XXVIII

Annual

Rochester Symposium For Physics
(Astronomy & Optics) Students
SPS Zone 2 Regional Meeting
West Point

April 4, 2009

Department of Physics and Astronomy
University of Rochester
Rochester, NY 14627-0171

Cosponsored by:
National Office of the Society of Physics Students; University of Rochester; National Science Foundation (REU Program); Department of Energy; U.S. Military Academy West Point

Rochester, April 4, 2009

Dear Participants:

Welcome to the 28th 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. RSPS 2009 is held this year at West Point. This will continue our recent tradition to host RSPS at locations away from Rochester every third or fourth year.

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/RSPS2009.

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. In 2006, RSPS was held for the first time at a location other than Rochester.

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

For example: Stephen Thorndike, an REU undergraduate, working with Professor Alice Quillen in the summer of 2002, discovered a new planet. Their findings have been published in the Astrophysical Journal. Examples of awards won by REU students at Rochester include (1) Govind S. Krishnaswami who won the 1999 Apker Award, given by the APS for the best undergraduate research in the USA in Physics, for his work with Professor Sarada Rajeev in theoretical particle physics, (2) Grant Tremblay, Matthew Barczys and Kevin Flaherty won the Astronomical Society of New York (ANSY) Undergraduate Student Prize for a distinguished research paper in Astronomy in 2000, 2005, and 2006 respectively, and (3) Albert Torr-Jong Wang, who worked in condensed-matter physics with Professor Steve Teitel, and was one of the three Apker Award Finalist in 2001.

Your audience will include both students and faculty members and will provide you with the opportunity to address a knowledgeable and appreciative assembly of fellow researchers. Scientific research is an extraordinary activity. We certainly hope that many of you will decide to pursue careers that involve you intimately in mankind's greatest intellectual adventure, to comprehend nature. To quote Albert Einstein, "The eternal mystery of the world is its comprehensibility."

Frank Wolfs (Chair RSPS)
Department of Physics and Astronomy
University of Rochester

LIST OF SPEAKERS

NAME	TIME	LOCATION
Aikens, Kurt	2:45 pm	Bartlett Hall 211
Allen, George	8:45 am	Bartlett Hall 211
Ballard, Daniel	1:45 pm	Bartlett Hall 211
Coyle, Laura	9:00 am	Bartlett Hall 211
De Haas, Timothy	9:30 am	Bartlett Hall 211
Douglas, Scott	11:30 am	Bartlett Hall 211
Dove, Justin	9:15 am	Bartlett Hall 211
Gresh, Daniel	2:15 pm	Bartlett Hall 211
Haas, Daniel	10:00 am	Hallway outside Bartlett Hall 211
Haas, Daniel	2:00 pm	Bartlett Hall 211
Henderson, Kelly	2:30 pm	Bartlett Hall 211
Kajubi, Sendawula	10:00 am	Hallway outside Bartlett Hall 211
Lopez, Jose′	10:00 am	Hallway outside Bartlett Hall 211
Qi, Zhen	10:00 am	Hallway outside Bartlett Hall 211
Ramkhalawon, Roshita	10:00 am	Hallway outside Bartlett Hall 211
Rapson, Valerie	11:15 am	Bartlett Hall 211
Richter, Isaac	9.45 am	Bartlett Hall 211
Rivers, Christopher	10:30 am	Bartlett Hall 211
Robinson, Adi	1:30 pm	Bartlett Hall 211
Sendawula Kajubi	10:00 am	Hallway outside Bartlett Hall 211
Thompson, Stephen	10:00 am	Hallway outside Bartlett Hall 211
Townsend, Ryan	10:45 am	Bartlett Hall 211
Tullia, Matthew	11:00 am	Bartlett Hall 211

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

PROGRAM

8.00 AM – 8.30 AM: REGISTRATION (BARTLETT HALL 202)

8.30 AM: WELCOME (BARTLETT HALL 211)

COL Raymond Winkel, Professor and Department Head, Department of Physics, West Point.

