JWA1  

JWA2  
Fabrication of Gold-Platinum Nanoparticles by Intense, Femtosecond Laser Irradiation of Aqueous Solution,  Takahiro  Nakamura,  Hideyuki Masura,  Yasutaka Hikami,  Akiko Inoue,  Shunichi Shindo,  Inst. of Multidisciplinary Res. for Advanced Materials,  Tohoku Univ.,  Japan.  We demonstrated fabrication of gold and platinum composite and/or alloy nanoparticles by intense, femtosecond pulse laser irradiation of mixed auric and platinum aqueous solution.

JWA3  
Pulsed Laser Ignition Thresholds of Energetic Multilayer Foils,  Joel P. McDonald1,  Yoosuf N. Perera2,  Steven M. Yalowitz2,  David P. Adams2,  Sandia National Labs,  Livermore,  USA.  NREL,  USA,  Univ. of Michigan,  USA.  Ignition thresholds for energetic multilayer foils comprised of aluminum (Al) and platinum (Pt) layers are presented as a function of foil properties for laser pulse durations of 100 femtosecond (fs) and 30 nanosecond (ns).

JWA4  
Waveguide Writing and Characterization in Tellurite Glass,  Mark Ramme1,  Troy P. Anderson1,  Feonon Cho1,  Heike Ebendorff-Heidepriem2,  Tanya M. Morin3,  Martin C. Richardson4,  Townes Laser Inst.,  College of Optics and Photonics,  Univ. of Central Florida,  USA,  Ctr. of Expertise in Photonics,  School of Chemistry and Physics,  Univ. of Adelaide,  Australia.  Ultra-fast laser-induced positive refractive index changes in bulk tellurite glass were investigated.  The refractive indexes of waveguiding structures were measured using the far-field approach.  Filamentation was observed for certain irradiation conditions.

JWA5  
Ultrafast Laser filamentation Control Techniques for Remote Applications,  Jean-Francois Daugas1,  Olga Konarzewa2,  Seong Choon Choo3,  Yosef Kamal4,  Gilles Roy5,  Jacques Dubata6,  Marc Chatelain7,  Francis Thébert8,  Ctr. of Optique,  Photono etique et Laser (COP),  Univ. Laval,  Canada,  Inst. Laser Cent.,  Phys. Dept.,  M.V. Lomonosov Moscow State Univ.,  Russia,  Federation,  Defence Res. and Development Centre,  Valcartier,  Canada.  Filaments are generated from pulses focused by a telescope equipped with a AO system.  Strong signals were detected at a distance of 90m.  In other scheme,  an aperture enhanced the length and ionization densities.

JWA6  
Investigation of Phase-Sensitive Image Amplification with Elliptical Gaussian Pump,  Michael Vassilyev1,  Nikolai Steinhardt2,  Pcem Kumar3,  Univ. of Texas at Arlington,  USA,  Northwestern Univ.,  USA.  We numerically analyze phase-sensitive parametric amplification of a multi-pixel test image and demonstrate that >10 DB gain is achievable with ~10 kw total pump peak power,  which makes it compatible with compact pump sources.

JWA7  
Type-II Quasi-Phase-Matched Second-Harmonic Generation in Domain-Disordered Semiconductor Waveguides,  Barry M. Holmes1,  Uriman Yariv2,  David C. Hutchings3,  Sean I. Wagner4,  Anne S. Hejny5,  J. Stewart Atchison6,  Univ. of Glasgow,  UK,  Univ. of Toronto,  Canada.  Second-harmonic generation is demonstrated in periodically intermixed GaAs/AlGaAs superlattice waveguides by Type-II phase matching.  Second-harmonic powers of 20 W were generated at fundamental phase matching wavelength of 157.7 nm.

JWA8  
Optical Auto-Correlation Peak Discriminator for Optical CDMA Signal Detection,  Mable P. Fok1,  Yanhua Deng2,  Paul R. Prucnal3,  Franklin Univ.,  USA.  We experimentally demonstrate a compact optical auto-correlation peak discriminator based on four-wave mixing in a highly nonlinear bismuth-oxide fiber.  The discriminator rejects cross-correlation peaks,  thus improves the detection of optical CDMA signal and removes the error floor.

JWA9  
Comparative Study of Pump-Induced Refractive Index Changes in Aluminum and Phosphat Silicate Yb-Doped Fibers,  Andrei Fedotov1,  Olga E. Antipova2,  Igor A. Brefetov3,  Evgeny M. Diakov4,  Patrice Mgeist1,  Faculté Polytechnique de Mons,  Belgium,  3Institut Physique-Technique Inst. of Research,  Sciences of Russia,  Federation,  4Inst. of Applied Physics of Russian Acad. of Sciences,  Russian Federation,  Fiber Optics Res. Ctr. of the Russian Acad. of Sciences,  Russia.  The influence of fiber glass composition on dynamics of pump-induced refractive index changes in Yb-doped silicate fibers is reported.  The Yb ions polarizability difference responsible for the effect is determined for fibers with different Yb ion lifetimes.

JWA10  
Sodium-Yellow Laser Generation from a Three-Stage X3 Process in an Optical Parametric Oscillator,  Rong-Yu Tu1,  Yen-Yin Lin2,  Shoutai Liu3,  Ting-Dong Wang4,  Chin-Yuan Chen5,  Chen-Chieh Huang1,  Inst. of Photonics Technology,  Natl. Tsinghua Univ.,  Taiwan.  We investigated three-stage nonlinear frequency conversion in an optical parametric oscillator to generate 589 nm laser radiation.  We successfully demonstrated the sodium-yellow laser radiation at a threshold of 650 W by using a 1064 nm pump laser.

JWA11  
Polarization Pulling Induced by Raman Amplification in Telecommunication Optical Fibers,  Paolo Martelli1,  Matteo Ciriglione2,  Maddalena Ferrari3,  Lucia Manzetti4,  Marco Martinelli2,  Consorzio per Comunicazione,  Italy,  Dept. di Elettronica e Informazione,  Politecnico di Milano,  Italy.  We exploit the polarization dependence of the Raman amplification to obtain a polarization pulling effect in telecommunication optical fibers.  Experiments carried out with 1571 nm signal and copropagating high-power 1488 nm pump evidence the polarization pulling.

JWA12  
Cascaded Third-Harmonic Generation in a Single-Two-Dimensional Nonlinear Photonic Crystal with a Short-Range Order,  Yun Sheng1,  Solomon M. Saltiel2,  Kaloian Koynov2,  Max Planck Inst. for Polymer Res.,  Germany,  Faculty of Physics,  Univ. of Sofia,  Bulgaria.  Short-range ordered nonlinear photonic crystals (SRO-NPC) are new, promising class of materials for optical frequency conversion.  We describe a method for designing such SRO-NPC, for efficient collinear third-harmonic generation (THG) at arbitrary wavelength.

JWA13  
High Repetition Rate Bismuth Borate Optical Parametric Oscillator Pumped by a Cavity-Dumped Nd:YLF Laser,  Dae-Su Yee1,  Dae-Sup Lee2,  J. R. Drayne Miller1,  Robin Castlin1,  Stuart Foster1.  Inst. for Optical Sciences,  Univ. of Toronto,  Canada,  Sunnybrook Health Sciences Ctr.,  Canada.  We present a bismuth borate optical parametric oscillator pumped by cavity-dumped Nd:YLF laser delivering low jitter 9.5 mmjoule pulses at 1 kHz tunable from 720 to 900 nm that is ideally suited for photoacoustic medical imaging.

JWA14  
Polarization of THz Radiation from Laser Generated Plasma Filaments,  Damien Dietietz1,  Michael Marfil1,  Jaraj Daruri2,  Stefan Raether1,  Aurélie Pufigly1,  James N. Hayman1,  Karl Unterreiner2,  Vienna Univ. of Technology,  Austria,  Macalester College,  USA.  We analyze the dependence of the polarization of THz radiation generated by four-wave-mixing in laser induced plasma filaments on the input polarizations and compare these results to current models for plasma assisted THz generation.

JWA15  
Generation of Terahertz and Harmonic Radiation in Ultrashort Laser-Gas Interactions,  Dong-Won Jeong1,  Sung-Yong Kim1,  Univ. of Maryland,  USA.  The generation of terahertz and harmonic radiation in ultrashort laser-gas interactions is simulated on a basis of transient electron currents.  The simulations include two-color laser mixing in gases and photoionization by femtosecond laser pulses.

JWA16  
Improved Ti:ZnGeO3 Imaging with a Virtual-Source Based Spectrally Tunable Aperture Weighting Technique,  Hannah Zhang1,  Takashi Buma2,  Univ. of Delaware,  USA.  We combine a virtual-source based spectrally tunable aperture focusing technique with coherence weighting to overcome the limited depth-of-focus of high numerical aperture Ti:ZnGeO3 optics.  Images show depth-independent spatial resolution and a 14 dB improvement in SNR.

JWA17  
Fourier-Transform Terahertz Spectroscopy Using Terahertz Frequency Comb,  Dae-Soo Yee1,  Youngchun Kim1,  Jiwook Ahn1,  Korea Res. Inst. of Standards and Science,  Republic of Korea,  KAIST,  Republic of Korea.  We demonstrate high-resolution Fourier-transform terahertz spectroscopy using two terahertz frequency combs with stabilized different repetition frequencies without a mechanical time delay tool.
JWA18
Terahertz Near-Field Imaging: Rigorous Model for Interpreting “Antenna Approach,” Sergei Popov1, Yanlu Li2, Sergey Sergeev3, Ari T. Friberg4,5; 1Royal Inst. of Technology, Sweden, 2Waterford Inst. of Technology, Ireland, 3Helsinki Univ. of Technology, Finland, 4Univ. of Jyvaskyla, Finland. Classical Mie theory fails to explain high resolution of a terahertz imaging system exploiting scattering of the near-field radiation. Reported numerical model confirms the feasibility of an antenna model which proves the enhanced resolution.

JWA19
Optical-Pump THz-Probe Spectroscopy of P3HT, Paul D. Cunningham, L. Michael Hayden; 1Univ. of Maryland, Baltimore County, USA. We measured the photoconductivity in P3HT excited above and below the band gap using OPTP spectroscopy and extracted values consistent with the intrinsic mobility. We have also investigated the advantages of broadband (>5 THz) spectroscopy.

JWA20

JWA21
Quasi-Phase Matched Electro-Optic Terahertz Detector, Junar Darma, Karl Uelterman; Photonics Inst., Vienna Univ. of Technology, Austria. An enhanced terahertz electro-optic detector with periodically-inverted crystalline structure is proposed and demonstrated. This concept enables to increase the detector sensitivity to the multi-terahertz frequencies by order of magnitude.

JWA22
Evaluating the Linear and Nonlinear Optical Properties of a Mixed Tellurite Chalcogenide Glass, Zhihan Jin, Ivan Biaggio, Jean Toulouse; Lehigh Univ., USA. A new type of tellurite chalcogenide glass is proposed. Our theoretical study shows an enhancement that linear refractive index nD (~1.315) and third-order susceptibility χ^(3) (~200 pm/V) are larger than the base tellurite glass.

JWA23
Characterization of Nonlinear Absorption in Phosphine Substituted Bisphenol, Timothy M. Pritchett1, Jianwei Wang2, Christopher M. Law, Qian Zhu1, Gary M. Gray1, ARL, USA, 2Univ. of Alabama at Birmingham, USA. The two-photon absorption cross-sections of two novel derivatives of 5,5’-bis(diphenylphosphino)-2,2’-bithiophene have been measured using Z scans employing 2-ps pulses at multiple pulse energies, yielding values of 1500 ± 50 GM and 2850 ± 50 GM.

JWA24
Nonlinear Optical Characterization of H-Bonded Chromophores in Linear-Dendritic Block Copolymers, Melvina Leuluckam1, Perra, Saap.Prasnarr1, Salimar Jimenez Diaz1, David J. McCarr2, Padma Gopalan1; 1Univ. of Wisconsin-Madison, USA, 2Univ. of Puerto Rico at Cayey, USA. Using the ATR-FTIR technique, we investigated the advantages of broadband (>5 THz) spectroscopy on measuring the photoconductivity in P3HT. JWA25
A Near-IR Transmitting “Black Glass” Synthesized from 75%TeO2-25%ZrO2-5%ZnO, Zhihan Jin, Aishong Zhang, Andria Kalvokaiti, Ivan Biaggio, Jean Toulouse; Lehigh Univ., USA. A new type of tellurite glass synthesized with composition 70TeO2-25ZrO2-5ZnO transmits between 2µm to 6µm. XPS reveal the existence of Zn-O-S and a reduction of tellurium oxide with formation of Te-Te bonds in the glass.

JWA26
Near-Infrared Quantum Cutting in SrF2:Pr3+, Yb3+ for Photovoltaics, Bryan M. van der Ende, Paul D. Cunningham, L. Michael Hayden; 1Duke Univ., USA, 2Univ. of Wisconsin-Madison, USA. A p-type single crystal with thin film laser has been metal/metal bonded onto silicon for good thermal dissipation and low threshold current. The threshold current density is 244 A/cm2.

JWA27
Nonlinear Refractive Indices in Undoped and Yb-Doped KTIOPO4, Christiano C. Moreira, Rui Ribeiro, Iara F. Braganca, João A. L. Fonseca, Lúcia A. G. Fonseca, António R. D. Silva; 1CMAF, 2IFC, 3FCUL, Portugal. We evaludate the nonlinear properties of KTIOPO4 in the wavelength range spanning from 400 to 1100 nm. The third-order nonlinear susceptibility χ^(3) (~20 times) are larger than the linear electro-optic values of 25 pm/V at 1550 nm.

JWA28
Paper Withdrawn.

JWA30
Nano-Ag-Polymeric Photonic Crystal All-Optical Switching, Xiaoyong Hu, Pingyang Cheng, Xin Hong, Yangong Qiu; Shanghai Gong, Dept. of Physics, Peking Univ., China. An ultrafast and low power photonic crystal all-optical switching is realized, made of nano-Ag-MEHP-PPV composite. The pump intensity is as low as 0.2 MW/cm^2. An ultrafast switching time of 35 ps is achieved.

JWA31
Sub Nanosecond Electrohydrologic Switching, Noam Sapirson, Aharon Weinstein, Aharon J. Agranat; Hebrew Univ, Israel. Electrohydrologic switching with rise-time of less than a nanosec- ond is henceforth demonstrated. The switching was done in the g_c configuration in which the Bragg condition is fulfilled for the entire spectrum of the electric field.

