Photon Gun Using a Finite-Size Photonic Crystal Waveguide, Stephen Hughes, V. C. S. Manga Racz, Queen’s Univ., Canada. We have applied the line-by-line pulse shaping. Flexible millimeter-wave comb synthesis using a novel time-multiplexed optical pulse shaping scheme by integrating fast wavelength switching, optical frequency comb generation, and spectral line-by-line pulse shaping.

Trapped Electron Detection using a Van der Pauw–van der Merwe Technique, R. W. McKinnon, Dalacu Frédéric, Entangled Pair Sources, Microcavities—A Scalable Route to Single and Entangled Pair Sources, Robin L. Williams et al., S. Fedorov et al., M. E. Reimer et al., P. Poole, G. Aers, D. Dalacu, M. Korkusinski, J. Lefebvre, J. Lapointe, W. R. McKinnon, P. Hawrylak, Inst. for Microstructural Sciences, Natl. Res. Council, Canada, Dept. of Physics, Univ. of Ottawa, Canada. We propose a scalable route to single and entangled photon pair sources at telecom wavelengths based on single InAs/InP quantum dots embedded within photonic crystal microcavities. The electrostatic gating of such dots is discussed.

We show that non-degenerate 4-wave mixing in gas filled HC-PBFs, Jan C. Petersen, Jan Hald; Danish Fundamental Metrology Ltd., Denmark. We demonstrate the observation of saturated absorption in several molecules in HC-PBFs. Characteristics of these molecular reference lines are discussed and the locking of fiber lasers to the molecular absorption lines is demonstrated.

Invited Two-Tone Lightwave Signal Generation, Tetsuya Kawashita, Takehide Sakamoto, Akito Chiba, Masahiro Tsuchiya, Hiroaki Toda, Natl. Inst. of Information and Communications Technology, Japan; Denshida Univ., Japan. Pure two-tone signal generation with spurious suppression ratio of 47 dB was demonstrated by using an optical Mach-Zehnder modulator with precisely balanced operation, where extinction ratio and chirp parameter were respectively 64 dB and 0.0099.

Modulated spontaneous emission from a single-quantum-dot embedded in a small finite-size, photonic-crystal slab waveguide are investigated. We subsequently demonstrate very large Purcell factors that can be exploited to emit efficient single photons “on-chip.”

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

Previously blended lines have been resolved.

An Interferometric Method for Dynamic Extinction Ratio Measurement, Ibrahim T. Ozdur, Sarper Orhanar, Dimitrios Mandridis, Peter J. Delfyett, CREOL and Florida Photonics Ctr. of Excellence, College of Optics and Photonics, Univ. of Central Florida, USA. We introduce a novel interferometric method for dynamic extinction ratio measurement of temporally demultiplexed pulses by using a high extinction modulator. The resulting extinction ratio is 44dB. Our method has a dynamic range of ~60dB.
These states reflect band-structure and dynamic injection is taken into account.

Electro-optical nonlinearities of Bragg-Spaced Quantum Wells, Wesley J. Johnson1, John F. Prineas1,2, Arthur L. Smith1, Dan T. Nguyen1,3, Hai K. Khong1, Ralf Bender1, Galina Khitrova2, Hyatt M. Gibbon2, ‘Lab for Photonics and Quantum Electronics and Dept. of Physics, Univ. of Iowa, USA, ‘College of Optical Sciences, Univ. of Arizona, USA. Spin- and polarization-dependent ultrafast blue shifts, transient gain and self-wave-mixing are observed in Bragg-spaced InGaAs/GaAs quantum wells. The data are in agreement with a microscopic theory.

JFBI • 8:00 a.m.

JFBI • 8:15 a.m.
Scalesing for Narrow-Band MeV Proton Beams from Laser Plasmas, Sebastian M. Pietzenhauer1, Oliver Jack1, Jens Palm1, Hans-Peter Schlenvoigt1, Malte C. Kaluza1, Heinrich Schweizer2, Alex P. L. Robinson2, Paul Gibbon2, Roland Sauermann1, Ken W. D. Leidinger1, ‘Inst. für Optik und Quantentechnik, Germany, ‘Forschungszentrum Dresden-Rossendorf, Germany, ‘Central Laser Facility, Rutherford Appleton Lab, UK, ‘Institut für Mathematische und Theoretische Physik, Universität Darmstadt, Germany, ‘Max-Born-Inst. für Nonlinear Optik und Ultrafast Physik, Germany. We demonstrate high energy pico-second pulses obtained directly from a thin-disk laser oscillator operating in ambient atmosphere. The average output power was up to 55 W at a repetition rate of 3.8 MHz.

CFC1 • 8:00 a.m.
Ultrafastbroadband Femtosecond Continuum Generation in Crystals of Bismuth Triborate, Alexander Gayday Brandon1,2, Ismail Nikoli3, Ivan Buch-van4,5, Frank Noack1, Valentijn Petrov1, Sofja Umar1, Bulgaria, ‘Max-Born Inst. für Nonlinear Optics and Ultrafast Spectroscopy, Germany. Ultrafast broadband generation of white-light continuum in the near-IR (~135 THz, 1.15-2.4 µm) is demonstrated in BiB3O5 pumped by 45% in long pulses at 800 nm, achieving an energy of 15 µJ at 1 kHz.

QELS • QELS • 8:00 a.m.-9:45 a.m.
Quantum Emitter Lasers in Photosynthetic Systems
Leonid Butov1, Univ. of California at San Diego, USA, Presider

QFC1 • 8:00 a.m.
Joint Optical Nonlinearities of Saturated Quantum Wells, Wesley J. Johnson, University of Iowa, USA; John F. Prineas, University of Iowa, USA; Arthur L. Smith, University of Iowa, USA; Dan T. Nguyen, University of Iowa, USA; Hai K. Khong, University of Iowa, USA; Ralf Bender, University of Iowa, USA; Galina Khitrova, University of Iowa, USA; Hyatt M. Gibbon, University of Iowa, USA; Lab for Photonics and Quantum Electronics and Department of Physics, University of Iowa, USA; College of Optical Sciences, University of Arizona, USA; Spin- and polarization-dependent ultrafast blue shifts, transient gain and self-wave-mixing are observed in Bragg-spaced InGaAs/GaAs quantum wells. The data are in agreement with a microscopic theory.
Genetic and Drug Reflectivity Mirror.

ficiency and output power are comparable to a grating stabilized Thulium fiber laser. Slope ef-

300pm linewidth is achieved in a volume Bragg Comb, Vikas Sudesh, Martin Richardson; CREOL, Narrow Linewidth Volume Bragg Grating CFN3 • 8:30 a.m. Coe-Rotated Lucent Technologies, USA, Presider

325μJ have been generated at 50kHz with 13ns pulses in the same amplifier.

A 4W Tunable Tm·Ho Silica Fibre Laser, Alexander Hemmings, Alexander Sabelk, Shayne Bennetts, Stuart D. Jackson, David G. Lancaster; ‘Defence Science and Technology Organisation, Australia, ‘Optical Fibre Technology Ctr., Univ. of Sydney, Australia. A multiwatt Tm·Ho co-doped silica fibre laser pumped at 0.79 μm is demonstrated with an extended tuning range from 1920-2120nm, compared with 1880-2040nm obtained using a Tm· only doped fibre.

Narrow Linewidth Volume Bragg Grating Stabilized Thulium Fiber Laser, Timothy S. Mc-Comb, Vikas Sadash, Martin Richardson; CREOL, College of Optics and Photonics, Univ. of Central Florida, USA. A spectrometer resolution limited 300pm linewidth is achieved in a volume Bragg grating stabilized Thulium fiber laser. Slope ef-
ficiency and output power are comparable to a similar resonator formed by a broadband high reflectivity mirror.

Label-Free and High-Throughput Screening of Biomolecular Interactions, Ismael E. Ozkumur, James W. Needham, David A. Bergstein, Michael Ruane, Bennett B. Goldberg, M. Selim Unlu; Eindhoven Univ. of Technology, Netherlands. We developed all optical traffic control and self-routing of WDM optical packets in cascaded all-optical Data Vortex switching nodes. In the experiment, WDM optical packets are successfully routed while maintaining a BER of 10^-10 or better.

Demonstration of Traffic Control and WDM Routing in All-Optical Data Vortex Node, Hyan-Do Jung, Edouard Tangdiongga, A. M. J. Kooren, Eindhoven Univ. of Technology, Netherlands. We demonstrate all-optical traffic control and self-routing of WDM optical packets in cascaded all-optical Data Vortex switching nodes. In the experiment, WDM optical packets are successfully routed while maintaining a BER of 10^-10 or better.

Functionalized Anthradithiophene and Di-cyanomethylene-benzodihydropyran Derivatives, Andrew D. Platt, Jonathan Day, John Anthony; Robert Twieg, Ok usa no Ot osso khou e, ‘Oregon State Univ., USA, ‘Univ. of Kentucky, USA, ‘Kent State Univ., USA. We present optical, fluorescent and photoconductive temperature dependent properties of novel high performance solution- processable functionalized anthradithiophene and dicyanomethylene-benzodihydropyran derivatives. Changes in fluorescence lifetime, fluorescence quantum yield, and photoconductivity with temperature are discussed.

Gradient Index Polymer Optics, G. Beadie, E. Fleet, A. Rosenberg, P. A. Lane, J. S. Shirks; Y. Jie, H. Tian, A. Kamdar, A. Hiltner, E. Baer; ‘NRL, USA, ‘Case Western Reserve Univ., USA. We developed novel lenses from gradient index, multi- polymer sheets. The sheets were processed into lenses with spherically-symmetric index profiles. An F/2.25 GRIN singlet produced images with 4x better contrast than a commercial F/2.25 glass singlet.
CFH1 • 8:00 a.m. Invited
Photonic Components for Short Range Optical Interconnects, Bert J. Offrein; IBM Res. GmbH, Switzerland. Optical interconnect technology will play an increasingly important role in servers and supercomputers as a means to keep pace with the increasing intra-system bandwidth requirements. Low-cost and high density optical packaging concepts are required.

CFH2 • 8:30 a.m.
Modeling and Characterization of Mach-Zehnder Silicon Electrooptic Modulators, Gui-Rong Zhou, Michael W. Geis, Steven J. Spector, Fawwan Gan, Matthew E. Gerst, Robert T. Schlein, Jung U. Youn, Donna M. Lennon, Erich P. Ippen, Theodore M. Lyssczak, Franz X. Kaertner; MIT, USA, MIT Lincoln Lab, USA. We present a comprehensive study of silicon Mach-Zehnder modulators based on carrier injection. Detailed comparisons between simulation results and measurements are made and excellent agreement is obtained for DC and AC characteristics.
observed for the first time because of microcavity definitive handedness from single quantum dots was microcavities for visible/telecom wavelengths.

We define a practical measure for the degree of fractional decay and establish conditions for the effect to be observable for quantum dots in photonic crystals exhibiting absorptive losses.

We define a practical measure for the degree of fractional decay and establish conditions for the effect to be observable for quantum dots in photonic crystals exhibiting absorptive losses.

We define a practical measure for the degree of fractional decay and establish conditions for the effect to be observable for quantum dots in photonic crystals exhibiting absorptive losses.

We define a practical measure for the degree of fractional decay and establish conditions for the effect to be observable for quantum dots in photonic crystals exhibiting absorptive losses.

We define a practical measure for the degree of fractional decay and establish conditions for the effect to be observable for quantum dots in photonic crystals exhibiting absorptive losses.

We define a practical measure for the degree of fractional decay and establish conditions for the effect to be observable for quantum dots in photonic crystals exhibiting absorptive losses.

We define a practical measure for the degree of fractional decay and establish conditions for the effect to be observable for quantum dots in photonic crystals exhibiting absorptive losses.