Prof. Frank Wolfs, Department of Physics and Astronomy, University of Rochester.

8.45 AM – 10.00 AM: SESSION I. QUANTUM OPTICS AND ASTRONOMY (BARTLETT HALL 211)

8.45 am. Experimental Study of Radiation Trapping
George Allen, Siena College.

9.00 am. Interference of Single Photons in Laguerre-Gauss Modes
Laura Coyle, Colgate University.

9.15 am. Quantum Interference Using Two Independent Sources
Justin Dove and Anthony Kolodzinski, Adelphi University.

9.30 am. Preliminary Analysis of RR Lyrae Light Curves in the Globular Cluster M15
T. De Haas and A. Missert, University of Rochester. S. Kanbur, SUNY Oswego.

9.45 am. On the possible resonances of very high order modes in Cepheids
I. Richter, University of Rochester. E. Antonello, L. Speroni, Osservatorio Astronomico di Brera. S. Kanbur, SUNY Oswego.

10.00 AM – 10.30 AM. POSTER SESSION
(HALLWAY OUTSIDE BARTLETT HALL 211)

Design and Construction of a Small Electron Accelerator
Stephen Thomson and Mark Yuly, Houghton College.

The (n, 2p) Reaction as a Probe for the Pre-existing Nuclear Δ^{++} Component
Daniel Haas, Bethany Little, Steve Thomson, Steve Wallace, and Mark Yuly, Houghton College.

Study of the operational properties of the Capillary Plasma Electrode (CPE) discharges
Jose Lopez, David Jacome, and Wei-Dong Zhu, Saint Peter's College. Margaret Figus, Merck & Co., Inc. Kurt H. Becker, Polytechnic Institute of NYU.

Efficient Second Harmonic Generation (SHG) of Ti:sapphire Laser Using Non-Linear BBO Crystal
Roshita Ramkhalawon, University of Rochester, Kyle Taylor, University of Wisconsin-Stevens Point.

Jet Clustering Algorithms in CMS
Zhen Qi, University of Rochester.

The Designing and Testing of Infrared Detector Arrays
Sendawula Kajubi, University of Rochester.

10.30 AM – 11.45 AM: SESSION II. APPLIED AND BIOLOGICAL PHYSICS
(BARTLETT HALL 211)

10.30 am. Defeat of chemical and biological IEDs
Christopher Rivers, West Point.

10.45 am. High-Energy Laser Weapons
Daniel Glusko and Ryan Townsend, West Point.

11.00 am. Photodissociation of Supercritical Carbon Dioxide
Brandon Dotson and Matthew Tullia, West Point.

11.15 am. Analysis of an aerosol-based geo-engineering proposal
Valerie A. Rapson and Robert S. Knox, University of Rochester.

11.30 am. Metabolic Energy Optimization in the Squid Giant Axon
Scott Douglas, Patrick Crotty, Colgate University.

12.00 PM: LUNCH (BARTLETT HALL 209 + 210)

12.45 PM: TOUR

1.30 PM – 3.00 PM: SESSION III. INSTRUMENTATION (BARTLETT HALL 211)

1.30 pm. Modernizing the Mossbauer Experiment.
Adi Robinson, University of Rochester.

1.45 pm. Refurbishing a Scanning Transmission Electron Microscope
Dan Ballard and Brandon Hoffman, Houghton College.

2.00 pm. Characterizing the Performance of the Houghton College Cyclotron
Daniel Haas and Mark Yuly, Houghton College.

2.15 pm. Effect of Thresholds on Noise and Jet Energy in ECAL
Dan Gresh, University of Rochester.

2.30 pm. Observation of Fluxon Diffusion in a Josephson Junction Array
Kelly Henderson, Colgate University.

2.45 pm. Design and Construction of a High Vacuum Thin Film Evaporation Chamber
Kurt Aikens and Brandon Hoffman, Houghton College.

