

Physics at Brown

NEWS FOR ALUMNI AND FRIENDS

2008 ISSUE

GREETINGS FROM THE CHAIR

Welcome to another issue of the Brown Physics Newsletter. Much has changed in the country, the University and the Department since I wrote a year ago. Regardless of the faltering global economy, we must move forward in these challenging times by continuing to strengthen our academic offerings and maintaining our commitment to provide our students with the best possible educational experience.

I am pleased to report in this issue on many notable faculty achievements over the past year. We welcomed our newest faculty member, Professor Savvas Koushiappas, in August. He is the first theoretician to join our active research program in the area of astrophysics, astro-particle physics and cosmology. Please join me in congratulating Professor Greg Landsberg for his promotion to the rank of Professor, effective July 1, 2008.

Two new staff members, Sara Tortora and Sabina Griffin, Department Manager and Administrative Assistant respectively, joined us this year, and Barbara Dailey was promoted to the important role of Student Affairs Coordinator. I am proud to report that President Simmons presented our laboratory manager, Ken Silva, with an Excellence Award for Innovation, and presented the entire Ladd Observatory team with an Excellence Award for Citizenship.

We continue our efforts to enrich our physics curriculum, and added five new courses this year. In addition, a new AB concentration, "Physics and Philosophy" has received a stamp of approval from the University. Community outreach remains a priority for us with a weekly open house at Ladd, the expanded five-year NSF supported GK-12 program, and a new outreach program involving middle school students at Community Preparatory School in Providence. Last fall, we signed a cooperative agreement with the Hanoi University of Science, and we continue to collaborate with the University of Hong Kong to host students for summer research at Brown.

Although we face many challenges, this is a time of change and hope. With the help of faculty, staff, students and our alumni and friends, I am certain we will emerge from this uncertain period to better serve the current and future generation of students and the broader community.

Chung-I Tan, Chair



FALL 2008 INCOMING GRADUATE STUDENTS

Juliette Alimena

University of Pennsylvania

Yana Cheng

Lanzhou University

Ata Karakci

Bogazci University

Li Wei Liu

Brown University

Xu Liu

University of Science &

Technology of China

Michael Luk

University of Cambridge &

Imperial College of London

Dhritiman Nandan

Brandeis University, IIT Kanpur

& University of Calcutta



Tharhenos Perides

University of Durham &

Harvard University

Wanming Qi

Peking University

Michael Segala

University of Rhode Island

Tutanon Sinthuprasith

Duke University

Hao Tu

University of Science

& Technology of China

Shu Wang

Tongji University

Terri Williams

University of Massachusetts

Qibin Ye

Peking University

Mengdi Zheng

Zhejiang University

2008 GALKIN FELLOW - XIAOJING ZOU

Xiaojing Zou is completing his Ph.D. dissertation research in the field of Spintronics with emphasis on the Magnetic Tunneling Junctions (MTJs) and Half-metallic Chromium Dioxide (CrO_2) Nanostructures. For the past five years, Xiaojing has conducted research at the Nano-scale Physics and Devices Lab in Brown University with his advisor Prof. Gang Xiao.

A newly-developed form of electronics, known as spintronics, has recently emerged. Instead of solely relying on the electron's negative charge to manipulate electron motion or to store information, spintronic devices further rely on the electron's spin degree of freedom. One advantage of spin-based electronics over charge-based electronics is their non-volatility. The spintronic MRAM (Magnetoresistive Random Access Memory) has the potential to become the ideal memory media for computing, which is able to achieve the speed of SRAM, the density of DRAM and the non-volatility of Flash Memory. Furthermore, the quantum-mechanical computing based on spintronics could achieve speeds unheard of with conventional electrical computing.

Xiaojing's first project when he joined Prof. Xiao's group was the development of a new generation of magnetic tunneling junctions that use (001) textured Magnesium Oxide (MgO) as tunneling barrier. Initially predicted by theorists and confirmed by a Japanese company and IBM, this type of MTJs exhibits magnetoresistance above 200% at room temperature which represents a significant milestone in spintronics. Xiaojing was the first to develop a sophisticated fabrication process which allowed him to bring the operating temperature of MTJs above 350 degree C. This work makes it possible to use MTJs in high temperature electronics, and Prof. Xiao's group was the first university lab in the US that grasped this technology.

Xiaojing moved on to half-metals, an important material category in spintronics. These ferromagnets exhibit a 100% spin polarization due to a band gap in the minority spin density of states near the Fermi level. Among these materials, CrO_2 is one of the few experimentally proven half metals and possesses the largest spin polariza-

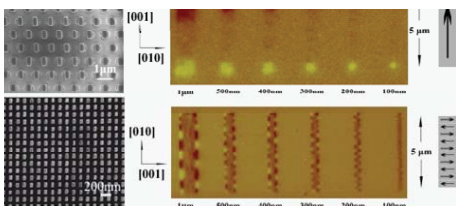
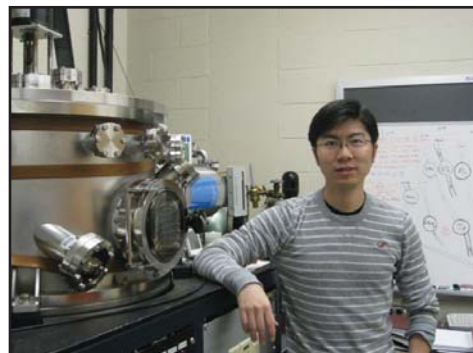
tion so far reported.

