

University of Rochester

Summer 2010 undergraduate research in Physics, Optics, and Astronomy

(Including a partial list of Journal articles and Conference Proceedings co-authored by the REU students, updated Dec. 17, 2011)

1. Steven Bandes, class of '12 at the University of Rochester, worked with Prof. Yonathan Shapir using mean first passage time methods to study diffusion on a random one-dimensional lattice with quenched asymmetric persistence probabilities.

1. Anomalous diffusion of random walkers on a disordered lattice with quenched persistence (RSPS 2011) Steven Bandes and Professor Yonathan Shapir University of Rochester

2. Matthew Bourque, class of '11 at Florida Institute of Technology, worked with Prof. Eric Mamajek and Dr. Eric Bubar in measuring the equivalent widths of absorption lines in high resolution stellar spectra of low mass F, G, and K stars in the nearest star forming complex (Scorpius-Centaurus) in order to derive their metallicities. He plans on applying to graduate school in physics.()

1. E.J. Bubar, M.J. Pecaut, E.E. Mamajek, **M. Bourque** and M.R. Meyer, "Spectroscopic and Photometric Parameter Effects in Young Stars: Sco-Cen", *Astrophysical J.*, p. , vol. , (2011). in preparation,

3. Greg Bentsen, class of '11 at the University of Rochester, worked with Prof. Sarada Rajeev on the single-impurity Anderson model for the spin-screening of magnetic impurities in a metal, as a toy model for non-perturbative renormalization in gauge theories. He plans to apply to graduate school in theoretical physics.

1. The Kondo Problem: A Toy Model for Renormalization (RSPS 2011) Gregory Bentsen and Sarada Rajeev University of Rochester

4. David Brown, class of '12 at University of Rochester, worked with Prof. James Zavislan. He designed, built, and calibrated a clinical instrument that will aid in understanding the lipid layer of the tear film, and its influence on Dry Eye Syndrome. He plans on graduate school for biomedical engineering.

5. Harry Chung, class of '11 at Bates College, worked with Dr. Howard Budd on electronics and the detector for test beam, a miniature version of the MINERvA project at Fermilab, to understand and monitor their behaviors with respect to various experimental conditions. He plans on applying to graduate school in physics/astrophysics.

6. Daniel deLahunta, class of '11 at University of Rochester, worked with Prof. Mathews Jacob on analyzing and displaying MR spectroscopy images of the human brain to determine the extent of a brain tumor more thoroughly than water based MRI images. He plans on applying to medical school.

1. MR Spectroscopic Imaging with MIDAS and Matlab (RSPS 2011) Daniel deLahunta and Jacob Mathews University of Rochester

7. Miles Dotson, class of '11 at the University of Miami, FL, worked with Prof. Mark Bocko on programmed manipulation of the modes of drum membranes for tone creation, implemented through a musical expression application for the mobile iOS 4 software for the iPhone and iPad. He plans on applying to graduate school in electrical/computer engineering.

8. Jamie Dougherty, class of '11 at the University of Rochester, worked with Prof. Alice Quillen analyzing the spiral structure evolution and resonance patterns found in a galactic simulation. She plans to apply for research positions or jobs related to astronomy or physics upon graduation.

[1.2011MNRAS.417..762Q](#) , [Quillen, Alice C.](#); [Dougherty, Jamie](#); [Bagley, Micaela B.](#); [Minchev, Ivan](#); [Comparetta, Justin](#) , Structure in phase space associated with spiral and bar density waves in an N-body hybrid galactic disc.

Monthly Notices of the Royal Astronomical Society, Volume 417, Issue 1, pp. 762-784. , 10/2011

9. Dale Fox, class of '13 at Northwestern University, worked with Bob Bradford and Howard Budd on light distribution of photo fibers used in Minerva neutrino experiment. He plans on applying to teach for America and graduate school in physics.

10. Josh Geller, class of '11 at the University of Rochester, studied with Prof. Joe Eberly to develop an entanglement measure for three- and four-qubit states by considering patterns of phase symmetry. He plans to apply to graduate school in physics. ()

1. **Measuring Entanglement in Multi-Qubit Systems** (RSPS 2010) Joshua S. Geller University of Rochester

2.. **Search for an Entanglement Measure for N-Qubit States via Phase Symmetry** (RSPS 2011) Joshua S. Geller University of Rochester

3. Josh Geller's report (Action, Camera, Light!) on the Optical Society of America meeting posted on website for the Student Perspectives on Physics Meetings of the American Physical Society

4. Josh Geller, presentation the March Meeting of the American Physical Society in Dallas, Texas (2011) titled "Search of an Entanglement Measure for N-Qubit States via Phase Symmetry".