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SESSION I. QUANTUM OPTICS AND ASTRONOMY
CHAIR: PROF. ROSENBERRY, SIENA COLLEGE

8.45 am. Experimental Study of Radiation Trapping
George Allen, Department of Physics and Astronomy, Siena College.
Advisor: Prof. Mark Rosenberry, Department of Physics and Astronomy, Siena College.

Optical pumping is a method used to transfer angular momentum from a laser to an atom. Conversely, radiation trapping randomizes the atomic spin through the absorption of spontaneously emitted photons. We can study these effects by measuring changes in polarizations when low pressures of different buffer gases are introduced to a high-density vapor of rubidium. Based on similarities in their quenching cross sections, we expected to observe C_2H_6 behave like Ar in its quenching ability and C_2H_4 to be similar if not better than N_2 as a buffer gas. We have determined the rubidium polarizations of C_2H_4 and C_2H_6, for densities of rubidium from $1x10^{12}$ to $5x10^{12}$ cm^{-3} and have fit them to a model to extract their effect on radiation trapping. Results have shown C_2H_6 does not perform well as a buffer gas, only achieving polarization percentages below 15% for our range of pressure. C_2H_4, although not as efficient as N_2 as a buffer gas, did show moderately high polarization percentages at certain densities of rubidium.

9.00 am. Interference of Single Photons in Laguerre-Gauss Modes
Laura Coyle, Department of Physics and Astronomy, Colgate University.
Advisor: Prof. Kiko Galvez, Department of Physics and Astronomy, Colgate University.

Laguerre-Gauss modes are the higher order solutions of the paraxial wave equation in cylindrical coordinates. Collinear interference of zero and first order modes create unique interference patterns due to the azimuthal phase dependence of the first order mode. We aim to recreate these interference patterns using single photons and demonstrate that retarding the phase of one of these modes causes predictable rotation of the interference pattern. Current results suggest that single photons do carry all the information necessary to reconstruct the beam intensity profile and produce rotation of the interference pattern, thus confirming their global behavior as predicted by quantum mechanics.

9.15 am. Quantum Interference Using Two Independent Sources

Justin Dove and Anthony Kolodzinski, Department of Physics, Adelphi University.
Advisor: Prof. Sean J. Bentley, Department of Physics, Adelphi University.

Quantum mechanics has been mysterious for its entire life. To unravel some of its secrets, many physicists test its effects on optics, such as Pfleegor and Mandel who demonstrated temporal interference between two attenuated lasers. Our study explores the possibility of producing double-slit interference in a similar manner.
This experiment uses two lasers of equal wavelength and polarization, prepared such that at the double slit one is directed through one slit and the other through the other slit, with effectively no overlap. We configure our apparatus such that the pattern from either individual source will appear at the same location in the detection plane. The lasers are then attenuated greatly so we transmit only one photon at a time.
Classically, one would not expect interference, due to lack of coherence between the sources. We explore the possibility of quantum interference by trying to erase any information that distinguishes the sources. If we are successful, a superposition state generating identical results as from a single broad, coherent source may be achieved. Alternatively, if a distinguishable mixture is formed, no interference should result. Ultimately, this experiment will address questions of knowledge of a state versus reality of a state.

9.30 am. Preliminary Analysis of RR Lyrae Light Curves in the Globular Cluster M15

T. De Haas and A. Missert, Department of Physics and Astronomy, University of Rochester.
Advisor: Prof. S. Kanbur, Department of Physics, SUNY Oswego.

RR Lyraes are found mainly in globular clusters in the halos of spiral galaxies. Knowledge of their absolute magnitudes as a function of metallicity leads to constraints on the theory of galaxy formation. Thus it is important to study RR Lyraes in a range of environments. We present an initial analysis of the BVI light curves of RRab stars in the metal poor Oosterhoff II globular cluster M15. Using Fourier analysis, we present the resultant period-color relations at minimum and maximum light and find the relation at minimum light is flat, though there is a large scatter. This has implications for the possible use of such a relation to determine the effect of interstellar reddening.

