

# Physics at Brown

NEWS FOR ALUMNI AND FRIENDS

2007 ISSUE

## GREETINGS FROM THE CHAIR - SPRING 2008

Welcome to another issue of the Brown Physics newsletter. I wrote three years ago, during my first term as the department chair--with a committed faculty, dedicated staff, enthusiastic students, supportive administration, and engaged alumni and friends--that the future of physics at Brown looked bright. Many things have taken place since then. Here we highlight some of the activities of the past year.

2007 marked the 50th anniversary of the BCS Theory of Superconductivity. We honored Prof. Leon Cooper with a two-day symposium on April 12-13. A brief description of this event is provided on page 3.

We also report on the establishment of the Institute for Molecular and Nanoscale Innovation, which represents an expansion for the newly created Center for Nanoscience and Soft matter (CNSSM), initially proposed by physics, chemistry and engineering. I am pleased to announce that Prof. Gang Xiao has agreed to serve as the first Director of CNSSM. In addition, please join me in congratulating Professor Jay Tang for his promotion to



the rank of Associate Professor with tenure. We also report on some notable faculty achievements for the past year.

We continue the tradition of highlighting the research of our 2007 Galkin Foundation Fellow on page 2. Also the effort in enriching our physics instruction continues. Three new courses are offered this year and proposals for three new physics concentrations are under way. Other noteworthy activities include WiSE, Poster Session, UTRA Awards, Resource Center, etc. In addition, community outreach remains a priority for the Department with a weekly open house at Ladd and a greatly expanded five-year NSF supported GK-12 program.

Thanks to a generous gift from his family, an Anthony Houghton Prize will be awarded annually for the best theoretical thesis. Thanks to gifts from friends of Prof. Kyungsik Kang, a special lecture on High Energy Particle Physics will be held on April 25, 2008. Lastly, we also welcome two new members of our staff, Ms. Elizabeth Barlow and Ms. Susan Mattraw as Financial Administrator and System Administrator, respectively.

## FALL 2007 INCOMING CLASS

**Mr. Michael Antosh**

University of New Hampshire,  
Durham

**Ms. Saptarna Bhattacharya**

Indian Inst. of Tech., Madras

**Mr. Andrew Blaeser**

Boston University

**Mr. Jeremy Chapman**

Syracuse University

**Mr. Richard Cook**

University College, London

**Mr. Alex Geringer-Sameth**

Washington University

**Mr. Carlos Hernandez Faham**

Arizona State University

**Mr. Ilyong Jung**

Kyungpook National University



**Mr. Son Le**

Hanoi University of Technology

**Mr. Chao Li**

University of Sci. & Tech. of China

**Mr. Pengyu Liu**

University of Sci. &  
Tech. of China

**Mr. David Malling**

Syracuse University

**Mr. Ryan Michney**

Dartmouth College

**Ms. Mirna Mihovilovic**

University of Zagreb

**Mr. Florian Sabou**

Babes-Bolyai University

**Mr. Antun Skanata**

University of Zagreb

**Mr. Chenjie Wang**

University of Sci. & Tech. of China

**Mr. Congkao Wen**

Zhejiang University

## 2007 GALKIN FELLOW - YONGXING GUO

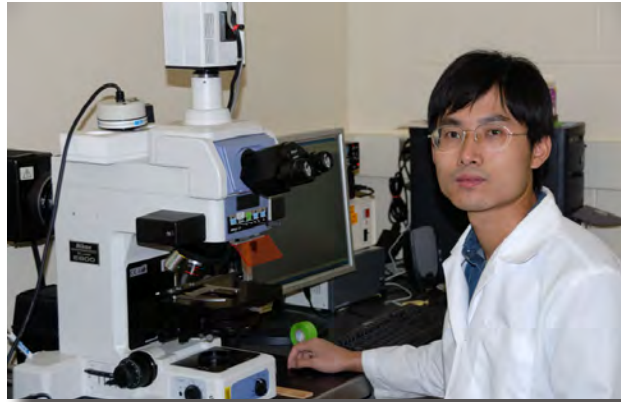
*Yongxing Guo, the 2007-2008 Galkin foundation fellow, is completing his Ph.D. dissertation research on Microtubule birefringence patterns. For the past four years Yongxing has conducted research at Brown University, with his advisor Prof. James Valles, in frequent collaboration with Prof. Jay Tang and his graduate student Yifeng Liu.*

