Rochester, April 9, 2011

Dear Participants:

Welcome to the 30th annual Rochester Symposium for Physics Students (RSPS). The RSPS was instituted to provide an opportunity for undergraduates to present an account of their own personal research at a meeting whose format was chosen to closely resemble those of professional scientific societies.

At these symposia, research projects are presented in talks or poster sessions by undergraduates representing many regional institutions. Topics include condensed-matter physics, atomic physics and optics, computational physics, astronomy, particle and nuclear physics, instrumentation and techniques, environmental physics, biological physics, medical physics, and educational physics. The abstracts of all the participants' papers are published annually in the RSPS proceedings and distributed to the participants. The information is also available on line at

http://www.pas.rochester.edu/urpas/page/RSPS2011.

Students who present these talks can list their RSPS presentation(s) on their resumes and show the above web page in their list of publications as an "On-line Published Abstract". We encourage students to follow up on their research with the aim of giving a presentation at a regular APS meeting (which now also has a special session on undergraduate research), and eventually follow up with a publication in a regular journal, or in the APS Journal of Undergraduate Research.

At Rochester, the Department of Physics and Astronomy and the Institute of Optics are jointly running two National Science Foundation (NSF) funded Research Experience for Undergraduates (REU) sites. We encourage you to apply to one of these summer programs. Examples of research projects, talks, publications and awards won by our REU participants can be found on our REU Web page:

http://www.pas.rochester.edu/urpas/page/specialreu

LIST OF SPEAKERS

NAME	TIME

XXX – ROCHESTER SYMPOSUM FOR PHYSICS (ASTRONOMY AND OPTICS) STUDENTS
SPS ZONE 2 REGIONAL MEETING

PROGRAM

8.15 AM – 8.45 AM: REGISTRATION AND POSTER SETUP (B&L LOBBY)

8.45 AM: WELCOME (B&L 109)

Prof. Frank Wolfs, University of Rochester.
Prof. Eric Mamajek, University of Rochester.

9:00 AM – 10.00 AM: SESSION IA. ASTRONOMY I (B&L 109)

SESSION CHAIR: PROF. CHRISTOPHER WELLS (HOUGHTON COLLEGE)

9:00 Period-Color Relations at Maximum/Minimum Light for Sloan Digital Sky Survey RR Lyraes
Anna Bontorno, SUNY Oswego

9:15 System Development for Projecting Firefly's Orbit Location

9:30 Search for an Entanglement Measure for N-Qubit States via Phase Symmetry
Joshua Geller, University of Rochester

9:45 Laser Induced Florescence Measurement of Ion Temperatures of Interacting Magnetic Flux Ropes in Argon Plasma
Corey Adams, University of Rochester

10.00 AM – 10.30 AM: SESSION II. POSTER SESSION (LOBBY B&L)

Improved design for a multibeam femtosecond Yb:KGW oscillator
Virginia Albany, U.S. Military Academy at West Point

Analysis of GALFACTS Data for the Study of Variable Radio Sources
Scott, Barenfeld, University of Rochester

Monitoring of spectral emissions using the Compact Spectrometer Array diagnostic on NSTX
Timothy DeHaas, University of Rochester

The NIFFTE TPC Gas Handling System,
Nicholas Fuller, Houghton College

Design and Implementation of a Timing Control System for use in a Bose-Einstein Condensate (BEC) Experiment
Daniel Gresh, University of Rochester

Deuteron Formation for Big Bang Nucleosynthesis Models
Katrina Koehler, Houghton College

Localization of a Hole on an Adenine-Thymine Radical Cation in B-Form DNA in Water
Shane Kravec, University of Rochester

The Design and Construction of a Deposition Chamber and Laser Interferometer for the Study of Thin Metal Films
Tyler Reynolds, Houghton College

Accretion Processes in Class 0/I Protostars
Patrick Sheehan, University of Rochester

Atomic Layer Deposition of TiO_2 Thin Films
Stephanie Swartz, University of Rochester

10:30 AM – 11.15 AM: SESSION IIIA. ASTRONOMY II (B&L 109)

SESSION CHAIR: PROF. DALE ZYCH (SUNY OSWEGO)

10:30 The development of photometry/extinction/database modules for the Chimera Robotic Telescope System
Joshua Brown, University of Rochester

10:45 Calibration routines for the Chimera Robotic Telescope Control System
Dennis Quill, SUNY Oswego

