DEPARTMENT OF PHYSICS

Annual Report

AY 2009-10

College of Arts & Sciences – Drexel University

Physics at a Glance

Table of Contents

Personnel

Tenure & Tenure Track: 21
Teaching Faculty: 1
Research Staff: 11
Professional and Technical Staff: 4

Enrollment

Students Enrolled in Physics Courses in 2009: 5,254
Student Credit Hours: 19,177
Undergraduate Enrollment: 68
Graduate Enrollment: 38
SAT Average (students enrolled): 1334

Degrees Conferred

BS Degrees Awarded: 16
MS Degrees Awarded: 3
PhD Degrees Awarded: 3

Research

External Research Grants Awards (FY): $ 2,333,722
Research Expenditures (FY): $ 2,414,818
Refereed Journal Publications: 43
Conferences and Other Presentations: 86

Dr. Michel Vallieres

Leading the Way

Our faculty members, researchers, and students continue to be involved in national and international collaborations, as well as collaborative and multidisciplinary research projects within the College of Arts and Sciences, the College of Engineering, and the School of Biomedical Engineering, Science & Health Systems.

Following recommendations of an external review done some years ago, we focused our research in four areas targeted for expansion and development: Astrophysics, Biophysics, Condensed Matter, and Particle Physics. This year we were able to add a new faculty in Condensed Matter.

Our departmental Tenure and Promotion Committee has been very busy reviewing three faculty cases. As you know, these procedures are rather lengthy and the conclusion will not be known until next year.

We have received $ 2.3 million dollars in new grants. Dr. Jelena Maricic and Dr. Charles Lane received almost $ 1 million in grants for their research in neutrino experiments. Dr. Steve McMillan was awarded an MRI grant from the NSF for near $450,000 to build a supercomputer.

After long and distinguished service to Drexel, Dr. T. Venkataraman retired in December 2009. In recognition for his services Dr. Venkataraman was appointed as Professor Emeritus by the University.

Our undergraduates continue to receive national awards. Amanda White was the recipient of the prestigious Barry M. Goldwater Scholarship and our Society of Physics Students received several awards.

I invite you to learn more about our Department by reading this report and by visiting our website.

Sincerely,

Michel Vallières
Department Head

Mission Statement

"To expand our understanding of the physical universe through basic and applied research and prepare students of all disciplines for technical excellence and thoughtful citizenship through innovative instruction and engagement in the process of discovery."

Honors & Awards

CoAS Honors Day

- **Dr. Stephen McMillan**, has been awarded a Major Research Instrumentation-Recovery and Reinvestment (MRI-R2) grant from the National Science Foundation (NSF). MRI grants are for funding the purchase or development of new scientific instrumentation. McMillan received $443,768 for his proposal "Acquisition of a GPU-accelerated High-Performance Computing Cluster". This project aims to build a supercomputer, along with automated performance tuning tools, for high-speed simulation with particular applications in astrophysics, molecular dynamics and image registration.

- *Amanda White,* physics major, achieved national distinction as the recipient of the prestigious Barry M. Goldwater Scholarship. The Barry M. Goldwater Scholarship Program was designed to foster outstanding students pursuing careers in mathematics, the natural sciences, and engineering. The federally endowed Goldwater Scholarship is the premier undergraduate award of its type in these fields. The Goldwater Scholarship was awarded twice in Drexel University history and both times were consecutively achieved by Physics students.

- The Drexel Chapter of the **Society of Physics Students** won the 2009 Outstanding Chapter Award from the American Institute of Physics. The Outstanding Chapter award is the highest honor given to a student organization by the AIP. The chapter was cited for their outreach program at a local middle school and efforts to increase chapter participation.

- For the fourth consecutive year, the Drexel chapter of the **Society of Physics Students** received the Marsh W. White Outreach Award from the American Institute of Physics for the proposal "Hollywood Physics: An Outreach Event" submitted by physics majors *Wendy Harris, Amanda White, Nick Kruczek* and *Jerome Mlack*. The purpose of the program is to expose students to new issues in physics, and the sciences in general, as well as principles of physics that the students would not normally encounter until much later in their academic careers.

- The **Society of Physics Students** chapter was also selected as one of the recipients of the 2010 Sigma Pi Sigma Undergraduate Research Awards for their proposal "Dynamic 3D-Image Projection System" submitted by physics majors *Kenneth Mui, Jerome Mlack, Amanda White*, and *Sajjan*

National Distinction

"Physics major, Amanda White was the recipient of the prestigious Barry M. Goldwater Scholarship."

Mehta. The chapter advisor is **Dr. Roberto Ramos**. This award provides grants to support local Chapter activities that are deemed imaginative and likely to contribute to the strengthening of the SPS program.

- The Drexel Chapter of the **Sigma Pi Sigma National Physics Honor Society** received its second consecutive national Chapter Project Award from the American Institute of Physics for the proposal "Honoring and Uniting Present and Future Faces of Physics" submitted by *Jerome T. Mlack* and *Vede Ramdass*, physics '10. Drexel's Sigma Pi Sigma Chapter is mentored by **Dr. Roberto Ramos.** This award recognizes chapter efforts to raise public awareness of the honor society, build Sigma Pi Sigma's student/alumni community, and promote inter-chapter activities.

- *Steven Carabello*, Ph.D. candidate, was awarded a Sigma Xi grant-in-aid for his research proposal "High-resolution studies of superconducting energy gap structure in differential conductance measurements of MgB2-based Josephson Junctions". Carabello works under the direction of **Dr. Roberto Ramos**. The Sigma Xi Grant-in-Aid of Research program has a highly competitive application process and only approximately 20% of applicants receive any level of funding.

- *Micholas Smith*, graduate student, won first place for his poster "Effects of Ions on The Folding Dynamics of Amyloid Beta Peptide Fragment (21-30)" in the Computation and Modeling (non-bio) category, Drexel Research Day.

- *Zenghui Liu*, Ph.D. candidate, was the recipient of the 2009-10 Teaching Excellence Award, Drexel University.

- *Pubudu Galwaduge,* Physics '10, won "Best Physics Poster Award" at the 2010 March Meeting of the American Physical Society in Portland, OR, for his poster "Laser Induced Structural Modification in Single-layer and Bilayer Graphene".

- *Travis Hoppe,* Ph.D. candidate, was a finalist for the Student Research Achievement Award Poster Competition for his poster "Wang-Landau Density of States Calculation in Crowded Protein Environments" which he presented at the 54th Annual Meeting of the Biophysics Society in San Francisco.

Physics Graduate Winners

The Department of Physics recognized the following graduate students:

- *Frank Jones,* received the Outstanding First Year Graduate Student Award.

- *Steven Carabello* received the Junior Research Achievement Award.

- *Travis Hoppe* received the Senior Research Achievement Award.

- *Donna Yosmanovich received the Graduate Service Award.*

CoAS Honors Day Winners

This annual event honors the academic achievements of CoAS undergraduate students:

- *Eric Carchidi and Vede Ramdass received the* Walter R. Coley Award.

- *Pubudu Galwaduge* received the Susan and Donald Larson Endowed Scholarship Award.

- *Wendy Harris, Didier Ndengeyintwali,* and *Ryan Wasson*, received the M. Russell Wehr Physics Award.

- *Sajjan Mehta* received the Henry S.C. Chen Memorial Award for Physics.

- *Amanda White* received the Lorenzo M. Narducci Memorial Endowed Scholarship Award.

Drexel students inducted into Sigma Pi Sigma

Physics majors *Tze Yee Lim, Asher Leff, Sajjan Mehta, Kevin Trainer, Stanley Jordan Viss, Douglas Wentzel, Amanda White; graduate students Steven Carabello, Daniel Cross, Austen Groener, Timothy Jones, Crystal Moorman, Marisa Roman;* and **Dr. Joseph Trout**, teaching faculty, were inducted into Sigma Pi Sigma National Physics Honor Society. A formal Induction Ceremony and dinner banquet was held on campus on April 17, 2010 under the direction of **Dr. Roberto Ramos**. *Amanda White* was selected the Most Outstanding Physics Student.

Years of Service

The University hosted an annual employee recognition event, honoring employees for their continued years of service to the University.