The viability of cells relies on large molecules self organizing into structures that support their shape and carry out the functions essential to life. A great deal of effort has focused on the mechanisms controlling and driving their self assembly. Yongxing Guo, a Galkin Fellow, has been investigating how a ubiquitous biopolymer manages to self assemble into a macroscopically visible structure. His work, while carried out in a test tube, nevertheless has provided insight into mechanical processes that can underlie biological pattern formation.

More than 10 years ago, workers discovered the spontaneous development of zebra-like stripes (see figure) in a solution of polymerizing Microtubules (MTs). MTs are hollow cylindrical filaments composed of protein subunits (tubulin) that form and grow rapidly in length when their solution is warmed to near body temperature. Because these bio-polymers serve as major components of the eukaryotic cell cytoskeleton, the stripe finding suggested an origin for structures observed in some cells. Models for the symmetry breaking process giving rise to the striated pattern were proposed, but none had been quantitatively verified. Yongxing, in close collaboration with fellow graduate student Yifeng Liu and supported by NASA, initially attacked this pattern formation problem using quantitative microscopy techniques. Those experimental investigations led to a microscopic view of and a quantitative model for the pattern formation.

Yongxing applied quantitative fluorescence and birefringence (i.e. polarization) imaging techniques to see the MT striations develop. He found that the striations

correspond to periodic variations of the fluorescence and birefringence intensity. Moreover, the variations could be explained by presuming that the MT's form bundles that take



on a sinusoidal shape. The sinusoidal undulations produce the striations provided all of the sine waves are locally in phase and neighboring sine waves "nest" together. The predicted density variations from this nested geometry are in quantitative accord with the measured data. The temporal evolution of the patterns revealed a surprising mechanism. It showed that MTs that are aligned by magnetic field or flow during

the initial stages of polymerization form bundles. The bundles, which polarize light, elongate and buckle in coordination with their neighbors. These buckled bundles create the birefringent stripes. This work was published in Proceedings of the National Academy of Sciences, U.S.A.

The observations suggested a mechanical model for the process, which Yongxing went on to develop aided by discussions with Professor Alan Bower. The model asserts that an individual MT bundle elongates through continued polymerization and buckles within the elastic network formed by the other bundles and unbundled microtubules. The stress



driving the buckling originates in the elongating bundle pressing against its surroundings. A normal mode stability analysis of the model shows that the characteristic wavelength and critical buckling force are determined by the properties of the bundles and their neighboring elastic network. By

analyzing the time lapse phase contrast microscopy images of the pattern and using cutting edge image analyzing algorithms created by Yongxing, the local MT bundle alignment directions were obtained, from which the MT bundle contour lengths were measured. The same growth rates among different MT bundles revealed that the MT bundles elongate uniformly along their contour during buckling and polymerization occur uniformly along the bundles. This work was published in Physics Review Letters.

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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.

AO WILLIAMS



The A. O. Williams lecture of 2007 was delivered by Prof. Joseph Taylor from Princeton to a packed auditorium. During the day, Prof. Taylor met with faculty and engaged in a lively lunchtime discussion with graduate students on science and careers in science.

Prof. Taylor and Russell Hulse (his former graduate student) were jointly awarded the 1993 Nobel Prize in Physics

for their discovery of a binary pulsar which enabled many tests of general relativity, and, in particular, the first evidence for the existence of gravitational waves.

