30 p.m. Lunch Break

NOTES

Rooms 318-320 | **Rooms 321-323** | **Rooms 324-326** — **CLEO** | **Room 314** — **IQEC**

1:30 p.m.–3:15 p.m.
CMW • Photonic Crystal Fiber
Ming-Jun Li; Corning Inc., USA, Presider

CMW1 • 1:30 p.m. Invited
Controlled Dispersion in Photonic Crystal Fibres, *Jonathan Knight, M. G. Welch, C. E. de Nobriga, R. Amezcua Correa; Univ. of Bath, UK.* We describe the basic features and state-of-the-art in controlling dispersion using hollow-core photonic bandgap fibers, with application in pulse compression and delivery. We present spectral measurements of group velocity dispersion in several different fiber designs.

CMW2 • 2:00 p.m.
Nonlinear Femtosecond Pulse Propagation in All-Solid Photonic Bandgap Fiber, *Tadeusz Martynkien[1], Bertrand Kibler[2], Christophe Finot[2], Julien Fatome[2], Marcin Szpulak[1], Jan Wojcik[3], Stefan Wabnitz[2], Waclaw Urbanczyk[1]; [1]Wroclaw Univ. of Technology, Poland, [2]Inst. Carnot de Bourgogne, France, [3]Maria Curie-Sklodowska Univ., Poland.* Nonlinear femtosecond pulse propagation in all-solid photonic bandgap fiber is investigated experimentally and numerically for both the photonic bandgap guiding in the central silica core and the total internal reflection in germanium doped inclusions.

CMW3 • 2:15 p.m.
Optical Fibre with an Aerogel-Filled Core, *Michael D. W. Grogan[1], Sergio G. Leon-Saval[1,2], Rhys Williams[1], Richard England[1], Tim A. Birks[1]; [1]Univ. of Bath, UK, [2]Univ. of Sydney, Australia.* We filled the core of hollow-core photonic crystal fibre with silica aerogel. The filled fibre exhibits a shifted bandgap and a region of broadband guidance in good agreement with simulation.

1:30 p.m.–3:15 p.m.
CMX • Terahertz Photonics
Daniel Mittleman; Rice Univ., USA, Presider

CMX1 • 1:30 p.m. Tutorial
Scientific and Technical Accomplishments of THz Photonics, *Daniel Grischkowsky; Oklahoma State Univ., USA.* THz photonics combines optics and ultrafast lasers with electronics to generate subps THz pulses. The use of such pulses for science and technology will be illustrated. Opportunities in research and applications will be described.

Daniel R. Grischkowsky is a Regents Professor and the Bellmon Professor of Optoelectronics at Oklahoma State University. He received his Ph.D. in physics from Columbia University in 1968. He then joined the IBM Watson Research Center, where he developed THz time-domain spectroscopy (THz-TDS). In 1993 he relocated to OSU. He is a Fellow of APS, OSA and IEEE. He was awarded the Boris Pregel Award for Applied Science and Technology (1985) by the New York Academy of Sciences, the R.W. Wood Prize from OSA (1989), and the William F. Meggers Award from OSA (2003).

1:30 p.m.–3:15 p.m.
CMY • 10 Years of Frequency Combs CLEO Symposium III
Franz X. Kaertner; MIT, USA, Presider

CMY1 • 1:30 p.m. Invited
10 Years of Femtosecond Combs in Boulder, *Steven Cundiff; JILA, NIST, Univ. of Colorado, USA.* Femtosecond combs have been a hot topic in Boulder for the last 10+ years. The first baby steps through the most recent developments will be surveyed.

CMY2 • 2:00 p.m.
Precision Spectroscopy with a Scanning Diode Laser and Measurement of Microcavity Dispersion, *Pascal Del'Haye[1], Olivier Arcizet[1], Ronald Holzwarth[1], Tobias Kippenberg[1,2]; [1]Max-Planck-Inst. for Quantum Optics, Germany, [2]École Polytechnique Fédérale de Lausanne, Switzerland.* We present a simple method that enables fast, broadband spectroscopy at sub-Megahertz resolution over >4 THz bandwidth using a mode-hop-free tunable diode laser and a frequency comb. This scheme is utilized to measure microresonator dispersion.

CMY3 • 2:15 p.m.
Ultrabroad Frequency Comb Spanning 0.4~4.2 µm from a Ti:Sapphire Laser by Difference Frequency Technique, *Hainian Han, Yanying Zhao, Qing Zhang, Hao Teng, Zhiyi Wei; Inst. of Physics, CAS, China.* An ultrabroadband frequency comb covered from 400nm to 4.2µm was demonstrated by shaping femtosecond Ti:sapphire laser to enhance the DFG in PPLN crystal, as our best knowledge it is the broadest comb with monolithic scheme.

1:30 p.m.–3:15 p.m.
IMG • Nano-Optics and Opto-Mechanics
Marko Lončar; Harvard Univ., USA, Presider

IMG1 • 1:30 p.m.
Cavity-Nano-Optomechanics Using Optical Gradient Fields, *Georg Anetsberger[1], Olivier Arcizet[1], Rémi Rivière[1], Albert Schliesser[1], T. J. Kippenberg[1,2]; [1]Max-Planck-Inst. of Quantum Optics, Germany, [2]École Polytechnique Fédérale de Lausanne, Switzerland.* We show that evanescent fields of microresonators can be employed for cavity-enhanced high-sensitivity monitoring of nanomechanical motion. This novel scheme opens the path to observing backaction effects using optical gradient forces in the resolved-sideband regime.

IMG2 • 1:45 p.m.
Optical Control of Surface-Tension Effects in Complex Nanofluids, *Yuval Lamhot[1], Costa H. Gurgov[1], Assaf Barak[1], Mordechai Segev[1], Carmel Rotschild[2], Meirav Saraf[1], Efrat Lifshitz[1], Demetrios Christodoulides[3]; [1]Technion-Israel Inst. of Technology, Israel, [2]MIT, USA, [3]CREOL, College of Optics and Photonics, Univ. of Central Florida, USA.* We study coupling between light and nano-particle suspensions, through surface-tension effects in capillaries. Increasing light intensity far-away from the interface causes huge changes in the fluid level, manifesting optical control over mechanical properties of fluids.

IMG3 • 2:00 p.m.
Three-Dimensional Super-Resolution Single-Molecule Fluorescence Imaging Using a Double-Helix Point Spread Function, *Michael A. Thompson[1], Sri Rama Prasanna Pavani[2], Julie S. Biteen[1], Rafael Piestun[2], W. E. Moerner[1]; [1]Stanford Univ., USA, [2]Univ. of Colorado at Boulder, USA.* Fluorescence imaging with resolution ten times better than the diffraction limit in three dimensions over a depth of field of 2 µm is demonstrated with a widefield microscope that exhibits a double-helix point spread function.

IMG4 • 2:15 p.m.
Optical Nanofibers for Probing Cold Atoms, *Michael M. Morrissey[1,2], Kieran Deasy[1,2], Laura Russell[2,3], Amy Watkins[2,3], Síle Nic Chormaic[2,3]; [1]Cork Inst. of Technology, Ireland, [2]Tyndall Natl. Inst., Ireland, [3]Univ. College Cork, Ireland.* We present a technique for measuring characteristics of cold atoms by monitoring the spontaneous emission coupled into guided modes of a nanofiber. We show the fiber is very sensitive to atoms close to its surface.

Room 315

IQEC

1:30 p.m.–3:15 p.m.
IMH • Nonlinear Effects in Semiconductors
David Hagan; CREOL, Univ. of Central Florida, USA, Presider

IMH1 • 1:30 p.m.
Measuring Photon Bunching at Ultrashort Timescale by Two-Photon Absorption in Semiconductors, *Fabien Boitier[1], Antoine Godard[1], Jean Bonnet[1], Emmanuel Rosencher[1,2], Claude Fabre[3]; [1]Onera, France, [2]Physics Dept., École Polytechnique, France, [3]Lab Kastler Brossel, Univ. Pierre et Marie Curie, France.* Photon bunching in highly chaotic sources (true blackbody and amplified spontaneous emission) is detected for the first time with femtosecond temporal resolution by use of a Hanbury-Brown-Twiss experiment relying on two-photon absorption in semiconductors.

IMH2 • 1:45 p.m.
Bloch Oscillations and Zener Tunneling in Bulk GaAs, *Wilhelm Kuehn[1], Peter Gaal[1], Klaus Reimann[1], Michael Woerner[1], Thomas Elsaesser[1], Rudolf Hey[2]; [1]Max-Born-Inst., Germany, [2]Paul-Drude-Inst., Germany.* Intense terahertz transients induce in GaAs at T=300K coherent ballistic electron motions exploring the conduction band through half the Brillouin zone. At T=80K we observe terahertz driven tunneling from the valence into the conduction band.

IMH3 • 2:00 p.m.
Many-Body Two-Quantum Coherences in 2-D Fourier-Transform Spectra of Semiconductors, *Denis Karaiskaj[1], Alan D. Bristow[1], Xingcan Dai[1], Lijun Yang[2], Shaul Mukamel[2], Richard P. Mirin[3], Steven T. Cundiff[1]; [1]JILA, Univ. of Colorado and NIST, USA, [2]Dept. of Chemistry, Univ. of California at Irvine, USA, [3]NIST, USA.* Two-quantum coherences in two-dimensional Fourier-transform (2-DFT) spectra are attributed to many-body interactions. 2-DFT spectroscopy allows two-quantum coherences in semiconductors to be isolated. As a result, many-body coherences can be separated from biexciton coherences.

IMH4 • 2:15 p.m.
Photon Detection by Non Degenerate Two Photon Absorption in GaAs: A Quantum "Leg up" Effect, *Fabien Boitier[1], Jean-Baptiste Dherbecourt[1], Antoine Godard[1], Emmanuel Rosencher[1,2]; [1]Onera, France, [2]Physics Dept., École Polytechnique, France.* Detection at optical communication wavelength is achieved, for the first time, in GaAs phototube by non degenerate two-photon absorption. Signal photon is supported by a pump field, producing a quantum "leg up" effect.

Room 316

CLEO

1:30 p.m.–3:15 p.m.
CMZ • Modulation Formats and Nonlinear Processing
Scott Hamilton; MIT, USA, Presider

CMZ1 • 1:30 p.m.
A Bandwidth Efficient Design of IM/DD Optical OFDM, *Huy-Dung Han[1,2], Junqiang Hu[2], Zhi Ding[1]; [1]Univ. of California at Davis, USA, [2]NEC Labs America, USA.* We present a new optical OFDM design that achieves significantly improved bandwidth efficiency. We introduce an optimum DC bias to the modulated signal prior to clipping and present an iterative receiver to combat nonlinear distortions.

CMZ2 • 1:45 p.m.
All-Optical Orthogonal Frequency Division Multiplexing Scheme with Cyclic Prefix Inserted, *Hongwei Chen, Minghua Chen, Shizhong Xie; Tsinghua Univ., China.* A novel all-optical orthogonal frequency division multiplexing scheme based on optical sampling is proposed and demonstrated. With the help of optical cyclic prefixes, the received eyediagrams have better performance and the dispersion tolerance increases greatly.

CMZ3 • 2:00 p.m.
Block Length Effect of Decision-Aided Maximum Likelihood Phase Estimation in Coherent Optical Communication Systems, *Shaoliang Zhang[1], Pooi Yuen Kam[1], Changyuan Yu[1,2]; [1]Natl. Univ. of Singapore, Singapore, [2]Agency for Science, Technology and Res., Inst. for Infocomm Res., Singapore.* We extend our decision-aided maximum likelihood phase estimation receiver for various coherent phase-modulated optical systems with laser phase noise, and investigate the optimal memory length by using extensive Monte-Carlo simulations.

CMZ4 • 2:15 p.m.
Pilot Decision-Aided Maximum Likelihood Phase Estimation in Coherent Optical QPSK and 8PSK Systems with Nonlinear Phase Noise, *Xiaojing Li[1], Shaoliang Zhang[1], Changyuan Yu[1,2], Pooi Yuen Kam[1]; [1]Natl. Univ. of Singapore, Singapore, [2]Agency for Science, Technology and Res., Inst. for Infocomm Res., Singapore.* We propose pilot decision-aided maximum likelihood phase estimation for nonlinear-phase-noise-dominant coherent optical phase-shift-keying (PSK) systems. The receiver sensitivity is shown to be improved by ~1dB compared to the differentially encoded PSK counterparts.

Room 317

1:30 p.m.–3:15 p.m.
CMAA • Silicon Photonic Communication Technologies
William Green; IBM Res., USA, Presider

CMAA1 • 1:30 p.m. Invited
Silicon Photonics in Quantum Communications, *Hiroki Takesue[1], Ken-ichi Harada[1], Hiroshi Fukuda[2], Tai Tsuchizawa[2], Toshifumi Watanabe[2], Koji Yamada[2], Yasuhiro Tokura[1], Sei-ichi Itabashi[2]; [1]NTT Basic Res. Labs, Japan, [2]NTT Microsystem Integration Labs, Japan.* Silicon photonics technologies are potentially useful in quantum communications. This talk describes the first entanglement generation experiment to use a silicon wire waveguide, and discusses the application of silicon-based entanglement sources in quantum communication systems.

CMAA2 • 2:00 p.m. Invited
Nanophotonic Devices for Optical Networks-on-Chip, *Dries Van Thourhout[1], Ian O'Connor[2], Alberto Scandurra[3], Liu Liu[1], Wim Bogaerts[1], Shankar Selvaraja[1], Gunther Roelkens[1]; [1]Ghent Univ.- IMEC, Belgium, [2]Lyon Inst. of Nanotechnology, École Centrale de Lyon, France, [3]ST Microelectronics, Italy.* We describe an optical network-on-chip built from passive wavelength routing circuits and tunable micro transmitters based on microdisk sources. Operation of the different subcomponents will be demonstrated.