11:00 Sample Images from0 0 Tm0 0 0Fs11:00 Teobotic Tel -0.2 (f (c) 0.2 (op) -0.2 (e) 0.2 (

1.45 PM – 3.00 PM: SESSION IVA. CONDENSED MATTER PHYSICS (B&L 407)

SESSION CHAIR: PROF. BRANDON HOFFMAN (HOUGHTON COLLEGE)

1:45 Anomalous diffusion of random walkers on a disordered lattice with quenched persistence
Steven Bandes, University of Rochester

2:00 Controlling the Sample Temperature in a Vacuum Thin Film Deposition Chamber
Adam Silvernail, Houghton College

2:15 Indium Thin Film XRD Characterization and Electrical Analysis
Andrew Gaul, The College at Brockport

2:30 The Kondo Problem: A Toy Model for Renormalization
Gregory Bentsen, University of Rochester

2:45

1.45 PM – 3.00 PM: SESSION IVC. EXPERIMENTAL TECHNIQUES (B&L 106)

SESSION CHAIR: PROF. JOHNSON-STEIGELMAN (THE COLLEGE AT BROCKPORT)

1:45 A Mutual Inductance Bridge for Electric and Magnetic Measurements

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SESSION IA. ASTRONOMY I

Period-Color Relations at Maximum/Minimum Light for Sloan Digital Sky Survey RR Lyraes

A. Bontorno, M. Berke, C. Phelps, C. Ngeow, and S. Kanbur
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We present period-color relations at maximum/minimum light for RR Lyraes observed in the Sloan Digital Sky Survey (SDDS). The survey has resulted in significant amounts of new data, especially for RR Lyrae stars. We analyzed a sample of RR Lyraes, observed by the SDDS, and used light curve template methods to reconstruct period-color relations at maximum/minimum light. Such relations are useful to determine astrophysical reddening.

System Development for Projecting Firefly's Orbit Location

John DeMatteo and Dr. Allan Weatherwax
Siena College

Once launched into orbit, having access to the latest orbital data of NASA's picosatellite Firefly Cubesat, will be imperative. We have developed a stand-alone computer program, utilizing Matlab and AGI's Satellite Tool Kit (STK), to create an automated process that obtains the latest known orbital information from Firefly and uses the STK to project an estimated orbit of the satellite. It is important to know where Firefly will be in order to determine what components on board of the satellite to use and when to use them. Matlab was used to read in a two-line element with orbital information from the satellite, send this information to the STK, use the STK to project where Firefly will be,

wavelength range of the spectra being studied. As we feed the neural network noisy spectra, we know what it is that the ANN trying to classify. Based on the results of this classification, we can determine the performance requirements of the technology that would be used by NASA to search for terrestrial planets.

Classifying Near Earth Asteroids

Shaun Dunn and Dr. Rose Finn
Siena College

We classify asteroids into three categories: type C, type S, and type X. Type C asteroids are carbon based and the most common. Type S asteroids are primarily made of silicon-based material. The final class of asteroids is the least common. They contain any material that is not carbon or silicon based. We can determine asteroid class based on reflectivity of light, denoted as the albedo. The albedo varies within the classes; type S asteroids have higher albedos than type C asteroids. Most of these near earth asteroids

SESSION IB. QUANTUM OPTICS AND PLASMA PHYSICS

Generation of Optical Vector Beams by Spatial Light Modulation

Enrique Galvez and William Schubert
Colgate University

We have developed a technique for the generation of optical vector beams. Vector beams are pure modes of light with spatially dependent polarizations. Our technique utilizes a spatial-light modulator (SLM). The SLM is a high-definition liquid crystal display that was programmed with a diffraction pattern in order to produce two Laguerre-Gauss or Hermite-Gauss beams. By varying the relative phase between these two beams, the vector beam can be shifted from radial to azimuthal polarization. The process was demonstrated by the producing a radially polarized Laguerre-

to the entanglement of the whole system of N-qubits represented by the full density matrix is a possible next step toward finding a measure of N-qubit entanglement.

Laser Induced Florescence Measurement of Ion Temperatures of Interacting Magnetic Flux Ropes in Argon Plasma

Corey Adams[1], Prof Walter Gekelman[2], and Dr. Bart van Compernolle[2]
(1) University of Rochester, (2) University of California - Los Angeles

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SESSION II. POSTER SESSION

Improved design for a multibeam femtosecond Yb:KGW oscillator

Virginia Albany, Robert Grimming, and Kraig Sheetz
U.S. Military Academy at West Point

Presentation of an improved design for an Yb:KGW oscillator that generates four beams of temporally delayed, 250-femtosecond pulses. This design provides for easier optimization and improved ability to manage the output beams.

