## C L E O

**ROOM 318-320**

**8:00 a.m. – 9:45 a.m.**

### CThA • Fundamentals of Femtosecond Laser/Material Interactions

*Donald Harter; IMRA America Inc, USA, Presider*

**CThA1 • 8:00 a.m.** Tutorial

**Ultrafast Micro and Nanomachining,** *Gerard Mourou; Ecole Polytechnique de Paris, France.* Abstract not available.

**ROOM 321-323**

**8:00 a.m. – 9:45 a.m.**

### CThB • Novel Semiconductor Laser Cavities

*Richard Jones; Intel Corp., USA, Presider*

**CThB1 • 8:00 a.m.**

**Nanoscale Semiconductor Plasmon Lasers,** *Farhan Rana[1], Christina Manolatou[1], Steven G. Johnson[2]; [1]Cornell Univ., USA, [2]MIT, USA.* We present several designs for surface-plasmon confined electrically pumped nanoscale semiconductor lasers. We show that low-loss laser nanocavities with subwavelength cavity sizes in all three dimensions are feasible.

**CThB2 • 8:15 a.m.**

**Polarization Controlled 0.85 µm VCSELs with Plasmonic Nanorods,** *Babu Dayal Padullaparthi, Koyama Fumio; Tokyo Inst. of Technology, Japan.* We demonstrate the polarization control of single transverse mode 0.85 µm VCSELs using plasmonic gold nanorods fabricated on the top surface. The large anisotropy of gold nanorods enables stable polarization control with suppressing metal absorption.

**CThB3 • 8:30 a.m.**

**Ultraviolet Lasing Characteristics of a GaN Photonic Crystal Defect Emitter,** *Chun-Feng Lai[1], Peichen Yu[1], Te-Chung Wang[1], Hao-Chung Kuo[1], Tien-Chang Lu[1], Shing-Chung Wang[1], Chao-Kuei Lee[2]; [1]Dept. of Photonics and Inst. of Electro-Optical Engineering, Natl. Chiao-Tung Univ., Taiwan, [2]Natl. Sun Yat-Sen Univ., Taiwan.* The fabricated GaN photonic crystal defect emitter demonstrated multimode lasing with a low optical pumping threshold of pulse engergy~0.15µJ. The device exhibited high spectral purity and enhanced spontaneous emission factor, β~0.045.

## J O I N T

**ROOM 324-326**

**8:00 a.m. – 9:45 a.m.**

### JThA • Attosecond Dynamics

*Presider to Be Announced*

**JThA1 • 8:00 a.m.** Invited

**Probing Proton Dynamics in Molecules on an Attosecond Time Scale,** *Sarah Baker[1], Joseph S. Robinson[1], Manfred Lein[2], Ciprian C. Chirila[2], Heidi C. Bandulet[3], Daniel Comtois[3], David Villeneuve[4], Jean-Claude Kieffer[3], John WG Tisch[1], Jonathan P. Marangos[1]; [1]Imperial College, UK, [2]Univ. of Kassel, Germany, [3]Advanced Laser Light Source, Canada, [4]Natl. Res. Council of Canada, Canada.* A technique for probing ultrafast (attosecond) structural rearrangement in molecules following laser ionization is discussed. The temporal window accessible has recently been extended beyond that previously reported by employing a driving field in the mid-IR.

**JThA2 • 8:30 a.m.**

**Attosecond Two-Slit Interference Controlled by Carrier-Envelope Phase,** *Mahendra M. Shakya, Steve M. Gilbertson, Hiroki Mashiko, Christopher M. Nakamura, Chengquan Li, Eric Moon, Zuoliang Duan, Jason Tackett, Zenghu Chang; Kansas State Univ., USA.* High harmonics generation was polarization gated with few-cycle laser pulses to produce two attosecond pulses with 104 XUV photons.The spectrum interference of the two pulses is affected by the carrier-envelope phase like in Young's experiments.

## C L E O

**ROOM 314**

**8:00 a.m. – 9:45 a.m.**

### CThC • $\chi^2$/Cascaded $\chi^2$ Devices

*Robert Fisher; R. A. Fisher Associates, USA, Presider*

**CThC1 • 8:00 a.m.**

**Parametric Generation in AlGaAs/$AlO_x$ Waveguides: Performances and Perspectives,** *Marco Ravaro, Jean-Pierre Likforman, Sara Ducci, Vincent Berger, Giuseppe Leo; Lab Matériaux et Phénomènes Quantiques, UMR, Univ. Paris 7-Denis Diderot, France.* Highly efficient frequency up- and down-conversion are performed in low-loss birefringent AlGaAs waveguides, obtained by AlAs selective wet oxidation. The perspective of a semiconductor integrated parametric oscillator is quantitatively discussed.

**CThC2 • 8:15 a.m.**

**Gain Enhancement Due to Transverse Effects in Chirped Quasi-Phase-Matched Optical Parametric Amplifiers,** *Mathieu Charbonneau-Lefort[1], Bedros Afeyan[2], Martin M. Fejer[1]; [1]Stanford Univ., USA, [2]Polymath Res. Inc., USA.* We investigate transverse effects in chirped QPM gratings such as cascaded phase shifts and non-collinear interactions. We find enhanced growth over a wide bandwidth with gains much larger than in the 1-D limit.

**CThC3 • 8:30 a.m.**

**Pulsed Picosecond UV Source by Frequency Quadrupling,** *Onur Kuzucu[1], Franco N.C. Wong[1], David E. Zelmon[2], Shrikrishna M. Hegde[2], Tony D. Roberts[3], Philip Battle[3]; [1]MIT, USA, [2]AFRL, USA, [3]AdvR, Inc., USA.* We report efficient picosecond UV generation by means of frequency quadrupling of an amplified picosecond fiber laser. This narrowband 390-nm source with 250 mW is suitable for a number of quantum information processing tasks.

**ROOM 315**

**8:00 a.m. – 9:45 a.m.**

### CThD • Optical Polymers

*Warren N. Herman; Lab for Physical Sciences, Univ. of Maryland, USA, Presider*

**CThD1 • 8:00 a.m.** Invited

**Biomimetic Optical Polymers,** *James Shirk[1], Guy Beadie[1], Richard S. Lepkowicz[1], Y. Jin[2], E. Baer[2], A. Hiltner[2]; [1]NRL, USA, [2]Dept. of Macromolecular Science and Engineering, Case Western Reserve Univ., USA.* A new class of nanostructured polymer optical materials can mimic biological optical materials. Application to gradient refractive index (GRIN) lenses with an unprecedented variety of index gradients and a nonlinear 1-D photonic crystal are described.

**CThD2 • 8:30 a.m.**

**Processible Polyacetylene-Based $\chi^{(3)}$ Materials for Photonic Applications,** *San-Hui Chi[1], Joel M. Hales[1], Jian-Yang Cho[1], Susan Odom[1], Qing Zhang[1], Richard R. Schrock[2], Seth R. Marder[1], Joseph W. Perry[1]; [1]Georgia Tech, USA, [2]MIT, USA.* A number of processing variations were carried out to optimize the morphology, third-order nonlinearity, and processability of substituted polyacetylene polymers. This allowed for spin coating of optical quality films with large nonlinearities.

**ROOM 316**

**8:00 a.m. – 9:45 a.m.**

### CThE • Spectral Control of Solid-State Lasers

*Hajime Nishioka; Inst. for Laser Science, Japan, Presider*

**CThE1 • 8:00 a.m.**

**Widely Tunable Yb:KYW Laser Locked by a Volume Bragg Grating,** *Björn Jacobsson, Jonas E. Hellström, Valdas Pasiskevicius, Fredrik Laurell; Laser Physics, KTH, Royal Inst. of Technology, Sweden.* We demonstrate a technique for laser tuning based on a volume Bragg grating. A peak power of 4.7 W, a bandwidth <0.1 nm and a 1000-1050 nm tuning range is achieved in an Yb:KYW laser.

**CThE2 • 8:15 a.m.**

**Monolithic Bragg-Locked Nd-Laser,** *Ida Häggström, Björn Jacobsson, Fredrik Laurell; Laser Physics, KTH, Royal Inst. of Technology, Sweden.* We demonstrate a monolithic $\text{Nd:GdVO}_4$ laser, operating in a single longitudinal mode by wavelength restriction from a volume Bragg grating. With temperature, the laser could be tuned continuously over 80 GHz.

**CThE3 • 8:30 a.m.**

**Lasing Action of $\text{Nd:GdVO}_4$ at 1070 nm by Volumetric Bragg Grating,** *Chien-Jung Liao[1], Yu-Hung Lien[1], Te-yuan Chung[2], Sidney S. Yang[1], Jow-Tsong Shy[1]; [1]Natl. Tsin Hua Univ., Taiwan, [2]Natl. Central Univ., Taiwan.* The 1070 nm lasing action of $\text{Nd:GdVO}_4$ is demonstrated for the first time to our knowledge. Using a volumetric Bragg grating, the 1063 nm lasing action is suppressed and the 1070 nm lasing is generated.

## QELS

**ROOM 317**

**8:00 a.m. – 9:45 a.m.**

### QThA • Novel Dynamic Measurements in Metals

*Michael Woerner; Max-Born-Inst., Germany, Presider*

**QThA1 • 8:00 a.m.** Tutorial

**Ultrafast Spectroscopy on Photonic Metamaterials,** *Martin Wegener[1], Stefan Linden[1], Costas Soukoulis[2]; [1]Karlsruhe Univ., Germany, [2]Ames Lab and Dept. of Physics and Astronomy, Iowa State Univ., USA.* We review recent progress in the emerging field of photonic metamaterials, emphasizing two highlights connected with femtosecond pulses: time-of-flight experiments on negative-index metamaterials and harmonic generation on magnetic metamaterials.

**ROOM 336**

**8:00 a.m. – 9:45 a.m.**

### QThB • Plasmonics I

*Mikhail Noginov; Norfolk State Univ., USA, Presider*

**QThB1 • 8:00 a.m.** Invited

**Nano-Particle Ions and Atoms,** *Nabil Lawandy[1,2]; [1]Solaris Nanosciences, USA, [2]Div. of Engineering and Dept. of Physics, Brown Univ., USA.* Charged particles attracted to metallic nano-particles via radial potentials exhibit hydrogenic quantum states. Two-particle electronic states exist with different correlations energies and tuning of plasmon resonance to the electronic transitions results in large radiative effects.

**QThB2 • 8:30 a.m.**

**Surface Plasmon Assisted Laser Cooling of Solids,** *Jacob B. Khurgin; Johns Hopkins Univ., USA.* Threshold and efficiency of laser cooling can be significantly improved due to rapid energy transfer from semiconductor to metal heat sink via excitation of surface plasmon polaritons and their subsequent decay in the metal.

## ROOM 337

## QELS

### 8:00 a.m. – 9:45 a.m.
### QThC • Laser Cooling of Mechanical Systems and Molecules
*John L. Harris; Univ. of Glasgow, UK, Presider*

**QThC1 • 8:00 a.m.** Invited
**Cooling of a Micro-Mechanical Oscillator Using Radiation-Pressure Induced Dynamical Backaction,** *Albert Schliesser[1], Nima Nooshi[1], Pascal Del'Haye[1], Kerry Vahala[2], Tobias J. Kippenberg[1]; [1]Max-Planck-Inst. of Quantum Optics, Germany, [2]Caltech, USA.* We demonstrate how dynamical backaction of radiation pressure can be exploited for passive laser-cooling of high-frequency (>50 MHz) mechanical oscillation modes of ultra-high-finesse optical microcavities from room temperature to 11 K.

**QThC2 • 8:30 a.m.**
**Laser Cooling of a Microcantilever Using a Medium Finesse Optical Cavity,** *Benjamin Zwickl, Andrew Jayich, Jack G. E. Harris; Physics Dept., Yale Univ., USA.* A 75mm optical cavity was formed using a microcantilever for one mirror. A finesse of 55 was achieved, not limited by diffraction around the cantilever. The microcantilever was passively laser cooled from 300K to 50K.

## CLEO

## ROOM 338

### 8:00 a.m. – 9:45 a.m.
### CThF • Nonlinear Optical Processing for Communications
*Michael Vasilyev; Univ. of Texas at Arlington, USA, Presider*

**CThF1 • 8:00 a.m.**
**320 Gbit/s DQPSK All-Optical Wavelength Conversion Using Periodically Poled $LiNbO_3$,** *Bernd Huettl[1], Alexandre Gual i Coca[1], Hubertus Suche[2], Reinhold Ludwig[1], Carsten Schmidt-Langhorst[1], Hans Georg Weber[1], Wolfgang Sohler[2], Colja Schubert[1]; [1]Fraunhofer Inst. for Telecommunications, Germany, [2]Univ. of Paderborn, Dept. Applied Physics, Germany.* We demonstrate wavelength conversion of 160Gbit/s DPSK and 320Gbit/s DQPSK data signals by cascaded second-harmonic and difference frequency generation in a periodically poled $LiNbO_3$ waveguide. Error free operation with negligible penalty is obtained.

**CThF2 • 8:15 a.m.**
**Polarization-Insensitive Wavelength Conversion of DPSK Signal Using Four-Wave Mixing in 32-cm Bismuth-Oxide Highly Nonlinear Fiber,** *Mable P. Fok, Chester Shu; Chinese Univ. of Hong Kong, Hong Kong.* We demonstrate polarization-insensitive wavelength conversion of 10-Gb/s DPSK signal using a polarization-diversity scheme for four-wave mixing in 32-cm bismuth-oxide highly nonlinear fiber. The polarization dependence is <1 dB and the power penalty is 3 dB.

**CThF3 • 8:30 a.m.** Invited
**Parametric Amplification and Processing in High-Confinement Optical Fibers,** *Stojan Radic; Univ. of California at San Diego, USA.* Recent advances in parametric amplification and processing in high-confinement fibers are reviewed. Selected demonstrations of advanced signal processing in near-infrared and distant optical bands are described.

## ROOM 339

### 8:00 a.m. – 9:45 a.m.
### CThG • Photonic Crystals
*David Erickson; Cornell Univ., USA, Presider*

**CThG1 • 8:00 a.m.**
**Development of an Analog-to-Digital Converter Using Photonic Crystals,** *Ahmed Sharkawy[1], Caihua Chen[2], Binglin Miao[2], Shouyuan Shi[2], Dennis Prather[2]; [1]EM Photonics, USA, [2]Univ. of Delaware, USA.* In this paper, we present novel designs for all optical analog-to-digital converters simulated and realized in photonic crystal platforms. Numerical simulation results as well as fabrication and characterization results are also included.

**CThG2 • 8:15 a.m.**
**Manipulation of Dielectric Particles Using Photonic Crystal Cavities,** *Michael Barth, Oliver Benson; Humboldt-Univ. Berlin, Germany.* A theoretical study of the optical trapping forces on dielectric particles in the highly localized field of planar photonic crystal cavities is presented. Intricate phenomena such as self-induced trapping and optical transport are investigated.

**CThG3 • 8:30 a.m.**
**What is the Velocity of Slow Light in Weakly Disordered Optical Slow-Wave Structures?** *Shayan Mookherjea, Andrew Oh; Univ. of California at San Diego, USA.* In an optical slow wave structure, even small disorder (few nanometer roughness) can greatly limit by how much the light velocity is reduced, for which we derive an analytical expression in agreement with experimental observations.

## ROOM 340

### 8:00 a.m. – 9:45 a.m.
### CThH • Continuum Generation and SBS in Fibers
*Karl Koch; Corning, Inc., USA, Presider*

**CThH1 • 8:00 a.m.**
**All-Fiber-Integrated Mid-Infrared Supercontinuum System with 0.7 Watts Time-Averaged Power,** *Chenan Xia[1], Malay Kumar[1], Mohammed N. Islam[1], Almantas Galvanauskas[1], Fred L. Terry[1], Mike J. Freeman[2]; [1]Dept. of Electrical Engineering and Computer Science, Univ. of Michigan, USA, [2]Omni Sciences Inc., USA.* All-fiber-integrated supercontinuum generation is demonstrated from ~0.9-3.6 µm with ~0.7 W time-averaged power by using a telecommunication laser diode, amplified by an erbium/ytterbium co-doped cladding-pumped fiber amplifier, and coupled into 35 m ZBLAN fluoride fiber.

**CThH2 • 8:15 a.m.**
**Bragg Gratings as Phase Matching Elements to Extend Continuum Generation at Short Wavelengths,** *Paul Westbrook, Jeffrey Nicholson, Kenneth Feder; OFS Labs, USA.* We show that a Bragg grating can act as a phase matching element allowing a continuum pulse to generate light in narrow bandwidth beyond the short wavelength edge determined by fiber dispersion.

**CThH3 • 8:30 a.m.**
**Tunable Spectral Enhancement in Supercontinuum with a Long-Period Fiber Grating,** *Dong-Il Yeom[1], Jeremy A. Bolger[1], Graham D. Marshall[2], Dane R. Austin[1], Boris T. Kuhlmey[1], C. Martijn de Sterke[1], Michael J. Withford[2], Benjamin J. Eggleton[1]; [1]CUDOS, School of Physics, Univ. of Sydney, Australia, [2]CUDOS, Dept. of Physics, Macquarie Univ., Australia.* A tunable narrow-band enhancement of supercontinuum generated in a microstructured fiber is created by modifying the broadened spectrum in a long-period fiber grating followed by propagation with self-phase modulation.

## ROOM 341

### 8:00 a.m. – 9:45 a.m.
### CThI • Terahertz Generation and Detection
*Yun-Shik Lee; Oregon State Univ., USA, Presider*

**CThI1 • 8:00 a.m.**
**Detection of Pulsed Terahertz Waves Using Ambient Air as the Sensor,** *Jianming Dai, Xu Xie, X.-C. Zhang; Rensselaer Polytechnic Inst., USA.* We report the first demonstration of both incoherent and coherent detection of pulsed terahertz waves using ambient air or laser-induced air plasma as the sensor through a third-order nonlinear optical process with femtosecond laser pulses.

**CThI2 • 8:15 a.m.**
**Generation of 5 µJ Broadband THz Pulses by Tilted Pulse Front Excitation,** *Matthias Hoffmann, Ka-Lo Yeh, János Hebling, Keith A. Nelson; MIT, USA.* Generation of sub-µJ and 5 µJ single-cycle THz pulses is demonstrated through optical rectification of ultrashort pulses from 1 kHz and 10 Hz laser systems, respectively. Further scaling-up to 10 µJ levels is in progress.

**CThI3 • 8:30 a.m.**
**Intense Coherent THz Pulse Generation by Two-Color Photoionization in Air,** *Ki-Yong Kim, Balakishore Yellampalle, James H. Glownia, Antoinette J. Taylor, George Rodriguez; Los Alamos Natl. Lab, USA.* Intense coherent terahertz radiation via two-color photoionization in air is examined experimentally and interpreted as a photocurrent effect by the symmetry-broken laser field. THz power scalability is also tested experimentally.

NOTES

**ROOM 318-320**

**CLEO**

## CThA • Fundamentals of Femtosecond Laser/Material Interactions—Continued

**CThA2 • 9:00 a.m.** Invited
**Subcellular Surgery and Nanoneurosurgery,** *Samuel H. Chung, Iva Z. Maxwell, Eric Mazur; Harvard Univ., USA.* We use femtosecond laser pulses to probe the mechanical properties of the actin network in live cells and to probe cell regeneration and the neurological basis of behavior in *C. elegans.*

**ROOM 321-323**

## CThB • Novel Semiconductor Laser Cavities—Continued

**CThB4 • 8:45 a.m.**
**Room-Temperature InAs/InP Quantum-Dot Photonic Crystal Microlasers Using Cavity-Confined Slow Light,** *Frederic Bordas[1], Christian Seassal[1], Emmanuel Dupuy[1], Philippe Regreny[1], Michel Gendry[1], Michael J. Steel[2], Adel Rahmani[3]; [1]Inst. des Nanotechnologies de Lyon - CNRS, France, [2]RSoft Design Group, Inc. and CUDOS Univ. of Sydney, Australia, [3]CUDOS and CLA, Macquarie Univ., Australia.* We achieved room temperature laser operation, around 1.5 mm, with a single layer of InAs/InP quantum dots in a photonic crystal structure using confined slow light. The lasing threshold is a few hundred microW.

**CThB5 • 9:00 a.m.**
**Electrically Pumped, Edge-Emitting, Large-Area Photonic Crystal Lasers with Straight and Angled Facets,** *Lin Zhu, Philip Chak, Joyce K.S. Poon, Guy A. DeRose, Amnon Yariv, Axel Scherer; Caltech, USA.* We propose and demonstrate electrically pumped, edge-emitting, large-area photonic crystal lasers. Effective index-guided and Bragg-guided lasing modes are obtained depending on the design of photonic crystal and facets.

**ROOM 324-326**

**JOINT**

## JThA • Attosecond Dynamics—Continued

**JThA3 • 8:45 a.m.** Invited
**All-Optical Quasi-Phase Matching and Quantum Path Control by Counter Propagating Pulse Trains,** *Xiaoshi Zhang, Amy Lytle, Henry Kapteyn, Margaret Murnane, Oren Cohen; Univ. of Colorado, USA.* We enhance high-order harmonic generation at 70eV in argon and 145eV in helium by orders of magnitude using counterpropagating pulsetrains. We also demonstrate coherent control on attosecond timescales by selective enhancement of different quantum trajectories.

**ROOM 314**

**CLEO**

## CThC • $\chi^2$/Cascaded $\chi^2$ Devices—Continued

**CThC4 • 8:45 a.m.**
**Tunable Blue/Green Light Source by Self-Cascaded $\chi^2$ Nonlinearity in ZnO:PPLN Crystal Fiber,** *Shan-Chuang Pei[1],[2], Li-Min Lee[3], Der-Fong Lin[4], Mon-Chang Tsai[3], De-Hao Sun[1], Sheng-Lung Huang[1,5], A. H. Kung[2,6]; [1]Graduate Inst. of Electro-Optical Engineering, Natl. Taiwan Univ., Taiwan, [2]Inst. of Atomic and Molecular Sciences, Academia Sinica, Taiwan, [3]Inst. of Electro-Optical Engineering, Natl. Sun Yat-Sen Univ., Taiwan, [4]Inst. of Communications Engineering, Natl. Sun Yat-Sen Univ., Taiwan, [5]Dept. of Electrical Engineering, Natl. Taiwan Univ., Taiwan, [6]Dept. of Photonics and Inst. of Electro-Optical Engineering, Natl. Chiao-Tung Univ., Taiwan.* A novel self-cascaded first-order SHG and third-order SFG in ZnO:PPLN crystal fiber for the generation of tunable blue/green light source is demonstrated. About 700-µW output power at 477.1-nm was measured with tuning range of 35-nm.

**CThC5 • 9:00 a.m.**
**Ultrashort Pulse Cascaded Third-Harmonic Generation in Two-Dimensional Quasi-Phase-Matching Structure,** *Nobuhide Fujioka[1], Satoshi Ashihara[1,2,3], Kengo Hayashi[1], Hidenobu Ono[1], Tsutomu Shimura[1], Kazuo Kuroda[1]; [1]Inst. of Industrial Science, Univ. of Tokyo, Japan, [2]Dept. of Applied Physics, Tokyo Univ. of Agriculture and Technology, Japan, [3]PRESTO, Japan Science and Technology Corp., Japan.* We propose and demonstrate group-velocity mismatch compensation in cascaded third-harmonic generation. Second- and third-harmonic generation efficiency of 25% and 7%, respectively, were experimentally obtained for femtosecond pulses by use of two-dimensionally periodically-poled lithium niobate.

**ROOM 315**

## CThD • Optical Polymers—Continued

**CThD3 • 8:45 a.m.**
**Integrated Active and Passive Polymer Optical Components with nm to mm Features,** *Mads B. Christiansen, Mikkel Schøler, Anders Kristensen; Technical Univ. of Denmark, Denmark.* We present wafer-scale fabrication of integrated active and passive polymer optics with nm to mm features. First order DFB lasers, defined in dye doped SU-8 resist are integrated with SU-8 waveguides.

**CThD4 • 9:00 a.m.**
**Demonstration of Polymer-Based Directional Coupler Modulator with High Linearity,** *Yu-Chueh Hung[1], SeongKu Kim[1], Harold R. Fetterman[1], Jingdong Luo[2], Alex Jen[2]; [1]Univ. of California at Los Angeles, USA, [2]Dept. of Materials Science and Engineering, Univ. of Washington, USA.* A linearized polymer-based directional coupler modulator is presented. The linearity was obtained by tailoring the coupling coefficient using photobleaching. A two-tone test of the device demonstrated an enhancement in intermodulation distortion compared with Mach-Zehnder modulator.

**ROOM 316**

## CThE • Spectral Control of Solid-State Lasers—Continued

**CThE4 • 8:45 a.m.**
**Wavelength Tunable Single Mode Nd:GdVO$_4$ Laser Using a Volume Bragg Grating Fold Mirror,** *Te-yuan Chung[1], Sidney S. Yang[2], Cheng-Wen Chen[2], Hung-Chih Yang[2], Chien-Ron Liao[2], Yu-Hung Lien[3], Jow-Tsong Shy[3]; [1]Dept. of Optics and Photonics, Taiwan, [2]Inst. of Photonics Technologies, Taiwan, [3]Dept. of Physics, Taiwan.* A Nd:GdVO$_4$ laser was built with a volume Bragg grating as the fold mirror, wavelength selector and spectral narrowing element. Over 2 nm tuning with wavelength centered at 1063.39 nm was achieved by angular tuning.

**CThE5 • 9:00 a.m.**
**Spectral Narrowing in a Dual Volume Bragg Grating Ti:Sapphire Oscillator,** *Michael Hemmer, TeYuan Chung, Ying Chen, Vadim Smirnov, Leonid Glebov, Martin Richardson, Michael Bass; CREOL, College of Optics and Photonics, USA.* Spectral narrowing of Ti:Sapphire down to two longitudinal modes has been achieved in the 3W pump power range and 200mW output using a compact design. Further improvements leading to single mode operation are discussed.

**ROOM 317**

**QELS**

## QThA • Novel Dynamic Measurements in Metals—Continued

**QThA2 • 9:00 a.m.**
**Blue-Shifting of Coherent Plasmon Radiation Due to Landau Damping,** *Denis Seletskiy[1], Michael P. Hasselbeck[1], Mansoor Sheik-Bahae[1], L. R. Dawson[2]; [1]Univ. of New Mexico, USA, [2]Ctr. for High Technology Materials, Univ. of New Mexico, USA.* Restricting the wave vector of coherent plasmons excited by ultrashort laser pulses results in a frequency blue-shift of the emitted THz radiation, consistent with the onset of Landau damping.

**ROOM 336**

## QThB • Plasmonics I—Continued

**QThB3 • 8:45 a.m.**
**Plasmon Enhancement of Photoinduced Resistivity Changes in Bi$_{1-x}$Ca$_x$MnO$_3$ Thin Films,** *Vera N. Smolyaninova, E. Talanova, Rajeswari Kolagani, G. Yong, R. Kennedy, M. Steger, K. Wall; Towson Univ., USA.* Considerable increase of the photoinduced resistivity changes was found in Bi$_{0.4}$Ca$_{0.6}$MnO$_3$ thin films after depositing gold nanoparticles on the surface due to resonant enhancement of local electromagnetic field in the vicinity of the gold nanoparticles.

**QThB4 • 9:00 a.m.**
**Experimental Measurement of the Dispersion Relations of Gold Nanoparticle Chains,** *Kenneth B. Crozier, Emre Togan; Harvard Univ., USA.* The dispersion relations of plasmon modes of gold nanoparticle chains are measured, and compared with quasistatic theory. In addition to one longitudinal and one transverse mode, the results reveal a third mode, not previously observed.

ROOM 337

**QELS**

## QThC • Laser Cooling of Mechanical Systems and Molecules—Continued

**QThC3 • 8:45 a.m.**
**Radiation-Pressure Effects upon a Micro-Mirror in a High-Finesse Optical Cavity,** *Pierre-Francois Cohadon, Olivier Arcizet, Chiara Molinelli, Tristan Briant, Michel Pinard, Antoine Heidmann; Lab Kastler Brossel, France.* We present an experiment where the motion of a micro-mechanical resonator is optically monitored with a quantum-limited sensitivity. Directs effects of intracavity radiation pressure are experimentally demonstrated. Applications to quantum optics are discussed.

**QThC4 • 9:00 a.m.**
**Observation of Radiation-Pressure Effects and Back-Action Cancellation in Interferometric Measurements,** *Tristan Briant, Thomas Caniard, Pierre Verlot, Pierre-Francois Cohadon, Michel Pinard, Antoine Heidmann; Lab Kastler Brossel, Univ. Pierre et Marie Curie, France.* We report the first experimental demonstration of back-action cancellation of radiation pressure, with a setup based upon a high-finesse optical cavity with movable mirrors. Further improvement will allow us to probe the quantum effects of radiation pressure.

ROOM 338

**CLEO**

## CThF • Nonlinear Optical Processing for Communications—Continued

**CThF4 • 9:00 a.m.**
**Low-Penalty Raman-Assisted XPM Wavelength Conversion at 320 Gb/s,** *Michael Galili, Hans C. Hansen Mulvad, Leif K. Oxenløwe, Anders T. Clausen, Palle Jeppesen; COM-DTU, Denmark.* We report on an experimental demonstration and optimization of cross-phase modulation-based wavelength conversion at 320 Gb/s assisted by Raman gain. Error free operation is demonstrated with low penalty.

ROOM 339

## CThG • Photonic Crystals—Continued

**CThG4 • 8:45 a.m.**
**Experimentally Demonstrated Waveguide-Coupled Corner-Cut Microcavities,** *Elton Marchena, Shouyuan Shi, Dennis Prather; Univ. of Delaware, USA.* We report the design and fabrication of waveguide-coupled corner-cut square microcavities in silicon. Potential applications for this microcavity include sensors, filters, and optically pumped lasers.

**CThG5 • 9:00 a.m.**
**Optical Add-Drop Filter Design Based on Photonic Crystal Ring Resonators,** *Weidong Zhou[1], Zexuan Qiang[1], Richard A. Soref[2]; [1]Univ. of Texas at Arlington, USA, [2]AFRL, USA.* We report an optical add-drop filter based on photonic crystal ring resonators. Both backward- and forward-dropping were achieved in dual-ring PCRRs with different modal symmetry. The scalability and tunability were also analyzed for electrooptical switches.

ROOM 340

## CThH • Continuum Generation and SBS in Fibers—Continued

**CThH4 • 8:45 a.m.**
**High Nonlinearity Glass Photonic Crystal Nanowires,** *Natalie A. Wolchover[1], Peter Domachuk[1], Mark Cronin-Golomb[1], Feng Luan[2], Alan K. George[2], Jonathan Knight[1], Fiorenzo G. Omenetto[1]; [1]Tufts Univ., USA, [2]Univ. of Bath, UK.* We present the tapering of photonic crystal fibers formed from SF6 glass to 400 nm core diameter. We generate supercontinuum in the tapers using pump pulse energies as low as 65 picojoules.

**CThH5 • 9:00 a.m.**
**Generation of Supercontinuum in a Waveguide with Slow Nonlinearity Related to Shock Formation,** *Anton Husakou, Ihar Babushkin, Joachim Herrmann; Max Born Inst. for Nonlinear Optics and Short Pulse Spectroscopy, Germany.* We predict the generation of octave-broad supercontinua in a waveguide with slow nonlinearity such as a photorefractive waveguide. In contrast to the case of instantaneous nonlinearity, the spectral broadening mechanism is related to shock formation.

ROOM 341

## CThI • Terahertz Generation and Detection—Continued

**CThI4 • 8:45 a.m.**
**Strong THz-Field-Induced Nonlinear Optical Effects in Electro-Optical Crystals,** *Yuzhen Shen, Takahiro Watanabe, Dario Arena, G. L. Carr, Chi-Chang Kao, James B. Murphy, Thomas Tsang, Xijie Wang; Brookhaven Natl. Lab, USA.* We demonstrate that time-dependent electric field associated with intense single-cycle THz pulses can induce nonlinear phase modulation in electro-optical crystals, leading to spectral shift, broadening and modulation of co-propagating laser pulses.

**CThI5 • 9:00 a.m.**
**Generation of High Power Terahertz Pulses at Advanced Laser Light Source (ALLS),** *Francois Blanchard[1], Luca Razzari[1], Gargi Sharma[1], Roberto Morandotti[1], Jean-Claude Keiffer[1], Tsuneyuki Ozaki[1], Matt Reid[2], Henry F. Tiedje[3], Harold K. Haugen[3], Denis Morris[4], Frank A. Hegmann[5]; [1]Inst. Natl. de la Recherche Scientifique, Univ. du Quebec, Canada, [2]Univ. of Northern British Columbia, Canada, [3]McMaster Univ., Canada, [4]Univ. de Sherbrooke, Canada, [5]Univ. of Alberta, Canada.* We report on terahertz pulse generation by optical rectification in a large aperture ZnTe single-crystal wafer. Terahertz pulse energies up to 0.76 μJ are measured, the highest ever observed from an optical rectification source.

NOTES

**ROOM 318-320** **ROOM 321-323** **ROOM 324-326** **ROOM 314** **ROOM 315** **ROOM 316** **ROOM 317** **ROOM 336**

**CLEO** **JOINT** **CLEO** **QELS**

**ROOM 318-320** — CLEO

### CThA • Fundamentals of Femtosecond Laser/Material Interactions—Continued

**CThA3 • 9:30 a.m.**
**Temperature Measurement of Aluminum Nanoparticles in Femtosecond Laser Ablation Plume Using Spatiotemporally Resolved XAFS Technique,** *Katsuya Oguri, Yasuaki Okano, Tadashi Nishikawa, Hidetoshi Nakano; NTT Basic Res. Labs, Japan.* We investigated the temperature of aluminum nanoparticles in a femtosecond laser ablation plume with a spatiotemporally resolved XAFS system. From the feature of the L-absorption edge of liquid nanoparticles, we successfully estimated their temperature distribution.

**ROOM 321-323** — CLEO

### CThB • Novel Semiconductor Laser Cavities—Continued

**CThB6 • 9:15 a.m.**
**Vertically-Coupled Microring Laser Array for Dual-Wavelength Generation,** *Chyng W. Tee[1], Kevin A. Williams[2,1], Richard V. Penty[1], Ian H. White[1], Michael Hamacher[3], Ute Troppenz[4], Helmut Heidrich[4]; [1]Ctr. for Photonic Systems, Cambridge Univ., UK, [2]Eindhoven Univ. of Technology, Netherlands, [3]Fraunhofer Inst. for Telecomminucations, Heindrich Hertz Inst.., Germany, [4]Fraunhofer Inst. for Telecommunications, Heinrich-Hertz-Inst., Germany.* We report the first demonstration of continuous-wave operation of a tunable, compact microring laser array based on a vertical-coupling architecture, well suited to larger-scale integration. Wavelength separation tunability from 4.9 to 6.3nm is observed.

**CThB7 • 9:30 a.m.**
**Integrated 10th Order Fresnel Lens Design for Beam Quality Enhancement in Tapered Laser Diode,** *F. K. Lau[1], C. W. Tee[1], C. H. Kwok[1], R. V. Penty[1], I. H. White[1,2], N. Michel[2], M. Krakowski[2]; [1]Cambridge Univ. Engineering Dept., UK, [2]Alcatel-Thales III-V Lab, France.* An integrated 10th order Fresnel lens capable of improving the laser beam quality is reported. The far-field divergence is narrowed by an average of 1.9° (29%) and an overall M2-factor improvement of 15% is recorded.