5. Josh Geller, Abstract, published in Bulletin of March Meeting of the American Physical Society in Dallas, Texas (2011) "Search of an Entanglement Measure for N-Qubit States via Phase Symmetry"

6. Josh Geller's presentation at the National Conference on Undergraduate Research in Ithaca, NY in April 2011.

11. Daniel Gonnella, class of '11 at Clarkson University, worked with Prof. John Howell to build a frequency stable interference filter external cavity diode laser. He plans to apply to graduate school in physics. ()

12. Sachiko Graber, class of '12 at Grinnell College, worked with Prof. Yongli Gao to study the effects of various surface treatments on the electronic energy levels of indium tin oxide substrates. She plans to apply to graduate school in physics.

13. Dan Gresh, class of '11 at the University of Rochester, designed and implemented a timing control system for use in a Bose-Einstein Condensate (BEC) experiment for Professor Nicholas Bigelow. He plans on applying to graduate school in physics. ()

1. *Implementing a Semantic Web Knowledge Database for Scientific Control and Diagnostic Systems (presented at RSPS 2007)* - Daniel Gresh and Prof. Richard Kidder, Laboratory for Laser Energetics, University of Rochester
2. **Effect of Thresholds on Noise and Jet Energy in ECAL (presented at RSPS 2009), Daniel Gresh and Prof. Regina Demina (Physics Dept. U of R).**
3. Design and Implementation of a Timing Control System for use in a Bose-Einstein Condensate (BEC) Experiment (**RSPS 2010**) Daniel N. Gresh and Nicholas P. Bigelow University of Rochester
4. **Design and Implementation of a Timing Control System for use in a Bose-Einstein Condensate (BEC) Experiment (RSPS 2011)** Daniel N. Gresh and Nicholas P. Bigelow University of Rochester
5. Dan Gresh, presentation at the Frontiers in Optics 2010/Laser Science XXVI and the 2010 Industrial Physics Forum) in Rochester, NY in October 2010
6. Daniel Gresh - Presentation, Annual Optical Society of America meeting in San Jose, California in October 2009

14. Jennifer Hansen, class of '11 at Grove City College, worked with Prof. Nicholas Bigelow to determine the feasibility of a permanent magnet Zeeman slower for sodium. She plans to apply to graduate school. ()

1. Optical Pumping for Vibrational Cooling of NaCs Molecules (RSPS 2010) Jennifer L. Hansen*, Patrick Zabawa, Amy Wakim, Nicholas P. Bigelow, University of Rochester and *Grove City College

2. Jennifer Hansen - Presentation, Frontiers in Optics 2010/Laser Science XXVI and the 2010 Industrial Physics Forum) in Rochester, NY in October 2010

3. Jennifer Hansen - Presentation, Annual Optical Society of America meeting in San Jose, California in October 2009

15. James Hanson, class of '12 at University of Minnesota, worked with Kevin McFarland on analyzing and removing cross-talk in the data from the MINERvA detector. He plans on applying to graduate school in physics.

16. Shane Kravec, class of '12 at the University of Rochester, worked with Dr. Esther Conwell studying the role of water in the motion and behavior of extraneous charges on DNA through computational simulations. He plans on applying to graduate school for biophysics.

1. Localization of a Hole on an Adenine-Thymine Radical Cation in B-Form DNA in Water (RSPS 2011) S. M. Kravec, C. D. Kinz-Thompson, and E. M. Conwell University of Rochester

2. [Localization of a Hole on an Adenine-Thymine Radical Cation in B-Form DNA in Water](#), Kravec S. M.; Kinz-Thompson C. D.; Conwell E. M.

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17. Molly Krogstad, class of '11 at the University of Minnesota, worked with Prof. Robert Boyd and Colin O'Sullivan studying ghost imaging with a pseudothermal light source. She plans to apply to graduate school in physics. ()

Molly Krogstad, presentation at the **Frontiers in Optics 2010/Laser Science XXVI and the 2010 Industrial Physics Forum) in Rochester, NY in October 2010**

18. Adam Lanman, class of '12 at the University of Rochester, studied eccentricity diffusion of an initially circular system with Prof. Alice Quillen. Through numerical measurement of diffusion rates, they sought an explanation for the exponential dependence of stability timescales on planet separation and mass. He plans to apply to graduate school for astrophysics. ()

19. Nate Lindsey, class of '11 at the University of Rochester, worked with Prof. Cynthia Ebinger to investigate seismicity patterns along zones of early tectonic spreading. He also used local earthquake records to study potential deep-crustal magma feeding associated with recent dike intrusions in the Afar Depression, Ethiopia. He plans to apply to graduate school in geophysics.()

20. Elizabeth Martens, class of '12 at the University of Rochester, worked under the leadership of Prof. Steven Manly to organize and teach the University's Pre-College Experience in Physics (PREP) program for young women. The program is a summer outreach program for local high school girls, the goal of which is to encourage young women to explore and pursue careers in science. Elizabeth is majoring in mechanical engineering.