JWA32
Ultrafast All-Fiber Third-Order Temporal Differential Interferometer, Luis M. Rivadeneira1,2, Sylvia Boudreau1, Yongwon Park1, Radan Slavík4, Sophie Larochelle3, Linda Aarts, Ramon Muller, Andreas Meierink1, Condensed Matter and Interfaces, Delft Heate Inst. for NanoMaterals Science, Utrecht Univ., Netherlands. Visible to NIR downconversion efficiency up to 140% is observed using time-resolved spectroscopy in SF5, Pr3+, Yb3+ with sensitization, this new technique is capable of arbitrary-odd-order optical temporal differential temporal switching with rise-time of less than a nanosecond.

JWA33
Intracavity Phase Modulation for Phase Noise Suppression in Mode-Locked Lasers, Sarper Ozturk, Ibrahim T. Ozarak, Franklyn J. Quinnan, Peter J. Deffyett; 1CREOL, 2College of Optics and Photonics, Univ. of Central Florida, USA. Using intracavity active phase modulation, we have verified the theory of Haus and Rana and realized timing jitter reduc- tion. Intracavity phase modulation allows for 150fs integrated to Nyquist frequency on a 10.24 GHz actively mode-locked pulsed train.

JWA34
Statistical Analysis of Incoherent Pulse Shaping, Christophe Dorier; Lab for Laser Energetics, Univ. of Rochester, USA. The statistical properties of incoherent pulse shaping are obtained from the derived probability density function of the shaped intensity obtained by temporal gating of an incoherent source followed by chromatic dispersion.

JWA35
Single-Drive Electro-Optic Modulator for Duo- Binary Modulation Utilizing Non-Periodically Polarization-Reversed Structure, Hiroshi Mut- suda1, Hai Vi Pham1, Yasuyuki Okamura1, Takahide Sakamoto1, Tetsuya Kawashita1, Osaka Univ., Japan, 2NICT, Japan. A new electro-optic duo-binary modulator is proposed. Utilizing non-periodic polarization reversal structures, a pair of Gaussian-like modulation frequency responses with an opposite sign is obtained. It operates with a single duo-binary signal without electrical/optical filters.

JWA36
Picosecond Pulse Generation Using Low-Driving Voltage MZM Driven with Step Recovery Diodes, Takahide Sakamoto, Iiao Morohashi, Tetsuya Kawashita, Iwao Hasho, NICT, Japan. We demonstrated synthesis of picosecond pulse train from a continuous-wave laser source using low-driving-voltage Mach-Zehnder modulator (MZM) asymmetrically large-amplitude driven with step-recovery diodes, without using high-power driver amplifiers. 2-GHz, 5.2-ps pulse train was successfully generated.

JWA37
Extremely Simple Device for Measuring Ultra Short Pulses in the Visible, Dongsoo Lee, Rick Trobino; Georgia Tech, USA. We demonstrate an extremely simple frequency-resolved optical gating device (GRENÓULLE) for the visible range. By angle-tuning a thick crystal, it can range includes the entire visible spectrum and should be ideal for measuring pulses from visible OPAs.

JWA38
Thin Film P-Ridge N-Stripe III-V Laser Broad Area Metal-Metal Bonded to Silicon, Sahersi Palit1, Jeremy Kirch1, Luke Maw5, Thomas Kuech2, Nan Jokerst2; 1Duke Univ., USA, 2Univ. of Wisconsin-Madison, USA. A p-ridge single quantum well thin film laser has been metal/metal bonded onto silicon for good thermal dissipation and low threshold current. The threshold current density is 244 A/cm2.

JWA39
Silicon-on-Insulator Integrated Waveguide Filters for Photonic Channelizer Applications, Marcel W. Pruessner, Todd H. Stievater, William S. Rabinovich, Preepat S. Dergyn, Vincent J. Urick; NRL, USA. We demonstrate wideband microfiber waveguide filters for channelizer applications. Various filters exhibit bandwidths of BW=2 GHz (16 pm), free spectral range FSR=83 GHz (1.87nm), and maximum finesse F=77. Several contributions to filter loss are examined.

JWA40
High-Density Optical Interconnect Based on TIR and Metal Coated Precise Mirror Attached Waveguide, Hideotake Numata, Shigeru Nakagawa, Yunoshi Taine; IBM Tokyo Res. Lab, Japan. We present high density optical interconnect based on TIR and metal coated precise mirror attached waveguide on a PCB. The structure and performance of 12-channel transmitter and receiver operating at 8-10 Gbps are presented.

JWA41
Broad Band 1 nm Channel Spacing Silicon-on-Insulator Wavelength Division Multiplexer, Bernard C. B. Kytokota1, Long Chen1, Michal Lipori2, School of Electrical and Computer Engineering, Cornell Univ., USA, 2Dept. of Physics, Univ. Federal de Pernambuco, Brazil. We demonstrate a compact silicon-on-insulator wavelength division multiplexer. The device supports 21 channels, has 1 nm channel spacing and less than -10 dB crosstalk.

Exhibit Hall
J O I N T
JWA • Joint CLEO/QSCE Poster Session II
JWA42 Colorless, Surface Normal Optical Modulator Based on Free Carrier Effect in Gallium Arsenide, Ojai P. Kulkarni, Malay Kumar, Mohammed N. Islam, Fred L. Terry, Jr.; Dept. of Electrical Engineering and Computer Science, Univ. of Michigan, USA. We demonstrate a surface-normal modulator based on free-carrier effect in GaAs and phase-to-amplitude conversion coupling to a single mode fiber. Operation over 1200-2400nm, modulation depth up to 43% and frequency up to 270MHz is observed.

JWA43 Influence of Free Carrier Absorption to Mach-Zehnder Interference-Based Photonic Switches, Hsienfeng Zhou, Yong Zhao, Fan Wang, Wanjuan Wang, Huiying Ma, Juan Yang, Minghua Wang, Xiaoqing Jiang; Dept. of Information Science and Electronic Engineering, Zhejiang Univ., China. The absorption penalty to free carrier dispersion effect seriously constraints the crosstalk of Mach-Zehnder interference-based photonic switch to a limit, which is demonstrated by theory and the fabricated 1×2 p-i-n silicon optical switches.

JWA44 2-D Confinement and Reduction of Polarization Dependence in Hollow Waveguide with High Index Contrast Grating, Maksh Kuman, Fumio Koyama, C.J. Chang-Hasnain; Tokyo Inst. of Technology, Japan, Univ. of California at Berkeley, USA. A tunable hollow waveguide with distributed Bragg reflector (DBR) mirror and a high-index contrast-grating (HCG) mirror has been proposed. We numerically show the possibility of 2-D-confinement and reduction in polarization-dependence of the proposed hollow waveguide.

JWA45 Multi-Channel Sensing with Resonant Microcavities Coupled to a Photonic Crystal Waveguide, Elisa Guillermin, Philippe M. Fauchet; Univ. of Rochester, USA. Resonant cavities coupled to a single photonic crystal waveguide operating as a multi-channel sensor are reported. The transmission spectrum presents as many dips as there are cavities. Infiltration of a solvent shifts the resonance wavelengths.

JWA46 Resolution Enhancement through Focal Field Polarization Depolarization Control in Third Harmonic Generation Microscopy, Omid Masihzadeh, Philip Schlip, Randy A. Bertels; Colorado State Univ., USA. Increased spatial resolution through control of the focal field polarization state in a laser scanning third harmonic generation (THG) microscope is demonstrated. THG polarization tomography is used to characterize the focal field polarization state.

JWA47 Atmospheric Pressure Femtosecond Laser Imaging Mass Spectrometry, Yves Ciello, Tissa C. Guzaratte, Marco Dantus; Michigan State Univ., USA. We present a novel imaging mass spectrometry technique using femtosecond laser pulses to sample the atmosphere pressure and without the need of a laser-absorbing matrix. A 10μm-resolution image of biological tissue is demonstrated.

JWA48 Optical Coherence Tomography Based on InTEGRAL Quantum dot Radiative Q-switch of Quantum Dot Light Emitting Diode, Petrov Zernov, Giovanni Pireddu, Robert W. Boyd, Jeffrey H. Shapiro; Inst. of Optics, Univ. of Rochester, USA, Res. Lab of Electronics, MIT, USA. We show theoretically that the longitudinal resolution of conventional OCT can be improved by a factor of 12 when two photon (as opposed to single photon) sensitive detector is used, and we present preliminary supporting results.

JWA49 Near-Infrared in vivo Fluorescence Sensor with Integrated Dielectric Emission Filter, Thomas D. O’Sullivan, Elizabeth Muraw, Christopher Conca; NATEC Photonics, Adam de la Zerda, Sanjiv S. Gambhir, James S. Harris, Steven Lev; Stanford Univ., USA, Univ. of Toronto, Canada, Oramics Technology Corp., USA. We present a monolithically integrated near-infrared fluorescent sensor incorporating a dielectric emission filter for in vivo applications. We successfully integrated a dielectric emission filter (OD3) onto a low-noise detector and sensed 50μM fluorescent dye concentration.

JWA50 Near-Infrared Fluorescent Labeling of Tissue Transglutaminase Substrates for Wound Healing Monitoring, Chia-Pin Hsu, Yi-Hua Chi, Charles Greenberg, Zishan Haroon, Gregory W. Faris; SIRI Int., USA, Duke University Med. Ctr., USA. A novel imaging strategy is developed to optically monitor the wound healing process by crosslinking near-infrared fluorescent labeled tissue transglutaminase substrates into the wound.

JWA51 Ultrahigh Resolution Optical Coherence Tomography Using Cr4+:YAG Fiber, Yu-Ta Wang, Po-Tsi Lu, Kuan-Yang Huang, Po-Kai Hsu, Sheng-Liang Huang; Inst. of Photonics and Optoelectronics, Natl. Taiwan Univ., Taiwan, Inst. of Electro-Optical Engineering, Natl. Sun Yat-Sen Univ., Taiwan. Using a CW 265-nm broadband source from Cr4+:YAG double-clad fiber, ultrahigh resolution optical coherence tomography was demonstrated with a 73-dB S/N ratio. A 3-μm TIO2 thin film was used to verify its 3.5-μm axial resolution.

JWA52 Hollow-Core Photonic Bandgap Fibers with Broadband Negative Dispersion Slope, Kamaluddin Satoh, Zbigniew Pilarski, Masatoshi Yoshida, Robert Scipii, Hiroki Akiyama, Japan, Furuhashi Electric Int. of Technology Ltd., Hungary; Res. Inst. for Solid State Physics and Optics, Hungary. Hollow-core photonic bandgap fibers exhibiting negative dispersion slope over a wide wavelength range around one micron for the fundamental air-core mode are presented by the introduction of partial reflector layer around the core.

JWA53 Tight Control of the Spectral Broadening Obtained by Nonlinear Conversion in a Photonic BandGap Fiber, Raphael Jamier, Nicolas Duvoisin, Sebastien Ferrer, Mikael E. Lhickher, Mikael Salomonski, Xim Univ. of Limoges, France, Optical Res. Ctr. Russian Federation, Inst. of Chemistry of High Purity Substances, Russian Federation. We have demonstrated and theoretically observed the complete extent of a spectral broadening obtained in a non-linear photonic bandgap fiber. A spatial single-mode 450 nm-wide spectrum is then obtained by the fiber self-filtering effect.

JWA54 3-D Modeling of Modal Competition in Fiber Laser: Application to HOM Suppression in Multi-Layered Fiber, Mathieu Devautour, Philippe Rey, Sebastien Ferrier; Xim, Univ. of Limoges, France. Three-dimensional modeling of modal competition in fiber lasers is presented. The numerical model is used to design a large mode area active fiber laser in which high order modes suppression is wavelength insensitive.

JWA55 Upconversion Assisted Auto-Oscillations in Erbium Doped Fiber Laser, Sergey V. Sergeev, Kirill O'Mahoney, Sergei Popov, Ar T. Friberg; Waterford Inst. of Technology, Ireland, Royal Inst. of Technology, Sweden, Helsinki Univ. of Technology, Finland, Univ. of Joensuu, Finland. A new model of auto-oscillations in high concentration erbium doped fiber laser has been developed with accounting for statistical nature of the excitation migration and upconversion, as well as resonance-like pump-to-signal intensity noise transfer.

JWA56 Temperature Response of Photonic Bandgap Fibers Based on High-Index Inclusions, Rafael E. P. de Oliveira, Christiano J. S. de Mato, Jonathan C. Knight, Toshihiko Taru, Arism C. Sedri; Univ. Pernambuco, Brazil, Univ. of Bath, UK, UNITCAMP Brazil. We observed spectral shifts for short heat lengths of photonic bandgap fibers based on high-index rods. Shifts are observed in even shorter lengths if the fiber is bent. Application as alternative distributed sensors is envisaged.

JWA57 Fiber Raman Amplifiers with Suppressed Polarization Impairments, Sergey V. Sergeev, Sergei Popov, Ar T. Friberg; Waterford Inst. of Technology, Ireland, Royal Inst. of Technology, Sweden, Helsinki Univ. of Technology, Finland, Univ. of Joensuu, Finland. By using two-section fiber where the first section has no spin and the second one is periodically spun, we demonstrate reduced polarization dependent gain and polarization mode dispersion in a distributed fiber Raman amplifier.

JWA58 Polarization Rotation in a Nanoscale Yb+3 Rod-Type Fiber Amplifier, Ramatou Bello-Doua, Francois Salin, Eric Freysz; EOLEIT Systems, France, UNIROE2L, France. We evidenced the polarization rotation in an Yb3+ rod-type fiber amplifier injected by a sub-nanosecond microlaser. Simple numerical simulations account for the observed phenomena.

JWA59 Zero-Broadening and Pulse Compression Brillouin Slow light Based on Doubly Gain Lines in an Optical Fiber, Guandong Qi, Takeshi Suzuki, Yuasaoka Ohishi, Toyota Technological Inst., Japan. We numerically demonstrated zero-broadening and pulse compression Brillouin slow light based on double gain lines in an optical fiber.

JWA60 Tm:Germanate Fiber Laser for Planetary Water Vapor Atmospheric Profiling, Simon Barnes, Russell J. De Young, NASA Langley Res. Ctr., USA. The atmospheric profiling of water vapor is necessary for finding life on Mars and weather on Earth. The design and performance of a water vapor lidar based on a Tm:germanate fiber laser is presented.