We define a practical measure for the degree of fractional decay and establish conditions for the effect to be observable for quantum dots in photonic crystals exhibiting absorptive losses.

We define a practical measure for the degree of fractional decay and establish conditions for the effect to be observable for quantum dots in photonic crystals exhibiting absorptive losses.
QELS • Polaritons in Confined Structures—Continued

JFB • Laser Acceleration—Continued

JFB4 • 8:45 a.m.
Direct Measurement of the Electron Density Driving the Laser Particle Acceleration with Thin Foils, Oliver Jakeli1, Sebastian M. Pfitzenmaier1, Jens Polz1, Hans-Peter Schlenvoigt1, Malte C. Klukatz1, Heinrich Schwentker2; 1Inst. für Optik und Quantentechnik, Germany, 2Inst. für Optik und Quantentechnik, Friedrich-Schiller-Univ., Germany. 3Laser Res. Inst., Univ. of Stellenbosch, South Africa. A method for time resolved optical probing of laser ion acceleration using interferometry is presented. The electron density in the accelerating fields were reconstructed in a time series with 10 fs resolution.

JFB5 • 9:00 a.m.
Relativistic Photodetachment Measurements from Ionization of Argon and Xenon in Ultrahigh Fields, Isaac Ghebregziabher1, Anthony DiChiana2, Sasi Palaniyappan2, Rob Sauer2, Rob Mitchell2, Jane Wieczeck2, Samantha White1, B. C. Walker1; 1Dept. of Physics and Astronomy, Univ. of Delaware, USA. Photodetachment angular distributions with energies as high as 1 MeV were measured and calculated with a semi-classical tunneling model at relativistic laser intensity. Measurements and theory show directional higher energy electrons and isotropic lower energy electrons.

JFB6 • 9:15 a.m.
1 GeV Electron Beams from a Laser-Driven Channel-Guided Accelerator, Ciska Toth1, K. Nakamura2, A. Gonsalves2, D. Fanarasen2, N. Matias2, C. G. R. Geddes1, C. B. Schroder2, E. Eversen, W. P. Leemann1; Lawrence Berkeley Natl. Lab, USA. GeV-class electron beams generated from laser wakefield accelerator with 40 TW laser pulses using a 33 nm hydrogen-based capillary discharge waveguide. Stable 0.5 GeV e-beams can produce bright radiation from THz to X-rays.

QFC5 • Polariton Condensates—Continued

QFC6 • 9:15 a.m.
A Non-Interferometric Pulse-Stacker for Photonic Crystal Lasers, Leonardo De Boni1, Carlos Toro1, Florencio E. Hernandez2; 1Univ. of Central Florida, USA, 2Univ. of California at Los Angeles, USA. We demonstrate that the supercontinuum picosecond generation (SC) preserves the polarization state, linear, elliptical and circular, of the pump source. Additionally, an analysis of the main mechanism was done based on the spectra polarization dependence.

QFC • Comb and Continuum Generation—Continued

CFB • Short Pulse and Pulse-Shaped Lasers—Continued

CFB4 • 8:45 a.m.
Type Free Sub-Picosecond Ultrafast Laser Amplifier, Eric Mottay1, Martin Delage1, Antoine Courjaud2; Amplitude Systems, France. We demonstrate a diode-pumped Ytterbium ultrashort pulse laser amplifier, avoiding chirped pulse amplification, resulting in a simple and robust laser system. The average power exceeds 10 W for repetition rates between 50 and 100 kHz.

CFB5 • 9:00 a.m.
11 MW Pico-Secund Pulses with >70 W Average Power from a Phase-Conjunct Nd:YVO4 Bounce Laser System, Kouji Nawata1, Naoki Shibai1, Masahito Okida1, Takahide Omatsu2; 1Chiba Univ., Japan, 2Japan Science and Technology Agency, Japan. A 78.5 W pico-second master-oscillator power-amplifier system based on a Nd:YVO4 bounce amplifier with a phase conjugator was demonstrated. The peak power of the output pulses was > 11 MW in a pulse repetition frequency region of 0.7-1 MHz.

CFB6 • 9:15 a.m.
Real Time Amplitude Noise and Jitter Comparison of Supercontinuum Generated at Different Dispersion Regimes, Nuh S. Yuksek1, Xinxu Sang2, En-Kuang Tien2, Feng Qian3, Qi Song4, Ozdal Boyraz4; 1Univ. of California at Irvine, USA. An experimental investigation on noise performances of supercontinuum generated in normal and anomalous dispersion fibers is carried out. The supercontinuum in the normal dispersion fiber has lower real time amplitude noise and timing jitter.

CFB7 • 9:30 a.m.
Operation Features of Regenerative Amplifiers at High Repetition Rate, Mikhail Grishin1, Vidmantas Gaidibin1, Andrejus Michailov1, Juozas Vaireckas2; 1EKSPLA sas, Lithuania, 2Inst. of Physics, Lithuania. Peculiar dynamics of high repetition rate regenerative amplifiers limits the system power efficiency. A basic model of regenerative amplifiers dynamics and experimental verification of operation efficiency are presented.

CFC • Laser Acceleration—Continued

CFC4 • 8:45 a.m.
Limiting Nature of Continuum Generation in Silicon, Prakash V. Koonath1, Daniel R. Soll2, Bahram Jalali1; 1Univ. of California at Los Angeles, USA. The generation of spectral continuum in silicon is studied experimentally and theoretically. The dynamics of the free carriers generated through two photon absorption (TPA) is found to limit the extent of the generated continuum.

CFC5 • 9:00 a.m.
Real Time Amplitude Noise and Jitter Comparison of Supercontinuum Generated at Different Dispersion Regimes, Nuh S. Yuksek1, Xinxu Sang2, En-Kuang Tien2, Feng Qian3, Qi Song4, Ozdal Boyraz4; 1Univ. of California at Irvine, USA. An experimental investigation on noise performances of supercontinuum generated in normal and anomalous dispersion fibers is carried out. The supercontinuum in the normal dispersion fiber has lower real time amplitude noise and timing jitter.

CFC6 • 9:15 a.m.
Polarization Preservation of White-Light Supercontinuum Generation, Leonardo De Boni1, Carlos Toro1, Florencio E. Hernandez2; 1Univ. of Central Florida, USA, 2Univ. of California at Los Angeles, USA. We demonstrate that the supercontinuum picosecond generation (SC) preserves the polarization state, linear, elliptical and circular, of the pump source. Additionally, an analysis of the main mechanism was done based on the spectra polarization dependence.

CFC7 • 9:30 a.m.
Polarized Supercontinuum from a 1064nm Microchip Laser and Application to Tunable Visible/UV Generation in BIBO, Chanyeong Xiong1, William J. Wadsworth1; 1Dept. of Physics, Univ. of Bath, UK. We generate a 99% polarized supercontinuum from a 1064nm microchip laser by use of a highly birefringent photonic crystal fiber. We also demonstrate tunable visible/UV generation in BIBO pumped by the polarized continuum source.
CFD • Thulium-Doped Fiber Amplifiers and Lasers—Continued

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

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

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

CFD7 • 9:30 a.m.
Actively Q-Switched Tm³⁺-Doped and Tm⁵⁺, Ho⁶⁺-Codoped Silica Fiber Lasers, Marc Eichhorn, Stuart D. Jackson; French-German Res. Inst. of Saint-Louis, France; Optical Fibre Technology Ctr., Univ. of Sydney, Australia. We report on the Q-switched operation of Tm³⁺-doped and Tm⁵⁺, Ho⁶⁺-codoped silica fiber lasers. Short pulses at high repetition rates and high average power could be achieved with the Tm³⁺-doped silica fiber.

CFE • High-Throughput Biosensing—Continued

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

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

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

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

CFE7 • 9:45 a.m.
Transmission of a Chaos-Masked Signal with In-Line All-Optical Wavelength Conversion, Paolo Minzioni, Mauro Benedetti, Giuseppe Aromatario, Ilaria Cristiani, Sabrina Merlo, Vartolo Annavuzzii Lodi; Electronics Dept., Univ. of Pavia, Italy. In this paper we demonstrate wavelength-conversion, of a message masked by additive chaos, along a transmission line. This result shows that chaos-based communications are compatible with channel-switching and wavelength-conversion as required in reconfigurable networks.

CFF • High-Throughput Microscope for Label-Free Detection of Protein and Small-Molecule Chemical Microarrays, Yiyun Fei, James P. Landry, Yun-Shin Sun, Jiantao Lai, Xiaobing Wang, Kit S. Lam, Xiangdong Zhu; Dept. of Physics, Univ. of California at Davis, USA. We describe a novel scanning optical microscope that enables high-throughput label-free detection of end-points and kinetics of multiple biomolecular reactions on microarrays with more than 10,000 protein or small-molecule targets.

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

CFG • Organic/Polymer Photonics—Continued

CFG4 • 9:00 a.m.
Steganographic Fiber-Optic Transmission Using Coherent Spectral-Phase-Encoded Optical CDMA, Bernard Wu, Anjuli Agarwal, Ivan Glei, Eugene Narimanov, Shahab Etemad; Paul R. Prucnal; Princeton Univ., USA, “Telcordia Technologies, USA. Stealth communication using coherent SPE-OCMDA is demonstrated. The coherent approach can provide higher spectral efficiency than incoherent optical CDMA.

Steven Forrest received his B.A. Physics in 1972 from the University of California, and his MSc and Ph.D. Physics in 1974 and 1979 from the University of Michigan. First at Bell Labs, he investigated photodetectors for optical communications. In 1985, Prof. Forrest joined the Electrical Engineering and Materials Science Departments at USC where he worked on optoelectronic integrated circuits, and organic semiconductors. In 1992, Prof. Forrest became the James McKennon Distinguished University Professor of Electrical Engineering at Princeton University. He served as director of the National Center for Integrated Photonic Technology, and as Director of Princeton’s Center for Photonics and Optoelectronic Materials (POEM). From 1997-2001, he served as the Chair of the Princeton’s Electrical Engineering Department. In 2006, he rejoined the University of Michigan as Vice President for Research, and as the William Gould Dow Collegiate Professor in Electrical Engineering, Materials Science and Engineering, and Physics. A Fellow of the IEEE and OSA and a member of the National Academy of Engineering, he received the IEEE/LEOS Distinguished Lecturer Award in 1996-1997, and in 1998 he was co-recipient of the IFOPI National Distinguished Inventor Award as well as the Thomas Alva Edison Award for Innovations in organic LEDs. In 1999, Prof. Forrest received the MRS Medal for work on organic thin films. In 2001, he was awarded the IEEE/LEOS William Streifer Scientific Achievement Award for advances made on photodetectors for optical communications systems. In 2008 he received the Jan Rajchman Prize from the Society for Information Display for invention of phosphorescent OLEDs, and is the recipient of the 2007 IEEE Daniel E. Noble Award for innovations in OLEDs. Prof. Forrest has authored ~425 papers in refereed journals, and has 173 patents. He is co-founder and founding participant in several companies, including Sensors Unlimited, Epitaxx, Inc., Global Photonic Energy Corp, Universal Display Corp. (NASDAQ: PANL) and ASAP, Inc.
A novel near-field nano-imager based on nanophotodetector (NPD) array is presented. Simulation shows λ/10 resolution imager based on nanophotodetector (NPD) array that has been fabricated and characterized, showing high (>35,000) internal gain under UV illumination.

We demonstrate scalable Si nanowire photodetectors that function as phototransistors. Etched planar and vertical Si nanowire photodetectors have been fabricated and characterized, showing high (>35,000) internal gain under UV illumination.

A silicon optical modulator has been demonstrated which is capable of operating in a forward bias mode for low power (<10 mW), or in a reverse bias mode for large bandwidth.