**ROOM 324-326** — JOINT

### JThA • Attosecond Dynamics—Continued

**JThA4 • 9:15 a.m.**
**Attosecond Pulse Compression in the Extreme Ultraviolet Region by Conical Diffraction,** *Luca Poletto[1], Fabio Frassetto[1], Paolo Villoresi[2]; [1]CNR - Natl. Inst. for the Physics of Matter, Italy, [2]Dept. of Information Engineering, Univ. of Padova, Italy.* A grating compressor for attosecond pulses in the extreme-ultraviolet region is presented. The instrument design and the phase properties are discussed.

**JThA5 • 9:30 a.m.**
**Isolated Attosecond Pulses in the Few-Cycle Regime,** *Giuseppe Sansone[1], Enrico Benedetti[1], Francesca Calegari[1], Caterina Vozzi[1], Salvatore Stagira[1], Sandro De Silvestri[1], Mauro Nisoli[1], Lorenzo Avaldi[2], Roberto Flammini[2], Luca Poletto[3], Paolo Villoresi[3], Carlo Altucci[4], Raffaele Velotta[4]; [1]ULTRAS CNR-INFM Dept. di Fisica Politecnico di Milano, Italy, [2]CNR-IMIP Area della Ricerca di Roma [1], Italy, [3]LUXOR CNR-INFM D.E.I., Univ. di Padova, Italy, [4]CNISM-Dept. di Scienze Fisiche, Univ. di Napoli, Italy.* We present the generation of isolated attosecond pulses using phase-stabilized 5-fs pulses with time dependent ellipticity. Using a complete temporal characterization technique, we demonstrate compression of the pulses down to 130 as (<1.2 optical cycles).

**ROOM 314** — CLEO

### CThC • $\chi^2$/Cascaded $\chi^2$ Devices—Continued

**CThC6 • 9:15 a.m.**
**High Efficiency Third Harmonic Generation in PPMgLN Disk Resonator,** *Kiyotaka Sasagawa, Masahiro Tsuchiya; Natl. Inst. of Information and Communications Technology, Japan.* High efficiency generation of third-harmonics of 1562 nm light is observed in a PPMgLN disk. The blue-green emission is ascribable to cascaded parametric processes of second-harmonic and sum-frequency generations in whispering gallery modes.

**CThC7 • 9:30 a.m.**
**Tunable Ring Optical Parametric Oscillator with a Volume Bragg Grating,** *Björn Jacobsson, Carlota Canalias, Valdas Pasiskevicius, Fredrik Laurell; Laser Physics, KTH, Royal Inst. of Technology, Sweden.* We demonstrate a new technique for locking and narrowing the wavelength of a ring optical parametric oscillator with a volume Bragg grating at an angle in a retroreflector design.

**ROOM 315** — CLEO

### CThD • Optical Polymers—Continued

**CThD5 • 9:15 a.m.**
**Linear and Nonlinear Absorption Studies of Polymethine, Squaraine and Tetraone Dyes,** *Scott Webster[1], Jie Fu[1], Olga V. Przhonska[2,1], Lazaro A. Padilha[1], David J. Hagan[1], Eric W. Van Stryland[1], Mikhail V. Bondar[1], Yuriy L. Slominsky[3], Alexei D. Kachkovski[3]; [1]Univ. of Central Florida, USA, [2]Inst. of Physics, Natl. Acad. of Sciences, Ukraine, [3]Inst. of Organic Chemistry, Natl. Acad. of Sciences, Ukraine.* To understand the effects of electron accepting bridges on the nonlinear absorption, we characterized both two-photon and excited-state absorption spectra of three cyanine dyes of increasing electron acceptor strength.

**CThD6 • 9:30 a.m.**
**Carbon Nanotube/Conducting Polymer Addressable Interconnects,** *Seon Woo Lee[1], Haim Grebel[1], David Katz[1], D. Lopez[2], A. Kornblit[2]; [1]New Jersey Inst. of Technology, USA, [2]Bell Labs, Lucent Technologies, USA.* We have grown individual carbon nanotube interconnects between pre-determined and addressable electrode tips and wrapped these interconnects with conducting polymers.

**ROOM 316** — CLEO

### CThE • Spectral Control of Solid-State Lasers—Continued

**CThE6 • 9:15 a.m.** Invited
**Solid-State Laser Development Activities in China,** *Jianqiang Zhu; Shanghai Inst. of Optics and Fine Mechanics, China.* Solid-state lasers have been progressing rapidly in China in recent years. Several joint projects sponsored by the government have been started to enhance the capabilities of innovation and development in high-power solid-state lasers.

**ROOM 317** — QELS

### QThA • Novel Dynamic Measurements in Metals—Continued

**QThA3 • 9:15 a.m.** Invited
**Adaptive Sub-Wavelength Control of Nanoscopic Fields,** *Martin Aeschlimann[1], Michael Bauer[2], Daniela Bayer[1], Tobias Brixner[3], F. Javier García de Abajo[4], Walter Pfeiffer[5], Martin Rohmer[1], Christian Spindler[3], Felix Steeb[1]; [1]Univ. Kaiserslautern, Germany, [2]Univ. Kiel, Germany, [3]Univ. Würzburg, Germany, [4]Inst. de Optica, Spain, [5]Univ. Bielefeld, Germany.* We combine two previously separated research fields, adaptive control and nano-optics, to achieve dynamic localization of electromagnetic intensity at sub-wavelength nanoscopic spatial resolution. This is demonstrated experimentally with femtosecond polarization shaping and photoemission electron microscopy.

**ROOM 336** — QELS

### QThB • Plasmonics I—Continued

**QThB5 • 9:15 a.m.**
**Slow Propagation, Anomalous Absorption and Total External Reflection of Surface Plasmon Polaritons in Nanolayer Systems,** *Mark I. Stockman[1,2]; [1]Georgia State Univ., USA, [2]Lab de Photonique Quantique et Moléculaire, Inst. d'Alembert, Ecole Normale Supérieure de Cachan, France.* We predict that a nanoscopic, high-permittivity layer on the surface of a plasmonic metal can cause total external reflection of surface plasmon polaritons (SPPs). The slow propagating and negative refracting SPP modes are highly damped.

**QThB6 • 9:30 a.m.**
**Engineering the Decay Rates and Quantum Efficiency of Emitters Coupled to Gold Nanoantennae,** *Mario Agio, Franziska Kaminski, Lavinia Rogobete, Sergei Kühn, Giorgio Mori, Vahid Sandoghdar; ETH Zurich, Switzerland.* We study the enhancement of radiative rate and quantum efficiency of a single emitter coupled to a nanoantenna. We show that by proper choice of the parameters quenching can be to a large extent avoided.

**10:00 a.m. – 10:30 a.m. COFFEE BREAK, EXHIBIT HALL, 100 LEVEL**

**10:00 a.m. – 4:00 p.m. EXHIBIT HALL OPEN**

**ROOM 337**

**QELS**

## QThC • Laser Cooling of Mechanical Systems and Molecules—Continued

**QThC5 • 9:15 a.m.**
**Rotationally-Resolved Depletion Spectroscopy of Ultracold KRb Molecules,** *Dajun Wang, Jin-Tae Kim, Court Ashbaugh, Edward E. Eyler, Phillip L. Gould, William C. Stwalley; Univ. of Connecticut, USA.* We use photoassociation of ultracold atoms to produce ultracold KRb molecules in high vibrational levels of the ground state. Depletion spectroscopy is employed to detect these molecules with both vibrational and rotational resolution.

**QThC6 • 9:30 a.m.**
**Electrostatic Surface Guiding of Supersonic $D_2O$ Molecular Beam,** *Yong Xia, Yaling Yin, Haibo Chen, Lianzhong Deng, Jianping Yin; East China Normal Univ., China.* We demonstrate the electrostatic surface guiding of cold heavy-water ($D_2O$) molecules by using a 2-D hollow electrostatic field generated by the combination of two parallel charged-poles and a grounded metal-plate.

**ROOM 338**

**C L E O**

## CThF • Nonlinear Optical Processing for Communications—Continued

**CThF5 • 9:15 a.m.**
**Wavelength Conversion Using Multi-Pump Raman-Assisted Four-Wave Mixing,** *S. H. Wang[1], Lixin Xu[1,2], P. K. A. Wai[1], H. Y. Tam[3]; [1]Hong Kong Polytechnic Univ., Hong Kong, [2]Dept. of Physics, Univ. of Science and Technology of China, China, [3]Photonics Res. Ctr. and Dept. of Electrical Engineering, The Hong Kong Polytechnic Univ., Hong Kong.* We proposed to use multi-pump Raman amplifier to assist four-wave-mixing based wavelength conversion. We achieved a conversion efficiency bandwidth of 10 nm and power penalty of 1 dB at BER of 10–9 at 10 Gb/s.

**CThF6 • 9:30 a.m.**
**Power Equalization for the Optical Subsystems Based on the SOA Polarization Rotation,** *Wu Chongqing[1], Li Yajie[1], Songnian Fu[2], Dong Hui[2], Zhou Junqiang[2], P. Shum[2]; [1]Inst. of Optical Information, School of Science, Beijing Jiaotong Univ., China, [2]Network Technology Res. Ctr., School of Electrical and Electronic Engineering, Singapore.* We demonstrate two aligned principal states of polarizations for the bias current variation or optical control pulse injection, thus power equalization is achieved for the SOA polarization rotation based subsystem with less than 0.3dB fluctuation.

**ROOM 339**

## CThG • Photonic Crystals—Continued

**CThG6 • 9:15 a.m.**
**Group Delay Measurements of High Quality GaAs Photonic Crystal Cavities,** *Thomas Sünner, Magdalena Gellner, Andreas Löffler, Martin Kamp, Alfred Forchel; Univ. Würzburg, Germany.* The group delay of light propagating through photonic crystal cavities was measured by the phase shift technique. The largest observed group delay was 132 ps for a cavity with a quality factor of 82 000.

**CThG7 • 9:30 a.m.**
**Silicon Based Photonic Crystal Electro-Optic Modulator Utilizing the Plasma Dispersion Effect,** *Timothy Hodson, B. Miao, C. Chen, A. Sharkawy, Dennis W. Prather; Univ. of Delaware, USA.* We present developments in the design and fabrication of a photonic crystal based electro-optic modulator which operates using the plasma dispersion effect of free carriers injected from a PIN diode.

**ROOM 340**

## CThH • Continuum Generation and SBS in Fibers—Continued

**CThH6 • 9:15 a.m.**
**Stimulated Brillouin Scattering Assisted Slow Light Generation in Single Mode Tellurite Fiber,** *Kazi S. Abedin, Guo-Wei Lu, Tetsuya Miyazaki; Natl. Inst. of Information and Connunications Technology, Japan.* Efficient slow light generation is demonstrated in single mode tellurite fiber. Pulses of 60 ns width can be delayed by 67 ns in a 2-m-long fiber with a pump power of 630 mW.

**CThH7 • 9:30 a.m.**
**Stimulated Brillouin Scattering (SBS) in Small Core Photonic Crystal Fibers (PCF),** *Jean Toulouse, Radha K. Pattnaik, John McElhenny; Lehigh Univ., USA.* SBS is studied in four different photonic crystal fibers with core diameters ranging from 8μm to 1.7μm. Of particular interest is the observation of several peaks and their strong polarization dependence in small core PCFs.

**ROOM 341**

## CThI • Terahertz Generation and Detection—Continued

**CThI6 • 9:15 a.m.**
**Intracavity Terahertz Generation in a Synchronously Pumped Optical Parametric Oscillator Using Quasi-Phasematched GaAs,** *Joseph E. Schaar, Konstantin L. Vodopyanov, Martin M. Fejer; Stanford Univ., USA.* We generated 1 mW of average power at 2.9 THz (540 GHz bandwidth) in a nearly-diffraction-limited beam by placing a room-temperature quasi-phasematched GaAs crystal inside the cavity of a synchronously pumped optical parametric oscillator.

**CThI7 • 9:30 a.m.**
**Generation of Terahertz Radiation from a New InGaP/InGaAs/GaAs Double Grating Gate HEMT Device,** *Yahya M. Meziani[1], Mitsuhiro Hanabe[1], Akira Koizumi[1], Takuma Ishibashi[1], Tomohiro Uno[1], Taiichi Otsuji[1], Eiichi Sano[2]; [1]Tohoku Univ., Japan, [2]Hokkaido Univ., Japan.* We observed a generation of terahertz radiation from different grating gate devices. The devices are subjected to the CW laser and then to the impulsive laser at room temperature.

**10:00 a.m. – 10:30 a.m. COFFEE BREAK, EXHIBIT HALL, 100 LEVEL**

**10:00 a.m. – 4:00 p.m. EXHIBIT HALL OPEN**

NOTES

## ROOM 318-320

**CLEO**

### 10:30 a.m. – 12:15 p.m.
### CThJ • Nanostructures in Femtosecond Laser Processing

*Chris Schaffer; Cornell Univ, USA, Presider*

**CThJ1 • 10:30 a.m.** Invited

**Femtosecond Laser Nanomachining Applications in Fused Silica,** *Rod S. Taylor, Cyril Hnatovsky, Eli Simova, Rajeev Pattathil, Jiaren Liu, David M. Rayner, Paul B. Corkum; Natl. Res. Council, Canada.* Focused femtosecond laser light can produce beautifully arrayed self-organized nanocracks inside fused silica. These nanocracks provide a unique capability for nanomachining arrays of micro- and nanofluidic channels, nanoporous capillaries and rewritable data storage elements.

## ROOM 321-323

**CLEO**

### 10:30 a.m. – 12:15 p.m.
### CThK • Near IR Diode Lasers

*Ian White; Univ. of Cambridge, UK, Presider*

**CThK1 • 10:30 a.m.**

**Linewidth Enhancement Factor of Semiconductor Lasers: Results from Round-Robin Measurements in COST 288 Action,** *Asier Villafranca[1], Javier Lasobras[1], Ignacio Garces[1], Guido Giuliani[2], Silvano Donati[2], Marek Chacinski[3], Richard Schatz[3], Christos Kouloumentas[4], Ioannis Tomkos[4], Pascal Landais[5], Judy Rorison[6], Jose Pozo[6], Andrea Fiore[7], Pablo Moreno[7], Wolfgang Elsässer[8], Guillaume Huyet[9], Mika Saarinen[10], Markus Pessa[10], Marc Sciamanna[11], Jan Danckaert[12], Krassimir Panajotov[12], Thomas Fordell[13], Asa Lindberg[13], Pascal Besnard[14], Frédéric Grillot[15]; [1]Univ. of Zaragoza, Spain, [2]Univ. di Pavia, Italy, [3]Royal Inst. of Technology, Sweden, [4]Athens Information Technology Ctr. (AIT), Greece, [5]Dublin City Univ., Ireland, [6]Univ. of Bristol, UK, [7]Ecole Polytechnique Fédérale de Lausanne, Switzerland, [8]Technische Univ. Darmstadt, Germany, [9]Natl. Univ. of Ireland, Univ. College, Cork, Ireland, [10]Tampere Univ. of Technology, Finland, [11]SUPELEC, France, [12]Vrije Univ. Brussel, Belgium, [13]Univ. of Helsinki, Finland, [14]FOTON-ENSSAT, France, [15]FOTON-INSA, France.* Round-Robin measurements on the linewidth enhancement factor are carried out within several laboratories participating to EU COST 288 Action. The alpha-factor is measured by applying up to 7 different techniques. Obtained results are compared.

## ROOM 324-326

**JOINT**

### 10:30 a.m. – 12:15 p.m.
### JThB • Attosecond Laser Pulses

*Paolo Villoresi; Univ. degli Studi di Padova, Italy, Presider*

**JThB1 • 10:30 a.m.** Tutorial

**Attosecond Technology and Wavefunction Tomography,** *Mauro Nisoli; Politecnico di Milano, Italy.* We will review recent experimental progress in the generation and characterization of attosecond pulses, and in wavefunction tomography using re-collision electron wavepackets produced by tunnel ionization in a strong laser field.

## ROOM 314

**CLEO**

### 10:30 a.m. – 12:15 p.m.
### CThL • Mid-IR Generation

*Ramesh Shori; Univ. of California at Los Angeles, USA, Presider*

**CThL1 • 10:30 a.m.**

**Enhancement of Phase-Matched Second-Harmonic Generation at 10.6 µm in an Annealed ZnGeP$_2$ Crystal,** *Yi Jiang, Yujie J. Ding; Lehigh Univ., USA.* Phase-matching angle for second-harmonic generation in an annealed ZnGeP$_2$ crystal from a CO$_2$ laser at 10.6 µm decreases as the pump power is increased. Such a dependence is used to significantly enhance the second-harmonic power.

## ROOM 315

### 10:30 a.m. – 12:15 p.m.
### CThM • Ultrafast Beams and Materials Processing

*Presider to Be Announced*

**CThM1 • 10:30 a.m.**

**Multiphoton Ionization in Dielectrics: Competition of Circular and Linear Polarization,** *Vasily V. Temnov[1], Klaus Sokolowski-Tinten[2], Ping Zhou[2], Abdalla El-Khambawy[2], Dietrich von der Linde[2]; [1]Experimentelle Physik IIb, Germany, [2]Univ. Duisburg-Essen, Germany.* Ultrafast time-resolved interferometry was used to investigate the six-photon ionization in dielectrics irradiated by linearly and circularly polarized femtosecond laser pulses. The theoretically predicted dominance of linear polarization in high-order multiphoton ionization is demonstrated.

## ROOM 316

### 10:30 a.m. – 12:15 p.m.
### CThN • Nanofabrication

*David D. Nolte; Purdue Univ., USA, Presider*

**CThN1 • 10:30 a.m.**

**Advances in Two-Photon 3-D Microfabrication,** *Joseph W. Perry[1], Vincent W. Chen[1], Wojciech Haske[1], Joel M. Hales[1], Wenting Dong[1], Jian Zhou[1], Yadong Zhang[2], Kelly Perry[2], Stephen Barlow[1], Seth R. Marder[1]; [1]Georgia Tech, USA, [2]Focal Point Microsytems, USA.* The development of two-photon materials for the fabrication of features with 80 nm resolution in 3-D microfabrication and the fabrication of a range of photonic crystals with mid-IR stop bands will be discussed.

## ROOM 317

**QELS**

### 10:30 a.m. – 12:15 p.m.
### QThD • High-Field and Molecular Dynamics

*Susan L. Dexheimer; Washington State Univ., USA, Presider*

**QThD1 • 10:30 a.m.**

**Laser-Assisted Photoemission from Surfaces,** *Luis Miaja-Avila[1], Guido Saathoff[1], Margaret M. Murnane[1], Henry C. Kapteyn[1], Martin Aeschlimann[2]; [1]JILA, Univ. of Colorado, USA, [2]Univ. of Kaiserslautern, Germany.* Using femtosecond time-resolved photoelectron spectroscopy, we present experimental measurements that distinguish the laser-assisted photoelectric effect from other inherent surface processes, such as above threshold photoemission, space-charge acceleration and hot electron excitation.

## ROOM 336

### 10:30 a.m. – 12:15 p.m.
### QThE • Plasmonics II

*Igor I. Smolyaninov; Univ. of Maryland, USA, Presider*

**QThE1 • 10:30 a.m.**

**Coupled Metallic Antenna Nanorod Arrays,** *Elizabeth J. Smythe, Ertugrul Cubukcu, Federico Capasso; Harvard Univ., USA.* We investigate coupling effects in arrays of gold nanorods, studying both strongly and weakly coupled regimes, with the ultimate goal of incorporating these arrays onto a compact fiber device.

**ROOM 337**

**QELS**

### 10:30 a.m. – 12:15 p.m.
### QThF • Quantum Information
*Perry Rice; Miami Univ., USA, Presider*

**QThF1 • 10:30 a.m.** Invited
**Site-Selectivity and Spin Exchange in a Double-Well Optical Lattice,** *Patricia J. Lee, Marco Anderlini, Ben Brown, Jennifer Sebby-Strabley, W. D. Phillips, James Porto; NIST, USA.* We have demonstrated site-selective radio frequency addressing of atoms with sub-wavelength resolution and a spin exchange mechanism for a square root of swap gate in a spin-dependent double-well optical lattice.

**ROOM 338**

**C L E O**

### 10:30 a.m. – 12:15 p.m.
### CThO • Fiber-Based Optical Sensing
*Mark Froggatt; Luna Technologies, USA, Presider*

**CThO1 • 10:30 a.m.**
**Selectively Infiltrated Photonic Crystal Fibers for Fluorescence Sensing,** *Stephan Smolka, Michael Barth, Oliver Benson; Humboldt-Univ. Berlin, Germany.* We investigate hollow core photonic crystal fibers for ultra-sensitive fluorescence detection by selectively infiltrating the central hole with fluorophores. Dye concentrations down to nanomole/liter can be detected using only nanoliter sample volumes.

**ROOM 339**

### 10:30 a.m. – 12:15 p.m.
### CThP • Photonic Crystals and Microcavities
*Presider to Be Announced*

**CThP1 • 10:30 a.m.**
**Novel Design to Increase the Angular Tolerance of Grating Resonance Devices at Oblique Incidence,** *Sakoolkan Boonruang, Andrew Greenwell, M. G. Moharam; College of Optics and Photonics/CREOL, Univ. of Central Florida, USA.* Guided-mode resonant (GMR) structure using hexagonal-lattice grating is proposed to enhance angular tolerance of resonances at oblique incidence. Exciting radial-propagation modes, resonances with high angular tolerance (~1°) and narrow spectral bandwidth (~0.3 nm) are achieved.

**ROOM 340**

### 10:30 a.m. – 12:15 p.m.
### CThQ • Nonlinear Pulse Compression and Shaping in Fibers
*Jean Toulouse; Lehigh Univ., USA, Presider*

**CThQ1 • 10:30 a.m.** Invited
**Pulse Compression Techniques Using Highly Nonlinear Fibers,** *Takashi Inoue, Jiro Hiroishi, Ryo Miyabe, Naomi Kumano, Masanori Takahashi, Misao Sakano, Takeshi Yagi, Yu Mimura; Furukawa Electric Co., Ltd., Japan.* We review pulse compression technique based on "comb-like profiled fiber (CPF)," comprised of alternate concatenations of highly nonlinear fiber and anomalous-dispersion fiber. We show CPF has truly practical and flexible features for optical pulse compression.

**ROOM 341**

### 10:30 a.m. – 12:15 p.m.
### CThR • Terahertz Technologies
*David Citrin; Georgia Tech, USA, Presider*

**CThR1 • 10:30 a.m.**
**InGaAs Photoconductive Antennas for THz Emission and Detection with 1.56 μm Excitation,** *Akihiro Takazato, Takashi Matsui, Jiro Kitagawa, Yutaka Kadoya; Hiroshima Univ., Japan.* The performance of photoconductive antennas made on low-temperature-grown InGaAs was significantly improved by the reduction of the In content. We demonstrate a completely 1.56 μm-based THz-emission and detection using the PC antennas.

***PhAST* ROOM 1**
**(EXHIBIT FLOOR)**

**J O I N T**

### 10:30 a.m. – 12:30 p.m.
### JThC • Joint CLEO/*PhAST* Symposium on BioPhotonics and Applications I
*Adam Wax; Duke Univ., USA, Presider*

**JThC1 • 10:30 a.m.** Invited
**Intraoperative Near-Infrared Fluorescence Imaging,** *Siavash Yazdanfar[1], Stephen A. Latham[1], Deborah S. Lee[1], Carl S. Lester[1], Robert J. Filkins[1], Stephen J. Lomnes[1], John V. Frangioni[2]; [1]GE Global Res., USA, [2]Beth Israel Deaconess Medical Ctr., USA.* We have developed a low-cost, safe, and easy to use NIR fluorescence intraoperative imaging system that permits the surgeon to see, in real time, surgical anatomy and invisible NIR fluorescence simultaneously.

***PhAST* ROOM 2**
**(EXHIBIT FLOOR)**

***P h A S T***

### 10:30 a.m. – 12:30 p.m.
### PThA • Novel Optics and Optical Sources
*Peter Hairston; Northrop Grumman Corp., USA, Presider*

**PThA1 • 10:30 a.m.** Invited
**AlGaN Based Compact UV Light Emitting Diodes for Fluorescence Applications,** *Tom Katona, Vinod Adivarahan, Qhalid Fareed, Michael Gaevski, Asif Khan; Photonics and Microelectronics Lab, Univ. of South Carolina, USA.* We will report on the current status and development of deep ultraviolet light emitting diodes. Deep UV LEDs have many applications in germicidal sterilization and disinfection, biomedical instrumentation, bio-agent detection, analytical instrumentation, and industrial curing.

***PhAST* ROOM 3**
**(EXHIBIT FLOOR)**

### 10:30 a.m. – 12:30 p.m.
### PThB • High-Power Lasers Systems I
*Hagop Injeyan; Northrop Grumman Corp, USA, Presider*

**PThB1 • 10:30 a.m.** Invited
**High-Power Fundamental Mode Lasers for Gravitational Wave Detection,** *Maik Frede; Laser Zentrum Hannover, Germany.* Abstract not available.

ROOM 318-320

CLEO

## CThJ • Nanostructures in Femtosecond Laser Processing—Continued

**CThJ2 • 11:00 a.m.**
**"Quill" Writing with Ultrashort Light Pulses in Transparent Optical Materials,** *Peter G. Kazansky[1], Weijia Yang[1], Erica Bricchi[1], James Bovatsek[2], Alan Arai[2]; [1]Optoelectronics Res. Ctr., UK, [2]IMRA America, Inc, USA.* Writing in silica glass in opposite directions can be different. The phenomenon resembles quill writing and is interpreted in terms of anisotropic trapping of electron plasma by a tilted front of the ultrashort laser pulse.

**CThJ3 • 11:15 a.m.**
**Self-Assembled Nanostructures and Two-Plasmon Decay in Femtosecond Processing of Transparent Materials,** *Peter G. Kazansky[1], Erica Bricchi[1], Yasuhiko Shimotsuma[2], Kazuyuoki Hirao[2]; [1]Optoelectronics Res. Ctr., Univ. of Southampton, UK, [2]Kyoto Univ., Japan.* Self-assembled nanostructures in transparent materials irradiated by ultrashort light pulses reveal two-dimensional periodicity. The mechanism of the phenomenon based on interference of bulk plasma waves excited via two plasmon parametric decay is proposed.

ROOM 321-323

## CThK • Near IR Diode Lasers—Continued

**CThK2 • 10:45 a.m.**
**Linewidth Enhancement Factors in 1.55 $\mu$m Quantum Dot, Quantum Dash, and Quantum Well Amplifiers,** *A. J. Zilkie[1], J. Meier[1], P. W. E. Smith[1], M. Mojahedi[1], J. S. Aitchison[1], P. J. Poole[2], P. Barrios[2], D. Poitras[2], R. H. Wang[3], T. J. Rotter[3], C. Yang[3], A. Stintz[3], K. J. Malloy[3]; [1]Univ. of Toronto, Canada, [2]Natl. Res. Council Canada, Canada, [3]Univ. of New Mexico, USA.* We compare the $\alpha$-factor of a QD amplifier operating at 1.55 $\mu$m to a quantum dash and quantum well amplifier at 1.55 $\mu$m. The QD has the lowest $\alpha$-factor with a minimum $\alpha$ of 1.

**CThK3 • 11:00 a.m.**
**Experimental Modulation Response beyond the Relaxation Oscillation Frequency in a Multiple-Spatial-Mode Laser Diode Based on Active Spatial Mode Coupling,** *Weiguo Yang[1], Lawrence L. Buhl[1], Matthew R. Fetterman[2]; [1]Bell Labs, USA, [2]Penn State Electro-Optics Ctr., USA.* Single-section multiple-spatial-mode passively mode-locked Fabry-Perot laser diodes are demonstrated to have resonant modulation responses between the relaxation oscillation resonance and the mode-locking frequency. The effect is attributed to the intra-cavity active spatial mode coupling.

**CThK4 • 11:15 a.m.**
**Transient Gain Spectroscopy of (GaIn)As Quantum Well Structures,** *Christoph Lange[1], Sangam Chatterjee[1], Christoph Schlichenmaier[1], Angela Thränhardt[1], Stephan W. Koch[1], Wolfgang W. Rühle[1], Galina Khitrova[2], Hyatt M. Gibbs[2]; [1]Philipps-Univ. Marburg, Germany, [2]Univ. of Arizona, USA.* Transient gain measurements are performed for (GaIn)As quantum well structures. Gain up to 2000/cm on a timescale of several hundred ps is observed. A microscopic model quantitatively provides theoretical support without introducing fit parameters.

ROOM 324-326

JOINT

## JThB • Attosecond Laser Pulses—Continued

ROOM 314

CLEO

## CThL • Mid-IR Generation—Continued

**CThL2 • 10:45 a.m.**
**SHG of $CO_2$ Laser Radiation at 10.6 $\mu$m in the Highly Nonlinear Chalcopyrite $LiGaTe_2$,** *Jean-Jacques Zondy[1], Franck Bielsa[2], Albane Douillet[2], Laurent Hilico[2], Ouali Acef[3], Valentin Petrov[4], Alexander Yelisseyev[5], Ludmila Isaenko[5], Pavel Krinitsin[5]; [1]CNAM, France, [2]Univ.d'Evry, France, [3]Observatoire de Paris, France, [4]Max-Born-Inst., Germany, [5]Inst. of Geology and Mineralogy, Russian Federation.* Type-I phase-matching for second harmonic generation at 10.6 $\mu$m in $LiGaTe_2$ is demonstrated and the effective nonlinearity (34.5 pm/V) for this process is estimated by comparison with $AgGaSe_2$ using a tunable single-frequency continuous-wave $CO_2$ laser.

**CThL3 • 11:00 a.m.** **Invited**
**Advances in Mid-IR Materials,** *Peter G. Schunemann; BAE Systems, USA.* Improved processing continues to reduce absorption losses in new and old bulk birefringent nonlinear optical crystals, while advances in all-epitaxial grown QPM GaAs promises to extend efficient, high-power frequency conversion to longer wavelengths.

ROOM 315

## CThM • Ultrafast Beams and Materials Processing—Continued

**CThM2 • 10:45 a.m.**
**Spatio-Spectral Analysis and Encoding of Ultrashort Pulses with Higher-Order Statistical Moments,** *Ruediger Grunwald, Martin Bock; Max-Born-Inst., Germany.* Spatio-spectral analysis of femtosecond laser pulses using higher order statistical moments is presented. Exploiting skewness and kurtosis parameters of local spectra, we obtain an effective data reduction and information transfer at discriminated lower moments.

**CThM3 • 11:00 a.m.**
**Dual Wavelength Femtosecond Laser Materials Processing,** *Masanao Kamata, Susumu Tsujikawa, Tetsumi Sumiyoshi, Hitoshi Sekita; Cyber Laser Inc., Japan.* Femtosecond laser ablation using the combination of 260 nm pulses and 780 nm pulses is explored for the high speed and high quality selected removal of insulating layers.

**CThM4 • 11:15 a.m.**
**Low Insertion Loss Waveguides in Lithium Niobate Using Multi-Scan Femtosecond Waveguide Inscription,** *Henry T. Bookey[1], Robert R. Thomson[1], Nicholas D. Psaila[1], Ajoy K. Kar[1], Nicola Chiodo[2], Roberto Osellame[2], Giulio Cerullo[2]; [1]School of Engineering and Physical Sciences, Heriot Watt Univ., UK, [2]Inst. di Fotonica e Nanotechnologie del CNR - Dept. di Fisica del Politecnico di Milano, Italy.* We have fabricated waveguides in z-cut lithium niobate using multi-scan femtosecond inscription of the bulk material. Insertion losses as low as 3.5 dB have been measured coupling to single mode fibre at 1550 nm.

ROOM 316

## CThN • Nanofabrication—Continued

**CThN2 • 10:45 a.m.**
**Large-Area Metal Grid Ultraviolet Filter Fabricated by Nanoimprint Lithography,** *Wen-Di Li, Stephen Y. Chou; Princeton Univ., USA.* For the first time, a wafer-scale metal grid UV filter is fabricated by nanoimprint lithography and demonstrates cut-off wavelength of 350nm, peak transmission of 27% at 285nm and rejection ratio of 20dB at visible wavelength.

**CThN3 • 11:00 a.m.**
**2-Photon Polymerization for Plasmonic Applications,** *Sven Passinger, Roman Kiyan, Andrey Stepanov, Carsten Reinhardt, Boris Chichkov; Laser Zentrum Hannover e.V., Germany.* We present investigations on dielectric 2-D surface-plasmon-polariton-(SPP)-structures on metal surfaces and their characterization. Line-, dot-, and waveguide-structures are fabricated by two-photon polymerization (2PP) of high refractive index inorganic-organic hybrid polymer.

**CThN4 • 11:15 a.m.**
**Novel Shadow Mask Structure for Sampled Bragg Gratings in Chalcogenide ($As_2S_3$) Planar Waveguides,** *DukYong Choi[1], Steve Madden[1], Andrei Rode[1], Rongping Wang[1], Barry Luther-Davies[1], Neil J. Baker[2], Benjamin J. Eggleton[2]; [1]Laser Physics Ctr./RSPhysse, Australia, [2]School of Physics, Univ. of Sydney, Australia.* We report a new shadow mask structure for writing sampled Bragg gratings into chalcogenide ($As_2S_3$) planar waveguides. This allows long gratings to be written without tilt to produce a grating response with narrow rejection peaks.

ROOM 317

QELS

## QThD • High-Field and Molecular Dynamics—Continued

**QThD2 • 10:45 a.m.**
**Measuring Attosecond Ionization Dynamics inside Dielectrics,** *Marina Gertsvolf[1,2], Rajeev P. Pattathil[1], David M. Rayner[1], Paul B. Corkum[1]; [1]Natl. Res. Council of Canada, Canada, [2]Univ. of Ottawa, Canada.* We resolve attosecond dynamics of multiphoton ionization in solids. We subdivide the laser cycle using differential absorption between the major and the minor axes of elliptically polarized beam.

**QThD3 • 11:00 a.m.**
**Direct Measurement of Intense Field Ionization Rates in Sapphire and Water during Short Pulse Laser Propagation,** *Georgia C. Modoran, Douglass Schumacher; Ohio State Univ., USA.* We describe a pump-probe experiment that directly measures electron ionization rates via plasma-induced blue-shifting during filamentation of a short laser pulse. We compare to Keldysh and Thornber theory.

**QThD4 • 11:15 a.m.**
**Using High-Order Harmonics with Momentum Imaging Techniques to Study Atomic and Molecular Dynamics,** *Etienne Gagnon, Margaret Murnane, Henry Kapteyn, Arvinder Sandhu; JILA, Univ. of Colorado and NIST, USA.* We use high harmonics in conjunction with coincidence momentum imaging (COLTRIMS) techniques to study simple molecules like CO, $CO_2$ and $N_2$. We explore the dynamics near the double ionization threshold using EUV/IR pump/probe techniques.

ROOM 336

## QThE • Plasmonics II—Continued

**QThE2 • 10:45 a.m.**
**Ellipsometrically Probed Plasmonic Resonances in a Square Array of Au Nanocubes,** *Yi-Hao Chen[1], Brandon D. Lucas[2], L. Jay Guo[1,2]; [1]Dept. of Electrical Engineering and Computer Science, Univ. of Michigan, USA, [2]Applied Physics, Univ. of Michigan, USA.* Localized Surface Plasmon Resonance (LSPR) of metallic nanoparticles has been widely studied for sensing applications. We propose an ellipsometry-based configuration for sensing exploiting the polarization dependent LSPR excited on anisotropic and uniformly oriented Au nanostructures.