40 Years

- Dr. Shyamalendu Bose
- Dr. Frederick House
- Dr. Teck-Kah Lim

30 Years

- Dr. Frank Ferrone
- Ms. Janice Murray

20 Years

- Ms. Jacqueline Sampson

10 Years

- Dr. Alexey Aprelev
- Dr. Guoliang Yang

Degrees Awarded

B.S. Degree

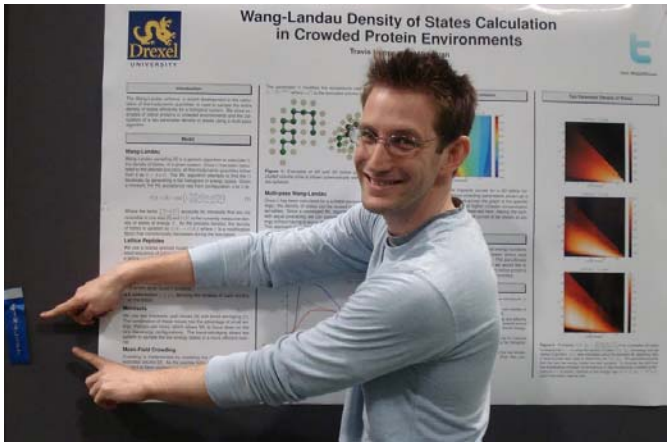
Angelo, Joseph
Bolesta, Alexander
Calva Flores, Pablo
Czaja, William
Gallagher, Casey
Galwaduge, Pubudu
McGurty, Rory
Mlack, Jerome
Politis, Kaleb
Ramdass, Vede
Serratore, David
Soloff, Max
Stephenson, William
Tyler, Page
Viss, Stanley
Wall, Sarah

M.S. Degree

Krawczyk, Coleman
Mitchell, Derek
Whitehead, Alfred

Ph.D. Degree

Cross, Daniel
Deb, Sanghamitra
Parejko, John



Engagement & Outreach

Kaczmarczik Lecture

Kaczmarczik Lecture Addressed by Nobel Laureate

"Nobel Laureate David J. Gross presented "The Coming Revolutions in Fundamental Physics."

Events & Conferences Organized

- The Kaczmarczik Lecture, hosted by the Department of Physics, took place on March 4, 2010 and was attended by over 800 people, including 400 visiting high school students from across the Philadelphia area. Guest speaker Dr. David J. Gross presented "The Coming Revolutions in Fundamental Physics." Gross, Frederick W. Gluck Professor of Theoretical Physics and director of the Kavli Institute for Theoretical Physics at the University of California Santa Barbara, has been a central figure in particle physics and string theory, including the discovery of asymptotic freedom and the consequent development of Quantum Chromodynamics, and the theory of the strong nuclear force. His awards include the Sakurai Prize, MacArthur Prize, Dirac Medal, Oscar Klein Medal, Harvey Prize, the EPS Particle Physics Prize, the Grande Medaille d'Or and the 2004 Nobel Prize in Physics. The Kaczmarczik Lecture continues to be a significant event on Drexel campus. Numerous Nobel Laureates and prominent scientists have been invited in recent years to address the audience. As part of the activities, the Department conducted an Open House for High School students in which physics researchers gave brief presentations on topics such as biophysics, astrophysics, computational physics, condensed matter and chaos theory, along with a tour of the Department of Physics facilities. This annual event exposed thousands of local high school students to recent discoveries in physics and gave them the opportunity to meet with some of the country's leading scientists.

- The Joseph R. Lynch Observatory Open Houses, hosted by the Department of Physics, were successfully held throughout the year. These observing sessions are free and open the public. This program is run by *Alfred Whitehead*, Ph.D. candidate, under the supervision of **Dr. Gordon T. Richards**, Director of the Observatory.

- The Society of Physics Students met with seventh and eighth graders from the Independence Charter School in Philadelphia on a bi-weekly basis, presenting physics demonstrations. The Car Competition event was the culmination of this mentoring project. The SPS also presented "Hollywood Physics: An Outreach Event" at Abington Friends High School. This event exposed the use of "good" and "bad" physics in movies. On Martin Luther King Jr. Day, they presented demonstrations of conservation of angular momentum, the Doppler effect, static electricity, and vortex physics to students at Penrose Elementary School in Philadelphia.

- **Dr. Jelena Maricic**, workshop leader, "Expanding your horizons" conference for local middle school girls aimed at fostering an interest in mathematics, the sciences, engineering, Swarthmore College, March 20, 2010.
- **Dr. Stephen McMillan**, organizer, Advanced School and Workshop on Computational Gravitational Dynamics, Lorentz Center, Leiden University, the Netherlands, 3 – 13 May, 2010.
- **Dr. Stephen McMillan**, organizer, Dr. **Enrico Vesperini**, Scientific Advising Committee, MODEST-10, Dynamics of Dense Stellar Systems, National Astronomical Observatory of China and Kavli Institute for Astronomy and Astrophysics, Beijing, China, 30 August – 3 September, 2010.
- **Dr. Gordon Richards**, organizing committee, AstroPhilly 2010 Meeting, Swarthmore, PA, 9 June 2010.
- *Marisa Roman* and *Donna Yosmanovich*, organizers, October Meeting Association for Women in Science, Philadelphia, PA, 15 October 2009.
- **Dr. Joe Trout** led his UNIV101 class in preparing seven large casseroles and approximately 14 dozen cookies to deliver to St. John's Hospice. Dr. Trout also led his UNIV101 class on a second trip to St. Francis Xavier School. The students taught middle school graders a variety of topics in physics.

Editorial Boards

- **Dr. Frank Ferrone**. Associate Editor, *PMC Biophysics.*
- **Dr. Brigita Urbanc**. Member, Editorial Board, *Journal of Biological Physics.*
- **Dr. Brigita Urbanc.** Member, Editorial Board, *The Open Biochemistry Journal.*

Grant/Program Review

- **Dr. Luis Cruz**, Proposals Reviewer, GRID Drexel.
- **Dr. Frank Ferrone**, Proposal Reviewer, National Institute of Health and Canadian Research Corporation.
- **Dr. David Goldberg**, INCITE Panel Review Member, Department of Energy.
- **Dr. Jelena Maricic**, Panel Reviewer, National Science Foundation.
- **Dr. Gordon Richards**, Proposal Reviewer, Spitzer Cycle 7.
- **Dr. Brigita Urbanc**, Proposal Reviewer, National Science Foundation.
- **Dr. Guoliang Yang,** Proposal Reviewer, National Institute of Health.
- **Dr. Jian-Min Yuan**, Petroleum Research Fund, American Chemical Society Research Corporation.

Invited Talks & Presentations

- **Aprelev, A.**, W. Stephenson, H. Noh, M. Meier, M. MacDermott, N. Lerner, and **F.A. Ferrone**, Sickle Cell Occlusion in Microchannels, poster presentation, Southern Biomedical Engineering Conference, University of Maryland, College Park, Maryland, 30 April – May 2, 2010. S.N.
- **Barz, B.**, **B. Urbanc**. All-atom Molecular Dynamics Stability Study of Amyloid ®-Protein (1-40) and (1-42) Dimers Relevant to Alzheimer's Disease, poster presentation, Biophysical Society 54th Annual Meeting, San Francisco, February 2010.
- Behera, S.N., **S.M. Bose**, D. Ndengeyintwali. Electronic Transport through a Quantum Dot with Metallic Contacts, oral presentation, American Physical Society March Meeting 381,

Portland, OR, 15 – 19 March 2010.

- Betnel, M., **L. Cruz**, B. Wolozin, **B. Urbanc**. Computational Studies of Protein Folding and Aggregation in Parkinson's Disease, poster presentation, American Chemical Society Meeting, Washington, DC, August 2009.

- **Bose, S.M**. Raman Spectra of Carbon Nanotubes in the Presence of Electronic Interactions, invited talk, National Institute of Science and Technology, Berhampur, Orissa, India, January 2010.

- **Bose, S.M**. Plasmons in Nanomaterials, invited talk, National Workshop of Electron Dynamics in Quantum Systems, Digha, West Bengal, India, 17 – 19 February 2010.

- *Caden, E*. Front End Electronics Development, oral presentation, Double Chooz Collaboration Meeting, Reims, France, 22 – 24 October 2009.

- *Caden, E.* Front End Electronics Testing and Installation, oral presentation, Double Chooz Collaboration Meeting, Givet, France, 7 – 8 June 2010.

- *Carabello, S., J. Lambert, Z. Thrailkill*, **R. Ramos**. Quantum States in Graphene-based Josephson Junctions, poster presentation, 2009 MRS Fall Meeting, Boston, MA, 29 November – December 2, 2009.

- *Carabello, S., J. Lambert, J. Mlack, Z. Thrailkill*, **R. Ramos**. Differential Conductance and Microwave Resonant Activation Measurements of MgB2-based Superconducting Josephson Junctions, poster presentation, 2010 IEEE Graduate Forum's Third Annual Research Symposium, Philadelphia, PA, 26 February, 2010.

- *Carabello, S.A., J.G. Lambert, J.T. Mlack*, **R.C. Ramos**. Exploring the Sigma and Pi Band Gaps of MgB2 by Characterizing MgB2/I/Pb and MgB2/I/ Josephson Junctions Below 1 Kelvin, poster presentation, 2010 ASC Applied Superconductivity Conference, Washington, DC, 1 – 6 August 2010.