Carrier Injection Mode, that Can Be Operated in Carrier Depletion or Carrier Depletion in Offset Multiple-Quantum-Well, Hui-wen Chen, Ying-hao Kuo, John E. Bowers; Univ. of California at Santa Barbara, USA. We demonstrate a phase modulator based on carrier depletion on the hybrid silicon evanescent platform. The device has a modulation efficiency of 4Vmm, along with a bandwidth of 100nm and power capability up to 20mW.
Ballroom A1 and A8  
**QELS**

**QFD 1 • 10:15 a.m.**
Random Lasers, Allard P. Mosk; Univ. of Twente, Netherlands. Random lasing is a unique tool to investigate the longest-lived light modes in a disordered material. The behavior of very strongly scattering random lasers in our experiments is well understood in terms of these modes.

**QFD 1 • 10:15 a.m.**
Invited
Random Lasers, Hui Cao; Northwestern Univ., USA, Presider

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

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

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

**QFD3 • 11:00 a.m.**
Random Laser Emission from ZnO Nanocomposite Hybrids, Andreas Staatsopoulou1; Evangelos D. Tzagarakis1, Rahul V. Dua, Spiros H. Anastassiadis4, Emmanuel P. Giannelis1, Dimitrios G. Papazoglou1, Demetrios Anglos1; Inst. of Crete, Greece, ‘Dept. of Physics, Univ. of Crete, Greece, ‘Dept. of Materials Science and Engineering, Cornell Univ., USA, ‘Dept. of Chemical Engineering, Aristotle Univ. of Thessaloniki, Greece, ‘Dept. of Physics, Univ. of Crete, Greece. Highly scattering ZnO-hybrid nanostructures are produced exhibiting random laser action upon optical excitation. Studies that investigate the influence of pump pulse duration on the random laser efficiency are presented along with coherence length measurements.

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

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

**QFE2 • 10:30 a.m.**
High-Quality Telecom-Band Polarization-Entangled Photons Pairs from a Stable, Pulse-Pumped, Short PPLN Waveguide, Han Chuan Lim1, Akio Yoshizawa2, Hiroshi Fukuda3, Taku Tsuchida2, Kazuyo Kikuchi3; Graduate School of Frontier Sciences, Univ. of Tokyo, Japan, ‘Natl. Inst. of Advanced Industrial Science and Technology (AIST), Japan, ‘CREST, Japan Science and Technology Agency (JST), Japan. We demonstrate an ultra-stable, pulse-pumped source of telecom-band polarization-entangled photon-pairs using 1-mm-long PPLN waveguide placed in a polarization-diversity fiber-loop without temperature control. Full tomographic characterization confirms a purity higher than 0.94 and fidelity exceeding 0.06.

**QFE3 • 10:45 a.m.**
Generation of 1.5-µm Band Polarization Entanglement Using Silicon Wire Waveguide, Hiroki Takesue1, Hiroshi Fukuda1, Taku Tsuchida2, Toshiyuki Watanabe1, Koji Yamada2, Yasuhiko Tokura1; Sci.-i Lab,1,1 NTT Basic Res. Labs,2 NTT Corp., Japan, ‘CREST, Japan Science and Technology Agency, Japan, ‘NTT Microsystem Integration Labs, NTT Corp., Japan. We present the first experimental generation of 1.5-µm band polarization entanglement based on spontaneous four-wave mixing in a silicon wire waveguide. Two-photon interference fringes with >93% visibility were successfully obtained.

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

**CFI1 • 10:15 a.m.**
Efficient High Power Passively Mode-Locked Yb:Lu2O3, Thin Disk Laser, Cyrill R. E. Baer1, Sergio V. Marchese1, Ann G. Engqvist2, Matthias Golling1, Ferun J. H. Mait1, Thomas Sidtneyer3, Ursula Keller1, Rigo Peters2, Christian Kränkel1, Klaus Petermann1, Quinter Huler2; 1Dept. of Physics/ETH Zurich, Switzerland, ‘2Institut für Laser Physik, Univ. of Hamburg, Germany. The first passively mode-locked Yb:Lu2O3 thin disk laser generates 370-fs pulses with 20.5 W average power. Yb:Lu2O3 is an excellent alternative to femtosecond Yb:YAG thin disk lasers, achieving higher optical-to-optical efficiencies and shorter pulse durations.

**CFI2 • 10:30 a.m.**
High-Power, Diode-Pumped Mode-Locked Cr3+:LiCAF Laser, Mit Demirbas1, Alihan Senmuroglu1, Franz X. Kärntner1, James G. Fujimoto2, 1MIT, USA; 2Koc Univ., Turkey. We describe a diode-pumped Cr3+:LiCAF laser which produces 590 mW of continuous-wave output power using two pump diodes. Passive mode locking with a semiconductor saturable absorbing mirror produces 97-fs, 2.8-nJ pulses near 800 nm wavelength.

**CFI3 • 10:45 a.m.**
Self-Starting Kerr-Mode-Locked Polycrystalline Cr3+:ZnSe Laser, Igor S. Maksalev, Vladimir V. Fedorenko, Sergey S. Mitrow; Univ. of Alabama at Birmingham, USA. We demonstrate a middle infrared self-starting Kerr-mode-locked Cr:ZnSe laser operating at 1067 nm repetition-rate with estimated lower limit of the pulse width of 306 fs and output power of 50 mW at 2.4 µm wavelength.

**CFI4 • 11:00 a.m.**
Attosecond-Resolution Timing Jitter Characterization of Free-Running Mode-Locked Lasers, Jungwon Kim, Jeff Chen, Jonathan Cox, Franz X. Kärtner1; MIT, USA. Timing jitter characterization of free-running mode-locked lasers is demonstrated using balanced optical cross-correlation in the timing detector and the timing delay configurations. The limitation set by shot noise is 470 attoseconds in 10-MHz bandwidth.

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

**QFE4 • 11:00 a.m.**
Experimental Test of Non-Local Realism Using a Fiber-Based Source of Polarization-Entangled Photons, Matthew D. Eisaman, Elizabeth Goldschmidt, Jungwon Fan, Alan Migdall; National Inst. of Standards and Technology, USA. We describe a method to test non-local realism using polarization entangled photon-pairs using 1-mm-long PPLN waveguide source of telecom-band polarization-entangled photon-pairs. The first experimental observation of a Hong-Ou-Mandel dip with 1.5-µm photon pairs generated in a periodically poled lithium niobate waveguide with integrated mode-decoder. The visibility of the dip was 78% without subtraction of any noise.

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

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

**JFC2 • 10:45 a.m.**
Generation of Multi-Octave Optical-Frequency Combs in a Kagome Lattice Hollow Core Photonic Crystal Fiber, Francisco Cuny3, Peter J. Roberts1, Peter J. Roberts2, Phil S. Light2, Michael G. Raymer1; 1Cir. for Photons and Photonic Materials, Dept. of Physics, Univ. of Bath, UK; ‘COM, Technical Univ. of Denmark, Denmark, ‘Oregon Cir. for Optics and Dept. of Physics, Univ. of Oregon, USA. A 3-octave spectral comb is generated in a hydrogen-filled hollow-core photonic-crystal fiber: the spectrum consists of up to 45 high-order Stokes and anti-Stokes lines generated by coherently stimulated Raman scattering in the transient regime of amplification.

**JFC3 • 11:00 a.m.**
Dispersive Pulse Compression in Hollow-Core Photonic Bandgap Fibers, Jesper Leggregaard, Peter J. Roberts, Dept. of Communications, Optics and Materials, Technical Univ. of Denmark, Denmark. Dispersive pulse compression in a hollow-core photonic bandgap fiber is studied numerically. The limits to peak power for high pulse quality arising from fiber nonlinearities are investigated, along with the validity of approximate scaling relations.
QFF1 • 10:15 a.m.
Ultrasound Carrier-Envelope-Offset Phase Control of Optical Rectification in Resonantly Excited Semiconductors, Cole P. Van Vlack, Stephen Hughes; Queen’s Univ., Canada. Ultrasound pulse light-matter interactions in a semiconductor are theoretically investigated within the regime of resonant optical rectification. Using 5 µ pulse envelope areas of around 1.5-3 n, a single-shot dependence on carrier-envelope offset phase.

QFF2 • 10:30 a.m.
Adaptive Control of Transient Vibrational Wave-Packet Motion by Using Chirped Pulse Sequences, Kenji Horikoshi1, Kazuhiko Mimura2; Tokyo Univ. of Agriculture and Technology, Japan, 1CRISP, Japan Science and Technology Agency, Japan. We report on the successful operation of an analog computer designed to factor numbers. A sequence of shaped femtosecond pulses is used to implement a Gauss sum. N = 1340334 404807.

QFF3 • 10:45 a.m.
Interfering Random Waves, Sébastien Weber, Beatrice Chatel, Bertrand Giraud, Lab Collisions, Agirgén, Reactivité, CNRS, France. We report on the successful operation of an analog computer designed to factor numbers. A sequence of shaped femtosecond pulses is used to implement a Gauss sum. N = 1340334 404807 has been successfully factorized.

JFD • 10:15 a.m.
The Physics of High-Order Harmonic Generation, Anne L’Huillier; Lund Univ., Sweden. This tutorial will describe the field of high-order harmonics in gases, including attosecond pulse generation. Biography and photo not available.

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

CFJ1 • 10:15 a.m.
Quasi-Flat Top - Frequency-Doubled Nd:Glass Laser for Pumping of High-Power Ti: Sapphire Amplifiers at 0.1 Hz Repetition Rate, Victor P. Yaroslavskii1, Galina Ekinchenkova2, Pascal Rousseau2, Vladimir Chmyrov, Gerard Mourou2, Karl Krushelnick2; Univ. of Michigan, USA, Lab d’Optique Appliquée, Ecole Natl. Superieure de Techniques Avancées, Ecole Polytechnique, France. Nd:glass laser delivers up to 120 J-energy with flat-top profile at 0.1 Hz. The output is frequency doubled with 50% efficiency and used to pump Ti:sapphire. The developed design is perspective for ultra-high-intensity laser development.

CFJ2 • 10:30 a.m.
High Energy Amplification of a Continuous Wave Mode-Locked Picosecond Nd:YVO4 Laser by a Pulsed Grazing-Incidence Slab Amplifier, Luca Carral, Antonio Agneri, Paolo Dalloschek, Federico Pirzio, Giancarlo Reali, Alessandra Tomassi, Daniele Scarpa, Carla Vecchi; Univ. of Pavia, Italy. A single pass, side pumped grazing incidence Nd:YVO4 amplifier, optimized for minimum ASE noise, was used to increase the energy of 10-ps mode-locked seed pulses from 1 nJ to 210 nJ, with M2=1.3.

CFJ3 • 10:45 a.m.
Watt-Level Single-Longitudinal-Mode, Tunable Dual-Wavelength, CW Nd:YVO4 Laser, Yen-Yin Lin1, Y. H. Chen1, T. D. Wang1, R. Y. Tu1, S. T. Lin1, A.C. Chang1, Y. C. Huang1; Inst. of Photonics Technologies, Natl. Tsinghua Univ., Taiwan, 2Lab of Physics, Natl. Central Univ., Taiwan. We report a watt-level, single-longitudinal-mode, tunable dual-wavelength, CW Nd:YVO4 laser. The measured spectral widths and average power were 450 MHz, 1.2 W at 1064 nm and 400 MHz, 0.9 W at 1342 nm.

