

SYMPOSIUM ON UNDERGRADUATE RESEARCH

Division of Laser Science of A.P.S. - LS XXX - 20 October 2014 - Tucson, AZ

PARTICIPANTS' LUNCHEON - Tucson Ballroom E - 12:00

The participants' luncheon will bring together the Symposium students and distinguished laser scientists, including Jannick Rolland, Joe Eberly, Paul Corkum, Toni Taylor, Steve Cundiff, Moti Segev, and others.

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

POSTER SESSION - Tucson Ballroom E - 12:30

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Session LM2A: 12:30 - 3:25 PM, Tucson Ballroom E, Kristan Corwin, Kansas State Univ., Presider

LM2A-1 - Blue Light Stimulates Nematodes: A Study of *C. elegans* Behavior Using Continuous Wave Lasers. *Ramy Abbady, Caiti Bell, Kathleen M. Raley-Susman, and Jenny Magnes, Vassar College, Poughkeepsie, NY 12604.* *C. elegans* is a soil-dwelling nematode that can detect light. We studied the nematodes' behavioral response to blue light using laser diffraction to calculate swimming rate from moving diffraction patterns. We showed that *C. elegans* swims faster in blue light than in red light, indicating a behavioral response. Supported by Vassar College Undergraduate Research Summer Institute, Lucy Maynard Salmon Research Fund, and NSF.

LM2A-2 - Optical Properties on Magnetic Dielectric KNiF₃. *Leor Gayr^{1,2}, Zahir Houssin,¹ and Robert R Alfano,¹* 1) *Institute of Ultrafast Spectroscopy and Lasers, Physics and Electrical Engineering, The City College of New York, New York NY 10031,* 2) *Physics, Stony Brook University, Stony Brook, NY 11794-3800.* Perovskite anti-ferromagnetic KNiF₃ has a potential to be a magnon tunable laser. The absorption spectrum from 200nm to 1600nm was measured. The electronic dipole transitions from multi lines about 420nm and the magnetic dipole transitions about 800nm and 1400nm are observed. The photoluminescence emission at 460 nm points towards a potential magnon source.

LM2A-3 - Vortex Phase Contrast Microscopy Using a Q-Plate. *Richard Gozali, Thien-An Nguyen, and Robert R. Alfano, Institute for Ultrafast Spectroscopy and Lasers, Physics and Electrical Engineering, The City College of New York, NY 10031.* A q-plate is placed in the Fourier plane of a 4F system, where it is used as an edge enhancer to improve imaging of objects: a metal 3digit, metal bars, and an amoeba. The q-plate acts as a phase filter effectively "opening a window" to see scattered light.

LM2A-4 - Plasma Density of Laser Filament. *Danielle Harper, Khan Lim, Michael Chini, Matthieu Baudelet, and Martin Richardson, Townes Laser Institute & CREOL, University of Central Florida, Orlando, FL.* When the peak power of a laser pulse exceeds the critical power, self-focusing can result in filamentation, forming a nearly non-diffracting beam and an ionized plasma column. To further understand filamentation, we built an optical system to measure the electron density of filament plasma. Supported by the Army Research Office.

LM2A-5 - Optical Transport of ⁴⁰K Atoms Within a Dipole Trap. *Allison Mueller, Rabin Paudel, Roman Chapurin, Tara Drake, and Deborah Jin, JILA, Boulder, CO 80309.* We explore using focus-tunable lenses for moving a cloud of ultracold ⁴⁰K atoms confined by an optical dipole trap. The trap position must be stable and precisely controlled. This system is part of a new apparatus being built for studying a strongly interacting Fermi gas. Supported by NSF.

LM2A-6 - Ultracold Trimer Formation Energetics of Rb and K. *Michael Cantara and William Stwalley, Department of Physics, University of Connecticut, Storrs, CT 06269-3046.* Producing molecules at ultracold temperatures allows for high resolution laser spectroscopy that reveals vibrational and rotational levels not discernible at room temperature. Here we discuss the current experimental apparatus utilized as well as pathways to the formation of ultracold [Rb₃]⁺ that are to be investigated experimentally. Supported by NSF, AFOSR (MURI) and the University of Connecticut.

