XXXVIII

Annual

Rochester Symposium for Physics (Astronomy & Optics) Students

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

Cosponsored by:
National Office of the Society of Physics Students; Department of Physics and Astronomy, University of Rochester; National Science Foundation (REU Program); Department of Energy

University of Rochester, March 30, 2019

Dear Participants:

Welcome to the 38th 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

distributed to the participants. The information is also available on line at:
http://www.pas.rochester.edu/news-events/rsps/2019/index.html

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

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: https://www.pas.rochester.edu/undergraduate/reu/index.html

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

LIST OF SPEAKERS

PRESENTER	TIME

PRESENTER	TIME	ROOM
YUE WANG	11:45 AM	B&L 109
FAITH WILLIAMS	10:30 AM	B&L 208
MATTHEW WITHEY	9:45 AM	B&L 106
FATIMA ZAIDOUNI	10:00 AM	B&L 106
SAIYANG ZHANG	9:00 AM	B&L 106

XXXVIII – ROCHESTER SYMPOSIUM FOR PHYSICS (ASTRONOMY AND OPTICS) STUDENTS
SPS ZONE 2 REGIONAL MEETING

PROGRAM

8:00 AM – 8:45 AM: REGISTRATION AND POSTER SETUP (B&L LOBBY)

8:45 AM: WELCOME: PROF. FRANK WOLFS, UNIVERSITY OF ROCHESTER (B&L 109)

9:00 AM – 10:30

9:00 AM – 10:30 AM: SESSION IB. ASTRONOMY AND ASTROPHYSICS (B&L 106)

SESSION CHAIR: PROF. ZACHARY ROBINSON, THE COLLEGE AT BROCKPORT

9:00 AM	**Multi-scatter Capture of Super Massive Dark Matter by the First Stars** Saiyang Zhang, Colgate University
9:15 AM	**Observable Relics of the Simple Harmonic Universe** Dr. Bart Horn and Peter Gilmartin, Manhattan College
9:30 AM	**Moon Formation** Diana Bateman and Florence LaPlaca, SUNY Fredonia
9:45 AM	**CaII Absorbers in Quasar Spectra** Matthew Withey, The College at Brockport, State University of New York
10:00 AM	**Cosmic voids in galaxy redshift surveys** Fatima Zaidouni, University of Rochester
10:15 AM	**Simulations of Precession Damping for Homogeneous Viscoelastic Rotators** Alice C. Quillen, Katelyn J. Wagner, Paul Sanchez, University of Rochester

10:30AM – 11:00 AM: SESSION II. POSTER SESSION (B&L 208)

11:00 AM – 12:00 PM: SESSION IIIB. ASTRONOMY & ASTROPHYSICS/BIOLOGICAL PHYSICS/INSTRUMENTATION & EXPERIMENTAL TECHNIQUES/ NUCLEAR & PARTICLE PHYSICS (B&L 106)

1:30 PM – 2:45 PM: SESSION IVB. QUANTUM OPTICS/CONDENSED MATTER PHYSICS/ INSTRUMENTATION & EXPERIMENTAL TECHNIQUES (B&L 106)

SESSION CHAIR: PROF. CANDICE FAZAR, ROBERTS WESLEYAN COLLEGE

2:00 PM **Ito or Bayesian? An Investigation of Quantum Trajectory Models and Their Optimal Paths**
Kurt Cylke, University of Rochester

2:15 PM **Growth and Characterization of a New Family of Frustrated Ferromagnets**
David Mayrhofer, Alexandra Cote, Dalmau Reig-i-Pleissis, Gregory MacDougall, University of Rochester, University of Illinois, NSF

2:30 PM **Utilizing Neural Networks for Faster Optical Alignment**
John Piotrowski, University of Rochester, co-op at MIT Lincoln Laboratory

SESSION IA. INSTRUMENTATION & EXPERIMENTAL TECHNIQUES

Construction of a Low-Speed Closed-Return Wind Tunnel
Jonathan G. Durbin, Houghton College

A small-scale, low-speed, closed-return wind tunnel is being designed and constructed at Houghton College to provide opportunities for new research and further education. Empirical correlations were used by previous students to generate a preliminary design based on various constraints. Examples of such constraints include the size of the room, the speed within the test section, and the desired flow quality. The wind tunnel will be 4.72 meters long, have an area ratio of 4.99 between the nozzle and test section, a maximum test section speed of 44.7 m/s (100 mph), and one side of the wind tunnel will be made almost entirely out of Plexiglass. The wind tunnel will also have a maximum Reynolds number per meter of $3\sharp\Delta\ 10^6$ (Reynolds number per foot of $9\sharp\Delta\ 10^6$). In this presentation, specific attention is given to one of the diffusers and two of the corners. Additional details for the other components of the wind tunnel will be presented and future work discussed.