The Department is looking forward to the A. O. Williams lecture of 2008, which will be delivered by Prof. Nigel Goldenfeld from the University of Illinois. 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 for the years 1982-1985 was a postdoctoral fellow at the Institute for Theoretical Physics, University of California at Santa Barbara. Prof. Goldenfeld has been an Alfred P. Sloan Foundation Fellow, a University Scholar of the University of Illinois, a recipient of the Xerox Award for research, and a recipient of 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. Prof. Goldenfeld 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.



2007 COOPER CONFERENCE



A two-day symposium, “50 Years of the BCS Theory of Superconductivity”, was held during April 12-13, 2007 at Brown, highlighting and celebrating the 50th anniversary of the theory of superconductivity. The BCS theory stands as an outstanding achievement in the development of twentieth century knowledge with far reaching applications in science and technology. The Nobel Prize given for this work (to Bardeen, Cooper and Schrieffer) represents one of the glowing successes of US science.



The symposium began in the morning of April 12th with talks by several distinguished speakers: Anthony J. Leggett (Illinois) 2003 Nobel Prize in Physics for his work on superfluidity; Frank Wilczek (MIT), 2004 Nobel Prize in Physics for the discovery of asymptotic freedom in the theory of the strong interaction; Wolfgang Ketterle (MIT) a recipient of the 2001 Nobel Prize in Physics for Bose-Einstein



condensation. A series of public lectures under “Superconductivities; from Mystery to Mastery” was held in the afternoon. Dr. Alexis P. Malozemoff, (American Superconductor Corporation), lectured on: “New Horizons for Superconductor Applications: the Electric Power Grid”. Prof. Leon Cooper also gave a lecture on: “Superconductivity and other insoluble problems.” A panel discussion was held involving all these speakers, including Prof. David Lee (Cornell), a recipient of the 1996 Nobel Prize in Physics, for his work on superfluidity.



The second day featured new scientific developments and breakthroughs with talks by Eugene Demler (Harvard), Alexei Kitaev (Caltech), Robert Schoelkopf (Yale), J.S.Tsai (NEC Research, Tokyo), and with additional contributions from Profs. Sean Ling, Gang Xiao and Brad Marston. Profs. A. Jevicki and G. Xiao, who were responsible for organizing this highly successful symposium.





2007 PhD RECIPIENTS



**Elnaz Alipour-Assiabi** “*Shape Transformations in Lipid Bilayer Membranes and Other Problems in Physical Biology*”  
 Advisor: Prof. Powers

**Thorsten Jens Battefeld** “*Cosmological Perturbations in the Early Universe*” Advisor: Prof. Brandenberger



**Ivo Kolev Dimitrov** “*Ultrasonic Attenuation, AC Magnetic Susceptibility and Small-Angle Neutron Scattering Studies of Vortex States in Single-Crystal Nb and V-Ti Alloys*” Advisor: Prof. Ling

**Aristomenis Donos** “*Bubbling AdS and Droplet Descriptions of BPS Geometries in IIB Supergravity*” Advisor: Prof. Jevicki

**Yun-Hu Huang** “*Solar Neutrino Detection Utilizing a Variant of a Coded Aperture on a Large Scale (HERON)*” Advisor: Prof. Lanou