The fabrication of CrO_2 small structures has long been a challenging task due to the metastable nature of this material since it can easily decompose into another oxide phase Cr_2O_3 . Xiaojing successfully developed a reliable way, based on the selective-area growth technique, to fabricate high quality CrO_2 nanostructures in both polycrystalline and epitaxial forms, with individual feature size smaller than 50 nm. His method prevents the damage caused by post-deposition etching and allows the observation of detailed growth process of CrO_2 nanocrystals.

For the first time, Xiaojing was able to study the magnetic properties of nanoscaled epitaxial half-metallic structures such as nanodots, nanowires, nanorings, etc. His experimental results show that unlike the dominance of shape anisotropy in commonly used polycrystalline ferromagnetic small structures, the domain configuration of epitaxial magnetic structures is determined by the competition between the magnetocrystalline anisotropy and the shape anisotropy. Furthermore, the magnetocrystalline anisotropy in nanoscaled epitaxial CrO_2 can be so strong that the shape induced effect is almost negligible.

Xiaojing systematically compared the electrical transport and magnetoresistance behavior of polycrystalline and epitaxial CrO_2 nanowires. Low-temperature transport measurements have shown that the dc resistivity of polycrystalline CrO_2 wires is strongly dependent on the width of the wires. Below a critical temperature, a transition from a positive to a negative temperature coefficient of resistivity is observed, due to a competition between the scattering of the conduction electrons inside the grains and scattering across the grain boundaries. Conversely, epitaxial CrO_2 wires behave in a highly metallic fashion, and the resulting magnetoresistance properties are found to be closely related to the orientation of the wire axis due to different domain structures. By taking advantage of this property, one can design certain CrO_2 structures with unique magnetic domain configurations, which can lead to interesting spin-dependent transport behavior.

Xiaojing has published four first-author scientific papers, made several presentations in the Annual Conference of Magnetism and Magnetic Materials (MMM), and has been awarded a student travel grant for the 2008 MMM conference.



Nanostructures made by Xiaojing Zou. Right shows magnetic domains of small magnetic wires.

The Galkin Foundation Fellowships are funded through a generous donation by Mr. Warren Galkin, Class of 1951. Each year, the Fellowship recognizes exceptional promise and achievement in physics by a senior graduate student.

IN MEMORIAM - ROBERT T. BEYER

Professor Robert T. Beyer passed away peacefully last August at the age of eighty-eight.

He received his AB in mathematics from Hofstra College, and PhD. in Physics from Cornell University. He joined Brown in 1945, and for more than forty years, served Brown as a faculty member of the Physics Department. He was appointed the Hazard Chair Professor of Physics, and served as Executive Officer and Chair of the Department.

During his illustrious career, he taught physics with passion, and wrote prolifically. He taught physics at all levels, and also taught non-specialist courses, such as “the physics of music.” He wrote three textbooks on Introductory Physics, and two advanced treatises on “Physical Ultrasonics” and “Nonlinear Acoustics.” His research specialty was physical acoustics of ultrasound. He was a Fellow of the American Physical Society, Acoustical Society of America, and IEEE, and won the Acoustical Society’s prestigious Gold Medal Award in 1984. His

language abilities were legendary, and he translated many scientific works from German and Russian, and for two years, edited the English translation of the “Chinese Journal of Physics (Peking).”

He was a physicist with compassion for others and a man of action. In 1964, at the height of the civil rights movement, Bob went to Mississippi to visit Tougaloo and other black colleges in the South. He went to teach and to learn, and was clearly moved by his experience.

Early in George W. Bush’s presidency, he was drifting in and out of consciousness after surgery. Responding to a question about whether he needed anything, he said “Just get me a piece of paper that says George Bush is no longer president of the United States.” He repeated this again shortly before he died: “I’m still waiting for that piece of paper.” He voted for Obama in the primaries, and sent a check to his campaign. It would have been wonderful if he could have witnessed the election outcome.

Bob was a physicist, linguist, and humanitarian who appreciated and lived life to its fullest. We miss him.

THIRD ANNUAL STRING THEORY MEETING HELD AT BROWN

The third annual New England String Meeting was held at Brown on October 24, 2008. About 70 students, postdocs, and faculty gathered for the one-day conference to hear six presentations. Andrew Strominger (Harvard) started the program with a talk about the Kerr/CFT Correspondence. He was followed by Zvi Bern (UCLA), who presented an overview of recent developments in scattering amplitudes. The participants then took a lunch break, and came back to hear Vijay Balasubramanian (University of Pennsylvania) talk about statistical predictions from effective field theory landscapes. Jonathan Bagger (Johns Hopkins) gave a presentation entitled “Three-algebras and theories of multiple M2-branes” which was followed by a talk by Gregory Moore (Rutgers) about four-dimensional wall-crossing from three-dimensional field theory. Frederik Denef (Harvard) concluded the speaking program with a presentation about the M-theory landscape of holographic superconductor. The schedule included plenty of time for participants to chat informally about their work, and the day ended with dinner at various local restaurants.