Room 336	Room 337	Room 338	Room 339

CLEO

1:30 p.m.–3:15 p.m.
CMBB • Laser Sources
Jens Biegert; ICFO -The Inst. of Photonic Sciences, Spain, Presider

CMBB1 • 1:30 p.m.
Compact Femtosecond Nd:Phosphate Prismless Oscillator Pumped by a Single-Mode 150-mW Laser Diode, *Antonio Agnesi, Federico Pirzio, Giancarlo Reali; Electronics Dept., Univ. of Pavia, Italy.* We present a compact, passively mode-locked and prismless Nd:phosphate laser, pumped by a single-mode, low-power (150-mW) laser diode. We obtained self-starting 270-fs near transform-limited pulses, employing a single Gires-Tournois mirror for intracavity dispersion compensation.

CMBB2 • 1:45 p.m.
200 fs, 50 W Fiber-CPA System Based on Chirped-Volume-Bragg-Gratings, *Matthew Rever[1], Shenghong Huang[1], Caglar Yahus[1], Vadim Smirnov[2], Eugene Rotari[2], Ion Cohanoshi[2], Sergiy Mokhov[3], Leonid Glebov[3], Almantas Galvanauskas[1]; [1]Univ. of Michigan, USA, [2]OptiGrate, USA, [3]CREOL, College of Optics and Photonics, Univ. of Central Florida, USA.* Record-short pulses of 200fs have been obtained from a power-scalable-Yb-fiber-CPA system that uses chirped-volume-Bragg-gratings for the stretcher and compressor. The power was scaled up to 50W with a corresponding 33W of compressed power.

CMBB3 • 2:00 p.m.
Shortest Pulse Duration of Mode-Locked Thin Disk Lasers: Ultrafast Yb:$LuScO_3$ Laser Generates 227-fs Pulses, *Christian Kränkel[1], Cyrill R. E. Baer[1], Oliver H. Heckl[1], Matthias Golling[1], Thomas Südmeyer[1], Ursula Keller[1], Rigo Peters[2], Klaus Petermann[2], Günter Huber[2]; [1]ETH, Switzerland, [2]Inst. of Laser-Physics, Univ. of Hamburg, Germany.* The first mode-locked Yb:$LuScO_3$ thin disk laser generates 7.2W average power in 227-fs pulses, which are the shortest pulses obtained from any ultrafast thin disk laser. 10.1W average power was achieved at longer pulse durations.

CMBB4 • 2:15 p.m.
Dispersion Balancing of Complex CPA-Systems Using the Phase-Shifting Technique, *Constantin Haefner, Richard Hackel, John Halpin, John K. Crane, Mike Messerly, James Nissen, Miro Shverdin, Brian Shaw, Jay Dawson, Craig W. Siders, Christopher P. J. Barty; Lawrence Livermore Natl. Lab, USA.* Dispersion balancing in complex high-intensity laser systems is critical for the temporal pulse fidelity. We demonstrate a method for dispersion management of the eight-beam Petawatt Advanced Radiographic Capability Laser utilizing the phase shift technique.

1:30 p.m.–3:15 p.m.
CMCC • Endoscopic Imaging Applications
Brian Applegate; Texas A&M Univ., USA, Presider

CMCC1 • 1:30 p.m.
2-D Spectrally Encoded Confocal Microscopy and Its Application for Simultaneous Imaging and Laser Surgery with a Single Fiber Probe, *Kevin K. Tsia, Keisuke Goda, Bahram Jalali; Univ. of California at Los Angeles, USA.* We demonstrate an endoscope-compatible, mechanical-scan-free microscopy technique and its application as a highly flexible fiber probe which can simultaneously perform imaging and high precision *in situ* laser microsurgery.

CMCC2 • 1:45 p.m.
Common-Path Fourier-Domain Optical Coherence Tomography with a Fiber Optic Probe Integrated into a Surgical Needle, *Jae-Ho Han[1], Marcin Balicki[1], Kang Zhang[1], Xuan Liu[1], James Handa[2], Russell Taylor[1], Jin U. Kang[1]; [1]Johns Hopkins Univ., USA, [2]Johns Hopkins School of Medicine, USA.* We have demonstrated three-dimensional imaging of a rat cornea and retina using a 0.8-µm common-path Fourier-domain OCT with an integrated surgical needle probe.

CMCC3 • 2:00 p.m.
***In vivo* Micron Scale Arthroscopic Imaging of Human Knee Osteoarthritis with OCT: Comparison with MRI and Arthroscopy,** *Kathy Zheng[1], Scott Martin[1,2], Christopher Rashidifard[1], Bin Liu[1,2], Mark E. Brezinski[1,2]; [1]Brigham and Women's Hospital, USA, [2]Harvard Medical School, USA.* In this study, we perform *in vivo* OCT human arthroscopic imaging in patients undergoing menisectomy. Results are compared to MRI and arthroscopy.

CMCC4 • 2:15 p.m.
***In vivo* Fluorescence Endoscopic Cellular Imaging of Internal Organs in Mice,** *Pilhan Kim[1], Georges Tocco[2], Cavit D. Kant[2], Gilles Benichou[2], Seok H. Yun[1]; [1]Harvard Medical School and Wellman Ctr. for Photomedicine, Massachusetts General Hospital, USA, [2]Harvard Medical School and Surgery/Transplantation Unit, Massachusetts General Hospital, USA.* High-resolution optical imaging of mice internal organs has been challenging due to the difficulty of access and physiological tissue motion. We describe a motion-stabilizing laser-scanning confocal endoscope and demonstrate a wide range of biomedical applications.

1:30 p.m.–3:15 p.m.
CMDD • Spectroscopic Gas Sensing I
Lin Ma; Clemson Univ., USA, Presider

CMDD1 • 1:30 p.m. Invited
Time and Frequency-Domain Spectroscopy with Dual Frequency Combs, *Nathan R. Newbury, Ian Coddington, William C. Swann; NIST, USA.* High-resolution spectroscopic measurements of the amplitude and phase spectra from a gas sample can be acquired by use of dual frequency combs. Here we discuss the corresponding gas signature in the time domain.

CMDD2 • 2:00 p.m.
Spectroscopic Sensing at the Quantum Limit by Active Cavity Impedance Matching, *Jong H. Chow[1], David S. Rabeling[1], Andrew Wade[1], Ian C. M. Littler[1], Malcolm B. Gray[2], David E. McClelland[1]; [1]Australian Natl. Univ., Australia, [2]Natl. Measurement Inst., Australia.* We demonstrate an active cavity impedance matching control technique using radio-frequency amplitude modulation homodyne interferometry, and show it can be used for absorption spectrometry at the quantum limit for both narrow and broadband molecular transitions.

CMDD3 • 2:15 p.m.
Multi-Wavelength Sensing of Greenhouse Gases by Rapidly Swept Continuous-Wave Cavity Ringdown Spectroscopy, *Yabai He[1], Ruifeng Kan[2], Florian V. Englich[1,3], Wenqing Liu[2], Brian J. Orr[1]; [1]Macquarie Univ., Australia, [2]CAS, China, [3]Caltech, USA.* The greenhouse gas molecules CH_4, CO_2, and H_2O are detected by using a cavity ringdown laser spectrometer with rapidly swept optical cavity and multi-wavelength coherent radiation. This sensitive portable instrument is applicable to environmental monitoring.

1:30 p.m.–3:15 p.m.
CMEE • Ultraviolet and Blue Light Emitters
Leo J. Schowalter; Crystal IS, Inc, USA, Presider

CMEE1 • 1:30 p.m. Invited
Recent Progresses of AlGaN and InAlGaN-Based Deep-UV LEDs, *Hideki Hirayama[1,2]; [1]RIKEN, Japan, [2]JST, CREST, Japan.* We demonstrated 222-282 nm AlGaN and InAlGaN-based efficient deep-ultraviolet (DUV) light-emitting diodes (LEDs) fabricated on low threading dislocation density (TDD) AlN. We achieved over 10 mW CW UV output power for 264-282 nm LEDs.

CMEE2 • 2:00 p.m.
Time-Resolved Photoluminescence Studies of AlGaN-Based Deep UV LED Structures Emitting down to 229 nm, *Gregory A. Garrett[1], Craig G. Moe[1], Meredith L. Reed[1], Michael Wraback[1], Wenhong Sun[2], Max Shatalov[2], Xuhong Hu[2], Jinwei Yang[2], Yuriy Bilenko[2], Alex Lunev[2], Michael S. Shur[2], Remis Gaska[2]; [1]ARL, USA, [2]Sensor Electronic Technology, Inc., USA.* Photoluminescence lifetime and internal quantum efficiency measurements of deep ultraviolet (~230 nm) light-emitting diode structures are correlated to packaged devices and compared to measurements on more mature 280 nm structures.

CMEE3 • 2:15 p.m.
Reliability of Deep UV LEDs, *Max Shatalov[1], Yuri Bilenko[1], Remis Gaska[1], Sergey Rumyantsev[2], Michael Shur[1,2]; [1]Sensor Electronic Technology, Inc., USA, [2]Rensselaer Polytechnic Inst., USA.* We report on reliability of deep UV LEDs with wavelengths ranging from 235 to 310 nm. The current-voltage characteristics and the spectrum remain nearly unchanged, relating degradation mechanisms to the p-cladding layers and p-type contacts.

Room 340 | Room 341 | Rooms 328-329

IQEC

1:30 p.m.–3:15 p.m.
IMI • Quantum Information II
Brian J. Smith; Univ. of Oxford, UK, Presider

IMI1 • 1:30 p.m.
Experimental Realization of Quantum Teleportation as Cluster Computation, *Ryuji Ukai[1,2], Seiji Charles Armstrong[1,3], Peter Van Loock[4], Akira Furusawa[1,2]; [1]Univ. of Tokyo, Japan, [2]CREST-JST, Japan, [3]Australian Natl. Univ., Australia, [4]Univ. Erlangen-Nürnberg, Germany.* We demonstrate quantum teleportation of a coherent state as cluster computation using a four-mode linear cluster state. This is the first example of realization of cluster computation in continuous-variable systems.

IMI2 • 1:45 p.m.
Teleportation of Quantum Information between Distant Atomic Qubits, *P. Maunz[1], S. Olmschenk[1], D. Hayes[1], D. N. Matsukevich[1], L.-M. Duan[2], C. Monroe[1]; [1]Joint Quantum Inst. and Dept. of Physics, Univ. of Maryland, USA, [2]FOCUS Ctr. and Dept. of Physics, Univ. of Michigan, USA.* We teleport quantum information between two distant ytterbium ions trapped in different vacuum chambers separated by one meter. Full state tomography shows that the heralded probabilistic process employed has a fidelity of 90%.

IMI3 • 2:00 p.m.
A Photonic Cluster State Machine Gun, *Netanel H. Lindner[1], Terry Rudolph[2]; [1]Technion-Israel Inst. of Technology, Israel, [2]Optics Section, Blackett Lab, Imperial College London, UK.* We present a method to convert certain single photon sources, in particular semiconductor quantum dots, into devices capable of emitting large strings of photonic cluster state in a controlled and pulsed "on demand" manner.

IMI4 • 2:15 p.m.
Demonstration of a Loop Cluster for Quantum Information Applications, *Yasaman Soudagar[1], Xingxing Xing[2], Elham Kashefi[3], Nicolas Godbout[1], Aephraim M. Steinberg[2]; [1]École Polytechnique de Montrèal, Canada, [2]Ctr. for Quantum Information and Quantum Control and Inst. for Optical Sciences, Dept. of Physics, Univ. of Toronto, Canada, [3]School of Informatics, Univ. of Edinburgh, UK.* We demonstrate creation of a 4-qubit "loop cluster," a resource for one-way quantum computation, with one input and two outputs, from a pair of hyperentangled photons. This cluster possesses no flow, but only generalized flow.

CLEO

1:30 p.m.–3:15 p.m.
CMFF • Four-Wave Mixing
Jason Fleischer; Princeton Univ., USA, Presider

CMFF1 • 1:30 p.m. Invited
Ultra-Low Power Frequency Conversion in High-Index Doped Silica Glass Micro-Ring Resonators, *David J. Moss[1], Marcello Ferrara[2], Luca Razzari[2], David Duchesne[2], Roberto Morandotti[2], Z. Yang[3], Marco Liscidini[3], John Sipe[3], Sai Chu[4], Brent E. Little[4]; [1]Univ. of Sydney, Australia, [2]INRS-EMT, Canada, [3]Dept. of Physics, Univ. of Toronto, Canada, [4]Infinera Ltd., USA.* We demonstrate four-wave-mixing with <5mW CW pump power in high-index, doped silica glass micro-ring resonators. We demonstrate efficient self-phase modulation with < 100W pulses, with negligible nonlinear absorption at 25GW/cm^2.

CMFF2 • 2:00 p.m.
Broadband Four-Wave Mixing and Supercontinuum Generation in Multi-Component-Core Photonic Crystal Fiber, *Vincent Tombelaine[1], Alexis Labruyère[2], Jens Kobelke[1], Kay Schuster[1], Philippe Leproux[2], Vincent Couderc[2], Raphael Jamiër[2], Volker Reichel[1], Hartmut Bartelt[1]; [1]Inst. of Photonic Technology, Germany, [2]Xlim Inst., France.* We report a new system based on a microstructured optical fiber having a multi-component glass rod in the core center. This system is used for ultra broadband four-wave mixing (> 110 THz) and supercontinuum generation.

CMFF3 • 2:15 p.m.
Single Shot Time and Frequency Resolved Four Wave Mixing Spectroscopy, *Andrey Shalit, Yuri Paskover, Yehiam Prior; Weizmann Inst. of Science, Israel.* A new method is demonstrated whereby strict phase matching conditions in forward propagating four wave mixing experiments allow both spectral and temporal resolution within a single ultrashort laser pulse.

1:30 p.m.–3:15 p.m.
CMGG • VCSELs I
James J. Raftery, Jr.; U.S. Military Acad., USA, Presider

CMGG1 • 1:30 p.m. Invited
Recent Progress in Electrically Pumped Blue GaN-Based VCSELs, *Shing-Chung Wang; Natl. Chiao Tung Univ., Taiwan.* Recent progress on fabrication technology and demonstration of current injection GaN-based blue VCSELs are presented. Performance of current injection blue VCSELs with threshold current of 1.4 mA and emission wavelength of 462 nm are described.

