SYMPOSIUM ON UNDERGRADUATE RESEARCH

Division of Laser Science of A.P.S - LS XXXII - 18 October 2016 - Rochester, NY

PARTICIPANTS' LUNCHEON - Highland A/K - 12:00

The participants' luncheon will bring together the Symposium students and distinguished laser scientists.

Sandwich lunches will be provided for participants and invited guests only.

REMINDER: Group Photo Break 2:55 – 3:00 PM - PLEASE assemble at the designated place!!!

POSTER SESSION - Riverside Court - 12:15

Session LM2A (poster) 12:15 - 2:55 PM, Riverside Court – Chad Hoyt, Bethel Univ., Presider

LTu2J - 1 Photonic Microwave Generation Using Nonlinear Dynamics in Optically Injected Vertical- Cavity Surface-Emitting Lasers (VCSELs). *Salim Ourari, Tianyao Huang, and Hong Lin,* Physics and Astronomy, Bates College, Lewiston, ME 04240. We study VCSELs subject to orthogonal injection. Tunable microwave signals are obtained in the period one regime of single beam injection and in the double locking regime of two-beam injection. Results show that multi-transversemode VCSEL is more effective than single-mode VCSEL for microwave generation. Supported by Bates College.

LTu2J - 2 Computer-controlling a Manually-Operated Monochromator. *Jared Barker, Candace Brooks, Aric Tate, Darby Hewitt. Abilene Christian University, Abilene, TX.* We refurbished a 1960s-era, 1/3-meter monochromator by coupling its crankshaft to a stepper motor controlled by an Arduino UNO. Commands are sent to the Arduino via a USB serial connection using Python. This monochromator has been incorporated into a fully-automated experimental arrangement for the detection of optical emission spectra.

LTu2J - 3 An Active Laser Polarization Controller for Laser Cooling Experiments. *Robert W.A. Brooke, Garrett Ott, Maxwell Praniewicz, Guilherme Tomassia, andTheodore A. Corcovilos*. We present a homemade linear polarization rotator, based on a Mach-Zehnder interferometer with active feedback. The optical path length of one interferometer arm is adjusted by tilting a glass plate. The relative phase between the arms determines the output linear polarization, which is monitored and drives an Arduino feedback servo. Supported by by the Charles E. Kaufman Foundation and the Univ. of Pittsburgh

LTu2J - 4 Compact Diode Laser for Near Infrared Methane Spectroscopy, *Ottillia Ni[1], Ryan Luder[2], Brett DePaola[2], Brian Washburn[2], and Kristan Corwin[2], 1) Willamette Univ., Salem, OR, 2) Kansas State Univ., Manhattan, KS.* An external cavity diode laser is assembled at 1.6 microns wavelength. The wavelength of the laser will be tuned to resonance with the methane gas and coupled with an optical fiber to perform absorption spectroscopy and sub-Doppler spectroscopy. The construction of laser will be discussed. Supported by NSF and AFOSR.

LTu2J - 5 Optical Polarimetry for Cosmic Axion Spin Precession Experiment (CASPEr) Magnetometry: *Kimmy Cushman[1], John Blanchard[2], Lykourgos Bougas[2], Nataniel Figueroa[2], and Arne Wickenbrock[2], 1) SUNY Oneonta, Oneonta New York, 2) Johannes Gutenberg Univ. 55122 Mainz, Germany.* CASPEr searches for ultralight dark matter particles called axions using nuclear magnetic resonance techniques. Axions would couple to nuclear spins, inducing precession in a polarized sample. Here, we show techniques for polarization and measurement of polarization for the development of hyperpolarized ^{129}Xe to be used in CASPEr experiments. Supported by PRISMA Program Mainz, SUNY Oneonta research grant, Helen and Michael Casper Fellowship.