9.45 am. On the possible resonances of very high order modes in Cepheids

I. Richter, Department of Physics and Astronomy, University of Rochester, E. Antonello and L. Speroni, Osservatorio Astronomico di Brera.
Advisor: Prof. S. Kanbur, Department of Physics, SUNY Oswego.

Research on resonances between pulsation modes in Cepheids in the past twenty years have permitted an understanding of the characteristics of Fourier parameters of the light and velocity curves. A general assumption here has been that resonances occur between a pulsationally unstable fundamental (or first overtone) radial mode and a pulsationally stable low order radial overtone. Some observational and theoretical model results discussed here suggest the presence of other possible effects due to resonances between the fundamental mode and much higher overtones.

POSTER SESSION

Design and Construction of a Small Electron Accelerator

Stephen Thomson, Department of Physics, Houghton College.
Advisor: Prof. Mark Yuly, Department of Physics, Houghton College.

The Houghton College electrostatic electron accelerator consists of a small Van de Graaff generator and an accelerator column made from alternating high-density polyethylene and aluminum rings to create a uniform electric field. The accelerator column is evacuated to about 10^{-6} torr by a rotary forepump and a diffusion pump. To produce the electrons, an electron gun made from a 3RP1A CRT is located in the high-voltage terminal. The electrodes of the electron gun require user-controlled voltages for the anode, focus and intensity grids. Since the gun is located in the HV terminal, a microcontroller and amplifier circuit was designed to produce the required voltages and communicate with the user via a non-conducting fiber optic RS232 link. The remote control system is being tested using a cathode ray tube.

The (n, 2p) Reaction as a Probe for the Pre-existing Nuclear Δ^{++} Component

Daniel Haas, Bethany Little, Steve Thomson, and Steve Wallace, Department of Physics, Houghton College.
Advisor: Prof. Mark Yuly, Department of Physics, Houghton College.

The ^{3}He(n, 2p)2n and ^{4}He(n, 2p)3n cross-sections are being measured as a means to explore the Δ^{++} component of the nuclear wave function. Scattered protons on beam right pass through a magnetic spectrometer which measures their momenta. The spectrometer consists of an initial thin ΔE scintillator, two drift chambers, two permanent magnets and two thin rear scintillators. On beam left, an array of thin horizontal ΔE scintillator strips in front of a thick vertical array of plastic scintillators detects scattered protons in coincidence with the magnetic spectrometer

Study of the operational properties of the Capillary Plasma Electrode (CPE) discharges

David Jacome, Department of Physics, Saint Peter's College. Margaret Figus, Merck & Co., Inc. (Rahway). Kurt H. Becker, Polytechnic Institute of NYU.
Advisors: Prof. Jose Lopez and Prof. Wei-Dong, Department of Physics, Saint Peter's College.

Various approaches have been pursued to create stable atmospheric pressure discharges by extending the lifetime of the diffuse phase of the discharge to hundreds of microseconds. Previous research showed that the stability of the diffuse mode is dependent on the frequency (in the kHz range), gas type power, mode of the excitation, and geometrical confinement. Some of the most promising approaches are based on the recognition of the arc formation in high-pressure plasmas can be avoided and stable high-pressure plasma can be generated and maintained when the plasma are spatially constricted to the dimensions of tens to hundreds of microns. The Capillary Plasma Electrode (CPE) discharge is stable to produce stable atmospheric pressure nonequilibrium plasma. The CPE is similar in design to the Barrier Electrode Discharge, but has perforated dielectrics. The configuration, aside from exhibiting a diffuse mode of operation, also exhibits the so-called "capillary jet" mode, in which the capillaries "turn on" and a bright plasma jet emerges from the capillaries. The capillary jets from adjacent capillaries overlap so that the discharge appears uniform when the electrode contains an array of holes. There appears to be a threshold frequency for the capillary jet formation, which is strongly dependent on the L/D ratio of the capillaries, where D is diameter of the capillary and L its length. However, the operating principles and basic properties of this behavior are not well understood. The current work explores these modes of operations of the CPE by characterizing the electrical and optical emission properties of this discharge by examining a multi-hole discharge as well as a single capillary discharge reactor.