**Ki-O Kim** “*Enhanced Echolocation via Robust Statistics and Super-resolution of Sonar Images*” Advisor: Prof. Cooper

**Jeffrey Kubo** “*Searching for Strong Galaxy-Galaxy Lenses in the Deep Lens Survey*”  
 Advisor: Dell’Antonio

**Bhaskar Sethumadhavan** “*Electrical Breakdown in Helium Cells at Low Temperature*”  
 Advisor: Prof. Seidel



**Weifeng Shen** “*Ultra-sensitive MgO-based Magnetic Tunnel Junctions for Spintronic Immunoassay*” Advisor: Prof. Xiao

**Matthew David Truch** “*The Balloon-borne Large Aperture Submillimeter Telescope*” Advisor: Prof. Tucker

**Qi Wen** “*Exploring the Mechanism of Like-charge Attraction in Polyelectrolyte Solutions*” Advisor: Prof. Tang

2006-2007 MASTER OF SCIENCE RECIPIENTS

<i>Van Anh Dao</i>	<i>Kewang Jin</i>	<i>Dung Van-Tien</i>
<i>Jun He</i>	<i>Hyunjin Kim</i>	<i>Nguyen</i>
<i>Zhijun Jiang</i>	<i>Feifei Li</i>	<i>Dina Naim</i>
<i>Dafei Jin</i>	<i>Cuong Kieu</i>	<i>Obeid</i>
	<i>Nguyen</i>	

2006-2007 GRADUATE AWARDS

**Galkin Foundation Fellowship:** *Dapeng Wang*  
**Forrest Awards:** *Dipanjan Mazumdar and Matthew Truch*  
**Anthony Houghton Award:** *Aristomenis Donos*  
**Dissertation Fellows:** *Wei Guo and Weifeng Shen*

PETER STUART VOSS, TRUSTEE, AWARDED DIPLOMAS

Peter Stuart Voss is chairman and chief executive officer of IXIS Asset Management Group, a global investment management firm with headquarters in Boston and Paris. He has served on the Board of Governors of the Investment Company Institute and as a member of the Board of the United Way of Massachusetts Bay. He is currently chair of the Investment



Committee for the endowments of two Boston-based philanthropic organizations, a regional vice chair for the Campaign for Academic Enrichment, a member of the Brown University Advisory Committee on Corporate Responsibility in Investing, and a member of the President’s Leadership Council. A 1968 graduate of Brown, Voss will serve as a term trustee through June 30, 2012.

2007 UNDERGRADUATE DEGREE RECIPIENTS

**Patrick Allen Courville:** *Bachelor of Science, Math-Physics with Honors, "Describing Black Holes with String Theory"* Advisor: Prof. Lowe

**Daniel John Finn-Foley:** *Bachelor of Science, Math-Physics*

**Peter Benjamin James:** *Bachelor of Science, Geo/Physics/Math with Honors*

**Stefan John Janiszewski:** *Bachelor of Science, Math-Physics with Honors, "Gravitational Lens Magnification and Mass Maps"* Advisor: Prof. Dell'Antonio, 2006-2007 Mildred Widgoff Prize for excellent thesis-presentation

**Li Wei Liu:** *Bachelor of Science, Math-Physics with Honors, "A Quantitative Comparison between Magnetic Force Microscopy and Scanning Magneto-Resistance Microscopy"* Advisor: Prof. Xiao

**Nathaniel Steven Safron:** *Bachelor of Science, Physics with Honors, "Characterization of the lowfield Behavior of Magnetic Tunnel Junction Devices via Novel Magnetotransport measurement Techniques"* Advisor: Prof. Xiao

**Robert McLellan Schaefer:** *Bachelor of Arts, Physics*



**Jonathan Ross Schwartz:** *Bachelor of Arts, Physics*

**Ryan Allen Shewcraft:** *Bachelor of Arts, Math-Physics*

**Lick-Kong Tam:** *Bachelor of Science, Math-Physics with Honors, "Near-Surface Swimming Caulobacter Tracked with Nanometer Sensitivity"* Advisor: Prof. Tang, 2006-2007 Mildred Widgoff Prize for excellent thesis-presentation

**Scott Justin Wolin:** *Bachelor of Science, Math-Physics with Honors, "Jet Energy Calibrations for the CMS Missing Transverse Energy Trigger"* Advisor: Prof. Landsberg, 2006-2007 R. Bruce Lindsay Prize for excellence in Physics

2006-2007 R. Bruce Lindsay Prize for excellence in Physics

**Chin Lin Wong:** *Bachelor of Science, Physics with Honors, "Implementation of the Pyramid Star Identification Technique"* Advisor: Prof. Tucker, 2006-2007 R. Bruce Lindsay Prize for excellence in Physics, Phi Beta Kappa