CMGG2 • 2:00 p.m.
Impact of High Contrast Grating Size in Tunable VCSELs, *Christopher Chase, Ye Zhou, Connie Chang-Hasnain; Univ. of California at Berkeley, USA.* We show the effects of shrinking the high contrast grating size on a wavelength-tunable VCSEL experimentally and theoretically. With a grating having only 4 periods, we demonstrate the fastest tunable VCSEL with speed >25 MHz.

CMGG3 • 2:15 p.m.
Laterally Intermixed Quantum Structure for Carrier Confinement of VCSELs, *Yuta Sugawara, Tomoyuki Miyamoto; Tokyo Inst. of Technology, Japan.* Quantum structure intermixing from lateral direction of the mesa sidewall is proposed for VCSELs. I_{th} decrease of 70% and η_d increase of 75% were achieved by suppression of the surface recombination in the post-type VCSEL.

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

CLEO | IQEC

CMW • Photonic Crystal Fiber—Continued

CMW4 • 2:30 p.m.
Compact Electrically Tunable Waveplate Based on Liquid Crystal Photonic Bandgap Fibers, *Lei Wei[1], Thomas Tanggaard Alkeskjold[2], Stephan Urs Keller[3], Jonas Michael Lindhard[4], Helle Vendelbo Jensen[4], Anja Boisen[3], Anders Bjarklev[1]; [1]DTU Fotonik, Dept. of Photonics Engineering, Technical Univ. of Denmark, Denmark, [2]Crystal Fibre A/S, Denmark, [3]DTU Nanotech, Technical Univ. of Denmark, Denmark, [4]DTU Danchip, Technical Univ. of Denmark, Denmark.* A compact tunable waveplate based on negative dielectric liquid crystal photonic bandgap fibers is presented. The birefringence can be tuned electrically to work as a quarter-wave or a half-wave plate in the wavelength range 1520nm-1580nm.

CMW5 • 2:45 p.m.
Depolarized Guided Acoustic Wave Brillouin Scattering in Photonic Crystal Fibers, *John E. McElhenny, Radha K. Pattnaik, Jean Toulouse; Lehigh Univ., USA.* Guided acoustic wave Brillouin scattering (GAWBS) in PCFs is altered by the air-silica structure of the inner cladding and does not depend on the cladding diameter as with standard fibers. This dependence is investigated.

CMW6 • 3:00 p.m.
Low-Loss Splicing of Photonic Crystal Fibres by Controlled Hole Collapse, *Zilun Chen[1], Chunle Xiong[2], Limin Xiao[1], William Wadsworth[1], Tim Birks[1]; [1]Univ. of Bath, UK, [2]Univ. of Sydney, Australia.* Low-loss splices have been formed between small-core photonic crystal fibres and fibres with much larger mode field diameters. The PCF's core is enlarged using controlled hole collapse before splicing with a conventional electric-arc fusion splicer.

CMX • Terahertz Photonics—Continued

CMX2 • 2:30 p.m.
Electro-Optic Sampling of Widely Tunable THz Transients with Electric Fields of up to 108 MV/cm, *Alexander Sell, Rüdiger Scheu, Alfred Leitenstorfer, Rupert Huber; Univ. of Konstanz, Germany.* A novel Er:fiber/Ti:sapphire hybrid laser generates phase-locked few-cycle terahertz transients tunable from 1 to 107 THz and electric fields of up to 108 MV/cm. 8-fs pulses from the fiber laser serve as electro-optic probe.

CMX3 • 2:45 p.m.
CW Terahertz Spectrometer with High-Precision Frequency Control, *Axel Roggenbuck[1], Anselm Deninger[1], Iván Cámara Mayorga[2], Holger Schmitz[3], Joachim Hemberger[3], Frank Lison[1], Markus Grüninger[3]; [1]TOPTICA Photonics AG, Germany, [2]Max-Planck-Inst. für Radioastronomie, Germany, [3]Physikalisches Inst., Univ. zu Köln, Germany.* We realized a continuous-wave terahertz spectrometer based on optical heterodyning of two near-infrared distributed-feedback diode lasers. Using active frequency stabilization we achieve 1 MHz resolution and a signal-to-noise ratio up to 80 dB.

CMX4 • 3:00 p.m.
High-Resolution Terahertz Time-Domain Spectroscopy Using a Wavelet Power Spectrum Estimation Technique, *Youngchan Kim[1], Dae-Su Yee[1], Jong Chul Ye[2], Jaewook Ahn[2]; [1]Korea Res. Inst. of Standards and Science, Republic of Korea, [2]KAIST, Republic of Korea.* It is shown that a wavelet power spectrum estimation technique can be applied to high-resolution terahertz time-domain spectroscopy using asynchronous optical sampling to effectively remove noises without sacrificing spectral features on a spectrum.

CMY • 10 Years of Frequency Combs CLEO Symposium III—Continued

CMY4 • 2:30 p.m.
C_2H_2 Absolutely Optical Frequency-Stabilized and 40 GHz Repetition-Rate-Stabilized, Regeneratively Mode-Locked Picosecond Erbium Fiber Laser at 1.53 µm, *Masataka Nakazawa, Masato Yoshida, Keisuke Kasai; Res. Inst. of Electrical Communication, Tohoku Univ., Japan.* The optical frequency and repetition-rate of a regeneratively mode-locked picosecond fiber laser was simultaneously stabilized to a 1.5-µm C_2H_2 absorption line and a 40-GHz synthesizer, respectively. The optical frequency stability reached $2x10^{-11}$ for τ=10~100 s.

CMY5 • 2:45 p.m.
Low-Noise Microwave Synthesis up to 80 GHz with Line-by-Line Processing of an Optical Frequency Comb, *Shijun Xiao, Leo Hollberg, Scott Diddams; NIST, USA.* 10 GHz optical pulses are generated by line-by-line phase compensation on an optical frequency comb. Residual pulse timing jitter ≤ 10 fs and high power signals at harmonics up to 80 GHz are measured.

CMY6 • 3:00 p.m.
Optical Frequency Comb Characterization–Self-Referenced Phase Retrieval via Spectral Shearing Interferometry in an A-PPLN Waveguide, *Houxun Miao[1], Chen-Bin Huang[2], Daniel E. Leaird[1], Carsten Langrock[3], Martin M. Fejer[3], Andrew M. Weiner[1]; [1]Purdue Univ., USA, [2]Natl. Tsing Hua Univ., Taiwan, [3]Stanford Univ., USA.* A self-referenced technique for measuring the phase of individual optical frequency comb lines is demonstrated. Spectral frequency shear is obtained from sum frequency generation of a signal comb with wavelength separated reference tones.

IMG • Nano-Optics and Opto-Mechanics—Continued

IMG5 • 2:30 p.m.
Broadband Heterodyne NSOM Characterization of Propagation Loss in Waveguide Bends, *Maurice Ayache, Maxim Abashin, Dawn T. H. Tan, Yeshaiahu Fainman; Dept. of Electrical and Computer Engineering, Univ. of California at San Diego, USA.* We use a heterodyne NSOM with superluminescent diode illumination to measure the loss in an SOI waveguide around a bend. For a bend of radius 10 µm, we measure loss of .09 dB.

IMG6 • 2:45 p.m.
Insulator-to-Metal Transition of Gold Films Observed by Interferometric Picometrology, *Xuefeng Wang, Ming Zhao, David D. Nolte; Dept. of Physics, Purdue Univ., USA.* We obtain the complex refractive index and dielectric properties of ultra-thin gold films as a continuous function of thickness from 0.2 nm to 10 nm using picometrology. The atom-to-bulk transition of gold is observed.

IMG7 • 3:00 p.m.
Spinoptics: Dynamics of Spinning Light in Nanoscale-Structure, *Erez Hasman, Yuri Gorodetski, Konstantin Y. Bliokh, Avi Niv, Vladimir Kleiner; Technion-Israel Inst. of Technology, Israel.* Observation of optical spin-hall effect that appears when a wave carrying spin angular momentum interacts with plasmonic nanostructures is presented. The measurements verify the geometric phase, demonstrated by the spin-dependent deflection of the surface waves.

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

NOTES

Room 315 | Room 316 | Room 317

IQEC | **CLEO**

IMH • Nonlinear Effects in Semiconductors—Continued

IMH5 • 2:30 p.m.
Two-Photon Detection in a MQW GaAs Laser at 1.55µm, *David Duchesne[1], Luca Razzari[1], L. Halloran[1], Roberto Morandotti[1], Anthony J. SpringThorpe[2], Dmitri N. Christodoulides[3], David J. Moss[1,4]; [1]Univ. du Québec, Canada, [2]Canadian Photonics Fabrication Ctr., Canada, [3]Univ. of Central Florida, USA, [4]CUDOS, School of Physics, Univ. of Sydney, Australia.* We report the first demonstration of two-photon photocurrent in a GaAs/AlGaAs MQW laser at 1.55 µm. The device efficiency, sensitivity and two-photon absorption coefficient has strong potential for signal processing at sub-Watt powers.

IMH6 • 2:45 p.m.
Observation of Clamping of Photoluminescence Intensities from Nonlinear Degenerate Electron Gas in InN, *Guibao Xu[1], Yujie J. Ding[1], Ioulia B. Zotova[2], Charles E. Stutz[3], Darnell E. Diggs[3], Nils Fernelius[3], Frank K. Hopkins[3], Chad S. Gallinat[4], Gregor Koblmüller[4], James S. Speck[4]; [1]Lehigh Univ., USA, [2]ArkLight, USA, [3]AFRL, USA, [4]Univ. of California at Santa Barbara, USA.* We observed that photoluminescence intensities clamped at certain values as the pump intensity was increased, due to the presence of nonlinear degenerate electron gas and saturation of photogenerated and localized holes in InN.

IMH7 • 3:00 p.m.
Terahertz Open-Aperture Z-Scan in Doped InGaAs, *Luca Razzari[1,2], Fuhai Su[3], Gargi Sharma[1], Francois Blanchard[1], Ayesheshim Ayesheshim[3], Heidi Bandulet[1], Roberto Morandotti[1], Jean-Claude Kieffer[1], Tsuneyuki Ozaki[1], Matthew Reid[4], Frank Hegmann[3]; [1]INRS-EMT, Advanced Laser Light Source, Univ. du Québec, Canada, [2]Univ. di Pavia, Italy, [3]Dept. of Physics, Univ. of Alberta, Canada, [4]Dept. of Physics, Univ. of Northern British Columbia, Canada.* We have performed open-aperture Z-scan measurements on n-doped InGaAs using intense few-cycle terahertz pulses. We observe a significant bleaching of the terahertz pulse absorption attributed to terahertz-electric-field-induced intervalley carrier scattering.

CMZ • Modulation Formats and Nonlinear Processing—Continued

CMZ5 • 2:30 p.m.
Optical Phase Noise Extraction and Amplification Technique and Its Application to Optical Phase Noise Monitoring for (D)PSK Systems, *Guo-Wei Lu, Tetsuya Miyazaki; NICT, Japan.* We propose an optical phase noise extraction and amplification (OPNEA) technique. By applying OPNEA to phase noise monitoring for (D) PSK, 13-dB dynamic range and 0.2-dB/degree sensitivity were achieved with a 50-120-degree phase deviation.

CMZ6 • 2:45 p.m.
Cancellation of Chromatic Dispersion-Induced Second Harmonic Using Dual Wavelengths and Balanced Photodetection, *Christopher E. Sunderman[1], Preetpaul S. Devgan[2], John F. Diehl[2], Vincent J. Urick[2], Keith J. Williams[2]; [1]Global Strategies Group North America, USA, [2]NRL, USA.* A method for canceling dispersion-induced second harmonic by simultaneously modulating two optical wavelengths combined with balanced photodetection is demonstrated. The second harmonic is reduced by ~30dB while the fundamental is increased by 6dB.

CMZ7 • 3:00 p.m.
320-Gbit/s Optical Time Multiplexing of Two 160-Gbit/s Channels Using Supercontinuum Generation to Achieve High-Speed WDM-to-TDM, *Xiaoxia Wu[1], Antonella Bogoni[2], Scott R. Nuccio[1], Omer F. Yilmaz[1], Alan E. Willner[1]; [1]Univ. of Southern California, USA, [2]Consorzio Nazionale Interuniversitario per le Telecomunicazioni, Italy.* We experimentally demonstrate multiplexing of two 160-Gbit/s WDM signals to one 320-Gbit/s signal based on supercontinuum generation in HNLF. Error free operation was achieved and less than 3 dB penalty was observed.

CMAA • Silicon Photonic Communication Technologies—Continued

CMAA3 • 2:30 p.m.
101-Element Cascaded-Microdisk Resonators on a Silicon Chip, *Xianshu Luo, Andrew W. Poon; Hong Kong Univ. of Science and Technology, China.* We propose many-element cascaded-resonator devices with gapless inter-cavity coupling using spiral and double-notch microdisk resonators. We demonstrate such devices with up to 101 elements in a silicon nitride-on-silica substrate.

CMAA4 • 2:45 p.m.
Temperature-Insensitive Silicon Microdisk Resonators Using Polymeric Cladding Layers, *Payam Alipour, Ehsan Shah Hosseini, Ali Asghar Eftekhar, Babak Momeni, Ali Adibi; Georgia Tech, USA.* A method for thermal-stabilization of silicon microdisk resonators, based on thermo-optic polymer coatings, is proposed. Two orders of magnitude improvement in thermal stability is expected. Effects on Q and major fabrication challenges are discussed.

CMAA5 • 3:00 p.m.
Arrayed Microring Filter with Tunable Resonance Wavelength, Extinction Ratio and Bandwidth, *Hao Shen, Maroof H. Khan, Yi Xuan, Lin Zhao, Minghao Qi; Purdue Univ., USA.* We demonstrate a tunable filter based on an array of silicon-on-insulator microring resonators. The resonance wavelength, extinction ratio and bandwidth can be simultaneously controlled by thermal tuning.