Efficient Second Harmonic Generation (SHG) of Ti:sapphire Laser Using Non-Linear BBO Crystal

Roshita Ramkhalawon, Department of Physics and Astronomy, University of Rochester.
Kyle Taylor, Department of Physics and Astronomy, University of Wisconsin-Stevens Point.
Advisor: Prof. Nicholas Bigelow, Department of Physics and Astronomy, University of Rochester.

We describe the set up of a bow-tie optical resonator, which is used to produce efficient second harmonic generation (SHG) light. We obtain 426 nm light by frequency doubling a 852 nm Ti:sapphire laser using a non-linear BBO crystal. Supported by NSF.

Jet Clustering Algorithms in CMS

Zhen Qi, Department of Physics and Astronomy, University of Rochester.
Advisors: Prof. Regina Demina, Department of Physics and Astronomy, University of Rochester, and Dr. Marek Zielinski, Fermi National Accelerator Laboratory.

The LHC is a proton-proton collider designed to search for new physics at the TeV scale. Many processes of interest contain partons in the final state which are not directly observable but transform into stable particles through hadronization. The CMS detector is one of several detectors built at the LHC with tracking and calorimeter systems that can detect these hadrons. The implementation of jet clustering algorithms allows the reconstruction of the hadronic energy as a jet. Proper jet reconstruction is designed to yield a good description of the parton-level hard interaction and also useful for beyond the standard model searches. An introduction of the SISCone algorithm is designed to account for infrared and collinear issues found in other algorithms. Performance tests using QCD dijet Monte Carlo events reveal SISCone has equal performance in comparison with current algorithms. Performance studies allow the proposal of SISCone to be the default cone based algorithm for CMS.

The Designing and Testing of Infrared Detector Arrays

Sendawula Kajubi, Department of Physics and Astronomy, University of Rochester.
Advisor: Craig McMurtry, Department of Physics and Astronomy, University of Rochester.

Assistance was provided to Mr. McMurtry and his graduate student David Rhodes with their infrared detector array research. This included detector array testing (e.g. measure quantum efficiency or dark current) processing data from detector array testing, preparation for testing new devices (e.g. design electronic circuitry, electronic component soldering, cable wiring, mechanic mount design and machining) and filling cryogens in the infrared detector array dewars. Work was begun on designing a connector in a computer schematic.

SESSION II. APPLIED AND BIOLOGICAL PHYSICS
CHAIR: PROF. BODEK, UNIVERSITY OF ROCHESTER

10.30 am. Defeat of chemical and biological IEDs
Christopher Rivers, Department of Physics, West Point.
Advisor: LTC(P) Bryndol Sones, Department of Physics, West Point.

Project Mission Statement: Defeat chemical and biological IEDs by simultaneously interdicting delivery mechanisms and neutralizing the chemical and biological agents.
Desired Performance Goals:
Time of emplacement: less then 10 minutes.
Target Damage: inoperable upon execution of device.
Chemical/Biological Agent: Rendered safe in one hour.
Objective: The aim of the project is to use the Sandia Decon foam projected from a shaped charge to disable a chemical and biological IED as well as neutralize it. The device will be a quick reaction option to finding a chemical or biological device.

10.45 am. High-Energy Laser Weapons
Daniel Glusko and Ryan Townsend, Department of Physics, West Point.
Advisor: MAJ John DeLong and MAJ Walter Zacherl, Department of Physics, West Point.

We explored the feasibility of and requirements on a high-energy laser (HEL) weapons system used to detonate incoming 82 mm mortars. We considered the minimum irradiance needed to neutralize the round and explore what laser parameters are necessary to achieve this threshold. Beginning with relevant, contemporary values for power, wavelength, jitter, and beam quality, we use perturbations to see which parameters are most effective. We also assessed the impact of varied atmospheric conditions, to include those characteristics of a desert environment, a polluted urban environment in the mid latitude north, and a summer tropical climate. This is important as the United States military develops directed energy weapon systems to protect soldiers and assets around the world.