**QThE3 • 11:00 a.m.**
**Effective Optical Response of Noble Metal Nanoparticle Arrays and Photonic Crystals with Embedded Nanoparticles,** *Elefterios Lidorikis[1], Shunji Egusa[2], John D. Joannopoulos[2]; [1]Univ. of Ioannina, Greece, [2]MIT, USA.* We numerically extract the effective optical constants of noble metal nanoparticle arrays and use them to study photonic crystals with embedded nanaparticles. We find sharp resonant features such as absorption doubling per nanometer wavelength.

**QThE4 • 11:15 a.m.**
**Surface Plasmons in Ordered and Disordered Chains of Metal Nanospheres,** *Vadim A. Markel[1], Andrey K. Sarychev[2]; [1]Dept. of Radiology, Univ. of Pennsylvania, USA, [2]Ethertronics, Inc., USA.* We describe two types of surface plasmons in ordered and disordered chains. The second kind is mediated by far-field interaction and is affected by Ohmic and radiative losses much less than the first kind.

## ROOM 337

**QELS**

### QThF • Quantum Information—Continued

**QThF2 • 11:00 a.m.**
**Entanglement and Rapid Measurement of Clock-State Qubits in Yb or Sr for Quantum Information Processing,** *Nathan S. Babcock, René Stock, Barry C. Sanders; Inst. for Quantum Information Science, Univ. of Calgary, Canada.* We devise protocols for entangling and rapidly measuring qubits encoded in the clock transitions in Yb or Sr. Our work provides concrete guidelines for experimental realizations of quantum computing and fundamental tests of quantum mechanics.

**QThF3 • 11:15 a.m.**
**Spins in Quantum Dot Molecules,** *Matthew Doty[1], Michael Scheibner[1], Eric Stinaff[1], Ilya Ponomarev[1], Allan Bracker[1], Vladimir Korenev[2], Tom Reinecke[1], Dan Gammon[1]; [1]NRL, USA, [2]Ioffe Physical Technical Inst., Russian Federation.* Through optical spectroscopy of Quantum Dot Molecules we observe spin interactions and g-factors that depend on electric field. We describe how these effects could be used to control spin states and optically gate spin interactions.

**CLEO**

## ROOM 338

### CThO • Fiber-Based Optical Sensing—Continued

**CThO2 • 10:45 a.m.**
**An In-Fibre Microcavity,** *Fredrik Laurell[1], Walter Margulis[1], Valdas Pasiskevicius[1], Pär Jelger[1], Åsa Claesson[2], Anders Engström[3]; [1]Royal Inst. of Technology, Sweden, [2]Acreo AB, Sweden, [3]Acreo Ab, Sweden.* A novel all-fiber spliced microcavity for chemical and biological optical studies is described. Its design allows coupling with low loss light from a fiber into a liquid or gas contained in a capillary or PCF.

**CThO3 • 11:00 a.m.**
**Mid-Infrared Methane Sensing Using an Optical Parametric Oscillator and a Photonic Bandgap Fiber as a Gas Cell,** *Lukasz W. Kornaszewski[1], Nicolas Gayraud[1], William N. MacPherson[1], Duncan P. Hand[1], Derryck T. Reid[1], James M. Stone[2], Alan K. George[2], Jonathan C. Knight[2]; [1]Heriot-Watt Univ., UK, [2]Univ. of Bath, UK.* Mid-infrared methane sensing is demonstrated using a photonic bandgap fiber-based gas cell and broadband idler pulses from a periodically-poled lithium niobate femtosecond optical parametric oscillator as the light source for Fourier transform infrared spectroscopy.

**CThO4 • 11:15 a.m.** Invited
**Geometry and Structure of Multimaterial Photodetecting Fibers: A Comparative Study,** *Fabien Sorin, Ayman F. Aboura, Nick D. Orf, Ofer Shapira, Jeff Viens, John D. Joannopoulos, Yoel Fink; MIT, USA.* We report on the influence of geometrical and structural changes on the performance of one dimensional distributed photodetecting fibers for applications in large area opto-electronic systems, remote sensing of analytes and functional fabrics.

## ROOM 339

### CThP • Photonic Crystals and Microcavities—Continued

**CThP2 • 10:45 a.m.**
**Photonic Crystal Reflection Prisms,** *Ethan Schonbrun[1], Qi Wu[1], Wounjhang Park[1], Tsuyoshi Yamashita[2], John Blair[2], Christopher Summers[2]; [1]Univ. of Colorado at Boulder, USA, [2]Georgia Tech, USA.* We present a photonic crystal cube-like polarization beam splitter and total internal reflection prism. By controlling diffraction, we experimentally show that free space optical prisms can now be implemented onto a planar silicon platform.

**CThP3 • 11:00 a.m.**
**Tunable Fabry-Perot Waveguide Microcavities with High Index Contrast Mirrors,** *Marcel W. Pruessner, Todd H. Stievater, William S. Rabinovich; NRL, USA.* Tunable micromachined SOI Fabry-Perot waveguide cavities with high-index-contrast silicon/air Bragg mirrors are demonstrated. The devices can be tuned thermo-optically or using integrated micro-electro-mechanical systems. Device fabrication, experimental data, and simulation results will be presented.

**CThP4 • 11:15 a.m.**
**NRZ-to-PRZ Format Conversion Using Silicon Second-Order Coupled-Microring Resonator-Based Notch Filters,** *Linjie Zhou, Hui Chen, Andrew W. Poon; Hong Kong Univ. of Science and Technology, Hong Kong.* We demonstrate NRZ-to-PRZ format conversion by using silicon second-order coupled-microring resonator-based notch filters. Our experiments show that 3.6-Gbps NRZ signals are converted to PRZ pulses with 40-ps width and 8-dB extinction ratio.

## ROOM 340

### CThQ • Nonlinear Pulse Compression and Shaping in Fibers—Continued

**CThQ2 • 11:00 a.m.**
**Enhancement of Self Phase Modulation Induced Spectral Broadening in Silicon Waveguides by Ion Implantation,** *Yang Liu, C. W. Chow, H. K. Tsang, S. P. Wong; Dept. of Electronic Engineering, The Chinese Univ. of Hong Kong, Hong Kong.* We experimentally demonstrated that helium-ion-implantation can reduce the optical loss due to free carriers produced by two photon absorption and enhance self-phase-modulation in silicon waveguide.

**CThQ3 • 11:15 a.m.**
**Parabolic Pulse Generation in Dispersion Decreasing Fiber Amplifier,** *Stefan Wabnitz[1], Christophe Finot[1], Alexej Sysoliatin[2]; [1]Univ.de Bourgogne, France, [2]Fiber Optics Res. Ctr., Russian Federation.* We obtain an exact dispersion profile that permits for the analytical description of self-similar pulse amplification and supercontinuum generation in tapered nonlinear fiber amplifiers.

## ROOM 341

### CThR • Terahertz Technologies—Continued

**CThR2 • 10:45 a.m.**
**THz Time-Domain Spectrometer Based on LT-InGaAs Photoconductive Antennas Exited by a 1.55 µm Fibre Laser,** *Rafal Wilk[1], Martin Mikulics[1], Klaus Biermann[2], Harald Künzel[2], Ida Z. Kozma[3], Ronald Holzwarth[3], Bernd Sartorius[2], Michael Mei[3], Martin Koch[1]; [1]Inst. fuer Hochfrequenztechnik, Germany, [2]Fraunhofer Inst. für Nachrichtentechnik Heinrich-Hertz-Inst., Germany, [3]Menlo Systems GmbH, Germany.* We present a THz time-domain spectrometer based on a 1.55 µm fibre laser and LTInGaAs/InAlAs MQW photoconductive antennas. We discuss the system stability and present first spectroscopic data taken with the system.

**CThR3 • 11:00 a.m.**
**Excitation Wavelength Dependence of Terahertz Emission from Indium Nitride Multiple Quantum Wells,** *Grace D. Chern[1], Hongen Shen[1], Michael Wraback[1], Gregor Koblmüller[2], Chad Gallinat[2], James Speck[2]; [1]US ARL, USA, [2]Univ. of California at Santa Barbara, USA.* We report the excitation wavelength dependence of terahertz emission from N-face InN/InGaN multiple quantum wells relative to that from bulk N-face InN when excited by femtosecond optical pulses tunable from 800 nm to 1700 nm.

**CThR4 • 11:15 a.m.** Invited
**Measurement of the Carrier-Envelope Phase of Few-Cycle Laser Pulses by THz-Emission Spectroscopy,** *Markus Kreß[1], Torsten Löffler[1], Mark D. Thomson[1], Hartmut G. Roskos[1], Reinhard Dörner[1], H. Gimpel[2], K. Zrost[2], T. Ergler[2], R. Moshammer[2], U. Morgner[2], J. Ullrich[2]; [1]Johann Wolfgang Goethe Univ., Frankfurt, Germany, [2]Max-Planck-Inst. für Kernphysik, Germany.* THz-emission from laser-generated plasmas opens a way to measure the carrier-envelope phase of few-cycle optical pulses, a parameter of critical significance for numerous experiments with sub-10-fs light pulses.

## *PhAST* ROOM 1 (EXHIBIT FLOOR)

**JOINT**

### JThC • Joint CLEO/*PhAST* Symposium on BioPhotonics and Applications I—Continued

**JThC2 • 11:00 a.m.** Invited
**Upcoming Commercial Applications of Biomedical Optical Spectroscopy: Applications to Heart Disease and Gynecology,** *Andres F. Zuluaga; Remicalm LLC, USA.* Abstract not available.

**PhAST**

## *PhAST* ROOM 2 (EXHIBIT FLOOR)

### PThA • Novel Optics and Optical Sources—Continued

**PThA2 • 11:00 a.m.** Invited
**Deep UV Lasers for UV Resonance Fluorescence and Raman Spectroscopy of Biological and Chemical Agents,** *William F. Hug, Ray D. Reid; Photon Systems, Inc., USA.* We review the status of deep UV lasers for use in miniature UR resonance Raman sensors for trace levels of biological and chemical agents. Our focus will be on lasers emitting at wavelengths below 250nm.

## *PhAST* ROOM 3 (EXHIBIT FLOOR)

### PThB • High-Power Lasers Systems I—Continued

**PThB2 • 11:00 a.m.** Invited
**The Big Bang Observer: High Laser Power for Gravitational Wave Astrophysics,** *G. M. Harry[1], William Folkner[2], Peter Fritschel[1], E. Sterl Phinney[3], Daniel A. Shaddock[2]; [1]LIGO Lab, USA, [2]JPL, USA, [3]Caltech, USA.* The Big Bang Observer is a proposed space-based gravitational-wave detector which will utilize two 300 W, 355 nm wavelength lasers on each of three spacecraft. This wavelength will be achieved by frequency tripling Nd:YAG lasers.

**ROOM 318-320**

**C L E O**

### CThJ • Nanostructures in Femtosecond Laser Processing—Continued

**CThJ4 • 11:30 a.m.**
**Single and Multi-Scan Femtosecond Laser Writing for Selective Chemical Etching of Glass Micro-Channels,** *Stephen Ho, Mi Li Ng, Shane M. Eaton, Peter R. Herman, James S. Aitchison; Univ. of Toronto, Canada.* High aspect-ratio micro-channels were fabricated in fused silica using a high-repetition-rate 522-nm femtosecond laser and selective chemical etching with diluted hydrofluoric acid. Single and multi-scanning writing is compared for controlling cross-sectional profile and wall roughness.

**CThJ5 • 11:45 a.m.**
**Solid-Phase Generation of Silicon Nanoparticles by Ultrafast Laser Irradiation,** *Amir H. Nejadmalayeri[1], Philip Scrutton[1], Jacky Mak[1], Amr S. Helmy[1], Peter R. Herman[1], Jonas Burghoff[2], Stefan Nolte[2], Andreas Tuennermann[2], Joerg Kaspar[3]; [1]Univ. of Toronto, Canada, [2]Friedrich-Schiller Univ., Germany, [3]Fraunhofer-Inst. für Werkstoff und Strahltechnik, Germany.* Ultrashort-laser irradiation of silica-silicon interfaces is presented as new means for 'all solid-phase' formation of high-purity silicon-nanoparticles in a silica host. Compressive stress measured in the silicon substrate is associated with positive refractive index modification.

**CThJ6 • 12:00 p.m.**
**Tunable Tungsten Nano-Gratings Deposited by a Single Femtosecond Laser Beam on Dielectrics,** *Mingzhen Tang, Haitao Zhang, Jerry McCoy, Tsing-Hua Her; Univ. of North Carolina at Charlotte, USA.* Subwavelength nano-gratings of tungsten were grown using a single femtosecond laser beam on many substrates. Period of the gratings can be tuned through managing the laser power and scanning speed of substrate.

**ROOM 321-323**

### CThK • Near IR Diode Lasers—Continued

**CThK5 • 11:30 a.m.**
**Integrated Chirped Bragg Gratings on Deeply Etched Tapered III-V Waveguides,** *Michael J. Strain, Marc Sorel; Univ. of Glasgow, UK.* Novel tapered deeply etched Chirped Bragg Grating devices are presented. Arbitrary chirp and coupling coefficient profiles may be implemented and fabricated fully post-growth. Simulation and experimental results are presented for passive gratings and DFB lasers.

**CThK6 • 11:45 a.m.**
**1.55 µm GaSb/AlGaSb MQW Diode Lasers Grown on GaAs Substrates Using Interfacial Misfit (IMF) Arrays,** *Manish Mehta, Ganesh Balakrishnan, Maya N. Kutty, Pravin Patel, Larry R. Dawson, Diana L. Huffaker; Univ. of New Mexico, USA.* We report a GaSb/AlGaSb multi-quantum well diode laser emitting at 1550 nm at 77 K. The laser is grown directly on a GaAs substrate using interfacial misfit (IMF) arrays rather than thick metamorphic buffer layers.

**CThK7 • 12:00 p.m.**
**480-mW DBR Laser Integrated with Micro Heaters for Wavelength Tuning,** *Martin H. Hu, Nick J. Visovsky, Sean Coleman, Yabo Li, Kechang Song, Hong K. Nguyen, Chung-en Zah; Corning Inc, USA.* We fabricated 1060-nm DBR lasers with 480-mW output power and integrated micro heaters. A 20-nm discrete wavelength tuning using Bragg-section heater alone and a 1-nm continuous tuning using both Bragg- and phase-section heaters are demonstrated.

**ROOM 324-326**

**J O I N T**

### JThB • Attosecond Laser Pulses—Continued

**JThB2 • 11:30 a.m.**
**Observation of Interferometric Autocorrelation Trace of an Attosecond Pulse Train,** *Toshihiko Shimizu[1], Tomoya Okino[1,2], Hirokazu Hasegawa[1,3], Kentaro Furusawa[1], Yasuo Nabekawa[1], Kaoru Yamanouchi[1,2], Katsumi Midorikawa[1]; [1]Laser Technology Lab, RIKEN, Japan, [2]Dept. of Chemistry, Graduate School of Science, Univ. of Tokyo, Japan, [3]Inst. for Molecular Science, Japan.* We report the direct observation of phase locking between adjacent pulses in an attosecond pulse train via interferometric autocorrelation, using the Coulomb explosion of $N_2$ caused by two-photon absorption.

**JThB3 • 11:45 a.m.**
**Single-Shot Observation of Quasi-Continuum High-Harmonic Spectrum Generated in a Two-Color Driving Field,** *Masanori Kaku[1], Akira Suda[1], Samuel Bohman[1,2], Shigeru Yamaguchi[2], Katsumi Midorikawa[1]; [1]RIKEN, Japan, [2]Tokai Univ., Japan.* We report the single-shot observation of quasi-continuum high-harmonic spectrum with a harmonic energy of 10 nJ in the XUV region by using a two-color laser field. It indicates a possibility of generating single attosecond pulses.

**JThB4 • 12:00 p.m.**
**Broadband Attosecond Pulse Shaping,** *Marko Swoboda[1], Erik Gustafsson[1], Thierry Ruchon[1], Thomas Remetter[1], Emilie Pourtal[1], Anne L'Huillier[1], Rodrigo López-Martens[2], Philippe Balcou[2]; [1]Dept. of Physics, Lund Univ., Sweden, [2]Lab d'Optique Appliquée, Ecole Natl.e Supérieure des Techniques Avancées, France.* We present experiments on the control over spectral amplitude and phase of attosecond pulses, using metallic and semiconductor thin-film dispersive filters. A pulse duration as short as 130 as is obtained.

**ROOM 314**

**C L E O**

### CThL • Mid-IR Generation—Continued

**CThL4 • 11:30 a.m.**
**Femotsecond Mid-Infrared Difference-Frequency-Gneration Tunable between 3.2 µm and 4.8 µm from a Compact Fiber Source,** *Christian Erny[1], Konstantinos Moutzouris[1], Jens Biegert[1], Ursula Keller[1], Dietrich Kühlke[2], Florian Adler[3], Alfred Leitenstorfer[3]; [1]ETH Zurich, Switzerland, [2]Furtwangen Univ. of Applied Sciences, Germany, [3]Univ. of Konstanz, Germany.* We demonstrate a mid-infrared laser source tunable between 3.2 µm and 4.8 µm with an average output power of more than 1 mW. The spectral bandwidth of up to 325 nm supports sub- 60-fs pulses.

**CThL5 • 11:45 a.m.**
**Mid-IR OPO Operating near Room Temperature Based on Vapor-Transport Equilibrated Periodically Poled Stoichiometric $LiTaO_3$,** *Mordechai (Moti) Katz, Pinhas Blau; SOREQ NRC, Israel.* A vapor-transport equilibrated (VTE) periodically-poled near-stoichiometric $LiTaO_3$ based OPO was demonstrated. 1.0-Watt of average output power at 4.03-µm under 10.2-Watt of 1.064-µm pumping was obtained. Simultaneously, 0.2-Watt at 4.685-µm was generated due to secondary OPO.

**CThL6 • 12:00 p.m.**
**Mid-IR Entangled-Cavity Doubly Resonant OPO Pumped by a Micro-Laser,** *Antoine Berrou[1], Antoine Godard[1], Emmanuel Rosencher[1], Michel Lefebvre[1], Stefan Spiekermann[2]; [1]Office Naitonal d'Études et de Recherches Aérospatiales, France, [2]LUMA NOVA, Germany.* By pumping a mid infrared entangled cavity doubly resonant optical parametric oscillator with a micro-laser, we demonstrate the full potentialities of this widely tunable source: high spectral purity, compactness and low threshold of oscillation.

**ROOM 315**

### CThM • Ultrafast Beams and Materials Processing—Continued

**CThM5 • 11:30 a.m.**
**Ultrafast p-Si Field Emitter Array Photocathode,** *Chin-Jen Chiang[1], Kendrick X. Liu[2], Jonathan P. Heritage[1]; [1]Univ. of California at Davis, USA, [2]NRL, USA.* The transient photo-field emission from p-type Si Field Emitter Array optically modulated by a mode-locked laser results in 130 ps duration electron bunch, demonstrating FEAs as promising photocathode for next generation Microwave Vacuum Electronic Devices.

**CThM6 • 11:45 a.m.**
**Ultrashort Lagguere-Gaussian Pulses with Angular and Group Velocity Dispersion Compensation,** *Iosif Zeylikovich, Henry Sztul, Vladimir Kartazaev, Tuan Le, R. R. Alfano; Inst. for Ultrafast Spectroscopy and Lasers. Dept. of Physics, City College and Graduate Ctr. of the City Univ. of New York, USA.* Coherent optical vortices are generated from ultrashort 6.4 fs pulses with carrier envelope phase control. The properties of angular dispersion and temporal chirp compensated pulses are consistent with a monochromatic Laguerre-Gaussian beam.

**CThM7 • 12:00 p.m.**
**Young's Interference Experiment with Ultrashort-Pulsed Bessel Beams,** *Ruediger Grunwald, Uwe Neumann, Martin Bock, Günter Steinmeyer; Max-Born-Inst., Germany.* Young's experiment was performed with multiple ultrashort-pulsed Bessel-like beams. The pseudo-nondiffracting nature of such beams is confirmed in a self-apodizing setup, with aperture diameters matched to the first field minimum and significantly reduced diffraction contrast.

**ROOM 316**

### CThN • Nanofabrication—Continued

**CThN5 • 11:30 a.m.**
**Fabrication of Garnet Waveguides and Polarizers for Integrated Optical Isolators,** *Sang-Yeob Sung, Xiaoyuan Qi, Bethanie J. H. Stadler; Univ. of Minnesota, USA.* YIG waveguides and photonic crystal polarizers were successfully integrated with Si using $SiO_2$ claddings. The films were grown by room temperature reactive RF sputtering and rapid thermal annealing. Faraday rotations of 0.2°/µm were achieved.

**CThN6 • 11:45 a.m.**
**Three-Dimensional Laser Nano-Structuring: Contrast in Three-Photon and Two-Photon Polymerization of SU-8,** *Ladan E. Abolghasemi, Shane Eaton, Abbas Hosseini, Peter R. Herman; Univ. of Toronto, Canada.* A femtosecond fiber laser with 100-kHz repetition rate was optimized for 3-D nanostructuring of photoresist. Contrasts in.three-photon (1045nm) and two-photon (522nm) resolution are presented together with prospects for creating photonic crystal templates and optical phasemasks.

**CThN7 • 12:00 p.m.**
**Electron-Beam Lithography Techniques for Micro- and Nano-Scale Surface Structure Current Injection Lasers,** *Guy A. DeRose, Lin Zhu, Joyce K. S. Poon, Amnon Yariv, Axel Scherer; Caltech, USA.* We demonstrate nanoscale patterning and overlay of two-dimensional gratings and waveguides with accuracy better than 45nm using electron-beam lithography for surface structure lasers with large areas.

**ROOM 317**

**QELS**

### QThD • High-Field and Molecular Dynamics—Continued

**QThD5 • 11:30 a.m.**
**30-fs Ultra Sensitive Absorption Spectroscopy of Low Vapor Pressure Molecules: Proton Transfer in the Gas Phase,** *Christian Schriever[1], Stefan Lochbrunner[1], David J. Nesbitt[2], Eberhard Riedle[1]; [1]LS BioMolekulareOptik, LMU München, Germany, [2]Joint Inst. for Lab Astrophysics, NIST, Dept. of Chemistry and Biochemistry, Univ. of Colorado, USA.* Our transient absorption spectrometer for gas phase and solution samples can resolve changes of $2x10^{-6}$ in optical density. This allows the first direct comparison of ultrafast proton transfer at low vapor pressure and in solution.

**QThD6 • 11:45 a.m.**
**Measurement of Transient Susceptibility Tensor Created by Rotational Wave Packets Excited by Arbitrarily Polarized Femtosecond Laser Pulses,** *Klaus K. Hartinger, Randy A. Bartels; Colorado State Univ., USA.* Transient susceptibility tensors produced by rotational wavepackets formed by femtosecond laser pulses with arbitrary polarization are shown to be biaxial or uniaxial. Single-shot measurements of the phase modulation of a probe pulse are demonstrated.

**QThD7 • 12:00 p.m.**
**Strong Field Coherent Control with Simple Pulse Shapes: Towards Shaped Pulse Spectroscopy,** *Carlos A. Trallero, Brett Pearson, Thomas C. Weinacht; Stony Brook Univ., USA.* We measure the dependence of molecular fragmentation on a simple pulse shape parameterization at different intensities. The results indicate that dynamic Stark shifts of intermediate resonances play an important role in closed loop learning control.

**ROOM 336**

### QThE • Plasmonics II—Continued

**QThE5 • 11:30 a.m.**
**Fluorescence Enhancement by Surface Gratings,** *Igor I. Smolyaninov, Yu-Ju Hung, Christopher C. Davis; Univ. of Maryland, USA.* Enhancement of fluorescence from Rhodamine6G molecules near a dielectric grating deposited onto a gold film is observed. The enhancement mechanism is consistent with excitation of surface plasmon polaritons on the film surface.

**QThE6 • 11:45 a.m.**
**Role of Radiation and Surface Plasmon in Optical Interactions between Nano-Objects on Metal Surface,** *Long Chen, Jacob T. Robinson, Michal Lipson; School of Electrical and Computer Engineering, Cornell Univ., USA.* It was recently suggested that both radiation and surface plasmon participate in optical interactions between nano-objects on metal surface. We investigate their individual contributions and demonstrate the substantial role of radiation for nano-objects with subwavelength-spacing.

**QThE7 • 12:00 p.m.**
**Hyperspectral Imaging of Plasmonic Excitations Induced by an Electron Beam,** *Maxim Bashevoy, Fredrik Jonsson, Nikolay Zheludev; Univ. of Southampton, UK.* We report on the first realization of a hyperspectral imaging technique of surface plasmon polaritons using a scanning electron beam. The technique provides for plasmon imaging and information on decay lengths with nanometer resolution.

**12:15 p.m. – 1:00 p.m. LUNCH BREAK (concessions available on exhibit floor)**

ROOM 337

QELS

## QThF • Quantum Information—Continued

**QThF4 • 11:30 a.m.** **Invited**
**Quantum Teleportation between Light and Matter,** *Eugene Polzik; Niels Bohr Inst., Copenhagen Univ., Denmark.* We demonstrate teleportation between objects of a different nature_light and matter, which represent 'flying' and 'stationary' media. A quantum state of a few-photon pulse is teleported onto macroscopic object (atomic ensemble containing 1012 caesium atoms).

**QThF5 • 12:00 p.m.**
**Multipartite Entanglement in Non-Equilibrium Quantum Phase Transition in a Collective Atomic System,** *Kishor T. Kapale[1], Girish S. Agarwal[2]; [1]JPL, USA, [2]Dept. of Physics, Oklahoma State Univ., USA.* We study multipartite entanglement in non-equilibrium quantum phase transition in a coherently driven atomic ensemble undergoing collective decay.

ROOM 338

CLEO

## CThO • Fiber-Based Optical Sensing—Continued

**CThO5 • 11:45 a.m.**
**A 100 km Ultra-High Performance Fiber Sensing System,** *Jong H. Chow, Ian C. M. Littler, David E. McClelland, Malcolm B. Gray; Australian Natl. Univ., Australia.* We demonstrate a 100 km remote fiber sensing system with broadband sub-picostrain or sub-µrad resolution. It overcomes traditional noise limits imposed by Rayleigh backscatter and other noise sources related to the long delivery lead fiber.

**CThO6 • 12:00 p.m.**
**Simplified Brillouin Optical Correlation Domain Analysis System with Optimized Time-Gating Scheme,** *Kwang-Yong Song, Kazuo Hotate; Univ. of Tokyo, Japan.* We report a simplified Brillouin optical correlation domain analysis system with an optimized time-gating scheme for noise suppression. Distributed strain sensing with 7 cm spatial resolution and 1 km measurement range is successfully demonstrated.

ROOM 339

## CThP • Photonic Crystals and Microcavities—Continued

**CThP5 • 11:30 a.m.**
**Flattened Broadband Filters with Strongly Modulated Gratings with Two Distinct Filling Factors within One Identical Period,** *YunChih Lee, C. F. Huang, M.L. Wu, C.L. Hsu, J.Y. Chang, Y.C. Liu; Dept. of Optics and Photonics/Natl. Central Univ., Taiwan.* In this paper, the flattened bandstop spectral response of 85 nm at the central wavelength of 1.22 µm and the high angular deviation of incident are experimentally obtained by guided mode resonance (GMR) filters.

**CThP6 • 11:45 a.m.**
**Sharply-Defined Optical Filters and Dispersionless Delay Lines Based on Loop-Coupled Resonators and "Negative" Coupling,** *Milos A. Popovic; MIT, USA.* Coupled-optical-microcavity geometries incorporating non-adjacent-cavity coupling and "negative" ("inductive") coupling are proposed. These enable new compact, quasi-elliptic microring filters, and can circumvent Kramers-Kronig causality constraints to support square-amplitude and linear-phase response over >80% of the passband.

**CThP7 • 12:00 p.m.**
**Single-Film Broadband Photonic Crystal Micro-Mirror with Large Angular Range and Low Polarization Dependence,** *Sora Kim[1], Sanja Hadzialic[2], Aasmund Sudbo[2], Olav Solgaard[1]; [1]Stanford Univ., USA, [2]Univ. of Oslo, Norway.* We experimentally demonstrate a photonic crystal (PC) slab dielectric mirror with reflectivity higher than 90% at optical communication wavelengths. The mirror shows low sensitivity to polarization and incident angle of the input beam.

ROOM 340

## CThQ • Nonlinear Pulse Compression and Shaping in Fibers—Continued

**CThQ4 • 11:30 a.m.**
**Soliton Compression to Few-Cycle Pulses Using Quadratic Nonlinear Photonic Crystal Fibers: A Design Study,** *Morten Bache[1], Jeffrey Moses[2], Jesper Lægsgaard[1], Ole Bang[1], Frank W. Wise[2]; [1]COM•DTU, Technical Univ. of Denmark, Denmark, [2]Dept. of Applied and Engineering Physics, Cornell Univ., USA.* We show theoretically that high-quality soliton compression from ~500 fs to ~10 fs is possible in poled silica photonic crystal fibers using cascaded $\chi^2$:$\chi^2$ nonlinearities. A moderate group-velocity mismatch optimizes the compression.

**CThQ5 • 11:45 a.m.**
**Long Range Soliton Interaction Related to Sidebands Generation in Mode-Locked Lasers,** *Rafi Weill, Amir Rosen, Michael Katz, Alexander Bekker, Vladimir Smulakovsky, Boris Levit, Omri Gat, Baruch Fischer; Technion, Israel.* Soliton formation in passively mode-locked lasers is often accompanied with spectral sidebands. We find how the exact spectral shape of the sidebands affects the long range interaction between pulses in a fiber laser cavity.

**CThQ6 • 12:00 p.m.**
**Coexistence and Competition between Different Soliton Shaping Mechanisms in a Laser,** *Dingyuan Tang[1], Luming Zhao[1], G. Q. Xie[2], Liejia Qian[2]; [1]School of Electrical and Electronic Engineering, Nanyang Technological Univ., Singapore, [2]Dept. of Optical Science and Engineering, Fudan Univ., China.* There exist two distinctive soliton shaping mechanisms in the mode-locked fiber lasers. Depending on the laser operation, either of them could dominate the pulse shaping in a laser when cavity dispersion is near zero.

ROOM 341

## CThR • Terahertz Technologies—Continued

**CThR5 • 11:45 a.m.**
**THz Radiation Transfer onto a Telecom Optical Carrier,** *Sukhdeep Dhillon[1], Carlo Sirtori[1,2], Jesse Alton[3], Stefano Barbieri[1], Alfredo de Rossi[2], Michel Calligaro[2], Harvey Beere[4], Dave Ritchie[4]; [1]Univ. Paris 7, France, [2]Thales Res. and Technology, France, [3]Teraview Ltd, UK, [4]Univ. of Cambridge, UK.* Intra-cavity THz-sideband generation over the entire telecom range is demonstrated by injecting a near-infrared beam into a quantum cascade laser (f=2.8THz). This process is phase-matched due to the phonon-induced anomalous dispersion typical of semiconductor compounds.

**CThR6 • 12:00 p.m.**
**Energy-Scalable THz-Wave Parametric Oscillator and Its Application to Scanning-Beam Terahertz-Wave Reflection Imaging,** *Tomofumi Ikari[1], Hiroaki Minamide[1], Hiromasa Ito[2,1]; [1]RIKEN Sendai, Japan, [2]Tohoku Univ., Japan.* We describe an energy-scalable surface-emitted terahertz-wave parametric oscillator (TPO) with output energy that was six times higher than that of the conventional TPO. Scanning-beam reflection imaging at the resolution of ca. 2λ was also demonstrated.

*PhAST* ROOM 1
(EXHIBIT FLOOR)

JOINT

## JThC • Joint CLEO/*PhAST* Symposium on BioPhotonics and Applications I—Continued

**JThC3 • 11:30 a.m.** **Invited**
**Time-Domain Optical Imaging: Toward Clinical Applications,** *Mario Khayat; ART Advanced Res. Technologies, Inc., Canada.* Pre-clinical and clinical applications and results using time-domain optical imaging are presented. The potential and challenges of introducing a new imaging modality in these environments are discussed.

**JThC4 • 12:00 p.m.** **Invited**
**Laser Capture Microdissection in Prostate Cancer,** *Angelo De Marzo; Johns Hopkins Univ., USA.* Abstract not available.

*PhAST* ROOM 2
(EXHIBIT FLOOR)

*PhAST*

## PThA • Novel Optics and Optical Sources—Continued

**PThA3 • 11:30 a.m.** **Invited**
**Developing High Brightness Semiconductor Lasers for Homeland Security and Defense Applications,** *Paul Rudy, M. L. Osowski, R. M. Lammert, S. W. Oh, C. Ocochlain, C. Panja, T. Stakelon, J. E. Ungar; QPC Lasers, Inc., USA.* We present recent advances in high brightness, high power semiconductor lasers and their applications in homeland security and defense including countermeasures, bio-chemical agent detection, rangefinding, targeting, and directed energy weapons.

**PThA4 • 12:00 p.m.** **Invited**
**Photonic Crystal Components: New Tools for Stand-off Detection and Tracking,** *Ed Johnson; ICx Ion Optics, USA.* Photonic crystals provide strong distinctive reflection and emission spectra in the infrared. Specific patterns with strong infrared resonances inside (or just outside) traditional infrared imaging bands, offer unique opportunities for remote sensing, tagging, and tracking.

*PhAST* ROOM 3
(EXHIBIT FLOOR)

## PThB • High-Power Lasers Systems I—Continued

**PThB3 • 11:30 a.m.** **Invited**
**Structure Loaded Vacuum Laser-Driven Particle Acceleration Experiments at SLAC and Possible Applications,** *Tomas Plettner; E.L. Ginzton Labs, USA.* Abstract not available.

**PThB4 • 12:00 p.m.** **Invited**
**High Power Lasers for Generation of EUV Light,** *Vivek Bakshi; Sematec, USA.* High power lasers (1-10 ns pulse width, 10-20 kW) are needed for laser-produced plasma (LPP)-based EUV sources to support extreme ultraviolet (EUV) lithography. The requirements and status of high power laser technology will be reviewed.

**12:15 p.m. – 1:00 p.m. LUNCH BREAK (concessions available on exhibit floor)**

## 1:00 p.m. – 2:30 p.m.
## JThD • Poster Session III

**JThD1**
**Optical Parametric Amplification of Optical Pulses with a Nearly One-Octave Bandwidth from a Hollow Fiber,** *Keisaku Yamane[1,2], Atsushi Iwasaki[1,2], Takashi Tanigawa[1,2], Taro Sekikawa[1,2], Mikio Yamashita[1,2]; [1]Hokkaido Univ., Japan, [2]Core Res. Evolutional Science and Technology, Japan Science and Technology Agency, Japan.* We developed an angularly dispersed noncollinear optical parametric amplifier with a 300-THz bandwidth (550 - 1000 nm) for the first time. To the best of our knowledge, this is the broadest parametric gain.

**JThD2**
**Femtosecond Time-Resolved Imaging Interferometry: A Technique to Investigate Ultrafast Phenomena in Solids,** *Vasily V. Temnov[1], Klaus Sokolowski-Tinten[2], Ping Zhou[2], Dietrich von der Linde[2]; [1]Experimentelle Physik IIb, Germany, [2]Univ. Duisburg-Essen, Germany.* Capabilities of time-resolved interferometry to study ultrafast phenomena in solids are explored by measuring nanometer-scale transient deformations on laser-excited surfaces and ultrafast evolution of small refractive index changes in the bulk of dielectrics.