JWA61 All-Optical Gain-Clamping Dispersion-Compensated Raman/EDFA for WDM Systems, Jeng-Cheng Tang, Yu-En Juan, Bing-Sheng Wu, Natl. Dong Hwa Univ., Taiwan. We design dispersion-compensated Raman/EDFA hybrid amplifiers recycling residual Raman pump for WDM systems. The first experimentally demonstration of broad band gain-clamped and gain flattened dispersion-compensated Raman/EDFA hybrid amplifiers with a single FBG for WDM systems.

JWA62 Optimization of Microresonator Parameters for a Quartz-Enhanced Photacoustic Spectroscopy Sensor, Lei Deng, Anatoly A. Kosterov, David Thomsen, Frank K. Tittel; Rice Univ., USA. A Quartz-Enhanced Photacoustic Spectroscopy based gas sensor was optimized to improve its compactness, spectral resolution, and performance. The impact of a 2-microresonator geometry on the detected signal and signal to noise ratio was investigated.

JWA63 Multiple-Pass Tapered Fiber-Optic Sensor with Logarithmic Detection, Ertan Salkı, Gabriel Andayas; California State Polytechnic Univ., USA. We report doubling of sensitivity for tapered fiber-optic sensors with logarithmic detection when light passes through the tapered region twice. Further sensitivity enhancement is possible with multiple passes through the taper.

JWA64 Sound Recording by Laser Interferometry, Balnhasa Fisch; Ernst Wittner; Vienna Univ. of Technology, Austria. A Fabry-Perot etalon is used as microphone. Refractive index dependant transmission is proportional to sound pressure over a large dynamic range. The current of the laser diode is tuned to take into account environmental influences.

JWA65 Measurement of the Oxygen (1-0) Band at 699 nm Using Continuous-Wave Cavity Ring Down Spectroscopy, James M. Ray, Berley L. Bister III, George M. Brooke IV; Virginia Military Inst., USA. We have measured the (1-0) band of the O2, X2Σ+ system in molecular oxygen at pressures ranging from 25 torr to 500 torr using continuous-wave cavity ring-down spectroscopy (CW-CRDS).

JWA66 Assessment of Dual Ammonia and Oxygen Open-Path Sensing with a Quantum Cascade Laser, Paul Carrigan, Maung Lwin, Barry Goss, Fred Mothay; City College of New York, USA. We present a theoretical assessment of two open-path quantum cascade laser (QCL) approaches (mono- bi-static and backscatter) to measure ambient ozone and ammonia concentrations to within 1% accuracy at distances to 10 km.
JWA67 Fiber Optic Sensor System for Stress Monitoring in Power Cables, Jörg Burmester, Wolfgang Schüppers, Wolfgang Schade, Clausthal University of Technology, Germany. A sensor system for power cables, based on a single microchip-laser and single mode fibers is presented. The system is capable of monitoring temperature, squeezing, bending and torsion, spatially resolved down to a few centimeters.

JWA68 Fiber Bragg Grating Fabry-Perot Resonator Based Acoustic Emission Sensor Using Active Feedback System, Raja Pappu, Wei Zhang, Ian Bennion, Kate Sugden; Aston University, UK. We propose a novel optical fiber grating based Fabry-Perot acoustic emission sensor and active feedback system that eliminates low frequency spectrum shifts caused by environmental perturbations, ensuring the sensor always work at optimum operation point.

JWA69 Optical Fiber Refractometer with Improved Sensitivity Based on an Offset Tilted Fiber Bragg Grating, Tuan Guo, Hwo-Yow Tam, Jacques Alberi; 1Dept. of Electrical Engineering, Hong Kong Polytechnic Univ., Hong Kong, 2Dept. of Electronics, Carleton University, Canada. Highly sensitive fiber-optic refractometer with an over-offset tilted fiber Bragg grating configuration is proposed based on strong cladding-core recombination. Reflection with two well-defined bands performs an improved refractive index measurement combining with power self-calibration property.

JWA70 Simultaneously Transfer Microwave and Optical Frequency through Fiber Using Mode-Locked Fiber Laser, Chao-Wei Kang, Tze-An Liu, Ren-Hsiu Shi, Chi-Ling Ping, Jen-Long Peng; 1Dept. for Measurement Standards, Taiwan, 2Natl. Chiao Tung Univ., Taiwan. Microwave and optical frequency references are simultaneously transferred through fiber using a frequency-stabilized mode-locked Er-fiber laser comb. The instability for transferred microwave and optical frequencies are 2.0×10⁻¹⁰ and 7.5×10⁻¹⁰ s⁻¹, respectively, for 3 km transmission.

JWA71 Microwave Frequency Transfer by Propagation of an Optical Frequency Comb over Optical Fiber, Giuseppe Murra, Stephen Lee, Helen Margolis, Patrick Gill; Natl. Physical Lab, UK. The repetition rate of a mode-locked laser is transferred over 50 km of spooled fiber with instability below 5×10⁻¹⁰ s⁻¹. We are able to transfer continuous, Q-switched and single pulses over a distance of 60 km.

JWA72 Development of a Comprehensive Programmable Array Microscope, Yuehao Wu, Caihua Chen, Peng Ye, Gonzalo Arce, Dennis Prather; Univ. of Delaware, USA. We present a comprehensive programmable array microscope design, which incorporates the compressive sensing principle into the patterned illumination microscope design, so that single pixel detectors can be used to capture microscopic images without mechanical scanning.

JWA73 Temporally Resolved Characterization of Iron Nanoparticles Using a Time-Resolved Laser Technique, Johannes Kiefer, Roland Sommer, Katya Danova, Nadejda Popova, Alfred Leiper; 1Institut für Technische Thermodynamik, Univ. Erlangen-Nürnberg, Germany, 2Institut für Chemische Reaktionskinetik, Univ. Erlangen-Nürnberg, Germany. For the first time, time-resolved laser-induced incandescence (TiRe-LII) has been used to investigate the metal-organic chemical vapor deposition (MOCVD) process of iron in a fluidized bed reactor characterizing nanoparticles deposited on a substrate surface.

JWA74 All-Fiber Common-Path Fourier-Domain Optical Coherence Microscopy for 3-D in vivo Endoscopic Subcellular Imaging, Kang Zhang, Jae-Ho Han, Jin U. Kang; Johns Hopkins Univ., Baltimore, Maryland, USA. We present a microscope incorporating the compressive sensing principle into a common-path optical coherence tomography system for 3D in vivo endoscopic subsurface imaging. Image resolution of 2μm × 9μm (transverse × longitudinal) is achieved with nucleus and cell walls clearly visualized.

JWA75 Observation of 100 GHz Beat Signal for Millimeter-Wave Generation Using Mach-Zehnder-Modulator-Based Flat Comb Generator, Isao Morohashi, Takahide Sakamoto, Kiyousuke Itoyama, ShunyaKatagiri, Takeshi Noda, Natl. Adv. Inst. Res., Japan. We demonstrate a novel distributed-feedback semiconductor laser with a high peak power that can output a 100-GHz comb signal using a Mach-Zehnder-modulator-based flat comb generator, and showed a 100 GHz beat signal by exciting two modes from 12.5 GHz spaced comb signals.

JWA76 STRAIN RELAXATION AND EMISSION CHARACTERISTICS OF SIZE-DEPENDENT GaN/InGaN NANO ARRS, Ching-Hua Chiou, Peichen Yu, C. H. Kuo, T. C. Lai, S. C. Wang, C. Y. Chang, Y. T. Wu; Dept. of Photonics and Inst. of Electro-Optical Engineering, Natl. Chiao Tung Univ., Taiwan, Inst. of Photonics and Optoelectronics and Dept. of Electrical Engineering, Natl. Taiwan Univ., Taiwan. InGaInGaN nanoarrays with various sizes are fabricated using self-assembled Ni nano-masks and inductively-coupled-plasma reactive ion etching. Numerical analysis using a valence force field model showed excellent agreement with the experiment results.

JWA77 EFFICIENCY ENHANCEMENT OF GaN/InGaN VERTICAL-JECT LIGHT EMITTING DIODES USING DISTINCTIVE INDIUM-TIN-OXIDE NANOARDOS, C. S. Yang, Peichen Yu, Ching-Hua Chiou, C. H. Chang, H. C. Kuo, Dept. of Photonics and Inst. of Electro-Optical Engineering, Natl. Chiao Tung Univ., Taiwan. Distinctive indium-tin-oxide nanorods are demonstrated using glancing-angle deposition. The nanostructured material exhibits enhanced transmission and is employed to enhance the light-output power of GaN/InGaN vertical-junction light emitting diodes by 20% at an injection current of 35mA.

JWA78 Nanorod Light Emitting Diode Arrays with High Concentration Radiation Profile and Strain Relaxed Structure, Liang-Yi Chen, Ying-Yuan Huang, Pei-Isuan Lin, Ming-Yang Ke, Jianfang Huang, Natl. Taiwan Univ., Taiwan. We have developed a nature lithography method to fabricate nanorod structure. The strain is released in nanorod structured LED, which is indicated by their nearly constant electroluminescence peak wavelength. The radiation profile is highly concentrated.

JWA79 EMISSION DEPTH DEPENDENCE OF EMISSION PROPERTIES from InGaN/GaN LIGHT EMITTING DIODES with Nanohole Arrays: Study of Analysis Relaxation and Surface States, Chieng-Yu Chang, Tuh-Ren Wu, Inst. of Photonics and Optoelectronics and Dept. of Electrical Engineering, Natl. Taiwan Univ., Taiwan. Our studies shows that the surface states and strain relaxation play significant roles when the etching hole depth is close to or penetrates the quantum well region, which leads the blue shift of the spectrum.

JWA80 WHITE LIGHT EMISSION FROM ORGANIC DIODE with ELectroluminescent Quantum Dots and ORganic Molecules, Toriihuiji, Sai Kojima, Haruo Takano, Dept. of Electronic and Micromechanical Engineering, Kansai University, Japan. An organic light-emitting device is used in combination with quantum dots and blue-light emitting organic molecules to produce flexile white light. Quantum dots are excited via direct electronic injection, unlike previously reported.

JWA81 INFLUENCE OF GUIDED MODE Absorption on the Effectiveness of GaN-on-Sapphire Photonic Crystal Light Emitting Diodes, Philip A. Shields, Szymon Lis, Tom Lee, Duncan W. E. Allsopp, Martin D. B. Charlton, Majid E. Zoorob, Wang N. Wang; Dept. of Electronic and Electrical Engineering, Univ. of Bath, UK, Max-Plank-Institut für Metallforschung, Stuttgart, Germany. Enhanced light extraction from photonic crystal light-emitting diodes etched into the device surface is described. Finite Difference Time Domain modeling indicates that scattering or absorption at the substrate/polymer interface is the dominant limiting process.

JWA82 Conical Thermosteafacture for Spatially Solved Surface Thermography of Transparent LEDs, Joseph A. Summers, Janice A. Hudgings; Materials Dept., Univ. of California at Santa Barbara, USA. We report on the use of conical thermosteafacture for accurate surface temperature measurement of transparent LEDs. Conical thermosteafacture effectively suppresses light from beneath the LED surface, compared to wiedfeld measurements, for a red GaLED.

JWA83 Effects of Prestrained Layers on Piezoelectric Field and Indium Incorporation in InGaAs/InP Quantum Wells, Jae-Ho Song, Ho-Jong Kim, Korea Advanced Institute of Science and Technology, Daejeon, Korea. We analyze the experiment results in single and tandem solar-cells comprising heterojunctions that increase the path of the photons inside the solar cell. For this purpose we exploit different physical phenomena in different material systems.

JWA84 Nonlocal Dispersion Cancellation Using Entangled Photons, So Young Baik, Young Woong Cho, Tae-Ho Kim; Pohang Univ. of Science and Technology (POSTECH), Republic of Korea. Using an entangled photon-pair traveling through two separate dispersive media, we experimentally demonstrate nonlocal dispersion cancellation in which the dispersion experienced by one photon cancels the dispersion experienced by the other photon.

JWA85 Sequential Time-Bin Entanglement Generation Using Periodically Poled KTP Waveguide, Litman Ma, Oliver Statters, Tianjun Chang, Xiao Tang; NIST, USA. We demonstrated non-degenerate sequential time-bin entanglement using periodically poled KTP waveguide at a repetition rate of 1 GHz. The wavelengths of signal and idler are 895 and 1310 nm. The two-photon-interference fringe visibility is 79%.

JWA86 Unconditional Continuous Variable Entanglement Cascading, Xueyuan Hu, Ying Qiu, Qihuang Gong, Guangyuan Guo; State Key Lab for Mesoscopic Physics and Dept. of Physics, Peking Univ., China, Key Lab of Quantum Information, Univ. of Science and Technology, China. A sequence of continuous-variable entanglement swapping is studied. We obtain the upper-bound of Gaussian cascaded entanglement and propose an unconditional protocol achieving it. We demonstrate entanglement can be unconditionally cascaded for any nonzero-squeezed entangled sources.

JWA87 Characterizing Single Photons by Photon Counting, Kaituo Laihia, Malte Aarhus, Kattiasiu N. Causento, Christine Silberhorn, Max Planck Res. Group, Germany. We study the ability to measure the non-Gaussian character of the single photon Fouck states via direct measurements of the photon number statistics of displaced quantum states.

JWA88 Observation of Whispering Gallery Modes in m-plane GaInN/GaN Microdisks, Adele C. Tambild, Samuel C. Schober, Anuoko Hiri, James S. Speck, Steven P. DenBaars, Evelyn L. Hriu; Materials Dept., Univ. of California at Santa Barbara, USA. Microdisks support high quality modes and low threshold lasing in GaN. We have fabricated nonpoly microdisks that have high quality whispering gallery modes with quality factors limited by quantum well reabsorption rather than cavity roughness.

JWA89 Photomangement in Thin Film Solar Cells, Curran Rockerfield, Stephan Fahr, Thomas Paal, Christoph Menzel, Karsten Bitkau, Thomas Becker, Reinhard Carstel, Falk Lerderer; 1Inst. of Condensed Matter Theory and Solid State Optics, Friedrich-Schiller-Universitat Jena, Germany, 2Inst. für Energieforschung, Forschungszentrum Jülich, Germany. We analyze the absorption enhancement in single and tandem solar-cells comprising nanostructures that increase the path of the photons inside the solar cell. For this purpose we exploit different physical phenomena in different material systems.
Fused Microfiber Resonators, modes are strongly favored over air modes. and field overlap. For several unrelated cavities, we ties requires optimization of modal quality factor (Q).