LTu2J - 6 Surface Raman Studies of Reduced Strontium Barium Niobate *Hope Whitelock[1] and JeanToulouse[2] , 1) Univ. of Connecticut, Storrs CT 06269 2)Lehigh Univ., Bethlehem PA 18105.* The vibrational spectra of $Sr_xBa_{1-x}\}Nb_2O_{(6-\delta)}$ (SBN, x = 0.61) are studied on the surface of single crystals for $\delta = 0$ (unreduced) and $\delta > 0$ (reduced) using Raman confocal microscopy. The surface spectra are compared with the bulk spectra measured using conventional Raman spectroscopy. Differences between bulk and surface measurements based on beam geometry will be discussed. Supported by NSF.

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LTu2J - 7 Optimizing Gamma-rays Detection in a Plastic Scintillator. *Sonia Cyuzuzo and Tim Head, Engineering and Physics, Abilene Christian University, Abilene, TX 79601.* Gamma-ray detection with a plastic scintillator detector was studied using a combination of bulk counting, a multichannel analyzer, and GEANT4 simulations. The objective is to increase the number and uniformity of gammas detected throughout the detector by optimizing optical photon collection.

LTu2J - 8 Dynamic Diffraction of C. elegans, *Clara Alivisatos, Miranda Hulsey-Vincent, Dr. Jenny Magnes, Vassar College, Poughkeepsie, NY.* C. elegans are widely-studied models of motion. We are recording the diffraction patterns resulting from placing a nematode in the beam of a Helium-Neon laser. Fourier transforms of the pattern's intensity changes may prove a faster, more quantitative method of motion analysis than video analysis. Supported by the Vassar College Undergraduate Research Summer Institute (URSI) , the Lucy Maynard SalmonResearch Fund, and the NSF.

LTu2J - 9 Thermoreflectance Imaging of Organic Photovoltaics. *Fernando Ayala, Jeremy Grigsby, Janice Hudgings, Physics, Pomona College., Claremont, CA.* Previously, we have shown that high-resolution thermoreflectance imaging can be used to characterize shunts and defects in conventional silicon solar cells. We extend this work to examine efficiency losses due to shunts and material defects in organic photovoltaics. Supported by NSF.

LTu2J - 10 Multistability in Torsional Cavity Optomechanics *Wyatt Wetzel, and M. Bhattacharya, Physics and Astronomy, College of Science, RIT, Rochester New York.* We consider a particle trapped on a ring by an optical lattice inside a cavity. Multistability is observed in the presence of external torque. The fixed points are governed by two of the roots of a quartic polynomial. One is unstable, and the other has stable and center manifolds. Supported by the NSF

LTu2J - 11 Constructing a Wavelength-Tunable, Two Photon Microscope to Image Green Fluorescent Protein. *Emily Miller and Michael E. Durst, Middlebury College, Middlebury, VT 05753.* We present a custom-built wavelength-tunable two-photon microscope optimized for long wavelength imaging of green fluorescent proteins (GFPs). Through the introduction of a wavelength-tunable dispersion-compensating prism pair, the microscope can now operate throughout the full wavelength range of a Ti:Sapphire laser while maintaining a chirp-free ultrashort pulse. Supported by an Institutional Development Award (IDeA) from NIH.

LTu2J - 12 Temporal Focusing with Optical Fiber Delivery, *Kirsten McNeill and Michael E. Durst, Middlebury College, Middlebury, VT 05753*. We present a temporal-focusing two-photon microscope with excitation delivered via a large-mode-area optical fiber, allowing us to separate the laser source and dispersion tuning system from the temporal focusing setup. We theoretically model and experimentally measure the pulse broadening caused by dispersion in the fiber. Supported by an Institutional Development Award (IDeA) from NIH.

LTu2J - 13 Realization of a Crossed-Beam Dipole Trap for Investigation of Spin-Dependent Forces on Rubidium BECs. *Tiago Correia and Nathan Lundblad, Bates College, Lewiston, ME 04240*. We prepare ultracold samples of rubidium-87 and transfer them to a crossed-beam dipole trap formed by a tunable Ti:Sapphire laser along one direction and a 1060 nm laser along another. We model and measure trap parameters such as lifetime and characteristic frequencies. Supported by the Sherman-Fairchild Foundation.