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LM2A-7 - Optimizing Image Reconstruction of Virtual *C. elegans* Diffraction Patterns using Iterative Fourier Transform Algorithms. *Elias Kim, Brian Deer, Jenny Magnes, Vassar College, Poughkeepsie, NY 12604.* Virtual diffraction patterns of *C. elegans* are taken by using Fourier transforms on images of *C. elegans* recorded by microscopes. The Fourier transform magnitude is plugged into an algorithm from J. Miao to reconstruct the image. Parts of the code are altered to optimize the algorithm for *C. elegans*. Supported by Vassar College Undergraduate Research Summer Institute, Lucy Maynard Salmon Research Fund, and NSF.

LM2A-8 - Generation of Intense Few-Cycle Pulses from the Visible to the Mid-IR. *Josh Nelson, Danny Todd, Adam Summers, Derrek Wilson, and Carlos Trallero, Physics Department and James R. Macdonald Lab, Kansas State University, Manhattan, KS 66502.* We used an axicon lens to couple Bessel beams into a hollow core fiber in order to increase the efficiency of intense few-cycle pulse generation. Because this approach is usually limited to the VIS to NIR region, we used difference frequency generation to generate Mid-IR femtosecond pulses at high energies. Supported by NSF.

LM2A-9 - Deuterium Passivation of Si <111> in-situ. *Tharon Morrison, Thomas Reay, and Mark G. Raizen, Department of Physics, University of Texas at Austin, Austin, Texas 78712.* Tritium-passivated Si <111> is a proposed source for the study of beta decay. Towards tritium passivation, we are developing a process for in-situ deuterium-passivated Si <111>. We will verify the process by time-of-flight analysis of reflected helium.

LM2A-10 - Polarization Mobius Loops. *Jonathan J. Zeosky and Enrique J. Galvez, Colgate University, Hamilton NY, 13346.* Our work was focused on searching for specific polarization structures predicted to occur when two vector beams are crossed at small angles relative to their axis of propagation. The polarization structures were predicted to be similar to Mobius loops, nested in concentric circles about the propagation axis.

LM2A-11 - Electromagnetically Induced Transparency and Four-Wave Mixing in Rubidium Vapor in a Paraffin Coated Cell. *Kelly Roman and Irina Novikova, The College of William and Mary, Williamsburg, VA 23187.* We investigate electromagnetically induced transparency and four-wave mixing in a Rb vapor cell with paraffin wall coating that maintains atomic quantum states upon wall collisions. We observed significant modification of resonant lineshapes in the presence of a strong, spatially-separated beam for a range of laser powers and detunings. Supported by NSF.

LM2A-12 - Edge-Thickness Assessment of Soft Contact Lens using Gabor-Domain Optical Coherence (GD-OCM). *Jungeun Won, Patrice Tankam, Ian Cox, and Jannick P. Rolland, The Institute of Optics, University of Rochester, Rochester, NY, 14627.* We propose GD-OCM as a non-invasive and accurate metrology to evaluate the edge-thickness of soft contact lenses in three environments: air, water, and on pig corneas. The algorithm precisely generates edge-thickness profiles that are crucial for the design of lenses and the comfort of wearers. Supported by the Xerox Corporation.

LM2A-13 - Rapid Generation of Light Beams Carrying Orbital Angular Momentum (OAM). *Changchen Chen, Mohammad Mirhosseini, Omar S. Magana-Loaiza, Brandon Rodenburg, Mehul Malik, and Robert Boyd, University of Rochester, Rochester, NY, 14627.* We present a technique for generating OAM and Laguerre-Gaussian modes using a digital micro-mirror device (DMD) at speed of 4 kHz, which is an enabling technology for fast spatial mode encoding communication system. Supported by DARPA/DSO InPho, Canadian Excellence Research Chair Program, and Marie Curie Fellowship.

LM2A-14 - Supersonic Nozzle Flow: Heterodyne Interferometry and Numerical Simulation. *Connor Fredrick, Richard Peterson, and Keith Stein, Bethel University, St. Paul, MN 55112.* The use of a heterodyne interferometer allows for direct comparisons between experiment and simulation on the microsecond time scales meaningful to highly transient, high speed, compressible flows. Results are presented to fully describe the flow from an axisymmetric converging diverging nozzle comparing simulation, high speed shadowgraphy, and heterodyne interferometry.

LM2A-15 - Time Delay Features in a Multimode VCSEL Subject to Polarization Rotated Optical Feedback. *Aliza Khurram and Hong Lin, Department of Physics and Astronomy, Bates College, Lewiston ME, 04240.* Time delay signatures were studied by evaluating the fast Fourier transform and the autocorrelation function of chaotic time series. Suppression of the time delay features was observed for large polarization angles and weak feedback strength. Supported by Bates College.