Design of Nanoslotted Photonic Crystal Waveguide Cavities for Single Nanoparticle Trapping, Shayan Lin, Jaehun He, Lionel Kimerling, Kenneth Crozier2, J. J. (Harvard Univ., USA). A modified surface plasmon antenna design is proposed. Simulation results show that the modified design has higher localized field enhancement than traditional rod and bowtie antennas.

Photonic Crystal Cavities for Sensing: Dielectric Modes versus Air Modes, Snjezana Tomljenovic-Hanic1, Adel Rahman1, Michael J. Steel1, C. Martin de Sterke1, CUDOS, School of Physics, Univ. of Sydney, Australia. Q-factor of 250,000 micropillar cavities with a nanoslot structure for single nanoparticle trapping. A 13X enhancement of optical gradient trapping force compared to plain waveguide trapping devices has been achieved.

Phononic Crystal Cavities for Sensing: Dielectric Modes versus Air Modes, Snjezana Tomljenovic-Hanic1, Adel Rahman1, Michael J. Steel1, C. Martin de Sterke1, CUDOS, School of Physics, Univ. of Sydney, Australia. Q-factor of 250,000 micropillar cavities with a nanoslot structure for single nanoparticle trapping. A 13X enhancement of optical gradient trapping force compared to plain waveguide trapping devices has been achieved.

Effective sensing with photonic crystal cavi- ties requires optimization of modal quality factor and field overlap. For several unrelated cavities, we find the quality factor dominates, so that dielectric modes are strongly favored over air modes.

JWA93 Fabrication of Intrinsic Fiber Mach-Zehnder Interferometers for Single Nanoparticle Cavity, Minuya Park1, Sejin Lee1, Wossung Ha1, Da-Kyu Kim1, Woon Jin Shin1, Kyungeun Oh1, Inst. of Physics and Applied Physics, Yonsei Univ., Republic of Korea. We have fabricated an intrinsic fiber Mach-Zehnder interferometer (MZI) by embedding a micro air-cavity using femtosec- ond laser- fused coupling region for mechanical robustness. We experimentally obtain a Q-factor of 250,000 at 1.55 μm.

JWA94 Fabrication of Intrinsic Fiber Mach-Zehnder Interferometer for Single Nanoparticle Cavity, Minuya Park1, Sejin Lee1, Wossung Ha1, Da-Kyu Kim1, Woon Jin Shin1, Kyung-heun Oh1, Inst. of Physics and Applied Physics, Yonsei Univ., Republic of Korea. We have fabricated an intrinsic fiber Mach-Zehnder interferometer (MZI) by embedding a micro air-cavity using femtosecond laser-fused coupling region for mechanical robustness. We experimentally obtain a Q-factor of 250,000 at 1.55 μm.

JWA95 Effective Parameters For Anisotropic Metamaterials, Christian Russel, Carsten Rockstuhl, Thomas Paul1, Thomas Pertsch1, Falk Lederer1, Inst. of Condensed Matter Theory and Solid State Physics, Friedrich Schiller Univ., Jena, Germany, 1ETH Zurich, Switzerland, 2Ctr. for Quantum Technologies, Natl. Univ. of Singapore, Singapore. We propose a narrow Rabi frequency window for competition between coherent population trapping and Raman absorption, which is followed by a rare frequency range at the cost of the vanishing of slow light effect.

JWA96 Submicron Diameter Micropillar Cavities with High Quality Factor and Ultra Small Mode Volume, Xuan Zhang, Marko Loncar, Harvard Univ., USA. We theoretically demonstrated high quality factor (Q=250,000) micropillar cavities with record low mode volume for a 50nm diameter titanium/silica micropillar. It represents a three orders of magnitude Q(V2) enhancement compared to any previous micropillar cavities.

JWA97 Impact of Anti-Zeno Effect on a Coupled Nonlinearity-Quantum-Dot System, Makoto Tomoyuki, Takashi Arso, Kazunobu Kojima, Saasuma Noza, Kyoto Univ., Japan. A comprehen- sive theory of couplings between a cavity and different charge configurations in a quantum dot is developed. It is shown that the quantum anti-Zeno effect is essential for the results obtained by QED experiments.

JWA98 Exploring the Limits of Single Emitter Detection in Fluorescence and Extinction, Jason Kwong, Gert Wrigge1, Ilja Gerhardt1, Gert Zumofen1, Va- hid Sandoghdar1, ETH Zurich, Switzerland. For quantum technologies, Singapore. We show experimentally that the signal-to-noise ratio of extinction detection can be advantageous to fluo- rescence measurements of a single molecule. We discuss the prospects of detecting weak emitters such as rare earth ions.

JWA99 Emission Control of NV Centers Embedded in an Opticall Photonic Crystal, Luke A. Stuart1, Yan-Hua Zhao1, Michael J. Steel1, Judith M. Daws1, James R. Rabeau2, Michael J. Withford1, Macquarie Univ., Australia. We investigate emission of dia- mond nanocrystals containing nitrogen-vacancy (NV) centers within optical photonic crystals (PC). The PC exhibits a stopband that overlaps the NV photoluminescence spectrum. A modified emission spectrum and increased lifetime were measured.

JWA100 Electromagnetically Induced Transparency Using Spatially-Periodic Light Control, Bin Luo, Hong Guo, Peking Univ., China. Using spatially periodic coupling light, we demonstrate that an ideal electromagnetically induced transparency (EIT) medium can be transparent in a wide frequency range at the cost of the vanishing of slow light effect.

JWA101 Contrary Behavior of Adsorption and Dispersion, Katrin Dahl1, Luca Spani Molella1, Rolf- Hermann Rinkelf1, Karsten Danzmann1, Albert Einstein Inst., Max Planck Inst. for Gravitational Physics, and Inst. for Geodetic and Geophysical, Leib- niz Univ. Hannover, Germany. A degenerate two-level system was investigated with circularly polarized probe and coupling lasers. An intensity dependent switch of an absorption peak to a dip was measured. The corresponding dispersion did not change.

JWA102 Time-Resolved Fourth-Order Optical Interferometry in a Band Photonic Crystal Source, Xingxing Xing1, Luciano Cruz1, Florian Wolf- gramm1, Morgan W. Mitchell2, Aephrasm M. Steinberg1, Ctr. for Quantum Information and Quantum Control and Inst. for Optical Sciences, Dept. of Physics, Univ. of Toronto, Canada, 1FCIO, Spain. We report our experimental progress observing time-resolved fourth order optical interference with a narrow-band, indistinguishable photon pair source from cavity enhancement. The required large dispersion is achieved by the electromagneti- cally induced transparency (EIT) effect.

JWA103 Measuring Atomic Oscillator Strengths by Single Atom Spectroscopy, Jiunn Lee, Syed Abdullah Aljundi1, Meng Khon Teo, Brenda Cheng, Goh Madelmann1, Christian Kuester1, Ctr. for Quantum Technologies, Natl. Univ. of Singapore, Singapore. We propose a method for assessing the oscillator strengths of atomic transitions by mea- suring the AC Stark shift of atomic energy levels for the single atom trapped in an optical tweezers.

JWA104 A Narrow Rabi Frequency Window for Compiti- tion between Coherent Population Trapping and Raman Absorption, Ti-Chi Lee1, Ray-Yuan Chang1, Zong-Syan He1, Ming-Tsung Lee1, Wei-Chia Fang1, Hsiao-Chen Chan1, Chien-Tsai Tsai2, Inst. of Electro-Optical Science and Engineering, Natl. Chung-Kung Univ., Taiwan, 1Dept. of Physics, Natl. Cheng-Kung Univ., Taiwan. We demonstrate the competition mechanism between coherent population trapping and Raman absorption in ladder-type system. While Rabi frequency of probe exceeds decay rate, a decoherence created by probe field and Raman absorption dominates the process.

JWA105 Proposed Bell’s Inequality Test Using Entangled Photon Holes, Junfin Liang, James D. Franson1, Todd B. Pittman1, Univ. of Maryland, Baltimore County, USA. We propose an experimental test of Bell’s inequality using entangled photon holes rather than entangled photon pairs. The experi- ment involves feeding entangled photon holes into a time-box based two-photon interferometer.

JWA106 Low-Roll Ultra-Fast Quantum Random Number Generator, Michael A. Wayne1, Paul G. Kwiat1, Univ. of Illinois at Urbana-Champaign, USA. We present a low-bias quantum random number generator based on the time interval between subsequent single-photon detections. Our cost-efficient and convenient implementation outputs data at rates in excess of 100 MHz/s.

JWA107 Experimental Implementation of Time-Coding Quantum Key Distribution at Telecommunication Wavelength, Olivier Morin, Simon Fouier1, Thierry Dubsieu, Thales Res. and Technology, France. A time-coding quantum key distribution protocol at telecommunication wavelength is investigated over a 25 km channel. Measured 98 % visibility and 2 % QBER enable 200 km security performance.

JWA108 Sub-Wavelength Sized Optical Cavity Resonators with Fishnet, Jingjing Li1, Lars Thyr12, Alex Bratkovski1, Shih-Yuan Wang1, Stanley Williams1, Harvard Univ., USA. A modified surface plasmon antenna design is proposed. Simulation results show that the modified design has higher localized field enhancement than traditional rod and bowtie antennas.

JWA109 Enhanced Birefringence of Inhomogeneous Slabs, Sergey Sukhor1, David P. Haefner1, Girish Agarwal1, Aristeide Dougari1, CRIOLP and FPCE, College of Optics and Photonics, Univ. of Central Florida, USA, 1Dept. of Physics, Oklahoma State Univ., USA. We show that the presence of an interface changes the local field distributions in inhomogeneous materials. The loss of field symmetry leads to a significant surface-induced birefringence of an inhomogeneous medium.

JWA110 A Tool for Designing Realizable Hyperlenses, Xinjui Ni, Zhibin Jacob1, Alexander Kildishev1, Vladimir Shalaev1, Eugene E. Narimanov1, Purdue Univ., USA. We developed an on-line simulation tool which can facilitate designing experimentally realizable hyperlenses with cylindrical layered structures. A design working at 355 nm with a resolution of quarter wavelength is presented.

JWA111 Effective Parameters For Anisotropic Metama- terials, Christian Russel, Carsten Rockstuhl, Thomas Paul1, Thomas Pertsch1, Falk Lederer1, Inst. of Condensed Matter Theory and Solid State Physics, Friedrich Schiller Univ., Jena, Germany, 2Inst. of Applied Physics, Friedrich Schiller Univ., Jena, Germany, ZIK Ultra Optics, Germany. We introduce a procedure to retrieve anisotropic effective parameters of metamaterials at oblique incidence. We show that such a homogenization fails near plasmonic resonances for all reasonable aspect ratios and discuss possible implications.

JWA112 Periodic Green’s Functions for Linear Arrays in Free-space and near Layered Media, Derek A. Van Orden, Vitaly Lumekin1, Univ. of California at San Diego, USA. We present a measurement/calculating the scalar and dyadic periodic Green’s functions for a linear periodic array of sources both in free-space and near a layered medium.

JWA113 The Sign of Refractive Index of Surface Plasmons in Metal-Dielectric-Metal Structures, Tian Yang, Kenneth R. Creaser1, Harvard Univ., USA. We have carefully examined the surface plasmon modes in the metal-dielectric-metal structures. By using the direction of energy decay to identify the sign of effective refractive index, we have obtained different results from previous reports.
Ultrafast Terahertz Probe of Spin-Density Wave Dynamics in Organic Conductor (TMTSF)2PF6

We observe torsional dynamics in a single quantum dot. This behavior is based on slant-stripe-type periodically-polled Rb-TiOPO4, which can be used to efficiently achieve second-harmonic generation within an ultra-wide spectral range of 1.7-4.0 μm.

Spectral and Temperature Dependence of Nonlinear Absorption in InSb

We show that the spectral dependence process inherent to supercontinuum generation may be described as a thermalization process, which results from the natural irreversible evolution of the optical field towards a thermodynamic equilibrium state.

Optical Tweezers with Optically Resonant Particles

We present a numerical and experimental study of the trapping force on such particles.
JWB1 • 1:30 p.m. [Tutorial]
AMO Research at the LCLS X-Ray Laser, Philip H. Bucksbaum, Stanford Univ., USA. This tutorial will explore the opportunities for novel AMO Physics at X-ray free-electron lasers such as LCLS, which begins operations in 2009.

Philip Bucksbaum is Professor of Physics, Applied Physics, and Photon science at Stanford University, and the Director of the Stanford PULSE Institute for Ultrafast Energy Science. He has previously worked at Lawrence Berkeley Laboratory, Bell Laboratories, and the University of Michigan. His research is in the area of ultrafast and strong field AMO physics.

JWB • Novel Light Sources I
Craig Siders; Lawrence Livermore Natl. Lab, USA, Presider

JWC1 • 1:30 p.m. [invited]
‘Trapped Rainbow’ Schemes for Storing Light in Engineered Waveguides, Konnas I. Tsakmakidis, Optin Hax; Advanced Technology Inst., School of Electronics and Physical Sciences, Univ. of Surrey, UK. We review recent progress in the realm of ultra-slow and stored light inside metamaterial waveguides. We elucidate a number of critical issues pertaining to the study of light propagation in various slow-light metamaterial structures.

JWC2 • 2:00 p.m.
Bulk Metamaterial with Hyperbolic Dispersion, M. A. Noginov1, Yu. A. Barnakov1, G. Zhu1, T. Tumkur2, Li Heng1, E. E. Narimanov2; ‘Norfolk State Univ., USA, ‘Summer Res. Program, Ctr. for Materials Res., Norfolk State Univ., USA, ‘Purdue Univ., USA. We have demonstrated bulk (51 μm thick) photonic metamaterial based on anodized alumina membranes filled with silver. The material is highly anisotropic and follows the hyperbolic dispersion law at λ=0.84 μm.

JWC3 • 2:15 p.m.
Optical Nonlocalities and Additional Waves in Epsilon-near-Zero Metamaterials, Viktor A. Podolecky1, Robert J. Pollard2, Anthony Murphy2, William R. Hendren2, Paul R. Evans2, Ron Atkinson3, Gregory Wurtz2, Anatoly V. Zayats2; 1Oregon State Univ., USA, 2Queen Univ. of Belfast, UK. We present experimental evidence of excitation of additional wave in nanorod metamaterials in ENZ regime. Analytical description of the phenomenon is developed and the effect on the optical response of the system is discussed.