3D Laser Object Scanner
Nico Carello, Siena College

Calibrating Three Axes Accelerometer for Alzheimer's Research
Jada Hawkins-Hill, Dr. Matthew Bellis, Siena College

Smart devices and similar equipment are steadily increasing in popularity in medical fields because of their compactness, inexpensiveness, and wide range of uses. However, if these devices are not calibrated correctly, then the data collected is of no use. This experiment utilizes an Arduino ADXL335 accelerometer to record a person's acceleration in the x-, y-, and z-axes in the hopes of diagnosing early onset Alzheimer's. There is a special focus specifically on calibrating the accelerometer correctly by simulating an accelerometer calibration experiment done by a University of Iowa graduate student for his Honors thesis; with a properly calibrated system, the device will be able to report accurate accelerations for each axis and help with understanding how these accelerations can distinguish between various gaits in order to apply it to Alzheimer's research.

Is it Worth Chasing the Sunset?
Stefano G. Mainella, Siena College

It is quite evident that solar technology is a useful tool to obtain energy naturally over and over again. The problem is, however, that some geographical regions are more optimal for this implementation than others. The broad purpose of this research project is to see whether or not it is worth it to use mobile solar technology in a place like Upstate New York in the winter. I compare the usage of a stationary solar panel to a mobile solar panel. Through data analytics, I can compare the power drawn from the stationary panel to the net power of the mobile panel and the power required to have it follow the suns path.

Power Consumption for Raspberry Pi Nature Cam
Jacqueline Van Slycke, Siena College

A current collaborative project at Siena College is the design and implementation of a low cost DIY nature trail camera. The complete kit uses a Raspberry Pi with accompanying camera, temperature, humidity, lux, and pressure sensors, encased in a 3D printed waterproof case. With varying camera capabilities, several sensors, and different models of the Raspberry Pi in use, it is vital to understand power consumption values of the Raspberry Pi at different levels of operation. Using an Adafruit electric energy tester, the different standards were measured and analyzed. This data will allow for the wisest decisions to be made moving forward with distribution of the trail camera in urban locations throughout Albany.

Effect Of Solar Tracking On Power Generated By A Solar Panel
Matthew Merchant, The College at Brockport

There are many aspects of solar panels that can be improved. Currently, commercial silicon solar panels are only about 14% efficient. Research into improving this via new materials is important, but there are additional improvements that would have an immediate effect to the current systems, and those of the future. One of these is a solar tracking stage for the panels. Solar panels absorb the largest amount of solar light when they are pointed directly at the sun. For this project, I designed and 3-d printed a motorized stage to study the effect of varying the angle between a solar panel and the sun. I then wrote a L(a)4d10 (h0 (w)nh0)/ti. (h)-4 (av)3 n(h)-40.001 Tc 1(h)-4 (aP2( )10

CaII Absorbers in Quasar Spectra
Matthew Withey, The College at Brockport State University of New York

CaII

SESSION II. POSTER SESSION

Outflows and star-formation feedback from young stellar objects in NGC1333
Natalie Allen, Edwin Bergin, Adam Frank, Thomas Gautier, Joel Green, S. Megeath, Gary

Quantum Entanglement in Medical Diagnosis
Faith Williams, Colgate University

When the light goes through brain tissue it scatters due to interactions between the

Effects of Deposition Temperature on Stacking Fault Density and Texture Transformation in Thin Silver Films

Sarah Olandt, Daniil Zhuravlev, Brandon Hoffman, Houghton College, Cornell University

X-Ray Diffraction analysis was used to measure stacking fault density and texture transformation in silver films produced via electron-beam evaporation. Films were deposited onto heated substrate to obtain samples with different deposition temperatures. Texture and fault density of samples was measured in as-deposited states to reveal fewer faults in films deposited at higher temperatures. Analysis of

Self Calibration of Isolated Star Formation

SESSION IIIA. NUCLEAR AND PARTICLE PHYSICS

Measurement Of Low-Energy Nuclear Cross Sections Using Inertial Confinement Fusion

Katelyn Cook, Houghton College

Inertial confinement fusion is a tool that can be used for fundamental nuclear science measurements. In the method under consideration, nuclear reaction products in the expanding atomic gas following the target implosion will be collected and trapped using a turbomolecular pump. The beta-decay of reaction products with half-lives ranging between 20 ms and 10 s will be measured in-situ using a phoswich detector system milliseconds after the implosion. Several previously unmeasured low-energy deuterium and tritium radiative capture and stripping cross sections could be measured using this technique. To study the feasibility, several small scale experiments are being carried out at Houghton College and SUNY Geneseo to

A Possible Solution To A Prevalent Electron Background In Liquid Xenon Dark Matter Detectors

Leesa Brown, Rafael Lang, Abigail Kopec, University Of Rochester, Purdue University