11.00 am. Photodissociation of Supercritical Carbon Dioxide

Brandon Dotson and Matthew Tullia, Department of Physics, West Point.
Advisor: Thomas Spudich, Department of Chemistry and Life Science, West Point.

Astronauts and sailors deployed in submarines require atmospheric scrubbers for their survival. An optical solution may minimize waste and increase efficiency for both missions. The goal of this research is to generate molecular oxygen from the photochemical breakdown of carbon dioxide in its supercritical state. While this process has been conventionally performed at lower temperatures and pressures with smaller yields, we posit that the increased density resulting from our processed use of supercritical carbon dioxide will not only allow for higher yields, but will also better facilitate physical separation of the photodissociated products based on relative solubilities in this acting supercritical solvent.

11.15 am. Analysis of an aerosol-based geo-engineering proposal

Valerie A. Rapson, Department of Physics and Astronomy, University of Rochester.
Advisor: Prof. Robert S. Knox, Department of Physics and Astronomy, University of Rochester.

By modeling a simulated series of volcanic eruptions that place large amounts of aerosols into the stratosphere, T. Wigley has made a quantitative estimate of the influence that aerosol geo-engineering would have on the overall temperature of the surface of the planet. We are able to simulate these results by linearly superimposing a four-box energy balance model solution upon itself, a solution that includes atmosphere-ocean coupling and that accurately models the eruption data from Mount Pinatubo. Negative surface feedbacks are needed to accurately handle the Pinatubo eruption. For a 1,000-year series of annual eruptions, we find a maximum temperature drop of -1.05°C at the surface, in disagreement with the Wigley model, which predicts -5.25°C. We believe that that model cannot simultaneously make such a large prediction and agree with the short-term observational data.

11.30 am. Metabolic Energy Optimization in the Squid Giant Axon

Scott Douglas, Department of Physics and Astronomy, Colgate University.
Advisor: Prof. Patrick Crotty, Department of Physics and Astronomy, Colgate University.

Action potential transmission in the squid giant axon can be successfully modeled using the model formulated by Hodgkin and Huxley in 1975 (the HH model). Each parameter in the HH model corresponds to a set of interacting biophysical properties of the neuron; by adjusting the parameters of the HH model and measuring the energy efficiencies in simulated neurons, we discover what parameters are optimized in real neurons and infer that evolution selected neurons to have these optimum parameters. Exploration of sodium/potassium equilibrium strength space yields a potential energy efficiency maximum near biological values.

SESSION III. INSTRUMENTATION
CHAIR: PROF. YULY, HOUGHTON COLLEGE

1.30 pm. Modernizing the Mossbauer Experiment.
Adi Robinson, Department of Physics and Astronomy, University of Rochester.
Advisor: Prof. Frank Wolfs, Department of Physics and Astronomy, University of Rochester.

In the 1950's there were numerous attempts to observe gamma-ray resonance in gases. Most of the attempts failed, due to energy loss to recoil. In 1957, Rudolf Mössbauer was able to observe resonance in solid iridium, which raised the question of why gamma-ray resonance was possible in solids, but not in gases. Mössbauer proposed that for the case of atoms bound in a solid, under certain circumstances, a fraction of the nuclear events could occur essentially without recoil. He attributed the observed resonance to this recoil-free fraction of nuclear events. Mössbauers' discovery was rewarded with the Nobel Prize in Physics in 1961. As part of the creation of the Advanced Nuclear Science Education Laboratory at the University of Rochester, we have developed a modern version of the classic Mössbauer experiment. Our experiment is based on the classic skeleton of the original experiment in which a radioactive source vibrates on a loudspeaker, but the electronics is replaced with state-of-the-art digital signal processing technology. A digital processing system, designed by Wojtek Skulski, is used to process the data from the ionization counter and the speaker system.