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

NOTES

Room 336 | Room 337 | Room 338 | Room 339

CLEO

CMBB • Laser Sources—Continued

CMBB5 • 2:30 p.m.
Nonlinear Absorption and Carrier Dynamics in Slab-Coupled Optical Waveguide Amplifiers, *Ali R. Motamedi[1], Erich P. Ippen[1], Jason J. Plant[2], Joseph P. Donnelly[2], Paul W. Juodawlkis[2]; [1]MIT, USA, [2]MIT Lincoln Lab, USA.* Loss due to the two-photon absorption and free-carrier absorption processes becomes a dominant factor for ultrashort-pulse amplification, leading to lower saturation energy. TPA and FCA coefficients are measured to be 65cm/GW and $7x10^{-17}$ cm^2, respectively.

CMBB6 • 2:45 p.m.
Mode-Locking via Active Gain Modulation in Quantum Cascade Lasers, *Lyuba Kuznetsova[1], C. Y. Wang[1], V. M. Gkortsas[2], L. Diehl[1], F. Kärtner[2], M. A. Belkin[3], A. Belyanin[4], X. Li[1], D. Ham[1], H. Schneider[5], H. C. Liu[6], Federico Capasso[1]; [1]Harvard Univ., USA, [2]MIT, USA, [3]Univ. of Texas at Austin, USA, [4]Texas A&M Univ., USA, [5]Inst. of Ion Beam Physics and Materials Res., Germany, [6]Natl. Res. Council, Canada.* A mode-locking mechanism by active gain modulation is studied numerically and experimentally. The parameter window for the emission of stable pulse trains was found. Pulses as short as 3ps (~0.5pJ) were characterized by second-order autocorrelation.

CMBB7 • 3:00 p.m.
Coherent Dynamics of One- and Two-Photon States in a Strongly Coupled Single Quantum Dot-Cavity System, *Jacek Kasprzak[1], Wolfgang Langbein[1], S. Reitzenstein[2], C. Kistner[2], C. Schneider[2], M. Strauss[2], S. Höfling[2], A. Forchel[2]; [1]Cardiff Univ., UK, [2]Technische Physik, Univ. Würzburg, Germany.* Heterodyne spectral interferometry is employed to perform four-wave mixing spectroscopy on a strongly-coupled system of an exciton confined in a single quantum dot and a photon mode of a pillar microcavtity.

CMCC • Endoscopic Imaging Applications—Continued

CMCC5 • 2:30 p.m.
Microfabricated out-of-Plane Scanning Microlens for Raman Spectroscopy, *Chin Pang Billy Siu[1], Haishan Zeng[2], Mu Chiao[1]; [1]Univ. of British Columbia, Canada, [2]British Columbia Cancer Res. Ctr., Canada.* We present a microfabricated out-of-plane scanning microlens for miniaturized Raman Spectroscopy. The out-of-plane actuation is electrostatic driven and achieves 90 µm scan-range at 1k Hz. A Raman spectrum analysis on the drug, Tylenol, is reported.

CMCC6 • 2:45 p.m.
Fiber-Optic Endomicroscopy for Intrinsic Two-Photon Fluorescence Imaging of Epithelial Cells and Tissues, *Yicong Wu[1], Jiefeng Xi[1], Yongping Chen[1], Michael J. Cobb[1], Ming-Jun Li[2], Xingde Li[1]; [1]Dept. of Bioengineering, Univ. of Washington, USA, [2]Science and Technology Div., Corning Inc., USA.* An endomicroscope with enhanced signal collection efficiency was developed using customized double-clad fiber and aspherical compound-lens. *Ex vivo* two-photon fluorescence imaging of epithelial tissues was demonstrated for the first time with an all-fiber-optic scanning endomicroscope.

CMCC7 • 3:00 p.m.
Handheld Single-Cell-Layer Optical Sectioning Reflectance Confocal Microscope for Interventional Imaging, *Karthik Kumar[1], Rony Avritscher[2], David C. Madoff[2], Xiaojing Zhang[1]; [1]Univ. of Texas at Austin, USA, [2]M. D. Anderson Cancer Ctr., Univ. of Texas, USA.* We introduce a handheld reflectance confocal microscope providing 4.2µm axial, 0.5µm lateral resolution, and 200x125µm field based on novel CMOS-MEMS 2-axis scanning micromirrors. Examination of *ex vivo* swine liver indicates applicability to clinical image-directed intervention.

CMDD • Spectroscopic Gas Sensing I—Continued

CMDD4 • 2:30 p.m.
Compact Gas Sensing System Based on Mid-Infrared LED and Resonant Detection with Quartz Tuning Fork, *Ulrike Willer, Claus Romano, Wolfgang Schade; Clausthal Univ. of Technology, Germany.* A Winston cone, used simultaneously as absorption cell, concentrates the radiation of a mid-infrared LED onto a prong of a quartz tuning fork acting as detector, providing a compact and cost efficient mid-infrared sensing system.

CMDD5 • 2:45 p.m.
Location-Resolved Gas Concentration Detection Using Frequency-Shifted Interferometry, *Fei Ye, Li Qian, Bing Qi; Univ. of Toronto, Canada.* We use frequency-shifted interferometry to detect the concentrations of the same gas species at different locations and in different mixtures by accurately correcting the spectral shadowing effect. Different gas species are also detected.

CMDD6 • 3:00 p.m.
Fourier Transform Spectrometry with a Near Infrared Supercontinuum Source, *Chris A. Michaels, Tony Masiello, Pamela M. Chu; NIST, USA.* Near-infrared Fourier transform absorption spectrometry with a supercontinuum (SC) source is demonstrated for trace methane detection. The SC source allows for long distance propagation while exhibiting amplitude noise ten times greater than comparable incandescent sources.

CMEE • Ultraviolet and Blue Light Emitters—Continued

CMEE4 • 2:30 p.m.
The Effects of Increasing AlN Mole Fraction on the Performance of AlGaN Based Ultraviolet Light Emitting Diode Active Regions, *Anand V. Sampath[1], Gregory A. Garrett[1], Wendy L. Sarney[1], H. Shen[1], Michael Wraback[1], James R. Grandusky[2], Leo J. Showalter[2]; [1]ARL, USA, [2]Crystal IS, USA.* Time-resolved photoluminescence and transmission electron microscopy results suggest that the density of point defects may have a more significant role than threading dislocations in the performance of UVLED AlGaN active regions emitting at shorter wavelengths.

CMEE5 • 2:45 p.m.
1-D Carrier Localization and Effective Quantum Wire Behavior inside "Wrinkled" QWs Deposited on Textured GaN, *Spilios Riyopoulos[1], Theodore Moustakas[2]; [1]SAIC, USA, [2]Boston Univ., USA.* Ridges among intersecting quantum wells deposited on textured GaN behave as 1-D quantum wires due to geometry and polarization effects. Carrier localization, carrier accumulation and emission blue shifting are derived theoretically.

CMEE6 • 3:00 p.m.
Towards Room Temperature Electrically Pumped Blue Vertical Cavity Surface Emitting Lasers, *Gatien Cosendey, Eric Feltin, Antonino Castiglia, Jean-François Carlin, Alexei Altoukhov, Jacques Levrat, Gabriel Christmann, Raphael Butté, Nicolas Grandjean; École Polytechnique Fédérale de Lausanne, Switzerland.* We report strategies to achieve lasing in electrically driven VCSELs at 300K, namely high quality microcavity suited for electrical injection, use of a ZnO contact with a current confinement layer, and oxidized AlInN/GaN Bragg reflectors.

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

NOTES

Room 340 | Room 341 | Rooms 328-329

IQEC | **CLEO**

IMI • Quantum Information II—Continued

IMI5 • 2:30 p.m.
One-Way Quantum Computation Using a Quantum Nondemolition Entangling Gate, *Yoshichika Miwa[1,2], Jun-Ichi Yoshikawa[1,2], Peter van Loock[3], Akira Furusawa[1,2]; [1]Univ. of Tokyo, Japan, [2]CREST-JST, Japan, [3]Univ. Erlangen-Nürnberg, Germany.* We demonstrate a $\hat{U}=\exp(i\kappa\hat{x}^2)$ gate as an example of one-way quantum computation. The coefficient κ is controlled via the local oscillator phase of a homodyne measurement. The squeezing below the shot noise limit is observed.

IMI6 • 2:45 p.m.
Engineering a Telecom-Band Controlled-NOT Gate, *Monika Patel[1,2], Joseph B. Altepeter[1], Mathew A. Hall[1], Milja Medic[1,2], Prem Kumar[1,2]; [1]Ctr. for Photonic Communication and Computing, Electrical Engineering and Computer Science Dept., Northwestern Univ., USA, [2]Dept. of Physics and Astronomy, Northwestern Univ., USA.* We experimentally characterize a linear optics, telecom-band quantum controlled-NOT gate using a fiber-based source of degenerate photon-pairs and bound its process fidelity to $0.907 \le F_p \le 0.948$.

IMI7 • 3:00 p.m.
Quantum Optics in Laser-Written Waveguide Circuits, *Graham D. Marshall[1], Jonathan C. F. Matthews[2], Alberto Politi[2], Peter Dekker[1], Martin Ams[1], Michael J. Withford[1], Jeremy L. O'Brien[2]; [1]Macquarie Univ., Australia, [2]Univ. of Bristol, UK.* Building quantum optical circuits with waveguides-on-a-chip networks is a practical route to scalable quantum information processing. We report circuits made using direct-write laser techniques that create high fidelity, 2 or 3-dimensional, fiber compatible quantum networks.

CMFF • Four-Wave Mixing—Continued

CMFF4 • 2:30 p.m.
Optical Parametric Amplification in the NIR in a Gaseous Medium by Use of a Hollow Fibre, *Alexander Grün[1], Daniele Faccio[1,2], Arnaud Couairon[3], Philip K. Bates[1], Olivier Chalus[1], Jens Biegert[1,4]; [1]ICFO-Inst. de Ciències Fotióniques, Mediterranean Technology Park, Spain, [2]CNISM-Dept. di Fisica e Matematica, Univ. dell'Insubria, Italy, [3]CNRS-Ctr. de Physique Théorique, École Polytechnique, France, [4]ICREA-Institucio Catalana de Recerca i Estudis Avancats, Spain.* We demonstrate efficient parametric generation of >4 µJ, 80 fs pulses centered at 1.3 µm in a gas-filled hollow fibre. The measured bandwidth supports few-cycle, passively CEP-locked infrared pulses for EUV and attosecond physics.

CMFF5 • 2:45 p.m.
Four-Wave Mixing in Integrated Silicon Nitride Waveguides, *Jacob S. Levy, Alexander Gondarenko, Amy C. Turner-Foster, Mark A. Foster, Alexander L. Gaeta, Michal Lipson; Cornell Univ., USA.* We demonstrate four-wave mixing in silicon nitride waveguides with -7.1 dB conversion efficiency between the signal and idler. We observe no evidence of nonlinear losses with pump powers as high as 110 W.

CMFF6 • 3:00 p.m.
Generation of Wavelength-Tunable Multicolored Femtosecond Laser Pulses in a Fused Silica Glass, *Jun Liu[1], Takayoshi Kobayashi[1,2,3,4]; [1]Univ. of Electro-Communications, Japan, [2]JST, ICORP, Ultrashort Pulse Laser Project, Japan, [3]Natl. Chiao Tung Univ., Taiwan, [4]Osaka Univ., Japan.* Multicolored femtosecond pulses were generated simultaneously through cascade four-wave mixing in fused-silica glass. They have excellent power stability, pulse duration, spatial model properties, and continuous tunable ability from 360nm to 1.2µm suited to multi-color devices.

CMGG • VCSELs I—Continued

CMGG4 • 2:30 p.m.
Microwave Signal Mixing in Coupled-Cavity VCSELs, *Chen Chen, Kent Choquette; Univ. of Illinois at Urbana-Champaign, USA.* Two microwave signals of different frequencies are used to modulate the top and bottom cavity of a coupled-cavity VCSEL. Signal mixing is observed, which can be engineered by varying the DC biases to the cavities.

CMGG5 • 2:45 p.m.
Long-Wavelength BTJ-VCSELs with Improved Modulation Bandwidth and Temperature Range, *Werner H. Hofmann[1], Michael Müller[1], Gerhard Böhm[1], Jürgen Rosskopf[2], Markus-Christian Amann[1]; [1]Walter Schottky Inst., Technische Univ. München, Germany, [2]VERTILAS GmbH, Germany.* InP-based VCSELs, emitting at 1.55 µm with improved active region and reduced parasitics are demonstrated. A superior modulation-bandwidth >10 GHz is achieved up to 85°C. Potential bit-rates of 12.5 or even 17 Gb/s are feasible.

CMGG6 • 3:00 p.m.
32 Gb/s Transmission Experiments Using High Speed 850 nm VCSELs, *Petter Westbergh[1], Johan S. Gustavsson[1], Åsa Haglund[1], Anders Larsson[1], Friedhelm Hopfer[2], Dieter Bimberg[2], Andrew Joel[3]; [1]Chalmers Univ. of Technology, Sweden, [2]Inst. für Festkörperphysik, Technische Univ. Berlin, Germany, [3]IQE Europe Ltd., UK.* We demonstrate error free transmission at bit rates up to 32 Gb/s at room temperature and 25 Gb/s at 85°C using a 9 µm oxide aperture 850 nm VCSEL.