GREG LANDSBERG: PROMOTED TO PROFESSOR OF PHYSICS

Greg does research in elementary particle physics, and his main research activity is the search for new physics phenomena, including extra dimensions in space. He has received the National Science Foundation Career Award (2003-2008), an Alfred P. Sloan Research Fellowship (2001-2005), a Salomon Faculty Research Award (2000) and the Aditya Sambamurti Memorial Award (1997), and he is a co-PI of a long-standing DoE grant for Brown High Energy Physics. Greg, a member of the CMS and DZero experiments operating at the energy-frontier facilities of the Fermilab Tevatron collider in Batavia, Illinois and the Large Hadron Collider in Geneva, Switzerland, is the U.S. CMS Physics Coordinator and CMS Exotica group convener. He received his B.S. in Physics from the Moscow Technical Institute in 1989 and his Ph.D. from the State University of New York at Stony Brook. Greg’s promotion was effective July 1, 2008.

2008 PhD RECIPIENTS

Nikolaos Daniilidis “*Experimental Studies of the Bragg Glass Transition in Niobium*” Advisor: Professor Ling

Yongxing Guo “*Microscopic Investigation and Modeling of Microtubule Self-Organization in Tubulin Solutions*” Advisor: Professor Valles



Adam Z. Hartman “*Effects of Nanoconfinement on Molecular Motors: Collective Kinesin Behavior, External Modulation, and Applications to Molecular Transport*” Advisor: Professor Xu

Maryam Jouzi “*Carbon Nanotube Nanoneedles and Their VBiological Applications*” Advisor: Professor Xu

Hossein Khiabani “*A Maximum-Likelihood Multi-Resolution Weak Lensing Mass Reconstruction Method*” Advisor: Professor Dell’Antonio



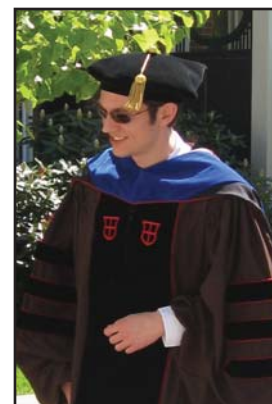
Dipanjan Mazumdar “*Coherent Magnetotunneling Based on (001) Magnesium Oxide Barrier*” Advisor: Professor Xiao

Hongbo Peng “*Towards Hybridization-Assisted Nanopore DNA Sequencing*” Advisor: Professor Ling

Yeuan-Ming Sheu “*Finite-Temperature quantum Electrodynamics: General Theory and Bloch-Nordsieck Estimates of Fermion Damping in a Hot Medium*” Advisor: Professor Fried



Peter F. Sorensen “*A Position-Sensitive Liquid Xenon Time Projection Chamber for Direct Detection of Dark Matter: the XENON10 Experiment*” Advisor: Professor Gaitskell



Michael D. Stewart, Jr. “*Superconductor to Insulator Transitions in Amorphous Nanohoneycomb Films*” Advisor: Professor Valles

Dapeng Wang “*Electronic Transport and Potential Applications of 1D and 2D Granular Nanotubes and Metals*” Advisor: Professor Zaslavsky

Scott J. Woltman “*Tunable Liquid Crystal Lasers*” Advisor: Professor Crawford

Hwi Dong Yoo “*Top Quark Pair Production Cross Section in the Lepton+Jets Channel Using b-tagging at $DØ$* ” Advisor: Professor Partridge

MASTER OF SCIENCE RECIPIENTS

Helen Hanson	Jeffrey Shainline
Shawna Hollen	Jing Wang
Paul Huwe	Xi Wang
Hye Yun Jung	Paul Weinger
Qian Miao	David Wiygul
Steven Palefsky	Jing Zhang



GRADUATE AWARDS

Galkin Foundation Fellowship: Yongxing Guo

Beyer Award: Michael Stewart

Forrest Award: Nikolaos Daniilidis

Anthony Houghton Award: Kam Tuen Law

Dissertation Fellows: Kam Tuen Law and Liang Wu

Award of Excellence as a Graduate TA: Paul Huwe and Georgios Papathanasiou

2008 UNDERGRADUATE DEGREE RECIPIENTS



Adam S. Backer, Bachelor of Science, Engineering-Physics, with honors

Edward B. Baker, Bachelor of Science, Math-Physics, with honors "Singularities in the Presence of M2-Branes" Prof. Lowe

Andrew M. Davenport, Bachelor of Science, Biophysics, with honors

Alan I. Gabel, Bachelor of Science, Physics, with honors, "Electrostatic Interactions of DNA in Nanofluidic Channels" Prof. Stein

Deepa Galaiya, Bachelor of Arts, Bachelor of Science, Biophysics

Gregory V. Hebert, Bachelor of Science, Physics, with honors, "Construction of a scanning tunneling microscope for imaging biomolecules: noise reduction issues" Prof. Ling

Jin F. Huang, Bachelor of Arts, Physics

David T. Jackson, Bachelor of Arts, Physics

Megha S. Katti, Bachelor of Science, Biophysics, with honors

John S. Keller, Bachelor of Science, Math-Physics, with honors, "A Search for Charged Massive Stable Particles at D0" Prof. Cutts

Rene P. Kessler, Bachelor of Science, Biophysics, with honors

James A. Kraemer, Bachelor of Science, Biophysics, with honors

Michael Mak, Bachelor of Science, Engineering-Physics, with honors "Microreology of F-actin Networks across Isotropic-Nematic Phase Transitions" Prof. Tang

Tobin L. Marcus, Bachelor of Arts, Political Science, Physics
Angus J. McMullen, Bachelor of Science, Physics, with honors, "Construction of a Scanning Tunneling Microscope for Imaging Biomolecules: System and Performance" Prof. Ling