1.45 pm. Refurbishing a Scanning Transmission Electron Microscope
Dan Ballard and Brandon Hoffman, Department of Physics, Houghton College.
Advisor: Prof. Mark Yuly, Department of Physics, Houghton College.

A JEOL 100CX Scanning Transmission Electron Microscope (STEM) is being refurbished for the purpose of exploring microstructures of thin metal films. A number of issues involving the vacuum system have been addressed. Modification of the electronics has allowed for more efficient troubleshooting techniques.

2.00 pm. Characterizing the Performance of the Houghton College Cyclotron
Daniel Haas, Department of Physics, Houghton College.
Advisor: Prof. Mark Yuly, Department of Physics, Houghton College.

The Houghton College Cyclotron briefly accelerated hydrogen ions for the first time in 2007 before a discharge from the filament to the chamber wall damaged the glass insulation and "dee" electrode. To prevent this from happening again, a new vacuum chamber and 15 cm diameter "dee" electrode were designed and constructed. Once placed between the poles of a 1.1 T electromagnet, low-pressure gas is released into the chamber where a filament, through electron collisions, ionizes the gas. The ions are accelerated by an alternating RF electric field and are forced to travel in a spiral path by the electromagnet. The new chamber and "dee" has successfully accelerated protons, molecular hydrogen and helium. Eventually, the $d(d,n)^3He$ reaction will be used to produce neutrons for use in small-scale nuclear experiments.

2.15 pm. Effect of Thresholds on Noise and Jet Energy in ECAL
Dan Gresh, Department of Physics and Astronomy, University of Rochester.
Advisor: Prof. Regina Demina, Department of Physics and Astronomy, University of Rochester.

Thresholds on the Electromagnetic Calorimeter (ECAL) in the Compact Muon Solenoid (CMS) detector are placed to minimize noise in the data sample while retaining as much real energy as possible. This study was conducted to examine the effect of lowering the thresholds on detector noise and particle jet energy. By analyzing the average noise in a cone size or radius R = 0.5 and by examining jet energy and jet p_T, we were able to propose a new threshold scheme with lower thresholds than the default scheme for the different regions of ECAL to gain a considerable amount of jet energy and jet p_T while introducing minimal noise into the data sample.

2.30 pm. Observation of Fluxon Diffusion in a Josephson Junction Array
Kelly Henderson, Department of Physics and Astronomy, Colgate University.
Advisor: Prof. Ken Segall, Department of Physics and Astronomy, Colgate University.

We study fluxon dynamics in Josephson junction arrays. We are working to observe fluxon diffusion with the aid of a lock-in amplifier in order to extract the nano-scale device signals from an extremely noisy environment. Using the lock-in amplifier as a slope detector we were able to reproduce the features in the IV curve of a SQUID. From these data we were able to estimate the uncertainty in a lock-in signal measurement and the minimum measurable resistance.

2.45 pm. Design and Construction of a High Vacuum Thin Film Evaporation Chamber
Kurt Aikens and Brandon Hoffman, Department of Physics, Houghton College.
Advisor: Prof. Mark Yuly, Department of Physics, Houghton College.

A high vacuum deposition chamber is being built at Houghton College for the production and study of thin metal films. Up to four electron-beam heated crucibles will evaporate metal atoms, which will then adsorb onto a silicon substrate, forming the film. Evaporation rates may be monitored via crucible temperatures or direct measurement of the ionized flux. The chamber will feature a computer-controlled shield enabling the deposition of samples with varying thickness gradients and an ion gun for substrate cleaning and ion beam assisted deposition (IBAD).