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LM2A-16 - Ultrafast Optics for the Undergraduate Advanced Laboratory. *Andrew Schaffer¹, Nate Parks¹, Andrew Thomas¹, Connor Fredrick¹, Chad Hoyt¹, and Jason Jones²* 1) Bethel University, St. Paul, MN 55112, 2) College of Optical Science, University of Arizona, Tucson, AZ 85721. An ultrafast optics advanced laboratory was developed in undergraduate optics courses using a mode-locked erbium fiber laser at 1550 nm. 220 fs pulses were measured with an auto-correlator using the two-photon response of a common silicon photodiode. An external grating-based dispersion compensation apparatus was used to adjust spectral chirp. Supported by NSF

LM2A-17 - Pulse-Shape Effects on the Autler-Townes Doublet in Strong-Field Ionization of Atomic Hydrogen. *Sean Buczek, John Emmons, Joel Venzke, Alexei Grum-Grzhimailo, and Klaus Bartschat, Drake University, Des Moines, IA 50311.* We studied the effect of the pulse shape, peak intensity, and central wavelength on theoretical predictions for the ejected-electron spectrum in two-photon ionization near the Autler-Townes doublet. We noticed a surprisingly strong dependence on the pulse details for cases that would result in a non-zero displacement of a free electron. Supported by NSF.

LM2A-18 - Experimental Validation of Nodal Aberration Theory Applied to Freeform Surfaces. *Isaac Trumper, Kyle Fuerschbach, and Jannick P. Rolland, The Institute of Optics, Univ. of Rochester NY 14627.* Nodal aberration theory predicts the aberration behavior of freeform surfaces. A Schmidt telescope is used to experimentally validate these predictions for a trefoil surface, a common mount-induced error. We observe field constant elliptical coma and field conjugate, field linear astigmatism. Funded by R.E. Hopkins Center, NSF and the II-VI Foundation.

LM2A-19 - Creating Airy Beams Using Simple Optical Elements. *Jonathan Gill^{1,2}, Martin G. Cohen² and John Noé²,* 1) Waldorf High School, Garden City, NY 11530, 2) Laser Teaching Center, Stony Brook University, Stony Brook, NY 11794. Airy beams resist diffraction and curve as they propagate. As proposed by Papazoglou *et al.* (Phys. Rev. **A81**, 2010), we used stock cylindrical lenses to create a 635 nm 1D Airy beam whose primary lobe follows a parabolic path and maintains its ~40 micron width over ~8 cm. Supported by the Simons Foundation.

LM2A-20 - Projective Measurement of LG Modes via Refractive Beam Shaping. *Rachel Sampson¹, Mohammad Mirhosseini², and Robert Boyd²,* 1) Physics and Astronomy, Stony Brook University, Stony Brook, New York 11794, 2) The Institute of Optics, University of Rochester, Rochester, New York 14627. We separated LG radial modes by imaging the modes onto their conjugate mode, producing a Gaussian and then coupling the beam into a single mode optical fiber. Using the Gerchberg-Saxton method, we calculated theoretical separation efficiencies of ~80% for p=1-5. Implementation of the experimental setup is ongoing. Supported by NSF-REU.

LM2A-21 - Enhancing Electric Quadrupole (E2) Transitions with OAM Beams. *Stefan Evans and Harold Metcalf, Physics and Astronomy, Stony Brook University, Stony Brook, NY 11794.* Atomic E2 transitions ($\Delta l=2$) require a strong electric field gradient as well as high intensity and thus could benefit from Laguerre Gaussian (LG) beams carrying orbital angular momentum $l=1$ or 3. We study the structure and transition rates for such beams and differences from plane waves to investigate the rate enhancement. Supported by ONR.

LM2A-22 - Fabrication and Characterization of SiO₂/Al Nanolayered Metamaterial. *Daniel White, Priscilla Kelly, and Lyuba Kuznetsova, San Diego State University, San Diego, CA 92182.* We have fabricated and characterized a SiO₂/Al nanolayered metamaterial using a sputtering technique. The Al layer thickness was adjusted based on effective medium approximation to achieve hyperbolic dispersion in the visible spectral range. Sputtering parameters (RF and DC powers, and chamber pressure) were varied to find the optimal conditions for low loss metamaterial. Supported by the SDSU President's Leadership Fund.