LTu2J - 14 Experimentally Determined Landé g-factors in Excited States of ^{20}Ne, *Theodore Kortenhof and John Brandenberger, Lawrence University, Appleton, Wi.* Using saturated absorption laser spectroscopy, Zeeman splittings in the $3p_8$, $3p_9$ and $3p_{10}$ excited states of ^{20}Ne have been measured to a precision that matches or exceeds currently accepted values. Ongoing work attempts to improve the precision of these measurements. Supported by Lawrence University.

LTu2J - 15 Möbius Polarization of Light, *Ishir Dutta, Enrique J. Galvez, Jonathan J. Zeosky, Kory Beach, Colgate University, Hamilton, NY.* We studied non-collinear superpositions of left and right circularly polarized Laguerre-Gauss beams. We confirmed the existence of Möbius strips formed by the polarization ellipse using MATLAB analysis of data and 3D printed our results. Supported by Colgate University.

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LTu2J - 16 Characterization of Frequency Stability in EIT-Based Atomic Clocks Using a Differential Detection Scheme. *Melissa Guidry[1], Elena Kuchina[2], Irina Novikova[1], and Eugeniy E. Mikhailov[1], 1) Physics, College of William & Mary, Williamsburg, VA 23187, 2)Thomas Nelson Community College, Hampton, Virginia 23666.* We investigate a recently proposed scheme for differential detection of the magneto-optic rotation effect and its application to electromagnetically-induced-transparency (EIT) atomic clocks. The suppression of laser noise can substantially improve the signal-to-noise in EIT atomic clocks. Our preliminary results demonstrate improvement in clock stability by incorporating the differential detection scheme.

LTu2J - 17 Design of Homemade, Portable, and Inexpensive Environmental Sensors, *Gage Tiber, Samuel Lehr, Aria Parangi, Louis Sollon, Partha Basu, Michael Van Stipdonk, Theodore Corcovilos, Duquesne University, PA.* Cost efficient and easy to use environmental sensors are in high demand. We present a fluorometric lead detector targeting drinking water and a gamma ray spectrometer for identification of radioactive elements in surface water. Supported by the Charles H. Leach II fund, the Dept. of Defense, and Innovation Works.

LTu2J - 18 Plasmonic Tweezing with Silver Nano-pillars, *Preston Huft and Nathan Lindquist, Bethel University, St. Paul, MN 55112.* We demonstrate plasmonic nano-tweezing on isolated silver nano-pillars with a 660 nm laser. The strong optical resonances of the nano-pillars allow efficient trapping of 200 nm fluorescent polystyrene beads, overcoming their Brownian motion. We fabricated the nano-pillars using a homemade electron beam lithography system and thermal deposition of silver. Supported by NSF.

LTu2J - 19 Terahertz Pulse Generation from a 200 kHz Femtosecond Laser, *Jonathan Nesper, Steven Solis, Aitor Sanjuan, John Beetar, Shima Gholam-Mirzaei, Michael Chini, Physics, Univ. of Central Florida, Orlando, FL.* We designed a setup for THz pulse generation from a high repetition rate femtosecond laser system, using LiNbO3 crystal and pulse front tilt technique. 1030nm, 280 fs pulses from a 20 W Yb:KGW amplifier are used to generate THz radiation in LiNbO3 at repetition rates ranging from 50-200 kHz. Supported by the UCF Office of Undergraduate Research.

LTu2J - 20 Examining the Structure of Marine Shell Organisms Using Polarized Light. *Anthony D'Addario, Rebecca Metzler, Enrique Galvez, and Joshua Jones, Colgate University, Hamilton, NY, 13346.* We studied the polarization speckle of light passing through sections of Nacre in shells of marine organisms. Nacre is composed of aragonite tablets and organics arranged in a "brick and mortar" structure. The two shells used, Pinctada fucata and Haliotis asinina, a bivalve and gastropod respectively, produced strikingly different results. Supported by Picker Interdisciplinary Institute of Colgate University.