Ryan P. Murphy, Bachelor of Science, Physics, with honors, "Fabrication and Study of nano-meter Scaled NIS Tunnel Junctions" Prof. Valles

Taylor H. Newton, Bachelor of Science, Math-Physics, with honors, "Lie Algebras and N=4 Yang-Mills Theory" Prof. Spradlin

Andrew C. Potter, Bachelor of Science, Engineering-Physics, with honors, "Interferometry with Anyons", Prof. Feldman, Phi Beta Kappa

Jacob M. Rosenberg, Bachelor of Science, Biophysics, with honors

Jean W. Rudnicki, Bachelor of Science, Biophysics, with honors

Benjamin H. Savitzky, Bachelor of Science, Chemistry-Physics, with honors, Phi Beta Kappa

Benjamin W. Schneider, Bachelor of Arts, Physics

Michael H. Schwarz, Bachelor of Science, Math-Physics, with honors, "Monte Carlo Simulations of Thin Nematic Liquid Crystal Samples with Quasicrystalline, Fivefold Symmetric Boundary Conditions" Prof. Pelcovits

Joshua A. Spechler, Bachelor of Science, Engineering-Physics, with honors

John D. Tilleman, Bachelor of Science, Engineering-Physics, with honors



2007-2008 UNDERGRADUATE AWARDS

R. Bruce Lindsay Prize for Excellence in Physics

Edward B. Baker and Andrew C. Potter

Mildred Widgoff Prize for Excellent Thesis Presentation

Gregory V. Hebert, Angus J. McMullen and Taylor H. Newton

2008 POSTER PARTY

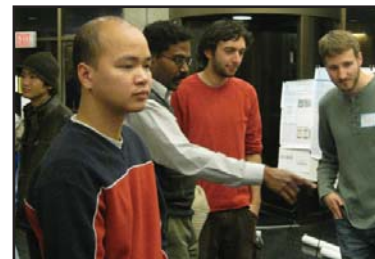
On November 19, 2008, the Department held its annual "Poster Party", where faculty and their undergraduate and graduate students displayed posters to illustrate the exciting research being carried out over a broad range of physics. Research groups in the Department as well as affiliated groups in the Department of Chemistry and the Division of Engineering were represented.



time for one-on-one conversations with potential research advisors and their current graduate students. The event also provides an opportunity for undergraduates to learn about departmental research and develop connections with faculty which will lead to summer participation in a research group through the University's UTRA program as well as senior thesis projects.



The event provides students with an easy and welcoming way to learn about research opportunities in the Department. First-year graduate students typically join research groups at the end of their first year, and the poster session provides an overview of the many opportunities available to them. The informal atmosphere allows ample



2007-2008 PHYSICS UTRA AWARDS

The UTRA program provides opportunities for collaboration between students and faculty members and allows students to gain insights into the structure of academic work in a particular field.

Alexander Cerjan '09 "Searching for High Redshift Clusters of Galaxies" Advisor: Prof. Dell'Antonio

Jackson Del Bonis-O'Donnell '09 "Electrostatic Properties of Charged Biomolecules in Nanofluidic Channels" Advisor: Prof. Stein

Stuart Elston '08.5 "Sub-Wavelength Optical Resonance Cavity" Advisor: Prof. Xu

Anne Fabricant '09 "A glimpse of Polynesian astronomy" Advisor: Prof. Gerritsen

Nicholas Hagerty '10 "Precise manipulation of DNA with optical

tweezers for genetic analysis using solid-state nanopores" Advisor: Prof. Stein

Colin Horowitz '11 "Statics and Dynamics of DNA Confined in Nanoslits with Embedded Nanoscale Topology" Advisor: Prof. Stein

Jensen Law '08.5 "Measurement of Adhesion between a Human Neutrophil and Yeast Hyphae Using a Micromanipulation Technique" Advisor: Prof. Tang

Eric Leonard '09 "Spinning a Spherical Geodesic" Advisor: Prof. Marston

Jacob Matlick '09 "Microcoils for NMR Study of Nanosize Structures" Advisor:

Prof. Mitrovic

Samuel Ocko '09 "Quantum Spin Liquids on the Kagome Lattice: Fact or Fiction?" Advisor: Prof. Marston

Christine Pappas '09 "Ordered lead dot array and silver bilayer films for study of the superconducting proximity effect" Advisor: Prof. Valles

Stefan Schaffer '09 "Using a Pressure-Driven Flow to Resolve DNA Molecules in Solid-State Nanopores" Advisor: Prof. Stein

Charles Wood '10 "Optical Tweezer Control of DNA in a Nanopore" Advisor: Prof. Stein & K. Silva

BROWN APPROVES A NEW AB CONCENTRATION

Brown University has approved a new AB concentration "Physics and Philosophy" that will be jointly run by the two departments of the same name. The concentration is for undergraduates who have a deep interest in understanding physics but do not need to acquire the laboratory and computational skills of a professional physicist. It acquaints students with the most philosophically interesting physics and balances the student's need to grapple with some computational problems with their need to deepen their investigation of conceptual and epistemological issues. By the end of the program, students are expected to possess an excellent conceptual understanding of the most philosophically interesting physics, relativity and quantum mechanics. They should be able to discuss the central interpretational issues in physics. The concentration should prepare a student either for graduate study, especially in a history and philosophy of science (HPS) program, or for employment in science education or journalism. Law and medicine also would look favorably on such concentrators as having versatile interests and being able to master difficult material.