IWA1 • 1:30 p.m.
Room Temperature Degenerate Four-Wave Mixing Due to Ultrafast Radiative Decay of Confined Excitons, Masayoshi Ichimiya1,2, Masaki Ashida1,2, Hideki Yasuda1,2,3, Hatime Ishihara1,2,3, Tadashi Inoh1,2,3; 1CREST-JST, Japan, 2Graduate School of Engineering Science, Osaka Univ., Japan, 3Graduate School of Engineering, Osaka Prefecture Univ., Japan. Degenerate four-wave mixing spectrum and the temperature dependence are investigated in a CuCl thin film with high crystalline quality. The signal at room temperature is firstly observed.

IWA2 • 1:45 p.m.
Interference-Induced Slow and Fast Light in Bulk Semiconductors, Bajiru Gao1, Naz H. Koving2, Rolf Binder1, Arthur L. Smith1; 1College of Optical Sciences, Univ. of Arizona, USA, ‘Univ. of Iowa, USA. The interference between the two exciton polaritons in semiconductors is predicted to give a time delay for traversing light pulses that is unrelated to the polaritons’ group velocities.

IWA3 • 2:00 p.m.
Picosecond Coherent Control of Dressed States in a Single Quantum Dot, Stephen J. Boyle1, Andrew J. Ramsay1, Albert P. Heberle2,3, Mark Hopkinson1, Mark Fox4, Maurice S. Skolnick1,2,3; 1Univ. of Sheffield, UK, 2Univ. of Pittsburgh, USA, 3Purdue R&D Ctr., Corning Inc., USA, 4EPSRC Natl. Ctr. for III-V Technologies, Univ. of Sheffield, UK. We demonstrate picosecond control of dressed states in a single quantum dot. The Rabi oscillations of the dressed states are directly resolved in the time domain through beating of the Autler–Townes doublet.

IWA4 • 2:15 p.m.
Coherent Control of Shift Currents in GaAs Using Chirped Optical Pulses, Ana Marin Bacu, Shekhar Priyadarshi, Uma Sengupta, Mark Bieler, Rolf Binder; Physikalisch-Technische Bundesanstalt, Germany. We demonstrate coherent control of shift currents in GaAs by adjusting the relative phase between two orthogonally polarized, chirped optical pulses. The novel technique allows us to control the shape of the generated current transients.
A system that permits one to simultaneously measure Raman photons was detected using an optical cavity. Interesting effects include lasing in the regime of a hot vapor of three-level atoms in an optical cavity. We study theoretically and experimentally the strongly-coupled, nonlinearly Broadened Atoms in an Optical Cavity, Nonlinear Optics of Three-Level, Inhomogeneous Excitations of optically-dark excitons in Cu2O. The theory is applied to describe nonlinear terahertz excitations in a new scheme of spectral shearing interferometer for coherent synthesis of optical parametric oscillators. A microscopic theory is applied to describe nonlinear terahertz excitations of optically-dark excitons in Cu2O. The theory is quantitatively compared to recent experiments. Signatures of Rabi flopping and ponderomotive forces exerted on the Raman emission from the scatterer. We study theoretically and experimentally the strongly-coupled, nonlinearly Broadened Atoms in an Optical Cavity. A new scheme of spectral shearing interferometer for coherent synthesis of optical parametric oscillators is demonstrated. Few-cycle pulse has been measured providing a wide observation window has been demonstrated. Few-cycle pulse has been measured with a temporal observation/resolution ratio of >10^4 and a dynamic range of >10^5.

A new scheme of spectral shearing interferometer for coherent synthesis of optical parametric oscillators is demonstrated. Few-cycle pulse has been measured providing a wide observation window has been demonstrated. Few-cycle pulse has been measured with a temporal observation/resolution ratio of >10^4 and a dynamic range of >10^5.
IWC1 • 1:30 p.m.
Multiple-Qubit Quantum State Parameterization, Joseph M. Altepeter, [Evan R. Jeffrey, Milija Medić, Prem Kumar; NorthWestern University, USA, ’Leiden Inst. of Physics, Netherlands. We present a method for graphically visualizing any two-qubit quantum state. This tool, based on the Poincaré sphere, provides an unambiguous, intuitive, and useful complement to photonic state tomography.

IWC2 • 1:45 p.m.
Near-Field Correlations in the Two-Photon Field, Martin P. van Exter, Henrique Di Lorenzo Martin P. van Exter, Henrique Di Lorenzo, Dietmar Korn, Dirk Puhlmann, Jarke J. Rieger, Adam Strub, Michael Durst, Chris Xu, Cornell University, USA. We demonstrate enhanced axial confinement in a temporal focusing setup using a shaped spectrum and a narrow emission filter, achieving 80% reduction of out-of-focus background when compared to conventional two-photon microscopy.

IWC3 • 2:00 p.m.
Change of Entanglement of Light on Propagation, Hoda Hosein-Nejad, Rene Stock, Daniel F. V. James, Univ. of Toronto, Canada. We demonstrate that entanglement of photons emitted in a large solid angle can change on propagation.

IWC4 • 2:15 p.m.
Spatial Entanglement Characterization in a Bichromatic Beam, Dietmar Korn, Dirk Puhlmann, Carsten Hensel, Robert Elsner, Martin Ostermeyer, Inst. for Physics and Astronomy, Univ. of Potsdam, Germany. Spatial entanglement is investigated in applications in quantum imaging relying on multi-photon absorption. A product of variances in space and momentum shows strong violation of the classical correlation bound.

CWC1 • 1:30 p.m.
Study of a Narrowband Two-Photon Parametric Oscillator at Degeneracy with a Transversely Chirped Bragg Grating, Matt Marsh, Robert W. Boyd, Jens H. Christensen, Univ. of Rochester, USA. We investigate the energy and spectral properties of a narrowband (0.9 nm) optical parametric oscillator, tunable around the degeneracy point from 1055 to 1066 nm, by usage of a transversely chirped volume Bragg grating.

CWC2 • 1:45 p.m.
Single Frequency and Tunable Operation of a Continuous Intracavity Frequency Doubled Singly Resonant Optical Parametric Oscillator, Thon Hen My, Osuuma Mibake, Cyril Drug, Fabien Bretenaker, Lab Aimé Cotton, Univ. Paris Sud, France. A continuous intracavity-frequency-doubled singly resonant OPO is described. It provides 485 mW of single-frequency orange radiation and is tunable between 585 and 678 nm. Its frequency is stabilized within 4 MHz over 20 minutes.

CWC3 • 2:00 p.m.
Spectral Properties of a Mirrorless Optical Parametric Oscillator, Gustav Stenström, Valdas Pasiškevičius, Carlotta Canalias, Royal Inst. of Technology, KTH, Sweden. In this work we show how the spectral properties of the pump are transferred to signal and idler in a mirrorless optical parametric oscillator and that the idler properties strongly depend on the grating vector.

CWC4 • 2:15 p.m.
High Efficient kHz Repetition Rate Injection Seeded Picosecond Optical Parametric Generator in LBO, Tobias Tracht, Felix Raubel, Johannes D’Hullier, Technische Univ. Kaiserslautern, Germany. We report on a high efficient kHz repetition rate pOPG in LBO with total conversion efficiencies of 75% in the near infrared. Injection seeding reduced the spectral bandwidth from typically 40 nm to 0.4 nm.

CWC1 • 1:30 p.m.
Multiple-Core Leakage-Channel Fibers with up to 26000 µm2 Combined Effective Mode-Field Area, Ingmar Hartl, H. A. McKay, A. M. Marcuskevitz, L. Dong, M. E. Fermann, IMRA America, Inc., USA. Hexagonally stacked all glass multi-core leakage-channel fibers consisting of seven fused silica cores of up to 100 µm in diameter were fabricated. Simultaneous fundamental mode propagation in all cores and their active coherent combination was demonstrated.

CWC2 • 1:45 p.m.
Mode Control in Large-Mode-Area Fiber Lasers via Gain Filtering, John R. Marcianca, Richard G. Reid, Univ. of Rochester, USA. Gain filtering of higher-order modes in large-mode-area fibers is experimentally demonstrated. While the beam quality degrades with pumping level in conventional fiber lasers, it remains constant in confined-gain fiber lasers due to gain filtering.

CWC3 • 2:00 p.m.
Optimizing Injection into Large-Mode-Area Photonic Crystal-Fiber Amplifiers by Spatially Resolved Spectral Interferometry, Jake Bramage, Christophe Dorner, Hilton J. Shaun Hill, Jonathan D. Zuegel, Univ. of Rochester, USA. Spatially-resolved spectral interferometry is used to measure the mode content of a Yb-doped photonic crystal-fiber amplifier having a 2300-µm2 mode area. The impact of misalignment at signal injection on the relative mode powers is quantified.

CWC4 • 2:15 p.m.
Characterizing the Modes of a Core-Pumped, Large-Mode Area Er Fiber Using Spatially and Spectrally Resolved Imaging, Jeff Nicholas, J. Jasapara, A. Desantolo, E. Monberg, F. Dimarcello, OFS Labs, USA. Higher-order modes of a 70-µm core-diameter, Er-doped fiber are characterized over a broad wavelength range using a supercontinuum with spatially and spectrally resolved imaging. Pumping the Er-doped-fiber with 1480-nm in the fundamental mode decreases the higher-order-mode content.

scaling the phase-locked output power to 100 W.

Photonics, USA.

Inoue, Y. Murayama, Y. Bessho, T. Goto, T. Kunisato, and making a cavity length long.

of 450mW by introducing a novel facet coating.

have successfully developed blue-violet laser diodes having the world’s highest output power of 450mW by introducing a novel facet coating structure, reducing the internal loss in devices, and making a cavity length long.

We show that terahertz waves transmit through a 1/30,000 nanogap separating two conducting planes. The field enhancement responsible for this light funneling has a 1/a dependence, which originates from the charging time of the gap.

We describe the realization of planar plasmonic THz guided-wave devices, including straight waveguides, Y-splitters and 3dB-couplers, using periodically perforated metal films. These perforated films behave as effective media whose waveguiding properties can be broadly engineered.

We have coherently combined an 10-element-array of 960-nm Slab-Coupled Optical Waveguide Lasers (SCOWLs). We are currently scaling the phase-locked output power to 100 W using SCOWL stacks.

We have coherently combined 1060-nm Multi Quantum Well Diode Lasers with Narrow Vertical Divergence Angle of 8° and High Internal Efficiency.

We demonstrate ultrafast optical control of terahertz surface plasmon resonance in subwavelength metallic hole arrays. The transient photocconductivity of the substrate allows modulation of the THz resonance amplitude with a time scale of ~10 ps.
JWB • Novel Light Sources I—Continued

JWB2 • 2:30 p.m.
Activation of a 1.1 Petawatt Hybrid, OPCPA-Nd: Glass Laser, Erhardt W. Gud, Mikael Martinez, Joel Blankenship, Martin Ringaude, Doug Hammond, Axel Jochem, Kamakura Encarnacion, Ted Berger, Gilles Dyke, Todd Ditmire; Univ. of Texas at Austin, USA.
We report on the activation of the 1.1 Petawatt Laser (190 J, 170 fs) based on optical parametric chirped pulse amplification (OPCPA) and mixed Nd: glass amplification.

JWB3 • 2:45 p.m.
A Multi-TW Few-Cycle Optical Parametric Chirped Pulse Amplifier, Lecio Velev, Daniel Herrmann, Raphael Tautz, Franz Tavella, Alexander Buck, Karl Schmidt, Vladimir Pervukh, Michael Scharrer, Philip Russel, Ferenc Krausz, Marius-Planck-Inst. fur Quantenoptik, Germany; HASLAB/DESY, Germany, Ludwig-Maximilians-Univ. Munchen, Germany, Univ. of Erlangen-Nuremberg, Germany.
We report on the generation of 8 fs, 125 mJ pulses in a noncollinear optical parametric chirped pulse amplifier with a temporal contrast reaching 10 orders of magnitude at 5 ps before the main pulse.

JWB4 • 3:00 p.m.
Precise Alignment of Large-Aperture Compressor Gratings for High-Power Lasers by Using Diffraction Interferometry, Vladimir Chyryk, Victor Yanovsky, Univ. of Michigan, USA.
We introduce novel method of precise compressor alignment for Petawatt-scale CPA lasers. The method is using compressor gratings as gratings of diffraction interferometer. It meets accuracy requirements (~10-4) and allows simple procedures of alignment.

JWC • Nanophotonics and Metamaterial Symposium I: Bulk Metamaterials—Continued

JWC4 • 2:30 p.m.
Bulk Nanowire Metamaterials for Negative Refraction at Broadband Frequencies from Visible to NIR, Zhao Wei Li, Jie Yao, Yongmin Liu, Yuan Wang, Cheng Sun, Gay Bartal, Angelica Stacy, Xiang Zhang; Univ. of California at Berkeley, USA, Univ. of California at San Diego, USA, Lawrence Berkeley Natl. Lab, USA.
We report the first bulk metamaterials at visible frequencies that shows intriguing negative refraction for all incident angles. The metamaterial is realized by growing silver nanowire in a porous alumina template.

JWC5 • 2:45 p.m.
Super-Resolution Imaging Using Spatial Fourier Transform Infrared Spectroscopy, Leonid Alekseev, Evgenii Narimanov, Jacob Khurgin; Princeton Univ., USA, Purdue Univ., USA, Johns Hopkins Univ., USA.
We describe a scheme for far-field subwavelength spectroscopy and imaging in the mid-IR and THz. This approach relies on scattering from an acoustic grating and recovers both the amplitude and the phase of incident field.

JWC6 • 3:00 p.m.
Impact of Disorder on Surface Plasmons in Two-Dimensional Arrays of Metal Nanoparticles, Jacob B. Khurgin, Greg Sun, Johns Hopkins Univ., USA.
We study the impact of on the properties of surface plasmons (SP) in the metal nanoparticles arrays and develop analytical expressions enabling us to ascertain degree of localization and mixing between the SP states.

IWA • Coherence and Control—Continued

IWA5 • 2:30 p.m.
Spin Hall Effect of Light in a Semiconductor, Jean-Michel Menaud, Adam Mattachioni, John E. Sipe, Arthur L. Smit, Henry M. van Driel; Univ. of Toronto, Canada, Lab for Photonics and Quantum Electronics, Univ. of Iowa, USA.
We demonstrate the spatial separation of right and left circularly polarized components of a linear polarized beam non-normally incident at an air-GaAs interface through the transverse separation of optically injected up- and down-spin electrons.