**JThD3**
**Development of a Spatial Light Modulator with an Over-Two-Octave Bandwidth from Ultraviolet to Near-Infrared,** *Kouji Hazu[1,2], Keisuke Narita[1,2], Yu Sakakibara[1], Kazuhiko Oka[1], Taro Sekikawa[1,2], Mikio Yamashita[1,2]; [1]Hokkaido Univ., Japan, [2]Core Res. for Evolutional Science and Technology, Japan.* A spatial light phase modulator with a high transmission>85% (260-1100 nm) and a phase modulation capability of 53 radian at 260 nm and 12 radian at 1100 nm has been developed for the first time.

**JThD4**
**The Noise Effect on Pulses in Passive Mode-Locking with Unrestricted Dispersive and Dissipative Parameters,** *Michael Katz[1], Ariel Gordon[2], Omri Gat[3], Baruch Fischer[1]; [1]Technion, Israel, [2]MIT, USA, [3]Hebrew Univ., Israel.* We study the statistical properties of pulses in passive mode-locking with noise for unrestricted dispersive and dissipative parameters. We find exact general expressions for the pulse power and the time and phase jitters.

**JThD5**
**Ultrafast Dynamics of Sub-Threshold Modes in Vertical-Cavity Surface-Emitting Lasers,** *Botao Zhang[1], Albert P. Heberle[1,2]; [1]Dept. of Physics and Astronomy, Univ. of Pittsburgh, USA, [2]Dept. of Electrical and Computer Engineering, Univ. of Pittsburgh, USA.* We investigate sub-threshold modes in single-mode vertical-cavity surface-mitting lasers (VCSEL's). These modes produce beating in the emission of VCSEL's after femtosecond optical pulse injection. The results provide information on the stability of the single-mode regime.

**JThD6**
**Broadband 2 GHz Femtosecond Ti:Sapphire Laser,** *Flavio C. Cruz, Giovana T. Nogueira; Univ. Estadual de Campinas, Brazil.* We report a 2.12 GHz prismless femtosecond Ti:sapphire ring laser with a broadband spectrum extending from 635 to 1060 nm, and with an average power of 0.93 W for 8 W of pump power.

**JThD7**
**A Total Internal Reflection Technique for Time Resolved Measurements of Index of Refraction,** *John R. Houser, Aaron C. Bernstein, Todd Ditmire; Univ. of Texas at Austin, USA.* We present a method using total-internal reflection for measuring small index-of-refraction changes ($\Delta n=1x10^{-5}$). The technique overcomes requirements of diffraction-limited laser performance, is autocalibrating, and paves the way for sensitive single-shot ultrafast measurements of material dynamics.

**JThD8**
**Numerical Simulations of the Ultrasimple Ultrashort-Laser-Pulse Measurement Technique, GRENOUILLE,** *Xuan Liu[1], Rick Trebino[1], Arlee V. Smith[2]; [1]Georgia Tech, USA, [2]Sandia Natl. Labs, USA.* Our simulations show that accurate GRENOUILLE measurements are easily obtained. The FROG algorithm further improves performance because it "sees through" distortions. We also obtain GRENOUILLE's spectral response, allowing spectral deconvolution for even better performance.

**JThD9**
**Ultrashort Pulse Electric-Field Reconstruction Using Only One Autocorrelator,** *Daniel A. Bender[1], Michael P. Hasselbeck[1], Mansoor Sheik-Bahae[1], Balakishore Yellampalle[2], Antoinette J. Taylor[2]; [1]Univ. of New Mexico, USA, [2]Los Alamos Natl. Lab, USA.* Full-field reconstruction of ultrashort laser pulses can be obtained using Modified spectrum auto-interferometric correlation (MOSAIC) traces and the pulse spectrum. This technique is implemented using only a single interferometric autocorrelator.

**JThD10**
**Improved Acousto-Optic Modulator for Ultrafast Laser Pulse Shaping,** *Chien-Hung Tseng[1], Martin G. Cohen[2], Thomas C. Weinacht[1]; [1]Physics Dept., SUNY at Stony Brook, USA, [2]Laser Teaching Ctr., SUNY at Stony Brook, USA.* We demonstrate an improved acousto-optic modulator for ultrafast optical pulse shaping making use of a diamond shaped transducer. Measurements of the spatial profile of the diffracted light beam agree well with Fresnel diffraction calculations.

**JThD11**
**Coherent Phonons Imprinted into Reflectivity Oscillations of Laser-Excited Bi through Electron-Phonon Coupling,** *Davide Boschetto[1], Eugene G. Gamaly[2], Andrei V. Rode[2], Barry Luther-Davies[2], David Glijer[1], Thomas Garl[1], O. Albert[1], Antoine Rousse[1], Jean Etchepare[1]; [1]Lab d'Optique Appliquée, ENSTA/Ecole Polytechmique, France, [2]Australian Natl. Univ., Australia.* We show that the reflectivity of laser-excited solid relates to phonons, driven by thermal forces, through the electron-phonon coupling rate. Controlled excitation of phonons is available by the optimum combination of laser and material parameters.

**JThD12**
**Molecular Control of the Evolution of Capillary-Generated Soft X-Ray High Harmonics,** *Sarah L. Stebbings[1], Edward T f Rogers[1], Ana M. De Paula[2], Matthew Praeger[1], Chris A. Froud[1], Ben Mills[1], David C. Hanna[1], Jeremy J. Baumberg[1], William S. Brocklesby[1], Jeremy G. Frey[1]; [1]Univ. of Southampton, UK, [2]Univ. Federal de Minas Gerais, Brazil.* High harmonic generation from targets of Ar, $N_2$ and $N_2O$ in a gas-filled capillary has been studied. A clear shift in the weighting of the harmonic intensity distribution with decreasing ionization energy is reported.

**JThD13**
**Reducing the Fast Carrier-Envelope Phase Jitter of Amplified Femtosecond Laser Pulses,** *Eric W. Moon, Chengquan Li, Zuoliang Duan, Jason Tackett, Kristan L. Corwin, Brian R. Washburn, Zenghu Chang; Kansas State Univ., USA.* Stabilizing the interference signal obtained from co-propagating a HeNe beam in the f-to-2f interferometer used for carrier-envelope phase stabilization of a femtosecond laser oscillator reduced the fast phase jitter of the amplified pulses by 40%.

**JThD14**
**Pulse Compression by Coherent Raman Scattering,** *Yuichiro Kida, Shin-ichi Zaitsu, Totaro Imasaka; Kyushu Univ., Japan.* The width of an ultraviolet pulse is compressed to sub-20 fs from 100 fs using a prism compressor by compensating the group delay dispersion among the Raman sidebands generated by coherent Raman scattering.

**JThD15**
**Supercontinuum Generation Using Imaging Taper,** *Kebin Shi[1], Fiorenzo G. Omenetto[2], Zhiwen Liu[1]; [1]Dept. of Electrical Engineering, Pennsylvania State Univ., USA, [2]Tufts Univ., USA.* We investigate supercontinuum generation from a Schott imaging fiber taper. Supercontinua simultaneously generated from two fibers of an imaging taper were demonstrated.

**JThD16**
**Pulse Characterization Using Hilbert Transformation Temporal Interferometry (HTTI),** *Tae-Jung Ahn, Yongwoo Park, José Azaña; Inst. Natl. de la Recherche Scientifique - Énergie, Matériaux et Télécommunications, Canada.* We propose a simple ultra-short optical pulse reconstruction method based on Hilbert transform temporal interferometry. The complex profile of a weak picosecond pulse after dispersion by a 100-m SMF is accurately reconstructed using this technique.

**JThD17**
**Filtered SOA De-Multiplexer Structure with Pattern Independence at 0.1 THz Repetition Rate,** *Claudio Crognale[1], Stefano Caputo[2], Sante Saracino[3]; [1]Technolabs S.p.A., Italy, [2]SMD Elettronica, Italy, [3]Siemens S.p.A., Italy.* We present the numerical analysis of the performances of a SOA-based architecture performing, with a simple optical filtering operation, the all-optical channel extraction from a 0.1THz, 1ps FWHM pulses sequence without any pattern-dependence.

**JThD18**
**Scaling Features in Passively Mode-Locked Inhomogeneously Broadened Lasers,** *Li Yan, Song Han; Univ. of Maryland, Baltimore County, USA.* Passive modellocking of inhomogeneously broadened lasers is studied in three regimes: pure SAM, soliton mode-locking, and with SPM and positive GDD. Scaling features of mode-locking characteristics with the gain linewidth, dispersion, and nonlinearities are presented.

**JThD19**
**Turn-On Dynamics of Semiconductor Quantum Dot Lasers,** *Ermin Malíc, Moritz Bormann, Philipp Hövel, Matthias Kuntz, Dieter Bimberg, Andreas Knorr, Eckehard Schöll; Technische Univ. Berlin, Germany.* We present a theoretical approach including Coulomb scattering to InAs/GaAs quantum dot lasers. In agreement with experiments we find strongly damped relaxation oscillations. We show the crucial importance of Coulomb interaction for this characteristic feature.

**JThD20**
**Robustness Enhancement of Iteration-Free Spectral Phase Retrieval by Interferometric Second-Harmonic Trace,** *Chen-Shao Hsu, Shang-Da Yang; Inst. of Photonics Technologies, Taiwan.* We theoretically demonstrated a new multi-slice scheme that could suppress the noise-induced spectral phase error in measurement of electric field by interferometric spectral trace observation (MEFISTO) by eightfold or better without measuring additional data.

**JThD21**
**Intersubband Transition of AlN/GaN Quantum Wells in Optimized AlN-Based Waveguide Structure,** *Toshimasa Shimizu[1], Chaiyasit Kumtornkittikul[1], Norio Iizuka[2], Masakazu Sugiyama[1], Yoshiaki Nakano[1,3]; [1]Univ. of Tokyo, Japan, [2]Toshiba Corp., Japan, [3]JST-SORST, Japan.* We achieved low-power saturation of intersubband absorption at 1.5 µm with AlN-based AlN/GaN quantum wells. By optimizing the etching condition of waveguides, the saturation energy was reduced by a factor of 3.

**JThD22**
**Pulse Shaping Using Binary Sequences Designed with Error Diffusion,** *Christophe Dorrer; Lab for Laser Energetics, Univ. of Rochester, USA.* Continuous optical and electrical pulse shaping is obtained by spectral filtering of binary discrete sequences of pulses designed with the deterministic error-diffusion algorithm. Experimental demonstration to RF pulse shaping is presented.

**JThD23**
**Polarization-Dependence of Ultrafast Optical Nonlinearities of Bragg-Spaced Quantum Wells,** *Nai H. Kwong[1], Dan T. Nguyen[1], Rolf Binder[1], Arthur L. Smirl[2]; [1]Univ. of Arizona, USA, [2]Univ. of Iowa, USA.* We present a microscopic theory for the polarization dependence of the nonlinear reflection of Bragg-spaced quantum wells. Our theory includes polariton correlations beyond third order. Comparisons with experimental results show reasonably good agreement.

**JThD24**
**Dynamic Coupling-Decoupling Crossover in the Current-Driven Vortex State in $Tl_2Ba_2CaCu_2O_8$ Probed by the Josephson Plasma Resonance,** *Verner K. Thorsmølle[1], Richard D. Averitt[2], Takasada Shibauchi[3], Michael F. Hundley[2], Antoinette J. Taylor[2]; [1]Ecole Polytechnique Fédérale de Lausanne, Switzerland, [2]Los Alamos Natl. Lab, USA, [3]Kyoto Univ., Japan.* Employing terahertz time-domain spectroscopy, we have measured the Josephson plasma resonance in $Tl_2Ba_2CaCu_2O_8$ high-Tc thin films, and studied the current-driven coupling-decoupling crossover in the driven vortex lattice.

**JThD25**
**Stimulated Polariton Scattering in Intersubband Lasers—Role of Motional Narrowing,** *Jacob B. Khurgin[1], H. C. Liu[2]; [1]Johns Hopkins Univ., USA, [2]Natl. Res. Council, Canada.* We have developed a theory of polariton scattering in the inhomogeneously broadened intersubband transitions and have shown that motional narrowing plays important role. This explains abnormally high gain of the experimentally observed parametric process.

**JThD26**
**Direct Dissociation and Laser Modulated Predissociation of $N^{2+}$,** *Ryan N. Coffee[1], Phil H. Bucksbaum[1], Li Fang[2], George N. Gibson[2]; [1]Stanford Linear Accelerator Ctr., USA, [2]Univ. of Connecticut, USA.* We compare the dissociation energy of $N^{2+}$ in 800 nm and 400 nm ultrafast laser fields. This comparison not only exposes multiphoton resonance but also reveals ionization into a Floquet manifold.

**JThD27**
**Ultrafast Intervalley Transitions in GaN Single Crystals,** *Shuai Wu[1], P. Geiser[2], J. Jun[2], Janusz Karpinski[2], Roman Sobolewski[1]; [1]Univ. of Rochester, USA, [2]Solid State Physics Lab, ETH, Switzerland.* We have studied time-resolved intervalley transitions of electrons between the conduction band $\Gamma$ and L valleys in bulk GaN crystals using a two-color, femtosecond, pump-probe technique. The transition threshold and intervalley scattering times were determined.

**JThD28**
**Probing Photoconductivity in Discotic Liquid Crystals by Terahertz Time-Domain Spectroscopy,** *Chen Xia, Volodimyr Duzhko, Hefei Shi, Kenneth D. Singer, Jie Shan; Dept. of Physics, Case Western Reserve Univ., USA.* Optical pump/terahertz probe spectroscopy was employed to investigate electronic charge trasport in discotic liquid crystals. Frequency dependent complex conductivity was observed in phthalocyanines for a few hundred of picoseconds following a femtosecond photoexcitation.

## JThD • Poster Session III—Continued

**JThD29**

**All-Optical Generation and Detection of Coherent Acoustic Phonons in GaN Single Crystals,** *Shuai Wu[1], P. Geiser[2], J. Jun[2], Janusz Karpinski[2], Roman Sobolewski[1]; [1]Univ. of Rochester, USA, [2]Solid State Physics Lab, ETH, Switzerland.* We report experimental and theoretical studies on time-resolved generation and detection of coherent acoustic phonons in bulk GaN single crystals with an ultrafast two-color pump-probe technique. Optically-induced electronic stress is responsible for the phonon generation.

**JThD30**

**Analytic Model of Rotational Wave Packet Excitation with Arbitrary Pump Polarization in the Impulsive Limit,** *Randy Bartels[1], Mark Baertschy[2], Omid Masihzadeh[1]; [1]Colorado State Univ., USA, [2]Univ. of Colorado at Denver, USA.* An analytic model for non-resonant rotational wave packet excitation in linear molecules by intense ultrafast elliptically polarized laser pulses in the impulsive limit is presented.

**JThD31**

**Identification in the Frequency Domain of Molecular Dissociation Fragments Detected by a Wavepacket,** *Yan Xiao, Brian Ricconi, Ju Gao, J. Gary Eden; Lab for Optical Physics and Engineering, Dept. of Electrical and Computer Engineering, Univ. of Illinois at Urbana-Champaign, USA.* Coherent control of $Rb_2$ predissociation by chirped femtosecond laser pulses is detected by a wavepacket probe. Specific atomic fragments of molecular dissociation are identified by viewing the wavepacket dynamics in the spectral domain.

**JThD32**

**Intra-Molecular Dynamics Probed Using High-Harmonic Generation,** *Xibin Zhou, Wen Li, Robynne Hooper, Nick Wagner, Henry Kapteyn, Margaret Murnane; JILA and Dept. of Physics, Univ. of Colorado, USA.* High-harmonic generation is used to probe vibrational and electronic dynamics in small molecules. We impulsively excite vibrations in $CF_3Cl$ and observe oscillations in harmonic emission. We electronically excite $CF_3I$ and observe changes in the yield.

**JThD33**

**Dissociative Ionization of an Aligned Molecular Sample,** *Sarah R. Nichols[1], Brett J. Pearson[1], George Gibson[2], Thomas C. Weinacht[1]; [1]Stony Brook Univ., USA, [2]Univ. of Connecticut, USA.* We investigate dissociative ionization of aligned $N_2$ molecules using intense ultrafast laser pulses. We find surprising differences in the yields of $N^{2++}$, $N^+(1,0)$ and $N^+(1,1)$ as a function of molecular axis-laser polarization angle.

**JThD34**

**Monitoring Vibrational Wave Packet Dynamics via Direct Femtosecond Pump-Probe Measurements,** *Dmitry Pestov, Ariunbold Gombojav, Xi Wang, Robert K. Murawski, Vladimir A. Sautenkov, Yuri V. Rostovtsev, Anil Patnaik, Alexei V. Sokolov, Marlan O. Scully; Inst. for Quantum Studies and Depts. of Physics and Chemical Engineering, Texas A&M Univ., USA.* Femtosecond pump-probe measurements are shown to reveal the evolution of excited vibrational wave packets in $Cs_2$ through the probe transmission modulation. Frequency-resolved acquisition allows for selective monitoring of different subsets of the Raman transitions excited.

**JThD35**

**Mechanistic Comparison of Different Solutions Found in Closed-Loop Quantum Control Simulations,** *James L. White, David Cardoza, Philip H. Bucksbaum; Stanford Univ., USA.* We investigate how variable number affects mechanistic complexity in solutions found using closed-loop learning control. We find that we can facilitate our mechanistic understanding by initially using fewer variables for the optimization.

**JThD36**

**Femtosecond Dynamics of the Laser-Induced Solid-to-Liquid Phase Transition in Aluminum,** *Maria Kandyla, Tina Shih, Eric Mazur; Harvard Univ., USA.* We present femtosecond time-resolved broadband measurements of the reflectivity of aluminum during the laser-induced solid-to-liquid phase transition. Our experiments show that this transition is a thermal process, settling an existing controversy.

**JThD37**

**Time- and Spectrally-Resolved PL Study of a Regular Array of InP/InAs/InP Core-Multishell Nanowires,** *Bipul Pal[1], Ken Goto[1], Michio Ikezawa[1], Yasuaki Masumoto[1], Premila Mohan[2], Junichi Motohisa[2], Takashi Fukui[2]; [1]Univ. of Tsukuba, Japan, [2]Hokkaido Univ., Japan.* Time- and spectrally-resolved PL from a periodic array of InP/InAs/InP core-multishell nanowires is presented. InAs layer shows multipeak PL spectra. PL decay is nonexponential and very slow, with decay rate depending on energy.

**JThD38**

**Characterication of the Complex Noise Transfer Function of a Modelocked Ti:Sapphire Laser,** *Theresa D. Mulder, Ryan P. Scott, Katherine A. Baker, Brian H. Kolner; Univ. of California, USA.* We measured the complex amplitude and phase noise transfer functions of a KLM Ti:sapphire laser by modulating the pump laser from 0.1 Hz to 10 MHz. The frequency dependence is in good agreement with theory.

**JThD39**

**A Compact Annular Beam Generator Based on a Laser Diode Pumped Power Build-up Cavity for Optical Tweezers,** *Jun-ichi Sato, Masamori Endo, Shigeru Yamaguchi, Kenzo Nanri, Tomoo Fujioka; Tokai Univ., Japan.* We report on a novel, very simple mode selective annular beam generator with a laser diode pumped power build-up cavity and cylindrical lens based mode converter. The system can readily be available for optical tweezers.

**JThD40**

**Cesium $6S_{1/2}$->$8S_{1/2}$ Two-Photon Transition Stabilized 822.5 nm Diode Laser,** *Wang-Yau Cheng, Chien-Ming Wu; Inst. of Atomic and Molecular Science, Taiwan.* Cesium $6S_{1/2}$->$8S_{1/2}$ two-photon transition stabilized 822.5 nm diode laser (CTSDL) is reported for the first time to our knowledge. We demonstrate that the CTSDL could be a reliable frequency reference.

**JThD41**

**Full Dispersion Characterization Using Single-Arm Interferometry on a mm-Length Fiber,** *Waleed S. Mohammed, Michael Galle, Joachim Meier, Chris Sapiano, Li Qian, Peter W. Smith; Univ. of Toronto, Canada.* We measure linear and quadratic dispersion parameters ($\beta_1$ and $\beta_2$) on a 6-mm twin-hole fiber using a single-arm interferometric technique. Furthermore, $?_0$ is extracted from the measured $\beta_1$ and $\beta_2$ through an optimization algorithm.

**JThD42**

**Absolute Mode Number Determination Using Two Er:Fiber Laser Combs for Optical Frequency Metrology,** *Jin-Long Peng, Ren-Hui Shu; Ctr. for Measurement Standards, Taiwan.* We uniquely determine the mode number using two erbium-doped fiber laser combs operating in different repetition rates for optical frequency measurement with no dependence on the frequency fluctuation of the laser under measurement.

**JThD43**

**High-Resolution Mode-Spacing Measurement of the Blue-Violet Diode Laser Using Interference of Fields Created with Time Delays Greater than the Coherence Time,** *So-Young Baek, Yoon-ho Kim; Pohang Univ. of Science and Technology, Republic of Korea.* Multi-mode cw blue-violet diode-lasers exhibit interference revival when the interferometric path-length-difference is much greater than the self-coherence time. Using the equally-spaced and recurring interference envelopes, high-resolution mode-spacing measurement is possible without using high-resolution spectrometers.

**JThD44**

**Fiber-Optic Voltage Sensor Using a Hybrid Laser Interferometer,** *Hyoung-Jun Park, Hyun-Jin Kim, Minho Song; Chonbuk Natl. Univ., Republic of Korea.* A hybrid interferometer, a Michelson and a Mach-Zehnder combined, is proposed to demodulate a fiber-optic voltage sensor. By using quadrature sampling with internal triggers, optical path difference can be obtained and translated into voltage output.

**JThD45**

**The Bragg Side-Band BioCD,** *Xuefeng Wang, David Nolte; Physics Dept., Purdue Univ., USA.* We present the interferometric detection of antibody binding using high-speed spinning-disk interferometry in the Bragg sideband of a dielectric disc in a BioCD format, enabling 4-channel detection through independent in-line, phase-contrast, light-scattering and fluorescence channels.

**JThD46**

**Reflected Pump Technique for Saturated Absorption Spectroscopy inside Photonic Bandgap Fibers,** *Kevin Knabe, Rajesh Thapa, Brian R. Washburn, Kristan L. Corwin; Kansas State Univ., USA.* Saturated absorption spectroscopy in acetylene-filled photonic bandgap fibers is investigated. A new simplified technique for saturated absorption spectroscopy is described, where pressure and power parameters have been optimized for use as a frequency reference.

**JThD47**

**Diode-Pumped Solid-State Ring Laser Gyroscope,** *Sylvain Schwartz, Gilles Feugnet, Jean-Paul Pocholle; Thales Res. and Technology, France.* We report achievement of a novel gyroscope based on CW diode-pumped Nd-YAG crystal ring laser with polarimetric stabilization of bidirectional emission. Experimental datas will be presented together with theoretical analysis.

**JThD48**

**Beam Characteristics of Mid-IR Quantum Cascade Lasers,** *Kannan Krishnaswami, Bruce Bernacki, Bret Cannon, Mark Phillips, Nicolas Ho, Paul Allen, Norman Anheier; Pacific Northwest Natl. Lab, USA.* We report divergence, astigmatism, and $M^2$ for 8.77μm quantum cascade lasers. Divergence of 62°x32° FWHM and $M^2$ of 1.81 and 1.22 were measured for fast and slow axes, respectively, with an astigmatism of ~4μm.

**JThD49**

**Real-Time 3-D Shape Measurement with High Accuracy and Low Cost,** *Hua Du, Zhaoyang Wang; Catholic Univ. of America, USA.* A real-time 3-D full-field shape measurement technique based on a generalized fringe projection profilometry is presented. The technique has the following features: high accuracy, real-time measurement, low cost, and easy implementation.

**JThD50**

**Absolute Surface Displacement Measurement Using Pulsed Photo-Electromotive-Force Laser Vibrometer,** *Zhongyang Chen[1], Jacob Khurgin[1], Ponciano Rodriguez[2], Jose Lorenzo[3], Sudhir Trivedi[3], Feng Jin[3], Chen-Chia Wang[3], Brad Libbey[4], James Habersat[4]; [1]Johns Hopkins Univ., USA, [2]INAOE, Mexico, [3]Brimrose Corp, USA, [4]US Army, S&T Div. NVESD, USA.* We demonstrate experimentally a new technique for measuring unambiguously the surface displacement of a vibrating surface, independent of speckles and power fluctuations, using a high sensitivity pulsed laser vibrometer based on the photo-electromotive-force (photo-EMF) sensors.

**JThD51**

**DAVLL with Absolute Frequency Reference,** *Christopher Lehman, Ethan Elliott, Frank Narducci; Naval Air Systems Command, USA.* We report on a simple addition to the standard DAVLL that combines the large frequency capture range of the DAVLL and the precision structure information available from standard saturated absorption. Experimental measurements are presented.

**JThD52**

**Optical Studies of Individual Single-Walled Carbon Nanotubes under Axial Strain,** *Yang Wu, Mingyuan Huang, Christophe Voisin, Hugen Yan, Bhupesh Chandra, James Hone, Tony F. Heinz; Columbia Univ., USA.* The effect of axial strain on individual single-walled carbon nanotubes has been investigated experimentally. Changes in the optical transition energies reflect both the nature of the transition being probed and crystallographic structure of the nanotube.

**JThD53**

**Chirality Dependence of Absorption in Carbon Nanotubes,** *Ermin Malic[1,2], Matthias Hirtschulz[1], Frank Milde[1], Andreas Knorr[1], Stephanie Reich[2]; [1]Technische Univ. Berlin, Germany, [2]MIT, USA.* We present an analytical approach to the optical absorption in arbitrary carbon nanotubes. We show the chirality dependence of the absorption coefficient to be the result from both the JDOS and the optical matrix element.

**JThD54**

**Terahertz Electric Polarizability of Multiple Excitons in CdSe Quantum Dots,** *Georgi L. Dakovski, Brian Kubera, Harsh Mathur, Jie Shan; Case Western Reserve Univ., USA.* Dependence of the polarizability of a QD on the number of excitons in it was investigated. A simple model of weakly interacting charge carriers in an infinite spherical potential well agrees well with the experiment.

**JThD55**

**Analysis of the Spontaneous Emission Rate Enhancement by Surface Plasmons in a Thin Metallic Layer Embedded in Semiconductor,** *Hideo Iwase[1], Jelena Vuckovic[2]; [1]Canon Inc., Japan, [2]Stanford Univ., USA.* We study the modification of spontaneous emission rates from multi-quantum wells beneath a thin metallic layer embedded in semiconductor.

**JThD56**

**Transmission through Composite Nano Aperture and Effects of Surface Plasmon Resonance,** *Shih-Wei Yin[1], Pi-Ju Cheng[1], Chung-Hao Tien[2]; [1]Dept. of Photonics and Inst. of Electro-Optical Engineering, Taiwan, [2]Dept. of Photonics and Display Inst., Taiwan.* Utilizing the characteristics of surface plasmon effect, we proposed a new design of metallic nano-aperture exhibits higher power throughput at 1.40x and similar spot size, in comparison with the proposed optimal performance of a C-aperture.

**JThD57**

**Lithography, Plasmonics and Sub-Wavelength Aperture Exposure Technology,** *Mario Dagenais[1], Yves Ngu[1,2], Marty Peckerar[1], Xiaoping Liu[1], Mike Messina[2], John Barry[1]; [1]Univ. of Maryland, USA, [2]ASML, USA.* We report enhanced transmission of 250 nm radiation by sub-wavelength square aperture arrays on silver and demonstrate its use in optical lithography with far-reduced number of addressed pixels to produce very good edge acuity.

**JThD58**

**An Offset Apertured Probe: A Hybrid Apertured and Scattering-Type Near-Field Scanning Optical Probe,** *Michael C. Quong, Abdulhakem Y. Elezzabi; Univ. of Alberta, Canada.* We present the results of simulations performed to characterize the influence of various factors on energy throughput and resolution of a NSOM tip having a subwavelength aperture offset from the apex.

**JThD59**

**Design and Analysis of Surface Plasmon-Enhanced Metal-Semiconductor-Metal Traveling Wave Photodetectors,** *Tzeng F. Kao[1], Hung-Ping Chen[1], Chi-Kuang Sun[1,2]; [1]Graduate Inst. of Electro-Optical Engineering, Taiwan, [2]Res. Ctr. for Applied Sciences, Academia Sinica, Taiwan.* We propose and analyze the bandwidth and efficiency issues of surface-plasmon-resonance (SPR) enhanced metal-semiconductor-metal traveling-wave photodetectors. With strong field confinement near the nano-sized metal fingers, SPR-effect is found to greatly enhance the device's highspeed performance.

**JThD60**

**Local Field Enhancement and Spectral Response of Resonant Nanostructures,** *C. Dineen[1], Matthias Reichelt[1], Armis R. Zakharian[1], Jerome V. Moloney[1], Stephan W. Koch[2]; [1]Univ. of Arizona, USA, [2]Univ. of Marburg, Germany.* Resonant behavior of metallic nanostructures is simulated using local mesh refinement of the FDTD method in 3-D. Influence of shape and tip geometry on the resonant structure and intensity of the optical fields is examined.

## JThD • Poster Session III—Continued

**JThD61**
**Nonlinear Optical Probe of a Singly-Charged Stranski-Krastanow Quantum Dot,** *Bo Sun[1], Xiaodong Xu[1], Jun Cheng[1], Yanwen Wu[1], Duncan G. Steel[1], Allan S. Bracker[2], Dan Gammon[2], Wang Yao[3], Lu Sham[3]; [1]Univ. of Michigan, USA, [2]NRL, USA, [3]Univ. of California at San Diego, USA.* We demonstrate coherent nonlinear response from a singly-charged self assembled quantum dot. A degenerate differential transmission spectrum shows carrier tunneling, leading to a Fano profile.

**JThD62**
**Observation of the Dark States of Near-Field Coupled InAs Quantum Dots Using Optical Near-Field Microscopy,** *Tadashi Kawazoe[1], Kazuhiro Nishibayashi[2], Kouichi Akahane[3], Naokatsu Yamamoto[3], Motoichi Ohtsu[2,1]; [1]Japan Science and Technology Agency, Japan, [2]Univ. of Tokyo, Japan, [3]Natl. Inst. of Information and Communications Technology, Japan.* We observed the dark states of coupled InAs quantum dots via an optical near-field. The experimental results show that the dipoles of near-field coupled InAs quantum dots are distributed with an anti-parallel configuration.

**JThD63**
**Optical Linewidth and Dephasing in Single InAs Quantum Dots and Coupled Dot-Microcavity Systems,** *Sergey Rudin[1], Thomas L. Reinecke[2]; [1]ARL, USA, [2]NRL, USA.* We study effects of carrier-phonon interactions on the optical spectra of single quantum dots in mesas and dots imbedded in cavities. The temperature dependence of the linewidths in single dots is compared with experimental results.

**JThD64**
**Electromagnetic Interaction between Nanoparticles and Optical Subwavelength Devices,** *Matthias Reichelt[1], Colm Dineen[1], Armis R. Zakharian[1], Jerry V. Moloney[1], Tineke Stroucken[2], Stephan W. Koch[2]; [1]Arizona Ctr. for Mathematical Sciences, USA, [2]Dept. of Physics and Materials Sciences Ctr., Phillips Univ., Germany.* A general approach to self-consistently describe the electromagnetic field in a nanophotonic environment is presented. It is applied to dielectric particles and quantum-dots in the optical subwavelength-limit and also yields the radiative force on them.

**JThD65**
**Transition between Rydberg 1s and 2p Exciton States of Biexcitons in Semiconductor Quantum Dots,** *Kensuke Miyajima, Hiroaki Sawada, Masaaki Ashida, Tadashi Itoh; Graduate School of Engineering Science. Osaka Univ., Japan.* In CuCl quantum dots, we have measured transient absorption spectra attributed mainly to transition from Rydberg 1s to 2p states of excitons and biexcitons, respectively. The dot size dependence of their transition energies is observed.

**JThD66**
**Optimizing Contrast of Tip-Enhanced Fluorescence Microscopy for Imaging High-Density Samples,** *Chun Mu, Jonathan R. Cox, Changan Xie, Jordan M. Gerton; Univ. of Utah, USA.* Quantum dots are imaged using tip-enhanced fluorescence microscopy. Optimization of the operation parameters leads to high-contrast images of high-density samples and a novel photon analysis improves contrast further.

**JThD67**
**Second-Harmonic Generation Driven by Local Field Asymmetry in Noncentrosymmetric Gold Nano-Ts,** *Brian K. Canfield[1], Hannu Husu[1], Janne Laukkanen[2], Benfeng Bai[2], Markku Kuittinen[2], Jari Turunen[2], Martti Kauranen[1]; [1]Tampere Univ. of Technology, Finland, [2]Univ. of Joensuu, Finland.* We demonstrate that second-harmonic generation from noncentrosymmetric gold nano-Ts with nanogaps is governed by asymmetric distribution of the local fundamental field, and not strictly according to field enhancement in small nanogaps.

**JThD68**
**Spectral Phase Control of Remote Surface-Plasmon-Mediated Two-Photon-Induced Luminescence,** *Jess M. Gunn, Melinda Ewald, Marcos Dantus; Michigan State Univ., USA.* We demonstrate the use of spectral phase modulation as a mechanism for control over surface-plasmon-mediated two-photon-induced luminescence at distances tens of microns from the focal spot of a femtosecond laser.

**JThD69**
**Dynamics of Exciton Recombination in InAs Quantum Dots Embedded in InGaAs/GaAs Quantum Well,** *Xiaodong Mu[1], Yujie J. Ding[1], Boon S. Ooi[1], Mark Hopkinson[2]; [1]Lehigh Univ., USA, [2]Univ. of Sheffield, UK.* Using time-resolved pump-probe differential photoluminescence technique, exciton decay time was measured to significantly increase as temperature was increased in InAs quantum dots embedded in an InGaAs/GaAs quantum well.

**JThD70**
**Thermo-Plasmonic Resonances in Hybrid Metallo-Dielectric Nano-Particles: Towards Tunable Standalone Nano-Sensors,** *Nikolaos J. Florous, Kunimasa Saitoh, Tadashi Murao, Masanori Koshiba; Div. of Media and Network Technologies, Graduate School of Information Science and Technology, Hokkaido Univ., Japan.* We theoretically investigate the intense nano-focusing of light through a novel family of metallo-dielectric nano-particles mediated by thermo-plasmonic resonances. The results show a significant sensitivity of the plasmonic resonance to temperature and environmental fluctuations.

**JThD71**
**Double Nanohole-Enhanced Raman Spectroscopy,** *Antoine Lesuffleur[1], L.K.S Kumar[2], Alexander G. Brolo[3], Karen L. Kavanagh[4], Reuven Gordon[2]; [1]Dept. of Electrical and Computer Engineering, Univ. of Minnesota, USA, [2]Dept. of Electrical and Computer Engineering, Univ. of Victoria, Canada, [3]Dept of Chemistry, Univ. of Victoria, Canada, [4]Dept of Physics, Simon Fraser Univ., Canada.* The cusps formed by two barely overlapping nanoholes in a metal film enhance the local field and allow for order of magnitude surface-enhanced Raman over single holes.