PARTNERSHIP WITH LOCAL GK-12 SCHOOLS

Last year, Brown received a five-year GK-12 award from the National Science Foundation to start a program entitled "Physical Processes and the Environment." Each year, a group of nine graduate student fellows is competitively selected. These individuals, who are already engaged in thesis research, work closely with teachers at two elementary schools and three high schools in Providence. The introduction of various aspects of their research into classroom settings serves the dual purpose of helping students to learn while enhancing research.



In the summer prior to the academic year, these fellows receive extensive training in order to work effectively in the classroom with teachers. As part of the program, a group of elementary school and high school teachers are selected to work with faculty mentors doing cutting-edge research in labs at Brown. The graduate student fellows participate in multi-week training in inquiry-based learning and other classroom skills, and work with the elementary and secondary teachers during the summer.

The GK-12 program has also organized successful outreach programs including a conference, "Empowering your Future", aimed at engaging girls in hands-on science and engineering, a science fair at an elementary school attended by over

100 people, and an after-school science club at a high school which inspired students to participate in the 2008 science olympiad.

This year's GK-12 fellows from the Physics Department are Shawna Hollen and Paul Huwe, who have focused on working with teachers at Vartan Gregorian Elementary School and Hope High School respectively. The program also enlists the aid of volunteer graduate students, some of whom will become teaching fellows the following year. The NSF GK-12 program is run in collaboration with the Engineering Division and Department of Geological Sciences.



ARTHUR O. WILLIAMS LECTURE

Nigel Goldenfeld delivered the 2008 A. O. Williams lecture to a packed auditorium. During the day, he met with faculty and engaged in a lively discussion over lunch with graduate students where he described his wide-ranging research in theoretical condensed matter physics.

Prof. Goldenfeld holds a Swanlund Endowed Chair and is a Professor of Physics at the University of Illinois at Urbana-Champaign. He received his Ph.D. from the University of Cambridge (U.K.) in 1982, and was a postdoctoral fellow at the Institute for Theoretical Physics, University of California at Santa Barbara from 1982-1985. Prof. Goldenfeld has been an Alfred P. Sloan Foundation Fellow, a University Scholar of the University of Illinois and a recipient of the Xerox Award for research and the A. Nordsieck award for excellence in graduate teaching. In 1996, he co-founded NumeriX, a company that specializes in high-performance software for the derivatives marketplace. He is a member of the Editorial Board of the International Journal of Theoretical and Applied Finance and is a Fellow of the American Physical Society.



NEW ALUMNI WEB SITE AND ALUMNI EVENT

Below is a sample of one of the many notes we received from alumni. Our call for news yielded a tremendous response that exceeded the space available in this publication. However, a new feature will be launched on our web site this spring that will post all of the news you sent us, and allow you to make updates and communicate with other alumni. On Brown Degree Day, scheduled for April 4, 2009, almost forty alumni will return to the Physics Department to offer career advice to undergraduate and graduate students.

George Wallerstein '51 - After graduating, the Korean War made me spend 2 years in the U.S. Navy, which introduced me to the West Coast. I applied to Caltech for graduate work in physics but was advised by Carl Anderson (1936 Nobel Laureate who discovered the positron) that my record might not get me in so I should also apply in astronomy. That worked, and I completed my PhD in 1958. I went to the Berkeley Astronomical Department where I spent seven years before becoming an associate professor. I was then asked to head up a new astronomy dept at the University of Washington in Seattle, a place I had always wanted to live because of the nearby mountains, and where I still live today. Our department here has granted PhD's to two Brown physics graduates: Tom Grenfell, now a research professor here, and Bernie Bates (actually a joint physics and geology major at Brown), now on the faculty of the University of the Puget Sound. After finally retiring in 2003, I have continued with research which, over the years, has earned me the American Astronomical Society's Russell Prize for career research. My senior thesis advisor was R. Bruce Lindsay whom I visited many years later. By then he no longer drove a car so his wife was waiting for him at his office. She was reading a book...in Latin! I was really impressed.

STAFF NEWS



Sara Tortora, Department Manager, joined Physics in July 2008. She has held various positions at Brown over the past fourteen years, including Associate Director of the Leadership Alliance and Special Assistant to the President. Sara has a B.A. in English and Spanish from Indiana University, and a B.S. in accounting from the University of Maryland. She is delighted to be working on the academic side of the University, and especially pleased to be part of the Physics Department.



Sabina Griffin joined the Physics Department as an Administrative Assistant in September. She is a graduate of Boston University College of Communications. Sabina worked at Boston Children's Hospital Orthopedics Department and at Harvard University Health Services as a Communication Specialist where she assisted in developing health promotion and education throughout the university. Sabina enjoys working with Physics faculty, staff and students and is thrilled to be a part of our vibrant community.



Barbara Dailey joined the Department in 2006 as Administrative Assistant/Facilities and was promoted to Student Affairs Coordinator last summer. Barbara came to Brown as an undergraduate in the late 1970's, and her connection to Brown has shaped her life in deep and lasting ways. She has really enjoyed working in Physics and being reconnected to the Brown community from a totally new vantage point.