LTu2J - 21 Optimization of a Novel Pulsed Molecular-Beam Valve *Gayle Geschwind[1], Yomay Shyur[2], and Heather Lewandowsky[2], 1)Physics and Astronomy, Stony Brook Univ., Stony Brook, NY, 11794-3800, 2) JILA and Physics, Univ. of Colorado, Boulder, Colorado 80309.* Many molecular beam experiments' first step is to allow gas flow from a reservoir into a vacuum chamber via a tiny hole. Currently, a piezoelectric crystal is utilized for the valve. The Nijmegen Pulsed Valve allows for shorter and more intense pulses of molecules to pass, improving molecular beam quality. Supported by NSF

LTu2J - 22 Measuring Rotation Rates of Absorbing Graphite Flakes in Laguerre-Gauss Modes *Lucas Tracy, Matthew Cattani, and Catherine Herne, S.U.N.Y. New Paltz, New Paltz, NY, 12561* This work demonstrates a novel technique for trapping and rotation of absorbing materials. We show rotation in Laguerre-Gauss modes by combining absorbing and transparent materials, and describe the implementation of a quadrant photodiode for accurate position and rotation measurements. We apply this to characterizing rotation frequency *vs.* Laguerre-Gauss mode index. Supported by the SUNY Research Found.

LTu2J - 23 Metasurface-based Spin-selective Optical Cavity *Michael Kopreski[1], Alan Zhan[2], Shane Colburn[3], and Arka Majumdar[2],* 1*) Physics, College of William & Mary, Williamsburg, VA 23185, 2) Physics, Univ. of Washington, Seattle, WA 98195, 3) Electrical Engineering, Univ. of Washington, Seattle, WA 98195,* We seek a low-contrast metasurface-based optical cavity that breaks degeneracy between left and right circularly polarized light. Using birefringent materials, we propose a novel cavity design and develop formalism to determine left- and right-handed polarization eigenmodes. We discuss our methodology for designing silicon nitride metasurface-based birefringent optics. Supported by NSF.

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LTu2J - 24 The Use of Supercontinuum Light in Fluorescence Lifetime Measurements. *Christopher Ayala, and Robert Pansu, 1) Physics, Stony Brook Univ. Stony Brook NY 11794 2) École Normale Supérieure de Cachan, Cachan, France.* Our goal is to create a Fluorescence Lifetime Imaging system under a microscope with selected wavelengths (<400nm) from a supercontinuum laser. This unique system allows us to set limits on jitter and walk in the timing of the pulse and examine key characteristics of different samples. We will discuss construction of the system. Supported by NSF

LTu2J - 25 An Enantiomer-specific Discriminatory Force on Chiral Molecules from a Polarization Helicity Gradient *J.C. Painter,[1] E.J. Galvez,[1] J.A. Jones[1] Physics and Astronomy, Colgate University, Hamilton, NY 13346.* A force that acts on chiral molecules due to a polarization helicity gradient of light has been theorized. This force acts in opposite directions for opposite-handed chiralities. We report recent attempts to observe and quantify this force using a beam with an adjustable helicity gradient.

LTu2J - 26 Creation, Confirmation, and Characterization of Monolayer WSe_2. *Chloe Lindeman[1], Eric Martin[2], Robert Dalka[2], and Steven Cundiff[2], 1) Haverford College, Haverford, PA 19041, 2) Univ. of Michigan, Ann Arbor, MI 48109.* Transition metal dichalcogenides such as WSe_2 exhibit unusual electronic properties including a transition from indirect to direct band gap for monolayer material. We present a procedure for the creation of monolayer WSe_2 flakes ~10um in diameter. Results were confirmed using photoluminescence spectroscopy. The sample was characterized using multidimensional coherent spectroscopy. Supported by NSF.