21. Dilyana Mihaylova class of '13 at the University of Rochester, worked with Prof. McFarland on the development of a three dimensional hough transform algorithm for the tracking of low energy events from MINERvA at Fermilab. ()

1. Designing an algorithm for a three-dimensional Hough transform of the reconstruction of low-energy events (RSPS 2011) Dilyana Mihaylova and Prof Kevin McFarland University of Rochester

22. Troy Mulholland, class of '11 at St. Bonaventure University, worked with Prof. Aran Garcia-Bellido at Fermilab on the DZero Experiment implementing a multivariate analysis technique to distinguish bottom quark jets from charm quark jets for single top quark analysis. He plans on applying to graduate school in physics.()

23. Matthew Noyes class of '12 at University of Rochester, assisted Prof. Adam Frank on the development and implementation of a parallel Magneto-Hydrodynamic Adaptive Mesh Refinement algorithm for performing astrophysical modeling, including the realm of jet winds and shocks. He plans on applying to graduate school in physics.()

24. Jeffrey Parvin, class of '11 at the University of Pittsburgh, worked with Prof. Wendi Heinzelman on development and testing of different wake-up systems for passive RFID wake-up radios for

wireless sensor networks, as well as characterizing the WISP-mote passive wake-up system through both field testing and simulation. He plans on applying to graduate school in electrical engineering.()

25. Kevin Pedro, class of '11 at Rensselaer Polytechnic Institute, worked with Prof. Aran Garcia-Bellido and Dr. Marek Zielinski at the LHC Physics Center, Fermilab, on several studies concerning jet responses and resolutions using both data and simulation from the CMS Experiment. He plans on applying to graduate school for high-energy physics.()

26. Thomas Rao, class of '11 at Stony Brook University, worked with Prof. Doug Cline on developing techniques to measure the angular distribution and subsequently the magnetic dipole moments of excited states in an 985MeV Hf178 beam excited by a Pb208 target from Gammasphere. This could have important implications for exploiting new generation exotic beam facilities. He plans on applying to graduate school in physics. ()

27. Ian Remming, class of '12 at the University of Rochester, worked with Prof. Dan Watson analyzing mid-infrared spectra of protoplanetary disks observed with the Spitzer Space Telescope. Specifically, he analyzed what are known as Class 0 and Class I objects, thought to be the youngest protostars, looking to find a relationship between their accretion rate and outflow rate.

1 [2011arXiv1107.3261A](#) Arnold, L. A.; Watson, Dan M.; Kim, K. H.; Manoj, P.; Remming, I.; Sheehan, P.; Adame, L.; Forrest, W.; Furlan, E.; Mamajek, E.; **and 4 coauthors** A Spitzer IRS Survey of NGC 1333: Insights into disk evolution from a very young cluster

2 [2011ApJ...733L..32P](#) Poteet, Charles A.; Megeath, S. Thomas; Watson, Dan M.; Calvet, Nuria; Remming, Ian S.; McClure, Melissa K.; Sargent, Benjamin A.; Fischer, William J.; Furlan, Elise; Allen, Lori E.; **and 5 coauthors** A Spitzer Infrared Spectrograph Detection of Crystalline Silicates in a Protostellar Envelope

The Astrophysical Journal Letters, Volume 733, Issue 2, article id. L32 (2011)

28. Andrew Richenderfer, class of '12 at Case Western Reserve University, worked with Prof. Lukas Novotny on the fabrication of optical antennas for near-field microscopy, as well as the synthesis of micron-sized single-crystalline gold plates for applications in plasmonics. He plans on applying to graduate school in physics.

29. **Cecilia Scribner, class of '12** at the University of Rochester, studied the remanent magnetic field and directional signature of South African hut floors circa 1200 A.D. with Prof. John Tarduno and Dr. Rory Cottrell of Rochester's Department of Earth and Environmental Science.()

1. Cecilia Scribner, poster at the American Geophysical Union's annual conference in December 2010 in San Francisco (advisor Prof. John Tarduno) titled "Archaeomagnetic analyses of Iron Age burnt hut floors from southern Africa".