Analysis of GALFACTS Data for the Study of Variable Radio Sources

Scott Barenfeld[1], T. Ghosh[2], and C. Salter[2]
(1) NAIC/University of Rochester, (2) NAIC

The G-ALFA Continuum Transit Survey (GALFACTS) is a spectro-polarimetric survey of Arecibo Observatory's visible sky from ity of(G(1225m /F1.0 1 Tf (') Tj ET Q q30.2 0.2 (y of) 50 0 0

CSA, viewing the divertor targets for a variety of plasma configurations, are presented along with our interpretation of the corresponding particle flux and erosion characteristics obtained using measured discharge parameters and available atomic databases.

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Localization of a Hole on an Adenine-Thymine Radical Cation in B-Form DNA in Water

S. M. Kravec, C. D. Kinz-Thompson, and E. M. Conwell
University of Rochester

Quantum/molecular-mechanics (QM/MM) molecular dynamics (MD) simulations have been carried out using CP2K for a hole introduced into a B-form DNA molecule consisting of 10 adenine-thymine (A/T) pairs in water. At the beginning of the simulation, the hole wavefunction is extended over several adenines. Within 20 to 25 fs, the hole wavefunction contracts so that it is localized on a single A. At 300 K, it stays on this A for the length of the simulation (several hundred fs) with little change in the wavefunction. At temperatures below 300 K, proton transfer from A to T is seen to take

amassed in the accretion disk and may be released onto the central star in an event similar to an FU Ori outburst, and thus supports the paradigm of episodic accretion.

Atomic Layer Deposition of TiO_2 Thin Films

Stephanie Swartz[1], Kasey Phillips[2], Jon Bradley[2], Mac Hathaway[3], and Eric Mazur[2]
(1) University of Rochester, (2) School of Engineering and Applied Sciences, Harvard University, (3) Center for Nanoscale Systems, Harvard University

If an optical switch can be made using a waveguide, we will be one step closer to creating an optical computer. Titanium dioxide (TiO_2) has optical properties that make it a good material to use in a waveguide. We chose Atomic Layer Deposition (ALD) as our method for creating TiO_2 thin films because it has the potential to create uniform and low-loss films. To do TiO_2 ALD, we developed a recipe for the films to use on our specific machine. Though our films do not yet guide light, they are anatase and they are very close to our ~200 nm thickness goal.

SESSION IIIA. ASTRONOMY II

The development of phototmetry/extinction/database modules for the Chimera Robotic Telescope System

J. Brown, J. Neeley, B. Gilfus, P. Thompson, P. da Silva. A. Kanaan, and S. Kanbur
University of Rochester, SUNY Oswego, and the Federal University of Santa Catarina, Brazil

We discuss photometry/extinction/database modules for the Chimera Robotic Telescope Control System. This is an easy-to-use, highly modular Robotic Telescope Control System written in Python. We also present some preliminary results of extinction coefficients taken at the Laborotorio Nacional Astrofisica, Brazil, in summer 2011.

Calibration routines for the Chimera Robotic Telescope Control System

D. Quill, J. Primrose, J. Brown, P. da Silva, A. Kanaan, and S. Kanbur
SUNY Oswego, University of Rochester, and the Federal University of Santa Catarina, Brazil

We present data-reduction and photometry-calibration routines for the Chimera Robotic Telescope Control System. These routines automatically take zeros, darks, and flats for a night of automated observing. We demonstrate these routines with a sample of images taken robotically in summer 2010.

Sample Images from the Chimera Robotic Telescope Control System: summer 2010,

J. Primrose, D. Quill, J. Brown, P. da Silva, A. Kanaan, and S. Kanbur
SUNY Oswego, University of Rochester ,and the Federal University of Santa Catarina, Brazil

We present a range of images taken entirely robotically with the Chimera Robotic Telescope Control System during summer 2010. The images taken were mainly of Galactic Open clusters containing Cepheids and demonstrate the viability of Chimera.

of biofilms alters the shape of the survival curve, such that individual cells are shielded from radiation by aggregates of other cells.