LTu2J - 27 Electronics Use in Laser Control *Gavriel Kleinwaks, Marek Haruza, Maitreyi Jayaseelan, Justin T. Schultz, Joseph D. Murphree, and Nicholas P. Bigelow, University of Rochester, Rochester NY 14627.* We built a feed-forward circuit to increase the tunable range of a diode laser and a shutter circuit to selectively block a laser beam. The circuits allow greater control of the frequencies and pulse durations of lasers used in cooling and trapping atoms and molecules. Supported by NSF.

LTu2J - 28 Optimization of an Ultrashort Pulse Prism Compressor for Plasmon Dephasing Experiments. *Ares Aguilera, Yaroslav V. Aulin, Stefan Piontek, Eric Borguet Temple Univ.: College of Science and Technology, Philadelphia PA 19121*. Plasmon dephasing occurs on tens of femtoseconds. Ultrafast lasers could be employed to study such phenomena. In order to compress the pulses produced by a Ti:sapphire laser (40 nm bandwidth) to their transform limit (~24 fs), we built a prism pair compressor. An autocorrelator was used to characterize the pulses.

LTu2J - 29 Single Molecule Isomerization. *Mayukh Banik, Kate Rodriguez, Nick Tallarida, Wills Harris and Vartkess A. Apkarian, Center for Chemistry at the Space-Time Limit, Univ. California at Irvine, Irvine, CA 92697.* Two ~100 nm gold spheres separated by a ~ 1 nm gap dramatically confine and enhance incident radiation. With only one molecule in the blistering junction we see "flickering" between multiple isomeric states. Moreover, this molecule occasionally gets electrified, indicated by a characteristic metal-molecule conduction signature in its Raman response. Supported by NSF

LTu2J - 30 Direct Spectral Imaging of Plasmonic Nanohole Arrays for Real-time Sensing *Spencer T Seiler, Isabel S Rich, and Nathan C Lindquist, Physics, Bethel University, St Paul, MN 55112.* Plasmonic nano-structures have created a new generation of optical sensors. Eliminating bulky spectrometers, we present a simplified optical system that positions the nanoholes directly onto a CMOS imager chip. With LED illumination, transmitted light diffracts from the nanoholes as a full spectrum, offering low-cost, real-time sensing of liquids and gases. Supported by the Minnesota Space Grant Consortium (MnSGC), part of the NASA Space Grant Program.

LTu2J - 31 Liquid Crystals and Q-Plates, *Ben Cvarch, Dr. Enrique Galvez, Joshua Jones, Colgate University, Hamilton, NY.* Techniques to fill cells with liquid crystal were investigated while the cell's resulting fullness was inspected utilizing aspects of liquid crystals' electric field dependent birefringence. Then the polarization singularities characteristic of higher order optical beams created by liquid crystal q-plates were simulated, produced, and mapped. Results will be discussed. Supported by Colgate University's NASC Division.

LTu2J - 32 Linewidth Reduction of a Vertical Cavity Surface Emitting Laser (VCSEL) Using Optical Feedback. *Eddie Chang[1], Zachary Newman[2], and John Kitching[2], 1) Univ. of Maryland, College Park, MD 20742, 2) National Institute of Standards and Technology, Boulder, CO 80305.* We explore an external cavity using an uncoated glass wedge to introduce optical feedback to an 852 nm VCSEL and reduce the laser linewidth. Free running VCSELs exhibit linewidths of tens of MHz. Linewidths of < 1 MHz may be useful for laser cooling and chip-scale wavelength and frequency standards.

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LTu2J - 33 Towards the Implementation of a Picometer-Resolution Digital Wavelength Meter *Timothy Ireland, Jake Klein, Isaac Davies and Theodore Corcovilos, Duquesne University, Pittsburgh PA 15219.* We present preliminary results on a digital high-resolution Michelson wavelength meter, updated from an existing design. Fringe counting is done by microprocessors and discrete logic. Cat's eye retroreflectors replace corner-cubes for easier alignment. A temperature stabilized HeNe laser provides the reference wavelength. Funding by the Charles E. Kaufman Foundation.