CFJ4 • 11:00 a.m.
Compact, High Peak Power, Passively Q-Switched Micro-Laser for Ignition of Engines, Masashi Tanaka1, Takayuki Inohara1, Akihiro Ando1, Kenji Kanehara2, Takanori Taira1; Japan Science and Technology Agency, Japan, 1Nippon Soken Inc., 2Japan Science and Technology Agency, Japan, 3Nippon Soken Inc., Japan, Inst. for Molecular Science, Japan. We report a PPLN crystal with a built-in electro-optic Bragg grating for both temperature-insensitive laser Q-switching and temperature-tuned wavelength conversion with 35% parametric efficiency from 1064 nm to mid-infrared wavelengths between 1440 and 2750 nm.

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

CFK2 • 10:30 a.m.
Over 10W Single-Pass Second Harmonic Green Light Generation with Periodically Poled MgO Doped Congruent LiNbO3, Yuzhiro Sato1, Yuhibo Higashi1, Masashi Hibi1, Tatsuo Okada; Graduate School of Information Science and Engineering, University of Tokyo, Japan. Novel waveguided PPLN-SHG device was demonstrated. Two types of dual-phase modulated PPLN device were fabricated and investigated. Inequilateral-type was similar to previously reported. Equilateral-type was newly proposed and demonstrated for first time.

CFK3 • 10:45 a.m.
Development of Dual-Phase-Modulators Integrated QPM-SHG Waveguide—Equilateral/Inequilateral-Scheme, Tatsuo Okada1, Hirofumi Watanabe1, Takeito Oki, Hirofumi Watanabe; 1Inst. for Molecular Science, Japan, 2Nippon Soken Inc., Japan, Inst. of Moleculer Science, Japan. We report a PPLN crystal with a built-in electro-optic Bragg grating for both temperature-insensitive laser Q-switching and temperature-tuned wavelength conversion with 35% parametric efficiency from 1064 nm to mid-infrared wavelengths between 1440 and 2750 nm.

CFK4 • 11:00 a.m.
Monolithically Integrated Laser Bragg Q-Switch and Wavelength Converter in a PPLN Crystal, Shouzi Liu1, Guoqun Chang1, YenYin Lin1, YenYin Lin1, Yunchi Huang2, A.C. Cianci2, Y.H. Chen1; 1National Taiwan University, Taiwan, 2Natl. Central Univ., Taiwan. We report a PPLN crystal with a built-in electro-optic Bragg grating for both temperature-insensitive laser Q-switching and temperature-tuned wavelength conversion with 35% parametric efficiency from 1064 nm to mid-infrared wavelengths between 1440 and 2750 nm.
Bi$_2$O$_3$-Based Fiber Laser with over 130 nm Tunable Range, Seiki Ohara, Tomoharu Hasegawa, Naoki Sugimoto; Asahi Glass Co., Ltd., Japan.

Optical Coherence Tomography Imaging with k-space Linear Fourier Domain Mode Locked Lasers, Christoph M. Eigenwillig, Benjamin R. Biedermann, Robert Huber; Ludwig-Maximilians-Universität, München, Germany.

We have experimentally, for the first time, demonstrated one-pump optical fiber parametric amplification (OPA) in Bismuth-Oxide-Based highly nonlinear fiber (Bi-HNLF), and realized narrowband (0.75nm) and tunable gain spectrum as high as 58dB.

Coherence Tomography has been used to study biological samples. We recently demonstrated one-pump optical fiber parametric amplification (OPA) in Bismuth-Oxide-Based highly nonlinear fiber (Bi-HNLF), and realized narrowband (0.75nm) and tunable gain spectrum as high as 58dB.

In this paper, we report the characterization of a Bi$_2$O$_3$-based fiber laser with over 130 nm tunable range. The laser was fabricated using a novel fabrication technique and demonstrated highly nonlinear properties and tunable gain spectrum. This work opens new possibilities for optical fiber applications in the biomedical field.
Crystal fiber. Into one of the hollow channels of a photonic crystal fiber, a broadband in-fiber polarizer with suppression >25dB over 300nm bandwidth is reported. It is broadband in-fiber polarizer with suppression.

Group, Univ. of Erlangen-Nuremberg, Germany. Prill Sempere, Philip St. J. Russell; Max Planck Res. Group, Univ. of Erlangen-Nuremberg, Germany.

Polarization Properties of PCF with Ge-Nanowire, Markus A. Schmidt, Hemant Tyagi, Luis Prill Sempere, Philip St. J. Russell; Max Planck Res. Group, Univ. of Erlangen-Nuremberg, Germany. A broad-band in-fiber polarizer with suppression >25dB over 300nm bandwidth is reported. It is made by introducing a high quality Ge nanowire into one of the hollow channels of a photonic crystal fiber.
Ballroom A2 and A7

QELS

QFD • Random Lasers—Continued

QFD4 • 11:15 a.m.
Experimental Study of Instability in Random Lasers. G. Zhu, W. L. Lundy, M. A. Noginov; Norfolk State Univ., USA. We have experimentally studied the pulse-to-pulse instability in Nd:Sc(BO)₃ random laser. The increase of the instability at the threshold and its reduction at further increase of pumping is in line with the theoretical predictions.

QFD5 • 11:30 a.m.
Random Laser with Ultra-High Concentration of Dye. J. K. Kitts, G. Zhu, M. Babourea, M. A. Noginov; Norfolk State Univ., USA. We have studied stimulated emission in rhodamine 6G-TiO₂ random laser. The minimal threshold has been found at ultra-high concentrations of both dye and TiO₂ nanoparticles.

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

QFE • Entangled Photon Sources I—Continued

QFE5 • 11:15 a.m.
Microstructure-Fiber-Based Source of High-Flux Hyperentangled Photon Pairs. Jun Chen¹,²; Jingyan Fan¹,²; Matthew D. Eisaman¹,²; Alan Migdall¹,²; Natl. Inst. of Standards and Technology, USA, ³Joint Quantum Inst., Univ. of Maryland, USA. We generate hyperentangled (time-bin and polarization) photon pairs using a microstructure-fiber Sagnac interferometer. Two-photon interference visibilities in both degrees of freedom are > 84%, and Bell’s inequality is violated by 27 σ at 1-kHz coincidence rate.

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

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

Ballroom A3 and A6

CLEO

CFI • Ultrafast Oscillators I—Continued

CFI5 • 11:30 a.m.
Low-Repetition-Rate Femtosecond Operation in Long Cavity Mode-locked Yb:CALGO Laser, Justine Boudelé¹, Dimitra Papadopoulos¹, Frédéric Draoui¹, Marc Hanna¹, Patrick Georges¹, Pierre-Olivier Petit¹, Philippe Golden¹, Bruno Vanu¹; Lab Charles Fabry de l’Inst. d’Optique, France, ²Lab de Chimie de la Matière Condensée de Paris, France. We report on long-cavity modelocked laser with Yb:CALGO crystal, with, first, a 27-MHz, sub-100-fs single-pulse regime and, second, a very atypical double-pulse dual-wavelength femtosecond regime.

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

QFF4 • 11:15 a.m.
Coherence Properties and Photon Statistics of Quantum-Dot Based Microcavity Lasers, Jan Wiersig, Christopher Gies, Sandra Ritter, Frank Jakobs; Inst. for Theoretical Physics, Univ. of Bremen, Germany. We present results of a microscopic theory for the photon correlation functions $g^{(2)}(\tau)$ and $g^{(3)}(\tau)$ describing the first-order coherence and the photon statistics of quantum-dot-based microcavity lasers with large spontaneous emission coupling.

QFF5 • 11:30 a.m.
Two-/Three-Photon Pumped Ultraviolet Nanofibers under Optical Excitation with Femtosecond-Regime of Linear Recombination of Singlet Excitons, Linz, Austria. Semiconductor and Solid State Physics, Univ. of Linz, Austria, Giovanni N. S. Sariciftci, Marceddu Cordella, An Organic Laser in the Monomolecular Region, Chunfeng Zhang, Fan Zhang, Jian Xu, Dept. of Engineering Science and Mechanics, Penn State Univ., USA. With femtosecond-pulse excitation, two- and three-photon absorption induced ultraviolet lasing with spectral linewidth 0.2-1 nm have been realized under very low excitation threshold from ZnO nanorod arrays at both room and liquid nitrogen temperatures.

QFF6 • 11:45 a.m.
An Organic Laser in the Monomolecular Region, Francesco Quaresmi, Michele Saba, Fabrizio Cordella, Agnieszka Gocalska, R. Corpino, M. Marceddu, A. Anedda, A. Andreoni, H. Sitter, N. S. Sariciftci, Andrea Murri, Giovanni Bonaguidi; 'Dept. di Fisica, Univ. di Cagliari, Italy, 'Inst. of Physics, Univ. Leoben, Austria, 'Inst. for Semiconductor and Solid State Physics, Univ. Linz, Austria, 'Linz Inst. for Organic Solar Cells, Univ. Linz, Austria. We demonstrated laser action in the regime of linear recombination of singlet excitons in para-sexiphenyl crystalline films in the form of nanotubes under optical excitation with femtosecond and nanosecond pulses.

JFD • High Harmonic Generation and Attosecond Physics I—Continued

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

JFD3 • 11:30 a.m.
Interferometric Measurement of High-Order Harmonic Fields with Attosecond Temporal Resolution, Toshitomo Shimizu, Yasuo Nishikawa, Eiji J. Takahashi, Katsumi Midorikawa; RIKEN, Japan. We demonstrate interferometric spectroscopy of high-order harmonic fields with a resolution of 1-0.1 ps. We also present the first measurement of true three level laser emission in diode-pumped Nd doped vanadate and YAG crystals. Wavelengths ranging from 900 to 869 nm open new doors to deeper blue emissions by SHG.

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

JFD5 • 11:15 a.m.
Passively Q-Switched Nd:YLF Laser in a D-rod Configuration, Bhabana Pati, Kevin F. Wall, Val-enia Iyyunna, Peter E. Mouleven; Q Peak, Inc., USA. We have developed a compact, efficient, passively Q-switched, solid-state laser, producing 7-nJ, < 10 ns pulses, and a near TEM00 beam. The cross section of the laser crystal was D-shaped and it was side pumped.

JFD6 • 11:30 a.m.
Invited Low Wavelength Emissions with Nd Doped Lasers, Marc Castaigne, Emile Herault, François Balibar, Patrick Georges; 'Lab Charles Fabry de l’Inst. d’Optique, Ctr. Natl. de la Recherche Scientifique, Univ. Paris-Sud, France, ‘Oxius SA, France. We report the first demonstration of true three level laser emission in diode-pumped Nd doped vanadate and YAG crystals. Wavelengths ranging from 900 to 869 nm open new doors to deeper blue emissions by SHG.

CFJ • Nd Lasers—Continued

CFJ5 • 11:15 a.m.
Group Velocity Mismatch and Third-Order Nonlinearities in Domain-Disordered Quasi-Phase-Matching Waveguides, Ahmed Al Mohairi, Sam J. Wagnier, J. Stewart Atchison, A. S. Helmy; Univ. of Toronto, Canada. Simulations show that group-velocity mismatch and third-order effects reduce second-harmonic generation efficiency by 23% and 13%, respectively, in GaAs/AlAs superlattice waveguides. Also, optimal waveguide lengths were found to be longer than the walkoff length.

CFJ6 • 11:30 a.m.
Efficient Second-Harmonic Generator and Electro-Optic Polarization-Mode Converter in Single Aperiodically Poled Lithium Niobate, Cheng-Liang Chang, Wei-Wen Chen, Chao-Huang Lin, Tien-Hung Chen; Dept. of Optics and Photonics, Natl. Central Univ., Taiwan. We report the first attempt on constructing an aperiodically poled LiNbO3, for optimally integrating dual nonlinear-optical devices. 55% second-harmonic generation conversion efficiency enhancement over a conventional cascaded periodically poled LiNbO3 is obtained with such a device.