Ken Silva, recently received a University Excellence Award for Innovation. The Excellence Awards recognize staff members whose outstanding contributions have uniquely reflected the values of the Brown University community. Excellence Award winners are nominated and selected by their peers in seven categories: Citizenship, Diversity, Efficiency, Innovation, Managing for Excellence, Rising Star, and Service. Ken has been with Physics since 2002 as a Laboratory Manager.

SAVVAS KOUSHIAPPAS, ASSISTANT PROFESSOR OF PHYSICS



Photo: John Abromowski

Professor Savvas Koushiappas joined the department in August of 2008. The focus of his research efforts is an inquiry into the nature of dark matter from a theoretical perspective, particularly the coupling of the physics of the dark matter particle to the large-scale structure of the Universe as deduced from numerical simulations and astronomical observations. Koushiappas graduated with a B.S. in astrophysics from the University of New Mexico, and after earning his Ph.D. from Ohio State University, he was a post-doctoral research fellow at the Swiss Federal Institute of Technology (ETH-Zurich) and at Los Alamos National Laboratory. He continues to participate in a collaborative effort led by Los Alamos scientists to analyze large cosmological simulations that model theoretical predictions of the distribution of dark matter and the effects of dark energy in the growth of cosmological structure. Koushiappas and his research group at Brown are also involved in the interpretation and theoretical implications of the latest results from a diverse group of present and future large scale experiments, such as the LHC at CERN (particle physics), FERMI & VERITAS (gamma rays), as well as CDMS, XENON 10 and LUX (direct detection) and IceCUBE (neutrinos). He also continues to be involved in the astrophysical field of galaxy formation and the complex brayonic processes that occur in the centers of dark matter halos. Koushiappas has created a new course, Stellar Physics and the Interstellar Medium, which examines the structure of stars, their evolution from birth to death, as well as their surrounding environment.

COMMUNITY PREP OUTREACH PROGRAM

With the generous support of **Wini Galkin '52**, a Brown alumna, a community outreach program was launched for the students of Community Preparatory School in South Providence last October. The intent of the program, directed by Professor Meenakshi Narain, is to spark enthusiasm for science while providing fun and hands-on ways for students to grasp various scientific concepts. The kickoff, attended by approximately 100 Community Prep students, was a demonstration conducted by Dean Hudek in one of Brown's physics laboratories. The local NBC channel was present and aired a news report on the program.

Several Brown students have led a series of weekly science club meetings at Community Prep since the initial demonstration show. The club meets after regular school hours on Friday, and is comprised of students in grades 6-8. Discussions during the weekly meetings have covered a wide range of topics such as light, energy, mass, buoyancy and density, and each session includes an activity to demonstrate a scientific principle that corresponds to the discussion. The students have created Cartesian divers, made pinhole cameras, and constructed small motors out of batteries and coiled wire. One memorable session involved the rigging of a speaker out of a magnet, a soup bowl from Au Bon Pain and a coil of wire. The Brown student leading the activity was thrilled to have the club participants clearly and correctly explain to him why it worked. The students are allowed to keep the devices they make, and the devices are intentionally constructed from common household items so students can make more at home if they wish. In addition to many more such hands-on modules based on physics and engineering concepts, an evening program at Ladd Observatory for Community Prep students is expected to take place this spring.



The Community Prep site coordinator said "I think it's great to see the kids so engaged in science when it's not for a grade or a reward. They're here because they have a genuine interest. With the help of the Brown students, our students are able to explore scientific principles in a relaxed and informal, yet safe and engaging environment." One of the Brown club leaders wrote, "The kids are wonderful and receptive and kind and funny, and I've enjoyed and gotten as much out of this experience as they have."



2009 A.O. WILLIAMS LECTURE

The 2009 A.O. Williams Lecture will be given on February 9, by Dr. Steven E. Koonin who will speak about emerging energy trends and technologies for the 21st century. Dr. Koonin serves as chief Scientist of BP, the third largest energy company, where he has held the position since 2004.



LADD OBSERVATORY



Ladd Observatory's 117th year was one of the busiest to date. An unusually high number of clear evenings for the Tuesday public nights attracted many visitors, and attendance at each open house continues to increase. One of the more beautiful astronomical events, a lunar eclipse, drew several hundred people last February, which is a typical turnout for events such as eclipses, transits, comets, and other ephemeral phenomena. Lectures and demonstrations are offered downstairs in the library on every public night. These are well-attended, and delivered in a way that provides listeners with new perspectives on science and the universe. The audience for Ladd's programs is diverse, and includes Brown faculty, staff and students as well as children and adults of all backgrounds and educational levels from the local community.

A Champlin grant supported the purchase of a weather station and an all-sky camera, both of which will be permanently installed on the roof of Ladd. In addition to informing the public on sky conditions during the open houses, the information and imagery from these instruments will soon be available online. A solar telescope with an H-alpha filter and several white light telescopes were purchased for use in public programming. Staff members have conducted workshops for teachers about solar and night-time astronomy, and these telescopes are also used by Physics staff and graduate students on visits to public schools.

Significant time had been dedicated to the renovation of historic scientific instruments at Ladd, many of which were given to the observatory when it opened in 1891. Some instruments are still in excellent condition and are used on public nights to demonstrate concepts from astrophysics.

In February 2009, the entire staff of Ladd Observatory, some of whom have served Ladd for more than three decades, was presented Brown's Excellence Award for Citizenship by President Ruth Simmons. They are grateful for this show of encouragement by the Department Chair Chung-I Tan and former Chair Dave Cutts, and are pleased to continue providing innovative science education for Brown and the local community.