LTu2J - 34 Affordable Infrared Viewers from Raspberry *Preston Ross, Andrew Hatchel, Ethan Clements, Eli Shlonsky, Alex Reigle, Samir Bali Physics, Miami University, Oxford, OH 45056* Using common equipment for the Raspberry Pi, we have developed a working infrared viewer capable of capturing images and working on a rechargeable battery. Software is open source and equipment totals at a cost of near $200, making this a much cheaper solution to viewing infrared.

LTu2J - 35 Development of a Simple Optimization Algorithm for Use in Atomic Physics Experiments. *T. Pena and M.J. Wright, Adelphi Univ., Garden City, NY 11530.* We are developing optimization algorithms to coherently control atomic excitation and/or ultracold atomic collisions with a frequency modulated laser. A simple genetic algorithm was used to optimize the results of numerical calculations of atomic excitation with the optical Bloch equation and the output of a passive band pass filter.

LTu2J - 36 Broad-Spectrum Measurement of Retardation – *Grant Richmond[1], Jessica Kurlander[1], Xiang Hua[1], Martin G. Cohen[1], and Sean Bentley[2], 1) Stony Brook Univ. Stony Brook, NY 11794. 2) Adelphi Univ., Garden City, NY 11530.* We exploited a robust, rapid, and accurate technique to measure the retardance of a wave plate versus wavelength across a broad spectrum. This method builds on a previous technique of Wang (Chin. Opt. Lett. 13, 012601 (2015)), and includes a reliable way to measure plate thickness and order. Supported by the Simons Foundation.

LTu2J - 37 Simulation of Ca+ Coulomb Crystal. *Jack Lichtman, Winthrop Smith, James Wells Physics, Univ. of Connecticut, Storrs, CT 06269-3046.* Simulation of a Paul trap with dual laser cooling used to examine interaction of Ca+ ions as they form Coulomb crystals. The principles of the simulation and the future work they will be compared to will be discussed in this talk. Supported by the NSF.

LTu2J - 38 Diffusion Induced Δn Amplification in Holographic Photopolymers, *Madeline B. Chosy[1], David J. Glugla[2], Amy C. Sullivan[2], Robert R. McLeod[2], 1) Carleton College, Northfield, MN 55057, 2)Univ. of Colorado, Boulder, CO 80309.* . Holographic photopolymers are limited in the index contrast they can achieve. Most academic results are limited to ~0.005 while commercial formulations achieve ~0.05. My research focused on using multiple exposures to amplify index contrast by a factor of 3, providing an alternative route to high contrast optical devices. Supported by NSF.

LTu2J - 39 Diffraction by Cylinders Offset Parallel to Laser Beam Propagation. *Alexander Gifford[1], Angela Pizzuto[1], Martin G. Cohen[1], and Sean Bentley[2], 1) Physics, Stony Brook Univ., Stony Brook NY 11794, 2) Physics, Adelphi Univ. Garden City NY 11530..* We measured far-field diffraction from two thin, parallel cylinders in a plane perpendicular to a laser beam, and also with one cylinder displaced along the beam path. Unique qualitative and quantitative signatures were identified, and are in excellent agreement with theory. We made experimental and analytical comparisons to the Babinet-equivalent, a tilted double slit. Supported by the Simons Foundation.

LTu2J - 40 Developing Multimode Excitation and Imaging Techniques for Photoluminescence Measurements, *Adnan Khan and Mohammad Hafezi, Univ. of Maryland, College Park, MD.* We are building a confocal microscope to perform photoluminescence measurements of 2D Dirac materials. In the first stage of our experiment, we use a Digital Micromirror Device to create multi-mode excitation configurations. We will present this work along with detection techniques for multi-mode imaging of the photoluminescence. Supported by AFOSR-MURI.