LM2A-23 - Measurement of Spatial Coherence through the Shadows of Small Obscurations. *Amber Betzold, Miguel Alonso, Thomas Brown, and Katelyn Sharma, Institute of Optics, University of Rochester, Rochester, NY 14627.* We further simplify our group's method for measuring spatial coherence by showing that measurements can be taken in the Fresnel region. This eliminates the use of a Fourier transforming lens in our setup and solidifies our method's potential for use in characterizing x-ray sources. Supported by NSF.

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LM2A-24 - Nonlinear Response of Nano-Particle Solution Induced by Strong-Field Laser Pulses. *Yukun Qin, Jeff Powell, Stefan Zigo, Chris Sorensen, and Carlos Trallero, James R. Macdonald Lab and Physics Department, Kansas State University, Manhattan, KS 66506.* The nonlinear response from gold nano-particles in solution, induced by a strong ultrafast pulse was observed. With a 4-f pulse shaper, we investigate the nonlinear response of the nano-particles as a function of intensity and different electric field shapes.

LM2A-25 - Generation and Pulse Shaping of sub 15 fs Laser Pulses. *Yingda Lin, David Foote, and Wendell Hill, University of Maryland, MD 20740.* The goal of this project is to be able to use few-cycle pulses in quantum coherent control experiments. We use hollow core fiber to generate sub 15 fs pulses and send it to the spatial light modulator to shape the pulses. Supported by NSF.

LM2A-26 - Portable sub-Doppler Gas-filled Hollow-core Fiber Frequency References with Acetylene and Methane. *Ryan Luder, Mattithyah Tillotson, Chenchen Wang, Shun Wu, Brian Washburn, and Kristan Corwin, Kansas State University, Manhattan, KS 66506.* A saturated absorption reference in hollow-core photonic crystal fiber forms a portable optical frequency reference. We investigate conversion of an existing acetylene reference at 1.5 microns to methane at 1.65 microns, which involves constructing an external cavity diode laser, and challenges to sealing the gas inside the fiber. Supported by AFOSR.

LM2A-27 - Engineered Structures of Laser Filaments. *Robert Short, Nicholas Barbieri, Matthieu Baudelet, and Martin Richardson, Townes Laser Institute & CREOL, University of Central Florida, Orlando, FL 32816.* We investigated techniques for the creation of arrays of laser filaments using a multi-terawatt femtosecond laser system. The filament arrays are created by modifying the wavefront of the Gaussian laser beam prior to filamentation. Such arrays have applications as microwave and optical waveguides. Supported by the Army Research Office.

LM2A-28 - Measurement of Hyperfine Splittings in ^{87}Rb . *Rachel Lindley and John Brandenberger, Lawrence University, Appleton, WI 54911.* Hyperfine splittings in the $6^2\text{D}_{5/2}$ state of ^{87}Rb have been measured using two-step Doppler-free excitation via two external-cavity diode lasers. Preliminary values for the measured magnetic dipole and electric quadrupole coupling constants are $A=-3.43(8)$ MHz and $B=0.7(3)$ MHz. Supported by Dale L. Skran, Sr. Research Fellowship and Lawrence Univ.

LM2A-29 - Supercontinuum Generation in ZBLAN Fiber. *Ben J. LeValley and Brian R. Washburn, Kansas State University, Manhattan, KS 66502.* We simulate ultrafast infrared pulses propagating through a ZBLAN fiber to understand the parameters necessary for generating an octave spanning supercontinuum. Supercontinuum generation will be optimized by varying the pulse's peak power, duration, and initial chirp. Supported by Kansas State University.

LM2A-30 - Direct Imaging of Surface Plasmon Polariton Dispersions in Silver and Gold Thin Films. *Megan Ives, Gaël Nardin, Travis Autry, and Steven Cundiff, University of Colorado, Boulder, CO, 80309.* Using the Kretschmann prism configuration, the surface plasmon polariton (SPP) resonance was observed in samples of gold and silver thin films of various thicknesses, using white light reflection spectroscopy. Direct measurement of the SPP dispersion was obtained using angle-resolved spectroscopy, and compared to theory. Supported by The JILA Physics Frontiers Center, and the Univ. of Colorado, Boulder.