- *Carabello, S.A., J.G. Lambert, J.T. Mlack*, **R.C. Ramos**. Differential Conductance Measurements of MgB2 – based Josephson Junctions Below 1 Kelvin, poster presentation, 2010 ASC Applied Superconductivity Conference, Washington, DC, 1 – 6 August 2010.

- Crenshaw, D.M., S. Kraemer, H. Schmitt, Y. Jaffe, **R. Deo**, N. Collins, T. Fischer. Outflows and Fueling Flows in the Seyfert 2 Galaxy Mrk 3, poster presentation, Washington, D.C., 3 – 7 January 2010.

- *Cross, D*. A Biological Algorithm for Data Reconstruction, oral presentation, 11th Experimental Conference on Chaos and Complexity, Lille, France, 14 June 2010.

- **Cruz, L.**, D.B. Teplow, **B. Urbanc**. Computational Study of Intermediate Structures in the Folding Nucleus of the Amyloid ®-Protein, oral presentation, Society for Neuroscience Annual Meeting, Neuroscience 2009, Chicago, Illinois, 17 – 29 October 2009.

- *Damon, E.*, **J. Maricic**. Articulated Arm Status, oral presentation, Double Chooz Meeting, 10 – 12 February 2010, Givet, France.

- *Deb, S.* Cluster Mass Reconstruction Using Gravitational Lensing, oral presentation, 215th meeting of the American Astronomical Society, Washington, D.C., 3 – 7 January 2010.

- **Deo, R.P.**, **G.T. Richards**, S.C. Gallagher, M. Elitzur, D.C. Hines, P.M. Ogle, K.M. Leighly, Z. Ivezic, M. Elvis. Optical-to-MIR Spectral Energy Distributions of Luminous Type 1 Quasars at z~2, poster presentation, 215th meeting of the American Astronomical Society, Washington, D.C., 3 – 7 January 2010.

- Djorgovski, S.G., P. Hut, **S. McMillan**, R. Knop, **E. Vesperini**, M. Graham, S. Portegies Zwart, W. Farr, A. Mahabal, C. Donalek, G. Longo.

Immersive Virtual Reality Technologies as a New Platform for Science, Scholarship, and Education, poster presentation, 215th meeting of the American Astronomical Society, Washington, D.C., 3 – 7 January 2010.

- Figueroa, M., W Stephenson, K Pourrezaei, **S Tyagi**. Tunable Nanoparticle Fractal Clusters for Surface Enhanced Raman Scattering (SERS), poster presentation, Drexel Engineering Research Symposium, Philadelphia, PA, March 2010.

- **Finegold, L.**, T. Thomson-Hohl, **S.Tyagi**. Physics and Religion, poster presentation, American Physical Society April Meeting, Washington, D.C., 13 – 16 February 2010.

- *Galwaduge, P., J. Lambert*, **R. Ramos**. Raman Imaging of Defects in Single-Layer and Multi-Layer Graphene, poster presentation, APS March Meeting 2010, Portland, OR, 15 – 19 March 2010.

- *Galwaduge, P., J. Lambert*, **R. Ramos**. Laser Induced Structural Modification of Single Layer and Bilayer Graphene, oral presentation, APS March Meeting 2010, Portland, OR, 15 – 19 March 2010.

- *Galwaduge, P., J.G. Lambert*, **R. Ramos**. Changes in the Charge Carrier Concentration of Graphene under Laser Irradiation, 2010 IEEE Graduate Forum's Third Annual Research Symposium, Philadelphia, PA, 26 February, 2010.

- **Goldberg, D.M.** The Physics of Time Travel, invited talk, the Franklin Institute, Philadelphia, PA, 11 March 2010.

- *Harris, W.B., M.K. Chessey*, **D.M. Goldberg**, **G.T. Richards**. Fold Lens Flux Anomalies: A Geometric Approach, poster presentation, 215th meeting of the American Astronomical Society, Washington, D.C., 3 – 7 January 2010.

- *Hoppe T.*, **J-M. Yuan**. Wang-Landau Density of States Calculation in Crowded Protein Environments, poster presentation, 54th Biophysical Society Annual Meeting, San Francisco, CA, 20 – 24 February 2010.

- *Hoppe, T.*, **J-M. Yuan**. Investigations Into Alpha-Helix to Beta-Sheet Phase Transitions, poster presentation, 54th Biophysical Society Annual Meeting, San Francisco, CA, 20 – 24 February 2010.

- *Jones, T.* Vortex Core Curves for Dynamical Systems, poster presentation, 11th Experimental Conference on Chaos and Complexity, Lille, France, 14 June 2010.

- Knop, R.A., J. Ames, G. Djorgovski, W. Farr, P. Hut, A. Johnson, **S. McMillan**, A. Nakasone, **E. Vesperini**. Visualization of N-body Simulations in Virtual Worlds, poster presentation, 215th meeting of the American Astronomical Society, Washington, D.C., 3 – 7 January 2010.

- *Kratzer, R.*, **G.T. Richards**, J.A. Hodge, R.H. Becker, R.L. White. The Fraction of Radio-loud Quasars at Faint Magnitudes and High Redshift, poster presentation, 215th meeting of the American Astronomical Society, Washington, D.C., 3 – 7 January 2010.

- *Krawczyk, C.M.*, **G.T. Richards**, *R.P. Deo*, S.C. Gallagher, P.B. Hall. Near-IR Through UV SEDs and Dust Reddening in SDSS Quasars, poster presentation, 215th meeting of the American Astronomical Society, Washington, D.C., 3 – 7 January 2010.

- *Kruczek, N.E.*, **G.T. Richards**, S.C. Gallagher, **R.P. Deo**, P.B. Hall, D.G. York, D.E. Vanden Berk. Blueshifting of CIV and the Baldwin Effect in 18,000 SDSS Quasars, poster presentation, 215th meeting of the American Astronomical Society, Washington, D.C., 3 – 7 January 2010.

- *Lambert, J., S. Carabello, Z. Thrailkill, T. Galwaduge*, **R. Ramos**. Investigating Classical and Quantum Behavior of Graphene-based Josephson Junctions, oral presentation, APS March Meeting 2010, Portland, OR, 15 – 19

March 2010.

- *Lambert, J., S. Carabello, Z. Thrailkill, T. Galwaduge*, **R. Ramos**. Investigating Possible Quantum Metastable States in Graphene-based Josephson Junctions, poster presentation, APS March Meeting 2010, Portland, OR, 15 – 19 March 2010.

- *Lambert, J.G., S. Carabello*, **R.C. Ramos**. Electrically Engineering Drexel's First Superconducting Artificial Atom, 2010 IEEE Graduate Forum's Third Annual Research Symposium, Philadelphia, PA, 26 February, 2010.

- Lane, R.A., O. Shemmer, A.M. Diamond-Stanic, X. Fan, S.F. Anderson, W. N. Brandt, **G.T. Richards**, D.P. Schneider, M.A. Strauss. The Optical to Mid-Infrared Spectral Energy Distribution of Weak-Emission Line Quasars, poster presentation, Washington, D.C., 3 – 7 January 2010.

- *Lin, H.*, **J-M. Yuan**. Statistics of Single-Molecular Kinetic Transitions with Application to A-N Switching of a Pre-Unfolding Green Fluorescence Proteins, poster presentation, 54th Biophysical Society Annual Meeting, San Francisco, CA, 20 – 24 February 2010.

- Lister, J.P., A. Inglis, K. Anand, **L. Cruz**, C.A. Barnes, D.L. Rosene, Statistical analysis of microcolumn structure in the rodent neocortex, Society for Neuroscience Annual Meeting, Neuroscience 2009, Chicago, Illinois, 17 – 21 October 2009.

- *Liu, Z.,* **A. Aprelev**, *M. Zakharov*, **F.A. Ferrone**. Sickle Hemoglobin Fiber Kinetics Revealed by Optical Patern Generation, poster presentation, 54th Biophysical Society Annual Meeting, San Francisco, CA, 20 – 24 February 2010.

- *Liu, Z.*, **A. Aprelev**, *M. Zakharov*, **F.A. Ferrone**. Sickle Hemoglobin Fiber Growth Rates Revealed by Optical Pattern Generation, poster presentation, Southern Biomedical Engineering Conference, University of Maryland, College Park, MD, 30 April – 2 May 2010.

- **Maricic, J.** Measuring Earth internal heat with neutrinos, invited talk, Technical University in Cacak, Serbia, December 2009.

- **Maricic, J**. Constraining the Earth models with neutrino measurement at KamLAND, invited seminar, Technical University in Cacak, Serbia, December 2009.

- **Maricic, J**. Probing the Earth Interior with Neutrinos, invited speaker, AWIS, Philadelphia, PA, 15 October 2009.

- **Maricic, J**. Experimental Overview of the Geo-Reactor Neutrinos, LowNu Conference, Reims, France, November 2009.