IWA6 • 2:45 p.m.
All-Optical Injection, Control, and Detection of Ballistic Spin and Charge Currents in Group IV Semiconductors, Arthur L. Smit, Eric J. Lorenz, Brian A. Razska, Lalan K. Weroke, Hui Zhao, Henry M. van Driel; Univ. of Iowa, USA, Univ. of Toronto, Canada.
Ballistic charge currents are injected into Ge and Si and pure spin currents into Ge using quantum interference techniques and are spatially and temporally resolved for the first time.

IWA7 • 3:00 p.m.
Ultrafast Coherent Control of Nonlinear Optical Processes in Plasmonic Nanostructures, Tobias Utschik, Mark I. Stockman, Albert P. Hohenester, Markus Epple, Harald Giessen; Max Planck Inst. for Solid State Res., Germany, Dept. of Physics and Astronomy, Georgia State Univ., USA.
We present a new technique to coherently control ultrashort nonlinear processes in a plasmonic nanostructure on a femtosecond timescale. By using a four-photon process our detection provides full information about the coherence in the system.

3:15 p.m.—4:45 p.m. Coffee Break and Exhibit-Only Time, Exhibit Hall

3:45 p.m.—5:00 p.m. PhAST Market Focus Session: Biophotonics-Therapy, Exhibit Hall

NOTES
Spatial and temporal interferences between four-wave mixing and six-wave mixing channels, Usab Khadka, Yangpeng Zhang, Blake Anderson, Min Xiao; Univ. of Arkansas, USA.

Spatial and temporal interferences between four-wave mixing and six-wave mixing signals are observed by using phase-control between these nonlinear optical processes in a four-level atomic system. Atomic coherence is the key to observe such phenomenon.

Anti-Stokes Photoluminescence from n-type Free-Standing GaN Based on Competing Two-Photon Absorption and Phonon-Assisted Absorption, Sreeruma K. Tripathy, Yajie J. Ding; Lehigh Univ., USA. Mechanisms for anti-Stokes photoluminescence observed at room temperature from n-type free-standing GaN have been attributed by us to the competition between two-photon absorption and phonon-assisted absorption.

Surface and Bulk Contributions to the Second-Order Nonlinearity of Gold, Fu Xiang Wang, Francisco I. Rodriguez, Martin Kauffman, William M. Albers; Risto Ahorinta, 3Dept. of Physics and Inst. for Optical Sciences, Univ. of Toronto, Canada.

Surface and bulk contributions to the second-order nonlinearity of gold. The results provide direct evidence of bulk contributions, nevertheless, surface-like contributions dominate the measured signals.
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<td><strong>IWC • Entangled Photons I—Continued</strong></td>
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<td>IWCS • 2:30 p.m.</td>
<td>Entanglement Distillation of Two-Photon Polarization Qubits Using Tunable Local Filters, Hee Sun Park, Hee Sun Park, Hee Sun Park, Hee Sun Park, Hee Sun Park, Korea Res. Inst. of Standards and Science, Republic of Korea. A tunable entanglement distiller for arbitrary two-photon polarization qubits is demonstrated using novel tunable local filters constructed with rotatable birefringent prisms. The distillation is confirmed by comparing the concurrences of the two-photon states.</td>
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<td><strong>CWC • OPO I—Continued</strong></td>
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<td>CWC5 • 2:30 p.m.</td>
<td>1-GHz Femtosecond Optical Parametric Oscillator Pumped by a 76-MHz Ti:sapphire Laser, Omid Kakabeik , Adolfo Esteban Martin , Konstantinos Moutzouri , Majid Ebrahim-Zadeh , RIKPO - Inst. de Ciencias Fotonicas, Mediterranean Technology Park, Spain, Technological Educational Inst. of Athens, Greece, Instituto Catalana de Recerca i Estudis Avancats (ICREA), Spain. We demonstrate a ~1 GHz femtosecond optical parametric oscillator synchronously pumped by a 76-MHz Ti:sapphire laser using a cavity longer than the fundamental synchronous cavity length. Near-transform-limited pulses with average durations of 227 fs are generated.</td>
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<td><strong>CWC • Large Mode Area and Bend Insensitive Fiber—Continued</strong></td>
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<td>CWC6 • 2:45 p.m.</td>
<td>Tunable Phase-Stabilized Infrared High Power Parametric Source, Leng Xuxin, Zhang Chunmei, Wang Junliang, Wei Pengfei, Song Liwei, Li Chuanqun, Li Ruxin, Xu Zhizhan, Shanghai Inst. of Optics and Fine Mechanics, China. Tunable self-phase-stabilized femtosecond pulses are generated from an optical parametric amplifier. The output pulse wavelength is tunable from 1.53μm to 2.3μm. The maximum pulse energy at 1.8μm is ~1.2mJ/1kHz, with carrier-envelope-phase fluctuation of ~0.15rad.</td>
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<td><strong>CWE • Nonlinear Microscopy—Continued</strong></td>
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<td>CWE5 • 2:30 p.m.</td>
<td>Bend-Induced Changes in Group Delay and Comparison with S² Mode-Content Measurements, John M. Fini, Jeffrey W. Nicholson, OFS Labs, USA. Calculations show qualitative changes in relative index and group delay induced by typical coating of fiber. Comparison with S² measurement shows excellent agreement in relative group delay.</td>
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<td>CWE6 • 2:45 p.m.</td>
<td>What Are the Essential Technical Requirements for the New Bend Insensitive Fiber? David Z. Chen, Verizon, USA. Bandwidth requirements for residential customers have justified fiber penetration into buildings. Macro-bend-loss was identified as a major barrier in such small-dense-tight scenarios, in which copper was typically the choice. We present the requirements for deployment.</td>
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<td>CWE7 • 3:00 p.m.</td>
<td>Fiber-Optic Multiphoton in vivo Flow Cytometry, Yu-Chung Chang, Jing Yong Ye, Thommey Thomas, Zhenyi Cao, Alina E. Kolyvar, James R. Baker Jr., Theodore B. Norris, Univ. of Michigan, USA. We demonstrate the use of a double-clad fiber probe to conduct two-photon excited flow cytometry in vivo. High detection efficiency of GFP-expressing cells is demonstrated, and the initial dynamics of injected circulating cells is observed.</td>
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<td><strong>CWE • Nonlinear Microscopy—Continued</strong></td>
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<td>CWE8 • 2:45 p.m.</td>
<td>Nonlinear Optical Imaging with Sub-12fs Pulses, Yair Andegeko, Dmitry Pestov, Kyle E. Sprague, Vadim V. Lezouary, Marcus Dantas, Michigan State Univ., USA. Transform limited ultrashort pulses are used in a laser-scanning two-photon microscope for imaging of various biological specimens, demonstrating the importance of dispersion-free imaging system. Pulse characterization, qualitative and quantitative data are presented.</td>
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**NOTES**

3:15 p.m.–4:45 p.m. Coffee Break and Exhibit-Only Time, Exhibit Hall

3:45 p.m.–5:00 p.m. PhAST Market Focus Session: Biophotonics-Therapy, Exhibit Hall
Concurrent sessions are grouped across four pages. Please review all four pages for complete session information.
Wednesday, June 3

**CLEO/IQEC and PhotonXpo 2009** • May 31–June 5, 2009

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**JWD • Novel Light Sources II**
Jonathan Zuegel; Univ. of Rochester, USA, Presider

**JWD1 • 4:45 p.m. **
Laser Based Synchronization Light Sources, Heinrich Schwoerer1, Hans-Peter Schliwsko2, Kerstin Hauff3, Fabian Bude4, Erich Rohrer5, Jordan Gallacher6, Dino Jaroszynski7, Laser Res. Inst., Stellenbosch Univ., South Africa, 1Inst. für Optik und Quantenelektronik, Friedrich-Schiller-Univ., Germany, 2Univ. of Strathclyde, UK. We report on the generation of synchronization radiation from laser accelerated relativistic electrons propagating through an undulator. We discuss the necessary steps towards a tunable, ultrafast, coherent, UV light source.

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**JWE • Nanophotonics and Metamaterials Symposium II: Advances in Plasmonics**
Nikolay Zheludev; Univ. of Southampton, UK, Presider

**JWE1 • 4:45 p.m. **
Negative Radiation-Pressure Response of a Left-Handed Plasmonic Metamaterial, Henri Lezec1, Kenneth J. Chua2; 1NIST, USA, 2School of Engineering, Univ. of British Columbia, Canada. We present the design, fabrication and opto-mechanical characterization of a left-handed plasmonic metamaterial which exhibits a negative photon-pressure response in the visible frequency range.

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**JWE2 • 5:15 p.m. **
Planar Lenses Based on Nanoscale Slit Arrays in a Metallic Film, Lieven Verslegers, Peter B. Catrysse1, Zongyu Yu1, Justin S. White2, Edward S. Barnard2, Mark L. Brongersma3, Stanford Univ, Stanford, USA. We experimentally demonstrated planar lenses based on nanoscale slit arrays in a metallic film. Electromagnetic simulations of lens designs and confocal measurements on manufactured structures show excellent agreement, but deviate from simple theory.

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**JWE3 • 5:30 p.m. **
Photonic Metamaterials by Direct Laser Writing, Michael S. Rill1,2; 1NIST, USA, 2School of Engineering, Univ. of Illinois at Urbana-Champaign, USA. We experimentally demonstrated planar magnetic metamaterial fabricated using 3-D direct laser writing and silver chemical vapor deposition as well as a negative-index bi-anisotropic metamaterial metalized via silver shadow evaporation. Calculations and experiments show good agreement.

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**JWE4 • 6:00 p.m. **
Coherent Optical and Acoustic Phonons Coupled with the Charge-Ordering Phase Transition in La$_{1-x}$Pr$_{x}$Ca$_{3/8}$MnO$_{3}$, Kyung-In Jung1, Jiyoung Lim1, Yoonghee Kim2, Ke-Min Kwon3, Jai Seok Ahn1, Jang-Ho Park1, K. Tripathy1, Guishu Xu1, Xiaodong Ma1, Yajie J. Ding1, Muhammad Jamal2, Ronald A. Arijfs3, Nelson Tansu4, Jacob B. Khurgin1; 1Lehigh Univ., USA, 2Univ. of Illinois at Urbana-Champaign, USA, 3Inst. für Theoretische Physik, Heinrich-Heine-Univ., Düsseldorf, Germany, 4Inst. für Angewandte Physik and Ctr. for Electronenmikroskopie and Ctr. for Functional Nanostructures, Univ. Karlsruhe (TH), Germany. We present a planar magnetic metamaterial fabricated using 3-D direct laser writing and silver chemical vapor deposition as well as a negative-index bi-anisotropic metamaterial metalized via silver shadow evaporation. Calculations and experiments show good agreement.

---

**IWD • Photon-Lattice Interactions**
Jacob B. Khurgin; Johns Hopkins Univ., USA, Presider

**IWD1 • 4:45 p.m. **
Ultrafast Optical Measurements of Coherent Acoustic Phonon Attenuation in Silicon, Brian C. Dal1, Kunyang Kang1, David G. Cahill2, 1Vassar College, USA, 2Univ. of Illinois at Urbana-Champaign, USA. We report measurements of the attenuation of ~100 GHz coherent acoustic phonons in silicon and results are compared with existing theory. The results have implications for nanoscale thermal transport models and novel acoustic imaging schemes.

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**IWD2 • 5:00 p.m. **
Mechanism of the Multiple Raman Sidebands Generation in Diamond Pumped by Two Femtosecond Pulses, Etsihi Matsubara1,2, Kenetsu Fukuyma1, Taro Sekikawa1,2, Mikio Yamashita1,2; 1Hokkaido Univ., Japan, 2CREST, Japan Science and Technology Agency, Japan. Detailed angle resolved spectroscopy reveals that intense multiple Raman-Nath like CARS signals (350-720 nm) are generated in diamond under pumping of two-photon Raman peaks by two-color femtosecond pulses.

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**IWD3 • 5:15 p.m. **
Observation of Anti-Stokes Fluorescence from GaN Film Grown on Si (111) Substrate, Suvranta Gangopadhyay1,2, 1Vassar College, USA, 2School of Engineering, Univ. of Illinois at Urbana-Champaign, USA. We experimentally demonstrated planar lenses based on nanoscale slit arrays in a metallic film. Electromagnetic simulations of lens designs and confocal measurements on manufactured structures show excellent agreement, but deviate from simple theory.

---

**IWD4 • 5:30 p.m. **
Coherent Optical and Acoustic Phonons Coupled with the Charge-Ordering Phase Transition in La$_{1-x}$Pr$_{x}$Ca$_{3/8}$MnO$_{3}$, Kyung-In Jung1, Jiyoung Lim1, Yoonghee Kim2, Ke-Min Kwon3, Jai Seok Ahn1, Jang-Ho Park1, K. Tripathy1, Guishu Xu1, Xiaodong Ma1, Yajie J. Ding1, Muhammad Jamal2, Ronald A. Arijfs3, Nelson Tansu4, Jacob B. Khurgin1; 1Lehigh Univ., USA, 2Univ. of Illinois at Urbana-Champaign, USA, 3Inst. für Theoretische Physik, Heinrich-Heine-Univ., Düsseldorf, Germany, 4Inst. für Angewandte Physik and Ctr. for Electronenmikroskopie and Ctr. for Functional Nanostructures, Univ. Karlsruhe (TH), Germany. We present a planar magnetic metamaterial fabricated using 3-D direct laser writing and silver chemical vapor deposition as well as a negative-index bi-anisotropic metamaterial metalized via silver shadow evaporation. Calculations and experiments show good agreement.
Wednesday, June 3

IWE1 • 4:45 p.m. Tutorial
Cavity Optomechanics, Kerry Vahala: Caltech, USA. Cavity enhancement of optical fields is providing a new way to couple light and mechanical motion. Its application to mechanical cooling and amplification, example implementations, and prospects for new science and technology are reviewed.

Kerry Vahala is the Ted and Ginger Jenkins Professor of Information Science and Technology and Professor of Applied Physics at Caltech. His research on micro-cavities has led to wafer-based devices operating in the Q regime above 100 million, enabling micro-scale Raman and Parametric sources as well as cavity QED on-a-chip systems. His current research is focused on cavity optomechanical phenomena associated with radiation pressure in microcavities. Vahala has received the IEEE Sarnoff Award for his work on quantum-well laser dynamics, was the first recipient of the Richard P. Feynman Hughes Fellowship and has also received an Alexander Von Humboldt Research Award. He is a Fellow of The Optical Society, was program co-chair for CLEO 99, General Chair for CLEO 2001 and has also served as associate editor on several journals.

