

# SYMPOSIUM ON UNDERGRADUATE RESEARCH

## Session SuA

12:30 PM – 2:30 PM - - Paradise II Ballroom - - John Noé, SUNY Stony Brook, USA, Presider  
Division of Laser Science of A.P.S - - LS XVIII - - 29 September 2002 - - Orlando, FL

SuA1 12:30 PM: **Feshbach Resonance Cooling of Atomic Gases**, *Joshua W. Dunn, Chris H. Greene, D. Blume, B. E. Granger, M. J. Holland, University of Colorado, Boulder, CO 80309-0440 USA.*

A method is proposed that utilizes a Feshbach resonance to cool an atomic gas to temperatures of quantum degeneracy. Application of a series of magnetic field ramps can cause atom pairs to lose energy while removal of pairs which gain energy results in an overall temperature decrease in the gas.

SuA2 12:45 PM; **Ablation Rates of Materials Irradiated by Femtosecond Laser Pulses**, *Tina Shih\*, Nikolai Vorobiev, Martin C. Richardson, University of Central Florida, Orlando, FL 32816-2700 USA (\*Massachusetts Institute of Technology).*

Material ablation rates produced by femtosecond pulses in metals and dielectrics, in air and vacuum, are of considerable interest. Ablation of nickel samples were conducted as preliminary tests to set up the ablation rates experiment. Additionally, a streak camera was reconstructed to examine the pulses and their interactions with materials.

SuA3 1:00 PM; **Calculations of Potential Curves for Alkali Dimers at Excited Asymptotes  $M^*(nS) + M$** , *Bradford Normand, Warren T. Zemke, Robin Cote, Marin Pichler, and William C. Stwalley, University of Connecticut, Storrs, Connecticut 06269-3046 USA.*

The weakly bound long range potential curves between highly excited  $M^*(nS)$  alkali atoms and ground state alkali atoms are calculated using simple but reasonably accurate models for dispersion and exchange interactions. Such curves will help in the design of experiments to observe corresponding spectra.

SuA4 1:15 PM; **Single Molecule Fluorescence from Organic Dyes in Thin Polymer Films**, *Robin Smith and Carl Grossman, Swarthmore College, Swarthmore, PA 19081 USA.*

Fluorescence from single organic dye molecules in thin polymethyl methacrylate films was studied with scanning confocal microscopy. Photon antibunching exhibited by the photon-pair correlation function  $g^{(2)}(\tau)$  at  $\tau = 0$  confirms that single molecule emission spectra were obtained. Spectral diffusion may explain deviation of these spectra from those of dyes in methanol.

SuA5 1:30 PM **Spectral Analysis of a Frequency-Chirped Diode Laser**, *A.J. Campbell, Oregon State University, Corvallis OR 97331-6507 USA, M.J. Wright and P.L. Gould, University of Connecticut, Storrs, Connecticut 06269-3046 USA.* The frequency of a diode laser can be easily and rapidly chirped by varying the injection current. We examine the effects of different current modulation waveforms, such as sinusoidal and triangle waves, on the laser's frequency spectrum. Measurements made with an optical spectrum analyzer are compared to theoretical predictions.

SuA6 1:45 PM **Power Law Decay of Phosphorescent Materials**, *Chungchi Chen, John Noé, and Harold Metcalf, Stony Brook University, New York 11794-3800 USA.*

The delayed visible light emission from a sample of commercial Eu-doped oxide ceramic phosphorescent film has been studied under different conditions of activation and decay. After the initial few minutes, the recorded light intensity accurately follows a power law  $L(t) = 1/t^n$ , with  $n \approx 1$ , for at least 20 hours.

SuA7 2:00 PM **Measurements of Prepulse Effects on Solid Targets Relevant to High-Intensity Ti:S Lasers**, *Judy Kim, Reed College, Portland, OR 97202, Ken Wharton, San Jose State University, San Jose, CA 95192 USA.*

We study the effects of prepulses for high intensity lasers incident on solid targets. We use a "pump-probe" technique to study the effects of nanosecond prepulses specific to Ti:Sapphire lasers at prepulse fluences above and below ionization levels. We see evidence of surface rippling and/or cluster formation for intensities  $\approx 10^8$  W/cm<sup>2</sup>.

**BREAK**

2:30 – 3:00 PM

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## Session SuB

3:00 PM – 4:45 PM -- Paradise II Ballroom -- John Noé, SUNY Stony Brook, USA, Presider  
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**SuB1 3:00 PM Temperature Dependent Refractive Index Change in YCOB Crystals**, *Theresa McGovern, Martin C. Richardson, Arnaud Zoubir, University of Central Florida, Orlando, FL 32816 USA.*

$\text{YCa}_4\text{O}(\text{BO}_3)_3$ , YCOB, is a nonlinear optical crystal with unique properties that can be used in solid state nonlinear laser systems. The refractive index of YCOB varies with temperature. This study is focused on measuring the change in the refractive index along the  $Y$  and/or  $b$  axis.

**SuB2 3:15 PM Wavepacket Calculations for Ionization by Particle and Photon Impact**, *Greg Ver Steeg and Seamus Riordan, Drake University, Des Moines, IA 50311, USA and Klaus Bartschat, Drake University and ITAMP, Cambridge, MA 02138 USA.*

We have proposed an alternative way of extracting energy-differential ionization cross sections from a time dependent treatment of the Temkin-Poet model for e-H collisions [PRA **65** 060701 (R) (2002)]. An application of our method to excitation, ionization, and dissociation in intense laser fields will be discussed for the molecular hydrogen ion. Supported by the NSF under PHY-0088917.

**SuB3 3:30 PM Diode Laser Stabilization and Statistics of Quantum Jumps**, *Daisy Raymondson and Dana Berkeley Los Alamos National Laboratory, New Mexico, USA.*

We constructed a 687 nm diode laser and accompanying servo system for use in improved laser cooling of trapped strontium ions. In addition, we examined the statistics of quantum jumps between the manifold of  $S_{1/2}$  and  $P_{1/2}$  states and the  $D_{5/2}$  state for a single ion and two simultaneously trapped ions.

**SuB 4 3:45 PM Sum Frequency Generation of Near Ultraviolet Light**, *Jose Mawyin, John Noé, and Harold Metcalf, Stony Brook University, New York, 11794-3800, USA.*

We describe a plan to produce up to 500 mW of 389 nm light using sum frequency generation and fiber amplification. We'll mix light from a 532 nm Verdi laser and a 1447 nm laser diode in a crystal. We discuss problems and possible solutions, and alternative methods for the non-linear mixing.

**SuB 5 4:00 PM Design and Performance of an Astigmatic Mode Converter**, *Alex Ellis, John Noé, and Harold Metcalf, Laser Teaching Center, Stony Brook University, New York, 11794-3800, USA.*

We discuss the design and performance of an astigmatic mode converter based on two cylinder lenses that transforms rectangular Hermite-Gaussian transverse modes into circular Laguerre-Gaussian modes. The initial HG modes were obtained from an open-cavity HeNe laser, and the resulting LG modes were characterized in part by analysis of CCD images.

-- SPECIAL GRAND FINALE --

**SuB 6 4:15 PM Bi-frequency Pendulum on a Rotary Platform: Teaching Various Optical Phenomena", Prof's M. J. Soileau and B. Ya. Zeldovich. CREOL, University of Central Florida, Orlando, FL 32816-2700, USA**

Teaching optical phenomena with the use of analogies to the motion of bi-frequency pendulum is described. The variety of demonstrations is aimed to different groups of audiences. Physical ideas may be understood and appreciated even in the middle schools and serve as a motivation for study of mathematics and science.