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

NOTES

Monday, June 1

Rooms 318-320

CLEO

3:45 p.m.–5:30 p.m.
CMHH • Novel Applications of Microstructured Films
John M. Fini; OFS Labs, USA, Presider

CMHH1 • 3:45 p.m. Invited
A Chirped Photonic Crystal Fiber for High-Fidelity Guiding of Sub-100 fs Pulses, *Julia S. Skibina[1], Rumen Iliew[2], Jens Bethge[3], Martin Bock[3], Dorit Fischer[3], Valentin I. Beloglasov[4], Reiner Wedell[5], Sven Burger[6], Günter Steinmeyer[3]; [1]Saratov State Univ., Russian Federation, [2]Inst. für Festkörpertheorie und Optik, Friedrich-Schiller-Univ. Jena, Germany, [3]Max-Born-Inst., Germany, [4]Nanostructured Glass Technology Co., Russian Federation, [5]Inst. für Angewandte Photonik e.V., Germany, [6]Zuse Inst. Berlin, Germany.* We demonstrate a novel photonic-crystal fiber architecture that breaks with the paradigm of lattice homogeneity and enables a new degree of freedom in photonic-crystal-fiber design. We experimentally demonstrate guiding of 20-fs pulses over meter distance.

CMHH2 • 4:15 p.m.
Ultra-Violet Guiding in High-Order Transmission Window of Hollow-Core Optical Fiber, *Sébastien Février, Frédéric Gérôme, Alexis Labruyère, Benoît Beaudou, Jean-Louis Auguste, Georges Humbert; Xlim, UMR CNRS, Univ. of Limoges, France.* A hollow-core fiber exhibiting three transmission windows from the NIR to the UV was designed and characterized. A good agreement between computed and measured loss was obtained. 2 dB/m loss was demonstrated at 0.355 µm-wavelength.

CMHH3 • 4:30 p.m.
Control of Optical Pulse at Visible Region Using Pulse Trapping in Photonic Crystal Fibers, *Norihiko Nishizawa, Kazuyoshi Itoh; Osaka Univ., Japan.* Control of optical pulse at visible region is directly demonstrated using pulse trapping by soliton pulse in photonic crystal fibers. Wavelength of trapped pulse is continuously blue-shifted from 0.53 to 0.45 µm by power control.

Rooms 321-323

IQEC

3:45 p.m.–5:30 p.m.
IMJ • Quantum Information III
Presider to Be Announced

IMJ1 • 3:45 p.m.
Single Photon Source for an Ion Trap Quantum Network, *Marc Almendros, Felix Rohde, Carsten Schuck, Jan Huwer, Nicolas Piro, Markus Hennrich, Francois Dubin, Jürgen Eschner; ICFO, Spain.* Trapped between high numerical aperture laser objectives, a single calcium ion is converted into a high-efficiency source of single photons, with controlled coherence properties. Thereby, various schemes to establish entanglement between remote ions are probed.

IMJ2 • 4:00 p.m.
A Single Ion Interacting with Single Spontaneous Parametric Down-Conversion Photons, *Nicolas Piro, Felix Rohde, Carsten Schuck, Marc Almendros, Jan Huwer, Markus Hennrich, Albrecht Haase, Morgan W. Mitchell, Francois Dubin, Jürgen Eschner; ICFO, Spain.* We present a tunable, frequency-stabilized, narrow-bandwidth source of frequency-degenerate, entangled photon pairs, which can address the two D-P transitions in $^{40}Ca^{+}$ ions. We also demonstrate single ion-single photon interaction by the detection of quantum jumps.

IMJ3 • 4:15 p.m.
Directing Nuclear Spin Flips in InAs Quantum Dots Using Detuned Optical Pulse Trains, *Samuel G. Carter[1], Andrew Shabaev[2], Sophia E. Economou[1], Thomas A. Kennedy[1], Allan S. Bracker[1], Thomas L. Reinecke[1]; [1]NRL, USA, [2]Dept. of Computational and Data Sciences, George Mason Univ., USA.* We demonstrate that the sign of detuning of an optical pulse train from quantum dot resonances controls the direction of nuclear spin flips. This effect can produce a narrow, precise distribution of nuclear spin polarizations.

IMJ4 • 4:30 p.m. Tutorial
Quantum Information Processing with Individual Atoms in Optical Tweezers, *Philippe Grangier; Lab Charles Fabry, Inst. d'Optique, France.* We present experimental techniques for using individual neutral atoms as qubits: trapping and moving single atoms, encoding qubits on hyperfine states, and entangling them. Special emphasis is given to recent techniques using Rydberg blockade.

Rooms 324-326

CLEO

3:45 p.m.–5:30 p.m.
CMII • High Repetition Rate Combs
Curtis Menyuk; Univ. of Maryland, Baltimore County, USA, Presider

CMII1 • 3:45 p.m. Invited
Femtosecond Laser Frequency Comb for Precision Astrophysical Spectroscopy, *Chih-Hao Li[1], Andrew J. Benedick[2], Claire E. Cramer[1], Guoqing Chang[2], Li-Jin Chen[2], Peter Fendel[2], Gabor Furesz[1], Alexander G. Glenday[1], Franz X. Kaertner[2], David F. Phillips[1], Dimitar Sasselov[1], Andrew Szentgyorgyi[1], Ronald Walsworth[1]; [1]Harvard-Smithsonian Ctr. for Astrophysics, USA, [2]MIT, USA.* High-resolution spectroscopy is a crucial tool for cosmology and the search for extrasolar planets. We present a laser comb with up to 40-GHz line spacing for use as a new spectrographic calibration source.

CMII2 • 4:15 p.m.
Fast Characterization of Optical Arbitrary Waveforms from a 10GHz Frequency Comb Using Dual-Quadrature Spectral Interferometry, *V. R. Supradeepa, Daniel E. Leaird, Andrew M. Weiner; Purdue Univ., USA.* We demonstrate fast(~1.4µs) amplitude and phase characterization of optical arbitrary waveforms generated by line-by-line control of a 10GHz frequency comb. Our technique enables coherent spectral phase measurement after dispersive propagation over long(~50km)lengths of optical fiber.

CMII3 • 4:30 p.m.
High-Resolution Spectroscopy Combined with Optical Frequency Comb and Heterodyne Detection Method, *Tatsutoshi Shioda[1], Kenichiro Fujii[2], Ken Kashiwagi[2], Takashi Kurokawa[2]; [1]Nagaoka Univ. of Technology, Japan, [2]Tokyo Univ. of Agriculture and Technology, Japan.* We have proposed high resolution spectroscopy based on an optical frequency comb and heterodyne detection method in a frequency range of 3 THz (1530nm~1560nm) with a spectral resolution of less than 1 MHz.

Room 314

IQEC

3:45 p.m.–5:30 p.m.
IMK • Nanoplasmonic Waveguides and Devices
Presider to Be Announced

IMK1 • 3:45 p.m.
Surface Plasmon Enhanced Magneto-Optic Isolator, *Juan Montoya[1], Joel M. Hensley[1], Krishnan Parameswaran[1], Mark G. Allen[1], Rajeev J. Ram[2]; [1]Physical Sciences Inc., USA, [2]MIT, USA.* We present an integrated isolator design based on nonreciprocal coupling into a magneto-optic surface-plasmon waveguide that achieves an isolation >30dB with an insertion <3dB in a device length <100 µm.

IMK2 • 4:00 p.m.
Magneto-Optical Manipulation of Surface Plasmons in Gold/Ferromagnetic/Gold Multilayer Films, *Vasily V. Temnov[1], Ulrike Woggon[2], Dmitry Guzatov[3], Gaspar Armelles[4], Alfonso Cebollada[4], Antonio García-Martín[4], José Miguel García-Martín[4], Tim Thomay[5], Alfred Leitenstorfer[5], Rudolf Bratschitsch[5]; [1]MIT, USA, [2]Inst. für Optik und Atomare Physik, Technische Univ. Berlin, Germany, [3]Res. Ctr. of the Resource Saving Problems, Belarus, [4]Inst. de Microelectrónica de Madrid, Spain, [5]Dept. of Physics and Ctr. for Applied Photonics, Univ. of Konstanz, Germany.* Modulation of the surface plasmon wave vector in composite Gold/Cobalt/Gold multilayer films due to periodic magnetization switching in Cobalt is observed with a tilted slit-groove microinterferometer.

IMK3 • 4:15 p.m.
Ultrafast All-Optical Switching in Silicon-Based Plasmonic Waveguides, *Zhanghua Han, Shawn Sederberg, Abdul Y. Elezzabi, Vien Van; Dept. of Electrical and Computer Engineering, Univ. of Alberta, Canada.* We propose and analyze 3- and 5-layer sub-wavelength Silicon-based plasmonic waveguide switches. Above-bandgap femtosecond pump pulses are used to modulate 1550nm signals with switching time ~5ps and high on/off contrast ratio of 23dB.

IMK4 • 4:30 p.m.
Enhanced Surface Third Harmonic Generation from Gold Nanorods, *Moussa N'Gom, Ashish Agarwal, Jing Yong Ye, Nicholas Kotov, Theodore B. Norris; Univ. of Michigan, USA.* We use tightly-focused-ultrashort-laser-pulses to produce a third-harmonic signal from an air-dielectric-interface containing gold nanorods. When the fundamental-frequency is resonant with the longitudinal plasmon of the nanorods, the third-harmonic-signal can be enhanced by more than three-orders-of-magnitude.

Room 315

IQEC

3:45 p.m.–5:30 p.m.
IML • Frequency Conversion
Martin M. Fejer; Stanford Univ., USA, Presider

IML1 • 3:45 p.m.
Adiabatic Sum-Frequency Conversion, *Haim Suchowski[1], Dan Oron[1], Ady Arie[2], Yaron Silberberg[1]; [1]Weizmann Inst. of Science, Israel, [2]Tel Aviv Univ., Israel.* We present a novel technique to achieve both high efficiency and broad bandwidth in SFG process using adiabatic conversion scheme, adapted from NMR and light-matter interaction. The robustness and tunability of the scheme are discussed.

IML2 • 4:00 p.m.
Broadband Two-Dimensional Multicolored Arrays Generation in a Sapphire Plate, *Takayoshi Kobayashi[1,2,3,4], Jun Liu[1,2]; [1]Univ. of Electro-Communications, Japan, [2]JST, Intl. Cooperative Res. Project, Ultrashort Pulse Laser Project, Japan, [3]Dept. of Electrophysics, Natl. Chiao Tung Univ., Taiwan, [4]Inst. of Laser Engineering, Osaka Univ., Japan.* Broadband two-dimensional multicolored array with nine periodic columns and more than ten rows was generated in a sapphire plate. The array structure was sensitive to the in-plane rotation of the sapphire plate.

IML3 • 4:15 p.m. Invited
Terahertz Generation and Detection Using Frequency Conversion, *Jerry C. Chen[1], Ka-Lo Yeh[2], M. J. Khan[1], Janos Hebling[2], Matthias C. Hoffmann[2], Sumanth Kaushik[1], Keith A. Nelson[2]; [1]MIT Lincoln Lab, USA, [2]MIT, USA.* Terahertz is nonlinearly upconverted to telecommunication wavelengths, resulting in detection with 4.5 pW/Hz$^{1/2}$ noise equivalent power and nanosecond temporal resolution. Optical frequencies from an ultrashort pulse mix, generating 3 mW of broadband terahertz.

Room 316

CLEO

3:45 p.m.–5:30 p.m.
CMJJ • Optical Packet Switchings and Novel Fiber
Ken-ichi Kitayama; Osaka Univ., Japan, Presider

CMJJ1 • 3:45 p.m. Invited
Recent Advances in Microstructured Fibers for Power Delivery, *David Richardson, Marco Petrovich, John Hayes, Franceso Poletti, Sonali Dasgupta, Xian Feng, Wei Loh, Neil Broderick; Optoelectronics Res. Ctr., Univ. of Southampton, UK.* We report recent advances in the development of fibers for the delivery of both single and heavily multimode laser beams in spectral regimes spanning the visible to mid-IR.

CMJJ2 • 4:15 p.m.
Fine (<0.5 ps) and Course Tuning (>15 ps) of Optical Delays Using Acousto-Optic Mixing with a 1-pm Tunable Laser, *Scott R. Nuccio, Omer F. Yilmaz, Xiaoxia Wu, Alan E. Willner; Univ. of Southern California, USA.* We demonstrate a new technique for fine tuning of optical delays using cascaded acousto-optic modulators. A 256-ns delay with <0.5-ps resolution is shown for 40-Gb/s RZ-OOK with no system penalty.

CMJJ3 • 4:30 p.m.
Wavelength Transparent and Power Level Tolerant All-Optical Packet Envelope Detection Circuit for Packet Switched Networks Applications, *Claudio Porzi[1], Francesco Fresi[1], Mircea Guina[2], Luca Potì[3], Antonella Bogoni[3]; [1]Scuola Superiore Sant'Anna, Italy, [2]Optoelectronics Res. Ctr., Tampere Technology Univ., Finland, [3]Consorzio Nazionale Interuniversitario per le Telecomunicazioni, Italy.* We performed extensive characterization of all-optical packet envelope detection circuit for ultra-fast packet switched networks. Correct operation with RZ-format data pulses is experimentally demonstrated over a broad range of input packets' wavelengths and power levels.

Room 317

3:45 p.m.–5:30 p.m.
CMKK • Optomechanical Devices
Miloš A. Popović; MIT, USA, Presider

CMKK1 • 3:45 p.m. Invited
Opto-Mechanical Oscillations in a Double-Disk Microcavity, *Qiang Lin, Xiaoshun Jiang, Matt Eichenfield, Ryan Camacho, Patrick Herring, Kerry Vahala, Oskar Painter; Caltech, USA.* We demonstrate giant opto-mechanical oscillations in a silica double-disk where the optical gradient force creates dramatic dynamic back action in comparison to radiation pressure.

CMKK2 • 4:15 p.m.
Ultralow Dissipation Optomechanical Resonators on a Chip, *Georg Anetsberger[1], Rémi Rivière[1], Albert Schliesser[1], Olivier Arcizet[1], Tobias J. Kippenberg[1,2]; [1]Max-Planck-Inst. of Quantum Optics, Germany, [2]École Polytechnique Fédérale de Lausanne, Switzerland.* We demonstrate, for the first time, independent control over mechanical and optical properties within single chip-scale optomechanical resonators. The direct observation of micromechanical normal-mode splitting enables combining ultra-high optical finesse with material-loss limited mechanical Q-factors.