**Anthony Nicholas Zorzos:** *Bachelor of Science, Engineering-Physics, "Visualization and Tracking of Electrospray Droplet Emissions"* Advisor: Prof. Breuer

2006-2007 UNDERGRADUATE AWARDS

**Mildred Widgoff Prize for Excellent Thesis Presentation:** *Stefan John Janiszewski and Lick-Kong Tam*

**R. Bruce Lindsay Prize for Excellence in Physics:** *Scott Justin Wolin and Chin Lin Wong*

PHYSICS WiSE



This semester saw a revival of the Physics WiSE (Women in Science and Engineering) affinity group. Led by juniors Amy Lowitz and Karriane Bergen, the Physics WiSE organized multiple events, including a presentation by Prof. Narain on her research and

experiences in physics. A forum on graduate school and careers after Brown which was attended by more than 20 undergraduates, graduate students, postdocs, and faculty was held. Many further activities have been planned for the spring semester.



UNDERGRADUATE RESOURCE CENTER

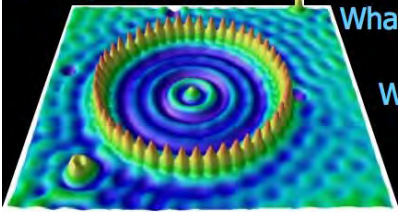
The Physics Resource Center continued in full swing; run by the physics Department Undergraduate Group (DUG) (in particular Andrew Potter (08), Ryan Murphy (08) and Teddy Baker (08)). The Resource Center was established in 2006 to provide additional assistance to students in the first- and second-year undergraduate classes (PHYS 0070, 0080, 0470, and 0500). On Wednesday and Thursday evenings, multiple tables in the lobby area are occupied by juniors and seniors, each of whom is coordinating a discussion with the 10 or so students present regarding the material in that week's problem set. In addition to getting further explanations on the course material, the students benefit from getting to know the older students and realizing that they are not fundamentally different from them. Meanwhile, the juniors and seniors benefit by learning how to explain concepts and gaining an even deeper understanding of the material; plus, the review of concepts is particularly helpful for preparing for the GREs.



## THREE NEW PHYSICS COURSES

**PHYS0120:** Assistant Professor Dima Feldman will be teaching a new first-year seminar course this Spring on “Adventures in Nanoworld” (PHYS0120). The course is a general introduction to the rapidly developing fields of nanoscience and nanotechnology. It will focus on nanoelectronics, quantum information, and the interface between nanoscale physics and biology. The quest for miniaturization has always been a major trend in technology as the rich history of the clock illustrates. Especially in modern electronics, making smaller and smaller components has become so important that for several decades now the number of transistors per integrated circuit has doubled every 24 months. The trend cannot however continue forever since the size of atoms sets a limit to possible miniaturization. Even before that limit is reached, quantum mechanics becomes crucially important. Thus, quantum paradoxes and puzzles such as the fate of famous Schrödinger’s cat are deeply connected with future technology.

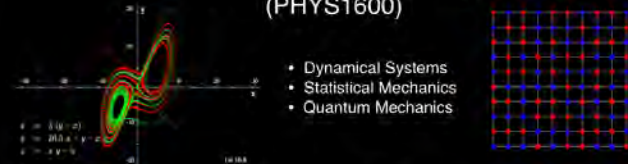
Besides quantum mechanics, the second major theme of the course will be self-organization: Interaction of numerous simple individual nanoparticles can result in complex behavior. The course will critically assess common myths and misconceptions about nanoscience. One of the assignments will be based on a bestselling science fiction novel about dangers of nanotechnology. Students will be asked to detect assumptions, exaggerations, and science mistakes in the story. The course will also make visits to laboratories to introduce students to nanoscience research being conducted at Brown.