LTu2J - 41 Generation and Conversion of Transverse Gaussian Laser Modes. *Max Stanley[1], Jay Rutledge[1], Marcus Lo[1], John Noé[1], Martin G. Cohen[1],and Sean Bentley[2], 1) Physics, Stony Brook Univ., Stony Brook NY 11794, 2) Physics, Adelphi Univ. Garden City NY 11530.* We built a two-stage Mach-Zehnder interferometer to study the intensity and phase structure of Laguerre-Gauss (LG) and sinusoidal Laguerre-Gauss modes to ninth order. The latter are interesting for gravity wave astronomy. LG modes are made by transforming Hermite-Gauss modes from an open-cavity HeNe laser and form complete alternative basis sets . Supported by the Simons Foundation.

Group Photo Break 2:55 – 3:00 PM - - - PLEASE assemble at the designated place !!!

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Session LM3B: 3:00 - 4:30 PM, Highland A/K -Janice Hudgings, Pomona College, Presider

LTu3E - 1 Realizing Single Qubit Gates by Manipulating a Bose-Einstein Condensate with Raman Processes. *Ziyue Wang[1], Joseph D. Murphree[1 3], Maitreyi Jayaseelan[1 3], Justin T. Schultz[2 3] and Nicholas P. Bigelow[1 2 3] 1) Physics and Astronomy, Univ. Rochester, Rochester, NY 14627, 2) Institute of Optics, Univ. Rochester, Rochester, NY 14627, 3)Center for Coherence and Quantum Optics, Univ. Rochester, Rochester, NY 14627.* We simulate single qubit gates by manipulating a Bose-Einstein condensate using diabatic, two-photon Raman processes corresponding to rotations on the Bloch sphere. We decompose each gate into separate rotations determined by properties of the optical beams. We set up a new timing system for computer control of this experiment. Supported by Univ. Rochester Discover Grant program.

LTu3E - 2 Modeling and Experimental Demonstration of High-Speed, High-Resolution Thermal Imaging. *Kyle Allison, Mark Hallman, and Janice Hudgings, Pomona College, Claremont, CA 91711.* High-resolution thermoreflectance imaging conventionally relies on a relatively slow signal processing algorithm using a modified four-point discrete Fourier transform. We have developed a method that increases the speed of this imaging technique; we present both theoretical modeling and experimental demonstration of an order of magnitude enhancement in imaging speed. Supported by Pomona College.

LTu3E - 3 Radial Measurements of Tapered Optical Nanofibers by Interference of Higher Order Modes. *Eliot F. Fenton[1,2], Freja Pedersen[2], Jürgen Appel[2], and Eugene Polzik[2] 1) Joint Quantum Inst., Univ. Maryland, College Park, MD 20742, 2) Niels Bohr Institute, Univ. of Copenhagen, Copenhagen, Denmark 2100.* Tapered optical nanofibers (TOFs) are becoming an increasingly valuable tool for applications ranging from microscopic detection to nonlinear optics. Following recent work by F. Fatemi (ARL), we measure the radial profile of a TOF by the beat length between propagating higher-order modes picked up by an evanescently coupled probe microfiber. Supported by PFC@JQI and European Research Council.

LTu3E - 4 Using Nonlinear Light-Matter Interaction to Probe Electronic Symmetries in Strongly Correlated Materials. *Jason Tran and Darius Torchinsky, Physics, Temple Univ., Philadelphia, PA 19122.* Characterizing the symmetries and interactions between lattice ions, electron charge, and spins is essential to understanding emergence in strongly correlated materials. We will describe how our nonlinear optical device can selectively examine symmetries of the respective individual degrees of freedom and discuss its application to understanding their interactions.

LTu3E - 5 Video of Double Slit Interference With Single Photons, *Maxwell Werner, Ben Kaiser, Andrew Norlander, Anna Slattery, and Chad Hoyt, Bethel Univ., St. Paul, MN* 55112. Single photons, generated in a nonlinear optical process, were directed at a double slit and into a cooled CCD array specified for single photon sensitivity. A video was created from the captured images, with tens of photons per frame. This revealed a diffraction pattern caused by single photon interference.
Supported by NSF.