CMKK3 • 4:30 p.m.
Optomechanically Tunable Photonic Crystals for Cavity QED, *Ryan Camacho, Matt Eichenfield, Jasper Chan, Oskar Painter; Caltech, USA.* A new cavity-optomechanical system comprised of two doubly-clamped silicon nitride cantilevers and a 1-D photonic crystal has been developed. We discuss the optical properties and potential applications to solid-state cavity QED with diamond color centers.

Room 336 | Room 337 | Room 338 | Room 339

CLEO

3:45 p.m.–5:30 p.m.
CMLL • Pulse Shaping
Fumihiko Kannari; Keio Univ., Japan, Presider

CMLL1 • 3:45 p.m.
Compression of High Energy Ultrashort Laser Pulses in Hollow Planar Waveguides, *Selcuk Akturk[1], Cord Arnold[1], Bing Zhou[1], Arnaud Couairon[2], Michel Franco[1], Andre Mysyrowicz[1]; [1]Lab d'Optique Appliquée, École Natl. Supérieure des Techniques Avancées, École Polytechnique, CNRS UMR, France, [2]Ctr. de Physique Théorique, CNRS, École Polytechnique, France.* We experimentally demonstrate that high energy ultrashort pulses can be compressed through self-phase-modulation in hollow planar waveguides. The beam is guided in one transverse dimension and propagates free in other, allowing scalability to higher energies.

CMLL2 • 4:00 p.m.
The Laser Scalpel: Controlling the Dissociation of Trapped Fluorescein Ions Using Shaped Femtosecond Pulses, *Christine L. Kalcic, Tissa C. Gunaratne, Marcos Dantus; Michigan State Univ., USA.* The ability of multiphoton intrapulse interference to direct the fragmentation pathway of protonated gas phase fluorescein ions is explored and monitored via ion trap mass spectrometry.

CMLL3 • 4:15 p.m.
Pulse Shaper Assisted Characterization of Single-Cycle Optical Pulses, *Zhi-Ming Hsieh[1,2], Chien-Jen Lai[1,2], Wei-Hong Liang[1,3], Tsung-Ta Tang[3], Wei-Jan Chen[1], Ru-Pin Pan[4], Ci-Ling Pan[3], A. H. Kung[1,3]; [1]Inst. of Atomic and Molecular Sciences, Taiwan, [2]Dept. of Physics, Natl. Taiwan Univ., Taiwan, [3]Dept. of Photonics, Natl. Chiao Tung Univ., Taiwan, [4]Dept. of Electrophysics, Natl. Chiao Tung Univ., Taiwan.* Shaper-assisted autocorrelation is developed to characterize single-cycle pulses. The correlation signal shows significantly improved signal-to-noise ratio, and thus accuracy, in pulse characterization when compared to cross-correlation obtained by splitting the spectral components of the pulse.

CMLL4 • 4:30 p.m.
Double-Sided-Actuated Deformable Mirror for Ultrafast Optics from UV to Mid-IR, *Stefano Bonora, Paolo Villoresi; CNR-INFM LUXOR-DEI, Univ. degli Studi di Padova, Italy.* Active mirrors with two planes of pads and capable to be deformed bidirectionally were developed for the pulse shaping in ultrafast optics from mid-IR to UV. Influence functions were measured and agreed with deformed-membrane model.

3:45 p.m.–5:30 p.m.
CMMM • Cellular and Molecular Techniques
Johannes F. de Boer; Vrije Univ., Netherlands, Presider

CMMM1 • 3:45 p.m.
An Optically Integrated Microfluidic Cell Counter Fabricated by Femtosecond Laser Ablation and Anodic Bonding, *Dawn N. Schafer[1], Emily A. Gibson[2], Evan A. Salim[2], Amy E. Palmer[2], Ralph Jimenez[2], Jeff Squier[1]; [1]Colorado School of Mines, USA, [2]Univ. of Colorado, USA.* We describe a method for integrating fiber optics in substrates by femtosecond laser ablation. In a first demonstration, we fabricate an optically integrated microfluidic device that counts cells by small angle light scattering.

CMMM2 • 4:00 p.m.
Optical Torques Guide Cell Motility, *Gabriel Biener[1], Emmanuel Vrotsos[2], Kiminogu Sugaya[2], Aristide Dogariu[1]; [1]CREOL, College of Optics and Photonics, Univ. of Central Florida, USA, [2]Biomolecular Science Ctr., Univ. of Central Florida, USA.* Through systematic experiments and stochastic modeling we demonstrate that cell motility can be guided by optical torques exerted by the light polarization. This torque affects the actin network which is responsible for cell's movement.

CMMM3 • 4:15 p.m.
Red He-Ne Laser Exposure Enhances Hydrogen Peroxide Production and Induces the "by-Stander" Effect and Modulations in Metabolic Activity in Malignant Human Brain Cancer, *Darrell B. Tata, Ronald W. Waynant; Food and Drug Administration, USA.* Enhanced generation of H_2O_2, modulations in metabolic activity, and the "by-stander" effect from malignant human brain cancer cells due to red He-Ne laser exposures have been quantified and found to be light exposure dose dependent.

CMMM4 • 4:30 p.m.
On-Chip Sub-Cellular Resolution Whole-Animal Manipulation for High-throughput *in vivo* Screening, *Christopher Rohde, Fei Zeng, Cody Gilleland, Chrysanthi Samara, Mehmet F. Yanik; MIT, USA.* We present a suite of technologies that can be combined to perform complex high-throughput whole-animal genetic and drug screens. When used in various combinations, these devices facilitate a variety of high-throughput assays using whole animals.

3:45 p.m.–5:30 p.m.
CMNN • Fiber Based Sensing
Anil Patnaik; Innovative Scientfic Solutions, Inc., USA, Presider

CMNN1 • 3:45 p.m.
Distributed Sensing in a Long-Length FBG Based on Synthesis of Optical Coherence Function with 1-kHz Sampling Rate, *Koji Kajiwara, Kazuo Hotate; Univ. of Tokyo, Japan.* Measurement of Bragg-wavelength distribution inside long-length fiber-Bragg-grating is demonstrated with higher sampling-speed based on synthesis-of-optical-coherence-function to realize real-time sensing. Local reflection spectrum is acquired with 1-kHz sampling-rate and total distribution is measured with 1-Hz measurement-speed.

CMNN2 • 4:00 p.m.
Bend Characteristics of Cladding Mode Resonances in FBG and Their Applications for Simultaneous Measurement, *Xuewen Shu, Kate Sugden, Ian Bennion; Aston Univ., UK.* We report bend-induced spectral changes in fiber Bragg gratings. It is observed that asymmetric-cladding-mode resonances are significantly enhanced under bending. The discovery provides an effective new way to discriminate between bend and strain/temperature.

CMNN3 • 4:15 p.m.
Fiber Bragg Grating Sensor for Simultaneous Measurement of Multiple Parameters, *Liqiu Men, Ping Lu, Qiying Chen; Memorial Univ. of Newfoundland, Canada.* We propose and demonstrate an approach to achieve simultaneous measurement of multiple environmental parameters by the use of multiplexed fiber Bragg gratings with coatings of different polymers and specifications on one standard single-mode optical fiber.

CMNN4 • 4:30 p.m.
Optical Time-Domain Measurement of Brillouin Dynamic Grating Spectrum in a Polarization Maintaining Fiber, *Kwang Yong Song[1], Weiwen Zou[2], Zuyuan He[2], Kazuo Hotate[2]; [1]Chung-Ang Univ., Republic of Korea, [2]Univ. of Tokyo, Japan.* We demonstrate the distributed measurement of Brillouin dynamic grating spectrum in a polarization maintaining fiber based on time-domain analysis. The temperature sensitivity of -370 MHz/°C is observed with a spatial resolution of 1.5 m.

3:45 p.m.–5:30 p.m.
CMOO • Novel Device Concepts for Solid-State Lighting
Mary Crawford; Sandia Natl. Labs, USA, Presider

CMOO1 • 3:45 p.m. Invited
Status and Prognosis for Solid-State Lighting Technology, *Michael Krames; Philips Lumileds Lighting Co., USA.* Sustained improvements in epitaxial materials, device design, and packaging have positioned light-emitting diodes (LEDs) as the solution for future lighting needs worldwide. State-of-the-art LED performance is reviewed along with discussion of challenges and future outlook.

CMOO2 • 4:15 p.m.
Surface Plasmon Enhanced Emission from InGaN Single-Quantum-Well Light Emitting Diodes, *Arthur J. Fischer, Daniel Koleske, Joel Wendt; Sandia Natl. Labs, USA.* Electrically injected surface plasmon LEDs have been demonstrated for InGaN light emitting diodes with emission at 460 nm. A seven times enhancement has been observed at high currents with larger enhancements observed at lower currents.

CMOO3 • 4:30 p.m.
Polarized Light-Emitting Diode with Its InGaN/GaN Quantum Well Coupled with Surface Plasmons on a Metal Grating, *Cheng-Yen Chen, Kun-Ching Shen, Jyh-Yang Wang, Hung-Lu Chen, Chi-Feng Huang, Yean-Woei Kiang, C. C. Yang; Natl. Taiwan Univ., Taiwan.* The enhanced and partially polarized output of a green light-emitting diode, in which its InGaN/GaN quantum well couples with surface plasmons on an Ag grating structure, is demonstrated by comparing with the conventionally fabricated devices.

Room 340

CLEO

3:45 p.m.–5:30 p.m.
CMPP • Novel THz Sources
Weili Zhang; Oklahoma State Univ., USA, Presider

CMPP1 • 3:45 p.m.
Effect and Elimination of Source Position Shifting in Two-Color Plasma Terahertz Sources, *François Blanchard, Gargi Sharma, Xavier Ropagnol, Luca Razzari, Roberto Morandotti, Tsuneyuki Ozaki; Univ. du Québec, Canada.* We report on an improved and robust scheme for the generation of terahertz (THz) waves via a two-color plasma source, based on the use of an off-axis parabolic mirror.

CMPP2 • 4:00 p.m.
Coherent Control of the Polarization of Ultrafast Terahertz Pulses, *Haidan Wen[1], Aaron M. Lindenberg[2]; [1]PULSE Inst., SLAC Natl. Accelerator Lab, USA, [2]Stanford Univ., USA.* The polarization of ultrafast terahertz pulses generated in a laser induced plasma can be controlled by the relative phase of the fundamental and the second harmonic optical fields.

CMPP3 • 4:15 p.m.
How Filament-Induced Birefringence Affects the THz Generation from the Filament in Air, *Yanping Chen[1], Claude Marceau[1], Weiwei Liu[2], Francis Théberge[3], Marc Châteauneuf[3], Jacques Dubois[3], See Leang Chin[1]; [1]Univ. Laval, Canada, [2]Nankai Univ., China, [3]Defence Res. and Development Canada-Valcartier, Canada.* A femtosecond laser filament can induce birefringence in an isotropic medium. This birefringence leads to the generation of elliptically polarized THz pulses emitting from a single-color/two-color filament in air.

CMPP4 • 4:30 p.m.
Record-High Powers for Narrowband Backward Terahertz Generation from Periodically-Poled Lithium Niobate, *Guibao Xu[1], Xiaodong Mu[1], Yujie J. Ding[1], Ioulia B. Zotova[2]; [1]Lehigh Univ., USA, [2]ArkLight, USA.* We have generated the backward terahertz pulses with record-high average powers of 2.3-11 µW and narrowest bandwidth of 6 GHz from multi-grating periodically-poled lithium niobate by optical rectification at room temperature.

Room 341

3:45 p.m.–5:30 p.m.
CMQQ • Optical Device Fabrication
Anders Kristensen; Technical Univ.of Denmark, Denmark, Presider

CMQQ1 • 3:45 p.m.
Uni-Traveling Carrier Phototransistor, *Junghwan Kim[1], Subramaniam Kanakaraju[1], William B. Johnson[2], Chi H. Lee[1]; [1]Univ. of Maryland, USA, [2]Lab for Physical Sciences, Univ. of Maryland, USA.* We propose a novel phototransistor using uni-traveling carrier photodiode structure in base and collector layer and obtained RF optical gain of 29dB at 1GHz and 9dB at 20GHz in 10µm by 10µm optical window device.

CMQQ2 • 4:00 p.m.
Photovoltaic Detectors Fabricated by Direct Imprinting of Mercury Cadmium Telluride, *Mariusz Martyniuk[1], Richard H. Sewell[1], Ryan Westerhout[1], Charles A. Musca[1], John M. Dell[1], Jarek Antoszewski[1], Laurie Faraone[1], Douglas S. Macintyre[2], Stephen Thoms[2], Charles N. Ironside[2]; [1]Univ. of Western Australia, Australia, [2]Univ. of Glasgow, UK.* This is the first report of photovoltaic detectors fabricated by direct imprinting of a semiconductor. Evidence is reported that is consistent with the indented region of p-type HgCdTe type converted to n-type HgCdTe.

CMQQ3 • 4:15 p.m.
Inversion of 3-Dimensional Polymer Photonic Crystal Fabricated by Diffractive Optics Laser Lithography, *Debashis Chanda, Nicole Zachari, Moez Haque, Liang Yuan, Mi Li Ng, Peter Herman; Univ. of Toronto, Canada.* Three-dimensional photonic crystal templates fabricated in polymer by single-step laser exposure through a 2-D diffractive optical element have been inverted in silica to provide robust structures with strong photonic stopbands in the telecom band.

CMQQ4 • 4:30 p.m.
Phase Tunable Holographic Lithography Using a Single Optical Element, *Di Xu[1], Kevin P. Chen[1], Ahmad Harb[2], Daniel Rodriguez[2], Karen Lozano[2], Yuankun Lin[2]; [1]Dept. of Electrical and Computer Engineering, Univ. of Pittsburgh, USA, [2]College of Science and Engineering, Univ. of Texas-Pan American, USA.* This paper presents the holographic fabrication of three-dimensional photonic crystal templates by forming a five beam interference pattern using a top-cut prism. The interconnecting of the multi-layer structures was controlled by phase-tuning one interfering beam.