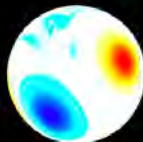
Can we build a machine from one molecule?  
How does a quantum computer work?  
Is teleportation a science fiction or reality?  
What is Nanotechnology?  
Why is small so **BIG** now?  
If you want to know the answers and love *adventures* then **PHYS 0120, Adventures in Nanoworld,** is for you! *Offered in Spring 2008*

## Computational Physics

(PHYS1600)



A new course this Spring of interest to science and engineering undergraduate concentrators as well as graduate students. Classes will be interactive, meeting in a computer lab. Python and the open source NumPy and SciPy libraries will be used to illustrate how computational methods can yield unique insight into physical systems. (No prior experience with python is necessary.)



Prerequisites: Physics 5 and 6, or 7 and 8; Physics 47; ability to write simple computer programs.  
For more information visit [courses.brown.edu](http://courses.brown.edu) or contact [Brad\\_Marston@Brown.edu](mailto:Brad_Marston@Brown.edu)

**PHYS1600:** Professor Brad Marston will be teaching a new course in the Spring on “Computational Physics” (PHYS1600). The course was designed by Professor Robert Pelcovits, and revives a similar course that he taught some time ago. It will provide students with an introduction to scientific computation, primarily as applied to physical science problems. It will assume a basic knowledge of programming and will focus on how computational methods can be used to study physical systems complementing experimental and theoretical techniques. The course will be taught interactively in a classroom equipped with computers and using the Python programming language. “Introduction to Computer Simulation Methods: Applications to Physical Systems,” third edition, by Gould, Tobochnik and Christian will be the course textbook. The course will be capped by a final project involving the computational analysis of a physical system chosen by the student and approved by the instructor. Topics to be covered include Introduction to computational physics, Simulating particle motion (solving differential equations on the computer), Simulating more complicated dynamics: many-body systems and molecular dynamics, Chaos and dynamical systems, Solving one-dimensional quantum mechanics problems, Numerical integration in high dimensions: Monte Carlo method, and Application of the Monte Carlo method to statistical mechanics problems.

**PHYS2610C:** Professor Gang Xiao taught PHYS2610C, “Selected Topics in Condensed Matter Physics,” this Fall. This new course helps graduate students broaden their scope of knowledge in condensed matter physics, learn how to leverage their existing background to select and conduct research, and develop a sense of how to build their professional career based on condensed matter physics. Selected topics include nanoscale physics, materials, and devices, spintronics and magnetism, high temperature superconductivity, strongly correlated systems, Bose-Einstein condensate, electrons in strong magnetic fields, and applications of condensed matter physics. The course also provides an introduction to some experimental techniques used in current research.

PROPOSALS FOR THREE NEW PHYSICS CONCENTRATIONS

The Physics Curriculum Committee has been working this Fall on three proposals for new undergraduate concentrations in “Physics and Philosophy,” “Biological Physics” and “Astrophysics.” As the proposals are refined they will go first to the full department for review, and if found desirable by the faculty, on to Brown’s College Curriculum Council chaired by the Dean of the College.

Spurred in part by the recent hire of a philosopher of physics, Assistant Professor Douglas Kutach, by Brown’s Philosophy Department, Prof. Dima Feldman has taken the lead in organizing a new “Physics and Philosophy” A.B. concentration. Students concentrating in “Physics and Philosophy” would take equal measures of courses in the Departments of Philosophy and Physics, including courses such as “quantum mechanics” and “epistemology.” The concentration is expected to be attractive to humanities students who might not otherwise consider taking physics courses.

Increasing numbers of undergraduate and graduate physics students are interested in science that lies at the intersection of biology and physics. Recent additions of new physics faculty who work in the area of biological physics, as well as a plan to hire a theoretical biological physicist, make it feasible now for the Department to consider offering a new Sc.B. concentration in

biological physics. One of the new faculty members, Assistant Professor Derek Stein, has been working with his colleagues on a proposed curriculum.