CFK • QPM Devices—Continued

CFK5 • 11:15 a.m.
Angular Quasi-Phase-Matching in MgO:PPLN, Yanick Petit, Benoit Boulanger; Patricia Segonds, Pierre Brand, Corrine Felix, Bertrand Mansuet, Hildiki Ileskuti, Takanori Tanai; ‘Inst. Natl. Ctr. Natl. de la Recherche Scientifique, Univ. J. Fourier, France, ‘Inst. for Molecular Science, Japan. We show that quasi-phase-matching corresponding to a propagation in a periodically poled non-linear medium at any angle with the grating vector provide wider wavelength tunability and spectral acceptance. The case of MgO:PPLN is studied.
Bismuth-Doped Fiber Laser at 1.16 μm, Seung-woo You, Myrolo P. Kalina, Jayanta K. Sahu, Johan Nilsson, David Payne, Optoelectronic Res. Ctr., Univ. of Southampton, UK. We used a bismuth-doped fiber with high pump absorption, 1.2 dB/m, to make a short (25 m) Bi fiber laser at 1.16 μm with 10% efficiency. We discuss the influence of host glass and unsaturable absorption.

Pulsed Raman Conversion to 2.14 μm by Means of a Thulium-Doped Fiber Laser and a GeO₂ Index Fiber, Delphine Gruppi, Antoine Hirth, Pierre Delgadillo, 'French-German Res. Inst. of Saint-Pierre, France; Laboratoires d’Optique de Nice, France. Pulsed Raman conversion to 2.14 μm is demonstrated. Peak Stokes power of 210 W (400 mW average) at 30 kHz with a slope efficiency of 40% of a Thulium-Doped Fiber Laser and a GeO₂ Index Fiber from silver halides singlemode at 10.6 μm and 5.5 μm are demonstrated. Experimental evidences are presented to establish the design cycle for optical systems. This approach enables fast prototyping and shortens the image degradation when operating in vitreous humor/saline solution.

The interactions of core-propagating light with an intersecting microstructured and step-index fibers from silver halides singlemode at 10.6 μm and 5.5 μm are demonstrated. Experimental and theoretical evidences are presented to establish that the fibers are singlemode at 10.6 μm.

Measurement of the Oxygenation Level of Hemoglobin with Spectroscopic Spectral-Domain Optical Coherence Tomography, Cheng-Kuang Lee, Chih-Wei Lu, Meng-Tsian Tsai, Tih-Ming Wang, C. C. Yang, Natl. Taiwan Univ., Taiwan. We report the measurement of hemoglobin oxygen saturation level in human blood with a spectroscopic spectral-domain optical coherence tomography system based on the cross-over behavior of Hb and HbO₂ absorption coefficients around 800 nm.

CFM • Optical Coherence Tomography—Continued

Time-Gated Infrared Four-Mode Optical Coherence Tomography, Matthew S. Mulley, James M. Fraser; Queen’s Univ., Canada. By combining incoherent time gating (sum-frequency mixing) with coherent gating (optical coherence tomography), we process light backscattered from a sample in the optical domain to improve imaging contrast by 29 dB.

QFG • Photonic Crystals: Waveguides and Cavities—Continued

Maximum Scaling of Second-Harmonic Generation in One-Dimensional Photonic Crystals, Marco Lisicinidi1, Andrea Locatelli2, Costantino De Angelis2, Lucio Claudio Andreani1; ‘Univ. of Toronto, Canada, ’Univ. of Pavia, Italy, ’Univ of Brescia, Italy. We demonstrate maximum scaling of second-harmonic generation as the eighth power of the photonic crystal length without phase matching (PM). This result challenges a commonly held view regarding the necessity of PM for large scaling.

We present the first experimental observation of self-collimation of white-light beams in specially designed fs laser-written curved waveguide arrays, where discrete diffraction was suppressed over the spectral range extending from blue to infrared wavelengths.

The interactions of core-propagating light with an intersecting microstructured and step-index fibers from silver halides singlemode at 10.6 μm and 5.5 μm are demonstrated. Experimental and theoretical evidences are presented to establish that the fibers are singlemode at 10.6 μm.

CFL4 • 11:15 a.m.
Bismuth-Based Fiber Devices—Continued

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

Pulsed Raman Conversion to 2.14 μm by Means of a Thulium-Doped Fiber Laser and a GeO₂ Fiber, Delphine Gruppi, Antoine Hirth, Pierre Pfeiffer; ‘French-German Res. Inst. of Saint-Pierre, France; Laboratoires d’Optique de Nice, France. Pulsed Raman conversion to 2.14 μm is reported. Peak Stokes power of 210 W (400 mW average) at 30 kHz with a slope efficiency of 62 % in a GeO₂-doped fiber is demonstrated.

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

CFN4 • 11:15 a.m.
Side-Detection of Out-Coupled Core Light from a Microfluidic Fiber Microsot, Yicheng Lai1, J. Petrovic1, T. Butler1, K. Sugden1, J. Bennion1; Aston Univ, UK; Fiberlogix Ltd, UK. The interactions of core-propagating light with an intersecting microcylinder within a conventional single-mode fiber are investigated. Orientation-dependent out-coupling of core light was utilized to create side-detection, miniature fiber rotation sensors.

Fluid-Filled Tunable Mold for Polymer Lenses, Sun Hwan Cho1, Frank S. Tsai2, Robert Vaska1, Jeff Vaska3, Yu-Hwa Lo2; ’Materials Science and Engineering Program, Jacobs School of Engineering, Univ. of California at San Diego, USA, ‘Electrical and Computer Engineering Dept., Jacobs School of Engineering, Univ. of California at San Diego, USA, ’Riberion Technology, Inc., USA. Polymer lenses were fabricated using a fluid-filled tunable molding process providing a simple and cost-effective way to control lens curvature and shape. This approach enables fast prototyping and shortens the design cycle for optical systems.

Fluid-Filled Tunable Mold for Polymer Lenses, Sun Hwan Cho, Frank S. Tsai, Robert Vaska, Jeff Vaska, Yu-Hwa Lo; Materials Science and Engineering Program, Jacobs School of Engineering, University of California at San Diego, USA, Electrical and Computer Engineering Department, Jacobs School of Engineering, University of California at San Diego, USA. Polymer lenses were fabricated using a fluid-filled tunable molding process providing a simple and cost-effective way to control lens curvature and shape. This approach enables fast prototyping and shortens the design cycle for optical systems.

Micro-Concentrator for Vanadium Nanorods by Efficient Light-Induced Convective Flow, Benjamin K. Wilson, Xiaoyu Miao, Lih Y. Lin; Univ. of California at San Diego, USA, Materials Science and Engineering Program, Jacobs School of Engineering, University of California at San Diego, USA. Avalanche concentration, a long-range accumulation of particles around a laser spot in a liquid sample, is demonstrated and characterized for VO₂ nanorods. The effect is found to be caused by efficient heating of VO₂ nanorods.

CFN6 • 11:30 a.m.
Micro-Concentrator for Vanadium Nanorods by Efficient Light-Induced Convective Flow, Benjamin K. Wilson, Xiaoyu Miao, Lih Y. Lin; Univ. of California at San Diego, USA, Materials Science and Engineering Program, Jacobs School of Engineering, University of California at San Diego, USA. Avalanche concentration, a long-range accumulation of particles around a laser spot in a liquid sample, is demonstrated and characterized for VO₂ nanorods. The effect is found to be caused by efficient heating of VO₂ nanorods.

CFN5 • 11:30 a.m.
Coupled Resonant Modes of Dual L3-Defect Planar Photonic Crystal Cavities, Sang Lam1, Alexander R. A. Chalcraft1, Dominik Seymann1, Ruth Orchard1, Ben D. Jones1, Danieli Savruttio, David O’Brien2, Thomas F. Krauss3, Hui-yun Liu3, Paul W. Fry4, Mark Hopkinson1; ’Univ. of St. Andrews, UK, ’Univ of Pavia, Italy, ’Univ of Brescia, Italy. We present the realization of 2-D photonic crystal cavities with a dual L3-defect geometry. The experimental results show consistent and predictable splitting of the fundamental modes and reveal clear evidence for strong cavity-cavity coupling.

Maximum Scaling of Second-Harmonic Generation in One-Dimensional Photonic Crystals, Marco Lisicinidi1, Andrea Locatelli2, Costantino De Angelis2, Lucio Claudio Andreani1; ’Univ. of Toronto, Canada, ’Univ. of Pavia, Italy, ’Univ of Brescia, Italy. We demonstrate maximum scaling of second-harmonic generation as the eighth power of the photonic crystal length without phase matching (PM). This result challenges a commonly held view regarding the necessity of PM for large scaling.

Observation of Broadband Self-Collimation in fs Laser-Written Waveguide Arrays, Alexander Szameit1, Ivan L. Garanovich2, Thomas F. Krauss3, Hui-yun Liu3, Paul W. Fry4, Mark Hopkinson1; ’Univ. of Sheffield, UK, ’Univ of St. Andrews, UK. We present the realization of 2-D photonic crystal cavities with a dual L3-defect geometry. The experimental results show consistent and predictable splitting of the fundamental modes and reveal clear evidence for strong cavity-cavity coupling.

CFN • Optofluidics—Continued

Fluid-Filled Tunable Mold for Polymer Lenses, Sun Hwan Cho, Frank S. Tsai, Robert Vaska, Jeff Vaska, Yu-Hwa Lo; Materials Science and Engineering Program, Jacobs School of Engineering, University of California at San Diego, USA, Electrical and Computer Engineering Department, Jacobs School of Engineering, University of California at San Diego, USA. Polymer lenses were fabricated using a fluid-filled tunable molding process providing a simple and cost-effective way to control lens curvature and shape. This approach enables fast prototyping and shortens the design cycle for optical systems.

Fluid-Filled Tunable Mold for Polymer Lenses, Sun Hwan Cho, Frank S. Tsai, Robert Vaska, Jeff Vaska, Yu-Hwa Lo; Materials Science and Engineering Program, Jacobs School of Engineering, University of California at San Diego, USA, Electrical and Computer Engineering Department, Jacobs School of Engineering, University of California at San Diego, USA. Polymer lenses were fabricated using a fluid-filled tunable molding process providing a simple and cost-effective way to control lens curvature and shape. This approach enables fast prototyping and shortens the design cycle for optical systems.

CFN6 • 11:30 a.m.
Micro-Concentrator for Vanadium Nanorods by Efficient Light-Induced Convective Flow, Benjamin K. Wilson, Xiaoyu Miao, Lih Y. Lin; Univ. of California at San Diego, USA, Materials Science and Engineering Program, Jacobs School of Engineering, University of California at San Diego, USA. Avalanche concentration, a long-range accumulation of particles around a laser spot in a liquid sample, is demonstrated and characterized for VO₂ nanorods. The effect is found to be caused by efficient heating of VO₂ nanorods.
CFO • Nano Fabrication Techniques and Novel Material—Continued

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

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

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

12:00 p.m.–1:30 p.m.
Lunch Break (on your own)
CQF3 • 2:00 p.m.
Coherent Control of Ultra-High Frequency Acoustic Resonances in Photonic Crystal Fibers, Gustavo S. Wiederhecker1,2, Andre Brenn1, Hugo L. Fragmente3, Philip St. J. Russell4, Inst. de Física, Univ. Estadual de Campinas, Brazil, 1Max-Planck Res. Group, Inst. of Optics and Photonics, Univ. of Erlangen-Nuremberg, Germany. Acoustic resonances trapped within the core (1 μm diameter) of a photonic crystal fibre are excited electrostrictively using laser pulses. Using pulse sequences we achieve coherent control leading to a 100-fold increase in their amplitude.

QF4 • 2:15 p.m.
Experimental Demonstration of Photonic Bandgap Tuning in Mixed Photonic Crystals, Hye J. Kim1, Dong Uk Kim1, Jee Yun1, Jeon Su1, Korea Univ., Republic of Korea. We experimentally demonstrated that the photonic bandedges of a mixed photonic crystal system shift monotonically as the mixing composition ratio is varied. Results are in excellent agreement with the virtual crystal approximation.