Rooms 328-329

3:45 p.m.–5:30 p.m.
CMRR • VCSELs II
Kent Choquette; Univ. of Illinois, USA, Presider

CMRR1 • 3:45 p.m.
8 mW Fundamental Mode Output of Wafer-Fused VCSELs Emitting in the 1550-nm Band, *Andrei Caliman[1], Vladimir Iakovlev[2], Alexandru Mereuta[1], Alexei Sirbu[1], Grigore Suruceanu[2], Eli Kapon[1,2]; [1]Swiss Federal Inst. of Technology, EPFL, Switzerland, [2]BeamExpress S.A., Switzerland.* Record fundamental mode output power of 8mW at 0°C and 6.5mW at room temperature is achieved with wafer-fused VCSELs incorporating regrown tunnel junction and emitting at the 1550nm waveband.

CMRR2 • 4:00 p.m.
1.3- µm Wavelength Coupled VCSEL Arrays Employing Patterned Tunnel Junction, *Lukas Mutter[1], Vladimir Iakovlev[2], Andrei Caliman[1], Alexandru Mereuta[1], Alexei Sirbu[1], Eli Kapon[1,2]; [1]Swiss Federal Inst. of Technology, Switzerland, [2]BeamExpress SA, Switzerland.* Using tunnel junction patterning and double wafer fusion, we demonstrate phase-locked arrays of VCSELs emitting at the 1300-nm waveband. CW powers as high as 10-mW and coherent beams are demonstrated for various array configurations.

CMRR3 • 4:15 p.m.
Long-Wavelength VCSEL Arrays with Partly Coherent Emission, *Werner H. Hofmann[1], Markus Görblich[1], Gerhard Böhm[1], Markus Ortsiefer[2], Markus-Christian Amann[1]; [1]Walter Schottky Inst., Technische Univ. München, Germany, [2]VERTILAS GmbH, Germany.* We present a monolithically integrated, InP-based 2-D long-wavelength VCSEL array with coupling near fields. These lasers, utilizing a buried tunnel junction for current confinement, show partly coherent emission at 1.55 µm wavelength.

CMRR4 • 4:30 p.m.
Uniform High Bandwidth, High CW Power VCSEL Arrays, *Rashid Safaisini[1], John R. Joseph[1], Gerard Dang[2], Kevin L. Lear[1]; [1]Colorado State Univ., USA, [2]ARL, USA.* A high bandwidth, high power, 980 nm vertical-cavity surface-emitting laser (VCSEL) array with 3dB frequency response over 7.5 GHz and continuous wave (CW) power of greater than 120 mW at room temperature is reported.

Rooms 318-320

CLEO

CMHH • Novel Applications of Microstructured Films—Continued

CMHH4 • 4:45 p.m.
Colorful Photonic Band Gap Fiber-Based Textiles, *Bertrand Gauvreau[1], Ning Guo[1], Kathy Shicker[2], Karen Stoeffler[1], F. Boismenu[1], Abdellah Ajji[3], Charles Dubois[1], Maksim Skorobogatiy[1]; [1]École Polytechnique de Montréal, Canada, [2]Univ. of the Arts, UK, [3]Industrial Materials Inst., Canada.* Polymer Bragg fiber-enabled, color changing photonic textiles are demonstrated. Such textiles show intrinsic and uniform lateral light extraction and evolutive visuals using both passive and active color control.

CMHH5 • 5:00 p.m.
All-Fiber Laser Cavity Dumping, *Zhangwei Yu[1,2], Walter Margulis[1,2], Oleksandr Tarasenko[2], Micke Malmström[1,2]; [1]Royal Inst. of Technology, Sweden, [2]Acreo AB, Sweden.* Cavity dumping of a fiber laser is demonstrated. A microstructured fiber with an electrically driven internal electrode is used for intracavity polarization rotation with nanosecond risetime. The optical flux can be dumped within one roundtrip.

CMHH6 • 5:15 p.m.
Mode Structure of Large Mode Area All-Solid Photonic Bandgap Fiber, *Sergei L. Semjonov[1], Olga N. Egorova[1], Andrew D. Pryamikov[1], Dmitry A. Gaponov[1], Alexander S. Biriukov[1], Evgeny M. Dianov[1], Mikhail Y. Salganskii[2], Vladimir F. Khopin[2], Alexey N. Guryanov[2]; [1]Fiber Optics Res. Ctr., Russian Federation, [2]Inst. of Chemistry of High-Purity Substances, Russian Federation.* We analyze optical properties of all-silica photonic bandgap fibers with an ultra low ratio of the cladding rods diameter to the center-to-center distance. Optical properties similar to those of LMA holey fibers are revealed.

Rooms 321-323

IQEC

IMJ • Quantum Information III—Continued

Philippe Grangier's research activities began in 1980 about the realization of experimental tests of Bell's inequalities, under the direction of Alain Aspect. He then worked on the generation of single-photon states (1986), squeezed-light-enhanced interferometer and pulsed squeezed light (1987), quantum non-demolition (QND) measurements in optics (1991-1998), and reducing the quantum noise of semiconductor lasers (1995-1999). In the last few years, his research has been centered on Quantum Information Processing and Communications, such as the implementation of new protocols for quantum key distribution, and the manipulation of individual atoms in microscopic dipole traps (optical tweezers). Philippe Grangier is author or co-author of about 150 publications in international journals. He has been involved in many European projects or networks in the domains of Quantum Optics and Quantum Information Processing, and he is presently coordinator of the large scale European Integrated Project *SCALA (Scalable Quantum Computing with Light and Atoms,* 2005-2009).

Rooms 324-326

CLEO

CMII • High Repetition Rate Combs—Continued

CMII4 • 4:45 p.m.
Frequency Stabilized Mode-Locked Laser with 1000 Finesse Intracavity Etalon, *Ibrahim T. Ozdur, Sarper Ozharar, Mehmetcan Akbulut, Franklyn Quinlan, Dimitrios Mandridis, Peter J. Delfyett; CREOL and FPCE, College of Optics and Photonics, Univ. of Central Florida, USA.* A low noise, frequency stabilized, semiconductor based, 10.287 GHz mode-locked laser with 1000 finesse intracavity etalon is demonstrated with a timing jitter (1Hz-100MHz) of 10.9 fs and optical frequency fluctuations less than 150 kHz.

CMII5 • 5:00 p.m.
Low Finesse Fabry-Perot Cavities for Wide Spaced Frequency Combs with Large Spectral Bandwidth, *Tilo Steinmetz[1], Tobias Wilken[1], Ronald Holzwarth[1], Theodor W. Hänsch[1], Thomas Udem[1], Constanza Araujo-Hauck[2]; [1]Max-Planck-Inst. für Quantenoptik, Germany, [2]European Southern Observatory, Germany.* We use low-finesse Fabry-Perot-cavities in series to generate frequency-combs with large mode spacing by simultaneously maintaining high spectral bandwidth. The suppression of the neighboring fundamental mode of the frequency comb exceeds 70dB for 5GHz cavities.

CMII6 • 5:15 p.m.
High Dynamic Range Optical System for Direct Detection of Exo-Planets by Unbalanced Nulling Interferometer and Adaptive Optics, *Kaito Yokochi[1], Jun Nishikawa[2], Naoshi Murakami[2], Lyu Abe[3], Takayuki Kotani[4], Motohide Tamura[2], Alexander V. Tavrov[5], Mitsuo Takeda[6], Takashi Kurokawa[1]; [1]Tokyo Univ. of Agriculture and Technology, Japan, [2]Natl. Astronomical Observatory of Japan, Japan, [3]Univ. de Nice-Sophia Antipolis, France, [4]Observatoire de Paris, France, [5]Space Res. Inst. RAS, Russian Federation, [6]Univ. of Electro-Communications, Japan.* We demonstrated a magnification of a wavefront aberration by an unbalanced nulling interferometer, and correction of the aberration by the phase amplitude correction for precise wavefront correction beyond an adaptive optics performance limit.

Room 314

IQEC

IMK • Nanoplasmonic Waveguides and Devices—Continued

IMK5 • 4:45 p.m.
Practical Limits of Absorption Enhancement near Metal Nanoparticles, *Greg Sun[1], Jacob B. Khurgin[2]; [1]Univ. of Massachusetts at Boston, USA, [2]Johns Hopkins Univ., USA.* We study the enhanced absorption of optical radiation by molecules placed near metal nano-particles that includes perturbation of the optical field and show that the enhancement is strong only for relatively weak and diluted absorbers.

IMK6 • 5:00 p.m.
Ultrashort Optical Pulse Propagation in Metal Nanoparticle Covered Dielectric Surfaces, *Jess M. Gunn, Scott H. High, Vadim V. Lozovoy, Marcos Dantus; Michigan State Univ., USA.* We characterize the behavior of optical pulse propagation in surfaces covered with silver metal nanoparticles and quantify the dispersion introduced as the pulse propagates.

IMK7 • 5:15 p.m.
Giant Modal Gain in a Metal-Semiconductor Waveguide, *Debin Li, Cun-Zheng Ning; Arizona State Univ., USA.* We show that a giant modal gain is achievable near surface plasmon resonance for guided modes in a metal-semiconductor-metal plasmonic waveguide. The giant gain is shown to originate from a reduction of average energy velocity.

6:00 p.m.–7:30 p.m. CLEO Plenary Session, *Baltimore Convention Center, Ballrooms III-IV*

NOTES

Room 315 | Room 316 | Room 317

IQEC | **CLEO**

IML • Frequency Conversion—Continued

IML4 • 4:45 p.m.
Observation of Strong Second Harmonic Generation from a Single Wurtzite GaAs Nanoneedle, *Shanna Crankshaw[1], Roger Chen[1], Matthias Kuntz[1], Linus C. Chuang[1], Michael Moewe[1], James Schuck[2], Connie Chang-Hasnain[1]; [1]Univ. of California at Berkeley, USA, [2]Lawrence Berkeley Natl. Lab, USA.* We demonstrate second harmonic generation from a single GaAs nanoneedle with a wurtzite crystal structure. The optical anisotropy of the polar crystal results in strong nonlinear optical conversion compared to normal zincblende GaAs.

IML5 • 5:00 p.m.
Second-Harmonic Generation from Single Core-Shell CdTe/CdS Quantum Dots, *Marcin Zielinski[1], Dan Oron[2], Dominique Chauvat[1], Joseph Zyss[1]; [1]Lab de Photonique Quantique et Moléculaire, École Normal Supérieure de Cachan, France, [2]Weizmann Inst. of Science, Israel.* We observed second harmonic generation from semiconducting CdTe/CdS nanocrystals with a diameter below 15 nm. Their submicron size, high nonlinearity and orientation sensitive SHG response are adapted for ultrafast, high resolution probing of optical near-fields.

IML6 • 5:15 p.m.
Highly-Efficient Second Harmonic Generation in ZnO Nanorods with Ultrashort Pulses, *Susanta K. Das[1], Martin Bock[1], Christopher O'Neill[1], Rüdiger Grunwald[1], Kyung M. Lee[2], Hwang W. Lee[2], Soonil Lee[2], Fabian Rotermund[2]; [1]Max-Born-Inst., Germany, [2]Ajou Univ., Republic of Korea.* Angularly and spectrally resolved second harmonic studies for c-axis ZnO nanorods are reported. 7.5 times higher efficiency than for BBO was found at 55 GW/cm^2 at Ti:sapphire laser oscillator wavelengths. Spectral profiles agree with simulations.

CMJJ • Optical Packet Switchings and Novel Fiber—Continued

CMJJ4 • 4:45 p.m.
Packet Compression from a 10-Gb/s to 270-Gb/s Using a Temporal Telescopic System, *Mark A. Foster, Reza Salem, Yoshitomo Okawachi, Amy C. Turner-Foster, Michal Lipson, Alexander L. Gaeta; Cornell Univ., USA.* We demonstrate compression of 24-bit 10-Gb/s NRZ data packets to 270 Gb/s using a temporal telescopic system. This technique's versatility allows format-transparent compression of packets (i.e. NRZ, RZ, DPSK) and analog waveforms by arbitrary factors.

CMJJ5 • 5:00 p.m.
Frequency Swapping Using an Optical Switch with Embedded Mach-Zehnder Structures for Wavelength-Converted Optical Signal Routing without Lightsources, *Akito Chiba[1], Takahide Sakamoto[1], Tetsuya Kawanishi[1], Kaoru Higuma[2], Masayuki Izutsu[3]; [1]NICT, Japan, [2]New Technology Res. Labs, Sumitomo Osaka Cement Co., Ltd., Japan, [3]Tokyo Inst. of Technology, Japan.* We proposed and experimentally investigated a frequency swapping technique for two lightwaves by using a $LiNbO_3$ optical switch where only Mach-Zehnder structures were nested. 10-GHz opposite frequency shifts for two lightwaves were successfully obtained.

CMJJ6 • 5:15 p.m.
40 Gb/s Buffered 2x2 Optical Packet Switching Using Photonic Integrated Circuits, *John P. Mack, Kimchau N. Nguyen, Matt. M. Dummer, Emily F. Burmeister, Henrik N. Poulsen, Biljana Stamenic, Geza Kurczveil, John E. Bowers, Larry A. Coldren, Daniel J. Blumenthal; Univ. of California at Santa Barbara, USA.* Contention resolution and forwarding of labeled optical packets at 40 Gb/s is demonstrated utilizing multiple InP based optical buffers and monolithic wavelength converters. Layer-2 packet recovery measurements are presented.

CMKK • Optomechanical Devices—Continued

CMKK4 • 4:45 p.m.
Cryogenic Properties of Optomechanical Silica Microcavities, *Olivier Arcizet[1], Rémi Rivière[1], Albert Schliesser[1], G. Anetsberger[1], Tobias Jan Kippenberg[1,2]; [1]Max-Planck-Inst. for Quantum Optics, Germany, [2]École Polytechnique Fédérale de Lausanne, Switzerland.* We expose cryogenic (1.6 K) optomechanical properties of high-Q toroidal silica microcavities. A thermally induced optical multistability and the influence of structural defects of amorphous materials on phonon propagation are described.