**JThD72**
**Surface Enhanced Raman with Nano-Holes,** *Chichang Zhang, H. Grebel; New Jersey Inst. of Technology, USA.* We have demonstrated Surface Enhanced Raman with array of nano-holes on aluminum substrate.

**JThD73**
**Ultra-Long Range Surface Plasmon Structures for Plasmonic Devices,** *Charles G. Durfee[1], Reuben T. Collins[1], P. David Flammer[1], Thomas E. Furtak[1], Russell E. Hollingsworth[2]; [1]Colorado School of Mines, USA, [2]ITN Energy Systems, USA.* Our computations show that adding a thin, low-index dielectric adjacent to a thin metal layer dramatically increases the surface plasmon propagation length. This geometry allows the integration of plasmonic waveguides with metal-oxide-semiconductor (MOS) structures.

**JThD74**
**AIRIS Remote Detection for Chemical Vapor Clouds: Systems Design and Detection Algorithms,** *A. Peter Snyder[1], James O. Jensen[1], Waleed M. Maswadeh[1], Louis Anderson[1], Bogdan R. Cosofret[2], Tracey E. Janov[2], Harry S. Kindle[2], Daisei Konno[2], Rex Miyashiro[2], William J. Marinelli[2]; [1]US Army, USA, [2]Physical Sciences, Inc., USA.* Detection and tracking of chemical vapors at kilometer distances constitute an important component in early warning for the US military. The Adaptive Infrared Imaging Spectroradiometer (AIRIS) passively interrogates chemical vapor infrared emission spectra.

**JThD75**
**Free Spectral Range Matched Scanning Interrogator,** *Fengguo Sun[1], Patrick Tsai[2], Gaozhi Xiao[1], Zhiyi Zhang[1], Dayan Ban[2]; [1]Photonic Systems Group, Inst. for Microstructural Science, Canada, [2]Dept. of Electrical and Computer Engineering,Univ. of Waterloo, Canada.* A free spectral range matched scanning interrogator has been proposed and demonstrated with an ultra high wavelength resolution of 5pm. This system has great applications for wavelength-modulated distributed sensors and multiple temperature/stress sensor arrays.

**JThD76**
**The Study on 3-D Image Laser Sensing Technology of Welding Seam,** *Yinqi Feng, Minshuang Huang, Junfen Huang, Lipei Jiang; Beijing Inst. of Petrochemical Technology, China.* Using Moiré Pattern technology, a 3-D image laser sensing system of weld seam was introduced. The realization method of the system and its image processing were explained. 3-D weld seam images were obtained with experiments.

**JThD77**
**15 mW, Tunable Difference Frequency Generation Source for Absorption Spectroscopy,** *Dirk Richter[1], Petter Weibring[1], Alan Fried[1,2], O. Tadanaga[2], Y. Nishida[2], M. Asobe[2], H. Suzuki[2]; [1]NCAR, USA, [2]NTT Photonics Labs, Japan.* A novel waveguide periodically poled lithium niobate crystal for difference frequency generation in the mid-IR region at 3.52microns is characterized. Mid-IR power of 15mW and a conversion efficiency of up to 19%/W have been obtained.

**JThD78**
**$H_2S$ Trace Detection Using Off-Axis Integrated Cavity Output Spectroscopy in the Near-Infrared,** *Weidong Chen[1], Anatoliy A. Kosterev[2], Frank K. Tittel[2]; [1]Lab de Physicochimie de l'Atmosphère, Univ. du Littoral Côte d'Opale, France, [2]Rice Quantum Inst., USA.* $H_2S$ trace detection has been performed by means of DFB diode laser-based off-axis integrated cavity output spectroscopy (OA-ICOS) near 1571.6 nm. A minimum detectable concentration of 700 ppb ($3\sigma$) was obtained.

**JThD79**
**Continuous Long-Term Observations of UV Laser- and LED-Induced Fluorescence of Processed Drinking Water,** *Anna V. Sharikova, Dennis K. Killinger; Univ. of South Florida, USA.* We have used a deep-UV laser-induced fluorescence system to monitor in real time organic species present in tap water. We have also tested a 265nm UV-LED as an excitation source for our system.

**JThD80**
**I/Q Data Processing Techniques for the Analysis of an Amplitude Modulated Laser Imaging System,** *Alan E. Laux, Linda J. Mullen, Brandon M. Cochenour; NAWCAD, USA.* I/Q data processing techniques utilizing the individual I & Q components are applied to the analysis of an amplitude modulated laser imaging system and shown to have advantages over the traditional magnitude only approach.

**JThD81**
**An Optical Fiber for Brillouin-Based Discriminative Sensing of Strain and Temperature,** *Weiwen Zou, Zuyuan He, Kazuo Hotate; Univ. of Tokyo, Japan.* A single mode fiber with a highly $GeO_2$-doped core and an F-doped inner-cladding is designed for Brillouin-based discriminative sensing of strain and temperature. The conditions to control high-order longitudinal acoustic modes are investigated.

**JThD82**
**Optical Reflectometry for *in-situ* Monitoring of Carbon Nanotubes Deposition by Optical Tweezers,** *Ken Kashiwagi[1], Shinji Yamashita[1], Sze Y. Set[2]; [1]Dept. of Electronic Engineering, Graduate School of Engineering, Univ. of Tokyo, Japan, [2]Alnair Labs Corp., Japan.* Reflectometry is adopted for *in-situ* monitoring of carbon nanotubes deposition to fiber end by optical tweezers. Reflectivity increases drastically once CNTs are deposited, and enhancement of layer uniformity is observed through damping of reflectivity flucutuation.

**JThD83**
**Multi-Species Trace Gas Detection by Rapidly Swept Cavity Ringdown Spectroscopy,** *Yabai He, Florian V. Englich, Brian J. Orr; Macquarie Univ., Australia.* A cavity ringdown spectrometer, based on a rapidly swept optical cavity and multiple-wavelength coherent radiation, detects several gas-phase molecules simultaneously. This comprises a compact, high-performance instrument for efficient spectroscopic sensing of gases.

**JThD84**
**Techniques Based on Digital Multiplexing Holography for Three-Dimensional Object Tracking,** *Jose A. Dominguez-Caballero, Nick Loomis, George Barbastathis, Jerome Milgram; MIT, USA.* Three techniques based on digital multiplexing holography for tracking objects in three-dimensional space are presented. Multiple holograms were combined into a single camera frame with high spatio-temporal resolution. Practical limitations and experiments are shown.

**JThD85**
**Compact Slit-Less Spectrometer Using Cylindrical Beam Volume Holograms,** *Chaoray Hsieh, Omid Momtahan, Ali Adibi; Georgia Tech, USA.* We present compact slit-less spectrometers using cylindrical beam holograms with several advantages over conventional spectrometers. We demonstrate large spectral range spectrometers using spatially multiplexed cylindrical beam holograms without adding any moving part in spectroscopic systems.

**JThD86**
**Phase Detection Based Surface Plasmon Resonance Biosensor in Infrared with Increased Sensitivity and Dynamic Range,** *Aykut Koc, Xiaobo Yin, Lambertus Hesselink; Stanford Univ., USA.* A novel method of phase-detection in the infrared is proposed to enhance the sensitivity and dynamic range of a single-wavelength Surface Plasmon Resonance biosensor. A structure is also proposed to prevent the sensitivity degradation.

**JThD87**
**A Chaotic Optical Cavity Combined with a Quantum Cascade Laser for Chemical Vapor Sensing,** *Abhishek Agrawal, Allen Hsu, Pat Whitworth, Evgenii Narimanov, Claire Gmachl; Princeton Univ., USA.* A novel multi-pass optical cavity with partially-chaotic ray dynamics has been combined with a Quantum Cascade laser for sensing of ethanol. The 4-cm diameter cavity shows an optical path length in the mid-infrared of ~4.5-m.

**JThD88**
**A Mid-IR DIAL System Using Interband Cascade Laser Diodes,** *Marcus Schuetz, Jack Bufton, Coorg R. Prasad; Science And Engineering Services, Inc, USA.* A compact, portable mid-IR differential absorption lidar system was built using Interband Cascade Lasers operating at 3.38 μm and 3.54 μm and its operation was demonstrated by measuring absorption of vapor phase ethanol.

## JThD • Poster Session III—Continued

**JThD89**
**Synthesis of Monodispersed DLC Nanoparticles in Intense Optical Field by Femtosecond Laser Ablation of Liquid Benzene,** *Takahiro Nakamura, Yuzuru Mochidzuki, Shunichi Sato; Inst. of Multidisciplinary Res. for Advanced Materials, Tohoku Univ., Japan.* We demonstrated a noble fabrication technique of highly monodispersed diamond-like carbon (DLC) nanoparticles in intense optical field (≈1018 W/cm2) by femtosecond pulsed laser ablation (PLA) directly from the liquid benzene.

**JThD90**
**Microbend Gratings Fabricated in Glass Substrates via Direct Writing with Near-Infrared Femtosecond Pulses,** *Jung-Ho Chung, Yu Gu, James G. Fujimoto; MIT, USA.* Microbend gratings were fabricated inside bulk glass via direct writing with femtosecond pulses from a multi-pass-cavity Ti:S laser. Critical periods, with maximum transmission loss, existed and shifted with waveguide refractive index, like fiber microbend gratings.

**JThD91**
***In-situ* Pulse Characterization for Silicon Micromachining,** *Xin Zhu, Tissa C. Gunaratne, Marcos Dantus; Michigan State Univ., USA.* Femtosecond pulse characterization and adaptive pulse compression is demonstrated using surface second harmonic generation from a silicon wafer using multiphoton intrapulse interference phase scan (MIIPS).

**JThD92**
**Temperature Dependence of Ultrafast Laser Ablation Efficiency of Crystalline Silicon,** *Ji Sang Yahng, Sae Chae Jeoung; KRISS, Republic of Korea.* Ultrafast laser ablation of crystalline silicon was investigated as a function of temperature. The ablation efficiency is slightly enhanced with an apparent decrease in ablation threshold and surface roughness at a high substrate temperature.

**JThD93**
**Inscription of Optical Waveguides with Ultrafast Bessel Beams,** *Véronique Zambon, Rosalie Forest, Nathalie McCarthy, Michel Piché; Univ. Laval, Canada.* Optical waveguides have been inscribed in fused silica by focusing femtosecond pulses with an axicon. The waveguides so fabricated exhibit low losses and no detectable birefringence due to their excellent circular symmetry.

**JThD94**
**Photonic Torque Microscope,** *Giovanni Volpe[1], Giorgio Volpe[1], Dmitri Petrov[1,2]; [1]ICFO, Spain, [2]ICREA, Spain.* A statistical analysis of the movement of an optically trapped sub-micron sphere in an external rotational force field permits us to measure the torque exerted on the sphere.

**JThD95**
**Design and Application of Circular Dammann Grating,** *Shuai Zhao, Fung Jacky Wen, Po Sheun Chung; Dept. of Electronic Engineering, City Univ. of Hong Kong, Hong Kong.* A novel circular Dammann grating is proposed to generate uniform-intensity impulse rings corresponding to different diffraction orders in the far field. Experimental demonstration and some applications are also presented.

**JThD96**
**Photonic Force Microscopy with Back-Scattered Light,** *Giovanni Volpe[1], Gregory Kozyreff[1,2], Dmitri Petrov[1,3]; [1]ICFO, Spain, [2]Optique Nonlinéaire Théorique, Univ. Libre de Bruxelles, Belgium, [3]ICREA, Spain.* We compare the sensitivity of the Photonic Force Microscope for the forward-scattering and backward-scattering geometries, calculating the total-scattered electromagnetic field from a dielectric bead in an optical trap using a Mie-Debye approach.

**JThD97**
**The Application of Laser-Driven Acoustic Waves in Modern Mass Spectrometry,** *Alexander V. Zinovev[1], Jerry F. Moore[2], Michael J. Pellin[1], Igor V. Veryovkin[1,2]; [1]Argonne Natl. Lab, USA, [2]MassThink, USA.* The generation of the acoustic vibration of laser back-irradiated thin metal foils and their influence on desorption of organic molecules from the foil's front surface were studied. The possible mechanisms of this phenomenon are discussed.

**JThD98**
**Toward 3-D Microfluidic Structures Fabricated with Two-Photon Laser Machining,** *Yibong Liu, Laura J. Pyrak-Nolte, David Nolte; Dept. of Physics, Purdue Univ., USA.* We have developed a method to fabricate 3-D microfluidic systems with two-photon polymerization in SU-8 photoresist. This approach will be an easy and accurate way to fabricate microfluidic systems simulating complex microstructures.

**JThD99**
**Application of Near-Field Optical Microscopy to the Study of Femtosecond Laser Micro-Structured Nd:YAG Crystals,** *Jorge Lamela[1], Francisco Jaque[1],[2], Gustavo Torchia[2], C. Mendez[2], I. Arias[2], L. Roso[2], Airan Ródenas[1], Daniel Jaque[1]; [1]Univ. Autonoma de Madrid, Spain, [2]Grupo de Optica, Dept. de Física Aplicada, Facultad de Ciencias Físicas, Spain.* The micro-structural modifications induced by femtosecond laser ablation of Nd:YAG crystals has been studied by Near Field Optical Microscopy. Results have been compared to those obtained from micro-luminescence experiments.

**JThD100**
**The Creation of Gaussian Beams with Extremely High Orbital Angular Momentum,** *Yana V. Izdebskaya, Vladlen Shvedov, Alexander Volyar; Taurida Natl. V. Vernadsky Univ., Ukraine.* We consider theoretically and experimentally an array of Gaussian beams whose axes lie on the surface of a hyperboloid of revolution. We show that such beams array can carry very high orbital angular momentum.

**JThD101**
**Increase of Ablation Rate Using Burst Mode Femtosecond Pulses,** *Jiyeon Choi, Robert Bernath, Mark Ramme, Martin Richardson; College of Optics/CREOL, Univ. of Central Florida, USA.* We investigate the ablation rates of metals and dielectrics using a Ti:Sapphire oscillator. Prior work on burst ablation has been performed using high-power lasers and significant increases were observed. These two modalities will be compared.

**JThD102**
**Multiscale Bessel Beams from Tunable Acoustic Gradient Index of Refraction Lenses,** *Euan McLeod, Craig B. Arnold; Princeton Univ., USA.* A device that uses acoustic waves within a fluid to phase modulate an incident laser beam and form tunable multiscale Bessel beams is presented. This device is both modelled and experimentally characterized.

**JThD103**
**SOI Ridge Waveguide Incorporating a Photonic Crystal Microcavity Multi-Channel Filter,** *Xiaohua Shi, Wei Ding, Duncan W. Allsopp; Univ. of Bath, UK.* A one-dimensional photonic crystal microcavity filter that transmits light simultaneously at several wavelengths has been designed and fabricated. Transmission peaks occurred at 1168, 1321 and 1562 nm wavelengths, meeting the design specification.

**JThD104**
**NOEMS Devices Based on Slot-Waveguides,** *Vilson R. Almeida[1,2], Roberto R. Panepucci[3]; [1]Inst. de Estudos Avancados (IEAv-CTA), Brazil, [2]Inst. Tecnologico de Aeronautica, Brazil, [3]Florida Intl. Univ. (FIU), USA.* We present device applications for Nano-Opto-Electro-Mechanical System (NOEMS) structures based on the evanescent-wave bonding acting on silicon slot-waveguides. Useful all-optical or electrooptical functionalities include: phase modulation, polarization mode dispersion, near-field probing and reconfigurable optical delay.

**JThD105**
**Monolithic Integration of Semiconductor Optical Amplifier and Photodiode through Quantum Well Intermixing,** *Jiansheng Tang[1], Shujun Yang[2], Apichai Bhatranand[3]; [1]Hunan First Normal College, China, [2]Applied Materials, Inc., USA, [3]King Mongkut's Univ. of Technology Thonburi, Thailand.* Monolithic integration of semiconductor optical preamplifier and photodiode is demonstrated through a two-stage laser-induced quantum well intermixing process. The integrated device has a peak responsivity of 5.7A/W and a 3-dB bandwidth of 14.7GHz.

**JThD106**
**Single Water Microdroplets Resting on a Superhydrophobic Surface: Largely Tunable Optical Microcavities,** *Alper Kiraz, Adnan Kurt, Mehmet Ali Dündar, Adem Levend Demirel; Koç Univ., Turkey.* More than 9 nm tunability of the whispering gallery modes of water microdroplets resting on a superhydrophobic surface is demonstrated. Tunability was achieved by introducing evaporation or condensation in microdroplets in a mini humidity chamber.

**JThD107**
**Random Laser Action inside a Photonic Crystal Fiber,** *Christiano J.S. de Matos[1], Leonardo de S. Menezes[2], Antonio M. Silva[2], Maria Alejandrina Martinez Gamez[3], Anderson S.L. Gomes[2], Cid B. de Araujo[2]; [1]Univ. Presbiteriana Mackenzie, Brazil, [2]Univ. Federal de Pernambuco, Brazil, [3]Ctr. de Investigaciones en Optica, Mexico.* Quasi-1-D random laser action is obtained in the liquid core of a photonic crystal fiber composed of a rutile-particle suspension in a rhodamine solution. Substantial improvement in efficiency is demonstrated in this novel laser geometry.

**JThD108**
**Tip-to-Sample Distance Control in Apertureless Near-Field Optical Microscopy,** *Alexander A. Milner, Kaiyin Zhang, Yehiam Prior; Weizmann Inst. of Science, Israel.* Novel mode of AFM operation is proposed providing the small, few nanometers tip to sample gap, appropriate for the ANSOM experiments. A set-up open for the run-time adjustments, working at ambient conditions is considered.

**JThD109**
**Demonstration of a Two Color 320 x 256 Quantum Dots-in-a-Well Focal Plane Array,** *Eric S. Varley[1], David Ramirez[1], Jay S. Brown[1], Sang Jun Lee[1], Andreas Stintz[1], Sanjay Krishna[1], Axel Riesinger[2], Mani Sundaram[2]; [1]Ctr. for High Technology Materials, Univ. of New Mexico, USA, [2]QmagiQ LLC, USA.* We report the first successful demonstration of a two color, co-located infrared focal plane array based on novel InAs/InGaAs quantum dots-in-a-well photodetectors. Two distinct responses (λ1~4.5um and λ2~8.5um) were observed under 300K f2 irradiance.

**JThD110**
**Dispersion Inversion in High Index Contrast AlGaAs-Nanowires,** *Joachim Meier, Mo Mojahedi, J. Stewart Aitchison; Univ. of Toronto, Canada.* We present numerical simulations of the temporal dispersion in high contrast AlGaAs nanowires, and predict the inversion of the group velocity dispersion for sub-micron sized wires.

**JThD111**
**Microring Resonators Using Multiphoton Absorption Polymerization,** *L. Li[1,2], W.-Y. Chen[1,2], T. N. Ding[1,2], W. N. Herman[1], P.-T. Ho[1,2], J. T. Fourkas[1,2]; [1]Lab for Physical Sciences, USA, [2]Univ. of Maryland, USA.* We demonstrate the fabrication of polymer microring add-drop filter using multiphoton absorption polymerization and present the characterization of these devices.

**JThD112**
**Super Mode Propagation in Low Index Medium,** *M. Z. Alam, J. Meier, J. S. Aitchison, M. Mojahedi; Univ. of Toronto, Canada.* We investigate a novel waveguide geometry consisting of a high dielectric medium adjacent to a metal plane with a thin low dielectric spacer. The mechanism of operation is explained and simulation results are presented.

**JThD113**
**Geometric Optics for Surface Plasmon Integrated Circuits,** *Fatemeh Eftekhari[1], Rashid Zia[2], Reuven Gordon[1]; [1]Univ. of Victoria, Canada, [2]Brown Univ., USA.* We use an analytic geometric optics method to solve for the cut-off, propagation and dispersion of surface plasmon stripe waveguides. Comprehensive computations are used to validate the method, which may be applied to other devices.

**JThD114**
**Non-Evanescently Pumped Raman Silicon Lasers Using Spiral-Shaped Microdisks,** *Hui Chen[1], Jonathan Y. Lee[1], Andrew W. Poon[1], H. K. Tsang[2]; [1]Hong Kong Univ. of Science and Technolgy, Hong Kong, [2]Chinese Univ. of Hong Kong, Hong Kong.* We propose non-evanescently pumped Raman silicon lasers using spiral-shaped microdisks. Our simulations suggest that pump lightwave can be seamlessly butt-coupled at the spiral notch, whereas the Stokes lightwave can be out-coupled either evanescently or non-evanescently.

**JThD115**
**Silicon Electro-Optic Switching Based on Coupled-Microring Resonators,** *Chao Li, Andrew W. Poon; Hong Kong Univ. of Science and Technology, Hong Kong.* We analyze silicon coupled-microring resonators-based electro-optic switching using injection-type p-i-n diodes. Numerical simulations and modeling suggest electronic-logic lightwave switching by applying two electrical data streams. We observe non-reciprocity between states (0, 1) and (1, 0).

**JThD116**
**Spiral-Shaped Microdisk Resonator Channel Drop/Add Filters: Asymmetry in Modal Distributions,** *Jonathan Y. Lee, Xianshu Luo, Andrew W. Poon; Hong Kong Univ. of Science and Technology, Hong Kong.* We report experiments and simulations of spiral-shaped microdisk resonator channel drop/add filters with a non-evanescently-coupled waveguide at the spiral notch. We observe asymmetry in modal distributions between the drop/add filters at the same resonance wavelengths.

**JThD117**
**Nonlinear Resonance Broadening and Shift Due to Thermo-Optical Instability in Microsphere Resonators,** *Arkadi Chipouline[1], Carsten Schmidt[1], Thomas Pertsch[1], Oleg Egorov[2], Falk Lederer[2], Andreas Tuennermann[3], Lev Deych[4]; [1]Ultra Optics Ctr., Germany, [2]Friedrich-Schiller Univ., Germany, [3]Fraunhofer Inst. of Optics and Fine Mechanics, Germany, [4]Queens College, USA.* Broadening of the resonance coupling peaks and their shifting have been observed in the tests of light coupling into the high-*Q* microspherical resonators. The both effects have been explained by thermo-optical nonlinearity causing resonance instability.

**JThD118**
**Silicon Depletion-Type Microdisk Electro-Optic Modulators Using Selectively Integrated Schottky Diodes,** *Nick K. Hon, Linjie Zhou, Andrew W. Poon; Hong Kong Univ. of Science and Technology, Hong Kong.* We report a design and analysis of silicon depletion-type microdisk electro-optic modulator with selectively integrated Schottky diodes. Our analysis suggests that the bandwidth is limited by the cavity lifetime rather than by the electrical performance.

## JThD • Poster Session III—Continued

**JThD119**
**Coupled-Mode Theory Analysis of Optical Bistability Involving Fano Resonances in High-*Q*/Vm Silicon Photonic Crystal Nanocavities,** *Xiaodong Yang, Chad Husko, Chee Wei Wong; Columbia Univ., USA.* We study optical bistability associated with Fano resonances in high-*Q*/Vm silicon photonic crystal nanocavities through the nonlinear coupled-mode theory framework. The $\chi^{(3)}$ effects, free-carrier dynamics, thermal effects, and linear losses are included and investigated numerically.

**JThD120**
**All-Optical Switching in Microring-Loaded Mach-Zehnder Interferometer Fabricated from Perfluorocyclobutyl (PFCB),** *Younggu Kim[1], Wei-lou Cao[1], Shengrong Chen[2], Dennis W. Smith[2], Warren N. Herman[1], Chi H. Lee[1]; [1]Lab for Physical Sciences, USA, [2]Tetramer Technologies, L.L.C, USA.* We demonstrate that all-optical switching in a microring-loaded Mach-Zhender interferometer fabricated from PFCB is possible, and obtained a response pulse width of about 30ps and a maximum modulation depth of 3.8 dB.

**JThD121**
**Design of Gradient Index (GRIN) Lens Using Photonic Non-Crystals,** *Paul Stellman[1], Kehan Tian[2], George Barbastathis[1]; [1]MIT, USA, [2]IBM Semiconductor Res. and Development Ctr., USA.* We use analytical and numerical techniques to design a cylindrical lens with a gradient index of refraction. In our device, we design the index distribution by using a photonic crystal with slowly-varying lattice parameters.

**JThD122**
**Optical Jitter Due to Refractive Index Variations in Slow-Light Photonic Crystal MZI Switches,** *Ashutosh R. Shroff, Philippe M. Fauchet; Univ. of Rochester, USA.* High effective index waveguides can reduce the size of integrated active MZIs significantly. We demonstrate numerically that they have high sensitivity to variations in material refractive index leading to significant pulse distortion due to jitter.

**JThD123**
**Transient Thermal Lensing at 1kHz Repetition Rate in a Cryogenically-Cooled High Average Power Ti:Sapphire Amplifier,** *Charles G. Durfee[1], Colby Childress[1], Wafa Amir[1], Thomas Planchon[1], Jeff A. Squier[1], Geoffrey H. Zeamer[2]; [1]Colorado School of Mines, USA, [2]Abbess Instruments and Systems, USA.* With 2-D spectral interferometry we characterize the transient thermal lensing in a liquid-nitrogen cooled cryostat designed for high thermal load. Even though the repetition rate is 1kHz, we observe substantial cooling between shots.

**JThD124**
**High Current Permanent Discharges in Air Induced by Femtosecond Laser Filamentation,** *Aurelien Houard[1], Ciro D'Amico[1], Yi Liu[1], Yves-Bernard Andre[1], Michel Franco[1], Bernard Prade[1], Estelle Salmon[2], Pascal Pierlot[3], Louis-Marie Cleon[3], Andre Mysyrowicz[1]; [1]Lab d'Optique Appliquée, ENSTA - Ecole Polytechnique, France, [2]LASIM, Univ. Lyon[1], CNRS, France, [3]Agence d'Essai Ferroviaire, SNCF, France.* Filaments created in air by an intense femtosecond laser pulse in the presence of an electric field generate a highly conductive permanent plasma column.

**JThD125**
**Wavefront Correction and Aberrations Pre-Compensation in the Middle of Petawatt-Class CPA Laser Chains,** *Federico Canova[1], Lorenzo Canova[1], Jean-Paul Chambaret[1], Xavier Levecq[2], Emeric Lavergne[2], Guillaume Dovillaire[2], Thomas Planchon[3]; [1]Lab d'Optique Appliquee - LOA, France, [2]Imagine Optic, France, [3]Colorado School of Mines, USA.* We describe preliminary experiences to validate correction of wavefront aberrations in middle of laser chain. This technique allows correction of aberrations from first part, and the pre-compensation of aberrations built in second part of laser.

**JThD126**
**Chirp-Dependent Above-Threshold Ionization,** *Takashi Nakajima; Inst. of Advanced Energy, Kyoto Univ., Japan.* By solving the three-dimensional Schrödinger equation for the sodium and hydrogen atoms we demonstrate that the above-threshold ionization spectra strongly depend on the chirp-rates of fs laser pulses.

**JThD127**
**Spatially Shaping the Longitudinal Focal Distribution into a Horseshoe-Shaped Profile,** *P. Brijesh, Terry J. Kessler, Jonathan D. Zuegel, David D. Meyerhofer; Lab for Laser Energetics, Univ. of Rochester, USA.* A novel three-dimensional laser focus, with a horseshoe-shaped longitudinal intensity profile, was realized experimentally from a single laser beam by the incoherent co-axial combination of Laguerre-Gaussian and Gaussian modes generated from segmented optical elements.

**JThD128**
**Generation of Isolated Sub-100-as XUV Pulses Using Time-Gate Assisted Few-Cycle Driving Pulses,** *Ya Cheng, Zhinan Zeng, Ruxin Li, Zhizhan Xu; State Key Lab of High Field Laser Physics, SIOM, China.* We propose a new approach to generating sub-100-as XUV pulses using time-gate assisted few-cycle driving pulses. Simulations show that the gate beam suppresses one electron trajectory, resulting in single electron trajectory in one driving cycle.

**JThD129**
**Pulse Shape Control of a High-Energy PW Laser for Fast Ignition of Laser Fusion,** *Keiichi Sueda[1], J. Lu[2], Kiminori Kondo[1], R. Mizoguchi[1], K. Tauchi[1], Noriaki Miyanaga[1]; [1]Inst. of Laser Engineering, Osaka Univ., Japan, [2]Yokogawa Electric Corp., Japan.* A laser-pulse shaping system of a high-energy PW laser has been developed for fast ignition of laser fusion. We have demonstrated flat-top pulses of 10 ps with a rise time of 1 ps.

**JThD130**
**Pump Beams Homogenization for Terawatt/Petawatt Class Ti:Sapphire Amplifiers,** *Federico Canova[1], Jean-Paul Chambaret[1], Fabien Reversat[2], Stephane Tisserand[2], Fabien Plé[3], Moana Pittman[3]; [1]Lab d'Optique Appliquee - LOA, France, [2]SILIOS Technologies, France, [3]LIXAM, France.* Our goal is to design robust configurations for Terawatt/Petawatt-class power amplifiers. We investigate the processes involved in Ti:Sa pumping: damage threshold of amplifying material, beam transport (relay-image or homogenization) and coherence properties of pump lasers.

**JThD131**
**Coherent Contrast Improvement by Cross-Polarized Wave Generation,** *Lorenzo Canova[1], Michele Merano[1], Aurélie Jullien[1], Gilles Chériaux[1], Rodrigo Lopez Martens[1], Olivier Albert[1], Nicolas Forget[2], Stoyan Kourtev[3], Nikolay Minkovsky[3], Solomon M. Saltiel[3]; [1]LOA, France, [2]FASTLITE, France, [3]Univ. of Sofia, Bulgaria.* Contrast improvement filter based on cross-polarized wave generation is addressing the coherent contrast issue by flattening the spectral phase of the pulse. Theoretical and experimental evidence of this effect on pulse spectrum are presented.

**JThD132**
**Optical Probing of Laser-Produced Plasmas for Laboratory Simulations of Magnetic Astrophysical Jets,** *Parrish C. Brady, Prashant Valanju, Roger Bengtson, Todd Ditmire; Univ. of Texas at Austin, USA.* We investigate laboratory simulations of magnetic astrophysical jets using optical probing. We have observed differences in laser-produced plasmas with and without a magnetic field using interferometric measurements.

**JThD133**
**Asymmetric Explosion of Laser-Irradiated Hydrogen Clusters,** *Yu-hsin Chen, Sanjay Varma, Vinod Kumarappan, Howard M. Milchberg; Inst. for Physical Science and Technology, Univ. of Maryland, USA.* Under conditions of small hydrogen cluster size, where we expected angular-dependent time-of-flight proton spectra consistent with isotropic coulomb explosions, we found explosion asymmetry with fast protons emitted preferentially in the direction of the laser polarization.

**JThD134**
**Optical Measurements of Heat and Shock Waves in a Dense Plasma,** *Irina V. Churina, Daniel R. Symes, Aaron C. Bernstein, Byoung-ick Cho, Todd Ditmire; Univ. of Texas at Austin, USA.* The dynamics of heat and shock waves in a dense plasma were studied using time-resolved reflectivity measurements of the rear surface of an aluminum foil following femtosecond irradiation at ~$5x10^{13}$ W/cm$^2$.

**JThD135**
**The Effect of Focal Geometry on Radiation from Atomic Ionization in Ultrastrong/Ultrafast Laser Field,** *Isaac Ghebregziabiher, Barry C. Walker; Univ. of Delaware, USA.* Larmor radiation calculated with non-paraxial approximation to the laser field peaks away from the laser propagation direction and has larger angular spread when compardd to the calculation with plane wave approximation.

**JThD136**
**Destructive Interference of High Harmonics Generated in Mixed Gases,** *Tsuneto Kanai, Eiji J. Takahashi, Yasuo Nabekawa, Katsumi Midorikawa; RIKEN, Japan.* We demonstrate destructive interference of high harmonics generated in a He-Ne mixed gas, which offers novel methods for observing the underlying attosecond electron dynamics as well as shaping harmonic pulses and measuring harmonic phases.

**JThD137**
**High-Dynamic-Range, 200-ps Window, Single-Shot Cross-Correlator for Ultrahigh Intensity Laser Characterization,** *Igor Jovanovic, Curtis Brown, Constantin Haefner, Miroslav Shverdin, Michael Taranowski, C. P. J. Barty; Lawrence Livermore Natl. Lab, USA.* A novel high-dynamic-range cross-correlator is presented that enables single-shot characterization of pulse contrast for ultrahigh intensity lasers in the temporal region up to 200 ps.

**JThD138**
**Spectral Broadening of Femtosecond Laser Pulses Using a Hollow Fiber with Symmetric Pressure Gradient,** *Samuel Bohman[1,2], Masanori Kaku[1], Akira Suda[1], Shigeru Yamaguchi[2], Katsumi Midorikawa[1]; [1]RIKEN, Japan, [2]Tokai Univ., Japan.* We propose and demonstrate a pulse compression technique using a symmetric pressure-gradient hollow fiber. This technique improves the spatial and spectral qualities of multi-mJ femtosecond laser pulses spectrally-broadened by self-phase modulation.

**JThD139**
**Accurate Contrast-Ratio Characterization of Femtosecond and Chirped Picosecond Pulses Using the Decorrelation of Third-Order Correlation Trace,** *Kyung-Han Hong, Jae Hee Sung, Tae Jun Yu, Il Woo Choi, Hyung Taek Kim, Young-Chul Noh, Do-Kyeong Ko, Jongmin Lee; Advanced Photonics Res. Inst., GIST, Republic of Korea.* We present the accurate characterization of the pulse contrast ratio using the decorrelation of high-dynamic-range third-order correlation traces. Experimental measurements with femtosecond and chirped picosecond pulses confirm the necessity of this method.

**JThD140**
**High Sensitive THz Faraday Rotation Measurements in Doped Semiconductors,** *Yohei Ikebe[1,2], Ryo Shimano[1,2]; [1]Dept. of Physics, Univ. of Tokyo, Japan, [2]PRESTO (JST), Japan.* We present a highly sensitive terahertz Faraday measurement scheme with the detection sensitivity of Faraday rotation as small as 1 mrad. The scheme was applied to n-doped Si to examine the carrier density and mobility.

NOTES

### *PhAST* ROOM 1 (EXHIBIT FLOOR)

**JOINT**

### 1:30 p.m. – 3:30 p.m.
### JThE • Joint CLEO/*PhAST* Symposium on BioPhotonics and Applications II

*Thomas Baer; Arcturus, USA and Jim Fujimoto; MIT, USA, Presiders*

**JThE1 • 1:30 p.m.** **Invited**
**Multi-Functional Video-Rate Optical Coherence Tomography Microscopy,** *James Jiang, Alex Cable; Thorlabs, USA.* A swept source OCT system capable of simultaneous imaging sample structural and bloodflow information is demonstrated. This system also has 3-D imaging capability which combines the advantages of OCT and microscopy in a single system.

**JThE2 • 2:00 p.m.** **Invited**
**Advances in Fourier Domain Optical Coherence Tomography,** *Eric Buckland; Bioptigen, USA.* Fourier-domain OCT enables the first real-time micrometer-scale imaging, with vastly superior image quality than previous implementations. Technologies driving resolution and acquisition speed continue to advance, while products increasingly emphasize image analysis and application-specific functionality.