- *Mehta, S.*, R.G. Mahon, **G.T. Richards**, P.C. Hewett. Optical+NIR Quasar Selection with the SDSS and UKIDSS, poster presentation, 215th meeting of the American Astronomical Society, Washington, D.C., 3 – 7 January 2010.

- *Mlack, J.T., J.G. Lambert, S.A. Carabello, Z.E. Thrailkill, P.T. Galwaduge*, **R.C. Ramos**. Spectroscopy Measurements of Magnesium Diboride Josephson Junctions, poster presentation, APS March Meeting 2010, Portland, OR, 15 – 19 March 2010.

- *Mlack, J.T., A. Wilson, W. Harris, A. White, S.S. Mehta*. Establishing a Physics mentoring Program for a Philadelphia Middle School, poster presentation, APS March Meeting 2010, Portland, OR, 15 – 19 March 2010.

- *Pan, D.*, **M.S. Vogeley**, F. Hoyle. Small Scale Structure of Cosmic Voids, oral presentation, 215th meeting of the American Astronomical Society, Washington, D.C., 3 – 7 January 2010.

- *Parejko, J.K.*, **M.S. Vogeley**, A. Constantin, J.T. Waters, A. Gray. The Environments of Bona-fide Low Luminosity AGN in the Local Universe, oral presentation, 215th meeting of the American Astronomical Society, Washington, D.C., 3 – 7 January 2010.

- **Ramos, R.**, *J. Lambert, S. Carabello, J. Mlack, Z. Thrailkill*. Microwave Resonant Activation of MgB2 Thin Film Josephson Junction, oral presentation, APS March Meeting 2010, Portland, OR, 15 – 19 March 2010.

- **Ramos, R.C.**, *J.G. Lambert, S.A. Carabello, J.T. Mlack*. Resonant Activation from the Zero-Voltage State of a Current-Biased MgB2 Josephson Junction, poster presentation, 2010 ASC Applied Superconductivity Conference, Washington, DC, 1 – 6 August 2010.

- **Ramos, R.C.**, *J.G. Lambert, S.A. Carabello, J.T. Mlack*. Microwave Resonant Activation of MgB2 Thin Film Josephson Junction, oral presentation, 2010 ASC Applied Superconductivity Conference, Washington, DC, 1 – 6 August 2010.

- **Ramos, R.C.** Quantum and Classical Behavior in Josephson Junction Devices Near Absolute Zero, invited colloquium, Temple University, Philadelphia, PA, 14 September 2010.

- **Ramos, R.C.** Measurement of Multiple Energy Gap Structure of MgB_2 Below 1 Kelvin, invited colloquium, George Masson University, 18 October 2010.

- **Ramos, R.C.** Really Cool Science: Artificial Atoms Cooled to Near Absolute Zero Temperatures, invited colloquium, Chestnut Hill College, 19 October 2010.

- **Ramos R.C.** Quantum and Classical Behavior in Josephson Junction Devices, invited presentation, Northrup-Grumman Corporation, 12 November 2010.

- **Ramos, R.C.** Quantum and Classical Behavior in Josephson Junction Devices Near Absolute Zero, invited colloquium, California State University, Fresno, CA, 20 November 2009.

- **Ramos, R.C.** Superconductor-based Artificial Atoms for Quantum Computing, invited colloquium, American University, Washington, DC, 1 December 2009.

- **Richards, G.T.**, S.F. Anderson, D.R. Ballantyne, A.J. Barth, W.N. Brandt, R.J. Brunner, G. Chartas, P. Coppi, W. de Vries, M. Eracleous, X. Fan, R.R. Gibson, A.G. Gray, R.F. Green, M. Lacy, P. Lira, G.M. Madejski, J.A. Newman, D.P. Schneider, O. Shemmer, H. Smith, M.A. Strauss, E. Treister, D.E. Vanden Berk. AGN Science with the LSST, poster presentation, 215th meeting of the American Astronomical Society, Washington, D.C., 3 – 7 January 2010.

- **Richards, G**. The First Galaxies, Quasars, & Gamma-Ray Burst Conference, invited talk, Pennsylvania State University, 6 – 10 June, 2010.

- **Richards, G**. Observations of AGN Outflows and their Contribution to Feedback, invited talk, COSPAR 2010, Bremen, Germany, 18 – 25 July 2010.

- **Richards, G.T**. Super-massive Black Holes: Rulers of the Universe? Invited colloquium, University of Nevada, Las Vegas, NV, March 26, 2010.

- Roehling, M., A. Remoto, *E. Caden*. Construction of the Double Chooz Far Detector, Neutrino 2010, Athens, Greece, 13 – 19 June 2010.

- Ross, N., E.S. Sheldon, A.D. Myers, C. Yeche, **G.T. Richards**, R.G. McMahon, J.F. Hennawi, K. Lee, W.M. Wood-Vasey, A. Weyant, P. Petitjean, D.J. Eisenstein, R.C. Nichol, N. Padmanabhan, D.J. Schlegel, D.P. Schneider, M.A. Strauss, D.H. Weinberg, M. White. The SDSS-III Baryon Oscillation Spectroscopic Survey (BOSS): Quasar Target Selection and Initial Results from the Commissioning Run, poster presentation, Washington, D.C., 3 – 7 January 2010.

- *Thrailkill, Z., J. Lambert, S. Carabello, T. Galaduge*, **R. Ramos**. Microwave Activation of a Current-Biased Josephson Junction-Near the Classical-Quantum Crossover, oral presentation, APS March Meeting 2010, Portland, OR, 15 – 19 March 2010.

- *Thrailkill, Z., J. Lambert*, **R. Ramos**. Multiple Resonators as a Multi-Channel Bus for Coupling Josephson Junction Qubits, poster presentation, APS March Meeting 2010, Portland, OR, 15 – 19 March 2010.

- *Thrailkill, Z., J.G. Lambert, S.A. Carabello, J.T. Mlack*, **R.C. Ramos**. Resonant Activation of Current-biased Josephson Junctions near the Classical-Quantum Crossover, poster presentation, 2010 ASC Applied Superconductivity Conference, Washington, DC, 1 – 6 August 2010.

- *Thrailkill, Z., J.G. Lambert, S. Carabello, P. Galwaduge*, **R.C. Ramos**. Classical to Quantum Crossover Behavior of Drexel's First Solid-State Quantum Bit, poster presentation, 2010 IEEE Graduate Forum's Third Annual Research Symposium, Philadelphia, PA, 26 February 2010.

- **Urbanc, B**. Computational Studies of Amyloid β-Protein Assembly Relevant to Alzheimer's Disease, invited colloquium, University of Delaware, Physics Department, Newark, 7 October 2009.

- **Urbanc, B.** Discrete Molecular Dynamics Simulations of Amyloid β-Protein Assembly, invited talk, Multiscale Modeling and Simulations of Hard and Soft Materials Conference, Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR), Bangalore, India, 19 December 2009.

- **Vesperini, E.** Formation and Dynamical Evolution of Multiple Stellar Populations in Globular Clusters, oral presentation, Space Telescope Science Institute Symposium on Stellar Populations in the Cosmological Context, Baltimore, MD, May 2010.

- **Vesperini, E.** Globular Cluster Second-Generation Stars in the Galactic Halo, oral presentation, The Multiple Populations in Globular Clusters Conference, Asiago, Italy, September 2010.

- **Vesperini, E.** Multiple Stellar Populations in Globular Clusters, invited seminar, Michigan State University, April 2010.

- **Vesperini, E.**, Dynamics of Multiple Stellar Populations in Globular Clusters, invited talk, Modeling Dense Stellar Systems10 Conference, Beijing, China, August 2010

- *Wang, Y.*, **A. Aprelev**, S. Kwong, R.W. Briehl, A. Emanuele, F**.A. Ferrone**. Light Scattering Measurements of Hemoglobin Critical Fluctuation and the Energy Landscape for Polymerization, poster presentation, 54th Biophysical Society Annual Meeting, San Francisco, CA, 20 – 24 February 2010.

- *Whitehead, A.*, **S.L.W. McMillan**, P. Zwart, **E. Vesperini**. Simulating Star Clusters with AMUSE, poster presentation, Modeling Dense Stellar Systems-10, Beijing, China, August 2010.

- **Yang, G**. Macromolecular Crowding Enhances the Mechanical Stability of Proteins. 4th Shanghai International Conference on Biophysics and Molecular Biology, invited talk, Shanghai, China, 8 – 12 August 2010.

- **Yang, G**. The effects of Macromolecular Crowding on the Mechanical Stability of Proteins, poster presentation, 2010 Gordon Research Conference on "Single-Molecule Approaches to Biology", Lucca, Italy, 27 June – 2 July, 2010.

- **Yang, G**. The Effects of Macromolecular Crowding on the Mechanical Stability of Proteins, invited talk, University of Modena and Reggio Emilia, Italy, 5 July 2010.