CWH1 • 4:45 p.m.
Thulium Fiber Laser 4-Pass End-Pumped High Efficiency 2.09-μm Ho:YAG Laser, Xiaodong Mo, Helmuth E. Metaxas, Hsiu-Chuan Lee; Orsa Optics, Inc., USA. Slope efficiency as high as 80% has been achieved in Tm-fiber laser end-pumped adhesive free bonded (AFB) YAG/Ho:YAG/YAG laser composite. 18.7-W output power at 2.09 μm has been achieved at pump power of 24.3 W.

CWI1 • 4:45 p.m. Invited
Optical Interferometers with Reduced Sensitivity to Thermal Noise, H. Jeff Kimble1, Benjamin L. Lev2, Jun Ye3; 1Caltech, USA, 2Univ. of Illinois, USA, 3Univ. of Colorado, USA. Thermal phase noise in optical interferometry can be compensated by exploiting coherence for underlying stochastic displacements and strains. The phase upon reflection from a fluctuating mirror’s surface can thereby have reduced sensitivity to thermal noise.

CWH2 • 5:00 p.m.
Q-Switched Tm3+:YAG Rod Laser with Crystal-line Fiber Geometry, Marc Eichhorn, Christelle Kiedek, Antoine Hirdh; French-German Res. Inst. of Saint-Louis, France. We present experimental results on TIR-pumped Q-switched Tm3+:YAG lasers pumped at 804 nm. Up to 5.6 mJ pulse energy is achieved (25.9 kW peak power at 216 ns pulse width).

CWI2 • 5:15 p.m.
Measurements of the Group Delay Dispersion in High Finesse Optical Cavities, T.J. Hammond, Arthur K. Mills, David J. Jones; Univ. of British Columbia, Canada. We present a simple method for determining the group delay dispersion of a high finesse optical cavity by measuring the dependence of the cavity’s optical path length on frequency.

CWH3 • 5:15 p.m.
Efficient Fiber-Laser-Pumped Ho:YLF Oscillator and Amplifier Utilizing the Transmitted Pump Power of the Oscillator, Hencharl J. Strauss, Wayne Koen, Christopher Bolig, M. J. Daniel Eiser, Dieter Pressler, Kwanmee Nyangaza, Coba Jcobz; Council for Scientific and Industrial Res., South Africa. We present a novel scheme for a compact and robust pulsed fiber-laser-pumped Ho:YLF oscillator and amplifier system, where the pump power transmitted by the oscillator is utilized to pump the amplifier.

CWH4 • 5:30 p.m.
1.88 μm InGaAsP Pumped, Room Temperature Ho:LuAG Laser, Norman P. Barnes1, Farzin Amzerjan1, Donald J. Reiche1, George Busch1, Paul Leisher2; 1NASA Langley Res. Ctr., USA, 2InLight, USA. A room temperature, directly diode pumped Ho:LuAG laser oscillated for the first time. Direct pumping of the Ho upper laser manifold maximizes efficiency, minimizes heating, and eliminates Ho:Tm energy sharing. Design and performance are presented.

CW11 • 4:45 p.m.
Optical Interferometers with Reduced Sensitivity to Thermal Noise, H. Jeff Kimble1, Benjamin L. Lev2, Jun Ye3; 1Caltech, USA, 2Univ. of Illinois, USA, 3Univ. of Colorado, USA. Thermal phase noise in optical interferometry can be compensated by exploiting coherence for underlying stochastic displacements and strains. The phase upon reflection from a fluctuating mirror’s surface can thereby have reduced sensitivity to thermal noise.

Effect of Structural Distortion on Fabry-Perot Temperature Response, Richard W. Fox, NIST, USA. Low expansion glass cavities with optically contacted mirrors can exhibit structural distortions at the mirrors which significantly shift the temperature at which dν/dT = 0. An analytical analysis that incorporates finite element modeling is given.
Pérot interferometers. We also theoretically show that the one-photon and vacuum components. Re-construction shows large vacuum and one-photon components.

CWJ1 • 4:45 p.m.
GaS\textsubscript{2}Se\textsubscript{4} Compounds for Nonlinear Optics, Vladimir L. Punyavut\textsuperscript{1},\textsuperscript{2} Alexander I. Zagumennyi\textsuperscript{1}, Abdoullamoune F. Zerrouk\textsuperscript{1}, Frank Nauwh\textsuperscript{1}, Val- entin Petrov\textsuperscript{1} Max Born Inst., Germany; General Physics Inst. of the Russian Acad. of Sciences, Russian Federation; Zecoset Photonics Singapore Pte Ltd, Singapore. We measure the nonlinearity and transparency of mixed GaS\textsubscript{2}Se\textsubscript{4} crystals and show that GaS\textsubscript{2}Se\textsubscript{4} is a promising nonlinear material for mid-IR (>5 µm) OPO operation without two-photon absorption for a pump wavelength of 1064 nm.

CWJ2 • 5:00 p.m.
OP-GaAs OPO Pumped by a Q-switched Ti:Sapphire Fiber Laser, Christelle Kieleck\textsuperscript{1}, Marc Eichhorn\textsuperscript{1}, Antoine Hirth\textsuperscript{2}, David Faye\textsuperscript{2}, Eric Lallier\textsuperscript{2}, Stuart D. Jackson\textsuperscript{2} French-German Res. Inst. of Saint-Louis (ISI), France, 'Thales Res. and Technology, France (TRT), France; 'Optical Fiber Technology Centre, Univ. of Sydney, Australia. We report on the first OP-GaAs OPO directly pumped by a 2.09 µm fiber laser. Up to 0.6 W average output power was achieved at 20 kHz repetition rate in the mid-infrared range.

CWJ3 • 5:15 p.m.
Achromatic Double-Pass Configuration in a Single Longitudinal Mode Doubly Resonant OPO, Bertrand Hardy, Sylvain Guillard, Antoine Berrou, Myrann Raybaud, Antoine Godard, Michel Lebreton; ONERA, The French Aerospace Lab, France. We present a new, low threshold, narrow linewidth, entangled cavity scheme for nanosecond OPO. Thanks to this compact design, open loop single longitudinal mode operation is achieved over hours with 5 MHz short term stability.

CWJ4 • 5:30 p.m.
Fiber-Laser-Pumped CW OPO for Red, Green, Blue Laser Generation, Shaoting Lin, Yen-Fin Liu, Rong Yu Tu, Ting-Dong Wang, Yen-Chih Huang; Natl. Taiwan Univ, Taiwan. We report a cw-RGB laser based on an Yb-fiber laser pumped OPO with intra- and extra-cavity wavelength converters. At 25-W pump power, the laser generated 5, 0.5, and 0.05-W at 633, 532, and 450 nm, respectively.

CWJ5 • 4:45 p.m.
Peak Power Scaling towards Ultrashort Pulses at High Repetition Rates, Steffen Hadwich\textsuperscript{1}, Jan Roth- hardt\textsuperscript{2}, Tino Eulam\textsuperscript{1}, Damien N. Schimpff, Fabian Raiser\textsuperscript{1}, Jens Limpert\textsuperscript{1}, Andreas Tünnermann\textsuperscript{2}; Friedrich Schiller Univ. Jena, Germany; Fraunhofer Inst. for Applied Optics and Precision Engineering, Germany. We present two scaling concepts for fiber based system. Ultrashort pulses with high peak power are generated while maintaining the advantages of fiber laser systems such as high repetition rate and good beam quality.

CWJ6 • 5:00 p.m.
Molecular Science, Insti, Japan, Presider

CWJ1 • 4:45 p.m.
CWJ2 • 5:00 p.m.
CWJ3 • 5:15 p.m.
CWJ4 • 5:30 p.m.
CWJ5 • 4:45 p.m.
CWJ6 • 5:00 p.m.
Concurrent sessions are grouped across four pages. Please review all four pages for complete session information.

**Room 340**

**IQEC**

4:45 p.m.–6:30 p.m.  
IWG • Applications of Cold Atoms  
Alberto Marino; NIST, USA, Presider

**Room 341**

**CLEO**

4:45 p.m.–6:30 p.m.  
CWM • THz Imaging  
Takeshi Yasui; Osaka Univ., Japan, Presider

**Rooms 328-329**

**PHAST**

4:45 p.m.–6:45 p.m.  
PWB • Lasers and Optics for Astronomy and Spacebased Sensing  
Robert L. Byer; Stanford Univ., USA, Presider

**IWG1 • 4:45 p.m.**  
Accuracy of a High Sensitivity Atomic Gravimeter, Nicola Malosn, Quentin Bodart, Sebastien Merlet, Andre Clairon, Arnaud Landragin, Franck Pereira Dos Santor; Lab Natl. de Metrolgie et d’Essais—Systeme de References Temps-Espace (LNE-SYRTE), France. Systematic effects on the stability (1.4×10^-8 g at 1s) and accuracy of a compact cold atoms gravimeter at SYRTE-LNE are studied with special emphasis on the effect due to light wave aberration of the Raman Lasers.

**IWG2 • 5:00 p.m.**  
Quantum Information Processing with Double-Well Optical Lattices, Nathan Landblad, James V. Porto; NIST, USA. We demonstrate a technique to address a spatially dense field-insensitive qubit register composed of neutral atoms held in a double-well optical lattice. We robustly perform single-qubit rotation on qubits located at addressed lattice sites.

**IWG3 • 5:30 p.m.**  
Ultra-Sensitive Faraday Rotation Measurements from an Atom-Light Quantum Interface, Marco Kaschierreck, Marta Napoliatena, Brice Dubost, Morgan W. Mitchell; ICFO, Spain. High sensitive Faraday rotation measurements are performed on an ensemble of ^87Rb. The deduced interaction strength is discussed in the context of spin squeezing. We present a method for spin state tomography based on Faraday rotations.

**CWM1 • 4:45 p.m.**  
Mode Imaging and Dispersion Analysis in Terahertz Waveguides Using Terahertz Near-Field Microscopy, Oleg Mitrofanov, Thomas Tan, Paul R. Marke; Bradley Boosde, James A. Harrington; Univ. College London, UK, Rutgers Univ., USA. Mode structure, transmission loss and dispersion are characterized in low-loss (~1dB/m) Terahertz (THz) dielectric-lined hollow-metallic waveguides. THz near-field probe imaging and spectroscopy is applied for precise mode imaging and selective mode probing.

**CWM2 • 5:00 p.m.**  
THz Subwavelength-Fiber-Based Near-Field Microscope, Hung-Wen Chen, Chui-Min Chiu, Yu-Ru Huang, Chun-Chiu Kuo, Yuh-Jing Huang, Wen-Jeng Lee, Chi-Kuang Sun; Graduate Inst. of Photonics and Optoelectronics, Natl. Taiwan Univ., Taiwan, Academia Sinica, Taiwan, Natl. Taiwan Univ. Hospital, Taiwan, Dept. of Electrical Engineering and Graduate Inst. of Photonics and Optoelectronics, Natl. Taiwan Univ, and Res. Ctr. for Applied Sciences, Academia Sinica, Taiwan. We successfully established a compact all-THz fiber-scanning near-field microscope operating at room-temperature. This upright transmission-illumination microscope was applied for diagnosis of breast tumor biopsy samples with ~100% specificity and ~100% sensitivity.

**CWM3 • 5:15 p.m.**  
New Approach for an Electro-Optic THz-Detector Array Using Photonic Mixing Device Camera, Gunnar Spickermann, Peter Haring Bolivar; Siegen Univ., Germany. We present a new 2-D electrooptical THz detector using a photonic mixing device (PMD) camera. This combination increases sensitivity drastically, enabling the use of non amplified fs laser sources for high resolution real-time THz imaging.

**CWM4 • 5:30 p.m.**  
Time-Reversal and Model-Based Imaging in a THz Waveguide, Malakeh A. Musheinesh, Charles J. Dixon, Jeffrey A. Fessler, Theodore B. Norris; Univ. of Michigan, USA. A substantial improvement in the reconstruction of time-reversed THz fields is demonstrated by adapting a waveguide technique from ultrasound imaging. Furthermore, a model based reconstruction method is considered as an alternative to time-reversal THz imaging.

**PWB1 • 4:45 p.m.**  
The Decadal Survey, Berrien Moore; Climate Central, USA. Two years ago, the National Research Council released a Decadal Survey that laid out recommendations for the next ten years of observing Earth from space. This paper discusses that report and the government’s subsequent actions.

**PWB2 • 5:15 p.m.**  
Lasers and Electro-Optics for Ground-Based Astronomy, Richard Dekany; Caltech, USA. To expand their science reach, terrestrial observatories have long demanded innovative optical technologies. Today, photonics enabling the active control, compensation, and detection of astronomical light are once again opening new vistas on our Universe.

**IWG4 • 5:30 p.m.**  
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Lasers and Electro-Optics for Ground-Based Astronomy, Richard Dekany; Caltech, USA. To expand their science reach, terrestrial observatories have long demanded innovative optical technologies. Today, photonics enabling the active control, compensation, and detection of astronomical light are once again opening new vistas on our Universe.
**JWD • Novel Light Sources II—Continued**

- JWD4 • 5:45 p.m.
  Coherent Betatron Radiation from Laser-Wakefield Accelerated Bundles of Monoelectronic Electrons, Stuart P. D. Mangles1, Stefan Knap1, Christopher McGregor1, Stephan S. Balunov1, Vladimir Chklovskii2, Franklin Dallner3, Y. Horvath1, C. Huntington1, Galina Kalintchenko1, Anatoliy Maksimchuk1, Takeshi Matsuoka1, Charlotte Palmer1, Kim Ta Phuc1, Pascal Roussaux1, Victor Yenovsky1, Karl Krushelnick1, Zulfikar Najmudin1, 1Imperial College London, UK, 2Univ. of Michigan, USA, 3Lab d’Optique Applique, France. X-rays generated by 0.1-0.5 GeV electron beams generated using a 100 TW laser are shown to have a low emittance, be spatially coherent and have a peak brightness comparable to 3rd generation synchrotron sources.