LM2A-31 - Physics Approaches to Studying the Biology of *C. elegans*. *Caiti Bell, Ramy Abbady, Brian Deer, Elias Kim, Kathleen M. Raley-Susman, and Jenny Magnes, Vassar College, Poughkeepsie, NY 12604.* Traditional microscopic methods to study the soil dwelling nematode, *C. elegans*, are limited to a two-dimensional environment. In our study, optical methods such as shadow imaging and laser diffraction of single and multiple *C. elegans* in a cuvette, allow the study of the nematodes' behavior in a three-dimensional environment. Supported by Vassar College Undergraduate Research Summer Institute and NSF.

LM2A-32 - Optical Transitions of Eu Ions in GaN: The Puzzle of the 634 nm Peak. *Courtney Au-Yeung¹ and Volkmar Dierolf², 1) Duquesne University, Pittsburgh, PA 15219, 2) Lehigh University, Bethlehem, PA 18015.* We studied GaN doped with Eu, specifically looking at the 634 nm peak in the emission spectra that occurs after excitation. To determine the 634 nm peak's origin, several factors were measured using confocal spectroscopy. Supported by NSF.

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Session LM2A: 12:30 - 3:25 PM, Tucson Ballroom E, Kristan Corwin, Kansas State Univ., Presider

LM2A-33 - Investigation of the Transition to Rydberg States from Metastable Helium Using STIRAP. *Casey McKenna, Vladislav Zakharov, DeQuian Yuan, and Harold Metcalf, Department of Physics and Astronomy, Stony Brook University, Stony Brook, NY 11794.* Optical excitation from the 2^3S state of atomic helium via STIRAP through the 3^3P state is a very efficient way to populate the Rydberg states. We have optimized our He 2^3S source, enhanced our vacuum system, and prepared our laser systems to make absolute measurements of the excitation efficiency. Supported by ONR.

LM2A-34 - Modeling of Optical Scattering Using the Bidirectional Reflectance Distribution Functions of Advanced LIGO Test Masses. *Hunter Rew¹ and Joseph Betzwieser², 1) College of William and Mary, Williamsburg, VA 23187, 2) California Institute of Technology, Pasadena, CA 91125.* Measured optical scatter in the interferometer is compared against scatter modeled from the pre-installed test masses using data from the baffle photodiodes and the Stationary Interferometer Simulation (SIS) package. A new model, characterized by the condition of the installed test masses, is developed from this comparison.

LM2A-35 - Demonstration of Random Aperture Design for Fresnel Diffraction Patterns with Arbitrary Sizes. *Jessica Margiewicz¹, Yijia Wu², Ziyi Zhu¹, Zhimin Shi¹, and Daomu Zhao² 1) Department of Physics, University of South Florida, Tampa, FL 33620, 2) Department of Physics, Zhejiang University, Hangzhou, 310027. China.* We present a theoretical design procedure taking the advantage of a recently proposed random aperture design for Fresnel diffraction patterns with the well-known thin-lens imaging condition. As a result, we are able to obtain any desired intensity patterns with a wide range of different sizes at one fixed distance. Supported by NSF.

LM2A-36 - Polarimetry of Nacre in Iridescent Shells. *Samantha Spano, Enrique Galvez and Rebecca Metzler; Physics, Colgate University, Hamilton, NY 13346.* We studied iridescent shells by analyzing the polarization of the light passing through thin slices of nacre. Using Mueller polarimetry, we analyzed the degree of order within the aragonite tablets that compose the nacre.

LM2A-37 - Science and Preservation of the Daguerreotype. *Travis Kohler, Nicholas Bigelow, Brian McIntyre, and Alex Shestopalov, University of Rochester. Ralph Wiegandt, and Nicholas Brandreth: George Eastman House Department of Physics and Astronomy University of Rochester Rochester, NY 14627.* Using X-ray photoelectron spectroscopy and scanning electron microscopy we analyzed the the top few hundred nanometers of the daguerreotype surface. Additionally we developed a technique to create a removable cross section by focused ion Beam milling. Supported by NSF.

LM2A-38 - Measurement of Instantaneous Velocity of Brownian Particles in Liquid. *Patrick Plusnick, Jianyong Mo, and Mark G. Raizen, Center for Nonlinear Dynamics and Dept. of Physics, University of Texas at Austin, Austin, TX 78712.* Brownian motion is fundamental to many branches of science. We used high-power optical tweezers to trap microspheres and measured the instantaneous velocity of their Brownian motion via a fast balanced photodetector. Supported by the R. A. Welch Foundation.