- *Yosmanovich, D.*, **A. Aprelev**, **M. Rotter**, **F.A. Ferrone**. Do Different Ligands Produce Different Effects in Sickle Hemoglobin Polymer Growth?, poster presentation, 54th Biophysical Society Annual Meeting, San Francisco, CA, 20 – 24 February 2010.

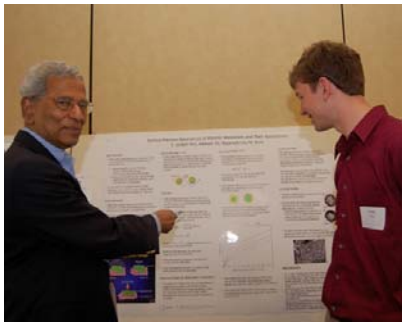
- **Yuan, J-M**. Helix-Coil-Sheet Transitions of Protein

Systems, invited seminar, Institute of Atomic and Molecular Sciences, Academia Sinica, Taipei, Taiwan, 16 July 2010.

- **Yuan, J-M.** Statistical Physics, Critical Phenomena and Complex Biological Systems, invited talk and session chair, Academia Sinica, Nankang, Taipei, Taiwan, 27 - 31 July 2010.
- **Yuan, J-M.** What a Physical Chemist does for Alzheimer's Disease and Cancer, invited colloquium, Department of Applied Chemistry at National Chiao-Tung University, Hsin Chu,

Colloquia

- Dr. Rama Bansil, Boston Univ., Gelation of Stomach Mucus and its Relevance to Motility of the Ulcer Causing Bacterium, October 22, 2009.
- Dr. Joan Shea, Univ. of California, Simulations of Protein Aggregation", October 28, 2009.
- Dr. Zein-Eddine Meziani, Temple Univ., Spin Structure of the Nucleon and QCD, November 12, 2009.
- Dr. Peter Entel, Univ. of Duisburg-Essen, Materials on Supercomputers, December 3, 2009.
- Dr. Amos Yarom, Princeton Univ., Applied String Theory, January 14, 2010.
- Dr. Wei-Heng Shih, Materials Eng, Drexel, Piezoelectric Freestanding Sheets: Synthesis, Properties and Applications, January 21, 2010.
- Dr. Jack Harris, Yale Univ., Applying Quantum Mechanics to an Entire Electrical Circuit, January 28, 2010.
- Dr. Christopher Mauger, LANL, Exploring the Smallest Masses with the Largest Man-made Baselines: Neutrino Oscillations in the 21st Century, February 4, 2010.
- Dr. T.J. Cox, Carnegie Observatories, Using Numerical Simulations to Study the Formation and Evolution of Galaxies, February 18, 2010.
- Dr. Michael Blanton, NYU, Massive Spectroscopic Surveys for Cosmology, February 25, 2010.
- Dr. Mumtaz Qazilbash, Univ. of California, Mott Transition in VO_2 Observed by Infrared Spectroscopy and Nano-imaging, March 11, 2010.
- Dr. Daniel Goldman, Georgia Inst. of Tech., Biophysics in the Sandbox: the Mechanics of Swimming of the Sandfish Lizard, April 1, 2010.
- Dr. Elina Vitol, Drexel Nanotechnology Institute, Nanopipettes for Single Cell Surface-enhanced Raman Spectroscopy, April 15, 2010.
- Dr. Jayanth Banavar, Penn State, Geometry and Physics of Proteins, April 22, 2010.
- Dr. Tom Gaisser, Univ. of Delaware, IceCube - Neutrino Telescope and Cosmic-ray Detector, April 29, 2010.
- Dr. Kathleen Howell, Purdue Univ., Trajectory Analysis for ARTEMIS Mission Design, May 6, 2010.
- Dr. Dmitri Klimov, George Mason Univ., Molecular Dynamics Simulations of Anti-aggregation Effect of Ibuprofen, May 13, 2010.
- Dr. Ravi Radhakrishnan, Univ. of Pennsylvania, Minimal Biophysical Models for Cell-Membrane-Mediated Trafficking, May 20, 2010.
- Dr. Beth Willman, Haverford College, The Invisibles: Revealing Dark Matter and the Lower Limit on Galaxy Formation, May 27, 2010.
- Dr. Teresa Brainerd, Boston Univ., Seeing the Unseeable: Clues to the Orientations of Galaxies within their Dark Matter Halos, June 3, 2010.



Jordan Viss & Dr. Bose

Undergraduate Research

The Department of Physics offers opportunities for students to engage in a wide range of research. Students undertake research projects under the supervision of a faculty member.

- *Alex Bolesta*, senior project "Development of a PMT Light Concentrator for the Long Baseline Neutrino Experiment with Dr. Jelena Maricic.
- *Pablo Calva*, senior project and also worked over the Summer, "Automatic detection and 3D visualization of neurons from confocal images of the fruit fly brain" with Dr. Luis Cruz
- *Mary Chessey* and *Wendy Harris*, worked on Studying strongly lensing galaxies with Dr. David Goldberg
- *William Czaja*, senior project "Can you hear the shape of the Liberty Bell?" with Dr. Robert Gilmore.
- *Brian Cohen* worked during the summer on parallel programming and profiling with Dr. Steven McMillan.
- *David Gurmai* worked during the Spring/Summer on photomultiplier tube (PMT) testing with Dr. Jelena Maricic.
- *Michael Jewell,* STAR research, "Study of the spatial distribution and properties of hydrogen clouds in voids (data from Hubble Space Telescope and SDSS)" with Dr. Michael Vogeley.
- *Mark Kondria* worked during the Spring on astronomical imaging with Dr. Richard Steinberg.
- *Chris Kepic* worked during the Spring/Summer on Tetrahedron model of protein assembly with Dr. Brigita Urbanc.
- *Nicholas Kruczek* worked with Dr. Gordon Richards on disk winds.
- *Pubudu Galwaduge*, senior project "Radiation Induced Modification of the Structural and Electronic Properties of Single Layer and Bi-layer Graphene: A Raman Spectroscopic Study" with Dr. Roberto Ramos.
- *Jerome Mlack*, senior project "Investigating the Classical Behavior of Magnesium Diboride Josephson Junctions" with Dr. Roberto Ramos.
- *Sajjan Mehta* worked on Bayesian quasar selection code to include the use of near-infrared and mid-infrared data with Dr. Gordon Richards.

Got Research?

"I traveled to Japan to work on site at the KamLAND experiment."—J. Monahan, physics senior.

- *Didier Ndengeyintwali,* senior project "Electrical transport through a quantum dot with metallic contacts" with Dr. Shyamalendu Bose.
- *Keneth Mui* worked on low-temperature physics with Dr. Roberto Ramos.
- *James Monahan* worked on Cherenkov calibration source development with Dr. Jelena Maricic.
- *Kaleb Politis*, senior project on "Simulating Globular Clusters with MUSE" with Dr. Steven McMillan.
- *Vede Ramdas*, senior project on "Studying the Effect of Sickling on an Adherent Red Blood Cell via the p-selectin Adhesion Mechanism" with Dr. Frank Ferrone.
- *Othmane Rifki* worked during the Spring/Summer on PMT testing with Dr. Jelena Maricic.
- *Nathan Scott* worked on literature survey on the effects of magnetic fields on organisms with Dr. Leonard Finegold.
- *William Stephenson*, senior project "Sickle Cell Occlusion in Microchannels" with Dr. Frank Ferrone.
- *Page Tyler*, senior project "Half-Value Layers for High-Energy Photon Shielding" with Dr. Charles Lane.
- *Jordan Viss*, senior project "Surface Plasmon Resonance in Metallic Concentric Spherical and Spheroidal Nanoshells and their Applications" with Dr. Shyamalendu Bose.
- *Sarah Wall*, senior project "AFM studies of DNA-protein interactions" with Dr. Guoliang Yang.
- *Amanda White* worked on a thesis on ultraviolet and optical properties of void galaxies in the SDSS wit Dr. Michael Vogeley.
- *Jacob Zettlemoyer,* STAR research "Mie scattering effects in large water Cherenkov detector" with Dr. Jelena Maricic.

Drexel Co-op

Students in the Department of Physics have recently completed co-ops with Sandia National Laboratories, Lockheed Martin, Intel, University of Delaware, Lupus Foundation of America, Penn State University, Exelon Corporation, and several have done their co-ops within our Department.

Students Profiles

Tim McJilton

Tim McJilton, physics '11

"I am a fifth year dual major in Physics and Computer Science. I have had the opportunity to be involved with both the Society of Physics Students and the Peace & Power Christian Fellowship. I find myself spending a lot of time in the lab and enjoying the rock climbing wall in the recently renovated gym.