Cell Classification based on Artificial Neural Networks

James Crawford and Dr. Theodore von Hippel
Siena College

The idea of my project is to develop a working Artificial Neural Network (ANN) to differentiate and classify specific abnormal (cancerous) cells from normal cells. Further, automate this process to work as a pathology decision-making algorithm, thus providing quick identification and diagnosis. This is done by extracting parameters from microscopic images of various tissues, like lung, breast, and prostate tissues, to obtain data of normal and abnormal cells. The data is run through the network-learning phase so that the ANN eventually recognizes patterns to identify the different cell types. The ultimate goal is to automate the entire process and get quality results. This network could have major benefits in the medical field where it can provide faster cell identification, resulting in quicker patient diagnosis, as well as a reduction of the number of false negatives and positives, which is very important in oncology. It can decrease the costs associated with medical tests and procedures. A well-trained network could provide an even better, more consistent, diagnosis and the results are not affected by human errors.

MR Spectroscopic Imaging with MIDAS and Matlab

Daniel deLahunta and Jacob Mathews
University of Rochester

MR spectroscopic imaging (MRSI) is a method used to image the concentrations of different metabolites in the human body. The MRI that everyone usually thinks about measures just the signal coming from the protons in the water molecules in the tissue. MRSI measures the signals coming from the protons in many of the other metabolites present in the tissue. The difference is that the water signal is much larger than that of the other metabolites. As a result, the signal-to-noise ratio (SNR) is much lower in MRSI and the metabolite images are of lesser quality than the water images. Valuable information can still be obtained from these images however. We used a software package (MIDAS) and imaging sequence developed at University of Miami to process data that was taken at the University of Rochester using the imaging sequence. We then developed a program in Matlab that displays the image information in a suitable manner.

SESSION IVA. CONDENSED MATTER PHYSICS

Anomalous diffusion of random walkers on a disordered lattice with quenched persistence

families of [K 1 and K 2] x-ray doublets revealed the films' micro-crystal sizes and

Water Desorption from Various Ferroelectric and Dipole Oriented Polymers

Mark Stewart, Michael Evans, Lillie Ghobrial, Gregory Maslak, Luis Rosa, Peter Dowben, and Carolina Ilie
SUNY Oswego

Herein we compare the water absorption / adsorption on three different polymer films: the ferroelectric co-polymer poly (vinylidene fluoride with trifluoroethylene) P(VDF-TrFE), the strongly dipole oriented polymer poly (methyl vinylidene cyanide) (PMVC) [1], and the dipole oriented poly (methyl methacrylate) (PMMA). We investigate the dipole-dipole interaction of the water molecule and the ferroelectric / dipole oriented

SESSION IVB. NUCLEAR AND PARTICLE PHYSICS

Design and Construction of a Compact 2 MeV Proton Cyclotron – "The Cyclotron

Siena's Muon Detector
Kristin Del Belso and Dr. John Cummings
Siena College

The purpose of this procedure is the creation of an apparatus that accurately determines the lifetime of a muon. Through the use of a scintillator, photomultiplier tube and CAMAC crate, connected to a computer program we are able to collect data over an extended period of time. This allows us to be able to graph the data and determine the average muon lifetime. This apparatus will be useful for future students in their attempts to understand more about particles such as muons and their lifetime.

Neutron-Induced Deuteron Breakup
Katrina Koehler and Prof. Mark Yuly
Houghton College

An experiment to measure the quasielastic d(n, np)n scattering cross-sections at intermediate incident neutron energies, ranging up to 800 MeV, was conducted by a collaboration of researchers from Houghton College, MIT, the University of Kentucky and Los Alamos National Laboratory at the Los Alamos Neutron Science Center (LANSCE). Scattered protons from deuteron breakup travel through a magnetic spectrometer, consisting of an initial thin plastic E scintillator, a set of drift chambers, two permanent magnets, another set of drift chambers and two rear plastic scintillators. An array of nine two-meter high plastic scintillators detects scattered neutrons. The np elastic scattering data collected in tandem with this experiment is being analyzed to determine normalization for the cross-section for the n-d breakup reaction.

SESSION IVC. EXPERIMENTAL TECHNIQUES

A Mutual Inductance Bridge for Electric and Magnetic Measurments

Todd Rutkowski, Dr. M. Z. Tahar, Dr. E. Monier, and Dr. H. T. Johnson-Steigelman
The College at Brockport

A mutual inductance bridge system is developed and used to preform measurements on various metal samples. Starting with Maxwell Equations the system is modeled and

LIST OF PARTICIPANTS

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