30. **Patrick Sheehan, class of '11** at the University of Rochester, worked with Prof. Dan Watson on modeling the water emission in the protostars IRAS 13036 and MMS 6 North. He plans on applying to graduate school in astrophysics.

1. [2011arXiv1110.4172L](#) Lisse, C. M.; Wyatt, M. C.; Chen, C. H.; Morlok, A.; Watson, D. M.; Manoj, P.; Sheehan, P.; Currie, T. M.; Thebault, P.; Sitko, M. L. Spitzer Evidence for a Late Heavy Bombardment and the Formation of Urelites in $\{\eta\}$ Corvi at ~ 1 Gyr

2. [2011arXiv1107.3261A](#) Arnold, L. A.; Watson, Dan M.; Kim, K. H.; Manoj, P.; Remming, I.; Sheehan, P.; Adame, L.; Forrest, W.; Furlan, E.; Mamajek, E.; and 4 A Spitzer IRS Survey of NGC 1333: Insights into disk evolution from a very young cluster

3 [2011LPI....42.2438L](#) Lisse, C. M.; Chen, C. H.; Wyatt, M. C.; Morlok, A.; Thebault, P.; Bryden, G.; Watson, D. M.; Manoj, P.; Sheehan, P.; Sloan, G.; Currie, T. M. Spitzer Observations of η Corvi: Evidence at ~ 1 Gyr for an LHB-Like Delivery of Organics and Water-Rich Material to the THZ of a Sun-Like Star

4 [2009ApJ...701.1367C](#) Chen, Christine H.; Sheehan, Patrick; Watson, Dan M.; Manoj, P.; Najita, Joan R. Solar System Analogs Around IRAS-Discovered Debris Disks, The Astrophysical Journal, Volume 701, Issue 2, pp. 1367-1372 (2009).

5 . **Accretion Processes in Class 0/I Protostars** (RSPS 2011) P.D. Sheehan, P. Manoj, and D.M. Watson University of Rochester

6. C.M. Lisse, C.H. Chen, M.C. Wyatt, A. Morlok, I. Song, G. Bryden and P. Sheehan, "Abundant Circumstellar Silica Dust and SiO Gas Created by a Giant Hypervelocity Collision in the ~ 12 Myr HD172555 System", Astrophys. J, p. 2019, vol. 701, (2009).

7. **Accretion Processes in Class 0/I Protostars** (RSPS 2011) P.D. Sheehan, P. Manoj, and D.M. Watson University of Rochester,

31. **Andrew Sifain, class of '11'** at the University of Rochester, is working with professor Yonathan Shapir to extract the density of states of vibrational modes and eigenvalues of the Laplacian of the Extended Tree (ET) using a random walk and Green's function formalism to furthermore understand the physics of linear process on the ET compared to those in hyperbolic space.

32. Marek Slipski, class of '11 at the University of Rochester worked with Prof. Eric Mamajek on improving age estimates for extrasolar planet host stars. He plans to apply to graduate school for astrophysics.

1 [2010AAS...21542301S](#) Slipski, Marek; Mamajek, E. E. , Improved Ages Estimates for Extrasolar Planet Host Stars, American Astronomical Society, AAS Meeting #215, #423.01; Bulletin of the American Astronomical Society, Vol. 42, p.326, 1/2010.

33. Tim Sternfeld, class of '11 at the University of Rochester, worked with Prof. Jack Mottley to develop, manufacture and test a system for analyzing and modeling pipe organ keyboard haptics. He plans to apply to graduate school in Electrical and Computer Engineering.

34. Amy Van Newkirk class of '11 at Grove City College, worked with Prof. Nick Bigelow on an optical dipole trap with a fiber laser and its application to Bose-Einstein Condensates. She plans to apply to graduate school for optics.

1. Amy Van Newkirk, presentation at the Frontiers in Optics 2010/Laser Science XXVI and the 2010 Industrial Physics Forum) in Rochester, NY in October 2010

4. Amy Van Newkirk, presentation of a poster the March Meeting of the American Physical Society in Dallas, Texas (2011) titled: “Designing an optical dipole trap for the creation of Bose-Einstein condensates”.

5. Amy Van Newkirk, Abstract, published in Bulletin of March Meeting of the American Physical Society in Dallas, Texas (2011) “Designing an optical dipole trap for the creation of Bose-Einstein condensates”.