### *PhAST* ROOM 2 (EXHIBIT FLOOR)

***PhAST***

### 1:30 p.m. – 3:30 p.m.
### PThC • Emerging Applications and Technologies

*Kunihiko Washio; Paradigm Laser Res. Ltd., Japan, Presider*

**PThC1 • 1:30 p.m.** **Invited**
**Precision Resistor Laser Trimming for Analog Microelectronics,** *Michel Meunier[1,2], Yves Gagnon[2], Alain Lacourse[2], Mathieu Ducharme[2], Simon Rioux[2], Yvon Savaria[1,2]; [1]Ecole Polytechnique de Montreal, Canada, [2]LTRIM Technologies, Canada.* A fast, low cost laser trimming technique of highly accurate resistor has been developed for analogue microelectronics. Modelling of the technique is described and an example of tuning a reference voltage circuit is given.

**PThC2 • 2:00 p.m.**
**Asymmetrical $M^2$ in Solid-State Laser Beam Shaping for the Line Scanning Laser Annealing,** *Maxim Ya. Darscht, Yuri V. Miklyaev, Alexei V. Mikhailov, Vitalij N. Lissotschenko; LIMO GmbH, Germany.* A new type of beam shaping system in combination with characterization of laser parameters provides several mm depth of focus by narrow width and good homogenization of the line-shaped laser intensity distribution for scanning annealing.

**PThC3 • 2:15 p.m.**
**Micromachining with Tailored Pulse Parameters,** *Hans Herfurth[1], Tim Lauterborn[1], Stefan Heinemann[1], Henrikki Pantsar[2]; [1]Fraunhofer USA, USA, [2]VTT Technical Res. Ctr. of Finland, Finland.* Experiments on different metals and silicon were conducted to optimize removal rate or surface finish with nanosecond pulses of different parameters. A special fiber laser allows independent adjustment of pulse parameters while keeping beamquality constant.

### *PhAST* ROOM 3 (EXHIBIT FLOOR)

### 1:30 p.m. – 3:30 p.m.
### PThD • High-Power Lasers Systems II

*Hagop Injeyan; Northrop Grumman Corp, USA, Presider*

**PThD1 • 1:30 p.m.** **Invited**
**Commercial Laser Peening for Fatigue Resistance and Mechanical Shaping of Metal Components,** *Brent Dane; Metal Improvement Co., USA.* Abstract not available.

**PThD2 • 2:00 p.m.** **Invited**
**Laser Coating Removal: The Modern Alternative to Sandpaper,** *James Thomas; General Lasertronics, USA.* While laser paint removal is not a new concept, advancements in high average power lasers and control schemes have made them a viable option for industrial de-coating. I will discuss these advancements and the results.

**ROOM 318-320**

CLEO

### 2:30 p.m. – 4:15 p.m.
### CThS • Waveguide Writing with Ultrashort Lasers
*Narasimha S. Prasad; NASA Langley Res. Ctr., USA, Presider*

**CThS1 • 2:30 p.m.**
**Writing High-Strength Bragg Grating Waveguides in Bulk Glasses with Picosecond Laser Pulses,** *Haibin Zhang, Shane M. Eaton, Jianzhao Li, Amir H. Nejadmalayeri, Peter R. Herman; Univ. of Toronto, Canada.* Strong >30-dB first-order Bragg-gratings were inscribed inside borosilicate glasses in a single laser waveguide-writing step driven by type-II photosensitivity response. Mode profiles, propagation losses, waveguide birefringence, and grating responses were optimized for the Telecom band.

**CThS2 • 2:45 p.m.**
**Integration of Optical Waveguides and MicrofluidicChannels Fabricated by Femtosecond Laser Irradiation,** *Valeria Maselli[1], Roberto Osellame[2], Rebeca Martinez Vazquez[2], Paolo Laporta[1], Giulio Cerullo[1]; [1]Dept. di Fisica - Politecnico di Milano, Italy, [2]Inst. di Fotonica e Nanotecnologie - CNR, Italy.* We use a femtosecond laser to fabricate on a glass substrate both microfluidic channels and high quality optical waveguides, intersecting each other. Waveguide-channel integration opens new prospects for in-situ sensing in lab-on-chip devices.

**ROOM 321-323**

CLEO

### 2:30 p.m. – 4:15 p.m.
### CThT • Ceramic Lasers
*Mark Dubinskii; ARL, USA, Presider*

**CThT1 • 2:30 p.m.** Invited
**Synthesis and Performance of Advanced Ceramic Lasers,** *Akio Ikesue; World Lab Co., Ltd., Japan.* We demonstrated not only high-efficiency laser generation from polycrystalline Nd:YAG ceramics for the first time, but succeeded in fabrication of high-functional ceramic lasers such as composite, fiber, micro-sphere, and single crystal by sintering method, etc.

**ROOM 324-326**

CLEO

### 2:30 p.m. – 4:15 p.m.
### CThU • THz Imaging and Applications
*Daniel Mittleman; Rice Univ., USA, Presider*

**CThU1 • 2:30 p.m.** Tutorial
**Terahertz Technology in Outer and *Inner* Space,** *Peter Siegel; Caltech and JPL, USA.* After 30 years of niche applications in space science, the field of Terahertz Technology is entering a true Renaissance. This talk surveys terahertz technology and applications from space science and spectroscopy to recent biomedical uses.

**ROOM 314**

CLEO

### 2:30 p.m. – 4:15 p.m.
### CThV • Nonlinear Optics of Nanostructures
*Presider to Be Announced*

**CThV1 • 2:30 p.m.**
**Carbon Nanotube-Polyimide Saturable Absorbing Waveguide Made by Simple Photolithography,** *Toshiyuki Oomuro[1,2], Ryousaku Kaji[1], Tarou Itatani[1], Hiroyuki Ishii[1], Emiko Itoga[1], Hiromichi Kataura[1], Masafumi Yamashita[2], Masahiko Mori[1], Youichi Sakakibara[1]; [1]Natl. Inst. of Advanced Industrial Science and Technology, Japan, [2]Tokyo Univ. of Science, Japan.* Using photosensitive polyimide, we fabricated a buried waveguide containing carbon nanotubes by a simple photolithography process. Anisotropic linear absorption and saturable absorption due to the alignment of nanotubes were observed in the guided transmission.

**CThV2 • 2:45 p.m.**
**Resonant Nonlinear Optical Properties of CdSe Quantum Dots,** *Gero Nootz, Lazaro A. Padilha, Scott Webster, David J. Hagan, Eric W. Van Stryland; Univ. of Central Florida, USA.* We report theoretical and experimental results of nonlinear absorption and refraction in a series of colloidal CdSe quantum-dots. A two-level-model is used to describe the nonlinearities when quantum-dots are excited close to their first resonance.

**ROOM 315**

JOINT

### 2:30 p.m. – 4:15 p.m.
### JThF • Laser Wakefield and Relativistic Plasma Interactions
*Donald Umstadter; Univ. of Michigan, USA, Presider*

**JThF1 • 2:30 p.m.**
**Direct Laser Acceleration of Electrons in the Corrugated Plasma Waveguide,** *Andrew G. York, Brian Layer, Howard M. Milchberg; Inst. for Physical Science and Technology, USA.* Direct electron acceleration by a radially polarized laser pulse can be quasi-phase matched in a corrugated plasma channel [1]. Modest laser pulses (1 mJ, 100fs) could give large gradients (> 10 MV/cm) over many centimeters.

**JThF2 • 2:45 p.m.** Invited
**Injection of Electrons into Plasma Waves by Colliding Laser Pulses into an Underdense Plasma,** *Jerome Faure, Clément Rechatin, Andreas Norlin, Agustin Lifschitz, Victor Malka; Lab d'Optique Appliquee, France.* Controlled injection of electrons into a laser-plasma accelerator is achieved by colliding two counter-propagating laser pulses into a plasma. It results in monoenergetic, high quality, stable and tuneable electron beams (from 15 to 300 MeV).

**ROOM 316**

CLEO

### 2:30 p.m. – 4:15 p.m.
### CThW • Fabrication of Periodic Nanostructures
*Presider to Be Announced*

**CThW1 • 2:30 p.m.** Invited
**Nanofabricated Negative Permeability Media,** *Alex Grigorenko; Univ. of Manchester, UK.* We describe negative index optical media produced by pairs of gold nanopillars. We demonstrate new phenomena of optical impedance matching, negative optical path length and discuss possible applications of the media for biosensing and nanotweezing.

**ROOM 317**

CLEO

### 2:30 p.m. – 4:15 p.m.
### CThX • Optical Combs Technology I
*Ingmar Hartl; IMRA America, Inc., USA, Presider*

**CThX1 • 2:30 p.m.**
**Nearly Three-Octave-Spanning Frequency Comb from a Phase-Controlled Femtosecond Ti:sapphire Laser and Synchronously Pumped Optical Parametric Oscillator,** *Jinghua Sun, Barry J. S. Gale, Derryck T. Reid; Heriot-Watt Univ., UK.* A repetition-rate-stabilized frequency comb ranging from the violet to the mid-infrared is obtained by phase-locking a femtosecond Ti:sapphire laser and synchronously pumped optical parametric oscillator to a common supercontinuum reference.

**CThX2 • 2:45 p.m.**
**Carrier-Envelope Phase Measurement and Control of Sub-10fs Laser Pulse at High Repetition Rate with Difference Frequency Technique,** *Yangying Zhao, Wei Zhang, Hainian Han, Qiang Du, Zhiyi Wei; Beijing Natl. Lab for Condensed Matter Physics, Inst. of Physics, Chinese Acad. of Sciences, China.* 6~8fs laser pulses at repetition rates of 160MHz and 350MHz were generated from Ti:sapphire oscillators with unprecedented simplicity. By difference frequency the ultrabroaden spectrum with PPLN crystal, we measured and locked the carrier-envelope phase.

**ROOM 336**

QELS

### 2:30 p.m. – 4:15 p.m.
### QThG • Plasmonics III
*Anatoly V. Zayats; Queen's Univ. of Belfast, UK, Presider*

**QThG1 • 2:30 p.m.** Invited
**Metal Strips and Wires as Plasmonic Waveguides for Integrated-Optics Components,** *Alexandra Boltasseva[1], Kristjan Leosson[2], Sergey I. Bozhevolnyi[3], Thomas Søndergaard[3], Kasper B. Jørgensen[4], Rasmus H. Pedersen[4], Anders Kristensen[4]; [1]COM•DTU, Denmark, [2]Univ. of Iceland, Iceland, [3]Aalborg Univ., Denmark, [4]MIC, DTU, Denmark.* Propagation of long-range surface plasmon polaritons in different waveguide components based on nm-thin and µm-wide metal strips and symmetrical sub-wavelength metal nanowires embedded in a uniform dielectric is experimentally studied at telecom wavelengths.

ROOM 337

## QELS

### 2:30 p.m. – 4:15 p.m.
### QThH • Quantum Communication

*James P. Clemens; Dept. of Physics, Miami Univ., USA, Presider*

**QThH1 • 2:30 p.m.** Invited

**Efficient Source of Single Photons from Charge-Tunable Quantum Dots in a Micropillar Cavity,** *Matthew T. Rakher[1], Stefan Strauf[1,2], Nick Stoltz[3], Larry Coldren[3], Pierre Petroff[3], Dirk Bouwmeester[1]; [1]Physics Dept., USA, [2]Physics Dept., Stevens Inst. of Technology, USA, [3]Materials Dept., USA.* A single photon source is demonstrated using a novel oxide-apertured micropillar cavity embedded with InGaAs quantum dots. A bright 80 MHz count rate is enabled by the Purcell effect and charge-tuning of the quantum dots.

ROOM 338

## C L E O

### 2:30 p.m. – 4:15 p.m.
### CThY • Remote Sensing I

*Sukesh Roy; Innovative Scientific Solutions, Inc., USA, Presider*

**CThY1 • 2:30 p.m.**

**Regional Aerosol Transport Study Using a Compact Aircraft Lidar,** *Jasper R. Lewis[1], Russell J. DeYoung[2], Kurt Severance[2]; [1]Hampton Univ., USA, [2]NASA Langley Res. Ctr., USA.* A compact aircraft lidar using a Nd:YAG pulsed laser, fiber coupled telescope, and three-channel receiver was flown in the Norfolk-Virginia Beach and California Central Valley regions to show lidar can reveal complex regional aerosol distributions.

**CThY2 • 2:45 p.m.** Invited

**RADAR REMPI: A New Approach to Detection, Spectroscopy and the Dynamics of Gases for Combustion, Fluid Dynamics and Homeland Defense,** *Richard Miles, Zhili Zhang, Mikhail N. Shneider, Sohail H. Zaidi; Princeton Univ., USA.* Radar REMPI has the promise of remotely measuring atomic and molecular species with high sensitivity and high selectivity. High sensitivity is achieved through detection by microwave scattering. High selectivity is achieved through resonant enhanced ionization.

ROOM 339

### 2:30 p.m. – 4:15 p.m.
### CThZ • Applications of Photonic Crystals

*Presider to Be Announced*

**CThZ1 • 2:30 p.m.**

**Chip-Scale Photonic Crystal Spectrometers with High Resolution for Lab-on-a-Chip Sensing Applications,** *Babak Momeni, Ehsan Shah Hosseini, Murtaza Askari, Saeed Mohammadi, Mohammad Soltani, Ali Adibi; Georgia Tech, USA.* We demonstrate that utilizing unique PC dispersive properties (superprism effect, negative diffraction, and negative refraction) results in high-resolution on-chip spectrometers. Such spectrometers are of interest for spectral interrogation of optical signals in lab-on-a-chip sensing applications.

**CThZ2 • 2:45 p.m.**

**Label-Free Optical Biosensor Built with Two-Dimensional Silicon Photonic Crystal Microcavity,** *Mindy Lee[1], Philippe M. Fauchet[1,2]; [1]Inst. of Optics, Univ. of Rochester, USA, [2]Dept. of Electrical and Computer Engineering, Univ. of Rochester, USA.* We experimentally demonstrate a silicon-based photonic crystal microcavity biosensor. This device is capable of detecting ~1 femtogram of analyte. Its performance is tested with glutaraldehyde-BSA model for quantitive measurements and biotin-streptavidin recognition for selectivity demonstration.

ROOM 340

### 2:30 p.m. – 4:15 p.m.
### CThAA • Optical Fiber Applications

*John Harvey; Univ. of Auckland, New Zealand, Presider*

**CThAA1 • 2:30 p.m.** Invited

**Fiber-Based All-Optical Sampling,** *Mathias Westlund; Dept. of Microelectronics, Photonic Lab, Chalmers Univ. of Technology, Sweden.* Optical sampling techniques that provide sub-picosecond temporal resolution are reviewed in terms of complete system performance. Several critical design trade-offs among the performance measures are identified. We briefly discuss techniques for high-speed real-time optical sampling.

ROOM 341

### 2:30 p.m. – 4:15 p.m.
### CThBB • Security Issues in Optical Networking

*David Moss; JDS Uniphase Corp., Canada, Presider*

**CThBB1 • 2:30 p.m.**

**Demonstration of 1550 nm QKD with ROADM-Based DWDM Networking and the Impact of Fiber FWM,** *Paul Toliver[1], Robert J. Runser[1,2], Tom Chapuran[1], Matthew S. Goodman[1], Janet Jackel[1], Scott R. McNown[2], Richard J. Hughes[3], C. G. Peterson[3], Kevin McCabe[3], Jane E. Nordholt[3], Kush Tyagi[3], Phil Hiskett[3], Nick Dallmann[3]; [1]Telcordia Technologies, Inc., USA, [2]Lab for Telecommunications Sciences, USA, [3]Los Alamos Natl. Lab, USA.* We demonstrate compatibility of 1550 nm QKD with a MEMS-based ROADM and also show that four-wave mixing resulting from copropagating DWDM signals can become the dominant source of background noise within the QKD channel passband.

**CThBB2 • 2:45 p.m.** Invited

**Enhanced Confidentiality with Multi-Level Phase Scrambling in SPE-OCDMA,** *Anjali Agarwal, Ronald Menendez, Paul Toliver, Janet Jackel, Shahab Etemad; Telcordia Technologies, USA.* We demonstrate multi-level phase scrambling in a multi-user, WDM-compatible SPE-OCDMA system through the programmable control of optical phase. Self-obscuring groups coupled with phase scrambling is a promising technique for photonic layer confidentiality in networks.

*PhAST* ROOM 1
(EXHIBIT FLOOR)

## J O I N T

### JThE • Joint CLEO/*PhAST* Symposium on BioPhotonics and Applications II—Continued

**JThE3 • 2:30 p.m.** Invited

***In vivo* Imaging Using Harmonic Generation Microscopy,** *Chi-Kuang Sun; Natl. Taiwan Univ., Taiwan.* With a virtual-transition characteristic, harmonic generation microscopy provides high-penetration non-invasive intravital optical images with a sub-micron 3-D resolution, ideal for *in vivo* disease diagnoses and longterm live animal studies.

*PhAST* ROOM 2
(EXHIBIT FLOOR)

## *P h A S T*

### PThC • Emerging Applications and Technologies—Continued

**PThC4 • 2:30 p.m.**

**Laser Dicing,** *Brian Hoekstra; Applied Photonics, USA.* Abstract not available.

**PThC5 • 2:45 p.m.**

**Laser Processing Silicon Wafers,** *Richard Toftness; Vision Res. Inc., USA.* Abstract not available.

*PhAST* ROOM 3
(EXHIBIT FLOOR)

### PThD • High-Power Lasers Systems II—Continued

**PThD3 • 2:30 p.m.** Invited

**ZEUS Highly Mobile Laser Ordnance Neutralization System,** *Owen Hofer; Sparta, USA.* ZEUS is a self-contained laser system, which has evolved from a low powered system performing time independent missions to a higher powered system performing time dependent missions such as IEDs clearance of main supply routes.

ROOM 318-320

## CLEO

### CThS • Waveguide Writing with Ultrashort Lasers—Continued

**CThS3 • 3:00 p.m.**
**Femtosecond Laser Fabrication of Directional Couplers and Mach-Zehnder Interferometers,** *Yu Gu, Jung-Ho Chung, James G. Fujimoto; MIT, USA.* Spectral behavior of directional couplers and unbalanced Mach-Zehnder interferometers fabricated in glass with a MPC Ti:Sapphire laser is characterized. Spectral features can be controlled by controlling physical device parameters as well as writing speed.

**CThS4 • 3:15 p.m.**
**Submicron-Period Waveguide Bragg Gratings Direct Written by an 800-nm Femtosecond Oscillator,** *Jung-Ho Chung, Yu Gu, James G. Fujimoto; MIT, USA.* Using femtosecond pulses from a multi-pass-cavity Ti:S oscillator, submicron-period Bragg gratings were fabricated inside waveguides in bulk glasses without any phase masks. Transmission spectra with resonance wavelengths in the optical communication band were successfully observed.

**CThS5 • 3:30 p.m.**
**Femtosecond Laser Written Waveguide Arrays with Tailored Supermodes,** *Michael N. Nguyen, Kenneth H. Church; Oklahoma State Univ., USA.* Evanescently coupled waveguide arrays are written in fused silica using femtosecond laser pulses. Array supermodes are tailored by adjusting the writing conditions of a common central core and agree with Scattering Matrix Method simulations.

ROOM 321-323

### CThT • Ceramic Lasers—Continued

**CThT2 • 3:00 p.m.**
**Brightness Enhancement Using Core Doped Nd:YAG Ceramic Rods for Side Pumped Laser Heads in Laser Amplifiers and Oscillators,** *Alexander Sträßer, Martin Ostermeyer, Abdulrahman Scheikh Obeid; Univ. of Potsdam / Inst. of Physics, Germany.* Core doped Nd:YAG ceramic rods are employed in amplifier and oscillator setups. SBS-phase conjugating mirrors are applied to compensate for the rod's refractive index step. Brightness enhancement of 2 is demonstrated compared to conventional rod.

**CThT3 • 3:15 p.m.**
**Oscillation Property of Rod-Type Nd/Cr:YAG Ceramic Lasers with Quasi-Solar Pumping,** *Taku Saiki, Shinji Motokoshi, Kazuo Imasaki, Hisanori Fujita, Masahiro Nakatsuka, Yasukazu Izawa, Chiyoe Yamanaka; Inst. for Laser Technology, Japan.* We observed laser oscillations of rod-type Nd/Cr:YAG ceramics experimentally pumped using an arc-metal-halide lamp having a similar spectrum to solar light. An high optical-optical conversion efficiency of 43% was obtained by Cr ions co-doping.

**CThT4 • 3:30 p.m.**
**Specificity of Thermal Lensing in Laser Ceramics,** *Ilya Snetkov, Ivan Mukhin, Oleg Palashov, Efim A. Khazanov; Inst. of Applied Physics, Russian Federation.* We developed a model of thermal lens in laser ceramics, which takes into account random nature of grains orientation. Analytical equations for thermally induced phase predict phase modulation with characteristic scale of about grain size.

ROOM 324-326

### CThU • THz Imaging and Applications—Continued

**CThU2 • 3:30 p.m.**
**Continuous-Wave Terahertz Imaging with a Hybrid System,** *Torsten Löffler, Thilo May, Ali Alcin, Bernd Hils, Christian am Weg, Hartmut G. Roskos; Johann Wolfgang Goethe-Univ., Germany.* A hybrid system for THz reflectometric imaging at 0.6 THz synchronizes a multiplied Gunn source with a femtosecond lasers for electro-optic detection and reaches 60 db dynamic range and 25 ms measurement time per pixel.

ROOM 314

### CThV • Nonlinear Optics of Nanostructures—Continued

**CThV3 • 3:00 p.m.**
**Hierarchy in Optical Near-Fields by Nano-Scale Shape Engineering and its Application to Traceable Memory,** *Makoto Naruse[1,2], Takashi Yatsui[3], Jun Hyoung Kim[2], Motoichi Ohtsu[2]; [1]Natl. Inst. of Information and Communications Technology, Japan, [2]Univ. of Tokyo, Japan, [3]Japan Science and Technology Agency, Japan.* We numerically and experimentally studied the hierarchy of optical near-fields by engineering the shape of metal plates at nanometer-scale. Combined with localized energy-dissipation, this hierarchy should enable novel functionality, such as traceability of optical memories.

**CThV4 • 3:15 p.m.**
**Reducing Feature-Sizes of Two-Photon Polymerized Lines by Re-Polymerization in SCR500,** *Yan Li, Fengjie Qi, Dengfeng Tan, Hong Yang, Qihuang Gong; Peking Univ., China.* Based on re-polymerization between two structures close to each other, the feature-sizes of two-photon polymerized lines using SCR500 were reduced to wavelength/50, which demonstrated the potential for high resolution three-dimensional nanofabrication.

**CThV5 • 3:30 p.m.**
**Parametric Oscillation via Dispersion-Compensation in High-*Q* Microspheres,** *Imad H. Agha, Yoshitomo Okawachi, Mark A. Foster, Jay E. Sharping, Alexander L. Gaeta; School of Applied Physics, Cornell Univ., USA.* We demonstrate theoretically and experimentally that parametric oscillation via phase-matched four-wave mixing can be achieved in silica microspheres by suitable choice of size and pump power.

ROOM 315

## JOINT

### JThF • Laser Wakefield and Relativistic Plasma Interactions—Continued

**JThF3 • 3:15 p.m.**
**Wakefield Acceleration of Quasi-Monoenergetic 200MeV Electrons in Nitrogen and Helium Gas Targets,** *Zheng L. Chen, Ying Y. Tsui, Neda Naseri, Wojciech Rozmus, Robert Fedosejevs; Univ. of Alberta, Canada.* Quasi-monoenergetic electron beams of energies over 200MeV with high flux are generated from both nitrogen and helium gas with a modest laser power of 6.5TW. 2-D PIC simulations are in progress to compare to experiments.

**JThF4 • 3:30 p.m.**
**Coherence-Based Transverse Measurement of Synchrotron X-Ray Radiation from Relativistic Laser-Plasma Interaction and of Laser-Accelerated Electrons,** *Rahul C. Shah[1], F. Albert[1], K. Ta Phuoc[1], F. Burgy[1], J.-P. Rousseau[1], O. Shevchenko[1,2], D. Boschetto[1], A. Rousse[1], A. Pukhov[3], S. Kiselev[3]; [1]Lab d'Optique Appliquée, France, [2]Budker Inst. of Nuclear Physics, Russian Federation, [3]Inst. fur Theoretische Physik I, Heinrich-Heine-Univ., Germany.* Fresnel diffraction of X-ray beam from laser-plasma interaction shows incoherent-source diameter <8 µm. Analysis shows this corresponds to accelerated electron profile in plasma agreeing with simulation.

ROOM 316

## CLEO

### CThW • Fabrication of Periodic Nanostructures—Continued

**CThW2 • 3:00 p.m.**
**Enhanced Aspect Ratio of Focused Ion Beam Nanopatterning Technique in Semiconductors,** *Alex Hayat[1], Meir Orenstein[1], Alex Lahav[2]; [1]Dept. of Electrical Engineering, Technion, Israel, [2]Nano-Electronics Ctr., Technion, Israel.* We demonstrate a more than 10 aspect-ratio FIB semiconductor nanopatterning technique. The undesired semiconductor material decomposition by the beam-tail ions is prevented by a protective Ti layer acting as a mask for the semiconductor.

**CThW3 • 3:15 p.m.**
**Wafer Scale Texturing of LiNbO$_3$,** *Vijay P. Sivan[1], Anthony Holland[1], Lam Bui[1], Timothy Priest[2], Arnan Mitchell[1]; [1]RMIT Univ., Australia, [2]Defence Science Technology Organisation, Australia.* We report a novel technique for micro texturing of LiNbO$_3$. Well-defined raised ridges and etched trenches are demonstrated. This technique is suitable for the realization of surface relief gratings and photonic crystals.

**CThW4 • 3:30 p.m.**
**Diffractive Optical Elements Based Single-Step Fabrication of 3-Dimensional Photonic Crystal Templates,** *Debashis Chanda, Peter R. Herman; Univ. of Toronto, Canada.* A single laser exposure method of forming three-dimensional photonic crystal templates in photoresist has been demonstrated with multi-layer diffractive optical elements. Several photonic stopbands are identified in the near-infrared spectrum along multiple crystallographic directions.

ROOM 317

### CThX • Optical Combs Technology I—Continued

**CThX3 • 3:00 p.m.** Invited
**High-Resolution Spectroscopy with Femtosecond Optical Combs,** *Jason Stalnaker[1], S. A. Diddams[1], T. M. Fortier[1,2], V. Gerginov[1], Y. Le Coq[1], V. Mbele[1,3], C. W. Oates[1], D. Ortega[4], C. E. Tanner[5], L. Hollberg[1]; [1]NIST, USA, [2]Los Alamos Natl. Lab, USA, [3]School of Physics, Univ. of the Witwatersrand, South Africa, [4]Gleb Wataghin Physics Inst., State Univ. of Campinas, Brazil, [5]Univ. of Notre Dame, USA.* A stabilized femtosecond frequency comb has ~106 stable optical modes spanning hundreds of terahertz, making it an ideal tool for high-resolution spectroscopy. We demonstrate some features of frequency-comb spectroscopy using experiments involving calcium and cesium.

**CThX4 • 3:30 p.m.**
**Controlling Carrier-Envelope Phase of Grating-Based Chirped Pulse Amplifiers,** *Chengquan Li, Eric Moon, Zenghu Chang; J.R.Macdonald Lab, Dept. of Physics, Kansas State Univ., USA.* It was demonstrated that the carrier-envelope phase is sensitive to the variation of stretcher grating separation. By feedback controlling the grating separation, the phase of the amplified laser pulses is stabilized without disturbing the oscillator.

ROOM 336

## QELS

### QThG • Plasmonics III—Continued

**QThG2 • 3:00 p.m.**
**Coupling of Nano-Stripe and Nano-Slot Plasmonic Waveguides,** *Yinon Satuby, Nikolai Berkovitch, Meir Orenstein; Technion, Israel Inst. of Technology, Israel.* Coupling effects between two types of surface-plasmon-polariton waveguides in the subwavelength regime (stripes and slots) are measured experimentally at $\lambda$ = 1.55µm using near field microscopy and validated by finite element modal calculations.

**QThG3 • 3:15 p.m.**
**Measuring Group Velocity of Surface Plasmons by Surface Plasmon Interferometry,** *Vasily V. Temnov[1], Ulrike Woggon[1], José Dintinger[2], Eloise Devaux[2], Thomas W. Ebbesen[2]; [1]Experimentelle Physik IIb, Germany, [2]Univ. Louis Pasteur, France.* Broadband optical transmission spectra of metal films with subwavelength slit-groove pairs show pronounced interference fringes by surface plasmons travelling between slits and grooves. Interferometric fringe analysis provides accurate values for group velocity of surface plasmons.

**QThG4 • 3:30 p.m.**
**Metal-Less Optical Surface Plasmon Polariton,** *Pavel Ginzburg, Meir Orenstein; Technion, Israel.* We propose a Surface Plasmon Polarition based guiding at the interface of a dielectric and semiconductor quantum well structure, exhibiting a negative electrical permeability and possible gain in the vicinity of optical transition resonance.

### QThH • Quantum Communication—Continued

**QThH2 • 3:00 p.m.**
**Coherent Single-Photon Generation and Trapping with Practical Cavity QED Systems,** *David A. Fattal*[1], *Raymond G. Beausoleil*[1], *Yoshihisa Yamamoto*[2]; [1]*Hewlett-Packard Labs, USA,* [2]*Stanford Univ., USA.* We show how to coherently trap or generate a single photon in a practical cavity QED system that could operate well within the weak-coupling regime, and in the presence of realistic imperfections.

**QThH3 • 3:15 p.m.**
**Optical Coherent Manipulation of a Spin Wave in Tm:YAG,** *Anne Louchet, Yann Le Du, Fabien Bretenaker, Thierry Chanelière, Fabienne Goldfarb, Ivan Lorgeré, Jean-Louis Le Gouet; Lab Aimé Cotton, France.* Nuclear spin states are optically characterized in thulium-doped YAG. Thulium is considered as a substitute to praseodymium and europium in the prospect of quantum light storage in solids.

**QThH4 • 3:30 p.m.**
**One-Way Continuous-Variable Quantum Key Distribution over 5km of Standard Telecom Fiber,** *Lei-Lei Huang, Bing Qi, Li Qian, Hoi-Kwong Lo; Univ. of Toronto, Canada.* We report the first experimental demonstration of one-way Gaussian-modulated coherent state quantum key distribution system over kilometers of standard telecom fiber. Under realistic assumptions, the achievable secrete key rate is over 10kb/s.

### CThY • Remote Sensing I—Continued

**CThY3 • 3:15 p.m.**
**Laser-Induced Breakdown Spectroscopy of Polymer Matrix Nanocomposites,** *Caroline McEnnis*[1], *Yamac Dikmelik*[1], *Brigid O'Brien*[1], *James B. Spicer*[1], *Dajie Zhang*[1], *Frank C. De Lucia*[2], *Andrzej W. Miziolek*[2]; [1]*Johns Hopkins Univ., USA,* [2]*ARL, USA.* Laser-induced breakdown spectroscopy was used to study polymer matrix nanocomposites containing metal nanoparticles. We have observed emission from the silver and palladium nanoparticles as well as CN and $C_2$ molecules owing to the polymer matrix.

**CThY4 • 3:30 p.m.**
**Femtosecond Laser-Induced Breakdown Spectroscopy of Trinitrotoluene,** *Yamac Dikmelik, Caroline McEnnis, James B. Spicer, Paul J. Dagdigian; Johns Hopkins Univ., USA.* Femtosecond and nanosecond laser-induced breakdown spectroscopy were used to study TNT deposited on aluminum and glass substrates. We have observed emission from CN and $C_2$ molecules depending on excitation conditions.

### CThZ • Applications of Photonic Crystals—Continued

**CThZ3 • 3:00 p.m.**
**Photon Crystal Waveguide-Based Surface Plasmon Resonance Biosensor,** *Maksim Skorobogatiy, Andrei Kabashin; Ecole Polytechnique de Montreal, Canada.* Resonant excitation of a plasmon by the Gaussian-like leaky core mode of a metal covered 1-D photonic crystal waveguide is presented. Applications in sensing and major advantages over the existing waveguide-based schemes are discussed.

**CThZ4 • 3:15 p.m.**
**Fast and Efficient Simulation of Diffuse Light Using Wiener Chaos Expansion and Its Applications for Design of Photonic Crystal Spectrometers,** *Majid Badieirostami, Ali Adibi, Hao-Min Zhou, Shui-Nee Chow; Georgia Tech, USA.* We present an efficient model for simulation of spatially incoherent sources based on Wiener chaos expansion with two orders of magnitude improvement over brute-force techniques. It is applied to the analysis of photonic crystal spectrometers.

**CThZ5 • 3:30 p.m.**
**Photonic Crystal Enhanced Fluorescence,** *Nikhil Ganesh, Brian T. Cunningham; Univ. of Illinois at Urbana-Champaign, USA.* A new platform for fluorescence enhancement incorporating photonic crystal slabs is demonstrated. Fluorescence enhancement occurs by the effect of leaky eigenmodes that serve to enhance near-field intensities and simultaneously provide enhanced extraction.

### CThAA • Optical Fiber Applications—Continued

**CThAA2 • 3:00 p.m.**
**Polarization-Insensitive Wavelength Conversion at 40 Gb/s Using Birefringent Nonlinear Fiber,** *Anthony S. Lenihan, Gary M. Carter; Univ. of Maryland, Baltimore County, USA.* Polarization-nsensitive cross-phase modulation in a birefringent nonlinear photonic crystal fiber is used to realize wavelength conversion at 40 Gb/s. Error-free performance for polarization scrambled signals is obtained.

**CThAA3 • 3:15 p.m.**
**A Monolithic, Reconfigurable Optical Add-Drop Multiplexer Using Asymmetric Twin Waveguide Technology,** *Kuen-Ting Shiu*[1], *Shashank Agashe*[1], *Stephen Forrest*[2]; [1]*Princeton Univ., USA,* [2]*Univ. of Michigan, USA.* An InP-based monolithically integrated optical add-drop multiplexer (ROADM) is demonstrated with the asymmetric twin waveguide (ATG) technology. Its add/drop functionality has been measured and shows > 20dB drop extinction ratio.

**CThAA4 • 3:30 p.m.**
**Large Tunable Optical Delays via Self-Phase Modulation and Dispersion,** *Yoshitomo Okawachi, Jay E. Sharping, Chris Xu, Alexander L. Gaeta; Cornell Univ., USA.* We demonstrate continuously tunable delays and advancements of 3.5-ps pulses over a total range of more than 1200 pulsewidths in optical fiber using a combination of nonlinear spectral broadening and filtering.

### CThBB • Security Issues in Optical Networking—Continued

**CThBB3 • 3:15 p.m.**
**Security Analysis of Stealth Transmission over a Public Fiber-Optical Network,** *Bernard Wu, Ivan Glesk, Paul R. Prucnal, Evgenii Narimanov; Princeton Univ., USA.* We analyzed the security performance of stealth communications over a public fiber-optical network. We examined system's vulnerability against various eavesdropping strategies and constructed a metric to evaluate the level of security in the stealth transmission.

**CThBB4 • 3:30 p.m.**
**Security Issues in OCDMA with Multiple-User Aggregation,** *Zhi Jiang, Daniel E. Leaird, Andrew M. Weiner; Purdue Univ., USA.* We experimentally investigate security issues in OCDMA using the multiple-user aggregation scheme and demonstrate vulnerabilities that may permit an eavesdropper to recover data masked by aggregation.

### JThE • Joint CLEO/*PhAST* Symposium on BioPhotonics and Applications II—Continued

**JThE4 • 3:00 p.m.** Invited
**Teraherz Imaging,** *David A. Zimdars; Picometrix, Inc., USA.* The methods, instrumentation, and application of time domain terahertz imaging (a.k.a. THz or T-Ray Imaging) for non-destructive evaluation (NDE) and security are discussed.