I am doing my senior research on the cause of mass segregation in a system of stars in virial equilibrium. I am working with Dr. McMillan on the AMUSE code-base to do two things. One involves working with a CS Senior Design group to write a piece of software for creating experiments using the AMUSE library quickly and easily so the repetitive work that may take hours becomes something that is done in a matter of minutes. The second part of my research consists in using this new experiment creation tool to produce a simulation for investigating mass segregation.

I have been very fortunate to receive a $10,000 scholarship from Microsoft that was both merit- and need-base for Computer Science.

I had an internship with Intel in Folsom, CA, during which I lived in Sacramento CA. I was able to explore San Francisco, visit Berkeley, and just enjoy California for 6 months while on the internship.

I have been very blessed with my co-op experiences. I got to work for a research-oriented plasma physics laboratory in Princeton, big name defense contractor Lockheed Martin, and Intel. Drexel prepared me for professional interviews, teaching me about the process and how to stay calm. Through Drexel's co-op program, I have been to over 40 professional interviews at companies like: Lockheed Martin, Intel, Microsoft, Amazon and Google. And the networking opportunities are amazing. I have become friends with people all over the United States who are working at many big name companies. I can contact them for help or they can contact me. It has been an amazing learning experience, just as much as my experiences in the classroom.

After five years at Drexel, the one thing that stands out the most is the quality of the students I have spent hours upon hours working with. Getting a degree in physics at Drexel University is definitely a challenging path to take but one that is well worth it. I have spent many days working with other physics majors from the afternoon to early in the morning the next day. It would be a lot more challenging if it wasn't for the fact that these students are people of character. It is not hard to see that they care about the well being of not only themselves but their fellow students. They are not boastful and they do not put other students down. Instead, there is a great sense of community in the Drexel Physics department. I would not trade the friends I made for anything.

The physics program at Drexel is great for two reasons. First, our program is very computationally based which I feel is vital for the future of physics. It isn't all plugging numbers into equations, and that helps set us apart. The other great thing is that we cover everything. I was speaking with a friend who graduated from Drexel and is going to graduate school at the University of Pennsylvania for medical physics, and he pointed out that our Drexel's physics program covered everything so well and in such depth that he was well-prepared him for graduate work."

James Monahan

James Monahan, physics '11

"I was born and raised in Culpeper, Virginia, which is a small town almost unmolested by DC commuters. While in high school I developed an intense interest in physics thanks to my time at the Governor's School and some excellent teachers. I decided to pursue physics at the university level as a way to work on exciting projects in a field I enjoy. Drexel appealed to me because I liked the emphasis on experience and was drawn in by the bright lights of Philadelphia. When not in the lab I enjoy going out and experiencing the city, either by myself or with some friends.

My current research project is working with Dr. Lane in the High-Energy Physics Lab on developing a calibration flasher for Cherenkov water detectors for large particle physics experiments probing neutrino physics. Neutrinos are almost massless, neutral particles that interact only via the weak force and are useful probes into physics beyond the Standard Model. Since they only interact by the weak force, they are very difficult to detect and so large volume (megaton scale) detectors with incredible sensitivity are necessary. One component of these detectors are huge arrays of photomultiplier tubes (PMTs) looking for Cherenkov radiation in water. Cherenkov radiation is produced when a charged particle moves through a medium faster than the speed of light in that medium. Cherenkov radiation is a cone of light that gives information about the energy and direction of travel of the incoming particle. This information is very useful to identify particles and helps distinguish between muon

activity and neutrino events or proton decays. Currently the methods used to characterize PMTs are simple and rely on light sources that do not closely reproduce Cherenkov light. Common light sources have longer wavelengths than Cherenkov light and do not have the cone shape. This project seeks to replicate these distinctive characteristics to allow more precise PMT characterization and modeling of the detector. The goal of my project is to create a Cherenkov cone in a medium that is small enough to fit in a university lab and then use filters and lenses to simulate the cone that would be produced in a giant, megaton water detector.

While at Drexel, I received the following awards and scholarships:

- AJ Drexel Academic Scholarship
- Students Tackling Advanced Research (STAR) Scholar
- Group of Research on the Energetics of the Ionized Medium (GREMI) Participant
- Sigma Xi Grants-in-Aid of Research Recipient for Cherenkov Calibration Flasher Project

I have been very fortunate in opportunities to travel for research. The summer of my freshman year, while I was working with Dr. Lane as a STAR Scholar on PMT characterization and calibration, I traveled to Japan to work on site at the KamLAND experiment. The next year for co-op I worked at the University of Tübingen in Germany on PMT characterization, calibration, and encapsulation development for the Double Chooz experiment, I even got to go to the collaboration headquarters in Givet, France to give a presentation with the rest of the research group. The co-op in Germany gave me a chance to do some exploration of Europe in my spare time. The next year for co-op I went to Adelphi, Maryland to work in the Army Research Lab. The next year for the GREMI project I went to Orléans, France to attend a collaboration on the applications of plasma research. My final co-op was for Sandia National Laboratory in Livermore, California. While out there I lived in San Francisco and commuted out to the lab site and was able to really enjoy the area.

The co-op experience has been a profound experience for me. Not only the obvious benefit of traveling new and exciting places, but mostly the ability to actually work in the field and see some benefit to what I was learning in the classroom. Co-op allowed me to meet others in the field and talk to them, which expanded my knowledge of both physics and the world. It let me explore different areas of research and figure out which ones I liked and I got to compare working in a Defense lab vs. an Energy lab vs. an academic environment vs. a more industrial one. Each new experience taught me a little more about where I wanted to go with my career and myself. Co-op allowed me to step out of the classroom and into the lab, sometimes one that is deep in a mountain (KamLAND), and actually carry out my own experiments and learn about the universe hands-on, which is what I really love.

The amount and variety of research that I have been able to do and the places I have gone in the pursuit of that have been very special. Working with Dr. Lane in the High-Energy Lab for so long has enabled me to really dig into a field of physics that I probably would not have been exposed to if I went to another university. This ability to explore the practical implementation of physics with the academic reinforcement of classes is a very effective method of learning for myself and helped me figure out what I want to do with my professional life. Going to school in Philadelphia let me meet many exciting people and do interesting things in the city so that I didn't need to travel a continent away to have a new and exciting adventure. The people I have met at the university and while out on co-op have made my time at Drexel very meaningful and enjoyable.

The emphasis on practical research is the main advantage for pursuing physics as an undergraduate at Drexel. This lets you get into the lab and figure out if this is really what you want to pursue for your career, a question that is really difficult to answer coming straight out of high school. Those that decide that research is their path will be aided greatly by the support that the department gives. The co-op program gives you a very good framework to begin with for setting up

research experiences that will be much more in depth than the shorter summer research experiences that are more commonplace elsewhere. The faculty in this department are excellent at aiding students with an interest in research, finding opportunities for pursuing research and helping them take full advantage of those opportunities."

Amanda White

Amanda White, Physics '11

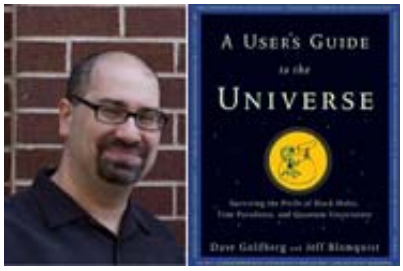
"I am currently a senior majoring in physics with a concentration in astrophysics. I came to Drexel in order to do research as an undergraduate. Many of the other universities I considered said I could possibly get involved with a research group as a junior or senior, if I was lucky, but at Drexel, I was given the opportunity to begin researching the summer after my freshman year. As someone who wishes to pursue a research career, the chance to get involved early was an important part in my decision to come here.

While at Drexel, I have been working with Dr. Michael Vogeley on the properties of interacting void galaxies. Voids are large underdense regions of the universe where there is little visible matter. This makes voids great places to study mergers without the added complication of other nearby objects that are not part of the interaction. My senior thesis project will build on this work but also deviate from it slightly; I will be studying the star formation rates of dwarf galaxies in voids.

As part of the interacting galaxy research project, I was able to use the 2.1meter telescope at the Kitt Peak National Observatory near Tucson, Arizona. Traveling to the observatory was a great experience that really helped me to decide to pursue astronomy professionally. The research I have done with the Drexel astrophysics group has also allowed me to reach national distinction. In 2010, I received a Barry M. Goldwater Scholarship.

I am in the four year, no co-op program so I have not been on any co-ops, however, I have been lucky enough to be admitted to REU programs during the summer. Research Experience for Undergraduates (REU) are highly competitive research programs that are funded by the NSF and take place at various universities across the country. My first REU was at SUNY Stony Brook on Long Island, NY. There I studied the infrared spectrum of ultra-cool brown dwarf HN Peg B. This was an analysis based project from which I learned several useful techniques for data reduction. My second REU was at the Institute for Astronomy which is part of the University of Hawai'i. I worked at the Advanced Technology Research Center and the Haleakala Observatories, both located on the island of Maui, HI. While there, I worked on a project geared toward the detection of molecular hydrogen in the polarized spectrum of the sun. This was an instrumentation project and I learned a great deal about equipment used in both the lab and the observatory. Both REUs allowed me to explore different areas of astronomy and expand my knowledge of objects other than the galaxies I study at Drexel. The experience I gained in these programs have been great additions to and have complemented my studies at Drexel.