More than 700 people have signed up for Ladd's Listserv to gain access to information on events at Ladd and celestial happenings overhead. To sign up, go to <http://www.physics.brown.edu/physics/commonpages/ladd/>



Dean Hudek, Michael Umbricht, Robert Horton, Francine Jackson, Craig Cortiss, Dean David Targan, Director, and David Huestis

MENTORING PROGRAM FOR GRADUATE TEACHING ASSISTANTS

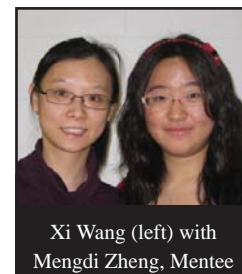
Graduate students in the Department of Physics have taken the initiative to develop and establish a program to train novice teaching assistants. The effort, supported by Department Chair Chung-I Tan and Professors Ian Dell'Antonio and Robert Pelcovits, is in its second year.

Working with Dr. Kathy Takayama of the Sheridan Center, a two-day orientation session on reflective teaching and grading was developed for incoming graduate students. The first day focused on the development of a teaching philosophy which prompted students to consider their own learning experiences and how they might build upon them for their own students. Developing consistent grading procedures among TAs has always been a concern, and the second day of the session included a series of activities to address this issue and cultivate an awareness of how perspective shapes grading outcomes. Inspired by the Physics Department, Dr. Takayama organized a Sheridan Center workshop in September on grading reports.

First-year graduate students were strongly in favor of the continuation of the orientation for teaching assistants, and they suggested the creation of a mentoring program which matches new TAs with experienced ones. As a result, a teaching mentor was added to the current department community mentor program. The call for volunteers to participate in this new program was overwhelmingly positive although the first year did not go as smoothly as hoped. Currently, the program is being reviewed and adjusted. Next year's program will incorporate more information on the various grading philosophies employed by the Physics Department.



Helen Hanson with Andy Blaeser, Mentee



Xi Wang (left) with Mengdi Zheng, Mentee

2008 FACULTY HONORS



Professor Michael Kosterlitz was appointed by the Korea Institute for Advanced Study as a KIAS Scholar at the School of Computational Sciences for a period of two years.

Professor Anastasia Volovich is a 2008 PECASE winner (Presidential Early Career Award for Scientists and Engineers). PECASE winners are chosen from the new NSF CAREER awardees. She was honored at a White House ceremony in December, 2008.



Professor Brad Marston was selected by the National Science Foundation as an American Competitiveness and Innovation Fellow.

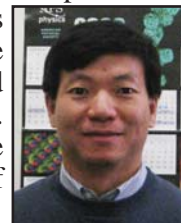


Professor Peter Westervelt received the Silver Medal in Physical Acoustics at the 156th meeting of the Acoustical Society of America.

Professor Robert Pelcovits received the President's Award for Excellence in Faculty Governance.

FACULTY IN THE NEWS

Professor Jay Tang, Dr. Guanglai Li, and former Brown undergraduate Lick-Kon Tam, completed a detailed study of the swimming patterns of a microbe, showing for the first time how its movement is affected by drag and a phenomenon called Brownian motion. Their findings were published in the Proceedings of the National Academy of Sciences.



Professor Rick Gaitskell presents a public lecture, "A Noble Endeavor – Looking for Dark Matter" at the University of South Dakota.

Professor Gerald Guralnik's 1964 paper on global conservation laws and massless particles has been cited as a Milestone Letter by the American Physical Society.



Professor Meenakshi Narain was selected as one of the 2008 Career Development Award Winners by the ADVANCE program at Brown.

Professor Dave Cutts was interviewed on Channel 10 about the launch of the much-heralded Large Hadron Collider (LHC) near Geneva, Switzerland last September.



BOB PELCOVITS RECEIVES ROYCE FAMILY PROFESSORSHIP IN TEACHING EXCELLENCE

Bob Pelcovits was selected in the spring of 2008 as one of two recipients of a Royce Family Professorship in Teaching Excellence. The professorships, supported by a fund established by Brown alumnus and trustee Charles M. Royce, are awarded for a term of three years. The award bestows an annual stipend in addition to regular salary, as well as a \$20,000 annual Teaching Excellence Fund which can be used to develop teaching aids and support scholarly activities, including employment of undergraduate and graduate research assistants.

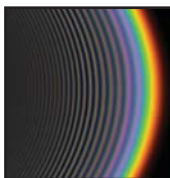
Royce Family Professors are selected by the Dean of the Faculty, Dean of Medicine and Biological Sciences, Provost and President and may be nominated by faculty peers or department chairs. All Royce Professors will offer a colloquium during their term that provides insight into their teaching approach or their scholarly interests.

Bob Pelcovits joined the Brown physics department in 1979. A graduate of the University of Pennsylvania, he received his Ph.D. from Harvard in 1978. He has done postdoctoral research at the University of Illinois and Brookhaven National Laboratory, and was an Alfred P. Sloan Fellow and a recipient of the Bergmann Memorial Award from the U.S.-Israel Binational Science Foundation. He was also a visiting professor at the Weizmann Institute of Science, Tel Aviv University, and Brandeis University.