### PThC • Emerging Applications and Technologies—Continued

**PThC6 • 3:00 p.m.**
**Industrial Excimer Laser Surface Treatment: An Overview,** *Ludolf Herbst, Gerd Spiecker, Rainer Paetzel; Coherent GmbH, Germany.* This presentation shows industrial examples about excimer laser-based manufacturing in the field of medical devices, solar cells, electronics.

**PThC7 • 3:15 p.m.**
**High Power EUVL Source Demonstration of Tin-Doped Droplet Laser Plasma Generated by Industrial Solid-State Lasers,** *Kazutoshi Takenoshita*[1], *Tobias Schmid*[1], *Simi A. George*[1], *Jose Cunado*[1], *Martin C. Richardson*[1], *Ben Fulford*[2], *Ian Henderson*[2], *Nick Hay*[2], *Samir Ellwi*[2]; [1]*College of Optics & Photonics, CREOL/FPCE, Univ. of Central Florida, USA,* [2]*Powerlase Ltd., UK.* High EUV source power has been demonstrated with a laser-plasma source exhibiting low debris and high conversion efficiency. This offers a viable path towards successful realization of EUV lithography for the next generation semiconductor devices.

### PThD • High-Power Lasers Systems II—Continued

**PThD4 • 3:00 p.m.** Invited
**Operational Implications of Laser Weapons,** *Richard Dunn; Northrop Grumman, USA.* Abstract not available.

ROOM 318-320

CLEO

### CThS • Waveguide Writing with Ultrashort Lasers—Continued

**CThS6 • 3:45 p.m.**
**Refractive Index Modifications in Chalcogenide Films Induced by Sub-Bandgap Near-IR Femtosecond Pulses,** *Troy P. Anderson[1], Nathan Carlie[2], Laeticia Petit[2], Juejun Hu[3], A. Agarwal[3], J.J. Viens[3], Jiyeon Choi[1], L. C. Kimmerling[3], Kathleen Richardson[2], Martin Richardson[1]; [1]Univ. of Central Florida, USA, [2]Clemson Univ., USA, [3]MIT, USA.* Refractive index modifications of film $Ge_{0.23}Sb_{0.07}S_{0.7}$ induced by 800nm femtosecond laser irradiation are studied for laser repetition rates of 1kHz and 80MHz. Measurements are taken using an interferometric method and analysis of the transmission spectra.

**CThS7 • 4:00 p.m.**
**Depth-Independent, Low-Loss Waveguides Formed by High-Repetition Rate Femtosecond Fiber Laser,** *Shane M. Eaton, Wei-Jen Chen, Haibin Zhang, Mi Li Ng, Peter R. Herman; Univ. of Toronto, Canada.* Effects of repetition rate, numerical aperture, and focus depth on femtosecond laser writing of buried waveguides were systematically studied in borosilicate glass to enable shallow and deep writing of low-loss waveguides with full 3-D functionality.

ROOM 321-323

### CThT • Ceramic Lasers—Continued

**CThT5 • 3:45 p.m.**
**Core-Doped Ceramic Nd:YAG Laser with Sm:YAG Cladding,** *Dietmar Kracht, Rafael Huß, Ralf Wilhelm, Jörg Neumann; Laser Zentrum Hannover e.V., Germany.* A core-doped ceramic Nd:YAG laser with a Sm:YAG cladding is presented. Applying q-cw pumping with a laser diode stack, a pulse energy of 5.9mJ in 3.9ns was achieved by passive Q-switching with $Cr^{4+}$:YAG.

**CThT6 • 4:00 p.m.**
**Ceramic YAG Composite with Nd Gradient Structure for Homogeneous Absorption of Pump Power,** *Tomosumi Kamimura[1], Takayuki Okamoto[2], Yan Lin Aung[3], Akio Ikesue[3]; [1]Dept. of Electronics, Information and Communication Engineering,Osaka Inst. of Technology, Japan, [2]Okamoto Optics Co. Ltd., Japan, [3]World Lab Co. Ltd., Japan.* Ceramic YAG composite with Nd gradient configuration was fabricated successfully for thermal management of absorbed pump power. Higher laser output was achieved as compared with that of the conventional composite (YAG-Nd:YAG-YAG) structure.

ROOM 324-326

### CThU • THz Imaging and Applications—Continued

**CThU3 • 3:45 p.m.**
**Real-Time, Transmission-Mode, Terahertz Imaging over a 25-Meter Distance,** *Alan W.m. Lee[1], Qi Qin[1], Sushil Kumar[1], Benjamin S. Williams[1], Qing Hu[1], John L. Reno[2]; [1]MIT, USA, [2]Sandia Natl. Labs, USA.* We demonstrate transmission-mode imaging over a 25 meter distance using a ~4.9-THz quantum-cascade laser, frequency-optimized for a low-loss (~0.5 dB/m) atmospheric window. The ~17-mW peak power allows real-time imaging with a 320x240 element microbolometer camera.

**CThU4 • 4:00 p.m.**
**Terahertz Imaging with Compressed Sensing and Phase Retrieval,** *Wai Lam Chan, Matthew L. Moravec, Richard G. Baraniuk, Daniel M. Mittleman; Rice Univ., USA.* We describe a new terahertz imaging method for high-speed image acquisition using a compressed sensing phase retrieval algorithm. This technique permits image reconstruction using a limited and randomly chosen subset of a Fourier image.

ROOM 314

### CThV • Nonlinear Optics of Nanostructures—Continued

**CThV6 • 3:45 p.m.**
**Exact Optimization-Based Analysis Method Applied to Nonlinear Processes in a Multi-Cavity Micro-Resonator,** *Guy Klemens, Yeshaiahu Fainman; Univ. of California at San Diego, USA.* An optimization-based analysis method is used to calculate the electric fields within a nonlinear resonant cavity made up of multiple coupled dielectrics. Unlike previous approximate, ad hoc calculation methods, this method is exact and general.

**CThV7 • 4:00 p.m.**
**Interband Second-Order Susceptibility Enhancement in Strained GaInP/AlGaInP Quantum Wells,** *Alex Hayat, Meir Orenstein; Dept. of Electrical Engineering, Technion, Israel.* We present a significant interband second-order susceptibility enhancement in strained GaInP/AlGaInP QWs at telecommunication wavelengths. More than order of magnitude increase in $x^{(2)}$ over the bulk value is shown by SHG measurements in two-dimensional waveguides.

ROOM 315

JOINT

### JThF • Laser Wakefield and Relativistic Plasma Interactions—Continued

**JThF5 • 3:45 p.m.**
**Imaging Electron Trajectories in Laser Wakefield Cavity Using Betatron X-Ray Radiation,** *Kim Ta Phuoc, Sébastien Corde, Rahul Shah, Félicie Albert, Romuald Fitour, Jean-Philippe Rousseau, Fréderic Burgy, Brigitte Mercier, Antoine Rousse; LOA, France.* We demonstrate that betatron X-ray radiation provides a direct imaging of electrons trajectories accelerated in laser wakefields. Electron excursions down to 0.7 +/- 0.2 micrometers have been measured in our parameter regime.

**JThF6 • 4:00 p.m.**
**THz Modulation of Relativistic Electrons Using a Vacuum Laser Beat-Wave,** *Sergei Tochitsky[1], Chieh Sung[1], Sven Reiche[2], James Rosenzweig[2], Claudio Pellegrini[2], Chan Joshi[1]; [1]Dept. of Electrical Engineering, Univ. of California at Los Angeles, USA, [2]Dept. of Physics, Univ. of California at Los Angeles, USA.* It is proposed to modulate electrons longitudinally by the ponderomotive force of a $CO_2$ laser beat-wave. For the 9.3 and 10.6 um lines, the beam injected into undulator radiates at ~ 77 um.

ROOM 316

CLEO

### CThW • Fabrication of Periodic Nanostructures—Continued

**CThW5 • 3:45 p.m.**
**Photonic Band Gap Syntheis by Optical Phase Mask Lithography,** *Timothy Y. M. Chan, Ovidiu Toader, Sajeev John; Univ. of Toronto, Canada.* We provide a simple and efficient approach for fabricating diamond architecture photonic crystals using single-exposure, single-beam, optical interference lithography based on diffraction of light through an optical phase mask.

**CThW6 • 4:00 p.m.**
**Orthorhombic or Tetragonal Woodpile-Type Photonic Crystals Template Fabricated by Laser Phase Mask Lithography,** *Yuankun Lin[1], Jorge Quintero[1], Zsolt Poole[2], Di Xu[2], Kevin P. Chen[2]; [1]Univ. of Texas at Pan American, USA, [2]Univ. of Pittsburgh, USA.* Face-centered-orthorhombic and face-centered-tetragonal woodpile-type photonic crystal templates have been fabricated with laser phase mask holographic lithography. Photonic band gap calculation predicts the existence of full band gap in those crystals.

ROOM 317

### CThX • Optical Combs Technology I—Continued

**CThX5 • 3:45 p.m.**
**Efficient Compression of Carrier-Envelope Phase-Locked Laser Pulses to 5 fs Using an Aluminum-Coated Hollow Fiber,** *Eisuke Haraguchi, Takashi Tanigawa, Eiichi Matsubara, Keisaku Yamane, Mikio Yamashita, Taro Sekikawa; Hokkaido Univ., Japan.* Carrier-envelope phase-lacked 0.13-TW, 5.2-fs laser pulses were generated by using a 56-cm-long aluminum-coated hollow fiber with an efficiency of 66 %, improved by coating aluminum inside the fiber with a core diameter of 500-µm.

**CThX6 • 4:00 p.m.**
**Carrier-Envelope Phase Stabilized 5.6 fs, 1.2 mJ Pulses,** *Hiroki Mashiko, Christopher M. Nakamura, Chengquan Li, Eric Moon, He Wang, Jason Tackett, Zenghu Chang; Kansas State Univ., USA.* Carrier-envelope phase stabilized 1.2 mJ pulses with duration of 5.6 fs were obtained from a Ne filled hollow-core fiber. With power locking the phase is controlled to 370 mrad measured by an out-loop f-to-2f interferometer.

ROOM 336

QELS

### QThG • Plasmonics III—Continued

**QThG5 • 3:45 p.m.**
**Polariton Emission from an Electrically Injected Semiconductor Device,** *Luca Sapienza[1], Raffaele Colombelli[2], Cristiano Ciuti[1], Angela Vasanelli[1], Ulf Gennser[3], Carlo Sirtori[1]; [1]Lab Matériaux et Phénomènes Quantiques, Univ. Paris Diderot, France, [2]Inst. d'Electronique Fondamentale, Paris-Sud, France, [3]Lab Photonique et Nanostructures, France.* We report on the first observation of polariton emission from an electrically pumped semiconductor device, operating up-to room temperature. The system is a quantum cascade electroluminescent structure, embedded in a planar microcavity.

**QThG6 • 4:00 p.m.**
**Optical Isolators Based on Surface Magneto Plasmon Polaritons,** *Jacob B. Khurgin; Johns Hopkins Univ., USA.* Strong nonreciprocal phase shift is attainable when plasmon polariton propagates on the interface between metal and magneto-optical material in presence of transverse magnetic field. This effect is a basis for short low loss nanoplasmonic isolators.

**4:15 p.m. – 4:45 p.m. COFFEE BREAK, EXHIBIT HALL, 100 LEVEL**

ROOM 337

QELS

## QThH • Quantum Communication—Continued

**QThH5 • 3:45 p.m.**
**Experimental Implementation of Non-Gaussian Attacks on a Continuous-Variable Quantum Key Distribution System,** *Jérôme Lodewyck*[1,2]*, Thierry Debuisschert*[1]*, Raul Garcia-Patron*[3]*, Rosa Tualle-Brouri*[2]*, Nicolas J. Cerf*[3]*, Philippe Grangier*[2]*;* [1]*THALES Res. and Technology, France,* [2]*Lab Charles Fabry de l'Inst. d'Optique, France,* [3]*QuIC, Ecole Polytechnique, Univ. Libre de Bruxelles, Belgium.* An intercept-resend attack on a continuous-variable quantum key distribution protocol is investigated experimentally. The users and eavesdropper available information rates are consistent with the optimality of Gaussian attacks resulting from the security proofs.

**QThH6 • 4:00 p.m.**
**Polarization Transformations Induced on Qubits Transmitted in a Space-to-Earth Quantum Communication Link,** *Cristian Bonato*[1,2]*, Markus Aspelmeyer*[3,4]*, Thomas Jennewein*[4]*, Claudio Pernechele*[5]*, Paolo Villoresi*[2]*, Anton Zeilinger*[3,4]*;* [1]*Boston Univ., USA,* [2]*CNR-INFM LUXOR, Dept. of Electrical and Computer Engineering, Univ. of Padova, Italy,* [3]*Inst. fuer Experimental Physik, Austria,* [4]*Inst. für Quantenoptik und Quanteninformation (IQOQI), Austria,* [5]*INAF, Italy.* We analyze the sources of polarization transformation for single photons in a Space-to-Earth quantum communication link, particularly the satellite pointing system, giving an estimate of the effect and discussing possible compensation techniques.

ROOM 338

C L E O

## CThY • Remote Sensing I—Continued

**CThY5 • 3:45 p.m.**
**Long Range Trace Detection in Aqueous Aerosol Using Remote Filament-Induced Breakdown Spectroscopy (R-FIBS),** *Jean-François Daigle*[1]*, Guillaume Méjean*[1]*, W. Liu*[1]*, F. Théberge*[1]*, H. L. Xu*[1]*, Y. Kamali*[1]*, J. Bernhardt*[1]*, A. Azarm*[1]*, Q. Sun*[1]*, P. Mathieu*[2]*, G. Roy*[2]*, J. R. Simard*[2]*, See Leang Chin*[1]*;* [1]*COPL, Univ. Laval, Canada,* [2]*Defense Res. and Development Ctr.-Valcartier, Canada.* R-FIBS is used for probing salt water aerosol. We demonstrate experimentally that it can be used to sense ppm level concentrations up to 70 m away and shows potential for kilometer range applications.

**CThY6 • 4:00 p.m.**
**Hybrid of Frequency and Time Resolved CARS,** *Dmitry Pestov, Robert K. Murawski, Ariunbold Gombojav, Xi Wang, Miaochan Zhi, Alexei V. Sokolov, Vladimir A. Sautenkov, Yuri V. Rostovtsev, Marlan O. Scully; Inst. for Quantum Studies and Depts. of Physics and Chemical Engineering, Texas A&M Univ., USA.* We introduce a novel technique that elegantly combines frequency- and time-resolved CARS spectroscopy. The proposed scheme is tested in back-scattered CARS experiments on a powder of sodium dipicolinate, holding promise for remote/stand-of detection applications.

ROOM 339

## CThZ • Applications of Photonic Crystals—Continued

**CThZ6 • 3:45 p.m.**
**High NA Fourier Space Imaging of Planar Photonic Crystals,** *Nicolas Le Thomas*[1]*, Romuald Houdre*[1]*, Maria V. Kotlyar*[2]*, Thomas F. Krauss*[2]*;* [1]*Ecole Polytechnique Federale de Lausanne (EPFL), Switzerland,* [2]*Univ. of St. Andrews, UK.* Fourier space imaging is used to retrieve the intrinsic properties of planar photonic crystal structures. A superresolution technique based on size effects of the structures gives access to the dispersion curves below the light cone.

**CThZ7 • 4:00 p.m.**
**Optical and Local Tuning of Planar Photonic Crystals Infiltrated with Organic Molecules,** *Pascale El-Kallassi*[1]*, Rolando Ferrini*[1]*, Libero Zuppiroli*[1]*, Nicolas Le Thomas*[2]*, Romuald Houdré*[2]*, Audrey Berrier*[3]*, Srinivasan Anand*[3]*, Anne Talneau*[4]*;* [1]*Lab d'Optoélectronique des Matériaux Moléculaires, Ecole Polytechnique Fédérale de Lausanne (EPFL), Switzerland,* [2]*Inst. de Photonique et Electronique Quantique, Ecole Polytechnique Fédérale de Lausanne (EPFL), Switzerland,* [3]*Dept. of Microelectronics and Applied Physics, Royal Inst. of Technology (KTH), Sweden,* [4]*CNRS-Lab de Photonique et de Nanostructures (LPN), France.* We report on the optical tuning of InP-based planar photonic crystals (PhCs) infiltrated with a photoresponsive liquid crystal system. Preliminary results on the local tuning of PhC devices are also presented.

ROOM 340

## CThAA • Optical Fiber Applications—Continued

**CThAA5 • 3:45 p.m.** Invited
**Fourier Domain Mode Locking (FDML) in the Non-Zero Dispersion Regime: A Laser for Ultrahigh-Speed Retinal OCT Imaging at 236kHz Line Rate,** *Robert Huber*[1]*, Vivek J. Srinivasan*[2]*, Desmond C. Adler*[2]*, Iwona Gorczynska*[2]*, James G. Fujimoto*[2]*;* [1]*Ludwig-Maximilians-Univ., Germany,* [2]*Res. Lab of Electronics, MIT, USA.* Fourier Domain Mode Locking (FDML) in the 1070nm wavelength range is investigated. Problems, design rules and the performance of an FDML laser with a dispersive cavity are discussed. Retinal OCT imaging at 236kHz is demonstrated.

ROOM 341

## CThBB • Security Issues in Optical Networking—Continued

**CThBB5 • 3:45 p.m.**
**Design of a Virtual Quadrant Receiver for 4-ary Pulse Position Modulation/Optical Code Division Multiple Access (4-ary PPM/O-CDMA),** *Vincent J. Hernandez*[1,2]*, Antonio J. Mendez*[3]*, Corey V. Bennett*[2]*, Robert M. Gagliardi*[4]*;* [1]*Univ. of California at Davis, USA,* [2]*LLNL, USA,* [3]*Mendez R&D Associates, USA,* [4]*Univ. of Southern California, USA.* We propose a virtual quadrant receiver for 4-ary PPM/O-CDMA. Numerical simulations determine the impact of multi-access interference and optical beat interference on correct symbol detection versus the number of concurrent, asynchronous users.

**CThBB6 • 4:00 p.m.**
**Improving Transmission Privacy Using Optical Layer XOR,** *Ivan Glesk, Y.-K. Huang, C.-S. Brès, P.R. Prucnal; Princeton Univ., USA.* We built novel "dual code" OCDMA transmitter and receiver with optical layer XOR, thus achieving data privacy approaching One-time Pad security. Enhanced secure communication among users was demonstrated at OC-24 with raw BER < $10^{-12}$.

**4:15 p.m. – 4:45 p.m. COFFEE BREAK, EXHIBIT HALL, 100 LEVEL**

NOTES

**CLEO**

**ROOM 318-320**

### 4:45 p.m. – 6:30 p.m.
### CThCC • Laser Processing and Measurements
*Detao Du; General Atomics, USA, Presider*

**CThCC1 • 4:45 p.m.** Invited

**Microfluidic Bead Array Device Using Laser-Machined Surface Microstructures on Silica Glass,** *Tadatake Sato, Thomas Gumpenberger, Ryozo Kurosaki, Yoshizo Kawaguchi, Aiko Narazaki, Hiroyuki Niino; Natl. Inst. of Advanced Industrial Science and Technology (AIST), Japan.* Laser-induced backside wet etching (LIBWE) method can be applied for fabricating novel microfluidic devices. We have fabricated a microfluidic device incorporating two-dimensional array of microbeads with 10 µm diameter for selective DNA capturing.

**ROOM 321-323**

### 4:45 p.m. – 6:30 p.m.
### CThDD • Novel Designs for Solid-State Lasers
*Markus Pollnau; Univ. of Twente & Swiss Fed. Inst. of Tech., Netherlands, Presider*

**CThDD1 • 4:45 p.m.**

**Cross Sections for Room and Low Temperature Operation of Er-Doped Sesquioxide Lasers,** *Larry D. Merkle[1], Nikolay Ter-Gabrielyan[1], Mark Dubinskii[1], Akio Ikesue[2]; [1]ARL, USA, [2]World Lab Co., Ltd., Japan.* Sesquioxides are attractive solid-state laser hosts, and $Er^{3+}$ is an important ion for eyesafe lasers. Using high-resolution spectra, absorption and stimulated emission cross sections of Er:sesquioxides are determined for both room temperature and 77K.

**CThDD2 • 5:00 p.m.**

**Numerical Simulation and Optimization of Giant Pulse Generation in 2 Microns Tm,Ho Lasers,** *Oleg A. Louchev[1], Yoshiharu Urata[1], Satoshi Wada[2]; [1]Megaopto Co., Ltd., Japan, [2]RIKEN, Japan.* Numerical simulation suggests two ways for optimizing giant pulse of solid state Tm,Ho: YLF laser by using: (i) 1 % Ho doping and (ii) 0.7 ms delay in Q-switch opening after 0.5 ms LD pumping.

**ROOM 324-326**

### 4:45 p.m. – 6:30 p.m.
### CThEE • High-Power Semiconductor Lasers
*George W. Turner; MIT Lincoln Lab, USA, Presider*

**CThEE1 • 4:45 p.m.**

**High-Brightness Wavelength-Beam-Combined Eyesafe Diode Laser Stacks,** *Juliet T. Gopinath, Bien Chann, T. Y. Fan, Antonio Sanchez-Rubio; MIT Lincoln Lab, USA.* At 1450 nm, we have demonstrated 20-W wavelength-beam-combined output from a 25-element single bar ($M^2$ ~ 1.9 x 10), and 80-W cw from a 6-bar diode stack ($M^2$ ~ 36 x 68).

**CThEE2 • 5:00 p.m.**

**High-Brightness, Fiber-Coupled Diode Laser System for Fiber Laser Pumping,** *S. David Roh, Daniel M. Grasso, Nels P. Ostrom, Brian O. Faircloth; Nuvonyx, Inc., USA.* The operation of a very high-brightness diode laser system for fiber laser pumping with over 1.7 kW of output power from a 400 µm core, 0.22 NA fiber is reported.

**ROOM 314**

### 4:45 p.m. – 6:30 p.m.
### CThFF • Spatial Nonlinear Effect
*Prem Kumar; Northwestern Univ., USA, Presider*

**CThFF1 • 4:45 p.m.**

**Photonic Crystal Fiber Based 10 GHz Optical Clock Recovery Using an Optical Parametric Oscillator,** *Ailing Zhang, H. Y. Tam, C. Lu, M. S. Demokan, P. K. A. Wai; Hong Kong Polytechnic Univ., Hong Kong.* We demonstrate a 10GHz optical clock recovery scheme based on optical parametric oscillator, in which the gain results from the Kerr nonlinearity in the highly nonlinear photonic crystal fiber.

**CThFF2 • 5:00 p.m.**

**Controlling Acousto-Optic Interactions in Photonic Crystal Fiber with Sub-Wavelength Core-Hole,** *Gustavo S. Wiederhecker[1,2], Andre Brenn[2], Holger Hundertmark[2], Cristiano M. B. Cordeiro[1], Jonathan C. Knight[3], Philip St. J. Russell[2], Hugo L. Fragnito[1]; [1]Inst. de Fisica Gleb Wathagin, Brazil, [2]Max-Planck Res. Group (IOIP), Univ. of Erlangen-Nuremberg, Germany, [3]Ctr. for Photonics and Photonic Materials, Univ. of Bath, UK.* The quasi-Raman interaction between confined acoustic phonons and light in PCF is strongly altered by the introduction of a sub-wavelength hole running axially through the core. Coupling calculations and forward scattering spectra illustrate the effect.

**JOINT**

**ROOM 315**

### 4:45 p.m. – 6:30 p.m.
### JThG • Laser Plasmas and Particle Acceleration
*Michael Downer; Univ. of Texas at Austin, USA, Presider*

**JThG1 • 4:45 p.m.**

**Proton Acceleration from Thin Foils Using Ultraintense, High-Contrast Pulses,** *Stephen A. Reed[1], Takeshi Matsuoka[1], Stepan Bulanov[1], Vladimir Chvykov[1], Andrei Brantov[2], Valery Yu Bychenkov[2], Galina Kalinchenko[1], Pascal Rousseau[1], Victor Yanovsky[1], Dale Litzenberg[3], Karl Krushelnick[1], Anatoly Maksimchuk[1]; [1]FOCUS Ctr. and Ctr. for Ultrafast Optical Science, USA, [2]P. N. Lebedev Physics Inst., Russian Acad. of Sciences, Russian Federation, [3]Dept. of Radiation Oncology, USA.* Proton production from ultrathin foils using $3x10^{20}$ W/cm$^2$ and $10^{-11}$ ASE contrast is explored. Maximum proton energy and laser transmittance for ultrathin foils are studied to achieve ion acceleration within the Directed Coulomb Explosion regime.

**JThG2 • 5:00 p.m.**

**Single-Shot Time Resolved Expansion and Emission Measurements of Proton-Heated Warm Dense Matter,** *Gilliss Dyer[1], Byoung-Ick Cho[1], Aaron Bernstein[1], Todd Ditmire[1], Ronnie Shepherd[2], Hui Chen[2], Yuan Ping[2], Pravesh K. Patel[2], Lee Elberson[3]; [1]Univ. of Texas at Austin, USA, [2]LLNL, USA, [3]Univ. of Maryland, USA.* We report the simultaneous, single shot, time-resolved measurements of self-emission and free expansion of aluminum isochorically heated by laser generated MeV protons. In this way we measure the equation of state along an isochore.

**CLEO**

**ROOM 316**

### 4:45 p.m. – 6:15 p.m.
### CThGG • Nanowires and Nanorods
*Venkatraman Gopalan; Pennsylvania State Univ., USA, Presider*

**CThGG1 • 4:45 p.m.**

**Effects of V/III Ratios for InP Nanowires Grown on Si Substrates,** *Linus C. Chuang[1], Michael Moewe[1], Shanna Crankshaw[2], Connie Chang-Hasnain[1]; [1]Dept. of Electrical Engineering and Computer Sciences, Univ. of California at Berkeley, USA, [2]Applied Science and Technology Group, Univ. of California at Berkeley, USA.* We report the effects of V/III ratio on the structural and optical properties for InP nanowires (NWs) grown on Si substrates. Non-tapered NWs with a sharp photoluminescence peak and intense emission are achieved.

**CThGG2 • 5:00 p.m.**

**Time-Resolved Spectroscopy of Epitaxial InP Nanowires,** *Shanna Crankshaw[1], Stephan Reitzenstein[2], Linus C. Chuang[1], Michael Moewe[1], S. Münch[2], C. Hofman[2], M. Lam[2], Alfred Forchel[2], Connie Chang-Hasnain[1]; [1]Univ. of California at Berkeley, USA, [2]Univ. Würzburg, Am Hubland, Germany.* We report time-resolved photoluminescence measurements on epitaxial (111) InP nanowires up to 110 K. The observed decay times increase with longer emission wavelengths, indicating the importance of surface effects on narrow InP wires.

**ROOM 317**

### 4:45 p.m. – 6:30 p.m.
### CThHH • Optical Combs Technology II
*Presider to Be Announced*

**CThHH1 • 4:45 p.m.**

**Determining Phase-Energy Coupling Coefficient in Carrier-Envelope Phase Measurements,** *Chengquan Li, Eric Moon, He Wang, Hiroki Mashiko, Christopher M. Nakamura, Jason Tackett, Zenghu Chang; J.R. Macdonald Lab, Dept. of Physics, Kansas State Univ., USA.* By using two f-to-2f interferometers, we measured the phase-energy coupling coefficient for the first time. The results reveal that a 1% in-loop laser energy change causes a 160 mrad carrier-envelope phase shift to output pulses.

**CThHH2 • 5:00 p.m.**

**Coherent Synthesis Using Carrier-Envelope Phase Controlled Pulses from a Dual-Color Femtosecond Optical Parametric Oscillator,** *Jinghua Sun, Barry J. S. Gale, Derryck T. Reid; Heriot-Watt Univ., UK.* A coherent waveform is synthesized from two co-resonant optical parametric signal pulses with different center wavelengths and independent carrier-envelope phase-slip frequencies. XFROG measurements confirm the synthesized waveform is a train of high-contrast 30 femtosecond pulses.

**QELS**

**ROOM 336**

### 4:45 p.m. – 6:30 p.m.
### QThI • Meta-Optics
*Vladimir M. Shalaev; Purdue Univ., USA, Presider*

**QThI1 • 4:45 p.m.** Invited

**Subwavelength Focusing of Light without Evanescent Waves by an Array of Nanoholes,** *Fu M. Huang[1], Yifang Chen[2], F. Javier Garcia de Abajo[3], Nikolay I. Zheludev[1]; [1]Optoelectronics Res. Ctr., UK, [2]Central Microstructure Facility, Rutherford Appleton Lab, UK, [3]Inst. de Optica, Spain.* We provide the first evidence of free-space subwavelength focusing without evanescent fields using a photonic nano-structure. Hot-spots smaller than half of the wavelength were observed at distances of tens of wavelengths from the structure.

## ROOM 337

### QELS

### 4:45 p.m. – 6:30 p.m.
### QThJ • Quantum Computing
*Daniel Steck; Univ. of Oregon, USA, Presider*

**QThJ1 • 4:45 p.m.**
**Improving Fidelity of Skewed Output States of Optical Zeno Gates,** *Patrick M. Leung, Timothy C. Ralph; Univ. of Queensland, Australia.* We have shown that high two-photon to one-photon absorption ratios are needed for a high fidelity free-standing Zeno CZ gate. Nevertheless, using this gate with distillation for cluster fusion can outperform linear optics fusion gate.

**QThJ2 • 5:00 p.m.**
**Fast Spin State Initialization of a Single Quantum Dot Electron,** *Xiaodong Xu[1], Yanwen Wu[1], Bo Sun[1], Jun Cheng[1], Qiong Huang[1], Duncan Steel[1], Allan Bracker[2], Dan Gammon[2], Clive Emary[3], L. J. Sham[3]; [1]Univ. of Michigan, USA, [2]NRL, USA, [3]Univ. of California at San Diego, USA.* We report the demonstration of fast spin state initialization with near unity efficiency in a singly-charged quantum dot by optically cooling an electron spin.

## ROOM 338

### CLEO

### 4:45 p.m. – 6:30 p.m.
### CThII • Remote Sensing II
*Mark Allen; Physical Sciences Inc., USA, Presider*

**CThII1 • 4:45 p.m.**
**Pushbroom Laser Altimetry Using Fiber Lasers and Photon Counting Detectors,** *James B. Abshire, David J. Harding, Xiaoli Sun, Michael A. Krainak, Antonios A. Seas, Philip W. Dabney; NASA-Goddard, USA.* We report on progress in developing a new swath mapping laser altimeter measurement approach using multiple laser measurement beams, modulated fiber lasers, photon counting detectors, and event timers for future space missions.

**CThII2 • 5:00 p.m.**
**The Lunar Orbiter Laser Altimeter and the Laser Ranging System on the Lunar Reconnaissance Orbiter,** *Xiaoli Sun[1], Haris Riris[1], John F. Cavanaugh[1], Jan F. McGarry[1], Glenn B. Jackson[1], Ronald S. Zellar[1], David E. Smith[1], Maria T. Zuber[2]; [1]NASA Goddard Space Flight Ctr., USA, [2]MIT, USA.* The design of Lunar Orbiter Laser Altimeter on the Lunar Reconnaissance Orbiter is presented. The one-way laser ranging system that provides precision tracking of the spacecraft position from Earth is also described.

## ROOM 339

### 4:45 p.m. – 6:30 p.m.
### CThJJ • Nanophotonic Structures and Devices
*Oskar Painter; Caltech, USA, Presider*

**CThJJ1 • 4:45 p.m.**
**Multi-Axis Electrothermal Scanning Micromirror with Low Driving Voltage,** *Kemiao Jia, Huikai Xie; Univ. of Florida, USA.* This paper presents the design, fabrication and measurement results of a low operating voltage, multi-degree-of-freedom electrothermal micromirror. This micromirror employs unique bimorph actuators to achieve one-dimensional piston motion and two-dimensional rotation.

**CThJJ2 • 5:00 p.m.**
**Fiber-Coupled $\Gamma$-point Photonic Crystal Bandedge Laser,** *Yeonsang Park, Sunghwan Kim, Chaeyoung Moon, Heonsu Jeon; Seoul Natl. Univ., Republic of Korea.* We demonstrate a fiber coupling scheme suitable for vertically emitting photonic crystal lasers. The device, capable of efficiently launching and collecting photons from/into a single mode fiber, produced fiber output close to 100 μW.

## ROOM 340

### 4:45 p.m. – 6:30 p.m.
### CThKK • Fiber Devices for Sensing and Metrology
*Paul Westbrook; OFS Labs, USA, Presider*

**CThKK2 • 5:00 p.m.**
**Two-Photon Long-Period Grating Inscription in Pure-Fused-Silica Photonic Crystal Fiber,** *Gilberto Brambilla[1], Andrei Fotiadi[2], Stephen Slattery[3], David Nikogosyan[4]; [1]Optoelectronics Res. Ctr., Univ. of Southampton, UK, [2]Faculté Polytechnique de Mons, Belgium, [3]Univ. College Cork, Ireland, [4]Photonics Res. Group, Electronic Engineering, Aston Univ., UK.* Photochemical inscription of a long-period grating in a pure fused silica photonic crystal fiber (PCF) is reported. The inscription in PCF is found to be ten times more efficient than in a standard telecom fiber.

## ROOM 341

### 4:45 p.m. – 6:30 p.m.
### CThLL • Terahertz Waveguides
*Daniel Grischkowsky; Oklahoma State Univ., USA, Presider*

**CThLL1 • 4:45 p.m.**
**A Terahertz Dual Wire Waveguide,** *Marx Mbonye, Victoria Astley, Wai Lam Chan, Jason Deibel, Daniel Mittleman; Rice Univ., USA.* We numerically model the propagation of terahertz radiation along a double wire waveguide using finite element analysis. This is a promising alternative configuration for terahertz waveguiding.

**CThLL2 • 5:00 p.m.**
**Missing Conductivity in the THz Skin-Depth Layer of Metals,** *Norman Laman, Daniel R. Grischkowsky; Oklahoma State Univ., USA.* The conductivity of the THz skin-depth layer of Al films in contact with silicon was measured via a parallel plate waveguide. The increase of conductivity at lower temperatures is extremely sensitive to the surface quality.

NOTES

## CThCC • Laser Processing and Measurements—Continued

**CThCC2 • 5:15 p.m.** **Invited**
**Nanometer-Scale Imaging and Ablation with Extreme Ultraviolet Lasers,** *C. S. Menoni[1], Fernando Brizuela[1], C. Brewer[1], H. Bravo[1], B. Langdon[1], M. Berrill[1], D. Martz[1], G. Vaschenko[1], M. C. Marconi[1], J. J. Rocca[1], W. Chao[2], E. H. Anderson[2], D. T. Attwood[2], A. V. Vinogradov[3,4], I. A. Artioukov[3,4], Y. P. Pershyn[3,4], V. V. Kondratenko[3,4], O. Hemberg[5], B. Frazer[5], S. Bloom[5]; [1]Colorado State Univ., USA, [2]LLNL, USA, [3]P. N. Lebedev Physical Inst., Russian Federation, [4]Natl. Technical Univ., Ukraine, [5]JMAR Technologies, Inc., USA.* The short wavelength and high brightness of compact extreme ultraviolet lasers is shown to enable the development of microscopes with spatial resolution of tens of nanometers and new types of nanoprobes.