LIST OF PARTICIPANTS

Name		Affliation
Kurt Aikens	Undergrad	Houghton College
George Allen	Undergrad	Siena College
Thomas Anderson	Undergrad	West Point
Daniel Ballard	Undergrad	Houghton College
Kapil Bastola	Undergrad	Saint Peter's College
Jamie Benitez	Undergrad	Adelphi University
Sean Bentley	Faculty	Adelphi University
Martin Berke	Undergrad	State University of New York at Oswego
Arie Bodek	Faculty	University of Rochester
Raymond Carlson	Undergrad	West Point
Nick Connelly	Undergrad	Siena College
Elizabeth Connors	Undergrad	West Point
Laura Coyle	Undergrad	Colgate University
Christopher Cross	Faculty	West Point
John Cummings	Faculty	Siena College
Timothy De Haas	Undergrad	University of Rochester
John DeLong	Faculty	West Point
John DeMatteo	Undergrad	Siena College
Dhruvkumar Desai	Undergrad	West Point
Brandon Dotson	Undergrad	West Point
Scott Douglas	Undergrad	Colgate University
Justin Dove	Undergrad	Adelphi University
Thomas Dunne	Undergrad	West Point
Paula Fekete	Staff	West Point
Janet Fogg	Staff	University of Rochester
Sean Gahagan	Undergrad	West Point
Kiko Galvez	Faculty	Colgate University
Daniel Gluszko	Undergrad	West Point
Daniel Gresh	Undergrad	University of Rochester
Lois Gresh	Staff	University of Rochester
Daniel Haas	Undergrad	Houghton College
Lee Harrell	Faculty	West Point
Kelly Henderson	Undergrad	Colgate University
Brandon Hoffman	Faculty	Houghton College
Adrian Ieta	Undergrad	State University of New York at Oswego
David Jacome	Undergrad	Saint Peter's College
Sendwula Kajubi	Undergrad	University of Rochester
Sashi Kanbar	Faculty	State University of New York at Oswego
Andrew Knisely	Undergrad	West Point
Patrick Koch	Undergrad	Adelphi University
Katrina Koehler	Undergrad	Houghton College
Anthony Kolodzinski	Undergrad	Adelphi University
Victor Kucherov	Undergrad	University of Rochester

Thomas Lainis	Faculty	West Point
Wes Laurion	Undergrad	State University of New York at Oswego
Jonathan Lent	Undergrad	Houghton College
Edwin Li	Undergrad	Adelphi University
Phillip Lloyd	Undergrad	Houghton College
Ronald Maldonado	Undergrad	Saint Peter's College
Tony Maldonado	Undergrad	Saint Peter's College
Anne Nagy	Undergrad	West Point
Raymond Nelson	Faculty	West Point
Sylvia Nicholis	Undergrad	Adelphi University
Erin O'Malley	Undergrad	Siena College
David Penskar	Undergrad	West Point
Michael Pfenning	Faculty	West Point
Zhen Qi	Undergrad	University of Rochester
Trevor Quirk	Undergrad	Siena College
Roshita Ramkhalawon	Undergrad	University of Rochester
Valerie Rapson	Undergrad	University of Rochester
Isaac Richter	Undergrad	University of Rochester
Christopher Rivers	Undergrad	West Point
Adi Robinson	Undergrad	University of Rochester
Mark Rosenberry	Faculty	Siena College
Adam Silvernail	Undergrad	Houghton College
Bryndol Sones	Faculty	West Point
Caroline Spencer	Undergrad	West Point
Sam Stedman	Undergrad	West Point
Lisa Taylor	Undergrad	West Point
Stephen Thomson	Undergrad	Houghton College
Linday Timian	Undergrad	Houghton College
Ryan Townsend	Undergrad	West Point
Matthew Tullia	Undergrad	West Point
Kyle Turck	Undergrad	Siena College
Lee White	Undergrad	West Point
Raymond Winkel	Faculty	West Point
Frank Wolfs	Faculty	University of Rochester
Michael Wood	Faculty	Canisius College
Mark Yuly	Faculty	Houghton College
Walter Zacherl	Faculty	West Point
Michael Zapas	Undergrad	Adelphi University
Rebecca Zheng	Undergrad	Adelphi University
Dale Zych	Faculty	State University of New York at Oswego