NEW CLASS OFFERINGS

PHYS 0110-Excursion to Biophysics Associate Professor Jay Tang's course introduces important physics concepts and techniques relevant to biology and medicine, such as diffusion and transport of molecules and intracellular components, Brown motion and active swimming of microbes, motion of particles confined by a harmonic potential, Boltzmann distribution, exponential growth or decay, and statistics of single molecule behavior. The goal of the course is to cultivate interest and provide essential basics for more rigorous study of biological physics as a branch of interdisciplinary science.

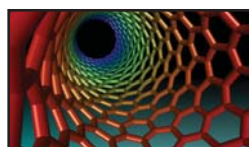


PHYS1250-Stellar Physics and the Interstellar Medium Assistant Professor Savvas Koushiappas has created a course that is an introduction to the physical processes that take place in stellar interiors, and the interstellar medium. It includes topics such as energy production, heat transfer, and stellar structure, as well as stellar evolution and the physics of compact stellar remnants, such as white dwarfs, neutron stars and black holes. In addition it explores the complex physics of the interstellar medium, including dynamical processes, such as ionization zones, and shock propagation.

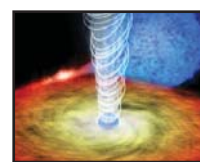


PHYS 0120-Adventures in Nanoworld Richard Feynman famously said, "There's plenty of room at the bottom," about the possibility of building molecular-size machines operating according to Quantum Mechanics. Students in this course will use basic physics and simple mathematical

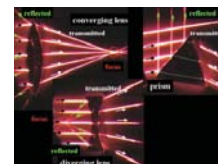
models to understand the phenomena and materials in the nanoworld. Non-science concentrators and potential science concentrators alike will learn about important classes of nano-systems such as macromolecules, nanotubes, quantum dots, quantum wires, and films. This course, taught by Assistant Professor Dmitri Feldman, addresses how people make and characterize nano-systems, and considers existing and potential applications of nanotechnology.



PHYS 1100-Introduction to General Relativity Assistant Professor Anastasia Volovich is teaching an introduction to Einstein's theory of gravity. The course includes topics relating to special relativity, spacetime curvature, cosmology and black holes. Students will gain familiarity with concepts and physical principles of general relativity as well as working knowledge of the mathematics underlying it. This course will be of particular interest to students interested in pursuing study in astrophysics, cosmology and theoretical physics.

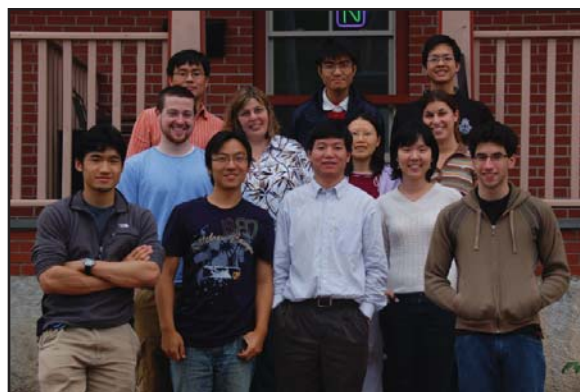


PHYS 1970B - Introductory Optics - Rudolf Oldenbourg, a visiting professor from Marine Biological Laboratories, is offering this course to students who have a foundation in physics and are especially interested in optics. The course covers the interaction of light with matter, geometric and wave optics, polarization, fluorescence, and optical instruments (e.g. interferometer, spectrometer, microscope and telescope).



"SURE" Program in Collaboration with the Chinese University of Hong Kong

In 2008, our department participated for the first time in the "Summer Undergraduate Research Exchange" (SURE), a collaboration with the physics department at the Chinese University of Hong Kong (CUHK). This program, funded by generous donors at CUHK, supports successful applicants from CUHK to engage in summer research projects in leading institutions overseas so they may gain valuable experience and exposure to cutting-edge research. Two students, Adam Fok and Richard Hui, came to Brown during the summer of 2008 to pursue research under the guidance of Professors Jay Tang and Bob Pelcovits. Both Brown and CUHK are very pleased with the results and have decided to continue collaborating via the "SURE" program for the coming years. Many of our faculty members have already indicated their willingness to serve as mentors for these summer visiting students from Hong Kong.



Adam Fok with Jay Tang's Group

Physics at Brown



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VIETNAM VISIT

On October 2, 2008, Hanoi University of Science (HUS) signed a memorandum of agreement to formalize cooperative relations with Brown's Department of Physics. Four representatives from HUS – Dr. Cam Bui, Rector; Dr. Nga Phan, Director of the Office of International Relations; Dr. Cong Bach, Dean of the Faculty of Physics; and Dr. Bing Nguyen, Vice Dean – participated in the signing ceremony with Provost David Kertzer. The delegation met with President Ruth Simmons immediately after the ceremony.

The purpose of the agreement is to develop a robust relationship between the two entities that includes the exchange of academic materials and teaching methods and joint educational, cultural and research activities. During their visit to campus, the Vietnamese delegation toured the instructional labs, attended a class on electricity and magnetism taught by Marcus Spradlin, discussed curriculum materials with several faculty members, and held meetings with Sheila Bonde, Dean of the Graduate School, and Clyde Briant, Vice President for Research.

They also had the opportunity to meet with a group of current Brown students from Vietnam, several of whom came to Brown for the graduate program in Physics from HUS. Initially, cooperative activities between the two universities will be limited to the discipline of physics but both parties agreed that the cooperation may expand to encompass other academic disciplines in the future.



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