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Division of Laser Science of A.P.S - LS XXVIII - 15 October 2012 - Rochester, NY

Session LM4B: 4:45 – 6:00 PM, Highland A/K – Catherine Herne, S.U.N.Y. New Paltz,, Presider

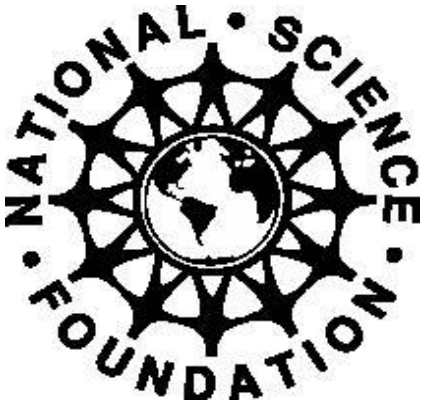
LTu5E - 1 Pump-Probe Spectroscopy in Near-Detuned Lattices *Ethan Clements, Anthony Rapp, Preston Ross, and Samir Bali, Physics, Miami Univ., Oxford, OH 45056.* The cold atom lab at Miami University has measured a 3D near-detuned lattice using pump-probe spectroscopy, and compared data to that from diffusion imaging. Vibrational, Rayleigh, and Brillouin resonances have all been observed and compared by polarization and probe angle, and suggest an interference between lattice and probe beams.

LTu5E - 2 Investigation of Structured Beam Propagation through Atmospheric Turbulence *Brian Kantor, Carlton Drew, Ziyi Zhu and Zhimin Shi, Physics, Univ. of South Florida, Tampa FL, 33620.* We study both numerically and experimentally the propagation of various types of structured beams through turbulent atmosphere. We emphasize on how the information contained in various degrees of freedom of the structured beams are affected upon propagation. Our study can offer new insights for imaging and free space communication. Supported by NSF.

LTu5E - 3 Endothelium Curvature Removal: Human and Mouse OCT Image Processing. *Johana G. C. Escudero [1], Patrice Tankam [1] , Zhiguo He [2] , Gilles Thuret [2] , Cristina Canavesi [3] , Thierry Lepine [2] , Holly Hindman [1] , Philippe Gain [2], and Jannick P. Rolland [1,3] . 1) University of Rochester, Rochester, NY 14627, 2) Jean Monnet University, Saint Etienne, France, 3) LighTopTech Corp., West Henrietta, New York 14586.* Gabor domain optical coherence microscopy yields high-definition volumetric images of human tissue. An algorithm is presented to remove the curvature in the volumetric dataset to reconstruct a full endothelium surface in a single frame. Results show a flattened endothelium surface that enables accurate endothelial cell-counting over a wide field-of-view. Supported by LighTopTech Corp., CEIS, and the NYSTAR Foundation.

LTu5E - 4 Linear and Nonlinear Properties of Pancharatnam's Phase, *Hyrum Richardson[1], Sean Nomoto[2], Reeta Vyas[2] and Surendra Singh[2], 1) Physics Department, Brigham Young Univ., Provo, UT 84602, 2) Physics, Univ. Arkansas, Fayetteville, AR 72701.* A computer animation to visualize linear and nonlinear properties of Pancharatnam's phase of light for arbitrary polarization circuit on Poincare sphere was developed and a new method was utilized to observe them experimentally for different polarization circuits. Supported by NSF-REU and Univ. Arkansas.

LTu5E - 5 Mode Conversion Analysis of Laguerre-Gaussian Laser Modes *Ethan Bendau, Sandra Mamani, Jeff Secor, Robert Alfano The City College of New York New York, NY 10031.* Laguerre-Gaussian beams transmitted through a tilted lens are converted to Hermite-Gaussian beams near the focal plane, providing a means to measure orbital angular momentum value of the LG beam. We analyze the mechanism of conversion as a Fourier transform of the beam through an astigmatic aperture. Funding by Army Educational Outreach Program Undergraduate Research Apprenticeship Program



Symposium organized by Harold Metcalf and Chad Hoyt