Electron trains are a major background in liquid xenon dark matter experiments. These are multiple S2 signals that occur over a millisecond time scale and are not correlated with S1s. As normally t

SESSION IIIB. ASTRONOMY & ASTROPHYSICS/BIOLOGICAL PHYSICS/ EDUCATIONAL PHYSICS/NUCLEAR AND PARTICLE PHYSICS

Observing Near-Earth Asteroids With The Breyo Observatory
Tyler King, Siena College

Observing Near Earth Asteroids is important because if we can detect and track them, then we can watch out for potential collisions with Earth. Observations can also tell us about their composition and rotation periods. Current surveys of Near Earth Asteroids are discovering and confirming NEA's, but there are many asteroids that still need to be confirmed and characterized. I am currently working on an effective method of data reduction for CCD images taken with the Breyo Observatory. The observatory features a brand new 0.7 meter telescope from the Sherman Fairchild Foundation named after John J. Breyo and his wife Marilyn Breyo. The Breyo Observatory is still new so one of the challenges is to figure out how best to operate it. Some observations of asteroids have already been taken with different filters, red, green, and blue. The goals for this project are to work on obtaining a light curve and aperture photometry of several near earth asteroids.

SESSION IVA. OTHER

Transition State Testing on Formic Acid
Jesus Lopez, Siena College

Our goal is to model Tandem Mass Spectrometry (TMS) computationally using a combination of molecular dynamics simulations, RRKM theory, and kinetic Monte Carlo techniques. The technique has been published in collaboration with research groups in Spain; however, the current implementation is difficult to modify and inconsistent. Therefore, this summer we have re-developed, from the ground up, the code that will automatically find transition states (TSs) as a first step towards this goal. Starting from just the cartesian coordinates of a molecule, the code automatically locates and stores the TS and minima for a the chosen chemical system. We tested our code using Formic Acid (FA). All relevant information is stored in a Sqlite3 database making it easily portable and retrievable.

Combining Databases
Meghan McDonough, Siena College

The National Ecological Observatory Network (NEON) is a continental-scale ecological observation network which collects open environmental data from field sites across the United States Unfortunately, NEON sites are primarily located in pristine or remote areas, so NEON lacks coverage of more urbanized or suburban areas. The Ecological Research as Education Network (EREN) is a network of faculty at primarily Undergraduate Institutions (PUIs) that have several collaborative research projects EREN data is also collected at a continental-scale, but most of the college campuses are located in suburban or rural sites. EREN researchers are interested in broadening the utility of these data by combining Permanent Forest Plot (PFPP) data (collected at EREN sites) with Woody and Herbaceous data (collected at NEON sites). Once these datasets are combined, relationships between vegetation data and other environmental variables (e.g., soils, elevation) collected across the sites can be explored.

A "Shiny" Monte Carlo optimization of datasets with missing entries
Thomas Becker, Siena College

SESSION IVB. INSTRUMENTATION/ EXPERIMENTAL TECHNIQUES

Ito

Ryan Mikulec	Undergraduate Student	Siena College
Benjamin Nussbaum	Undergraduate Student	University of Rochester
Sarah Olandt	Undergraduate Student	Houghton College
Susanna Phillips	Undergraduate Student	Roberts Wesleyan College
John Piotrowski	Undergraduate Student	University of Rochester
Tim Powers	Undergraduate Student	Houghton College
Yingsi Qin	Undergraduate Student	Colgate University
Steven Raymond	Undergraduate Student	Houghton College
Sarah Reese	Undergraduate Student	Manhattan College
Adina Ripin	Undergraduate Student	University of Rochester
Zachary Robinson	Faculty	The College at Brockport
Zachary Shumaker	Undergraduate Student	SUNY Fredonia
Lauren Stevens	Undergraduate Student	Siena College
Shannon Sweet	Undergraduate Student	Siena College
Grant Swinehart	Undergraduate Student	Houghton College
Hannah Ullberg	Undergraduate Student	University of Wisconsin - Whitewater
Jacqueline Van Slycke	Undergraduate Student	Siena College
Elijah Velazquez	Undergraduate Student	Roberts Wesleyan College
Graziano Vernizzi	Faculty	Siena College
Lysa Wade	Staff	University of Rochester
Katelyn Wagner	Undergraduate Student	Roberts Wesleyan College
Yue Wang	Undergraduate Student	University of Rochester
Faith Williams	Undergraduate Student	Colgate University
Matthew Withey	Undergraduate Student	The College at Brockport
Frank Wolfs	Faculty	University of Rochester
Mark Yuly	Faculty	Houghton College
Fatima Zaidouni	Undergraduate Student	University of Rochester
Nathaniel Zedomi	Undergraduate Student	Houghton College
Saiyang Zhang	Undergraduate Student	Colgate University