Another great part of my experience at Drexel has been my involvement with the Society of Physics Students (SPS). SPS is an undergraduate group which plans great events for physics majors. Through this group I have made many friends and I have really felt welcomed into the physics department. If given the chance to go to college again, I would still pick the Drexel Physics Department for my undergraduate education."



Publications & Grants

Dr. David Goldberg

Textbooks, Books, and Contributed Book Chapters

- E. Chaisson and **S. McMillan**. Astronomy Today, 7th edition (© 2011, Addison Wesley: San Francisco).
- S. Djorgovski, P. Hut, **S. McMillan, E. Vesperini**, R. Knop, W. Farr, and M. Graham. "Exploring the Use of Virtual Worlds as a Scientific Research Platform: The Meta-Institute for Computational Astrophysics (MICA)", Facets of Virtual Environments, Lecture Notes of the Institute for Computer Sciences, Social Informatics and Telecommunications Engineering, Volume 33. ISBN 978-3-642-11742-8. Springer Berlin Heidelberg, 2010, p. 29.
- **D. Goldberg** and J. Blomquist. A User's Guide to the Universe: Surviving the Perils of Black Holes, Time Paradoxes, and Quantum Uncertainty (2010 Wiley & Sons: Hoboken).

Peer-Reviewed Journals

- Abe, S., S. Enomoto, K. Furuno, Y. Gando, et al. (**C. E. Lane, J. Maricic**). "Production of Radioactive Isotopes through Cosmic Muon Spallation in Kamland." Physical Review C 81, no. 2 (2010).
- Baumgardt, H., G. Parmentier, M. Gieles, and **E. Vesperini.** "Evidence for Two Populations of Galactic Globular Clusters from the Ratio of Their Half-Mass to Jacobi Radii." Monthly Notices of the Royal Astronomical Society 401, no. 3 (2010): 1832-38.
- Cardamone, C., K. Schawinski, M. Sarzi, et al (*J. Parejko*). "Galaxy Zoo Green Peas: Discovery of a Class of Compact Extremely Star-Forming Galaxies." Monthly Notices of the Royal Astronomical Society 399, no. 3 (2009): 1191-205.
- Chen, C. M., J. Zhang, and **M. S. Vogeley**. "Making Sense of the Evolution of a Scientific Domain: A Visual Analytic Study of the Sloan Digital Sky Survey Research." Scientometrics 83, no. 3 (2010): 669-88.
- Croom, S. M., **G. T. Richards**, T. Shanks, et al. "The 2df-Sdss Lrg and Qso Survey: The Qso Luminosity Function at 0.4 < Z < 2.6." Monthly Notices of

the Royal Astronomical Society 399, no. 4 (2009): 1755-72.

- *Cross, D. J.,* and **R. Gilmore**. "Differential Embedding of the Lorenz Attractor." Physical Review E 81, no. 6 (2010).
- *Cross, D. J.*, and **R. Gilmore**. . "Representation Theory for Strange Attractors." Physical Review E 80, no. 5 (2009).
- *Cross, D. J., R. Michaluk,* and **R. Gilmore**. "Biological Algorithm for Data Reconstruction." Physical Review E 81, no. 3 (2010).
- D'Antona, F., P. Ventura, V. Caloi, A. D'Ercole, **E. Vesperini**, R. Carini, and M. Di Criscienzo. "Terzan 5: An Alternative Interpretation for the Split Horizontal Branch." Astrophysical Journal Letters 715, no. 2 (2010): L63-L67.
- **Deo, R. P., G. T. Richards**, D. M. Crenshaw, and S. B. Kraemer. "The Mid-Infrared Continua of Seyfert Galaxies." Astrophysical Journal 705, no. 1 (2009): 14-31.
- Faber, N. T., D. Stibbe, S. P. Zwart, **S. L. W. McMillan**, and C. M. Boily. "Particle-Based Sampling of N-Body Simulations." Monthly Notices of the Royal Astronomical Society 401, no. 3 (2010): 1898-903.
- Falder, J. T., J. A. Stevens, M. J. Jarvis, et al (**G. T. Richards)**. "The Environments of Z Similar to 1 Active Galactic Nuclei at 3.6 Mu M." Monthly Notices of the Royal Astronomical Society 405, no. 1 (2010): 347-58.
- **Gilmore, R.,** J. M. Ginoux*, T. Jones,* C. Letellier, and U. S. Freitas. "Connecting Curves for Dynamical Systems." Journal of Physics a-Mathematical and Theoretical 43, no. 25 (2010).
- **Goldberg, D. M**., *M. K. Chessey, W. B. Harris*, and **G. T. Richards.** "Fold Lens Flux Anomalies: A Geometric Approach." Astrophysical Journal 715, no. 2 (2010): 793-802.
- Hennawi, J. F., A. D. Myers, Y. Shen, et al. (**G. T. Richards)**. "Binary Quasars at High Redshift. I. 24 New Quasar Pairs at Z Similar to 3-4." Astrophysical Journal 719, no. 2 (2010): 1672-92.
- Inada, N., M. Oguri, M. S. Shin, et al (**G. T. Richards)**. "The Sloan Digital Sky Survey Quasar Lens Search. Iv. Statistical Lens Sample from the Fifth Data Release." Astronomical Journal 140, no. 2 (2010): 403-15.
- *Jenks, S.,* and **R. Gilmore**. "Quantum Dot Solar Cell: Materials That Produce Two Intermediate Bands." Journal of Renewable and Sustainable Energy 2, no. 1 (2010).
- Jiang, L. H., X. H. Fan, W. N. Brandt, C. L. Carilli, E. Egami, D. C. Hines, J. D. Kurk, **G. T. Richards**, Y. Shen, M. A. Strauss, M. Vestergaard, and F. Walter. "Dust-Free Quasars in the Early Universe." Nature 464, no. 7287 (2010): 380-83.
- Katriel, J., and **R. Gilmore**. "Entropy of Bounding Tori." Entropy 12, no. 4 (2010): 953-60.
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- *Lambert, J. G.,* C. Hernandez-Diaz, and J. C. Williamson. "Subwavenumber Charge-Coupled Device Spectrometer Calibration Using Molecular Iodine Laser-Induced Fluorescence." Review of Scientific Instruments 81, no. 1 (2010).
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in Macromolecular Manipulation Experiments Using Atomic Force Microscope." Review of Scientific Instruments 81, no. 6 (2010).

- Measey, T. J., K. B. Smith, S. M. Decatur, L. M. Zhao, **G. L. Yang,** and R. Schweitzer-Stenner. "Self-Aggregation of a Polyalanine Octamer Promoted by Its C-Terminal Tyrosine and Probed by a Strongly Enhanced Vibrational Circular Dichroism Signal." Journal of the American Chemical Society 131, no. 51 (2009): 18218.
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- **Urbanc, B**., M. Betnel, **L. Cruz,** G. Bitan, and D. B. Teplow. "Elucidation of Amyloid Beta-Protein Oligomerization Mechanisms: Discrete Molecular Dynamics Study." Journal of the American Chemical Society 132, no. 12 (2010): 4266-80.
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- **Vesperini, E., S. L. W. McMillan,** F. D'Antona, and A. D'Ercole. "The Fraction of Globular Cluster Second-Generation Stars in the Galactic Halo." Astrophysical Journal Letters 718, no. 2 (2010): L112-L16.
- **Vesperini, E., S. L. W. McMillan**, A. D'Ercole, and F. D'Antona. "Intermediate-Mass Black Holes in Early Globular Clusters." Astrophysical Journal Letters 713, no. 1 (2010): L41-L44.
- **Vesperini, E., S. McMillan,** and S. P. Zwart. "Origin and Dynamical Evolution of Young Mass-Segregated Clusters." Astrophysics and Space Science 324, no. 2-4 (2009): 277-82.
- *Zakharov, M. N.,* **A. Aprelev,** M. S. Turner, and **F. A. Ferrone.** "The Microrheology of Sickle Hemoglobin Gels." Biophysical Journal 99, no. 4 (2010): 1149-56.
- **Zbiri, K.** "Remark on the Studies of the Muon-Induced Neutron Background in the Liquid Scintillator Detectors." Nuclear Instruments & Methods in Physics Research Section a-Accelerators Spectrometers Detectors and

Associated Equipment 615, no. 2 (2010): 220-22.