QF1 • 1:30 p.m.
Catch and Release of Optical Pulses by Dynamic Q Control of a Photonic Crystal Nanocavity, Jeremy Upshum, Yutinurri Tanaka, Takashi Asano, Susumu Noda, Kyoto Univ., Japan. We demonstrate catching and releasing of optical pulses by dynamic Q factor control of a photonic crystal nanocavity. Optical pulses are caught and released on demand within the photon lifetime.

QF1 • 1:30 p.m.
Generation of Uncorrelated Photon Pairs in an Optical Fiber, Offer Cohen, Jeff S. Lundeen, Georgi S. Funes, Brian J. Smith, Peter J. Maloney, Ian A. Walmsley, Univ. of Oxford, UK. We demonstrate experimentally the realization of heralded pure photon generation in a birefringent optical fiber.

QF2 • 1:45 p.m.
All-Fibre Source of Heralded Single Photons at 1550nm, Chunlie Xiong1,2, Alexander B. McMillan1,2, Olivier Alibart3,4, John G. Rarity1,2, Inst. of Optics, Univ. of Bath, UK, 1Univ. of Nice Sophia Antipolis, France, 2Univ. of Bristol, UK. We demonstrate a bright fibre source of heralded single photons at 1550nm with detected rates greater than 10 kilocounts per second. Photonic generation and separation is performed in spliced fibre components.

QF3 • 2:00 p.m.
Paper Withdrawn

CFP2 • 1:45 p.m.
Passive Mode-Locking of Diode-Pumped Yb:KYF4 Laser, Gianluca Galcerano1, Nicola Coluccelli2, Lucia Bonelli2, Alberto Di ete3, Alessandra Tonelli4, Mauro Tonelli4, Paolo Laporta4, Orazio Svelto5, Inst. di Fotonica e Nanotecnologia-CNR, Dept. di Fisica, Politecnico di Milano, Italy, 2Inst. di Fotonica e Nanotecnologia-CNR, Dept. di Fisica, Univ. di Pisa, Italy. We report on the first demonstration of passive mode locked operation of a diode-pumped Yb:KYF 4 laser. Transform-limited pulses with duration of 170 fs, average power of 60 mW, and repetition rate of 55 MHz are obtained.

CFP3 • 2:00 p.m.
Single-Walled Carbon Nanotube Saturable Absorbers for Mode-Locked Laser Operation Near 1 μm, Andreas Schmidt1, Simon Rivier1, Günther Stranzer2, Valentin Peter1,1 Peter1,2, Won Bae Cho1, Valentin Peter1,2, Soonil Lee3, Fabian Rotermund4, Max-Born-Institut, Germany, 1Aoyama Univ., Republic of Korea. Single-walled carbon nanotube saturable absorbers were designed for passive mode-locking near 1 μm. Using Yb:KTN4 and Yb:KLaW5, nearly transform-limited sub-150 fs pulses were generated at 1037 nm and 1048 nm, respectively.

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

CQF4 • 2:15 p.m.
Fiber-Based Two-Photon Sources for Quantum Information, Alan Migdall1,2, Jingjun Fan1,2, NIST, USA, 1Joint Quantum Inst., Univ. of Maryland, USA. We review the merits of using fiber as a nonlinear media for production of correlated and entangled photon pairs for quantum information applications and we present history, status and future developments in this area.

CQF1 • 1:30 p.m.
Femtosecond Thin Disk Lasers with >10 pulse Energy, Thomas Sudmeyer, Sergio V. Marchese, Cyril B. Baer, Shigeaki Hashimoto, Anna G. Engeyot, Matthias Golling, Darin J. H. C. Maas, Ursula Keller, ETH Zurich, Switzerland. We present a SESAM-mode-locked Yb:YAG laser generating nearly transform limited femtosecond pulses with 11 µJ energy at 4 MHz repetition rate and excellent beam quality. We discuss the key challenges for further increase of the pulse energy.

JEF1 • 1:30 p.m.
Quantum Coherent Effects with Hollow-Core Photonic Crystal Fibers, Fetah Benabid, P. S. Light, E. T. Joffson; Alcatel-Lucent, USA, Presider to Be Announced
Faraday birefringence, which may be exploited without net magnetization, presents the Voigt and that a pure spin current in a semiconductor, even of Physics, Tsinghua Univ., China.

Electrons and holes.

Faraday birefringence, which may be exploited without net magnetization, presents the Voigt and that a pure spin current in a semiconductor, even of Physics, Tsinghua Univ., China.

Electrons and holes.

Faraday birefringence, which may be exploited without net magnetization, presents the Voigt and that a pure spin current in a semiconductor, even of Physics, Tsinghua Univ., China.

Electrons and holes.
We achieve 12dB of pump-induced pixel gain from image amplifier array based on high gain per unit length Yb+-doped phosphate fiber amplifier. The fiber is doped with 12 wt% Yb2O3 and only 47.5-cm long. A 25 W phosphate fiber laser with 52.7% slope efficiency is also reported.

We experimentally demonstrated that photodarkening is not uniformly distributed in the cross-section of bent LMA fibers. Photodarkening distribution depends on the bending radius of curvature, and affects the use of fibers in applications and their photodarkening propensity behavior. Photodarkening distribution depends on the bending radius of curvature, and affects the use of fibers in applications and their photodarkening propensity behavior. Photodarkening distribution depends on the bending radius of curvature, and affects the use of fibers in applications and their photodarkening propensity behavior.

We describe the first realization of a nanoscale emitter natu...
1:30 p.m.–3:15 p.m.
CFV • Novel THz Generation Schemes
Richard D. Averitt; Boston Univ., USA, Presider

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

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

CFV3 • 2:00 p.m. Invited
Intense THz Supercontinuum Generation in Femtosecond Laser-Gas Interactions, Ki-Yong Kim, Antoinette J. Taylor, George Rodriguez; Los Alamos Natl. Lab, USA. Intense coherent THz radiation from two-color laser interactions with various gas species is examined. Peak THz energy of >4.5 μJ per pulse with a bandwidth in excess of 78 THz is routinely produced.
QFH • Photonic Crystals: Control—Continued

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

QFI • Entangled Photon Sources II—Continued

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

QFH6 • 2:45 p.m.
Polarization Changes in Diffraction from Planar Periodic Patterns with Pure Structural and Molecular Chirality, Ksenia Dolgaleva, Robert W. Boyd, S. N. Volkov; Univ. of Ottawa, Canada, & QuantiX; Ottawa, Canada. An optical scattering theory is introduced that predicts significant disorder-induced resonance shifts in photonic-crystal nanocavities. Even for nm-scale imperfections, we calculate blue shifts of several meV, two orders of magnitude larger than the cavity linewidth.

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

QFI7 • 3:00 p.m.
Generation of Sub-30 fs Pulses from a Mode-Locked Ytterbium Fiber Laser Oscillator with a Combined Ceramics, Handong D. Sun, Yuri Svirko, Stanislav S. Straupe, Yoon-Ho Kim; Inst. of Optics, Univ. of Rochester, USA, & Inst. of Optics, Univ. of Rochester, USA. We discovered transverse photo-induced voltage in two-dimensional metallic photonic crystal slabs for oblique incident circularly polarized light. Signal sign is reversed by changing the sense of polarization or sign of incident angle.

QFH • Photonic Crystals: Control—Continued

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

QFI • Entangled Photon Sources II—Continued

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

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

QFI7 • 3:00 p.m.
Generation of Sub-30 fs Pulses from a Mode-Locked Ytterbium Fiber Laser Oscillator with a Combined Ceramics, Handong D. Sun, Yuri Svirko, Stanislav S. Straupe, Yoon-Ho Kim; Inst. of Optics, Univ. of Rochester, USA, & Inst. of Optics, Univ. of Rochester, USA. We discovered transverse photo-induced voltage in two-dimensional metallic photonic crystal slabs for oblique incident circularly polarized light. Signal sign is reversed by changing the sense of polarization or sign of incident angle.
We perform time-resolved Faraday rotation measurements on colloidal ZnO quantum dots. A biexponential decay of the dephasing time $T_2^*$ of the electron spins governed by competing recombination processes is observed.
Friday, May 9

CFS7 • 3:00 p.m.
Analysis of Spectroscopy and Amplification at 1.3 µm in Nd:Yb/Doped Tellurite Glass Fibers, Shuaizeng Shen, Billy Richards, Annemiek Hui; Univ. of Leeds, UK. We fabricated three core tellurite glass fiber having a different rare earth system in each of its cores. Three distinct sets of emission characteristics are observed with a single pump wavelength.

CFS8 • 2:45 p.m.
Energy Transfer and Gain Analysis for Tb3+-Yb3+ Co-Doped Silicate Glasses under the 0.98 µm Excitation, Jitnaya Yamauchi1, Yasutake Ohishi2, Toyota Technological Inst., Japan, Toyota Central RD Labs Inc., Japan. The energy transfer coefficients for Tb3+-Yb3+ codoped silicate glasses was obtained by rate equation model. The proposed model can be used to understand the amplification properties in the 0.54µm band under the 0.98µm pumping.

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

QFK6 • 3:00 p.m.
Long-Range Trapping and Rotation of Single Nanorods Using Plasmonic Tweezers, Xiaoyu Jiang, Jiahui Zhang, Ashish Agrawal, Nestor Zaluzec; Theodore B. Norris; ‘Univ. of Michigan at Ann Arbor, USA, ‘FEI Co., USA, ‘Argonne Natl. Lab, USA. The excitation of surface plasmons on individual nanorods is studied by high-resolution electron energy loss spectroscopy, and the results are compared to ensemble optical spectra. The transverse and longitudinal modes of these nanostructures were resolved.

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

CFU6 • 2:45 p.m.
Two-Photon Absorption Induced Photoluminescence and the Ultrafast Dynamics of Para-Sexiphenyl Nano-Needles, Kanglin Li1, Chuanfeng Zhang1, Zhiwei Li1, Ashish Agrawal1, Narayanan Ramesh2, Xianzhi Shang1, 1Physics Dept., Fudan Univ., China, 2Inst. of Semiconductor and Solid State Physics, Johannes Kepler Univ. Linz, Austria. Two-photon absorption induced photoluminescence of para-sexiphenyl nano-needles with high polarization and directional property was observed. The time-resolved measurement shows a very fast response and the absorption polarization selectivity of ground state.

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

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

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

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

3:15 p.m.–3:45 p.m.
Coffee Break, Concourse Level
We propose a novel scheme for subwavelength-resolution and superluminal effects.

We develop an imaging system capable of magnification, subwavelength-resolution and impedance matching, which minimizes reflection losses. We propose a practical design of the system based on available materials and existing fabrication technologies.

We measure the photon tunneling time through bandgaps of dielectric layer stacks with alternating refractive indices. We observe subtle structural changes in dielectric stacks drastically affecting photon traversal times, allowing for sub- and superluminal effects.

We apply this approach to spontaneous emission Hamiltonian onto a discrete basis of quasimodes. We treat multiple-quantum-dot–photonic crystal slab systems by projecting the multiple-photon dynamics in coupled-cavity photonic crystal slab systems by projecting the Hamiltonian onto a discrete basis of quasimodes. We apply this approach to spontaneous emission into two coupled cavi
ties.
Absorption by Confined Acoustic Phonons in Vertically Stacked Nanoparticles. It provides a new absorption related to the confined acoustic phonons in nanoparticles. We demonstrate generation of in low dimensional systems.

Concurrent sessions are grouped across four pages. Please review all four pages for complete session information.