LM2A-39 - Quantum Control Using the Landau Zener Effect. *Jake Hollingsworth¹, Tamas Budner¹, Thomas Carroll¹, Michael W. Noel², and Rachel Feynman², 1) Ursinus College, Collegeville, PA, 19034, 2) Bryn Mawr College, Bryn Mawr, PA 19010.* We excite ultracold Rubidium atoms in a magneto optical trap to a coherent superposition of two $|m_j|$ sub-levels of a Rydberg state. Following a short time delay, we ionize the atoms. We present calculations that show that varying the delay time permits control over the atoms final state energy distribution. Supported by NSF.

LM2A-40 - Programmable Arbitrary Timing Pulse Generator. *M.D. Mendiola, J.W. Lyons, and B.D. DePaola, Kansas State University, Manhattan, KS 66506.* We have developed a multi-channel, user programmable timing pulse generator of arbitrary TTL timing signals. Our device allows the user to specify signal outputs on up to 10 different channels during selected time intervals using a graphical user interface (GUI) and a BeagleBone Black computer. Supported by NSF.

LM2A-41 - Creating a Fast Piezo-Actuated Mirror for the Elimination of Fiber Noise. *Ananya Sitaram¹, Stephen Eckel², Gretchen Campbell², 1) University of Rochester, Rochester, NY 14627 2) National Institute of Standards and Technology, Gaithersburg, MD 20899.* We built a piezoelectric mirror with a bandwidth of ~40 kHz in a feedback loop circuit to adjust the path length of one of two interfering beams of light to counteract resonances and phase noise. Supported by NSF and NIST.

Group Photo Break -- Promptly at 3:30 PM
PLEASE assemble at the designated place !!!

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Division of Laser Science of A.P.S. - LS XXX - 20 October 2014 - Tucson, AZ

Session LM3I: 3:45 - 4:45 PM, Tucson Ballroom E, Steve Cundiff, JILA Colorado, Presider

LM3I-1 - Noninvasive Nanoparticles Detection Using Silicon Microdisks. *Grace Cordes and Lyuba Kuznetsova, Physics, San Diego State University, San Diego CA 92182.* We demonstrate a noninvasive ultra-sensitive biodetection platform using a 2 μ m diameter silicon microcavity by measuring the resultant resonance frequency shift in the microcavity when a nanoparticle (e.g., viruses) is in contact with the microdisk. Results show detection and sizing of particles (e.g., HIV virus) down to a single nanoparticle. Supported by The President's Leadership Fund (from SDSU).

LM3I-2 - Viscosity Response of Chalcogenide Glasses with Respect to Composition and Temperature. *Rebecca Whitsitt, Erick Koontz, Kathleen Richardson, University of Central Florida, Orlando, FL 32816.* We investigated the temperature and composition dependence of the viscosity of glasses in the Ge-As-Se family. The resulting viscosity curves aid in the understanding of precision glass molding of infrared lenses.

LM3I-3 - Generating Super-Resolving Single-Photon Number-Path-Entangled States. *Michelle Lollie^{1,2}, Wei Feng³, Kebei Jiang¹, M. Suhail Zubairy^{3,4}, and Jonathan P. Dowling^{1,3}, 1) Louisiana State University, Baton Rouge, LA 70803, 2) Rose-Hulman Institute of Technology, Terre Haute, IN 47803, 3) Beijing Computational Science Research Center, Beijing 100084, China, 4) Texas A&M University, College Station Texas, 77843.* A field in a single-photon state can carry multifold phase information. Two protocols are shown that generate this desired state with different probabilities depending on the type of detectors being used. Supported by NSF.

LM3I-4 - Improved Excited-State Interaction Potentials for Alkali-Rare Gas Pairs and Their Application to Alkali Laser System Development. *Chris Campbell¹, Darby Hewitt¹, Kyle Raymond², and Gary Eden² 1) Engineering and Physics, Abilene Christian University, Abilene, TX 79601. 2) Electrical and Computer Engineering, University of Illinois at Urbana-Champaign, Urbana, Illinois 61801.* We have determined the B states of several alkali-rare gas atom pairs via absorption spectra simulations. These improved B states can be used to determine the range of internuclear separation in which alkali-rare gas pairs can absorb pump radiation in an alkali-rare gas laser, facilitating the design of these systems. Supported by Abilene Christian University.