- JWD5 • 6:00 p.m.
  Generation of a 1 Picosecond Soft X-Ray Laser Pulses from an Injection-Seeded Plasma Amplitude, Yong Wang1, Mark Perrilli1, Francesco Pedaci1, M. M. Shklyev1, S. Gilbertson1, Zengyu Chang2, E. Granados1, Brad Luther1, M. A. Laronson1, Dave Alex1, Jorge Roquera1, Colorado State Univ., USA, 2Kansas State Univ., USA. Phase-coherent 1.3±0.5 ps soft x-ray laser(XXRL) were generated by injection-seeding a solid-target Ne-like Ti plasma amplifier with high harmonic pulses. This is the shortest pulse duration reported to date from a table-top SXRL amplifier.

- JWD6 • 6:15 p.m.
  Infrared Multimode Single-Filament Supercontinuum Generation, Oliver D. Mücke1, Aart J. Verhoef1, Andreas Paghi1, Andreas Baltuska1, Skirmantas Altukauskas1, Valerijus Smiglevicius1, Jonas Pocius1, Jonas Gintins1, Romuadas Danilevius1, Nicolas Forget1, 1Vienna Univ. of Technology, Austria, 2ViLIna Univ., Lithuania, 3Lithuanian, Lithuania.

**JWE • Nanophotonics and Metamaterials Symposium II: Advances in Plasmonics—Continued**

- JWE4 • 5:45 p.m.
  Plasma Resonance Variation from Strongly Interacting Gold Nanorods, Moussa N’Gom1, Theodore Norris1, Rolf Erni2, 1Univ. of Michigan at Ann Arbor, USA, 2Lawrence Berkeley Natl. Lab, USA. Electron-energy-loss-spectroscopy combined with spectral-imaging in a transmission-electron-microscope is used to probe-and-map the energy-distribution of the optical-frequency surface-plasmons of coupled gold nanorods. Local-field-enhancement and spectral-shift of the surface-plasmon modes is observed when two nanoparticles are electromagnetically coupled.

- JWE5 • 6:00 p.m.
  Femtosecond Surface Plasmon Interferometry with Gold Nanostructures, Vasily V. Temnov1, Keith Nelson2, Gaspur Aramesh2, Alfred Leitenstorfer1, Rudolf Bratschitsch1, 1MIT, USA, 2Inst. de Microelectricidad de Madrid, Spain, 3Dept. of Physics and Ctr. for Applied Photonics, Univ. of Konstanz, Germany. We measure ultrarapid electron dynamics in gold via ultrafast surface plasmon interferometry. A new plasmonic microinterferometer with tilted slit groove is used to unambiguously determine changes of real and imaginary parts of the dielectric function.

- JWE6 • 6:15 p.m.
  Surface Plasmon Waveguide Mode Hybridization and Lasing in Sub-wavelength Microdisks at 1.3μm, Ravir Pethia1, Thibaut F. Mayer-Alekse1, Amir Safavi-Naeini1, Oskar Painter1, Caltech, USA. Hybridization of surface plasmons and waveguide modes, in sub-wavelength surface plasmon microdisks with a varying diameter top metal contact, is simulated and experimentally verified. Lasing is achieved in weakly hybridized optically pumped sub-wavelength disks at λ=1.3μm.

**IWD • Photon-Lattice Interactions—Continued**

- IWD5 • 5:45 p.m.
  Bias-Controlled Coherent Acoustic Phonon Generation in InGaAs/GaAs Multiple-Quantum Wells Light Emitting Diodes, Pre-Hsun Wang1, Yu-Chich Wei1, Shi-Hao Guo1, Hong-Cheng Lai1, Peng-Ren Cheng1, Jen-Wei Shih1, Jen-Ien Chyi1, Chih-Ming Lai1, Chi-Kuang Sun2, 1Graduate Inst. of Photonics and Optoelectronics, Natl. Taiwan Univ., Taiwan, 2Dept. of Electrical Engineering, Natl. Central Univ., Taiwan, 3Dept. of Electronic Engineering, Ming Chuan Univ., Taiwan, 4Dept. of Electrical Engineering and Graduate Inst. of Photonics and Optoelectronics, Natl. Taiwan Univ., Taiwan. We demonstrate the control of coherent acoustic phonon generation by applying voltage across InGaAs/GaAs multiple-quantum-wells light emitting diodes (LEDs). The acoustic phonons oscillation can be switched off by increasing the reverse bias up to 25V.

- IWD6 • 6:00 p.m.
  Coherent Lattice Vibrations in Small Diameter Single-Walled Carbon Nanotubes, Yong-Sik Lim1, Jae-Geum Ahn1, Taeha Jo1, Jo-Hyuk Yoo1, E. H. Han1, L. G. Bouthoor2, J. Konot3, 1Dept. of Applied Physics, Konkuk Univ., Republic of Korea, 2Inst. of Chemistry, Pohang Univ. of Science and Technology, Republic of Korea, 3Dept. of Physics, Chungnam Natl. Univ., Republic of Korea. We report on coherent phonon oscillations of non-resonantly excited RBMs at the excitation as high as 500 meV above the E(2) transition level for (6,5) and (7,3) tubes in isolated Co-Mo-CAT SWNTs.
We demonstrate experimentally for the first time the possibility of controlling the propagation properties of a light pulse using cavity assisted radiation pressure coupling to mechanical modes. Both pulse delay and advancement are observed.

With the advent of miniaturized microresonator devices, we show evidence of strong coupling between pressure optomechanical modes of the resonator and the propagation of a light pulse. We observe a shift in the frequency of the mechanical resonance. This shift is observed over a wide range of driving forces. In addition, we observe an enhancement of the mechanical response to the driving force when the light pulse is present. This enhancement is observed for a range of driving forces and is more pronounced for larger driving forces. We explain this behavior by considering the feedback between the light and the mechanical modes.

We use a fiber-based semi-conductor optically pumped Q-switched Ho:YLF laser to perform this experiment. The laser has a repetition rate of 1.25kHz. The pulse duration and width of single longitudinal mode pulse are 5.5mJ and 50ns, respectively. The energy and width of single longitudinal mode pulse are 5.5mJ and 50ns, respectively. The repetition rate is 1.25kHz.

We measure the direction of a TEM00 Gaussian beam reflected from an air-glass interface. We report experimental evidence of observing angular deviations in specular reflection using optical comb sources and a high-resolution optical filtering. This technique uses a single laser and phase modulation - alleviating requirements on laser frequency stabilization and modulator bias control.

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entanglement can lead to sub-Rayleigh resolution in optics. The proposal that quantum entanglement can lead to sub-Rayleigh resolution in optics has received much attention lately. Here we present an experiment in which three entangled photons are used to demonstrate spatial super-resolution.

Observation of Nontrivial 3-Photon Correlation of Chaotic Thermal Light, Yu Zhou, Juanwei Liu, Yanhua Shih; Dept. of Physics, Univ. of Maryland, Baltimore County, USA. The reported experiment observed a nontrivial third-order temporal correlation (“three-photon bunching” effect) of chaotic-thermal light in the joint-detection of three individual photodetectors. In the view of quantum mechanics, “three-photon bunching” is a three-photon interference effect.

Generation of High Energy Sub-20-fs Pulses Tunable in the 250nm-310nm Region by Frequency Doubling of a High-Power Non-Collinear OPA, Marcus Beutler, Masoud Ghotbi, Frank Noack, Daniel Bride, Cristian Manzoni, Giulio Cerullo; 1Max-Born-Inst., Germany, 2Natl. Lab for Ultrashort and Ultraintense Optical Science, Inst. for Photonics and Nanotechnologies, Italian Natl. Res. Council, Italy. We report the generation of tunable DUV pulses with pulse durations below 20fs at 10µJ energy level. The pulses are generated by frequency doubling of a high-power non-collinear OPA and compressed to almost transform-limited duration.

High Repetition Rate Optical Parametric Amplitude Multiplication Based on a Single Yb: Fiber Laser, Yan-Wt Tzeng, Chen-Han Huang, Yen-Yin Lin, Jian-Ming Liu, Hsiang-Chen Chui, Hsiang-Lin Liu, James M. Stone, Jonathan C. Knight, Shi-Wt Chui; Dept. of Physics, Natl. Taiwan Univ., Taiwan, Inst. of Photonics and Nanotechnologies, Dept. of Electrical Engineering, Natl. Tsing-Hua Univ., Taiwan, Inst. Electro-Optical Science and Engineering, Natl. Cheng Kung Univ., Taiwan, Dept. of Physics, Natl. Taiwan Normal Univ., Taiwan, Ctr. for Photonics and Photonic Materials, Univ. of Bath, UK. 700-1900 nm tunable single-pass optical-parametric-amplification was demonstrated. The pump was a frequency-doubled Yb-laser, and the residual Yb-laser was recycled to generate supercontinuum as seeding. Over 30% conversion efficiency was obtained with 10-nJ pump energy.
Concurrent sessions are grouped across four pages. Please review all four pages for complete session information.

**Room 340**

**CWM** • THz Imaging—Continued

**IWG** • Applications of Cold Atoms—Continued

IWG4 • 5:45 p.m.
A Single Mode Optical Wavesguide for Matter Waves, Kenneth G. H. Baldwin, Sean S. Hodgman, Robert G. Dall, Mattias T. Johnson, Andrew G. Truscott; Australian Natl. Univ., Australia. We demonstrate single mode guiding of metastable helium atoms from a BEC confined in a far detuned optical potential. Multimode guiding is also shown and results in the creation of a matter wave speckle pattern.

IWG5 • 6:00 p.m.
Atom “Meta-Optics”: Negative-Index Media for Matter Waves in the nm Wavelength Range, Mehdi Hamamda, Gabriel Dutier, Mohammed Boustimi, Valja Bocvarski, Jules Grucker, Francisco Peralta, Jacques Baudon, Martial Ducloy; Lab de Physique des Lasers, Inst. Galilée, Univ. Paris, France. Meta-optics is extended to matter waves. “Co-moving” magnetic fields in Stern-Gerlach interferometers allows producing negative group velocity of atomic wave packets, resulting into a negative refraction of the matter wave and atom “meta-lenses”.

**IWG** • Tracking Quasi-Classical Chaos in Bose-Einstein Condensates, Maxence Lepers, Véronique Zehnti, Jean-Claude Garreau; Lab de Physique des Lasers, Atomes, et Molécules, Univ. des Sciences et Technologies de Lille, France. We study the dynamics of a Bose-Einstein condensate in a tilted optical lattice via the Gross-Pitaevskii equation. We track this behavior by using an easily measurable quantity, the condensate mean position.

**IWG** • Efficient Distributed Self-Mixing in Silicon CMOS Transistors, Abydas Lisanska1, Diana Gnaal1, Hartmut G. Steigl1, Erik Ojefer; Goethe-Univ. Germany, “Uni. of Wuppertal, Germany. A 645-GHz focal-plane array fabricated in a 0.25-μm CMOS process achieves a responsivity of up to 80 kV/W and a NEP of 300 pW/pHz. The mixing mechanism is analyzed. Heterodyne detection is also demonstrated.

**IWG** • Atom “Meta-Optics”: Negative-Index Media for Matter Waves in the nm Wavelength Range, Mehdi Hamamda, Gabriel Dutier, Mohammed Boustimi, Valja Bocvarski, Jules Grucker, Francisco Peralta, Jacques Baudon, Martial Ducloy; Lab de Physique des Lasers, Inst. Galilée, Univ. Paris, France. Meta-optics is extended to matter waves. “Co-moving” magnetic fields in Stern-Gerlach interferometers allows producing negative group velocity of atomic wave packets, resulting into a negative refraction of the matter wave and atom “meta-lenses”.

**IWG** • Observation of Semiconductor Test Circuits with Interconnect Defects Using Laser THz Emission Microscope, Masatsugu Yamasita1, Chuko Otake2, Toru Matsumoto2, Yoshihiro Midoh1, Katsuyoshi Miura2, Koji Nakamura3, Masayoshi Tonoouchi3, Kiyoshi Nakawa3; “RIKEN, Japan, 1Hamamatsu Photonics, Japan, 2Osaka Univ., Japan, 3Nec Electronics, Japan. To evaluate the performance for non-contact testing of semiconductor circuits, we observed simple test circuits with interconnect defects using laser THz emission microscope, which detects THz wave emitted from circuits excited by focused fs laser.

**IWG** • Terahertz Imaging of Aircraft Composites, Matthew J. Bohn1, Christopher D. Stoik1, James L. Blackshire2; 1Air Force Inst. of Technology, USA, 2AFRL, USA. Damaged aircraft composites were prepared simulating voids, delaminations, punctured holes, burns and paint removal. Terahertz time domain spectroscopy in reflection configuration was assessed as a Non-Destructive Evaluation (NDE) technique and compared to traditional NDE techniques.

**IWG** • Tracking Quasi-Classical Chaos in Bose-Einstein Condensates, Maxence Lepers, Véronique Zehnti, Jean-Claude Garreau; Lab de Physique des Lasers, Atomes, et Molécules, Univ. des Sciences et Technologies de Lille, France. We study the dynamics of a Bose-Einstein condensate in a tilted optical lattice via the Gross-Pitaevskii equation. We track this behavior by using an easily measurable quantity, the condensate mean position.

**CWM** • THz Imaging—Continued

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**PWB** • Lasers and Optics for Astronomy and Spacebased Sensing—Continued

**PWB3** • 5:45 p.m.
The Coming Generation of Large Optical Telescopes, Craig Foltz; NSF, USA. Three challenging designs for astronomical telescopes with apertures of 20-30 meters range will be described. Employing adaptive optics, these telescopes will improve our light grasp and angular resolution by factors of ten and three, respectively.

**PWB4** • 6:15 p.m.
GeoEye-1, the World’s Highest Resolution Commercial Satellite, Michael Madden; GeoEye, USA. GeoEye-1 is the world’s most advanced commercial imaging satellite. This LEO satellite provides multi spectral imagery at 41 centimeter spatial resolution, from 681 kilometers in space. This talk will outline GE-1’s system specifications and performance.

**CWM** • THz Imaging—Continued

**CWM6** • 6:00 p.m.
Terahertz Imaging of Aircraft Composites, Matthew J. Bohn1, Christopher D. Stoik1, James L. Blackshire2; 1Air Force Inst. of Technology, USA, 2AFRL, USA. Damaged aircraft composites were prepared simulating voids, delaminations, punctured holes, burns and paint removal. Terahertz time domain spectroscopy in reflection configuration was assessed as a Non-Destructive Evaluation (NDE) technique and compared to traditional NDE techniques.

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