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

CFX3 • 4:15 p.m.
Spatial Modulation Instability Driven by Light-Enhanced Nonlinearities in Semiconductor Cr2ZnTe4 Crystals, Sharon Stewart, Mordechai Sagie, Emil Zolotoyabko, Univ. El Hanany; Technion - Israel Inst. of Technology, Israel; Orbotech Medical Solutions, Israel. We present the observation of spatial-modulation-instability in Cr2ZnTe4, where the nonlinearities are greatly enhanced by light. We find that the index-change is composed of a huge (~0.01) uniform component and a 20-times smaller periodic component.

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

RAP  • 3:45 p.m.–5:30 p.m.
CFX • Nonlinear Optical Materials
Robert Fisher; RA Fisher Associates, USA, Presider
3:45 p.m.–5:30 p.m.  
**QFO • Micro- and Nanocavities**  
**Christoph Lienau; Carl von Ossietzky Univ., Oldenburg Inst., Germany, Presider**

*QFO1 • 3:45 p.m.*  
High-Q Photonic Nanocavity with a 2-ns Photon Lifetime, Yasushi Takahashi1, Hitoyuki Higano1, Yoshinori Tanaka1, Takashi Asano1, Saejum Noda12; 1Dept. of Electronic Science and Engineering, Kyoto Univ., Japan, 2Photronics and Electronics Science and Engineering Ctr., Kyoto Univ., Japan. We have developed a photonic crystal nanocavity with a quality factor of 2.5x10^6 and a photon lifetime over 2 ns. This lifetime is the longest recorded thus far in photonic crystal cavities.

*QFO2 • 4:00 p.m.*  
Disorder Induced Localized Photonic Modes in Planar Microcavities, Y. Kodjro1, D. Genov1, B. Shapiro2, M. E. Raikh3, S. Reitzenstein1, J. P. Reithmaier3, A. Forchel3; Technion, Israel, 1Univ. of Utah, USA, 2Univ. Würzburg, Germany. We detect localized modes in a planar microcavity containing a layer of quantum dots and measure their spatial intensity distribution. Theory based on disorder induced most probable fluctuation in the dielectric constant explains our findings.

*QFO3 • 4:15 p.m.*  
“Pick-and-Place” Positioning of Diamond Nanocrystals on Microcavities, Paul E. Barclay1, Oskar Painter1, Charles Santor1, Kai-Mei Fu2, Raymond G. Beausoleil1; Caltech, USA, 1Hewlett Packard Labs, USA. Diamond nanocrystals are deterministically positioned on high-Q microdisks using a fiber taper. The fiber taper is then used to collect nanocrystal emission.

*QFO4 • 4:30 p.m.*  
Nanocrystals in Photonic Crystal Cavities for Quantum Information Processing, Yun-Feng Xiao1,2, Jie Gao1,2, Xiaodong Yang1,2, Kai-Mei Fu2, Kai-Mei Fu2; Columbia Univ., USA, 1Univ. of Science and Technology of China, China. By virtue of a silicon high-Q photonic crystal nanocavity, we propose and examine theoretically interactions between a stationary electron spin qubit of a semiconductor nanocrystal and a flying photon qubit.

---

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

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

*CFY2 • 4:00 p.m.*  
Opening Hybrid Band Gaps in Two-Dimensional Photonic Crystals of Pb(Mg1/3Nb2/3O3), Having Very Low Refractive Index Contrast, Ratnaraj J. Khandelwal1, Nayeoun Q1, Bethanie J. H. Stadler1, Kevin Zou1; Univ. of Minnesota at Twin Cities, USA, 1Boston Applied Technologies Inc., USA. The effect of anisotropy on photonic crystals of Pb(Mg1/3Nb2/3O3) rods in air matrices was analyzed. Despite a low refractive index contrast (n=1.47), hybrid photonic bandgaps were achieved after optimization of the structure and the anisotropy.

*CFY3 • 4:15 p.m.*  
Templated Self-Assembly and Nano-Plasmonics of Nano-Void Surfaces, Bruno F. Soares1,2, Robin M. Cole1, Jeremy J. Baumberg1, F. J. Garcia de Abajo1, Sumeet Mahajan1,2,4, Oskar Adibi5, Ali Asghar Eftekhar, Ali Adibi; Georgia Tech, USA, 12NanoPhotonics Ctr., Cambridge Univ., UK, 3Inst. de Optica, CSIC, Spain, 4School of Chemistry, Univ. of Southampton, UK. Three-dimensionally nanostructured metal surfaces containing nano-scale voids produce strong localised plasmons. We show here the correlation between physical structure and plasmonic and electronic properties for several significant applications.
CFZ1 • 3:45 p.m. Invited
Terahertz-Field-Induced Carrier-Wave Rabi Oscillations in n-Type GaAs, Peter Gaal\(^1\), Wilhelm Kuehn\(^1\), Klaus Reimann\(^1\), Michael Woerner\(^1\), Thomas Elsaesser\(^1\), Rudolf Hey\(^2\); \(^1\)Max-Born-Inst. für Nichtlineare Optik und Kurzzeitspektroskopie, Germany, \(^2\)Paul-Drude-Inst. für Festkorperelektronik, Germany. Carrier-wave Rabi oscillations between bound impurity levels in n-type GaAs are demonstrated by ultrafast THz propagation experiments for driving fields up to 5 kV/cm. For stronger fields the two-level approach breaks down.

CFZ2 • 4:15 p.m.
Nonlinear THz-Pump/THz-Probe Measurements of Semiconductor Carrier Dynamics, Aaron M. Lindenberg\(^1\),2, Haidan Wen\(^1\), Erzsi Szilagyi\(^1\),2; \(^1\)Stanford Linear Accelerator Ctr., USA, \(^2\)Stanford Univ., USA. A table-top THz source has been employed to study the nonlinear response of semiconductors to near-half-cycle femtosecond pulses. We report nonlinear field-induced changes in the far infrared absorption coefficient, associated with impact ionization processes.

CFZ3 • 4:30 p.m.
Optical Detection of THz-Induced Strong Field Effects in Ensembles of Neutral Donors, Dan G. Allen, Sangwoo Kim, Mark S. Sherwin; Univ. of California at Santa Barbara, USA. Narrowband THz radiation drives transitions between bound electron states in GaAs neutral donors. Elastic light scattering from a donor bound exciton resonance allows time-resolved measurements of the excited state lifetime and THz-induced AC stark effect.
<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
<th>Title</th>
<th>Location</th>
<th>Speaker(s)</th>
<th>Institution(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>QFM5</td>
<td>Correlations in Two-Mode Cavity QED</td>
<td>Ballroom A7</td>
<td>David G. Norris, Jietai Jing, Rebecca Olson Knell, Luis A. Orozco, Arturo</td>
<td>Joint Quantum Inst., Dept. of Physics, Univ. of Maryland, USA, Ctr. de Optica</td>
</tr>
<tr>
<td></td>
<td>QFM5</td>
<td>Correlations in Two-Mode Cavity QED, Invited</td>
<td>Ballroom A7</td>
<td>ố, Luis A. Orozco, Arturo Fernandez, James P. Clemens, Perry R. Rice; Joint</td>
<td>Ctr. de Optica, Univ. de Concepcion, Chile, Dept. of Physics, Miami Univ.,</td>
</tr>
<tr>
<td></td>
<td>QFL6</td>
<td>Designs of Optical Cloak with Nonlinear Transformations</td>
<td>Ballroom A8</td>
<td>Wenhan Cai, Vladimir M. Shalaev; Purdue Univ., USA. Two novel designs for</td>
<td>Purdue Univ., USA. Two novel designs for optical cloaking based on nonlinear</td>
</tr>
<tr>
<td></td>
<td>QFM6</td>
<td>Modified Optical Cavity Transmission by an Intracavity Dispersive</td>
<td>Ballroom A7</td>
<td>Haibin Wu, Min Xiao; Univ. of Arkansas, USA. By balancing the sharp linear</td>
<td>Modified Optical Cavity Transmission by an Intracavity Dispersive Medium,</td>
</tr>
<tr>
<td></td>
<td>QFL7</td>
<td>Ideal Cylindrical Cloak and Influence of Tiny Perturbation</td>
<td>Ballroom A8</td>
<td>Wei Yan, Zhichao Ruan, Min Yan, Min Qiu, Royal Inst. of Technology (KTH),</td>
<td>Ideal Cylindrical Cloak and Influence of Tiny Perturbation, Wei Yan, Zhichao</td>
</tr>
<tr>
<td></td>
<td>QFM6</td>
<td>Modified Optical Cavity Transmission by an Intracavity Dispersive</td>
<td>Ballroom A7</td>
<td>Haibin Wu, Min Xiao, Univ. of Arkansas, USA. By balancing the sharp linear</td>
<td>Modified Optical Cavity Transmission by an Intracavity Dispersive Medium,</td>
</tr>
<tr>
<td></td>
<td>QFL7</td>
<td>Ideal Cylindrical Cloak and Influence of Tiny Perturbation</td>
<td>Ballroom A8</td>
<td>Wei Yan, Zhichao Ruan, Min Yan, Min Qiu, Royal Inst. of Technology (KTH),</td>
<td>Ideal Cylindrical Cloak and Influence of Tiny Perturbation, Wei Yan, Zhichao</td>
</tr>
<tr>
<td></td>
<td>QFM5</td>
<td>Correlations in Two-Mode Cavity QED</td>
<td>Ballroom A7</td>
<td>David G. Norris, Jietai Jing, Rebecca Olson Knell, Luis A. Orozco, Arturo</td>
<td>Joint Quantum Inst., Dept. of Physics, Univ. of Maryland, USA, Ctr. de Optica</td>
</tr>
<tr>
<td></td>
<td>QFL6</td>
<td>Designs of Optical Cloak with Nonlinear Transformations</td>
<td>Ballroom A8</td>
<td>Wenhan Cai, Vladimir M. Shalaev; Purdue Univ., USA. Two novel designs for</td>
<td>Purdue Univ., USA. Two novel designs for optical cloaking based on nonlinear</td>
</tr>
<tr>
<td>5:00</td>
<td>QF6</td>
<td>Antiresonant core walls in 7-cell hollow core fibers are used to</td>
<td>Ballroom A8</td>
<td>Brian Mangan, Jens K. Lyngsoe, Peter J. Robertson; Crystal Fibre A/S, Denmark,</td>
<td>Crysyal Fibre A/S, Denmark. Antiresonant core walls in 7-cell hollow core</td>
</tr>
<tr>
<td></td>
<td>QFL7</td>
<td>Ideal Cylindrical Cloak and Influence of Tiny Perturbation</td>
<td>Ballroom A8</td>
<td>Wei Yan, Zhichao Ruan, Min Yan, Min Qiu, Royal Inst. of Technology (KTH),</td>
<td>Ideal Cylindrical Cloak and Influence of Tiny Perturbation, Wei Yan, Zhichao</td>
</tr>
<tr>
<td>5:15</td>
<td>QFM6</td>
<td>Modified Optical Cavity Transmission by an Intracavity Dispersive</td>
<td>Ballroom A7</td>
<td>Haibin Wu, Min Xiao, Univ. of Arkansas, USA. By balancing the sharp linear</td>
<td>Modified Optical Cavity Transmission by an Intracavity Dispersive Medium,</td>
</tr>
<tr>
<td></td>
<td>QFM6</td>
<td>Modified Optical Cavity Transmission by an Intracavity Dispersive</td>
<td>Ballroom A7</td>
<td>Haibin Wu, Min Xiao, Univ. of Arkansas, USA. By balancing the sharp linear</td>
<td>Modified Optical Cavity Transmission by an Intracavity Dispersive Medium,</td>
</tr>
<tr>
<td></td>
<td>QFL7</td>
<td>Ideal Cylindrical Cloak and Influence of Tiny Perturbation</td>
<td>Ballroom A8</td>
<td>Wei Yan, Zhichao Ruan, Min Yan, Min Qiu, Royal Inst. of Technology (KTH),</td>
<td>Ideal Cylindrical Cloak and Influence of Tiny Perturbation, Wei Yan, Zhichao</td>
</tr>
<tr>
<td></td>
<td>QFM5</td>
<td>Correlations in Two-Mode Cavity QED</td>
<td>Ballroom A7</td>
<td>David G. Norris, Jietai Jing, Rebecca Olson Knell, Luis A. Orozco, Arturo</td>
<td>Joint Quantum Inst., Dept. of Physics, Univ. of Maryland, USA, Ctr. de Optica</td>
</tr>
<tr>
<td>5:15</td>
<td>QFM6</td>
<td>Modified Optical Cavity Transmission by an Intracavity Dispersive</td>
<td>Ballroom A7</td>
<td>Haibin Wu, Min Xiao, Univ. of Arkansas, USA. By balancing the sharp linear</td>
<td>Modified Optical Cavity Transmission by an Intracavity Dispersive Medium,</td>
</tr>
<tr>
<td></td>
<td>QFL7</td>
<td>Ideal Cylindrical Cloak and Influence of Tiny Perturbation</td>
<td>Ballroom A8</td>
<td>Wei Yan, Zhichao Ruan, Min Yan, Min Qiu, Royal Inst. of Technology (KTH),</td>
<td>Ideal Cylindrical Cloak and Influence of Tiny Perturbation, Wei Yan, Zhichao</td>
</tr>
</tbody>
</table>