## CThDD • Novel Designs for Solid-State Lasers—Continued

**CThDD3 • 5:15 p.m.**
**High-Power CW Operation and Beam Quality of a Diode Edge-Pumped, Composite All-Ceramic Yb:YAG Microchip Laser,** *Masaki Tsunekane, Takunori Taira; Inst. for Molecular Science, Japan.* >400W CW operation of a diode edge-pumped, composite all-ceramic Yb:YAG microchip (3mm-diameter core with a 200µm thickness) laser was successfully demonstrated. The $M^2$ factor less than 7 up to 200 W CW was obtained.

**CThDD4 • 5:30 p.m.** **Tutorial**
**Rod-Slab-Disc-Fiber, Design and Performance Comparison of High Power Laser Architectures,** *Dieter Hoffmann; Fraunhofer Inst. Lasertechnik ILT, Germany.* An overview on the fundamental potentials and limitations of the different solid state laser architectures is given and compared with the data demonstrated. Scaling laws and limits for CW and pulsed operation are discussed.

## CThEE • High-Power Semiconductor Lasers—Continued

**CThEE3 • 5:15 p.m.**
**High Power 7-GHz Bandwidth External-Cavity Diode Laser Array,** *Lei S. Meng, Boris Nizamov, Pratheepan Madasamy, Jason K. Brasseur, Tom Henshaw, David K. Neumann; Directed Energy Solutions, USA.* Spectral bandwidth of a diode laser array is narrowed to 7 GHz FWHM by using a thick volume Bragg grating. Total output power reaches 13.5 W cw, of which 86% is in the 7-GHz band.

**CThEE4 • 5:30 p.m.**
**High-Power (14 W CW), Narrow Far-Field (3° FWHM) 920 nm Quantum-Dots Tapered Laser Mini-Bar,** *Nicolas Michel[1], Michel Calligaro[1], Michel Krakowski[1], Wolfgang Kaiser[2], Stefan Deubert[2], Alfred Forchel[2], Johann-Peter Reithmaier[3], Benoît Boulant[4], Thierry Fillardet[4]; [1]Alcatel-Thales $^{3-5}$ Lab, France, [2]Technische Physik, Univ. Würzburg, Germany, [3]Technische Physik, Univ. Kassel, Germany, [4]Nuvonyx Europe, France.* We have realised the first high-power quantum-dots tapered laser mini-bar, which delivers 14 W CW, with a narrow far-field angle of 3° FWHM, and a reduced wavelength shift of 0.21 nm/K.

## CThFF • Spatial Nonlinear Effect—Continued

**CThFF3 • 5:15 p.m.**
**Power Threshold of Discrete Surface Solitons,** *Sergiy Suntsov[1], Konstantinos Makris[1], Demetrios N. Christodoulides[1], George I. Stegeman[1], Alain Hache[2], Roberto Morandotti[3], Haeyeon Yang[4], Gregory Salamo[4], Marc Sorel[5]; [1]College of Optics and Photonics, CREOL & FPCE, Univ. of Central Florida, USA, [2]Univ. de Moncton, Canada, [3]Univ. du Quebec, Canada, [4]Univ. of Arkansas, USA, [5]Univ. of Glasgow, UK.* We have investigated the power threshold of discrete Kerr surface solitons at the interface between discrete and continuous 1-D AlGaAs medium. Distinct thresholds were measured for interface solitons localized at different sites from the interface.

**CThFF4 • 5:30 p.m.**
**Observation of Two-Dimensional Discrete Surface Solitons and Surface Gap Solitons,** *Xiaosheng Weng[1,2], Anna Bezryadina[1], Zhigang Chen[1,2], K. G. Makris[3], D. N. Christodoulides[3], G. I. Stegeman[3]; [1]San Francisco State Univ., USA, [2]Nankai Univ., China, [3]CREOL & FPCE, Univ. of Central Florida, USA.* We report the first observation of two-dimensional surface solitons at the first bandgap with a self-defocusing nonlinearity and at the semi-infinite gap with a self-focusing nonlinearity. Experimental results are in agreement with theoretical predictions.

## JThG • Laser Plasmas and Particle Acceleration—Continued

**JThG3 • 5:15 p.m.**
**Streaking Transient Electric Fields with Laser Accelerated Proton Beams,** *Thomas Sokollik[1], Matthias Schnuerer[1], Sargis Ter-Avetisyan[1], Peter Viktor Nickles[1], Gerd Priebe[2], Enrico Risse[1], Mikhail Kalashnikov[1], Munib Amin[3], Toma Toncian[3], Oswald Willi[3], Wolfgang Sandner[1,4]; [1]Max-Born-Inst., Germany, [2]CCLRC Daresbury Lab, UK, [3]Heinrich Heine Univ. Düsseldorf, Germany, [4]Technische Univ. Berlin, Germany.* A long range electric field with nanosecond duration and a localized field at the rear side of a laser irradiated foil have been investigated. This scenario was recorded with a newly developed streak measurement setup.

**JThG4 • 5:30 p.m.** **Invited**
**Laboratory Simulations of Astrophysical Blastwaves Using Intense Laser Interactions,** *Todd Ditmire[1], D. Symes[1], A. Edens[2], J. Osterhoff[1], R. Fäustlin[1], M. Maurer[1], A. S. Moore[3], A. C. Bernstein[1]; [1]Univ. of Texas at Austin, USA, [2]Sandia Natl. Lab, USA, [3]Imperial College, UK.* Using high energy nanosecond and femtosecond lasers, we have studied the hydrodynamics of high Mach number, laser-driven radiative blast waves. These waves can be used to study various astrophysically relevant hydrodynamic phenomena and instabilities.

## CThGG • Nanowires and Nanorods—Continued

**CThGG3 • 5:15 p.m.**
**Photoluminescence of GaInAsP/InP Single Quantum Wires with Lateral Widths down to 6 nm Fabricated by Dry Etching and Regrowth,** *Hirotake Itoh[1], Masahiro Yoshita[1], Hidefumi Akiyama[1], Dhanorm Plumwongrot[2], Takeo Maruyama[2], Shigehisa Arai[2]; [1]Inst. for Solid State Physics, Univ. of Tokyo, and CREST JST, Japan, [2]Res. Ctr. for Quantum Effect Electronics, Tokyo Inst. of Technology, and CREST JST, Japan.* We measured photoluminescence of GaInAsP/InP single quantum wires with lateral widths down to 6 nm fabricated by dry etching and regrowth. Lateral quantum confinement energies up to 90 meV were systematically observed.

**CThGG4 • 5:30 p.m.**
**Second- and Third-Order Nonlinear Optical Properties of Arrayed ZnO Nanorods,** *Hwang Woon Lee, Jong Taek Kim, Kyung Moon Lee, Ken Ha Koh, Soonil Lee, Fabian Rotermund; Ajou Univ., Republic of Korea.* We performed second harmonic generation using Maker fringe technique and z-scan measurement to determine macroscopic second- and third-order nonlinear optical susceptibilities of vertically well-oriented ZnO nanorods of different diameters, grown by a hydrothermal process.

## CThHH • Optical Combs Technology II—Continued

**CThHH3 • 5:15 p.m.**
**High Repetition Rate, Low Jitter, Fundamentally Mode-Locked Soliton Er-Fiber Laser,** *Jian Chen, Jason W. Sickler, Erich P. Ippen, Franz X. Kaertner; MIT, USA.* Generation of low jitter 167fs pulses at a fundamental repetition rate of 194MHz from a passively mode-locked Er-fiber soliton laser via nonlinear polarization rotation is reported. Performance of the laser and potential applications are discussed.

**CThHH4 • 5:30 p.m.**
**Synchronizing Lasers over Fiber by Transmitting Continuous Waves,** *Russell Wilcox, John Staples; Lawrence Berkeley Natl. Lab, USA.* We have developed an interferometric method of delivering optical phase information over kilometers of fiber with sub-10fs long term stability. This enables temporal synchronization of pulsed lasers by transmission of CW signals.

## QThI • Meta-Optics—Continued

**QThI2 • 5:15 p.m.**
**Explaining Enhanced Optical Transmission through Sub-Wavelength Apertures: Surface Plasmon Polaritons vs. Composite Diffracted Evanescent Waves,** *Philip Flammer[1], Reuben Collins[1], Ian Schick[1], Russell Hollingsworth[2]; [1]Colorado School of Mines, USA, [2]ITN Energy Systems, USA.* Surface plasmon polaritons' (SPPs) and composite diffracted evanescent waves' (CDEWs) role in enhanced optical transmission are reviewed experimentally, via numerical modeling, and theoretically. All results support involvement of SPPs and contradict the existence of CDEWs.

**QThI3 • 5:30 p.m.**
**Magnetic Plasmon Resonances and Optical Activity,** *Dentcho A. Genov[1], H. Liu[2], D. W. Wu[1], Y. M. Liu[1], C. Sun[1], S. N. Zhu[2], X. Zhang[1]; [1]Univ. of California at Berkeley, USA, [2]Nanjing Univ., China.* Novel type of optical activity due to magnetic plasmon resonances is demonstrated for a first time. A linearly polarized light is shown to change polarization after passing through a metamaterial made of coupled magnetic dimers.

### QThJ • Quantum Computing—Continued

**QThJ3 • 5:15 p.m.** Invited
**Tolerable Noise in Scalable Quantum Computing,** *Manny Knill; NIST Boulder, USA.* Abstract not available.

### CThII • Remote Sensing II—Continued

**CThII3 • 5:15 p.m.**
**Phase Insensitive Frequency Modulation Sensor for Long Distance $CO_2$ Monitoring,** *Sheng Wu, Andrei Deev; PEER Ctr., Caltech, USA.* We report a long distance $CO_2$ monitoring LIDAR using phase insensitive Two-Tone Frequency Modulation (TTFM) over 1.4km. We could detect 1ppm single pass $CO_2$ changes, and could detect $CO_2$ leaks the open air.

**CThII4 • 5:30 p.m.**
**Remote Detection of Breath $CO_2$ with Tunable Diode Laser Absorption Spectroscopy,** *Andrew Wright, M. B. Frish; Physical Sciences Inc, USA.* Remote detection of vital signs is useful in various military and security scenarios. We describe a sensor measuring $CO_2$ in exhaled breath to 35 meters using an eye-safe tunable diode laser, for standoff respiration detection.

### CThJJ • Nanophotonic Structures and Devices—Continued

**CThJJ3 • 5:15 p.m.**
**Micromachined Quantum-Well Air-Clad Waveguides,** *Todd H. Stievater[1], William S. Rabinovich[1], Doewon Park[1], Jacob B. Khurgin[2], Subramaniam Kanakaraju[3]; [1]NRL, USA, [2]Johns Hopkins Univ., USA, [3]Lab for Physical Sciences, USA.* We have used surface micromachining to fabricate suspended InGaAs quantum well waveguides that are supported by lateral tethers. Their enhanced electro-optical and nonlinear-optical properties will be discussed.

**CThJJ4 • 5:30 p.m.**
**Polarization Effect in the Transmission through a Single Nanoscopic Aperture,** *Jochen Mueller, Peter Banzer, Susanne Quabis, Gerd Leuchs; Inst. of Optics, Information and Photonics, Max Planck Res. Group, Germany.* Transmission of a strongly focused light beam through a nanoscopic aperture differs for radial and azimuthal polarization and for holes and coaxial structures. Experimental results are compared with FDTD-calculations showing the relevance of surface plasmons.

### CThKK • Fiber Devices for Sensing and Metrology—Continued

**CThKK3 • 5:15 p.m.**
**First and Higher-Order All-Optical Temporal Differentiators Based on Fiber Bragg Gratings,** *Luis M. Rivas[1,2], Kanwarpal Singh[1], Alejandro Carballar[2], José Azaña[1]; [1]Inst. Natl. de la Recherche Scientifique (INRS), Canada, [2]Dep. Ingeniería Electrónica, Escuela Técnica Superior de Ingenieros, Univ. Sevilla, Spain.* We introduce a general approach for Nth-order all-optical time differentiation using fiber Bragg gratings (FBGs). Arbitrary signals with bandwidths up to a few hundreds GHz can be accurately and efficiently processed using readily feasible FBGs.

**CThKK4 • 5:30 p.m.**
**Low Insertion-Loss (1.8 dB) and Vacuum-Pressure All-Fiber Acetylene Cell Based on Hollow-Core PCF,** *Philip S. Light, Francois Couny, Fetah Benabid; Univ. of Bath, UK.* A novel hollow-core-PCF acetylene-cell fabrication technique based on helium-diffusion through silica is reported. The gas cell combines low insertion loss (1.8 dB) and low pressure (0.001 mbar). Electromagnetically-induced-transparency was used to determine the final acetylene-pressure.

### CThLL • Terahertz Waveguides—Continued

**CThLL3 • 5:15 p.m.**
**Silver/Polystyrene Coated Hollow Glass Waveguides for the Transmission of THz Radiation,** *Bradley Bowden[1], James A. Harrington[1], Oleg Mitrofanov[2]; [1]Rutgers Univ., USA, [2]Bell Labs, Lucent Technologies, USA.* We report on the design theory and fabrication of silver/polystyrene(PS) coated hollow glass waveguides (HGWs) for THz radiation. We find that Ag/PS coated HGWs have significantly lower attenuation for 119 micrometer radiation than Ag-only HGWs.

**CThLL4 • 5:30 p.m.**
**Ferroelectric All-Polymer Hollow Bragg Fibers for THz,** *Maksim Skorobogatiy; Ecole Polytechnique de Montreal, Canada.* Hollow Bragg fiber operating near ferroelectric resonance of one of its reflector materials is considered. Depending upon operating frequency, lowest loss design is: a band gap fiber, fiber with metamaterial reflector or a ferroelectric tube.

NOTES

ROOM 318-320

CLEO

## CThCC • Laser Processing and Measurements—Continued

**CThCC3 • 5:45 p.m.**
**Arrays of Sub-100 nm Features Fabricated with Table Top Extreme Ultraviolet Interferometric Laser Lithography,** *Przemyslaw W. Wachulak[1], Maria G. Capeluto[2], Mario C. Marconi[1], Carmen S. Menoni[1], Jorge J. Rocca[1]; [1]Colorado State Univ., USA, [2]Univ. de Buenos Aires, Argentina.* Arrays of nano-dots were demonstrated by multiple exposure interferometric lithography using a table top λ=46.9 nm wavelength laser. Patterns of different geometries with features ~ 60 nm FWHM were printed controlling the exposure dose.

**CThCC4 • 6:00 p.m.**
**Highly Sensitive Asymmetric Long Period Fiber Grating over 1545 ~ 1650 nm Using Optical Polymer on Deep-Ablated Cladding,** *Nan-Kuang Chen[1], Der-Yi Hsu[2], Sien Chi[1,3]; [1]Dept. of Photonics and Inst. of Electro-Optical Engineering, Natl. Chiao Tung Univ., Taiwan, [2]Inst. of Photonics Technologies, Natl. Tsing Hua Univ., Taiwan, [3]Dept. of Electrical Engineering, Yuan Ze Univ., Taiwan.* We demonstrate high temperature-sensitive, wideband-tunable, laser-ablated asymmetric long period fiber gratings with optical polymer overlay. The temperature sensitivity can be as high as 15.8 nm/°C over a wide spectral range from 1545 to 1650 nm.

ROOM 321-323

## CThDD • Novel Designs for Solid-State Lasers—Continued

ROOM 324-326

## CThEE • High-Power Semiconductor Lasers—Continued

**CThEE5 • 5:45 p.m.**
**Investigation of Catastrophic Optical Mirror Damage in High Power Single-Mode InGaAs-AlGaAs Strained Quantum Well Lasers with Focused Ion Beam and HR-TEM Techniques,** *Yongkun Sin, Nathan Presser, Brendan Foran, Maribeth Mason, Steven C. Moss; Aerospace Corp., USA.* We report our investigation of catastrophic optical mirror damage (COMD) in 980nm high power single spatial mode InGaAs-AlGaAs strained quantum well (QW) lasers using focused ion beam (FIB) and high-resolution transmission electron microscope (HR-TEM) techniques.

**CThEE6 • 6:00 p.m.**
**Power Scalable Semiconductor Disk Laser Using Multiple Gain Cavity,** *Esa J. Saarinen, Antti Härkönen, Soile Suomalainen, Oleg G. Okhotnikov; Optoelectronics Res. Ctr., Tampere Univ. of Technology, Finland.* We report on power scaling of optically-pumped semiconductor disk laser using multiple gain scheme. Increased power and threshold of rollover have been achieved in dual-gain configuration owing to reduced thermal load for each gain element.

ROOM 314

## CThFF • Spatial Nonlinear Effect—Continued

**CThFF5 • 5:45 p.m.**
**Nonreciprocal Transmission and Low-Threshold Bistability in Strongly Modulated Asymmetric Nonlinear WBGs,** *Masafumi Fujii[1], Tetsuya Takashima[1], Ayan Maitra[2], Juerg Leuthold[2], Wolfgang Freude[2], Christopher Poulton[3]; [1]Univ. of Toyama, Japan, [2]Inst. of High-Frequency and Quantum Electronics, Univ. of Karlsruhe, Germany, [3]Max-Planck Res. Group for Optics, Univ. Erlangen-Nuremberg, Germany.* Nonreciprocal optical bistability is numerically investigated in InGaAsP/InP nonlinear waveguide Bragg gratings having a strong and asymmetric sidewall modulation. Minimum switching power as low as 77 mW is predicted by choosing optimal switching conditions.

**CThFF6 • 6:00 p.m.**
**Polarization Instability in a Long Period Grating of $\chi^{(3)}$,** *Nicolas Belanger, Jacques M. Laniel, Alain Villeneuve; INRS, Énergie, Matériaux et Télécommunications, Canada.* We present a novel type of mode coupling phase matched by a long period grating of $\chi^{(3)}$ with no coupling due to the linear grating. We demonstrate its use for polarization switching.

ROOM 315

JOINT

## JThG • Laser Plasmas and Particle Acceleration—Continued

**JThG5 • 6:00 p.m.**
**Degenerate Four-Wave Mixing Mediated by Ponderomotive-Force-Driven Plasma Gratings,** *Kan-Hua Lee[1], Chih-Hao Pai[1,2], Ming-Wei Lin[1], Li-Chuang Ha[1,2], Jyhpyng Wang[1,2,3], Szu-Yuan Chen[1,3], Jiunn-Yuan Lin[4]; [1]Inst. of Atomic and Molecular Sciences, Academia Sinica, Taiwan, [2]Dept. of Physics, Natl. Taiwan Univ., Taiwan, [3]Dept. of Physics, Natl. Central Univ., Taiwan, [4]Dept. of Physics, Natl. Chung Cheng Univ., Taiwan.* Degenerate four-wave mixing mediated by ponderomotive-force-driven plasma gratings is demonstrated in the near-infrared regime, which may be used to compensate for wavefront distortion occurring in various laser-plasma-based devices.

ROOM 316

CLEO

## CThGG • Nanowires and Nanorods—Continued

**CThGG5 • 5:45 p.m.** Invited
**Trapping and Transport of Silicon Nanowires Using Lateral-Field Optoelectronic Tweezers,** *Aaron T. Ohta, Arash Jamshid, Peter J. Pauzauskie, Hsan-Yin Hsu, Peidong Yang, Ming C. Wu; Univ. of California at Berkeley, USA.* We present a new optoelectronic tweezers device that produces electric fields parallel to the plane of the device. This device is capable of trapping and transporting p-type silicon nanowires at velocities of 20 micrometers/s.

ROOM 317

## CThHH • Optical Combs Technology II—Continued

**CThHH5 • 5:45 p.m.**
**Pulse to Pulse Frequency Skew by Modulated Composite Cavity Structure for Range Detection,** *Sarper Ozharar, Sangyoun Gee, Franklyn Quinlan, Peter J. Delfyett; CREOL, USA.* We propose and experimentally demonstrate a novel intracavity modulation scheme to generate frequency shifted coherent pulses from a repetition rate multiplied harmonically mode-locked ring laser for range detection applications.

**CThHH6 • 6:00 p.m.**
**Frequency Stabilized Low Timing Jitter Mode-Locked Laser with an Intracavity Etalon,** *Franklyn J. Quinlan, Sangyoun Gee, Sarper Ozharar, Peter Delfyett; College of Optics and Photonics/CREOL, Unviersity of Central Florida, USA.* A low noise, semiconductor based, frequency stabilized, 10.24 GHz mode-locked laser with a pulse timing jitter and pulse amplitude jitter (1 Hz -100 MHz) of 7.5 fs and 0.04%, respectively, is demonstrated.

ROOM 336

QELS

## QThI • Meta-Optics—Continued

**QThI4 • 5:45 p.m.**
**Non-Local Effects in Effective Medium Response of Nanolayered Metamaterials,** *Viktor A. Podolskiy[1], Justin Elser[1], Ildar Salakhutdinov[2], Ivan Avrutsky[2]; [1]Oregon State Univ., USA, [2]Wayne State Univ., USA.* We demonstrate that the majority of plasmonic nanolayered composites, despite being subwavelength, are not described by effective medium theory and develop an adequate description of electromagnetism in these systems.

**QThI5 • 6:00 p.m.**
**Negative Meta-Magnetism in the Visible Range,** *Hsiao-Kuan Yuan[1], Uday K. Chettiar[1], Wenshan Cai[1], Alexander V. Kildishev[1], Alexandra Boltasseva[2], Vladimir P. Drachev[1], Vladimir M. Shalaev[1]; [1]Electrical and Computer Engineering Dept., Purdue Univ., USA, [2]Dept. of Communications, Optics and Materials, Technology Univ. of Denmark, Denmark.* Arrays of silver nanostrips reveal negative effective permeabilities of -1 and -1.7 at 770 nm and 725 nm. We show that lower silver deposition rate results in stronger magnetic resonances.

**ROOM 337**

**QELS**

## QThJ • Quantum Computing—Continued

**QThJ4 • 5:45 p.m.**
**Kerr-Induced Phase Noise in Quantum Parity Gates,** *Mohsen Razavi, Jeffrey H. Shapiro; MIT, USA.* Quantum parity gates that use weak nonlinearity between single photons and intense coherent pulses are analyzed using a continuous-time model for cross-phase modulation. An inevitable phase noise is shown to degrade gate fidelity.

**QThJ5 • 6:00 p.m.**
**Minimum Energy Pulses for Quantum Logic Cannot Be Shared,** *Julio Gea-Banacloche[1], Masanao Ozawa[2]; [1]Univ. of Arkansas, USA, [2]Tohoku Univ., Japan.* If an electromagnetic pulse with average photon number n is used to carry out the same quantum logical operation on a set of N atoms, the worst-case overall error probability scales as $N^2/n$.

**ROOM 338**

**CLEO**

## CThII • Remote Sensing II—Continued

**CThII5 • 5:45 p.m.**
**Lidar Approach for Measuring the $CO_2$ Concentrations in the Troposphere from Space,** *James B. Abshire[1], Haris Riris[1], Xiaoli Sun[1], Michael A. Krainak[1], Stephan R. Kawa[1], Jian-Ping Mao[2], Pey-Schuan Jian[2], John F. Burris[1]; [1]NASA-Goddard, USA, [2]Science Systems and Applications Inc., USA.* We report progress in assessing the feasibility of a new satellite-based laser-sounding instrument to measure $CO_2$ concentrations in the lower troposphere from space.

**CThII6 • 6:00 p.m.**
**Infrared Heterodyne Radiometry Using Quantum Cascade Laser as Tunable Local Oscillator: Application to Atmospheric Studies,** *Damien Weidmann, William J. Reburn, Kevin M. Smith; CCLRC Rutherford Appleton Lab, UK.* QCLs offer an alternative to gas lasers as local oscillators in infrared laser heterodyne radiometers (LHRs). A QCL-based LHR operating in frequency-sweep mode has been developed and deployed in laboratory and field measurements.

**ROOM 339**

## CThJJ • Nanophotonic Structures and Devices—Continued

**CThJJ5 • 5:45 p.m.**
**Circularly Polarized Emission from Colloidal Nanocrystal Quantum Dots Confined in Sculptured Thin Film Based Microcavities,** *Jian Xu[1], Fan Zhang[1], Akhlesh Lakhtakia[1], Sean Pursel[1], Michael Gerhold[2]; [1]Pennsylvania State Univ., USA, [2]Engineering Sciences Directorate, Army Res. Office, USA.* We report the simultaneous control of the polarization state and emission bandwidth of colloidal nanocrystal-quantum-dots by embedding them in chiral reflector-based microcavities, which arises from the enhanced coupling between the NQD-excitons and the confined-electromagnetic-field.

**CThJJ6 • 6:00 p.m.**
**Time-Resolved Photoluminescence Studies and Spectral Narrowing in ZnO Nanostructures,** *Gregory A. Garrett[1], Hongen Shen[1], Michael Wraback[1], Loucas Tsakalakos[2], Steven F. LeBoeuf[2]; [1]US ARL, USA, [2]General Electric—Global Res. Ctr., USA.* Pulsed-excitation photoluminescence studies of ZnO nanostructures show spectral narrowing and a corresponding decrease in lifetime with an increase in pump fluence. Results for structures grown on sapphire and silicon are presented.

**ROOM 340**

## CThKK • Fiber Devices for Sensing and Metrology—Continued

**CThKK5 • 5:45 p.m.**
**Nonlinear Phenomena in the Response of Interferometric Fiber-Optic Current Sensors,** *Klaus Bohnert, Philippe Gabus, Samuel Wiesendanger, Jürgen Nehring, Hubert Brändle; ABB Ltd, Switzerland.* The nonlinearities in the response of an interferometric fiber-optic current sensor associated with inherent temperature compensation of the Faraday effect are investigated at currents up to several 100 kA and temperatures between -40 and 80°C.

**CThKK6 • 6:00 p.m.**
**Multimode Fiber Loop Ring down Spectroscopy for Pressure Measurement,** *Huiye Qiu[1], Yishen Qiu[2], Zhihao Chen[3], Baoyu Fu[2], Xiyao Chen[2], Gaoming Li[2]; [1]Fujian Normal Univ., China, [2]Fujian Normal Univ, China, [3]Inst. for Infocomm Res., Singapore.* We demonstrate a multimode fiber loop ring down spectroscopy for pressure measurement with higher sensitivity over larger dynamic range of measurement compared with single mode fiber counterpart.

**ROOM 341**

## CThLL • Terahertz Waveguides—Continued

**CThLL5 • 5:45 p.m.**
**Air-Core Microstructure Fiber for Terahertz Radiation Waveguiding,** *Ja-Yu Lu[1], Chin-Ping Yu[1], Hung-Chung Chang[1], Hung-Wen Chen[1], Yu-Tai Li[2], Ci-Ling Pan[2], Chi-Kuang Sun[3]; [1]Graduate Inst. of Electro-Optical Engineering, Natl. Taiwan Univ., Taiwan, [2]Graduate Inst. of Electro-Optical Engineering, Natl. Chiao-Tung Univ., Taiwan, [3]Graduate Inst. of Electro-Optical Engineering and Dept. of Electrical Engineering, Natl. Taiwan Univ., and Res. Ctr. for Applied Sciences, Academia Sinica, Taiwan.* We demonstrate a simple and low-loss THz microstructure fiber for broadband THz waveguiding, which is constructed by using the highly flexible and readily available materials. Substantially low attenuation constant less than 0.01cm-1 has been achieved.

**CThLL6 • 6:00 p.m.**
**1-D THz Photonic Waveguides,** *Adam L. Bingham, Daniel R. Grischkowsky; Oklahoma State Univ., USA.* 1-D, lithographically fabricated, grooved (with and without defects) chips are inserted into a metal parallel plate waveguide. THz time-domain spectroscopy is used to characterize these waveguides. A good match between theory and experiment is shown.

**NOTES**

**ROOM 318-320**

**C L E O**

### CThCC • Laser Processing and Measurements—Continued

**CThCC5 • 6:15 p.m.**
**Transparent Thin-Film Characterization by Using Differential Optical Sectioning Interference Microscopy,** *Chun-Chieh Wang[1], Hong-Jhang Jian[2], Chau-Hwang Lee[3]; [1]Graduate Inst. of Physics, Natl. Chung Cheng Univ., Taiwan, [2]Graduate Inst. of Mechanical and Mechatronic Engineering, Natl. Taiwan Ocean Univ., Taiwan, [3]Res. Ctr. for Applied Sciences, Academia Sinica, Taiwan.* Differential optical sectioning interference microscopy is proposed for measuring the refractive index (n) and thickness (d) of transparent thin films with sub-micrometer lateral resolution. We demonstrate this technique with a 100-nm $SiO_2$ layer on Si.

**ROOM 321-323**

### CThDD • Novel Designs for Solid-State Lasers—Continued

**ROOM 324-326**

### CThEE • High-Power Semiconductor Lasers—Continued

**CThEE7 • 6:15 p.m.**
**Etched Micro-Structures for Control of Optical Mode Distribution for Improved Broad Area Laser Performance,** *Paul A. Crump[1], Tristan Matson[1], Victor Anderson[1], Derek Schulte[1], Jake Bell[1], Jason Farmer[1], Mark DeVito[1], Rob Martinsen[1], Y. K. Kim[2], K. D. Choquette[2]; [1]nLight Photonics Corp., USA, [2]Univ. of Illinois, USA.* Etching microstructures into broad area diode lasers leads allows for independent control of the optical modes. Appropriately designed microstructures are found to lead to more uniform near field and increased power conversion efficiency.

**ROOM 314**

### CThFF • Spatial Nonlinear Effect—Continued

**CThFF7 • 6:15 p.m.**
**Tip-Enhanced Near-Field Second-Harmonic Imaging of Ferroelectric Domain Structure of $YMnO_3$,** *Corneliu Catalin Neacsu[1], Bas B. Van Aken[2,1], Manfred Fiebig[2,1], Markus B. Raschke[3]; [1]Max-Born-Inst. für Nichtlineare Optik und Kurzzeitspektroskopie, Germany, [2]HISKP, Univ. Bonn, Germany, [3]Dept. of Chemistry, Univ. of Washington, USA.* The spatially resolved imaging of ferroelectric domain structure of unpoled $YMnO_3$ was achieved combining second-harmonic generation with tip-enhanced near-field optical microscopy. Domains elongated along the hexagonal axis with dimensions of several 100 nm were observed.

**ROOM 315**

**J O I N T**

### JThG • Laser Plasmas and Particle Acceleration—Continued

**JThG6 • 6:15 p.m.**
**Study of Hot Electron Transportation in Foils and Wedge Targets Irradiated with Ultrashort Laser Pulses,** *Byoung-ick Cho, Jens Osterholz, Gilliss Dyer, Stefan Kneip, Daniel Symes, A. Bernstein, Todd Ditmire; Univ. of Texas at Austin, USA.* We investigated the hot electron transport in foil and wedge shaped targets irradiated with ultra-intense laser pulses. The results suggest that the electrons are guided by the strong quasi-static electromagnetic fields at the wedge boundary.

**ROOM 316**

**C L E O**

**ROOM 317**

### CThHH • Optical Combs Technology II—Continued

**CThHH7 • 6:15 p.m.**
**Octave-Spanning Optical Waveform Synthesizer for Coherent Control Experiments,** *Stefan Rausch[1], Thomas Binhammer[1], Volker Scheuer[2], Franz X. Kaertner[3], Uwe Morgner[1]; [1]Univ. Hannover, Germany, [2]Nanolayers GmbH, Germany, [3]MIT, USA.* We present a unique combination of an improved octave-spanning laser oscillator and prism-based pulse shaper allowing for the generation of various pulse shapes and sequences for coherent control experiments.

**ROOM 336**

**QELS**

### QThI • Meta-Optics—Continued

**QThI6 • 6:15 p.m.**
**The Influence of Granularity on the Subwavelength Performance of a Negative Refractive Index Lens,** *Kevin J. Webb[1], Jia-Han Li[2]; [1]Purdue Univ., USA, [2]Natl. Taiwan Univ., Taiwan.* A model for a discrete negative refractive index slab lens is used to evaluate the impact of granularity on image resolution, in particular, on the evanescent field transfer function.

**6:30 p.m. – 8:00 p.m. DINNER BREAK (on your own)**

**8:00 p.m. – 10:00 p.m. CLEO/QELS POSTDEADLINE PAPER SESSIONS**

ROOM 337

QELS

## QThJ • Quantum Computing—Continued

**QThJ6 • 6:15 p.m.**
**Simple Experimental Generation of a Four-Photon Cluster State and Distinguishing Classes of Genuine Four-Qubit Entanglement Using Witness Operators,** *Yuuki Tokunaga[1,2,3], Shin Kuwashiro[2,3], Takashi Yamamoto[2,3], Masato Koashi[2,3], Nobuyuki Imoto[2,3]; [1]NTT, Japan, [2]Osaka Univ., Japan, [3]CREST-JST, Japan.* We experimentally demonstrate a simple scheme for generating a four-photon cluster state. We show that the produced state has genuine four-qubit entanglement which is discriminated from a class including GHZ and W types of entanglement.

ROOM 338

CLEO

## CThII • Remote Sensing II—Continued

**CThII7 • 6:15 p.m.**
**Tunable Diode Laser Wavelength Modulation Spectroscopy (TDL-WMS) Using a Fiber-Amplified Source,** *Richard Wainner, Michael Frish, Mark Allen, Matthew Laderer, David Green; Physical Sciences Inc., USA.* The potential for extended-range remote sensing of methane is examined, utilizing a fiber-amplified source. Details of WMS absorption signal characteristics and output laser characteristics are presented for an EDFA-amplified tunable DFB diode laser.

ROOM 339

## CThJJ • Nanophotonic Structures and Devices—Continued

**CThJJ7 • 6:15 p.m.**
**Performance Limits to Waveguide Isolators in InP,** *Taubid R. Zaman, Rajeev J. Ram; MIT, USA.* Limits of isolation and bandwidth for existing waveguide isolators in InP are analyzed. A new integrated waveguide isolator design is proposed which achieves an isolation greater than 38 dB and a loss of 1.4 dB.

ROOM 340

## CThKK • Fiber Devices for Sensing and Metrology—Continued

**CThKK7 • 6:15 p.m.**
**Novel Optical Frequency Domain Reflectometry with Measurement Range beyond Laser Coherence Length Realized Using Concatenatively Generated Reference Signal,** *Xinyu Fan, Fumihiko Ito; NTT Access Network Service Systems Labs, NTT Corp., Japan.* We have developed a novel optical frequency domain reflectometry (OFDR) technique with a measurement range beyond the laser coherence length by using concatenatively generated reference signal from an auxiliary interferometer.

ROOM 341

## CThLL • Terahertz Waveguides—Continued

**CThLL7 • 6:15 p.m.**
**THz Fiber Directional Coupler,** *Hung-Wen Chen[1], Ja-Yu Lu[1], Li-Jin Chen[1], Po-Jui Chiang[1], Hung-Chun Chang[1], Yu-Tai Li[2], Ci-Ling Pan[2], Chi-Kuang Sun[1]; [1]Graduate Inst. of Electro-Optical Engineering, Natl. Taiwan Univ., Taiwan, [2]Dept. of Photonics and Inst. of Electro-Optical Engineering, Natl. Chiao Tung Univ., Taiwan.* We demonstrated a THz subwavelength fiber coupler for future millimeter wave applications. Unlike traditional optical fiber couplers, its coupling ratio is independent of the length of the coupling region because of the anti-symmetric mode cutoff.

**6:30 p.m. – 8:00 p.m. DINNER BREAK (on your own)**

**8:00 p.m. – 10:00 p.m. CLEO/QELS POSTDEADLINE PAPER SESSIONS**

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