CMKK5 • 5:00 p.m.
Large Optical Springs in Picogram-Scale Optomechanical Oscillators, *Matt Eichenfield, Ryan M. Camacho, Jasper Chan, Oskar J. Painter; Caltech, USA.* We experimentally demonstrate a picogram-scale optomechanical system that increases its mechanical rigidity by more than 5x with the application of mW-level optical power. We discuss the theory and fabrication, making comparisons to existing optomechanical systems.

CMKK6 • 5:15 p.m.
Cavity Optomechanics with Crystalline Whispering Gallery Mode Resonators, *Johannes Hofer[1], Albert Schliesser[1], Tobias Kippenberg[1,2]; [1]Max-Planck-Inst. für Quantenoptik, Germany, [2]École Polytechnique Fédérale de Lausanne, Switzerland.* We investigate the optomechanical properties of a high-Q CaF_2 whispering gallery mode resonator. Mechanical modes with quality factors up to 135,000 are observed, optically probed and compared to simulation.

6:00 p.m.–7:30 p.m. CLEO Plenary Session, *Baltimore Convention Center, Ballrooms III-IV*

NOTES

CMLL • Pulse Shaping—Continued

CMLL5 • 4:45 p.m.
Time-to-Space Mapping System Using Double Electro-Optic Deflectors Fabricated on a Single $LiTaO_3$ Substrate with "U" Shaped Microstrip Line, *Shintaro Hisatake, Keiji Tada, Tadao Nagatsuma; Osaka Univ., Japan.* We demonstrate 2 ps temporal resolution of time-to-space mapping using double quasi-velocity-matched electrooptic deflectors operating at 16 GHz repetition frequency. Deflectors were fabricated on a single stoichiometric $LiTaO_3$ substrate with "U" shaped modulation microstrip line.

CMLL6 • 5:00 p.m.
Kilohertz Tunable Dispersion Compensation with a Bimorph Piezo Deformable Mirror, *Michael E. Durst, Chris Xu; Cornell Univ., USA.* We present a new technique for dispersion compensation with $>10^5$ fs^2 range and kilohertz tuning speed, enabling high-speed focal plane scanning of two-photon excited fluorescence in a temporal focusing setup.

CMLL7 • 5:15 p.m.
Single-Grating and Single-Grism Pulse Compressors, *Vikrant K. Chauhan, Pamela Bowlan, Jacob Cohen, Rick Trebino; Georgia Tech, USA.* We introduce single-grating and single-grism pulse compressors, which are compact and automatically aligned for distortion-free output, and the latter of which compensates for significant material dispersion up to third order.

CMMM • Cellular and Molecular Techniques—Continued

CMMM5 • 4:45 p.m.
Optical Control of Neural Activity by Waveguide Delivery in Genetically Targeted Brain Tissue, *Jiayi Q. Zhang[1], Farah Laiwalla[1], Jennifer Kim[1], Rick Van Wagenen[2], Yoon-Kyu Song[1], Barry Connors[1], Arto V. Nurmikko[1]; [1]Brown Univ., USA, [2]Blackrock Microsystems, USA.* Genetically targeted neurons in brain expressing light sensitive channel *Channelrhodopsin* can be stimulated optically. We report a novel optical waveguide probe for simultaneous optical stimulation and electrical recording of neurons to modulate neural network behavior.

CMMM6 • 5:00 p.m.
Laser Heated Nanodroplet PCR on a Petri Dish, *Hanyoup Kim, Siarhei Vishniakou, Gregory W. Faris; SRI Intl., USA.* We report the development of a real-time PCR system driven solely by laser heating with nanoliter droplets on a polystyrene Petri dish.

CMMM7 • 5:15 p.m.
Label-Free Optical Detection of Biomolecular Reaction Kinetics in Microarray Format for High-throughput Screening Applications, *Yung-Shin Sun[1], James P. Landry[1], Yiyan Fei[1], Juntao Luo[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.* Using a combination of an oblique-incidence reflectivity difference (OI-RD) scanning microscope and a customized 8-chamber sample cartridge, we detect 300 surface-immobilized molecular targets reacting with up to 8 different analytes simultaneously on a single slide.

CMNN • Fiber Based Sensing—Continued

CMNN5 • 4:45 p.m.
Realization of High-Speed Distributed Sensing Based on Brillouin Optical Correlation Domain Analysis, *Weiwen Zou, Zuyuan He, Kazuo Hotate; Univ. of Tokyo, Japan.* A novel method is proposed to demodulate the output of the BOCDA system using an analog signal processing unit. In experiment, we realize ~20-Hz distributed sensing over the entire 50-m fiber with 5-cm spatial resolution.

CMNN6 • 5:00 p.m.
Stable Entire-Length Measurement of Fiber Strain Distribution by Brillouin Optical Correlation-Domain Reflectometry Based on Polarization Scrambling Scheme, *Yosuke Mizuno, Zuyuan He, Kazuo Hotate; Univ. of Tokyo, Japan.* We demonstrate stable entire-length measurement of fiber strain distribution by suppressing fluctuation of Brillouin gain spectrum based on polarization scrambling scheme. Strain distribution along 100-m fiber was measured with 40-cm resolution and 19-Hz sampling rate.

CMNN7 • 5:15 p.m.
Functionalized Fiber Optic Devices for Surface Enhanced Raman Scattering Detection and Optical Trapping, *Elizabeth J. Smythe, Michael D. Dickey, Ethan Schonbrun, Kenneth B. Crozier, George M. Whitesides, Federico Capasso; Harvard Univ., USA.* This work demonstrates two fiber optic devices: one device detects *in situ* surface enhanced Raman scattering (SERS) from remote analytes, and the other is designed to perform three-dimensional trapping of small particles.

CMOO • Novel Device Concepts for Solid-State Lighting—Continued

CMOO4 • 4:45 p.m.
Growths of Staggered InGaN Quantum Wells Light-Emitting Diodes Emitting at 520-525 nm Employing Graded-Temperature Profile, *Hongping Zhao, Guangyu Liu, Xiaohang Li, G.S. Huang, Samson Tafon Penn, Volkmar Dierolf, Nelson Tansu; Lehigh Univ., USA.* The use of three-layer staggered InGaN quantum wells light-emitting diodes at 520-525 nm, grown by metal-organic chemical vapor deposition with graded-temperature profile, resulted in increase in efficiency and output power by 2-times.

CMOO5 • 5:00 p.m.
GaN-Based Film-Transferred Light-Emitting Diodes with Photonic Crystal, *Chun-Feng Lai[1], Jim-Yong Chi[2,3], Chia-Hsin Chao[3], Chia-En Lee[1], Hao-Chung Kuo[1], Chen-Yang Huang[3], Wen-Yung Yeh[3], Tien-Chang Lu[1]; [1]Dept. of Photonics and Inst. of Electro-Optical Engineering, Natl. Chiao-Tung Univ., Taiwan, [2]Inst. of Optoelectronic Engineering, Natl. Dong-Hwa Univ., Taiwan, [3]Electronics and Optoelectronics Res. Labs, Industrial Technology Res. Inst., Taiwan.* Experimental investigation of A-type and B-type guided modes was performed in GaN-based film-transferred photonic crystal light-emitting diodes. Good agreement with the band structure calculated in the limit of two-dimensional free photon was obtained.

CMOO6 • 5:15 p.m.
The Use of Polydimethylsiloxane Concave Microstructures Arrays to Enhance Light Extraction Efficiency of InGaN Quantum Wells Light-Emitting Diodes, *Yik-Khoon Ee, Pisist Kumnorkaew, Ronald A. Arif, Hua Tong, James F. Gilchrist, Nelson Tansu; Lehigh Univ., USA.* Novel approach to improve light extraction efficiency of InGaN-based light emitting diodes with polydimethylsiloxane concave microstructures arrays was demonstrated, which leads to enhancement of extraction efficiency by 1.60-times in good agreement with simulation.

6:00 p.m.–7:30 p.m. CLEO Plenary Session, *Baltimore Convention Center, Ballrooms III-IV*

NOTES

CMPP • Novel THz Sources—Continued

CMPP5 • 4:45 p.m.
Pump Beam Recycling for an Enhancement of the Output Power of Terahertz-Wave Parametric Oscillator, *Tomofumi Ikari[1], Hiromasa Ito[1], Dong Ho Wu[2]; [1]RIKEN Sendai, Japan, [2]NRL, USA.* We have implemented a recycled pump beam technique on a terahertz parametric oscillator (TPO). The TPO with a recycled beam produces a terahertz beam that is several times stronger than that of the conventional TPO.

CMPP6 • 5:00 p.m.
Broadband and High Power Monocycle Terahertz Pulse Generation by $\chi^{(2)}$ Cascaded Processes in $LiNbO_3$, *Mukesh Jewariya[1], Masaya Nagai[1,2], Yuki Ichikawa[3], Hideyuki Ohtake[3], Toshiharu Sugiura[3], Yuzuru Uehara[3], Koichiro Tanaka[1,4]; [1]Dept. of Physics, Kyoto Univ., Japan, [2]JST, Japan, [3]Aisin Seiki Co., Ltd., Japan, [4]Inst. for Integrated Cell-Material Science, Kyoto Univ., Japan.* We propose a novel technique for the generation of high power monocycle terahertz pulse beyond excitation pulse width limitation. When intense THz electric field generated by optical rectification lies in EO crystal, optical pulse gets modulated.

CMPP7 • 5:15 p.m.
Enhancement of Room-Temperature Terahertz Emission from a Double Grating-Gate Plasmon-Resonant Emitter, *A. El Fatimy, Y. Tsuda, T. Komori, A. El Moutaouakil, H. Horiike, T. Suemitsu, T. Otsuji; Res. Inst. of Electrical Communication, Tohoku Univ., Japan.* Terahertz photomixing in Plasmon-resonant emitter was investigated. The self-oscillation excited by a dc-current (around 2THz), was reinforced by the differential-frequency excitation (2.2THz), resulting in the emission enhancement. This indicates a possibility of injection-locked oscillation.

CMQQ • Optical Device Fabrication—Continued

CMQQ5 • 4:45 p.m.
Fabrication of Antireflection Nanostructures on GaAs by Holographic Lithography for Device Applications, *Young Min Song[1], Si Young Bae[1], Jae Su Yu[2], Yong Tak Lee[1]; [1]Gwangju Inst. of Science and Technology, Republic of Korea, [2]Kyung Hee Univ., Republic of Korea.* We demonstrate the fabrication of antireflection nanostructures on GaAs using holographic lithography. Measured results are in good agreement with the calculated values using a RCWA, effectively suppressing the surface reflection over visible and near-infrared ranges.

CMQQ6 • 5:00 p.m.
Plasmonic-Coupled Nanostructure for Improved Surface Plasmon Resonance Biosensing, *Haiping Matthew Chen, Lin Pang, Yeshaiahu Fainman; Univ. of California at San Diego, USA.* A three-dimensional (3-D) composite nanostructure with enhanced normal electrical field is simulated and fabricated for surface plasmon resonance (SPR) biosensing. The device is used to measure specific binding events of different proteins.

CMQQ7 • 5:15 p.m.
Ultra-Smooth Lithium Niobate Single Crystal Photonic Micro-Structures, *Sakellaris Mailis[1], Yongjun J. Ying[1], Collin L. Sones[1], Anna C. Peacock[1], Florian Johann[2], Elisabeth Soergel[2], Robert W. Eason[1], Mikhail N. Zervas[1]; [1]Optoelectronics Res. Ctr., Univ. of Southampton, UK, [2]Inst. of Physics, Univ. of Bonn, Germany.* Thermal treatment of microstructured lithium niobate, at temperatures close to the Curie point, induces preferential surface melting and re-crystallization. This process yields ultra-smooth single crystal superstructures suitable for fabrication of low scattering loss photonic micro-components.

CMRR • VCSELs II—Continued

CMRR5 • 4:45 p.m.
Optically-Pumped Circularly-Polarized Lasing in a (110)-Oriented VCSEL Based on InGaAs/GaAs QWs, *Hiroshi Fujino, Satoshi Iba, Toshiyasu Fujimoto, Shinji Koh, Hitoshi Kawaguchi; Nara Inst. of Science and Technology, Japan.* We demonstrated circularly-polarized lasing in a (110)-oriented VCSEL based on InGaAs/GaAs QWs by optical pumping for the first time. High degree of circularly polarization (0.94) was achieved reflecting long spin relaxation times in (110) QWs.

CMRR6 • 5:00 p.m.
Ultrafast Spin Dynamics in Spin-Polarized Vertical-Cavity Surface-Emitting Laser Devices, *Nils C. Gerhardt[1], Stephan Hoevel[1], Mingyuan Li[1], Hendrik Jaehme[1], Martin R. Hofmann[1], Thorsten Ackemann[2], Andrea Kroner[3], Rainer Michalzik[3]; [1]Photonics and Terahertz Technology, Ruhr-Univ. Bochum, Germany, [2]Dept. of Physics, Univ. of Strathclyde, UK, [3]Inst. for Optoelectronics, Univ. of Ulm, Germany.* Spin-polarized lasers offer new encouraging possibilities for future devices. We compare time-resolved luminescence measurements with theoretical models for spin dynamics in spin-polarized lasers and demonstrate ultrafast polarization switching during one short single-mode laser pulse.

CMRR7 • 5:15 p.m.
Red and UV Generation Using Frequency-Converted GaInNAs-Based Semiconductor Disk Laser, *Jussi Rautiainen, Antti Härkönen, Ville-Markus Korpijärvi, Janne Puustinen, Lasse Orsila, Mircea Guina, Oleg Okhotnikov; Optoelectronics Res. Ctr., Tampere Univ. of Technology, Finland.* We report on the intracavity frequency-doubling of a GaInNAs/GaAs disk laser. The laser operated at 1220 nm and delivered 4.6 W of power at ~610 nm. The red emission was further frequency-doubled to 305 nm.

6:00 p.m.–7:30 p.m. CLEO Plenary Session, *Baltimore Convention Center, Ballrooms III-IV*

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