**Friday, May 9**

**CLEO/QELS**

**QELS**

**QFL • Meta-Devices—Continued**

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

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

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

**CLEO**

**QFM • Quantum Nonlinear Optics—Continued**

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

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

**Joint**

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

**JFG4 • 4:45 p.m.**
Realization of Low Loss and Polarization Maintaining Hollow Core Photonic Crystal Fibers, Brian Mangan, Jens K. Lyngsoe, Peter J. Robertson; Crystal Fibre A/S, Denmark, Dept. of Communications, Optics and Materials, Technical Univ. of Denmark, Denmark. Antiresonant core walls in 7-cell hollow core fibers are used to reduce the attenuation to 9.3dB/km and create an intention-ally highly birefringent fiber with a beatlength as low as 0.2mm.
QFN • Ultrafast Phonon Dynamics—Continued

QFN5 • 4:45 p.m.
Observation of Coherent G-Mode Oscillations in Single-Walled Carbon Nanotubes via the Spectro-Raman Detection, J. H. Kim1, K. J. Yeo1, Y. S. Lim1, E. Hanno1, J. Kano1, Changnam Natl. Univ., Republic of Korea, Konkuk Univ., Republic of Korea, Rice Univ., USA. Coherent G-mode vibrations of single-walled carbon nanotubes are observed in the spectrum-resolved pump-probe measurements. The G-mode oscillation is relatively strong in the edge side of the laser spectrum while being weak for the central region.

QFN6 • 5:00 p.m.
Dynamics of the Dielectric Function in Fs-Laser Excited Bismuth, Andrei V. Rade1, Davide Baschettov2, Thomas Garl3, Antoine Rousse4, 1Australian Natl. Univ., Australia, 2Lab d’Optique Appliqué, ENSTA, Ecole Polytechnique, France. Time-resolved study of the dielectric function of femtosecond laser excited bismuth demonstrates that excitation of coherent phonons leads to a solid-liquid phase transition, and into a quasi-stable excited state lasting up to 4 ns.

QFN7 • 5:15 p.m.
Sub-Picosecond Time-Dependent Mobility in Low-Band-Gap Polyphenylene Fullerene Blend Probed by Terahertz Spectroscopy, Hynek Némec1, Han-Kwang Nienhuys2, Erik Perzon3, Fengling Zhang1, Olle Inganäs1, Petr Kuczer1, Ville Sundström1, 1Lund Univ., Sweden, 2FOM Inst. for Atomic and Molecular Physics, Netherlands, 3Chalmers Univ., Sweden. Linkoping Univ., Sweden. ‘Inst. of Physics, ASCR, Czech Republic. Time-resolved terahertz spectroscopy is used to investigate photoinduced dynamics of charge carriers in a polymer heterojunction. We directly observe instantaneous generation of highly mobile charge carriers followed by a rapid drop in their mobility.

JFH • High Harmonic Generation and Attosecond Physics III—Continued

JFH5 • 4:45 p.m.
Large Amplitude Modulation of High Order Harmonic Generation from Vibrationally Excited Molecules, Wen Li1, Xin Zhou1, Roushdy Lock1, Nick L. Wagner2, Henry C. Kapteyn1, Margaret M. Murnane1, Serguei Patchkovskii1, Albert A. Solodov1, 1ILLA and Dept. of Physics, Univ. of Colorado, USA, 2NIST, USA, ‘Stasiea Inst. of Molecular Science, Natl. Res. Council of Canada, Canada. We observe large vibrationally-induced modulations in high harmonic conversion in N₂O. We explain this result as due to the changing electronic structure induced by the vibration, leading to preferential emission at the outer turning point.

JFH6 • 5:00 p.m.
High-Order Harmonic Generation with a 1.5 µm Self-Phase-Stabilized Parametric Source, Caterina Vezzi1, Francesca Calegari1, Enrica Benedetti1, Mauro Nuzzo1, Giuseppe Saracene1, Sandra De Silvestri1, Salvatore Sagriné1, Fabio Frassetto1, Luca Poletto2, Paolo Villaregi1, Natl. Lab for Ultrafast and Ultraintense Optical Science, Inst. Natl. per la Fisica della Materia, Consiglio Natl. delle Res., Politecnico di Milano, Italy, ‘Lab for Ultraviolet and X-Ray Optical Res., Dept. of Information Engineering, Inst. Natl. per la Fisica della Materia, Consiglio Natl. delle Res., DEU, Univ. di Padova, Italy. We generated high-order harmonics with self-phase-stabilized near-IR pulses produced by a parametric source. We observed a significant cutoff extension with respect to 800 nm driving pulses at comparable peak intensity.

JFH7 • 5:15 p.m.
Imitation Gating for Tunable Isolated Attosecond Pulse Generation, Aurelie Ijilien1, Thomas Fjeltrer1, Mark I. Abi2, Phillip M. Nagel3, Justine Bell4, Daniel M. Neumark1, Stephen R. Leone5, 1Univ. of California at Berkeley, USA, 2Lawrence Berkeley Natl. Lab, USA. Ionization gating confines high-harmonic generation to the leading edge of the driver pulse. Experimentally produced soft-X-ray continuous radiation is spectrally broad and tunable. The method suggests isolated attosecond-pulse production with long driver pulses.

CFW • Advanced Solid-State Laser Materials—Continued

CFW4 • 4:45 p.m.
Laser Action in Bulk Nd³⁺-Doped Telluride Glass, Hamit Kalaycioglu1, Hussein Cankaya1, Gonul Ozer1, Lutfu Ovecoglu1, Istanbul Technical Univ., Turkey. We report on the first observation of lasing in bulk Nd³⁺-doped (0.8)TeO₃-(0.2)WO₃ glass at 1065 nm. Gain-switched operation was obtained with a slope efficiency of 12% at a pulse repetition rate of 1 kHz.

CFW5 • 5:00 p.m.
Developments toward a Reliable Diode-Pumped Hydrocarbon-Free 795-nm Rubidium Laser, Sheldon S. Q. Wu1, Thomas F. Soules1, Ralph H. Page1, Scott C. Mitchell1, V. Keith Kane1, Raymond J. Beach1, Lawrence Livermore Natl. Lab, USA, 1Univ. of California at San Diego, USA. We report a 795-nm diode-pumped Rb laser using a buffer gas of pure He. He gas enhances mixing of the 85 fine-structure levels. This enables efficient lasing at reduced He pressures and improved thermal management.

CFW6 • 5:15 p.m.
17 Watts Continuous Wave Rubidium Laser, Boris Zhdanov1, A. Stooke1, A. Boyadijian1, A. Voci1, Boris Zhdanov, A. Stooke, A. Boyadijian, A. Voci, Boris Zhdanov, A. Stooke, A. Boyadijian, A. Voci, 1Berkeley Natl. Lab, USA. We report on the use of noncollinear third-harmonic generation in thin organic films for ultrafast optical image processing using 80 fs pulses at 1550nm and compare it with the traditional degenerate four-wave mixing approach.

CFX • Nonlinear Optical Materials—Continued

CFX5 • 4:45 p.m.
Enhanced Electro-Optic Effect in InAs/GaAs Quantum Dots, Brandon F. Redding, Xi Long1, Nikolai Faleev, Istanbul Technical Univ., Turkey, Istanbul Technical Univ., Turkey. The electro-optic properties of InAs/GaAs quantum dots are studied in an external Mach-Zehnder Interferometer setup. The InAs/GaAs quantum dots are found to increase modulation relative to bulk GaAs and exhibit an electro-optic coefficient of 26pm/V.

CFX6 • 5:00 p.m.
Third-Harmonic Generation in Organic Thin Films as an Alternative to Degenerate Four-Wave Mixing Ultrafast Optical Image Processing, Carmen Fuentes-Hernandez1, Shawn Ye1, Tsinghua Chi2, 1Carnegie Mellon Univ., USA, 2Georgia Tech, USA. We report on the use of nonlinear third-harmonic generation in thin organic films for ultrafast optical image processing with 80 fs pulses at 1550nm and compare it with the traditional degenerate four-wave mixing approach.
Flexible, Large-Area Metamaterials Fabricated on Thin Silicon Nitride Membranes, Xomalin G. Peralta, Christian L. Arrington, Michael C. Wanne, Igal Brener, John D. Williams, Evgenya Smirnova, Antoinette J. Taylor, John F. O’Hara, Andrew Strikwerda, Richard D. Averitt, Willie J. Padilla; 1Sandia Natl. Labs, USA, 2CINT Sandia Natl. Labs, USA, 3ISR-6, Los Alamos Natl. Lab, USA, 4MPA-CINT, Los Alamos Natl. Lab, USA, 5Dept. of Physics, Boston Univ., USA, 6Dept. of Physics, Boston College, USA. We present terahertz metamaterials fabricated on large-area, free-standing thin (≤1 μm) silicon nitride membranes with the aim of reducing dielectric losses, enhancing metamaterial sensing capabilities, and enabling flexible and conformable designs.

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

Longitudinally Single Mode Laser-Diode Fabricated with Nanoimprint Lithography, Jukka P. Viheriälä, Juha Tommila, Tuomo Rytkönen, Lauri Tokkala, Mihail Dumitrescu, Tapio Niemi, Markus Pessa; Optoelectronics Res. Ctr., Tampere Univ. of Technology, Finland. We demonstrate diode lasers with integrated feedback gratings using Nanoimprint Lithography. Our process is developed for epitaxially grown semiconductors. Due to the feedback from the grating longitudinally single mode lasing is achieved.
CFZ4 • 4:45 p.m.  Invited
High-Power THz Generation, THz Nonlinear Optics and THz Nonlinear Spectroscopy, János Hebling\textsuperscript{1,2}, Ka-Lo Yeh\textsuperscript{1}, Matthias C. Hoffmann\textsuperscript{1}, Keith A. Nelson\textsuperscript{1}; \textsuperscript{1}MIT, USA, \textsuperscript{2}Dept. of Experimental Physics, Univ. of Pécs, Hungary. A review of generation of high-power terahertz single-cycle and shaped pulses by tilted pulse front excitation with up to 200 MW/cm\textsuperscript{2} intensity is given. Recent demonstrations of terahertz nonlinear optics and spectroscopy are then presented.

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