- Zhou, J., and **G. L. Yang.** "Focused Ion-Beam Based Nanohole Modeling, Simulation, Fabrication, and Application." Journal of Manufacturing Science and Engineering-Transactions of the Asme 132, no. 1 (2010).
- Zwart, S. P., T. Ishiyama, D. Groen, K. Nitadori, J. Makino, C. de Laat**, S. McMillan**, K. Hiraki, S. Harfst, and P. Grosso. "Simulating the Universe on an Intercontinental Grid." Computer 43, no. 8 (2010): 63-70.

New Grants (FY 2008-09)

PI	Project Title	Sponsor	Amount
Cruz, L.	Quantitative Analysis of Cerebral Cortex in Aging Monkeys	National Institutes of Health	$ 96,707
Goldberg, D.	Where is the information in Cluster Lenses?	National Aeronautics and Space Administration	$ 149,998
Lane, C.	Neutrino Physics: Task A: Physics at KamLAND and Double Chooz	Department of Energy	$ 310,000
Maricic, J.	A Proposal to Design a Megaton-Scale Water Cerenkov Detector for the Deep Underground Science and Engineering Lab	University of California, Davis	$ 298,380
Maricic, J.	Neutrino Physics: Task J: Enhancing the Precision of Low Energy Neutrino Experiments with Novel Calibration Technique	Department of Energy	$ 300,000
Maricic, J.	Recovery Act: Neutrino Research Infrastructure Improvement	Department of Energy	$ 58,500
McMillan, S.	Exploring the use of Immersive Virtual Reality Technologies for Scientific Research, Communication, and Outreach	National Science Foundation	$ 165,085
McMillan, S.	MRI-R2: Acquisition of a GPU-accelerated High-Performance Computing Cluster	National Science Foundation	$ 443,768
Olson, K.	Development and Modification of Numerical Algorithms for 1D Hydrodynamics and 3D Magnetohydrodynamics Adaptive-Mesh Refinement Codes	National Aeronautics and Space Administration	$ 107,129
Richards, G.	Mid-IR through UV SEDsof Type 1 SDSS Quasars	National Aeronautics and Space Administration	$ 40,000
Tyagi, S.	Detection of Viruses and Bacteria in Environmental Samples using Surface-enhanced Raman Scatter (SERS) Substrates based on Silver Nanoparticle Inks	PChem	$ 75,000
Vesperini, E.	Multiple Stellar Populations in Globular Clusters	National Aeronautics and Space Administration	$ 289,155
Total:			**2, 333,722**

Areas of Research

Astrophysics

Faculty:
D. Goldberg
S. McMillan
G. Richards
M. Vogeley

Researchers:
J. Allred
K. Olson
E. Vesperini

Grad. Students:
A. Groener
H. Finley
V. Kasliwal
R. Kratzer
C. Krawczyk
S. Lynch
E. Mamikonyan
C. Moorman
J. Parejko
D. Pan
A. Whitehead

Expenditures:
$ 1,182,203

Biophysics

Faculty:
L. Cruz
F. Ferrone
B. Urbanc
G. Yang
J. Yuan

Researchers:
A. Aprelev
B. Barz
S. Jampani
Y. Sereda

Grad. Studens:
F. Jones
T. Hoppe
T. King
H. Lin
R. Liu
Z. Liu
D. Meral
M. Roman
J. Schreck
M. Smith
Y. Wang
D.Yosmanovich

Expenditures:
$ 610,325

Condensed Matter

Faculty:
S. Bose
G. Karapetrov
R. Ramos
S. Tyagi

Grad. Students:
S. Carabelo
J. Lambert
Z. Thrailkill

Expenditures:
$ 40,026

Nonlinear Dynamics

Faculty:
R. Gilmore

Grad. Students:
B. Coy
D. Cross
S. Jenks
T. Jones
S. Kennerly
R. Michaluk
A. O'Brien
N. Romanazzi

Expenditures:
$ 45,271

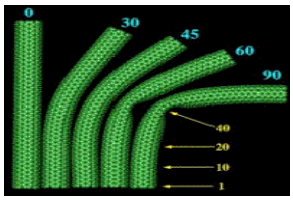
Particle Physics

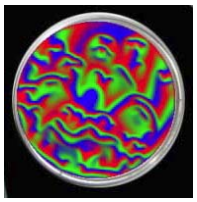
Faculty:
C. Lane
J. Maricic

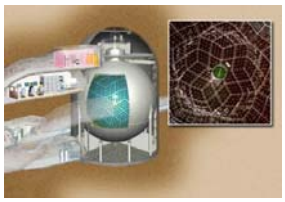
Researchers:
K. Zbiri

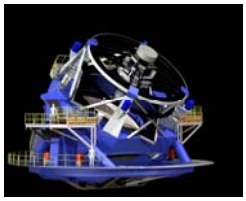
Grad. Students:
E. Caden
E. Damon
E. Smith

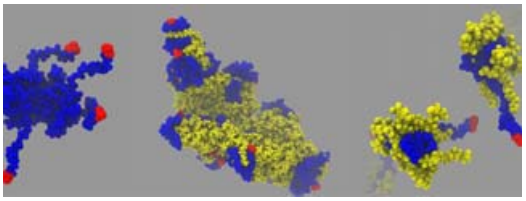
Expenditures:
$ 456,003











International Collaborations

Collaborator/ Collaboration	Institution	Description	Drexel Faculty
Double Chooz Neutrino Experiment Collaboration	France, Germany, Spain, Russia, Great Britain, Japan, Brasil, UK, USA	Experiment searching for the last non-measured neutrino mixing angle Theta 13.	C. Lane, J. Maricic, and K. Zbiri
Kamioka Liquid Scintillator Antineutrino Detector Collaboration	Japan, China, USA	KamLAND, ongoing reactor neutrino experiment in Japan, made the first ever measurement of antineutrinos of geological origin confirming the validity of the existing Earth composition model.	C. Lane, J. Maricic, and K. Zbiri
The Hawaiian Anti-neutrino Observatory Project	France, Germany, USA	Deep-ocean large 10 kton scintillator detector set to study geoneutrinos coming from the Earth's mantle off-shore Big Island, Hawaii.	J. Maricic
Large Synoptic Survey Telescope	USA, Chile, France	The 8.4m Large Synoptic Survey Telescope (LSST) is a wide-field telescope facility that will add a qualitatively new capability in astronomy.	G. Richards
Sloan Digital Sky Survey Collaboration	Korea, Japan, Germany, China, England	A project to map the universe with digital images and spectra of millions of galaxies, stars, and quasars.	G. Richards, M. Vogeley, and students
S. Portegies Zwart	Leiden University, The Netherlands	Starlab and the MUSE project. Computational astrophysics, using high-performance computing to address the evolution of young star clusters.	S. McMillan
F. D'Antona and A. D'Ercole	National Institute for Astrophysics, INAF, Italy	Theoretical studies of the formation of multiple stellar populations in globular clusters using dynamical simulations and detailed models of stellar evolution.	S. McMillan, E. Vesperini
R. van de Weygaert	Kapteyn Institute for Astronomy, University of Groningen, The Netherlands	Investigations of the formation and evolution of cosmic voids and void galaxies.	M. Vogeley
Changbom Park	Korea Institute for Advanced Study, Korea	Studies of the topology of large-scale structure in the universe and investigations of the properties of galaxies and their environment.	M. Vogeley
M. Lefranc	Universite des Sciences et Technologies de Lille, France	Topological understanding of strange attractors beyond thee dimensions.	R. Gilmore
C. Letellier	CORIA, Universite de Rouen, France	Invariant sets of chaotic attractors.	R. Gilmore
J.-M. Ginoux	Institut de Mathematiques de Jussieu, Universite Pierre et Marie Curie, France	Chaotic dynamics.	R. Gilmore
Sheng H. Lin	Institute of Atomic & Molecular Sciences, Academia Sinica, Taiwan	Protein folding, statistical mechanical approaches to secondary structural transformation of proteins.	J.-M. Yuan
Chin-Kun Hu	Institute of Physics, Academia Sinica, Taiwan	Systems behavior of p53 signaling pathways and cancers.	J.-M. Yuan
Feng-Yin Li	National Chung Hsing University, Taiwan	Self-aggregation of peptides and proteins, such as (AAKA)4.	J.-M. Yuan
Soonmin Jang	Sejong University, Korea	Self-aggregation of peptides and proteins, such as (AAKA)4.	J.-M. Yuan
S. Gallagher	University of Western Ontario, Canada	Study of winds in active galaxies.	G. Richards
P. Hewett and R. McMahon	Institute for Astronomy, University of Cambridge, UK	Active galaxies with the SDSS data.	G. Richards
J. Hennawi	Max Planck Institute for Astronomy, Germany	Study of galaxy mergers by looking at pairs of objects.	G. Richards
S. Croom	University of Sydney, Australia	AUS (AAOmega-UKIDSS-SDSS survey). Formation and evolution of active galaxies	G. Richards
S.N. Behera	Institute of Material Science, Bhubaneswar, India	Raman scattering from nanocarbon.	S. Bose