LM3I-5 - Faraday Optical Filters Using Rb Magneto-Optical Polarization Rotation. *Donna Taylor¹ and Irina Novikova², 1) Weber State University, Ogden, UT 84408, 2) College of William & Mary, Williamsburg VA, 23187.* We compared the performance of natural abundance and Rb-87 cells in a Faraday filter configuration. We measured >360° rotation and less than 4% absorption in the Rb-87 cell at 110°C and 26G applied magnetic field. Quantum noise was also evaluated for the Rb-87 cell. Supported by the NSF.

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Session LM4I: 5:00 - 6:00 PM, Tucson Ballroom E, Jannick Rolland, Univ. Rochester, President

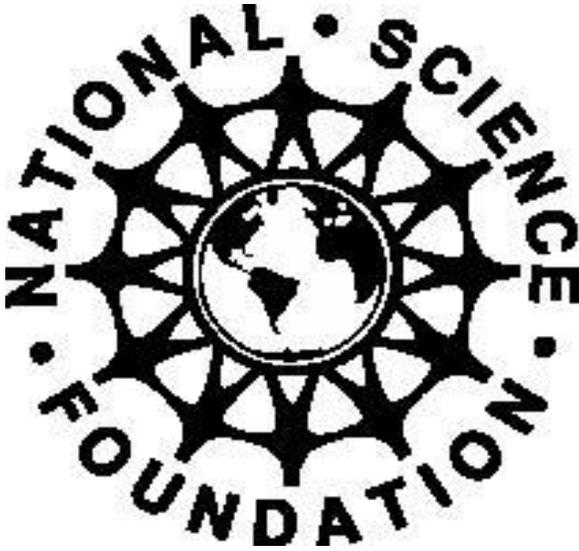
LM4I-1 - Optical Modulators for the Production of Chirped Light in Adiabatic Rapid Passage (ARP). *Thomas Ciavatti and Harold Metcalf, Physics and Astronomy, Stony Brook University, Stony Brook, NY 11794.* ARP can invert atomic populations also impart momentum exchange δk with the light. Multiple exchanges with different k-vector light beams makes significant atomic momentum exchanges. The optical modulators and associated GHz rf equipment used for these light pulses is set up, measured, characterized and fine-tuned. Supported by ONR.

LM4I-2 - Magneto Optical Trapping of Rb 87 Using Diode Lasers. *Connor Awe, Bachana Lomsadze and Steven Cundiff, University of Colorado, Boulder CO 80309.* We discuss our work building external cavity diode lasers to be used for the magneto optical trapping of Rubidium 87 atoms, as well as work on the magneto optical trap itself and future 2D Fourier transform spectroscopy experiments.

LM4I-3 - Laser Frequency Stabilization with Nonlinear Spectroscopy. *Alyssa Rudelis and Leo Hollberg, Stanford University, Stanford, CA 94305.* A novel method is presented to stabilize the frequency of a 1560 nm diode laser to rubidium transitions at 780 nm. This new approach involves frequency doubling in PPLN, lock-in detection of FM, and an RF system to control the laser frequency. Supported by the Stanford Physics Department and NASA.

LM4I-4 - Development of Compact Atomic Clocks Based on Laser-Cooled Atoms. *Samantha Rubeck¹ and Elizabeth Donley^{1,2}, 1) University of Colorado, Boulder, CO 80138, 2) National Institute of Standards and Technology, Time and Frequency Division (688), Boulder, CO 80305.* Using the techniques of magneto-optical traps and coherent population trapping, we developed a new atom interrogation setup which can be applied to compact atomic clocks. This setup allows for horizontal interrogation with separate counter-propagating beams to decrease the Doppler shift caused by atomic motion during interrogation. Supported by NSF, NIST, and DARPA.

LM4I-5 - Iterative Image Reconstruction of *C. elegans*. *Brian Deer, Elias Kim, and Jenny Magnes, Vassar College, Poughkeepsie, NY 12604.* Iterative image reconstruction of *C. elegans* from diffraction patterns generated in a dynamic diffraction setup is investigated. Using an algorithm provided by J. Miao, reconstructions of both digital and experimentally recorded diffraction patterns are studied. Key factors affecting image reconstruction and future work are discussed. Supported by NSF Grant for Physics of Living Physical Systems.



THORLABS



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Symposium organized by Harold Metcalf and John Noé, Stony Brook University