With the growth of our astrophysics group, including plans to hire a theoretical astrophysicist, it is also time to consider offering a Sc.B. degree in astrophysics. According to Martha Mitchell’s Encyclopedia Brunoniana, “astronomy was among the earliest subjects taught” at Brown. Originally the province of the Department of Mathematics, the subject passed to the care of the Physics Department upon the retirement of Professor Charles Smiley who led a number of expeditions to observe solar eclipses. Associate Professor Ian Dell’Antonio, who is also the physics concentration advisor, is proposing a rigorous and fully modern curriculum.



LECTURE SERIES ON HIGH ENERGY PARTICLE PHYSICS



A regular Lecture Series on High Energy Particle Physics is planned through gifts from friends of Prof. Kyungsik Kang. The first of this Series is planned for April 25 and will feature Prof. Matt Strassler of Rutgers University.

As noted in the Physics Newsletter a year ago, Prof. Kyungsik Kang came to Brown in 1964, and served Brown faithfully for more than forty years as a member of the Physics Department. Prof. Kang retired from teaching in 2005, and passed away unexpectedly in

May 2006. He graduated from Seoul National University and obtained his Ph.D. from Indiana University. He was an active researcher in the field of theoretical particle physics, with more than two hundred refereed journal publications and articles. He was elected a Fellow of the American Physical Society, the Korean Academy of Science and Technology, and the Korean Physical Society.

A memorial service was held on July 7th, 2006, during which it was noted that Kyungsik enriched us all by bringing us together as members of a global family. For us at Brown, this singular achievement is Kyungsik’s personal legacy.

JAY TANG: PROMOTED FROM ASSISTANT PROFESSOR TO ASSOCIATE PROFESSOR (WITH TENURE) OF PHYSICS EFFECTIVE JULY 1, 2008

Jay received his B.S. in Physics from Peking University in 1987 and his Ph.D. from Brandeis University in 1995. After postdoctoral training at Harvard Medical School, he served as assistant professor of physics at Indiana University from 1999-2002. Since 2003 he has served as an assistant professor of physics and engineering at Brown University. Jay’s lab is currently involved in a new research program of molecular biophysics. The main research goal is to understand the mechanisms and properties of protein

assemblies. In particular, Jay’s lab studies the assembly of the so-called cytoskeletal proteins, such as actin and tubulin, which form long filaments. Higher levels of assembly occur in solutions of these filaments, including isotropic networks, liquid crystalline phases, and densely packed lateral aggregates. “We seek to elucidate interactions that govern the formation of these states, predict and manipulate transitions among them, and explore biomedical applications.”

## 2007 POSTER SESSION

On November 14, 2007 the Department held its annual “Poster Party”, where faculty and their research students (both graduate and undergraduate) displayed posters illustrating the exciting research being carried out over a broad range of research areas. All research groups in the Department and affiliated groups in the Department of Chemistry and the Division of Engineering were represented.

This event is very informal and 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 event gives them an overview of the many opportunities available to them, allowing ample time for one-on-one conversation 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 leading to summer participation in a research group through the University’s UTRA program, as well as senior thesis projects.

## 2007-2008 PHYSICS UTRA AWARDS

**Edward Baker ‘08** “*On the Dynamics of Particles Near Space-Like Singularities*” Advisor: Prof. Lowe

**Daniel Butler ‘09** “*Neural Networks for Particle Discrimination in the XENON10 Detector*” Advisor: Prof. Gaitskell

**Simon Buttrick ‘09** “*Nanopore Barcoding of DNA/Protein Complexes*” Advisor: Prof. Stein

**John Cucco ‘09** “*Testing Cluster Effects on Mass Reconstructions*” Advisor: Prof. Dell’Antonio

**Deepa Galaiya ‘08** “*Physical Characterization and Modeling of Superhelical Actin Bundles*” Advisor: Prof. Tang

**Amandeep Gill ‘08** “*Black Holes Near and Far*” Advisor: Prof. Dell’Antonio

**John Keller ‘08** “*Research in Particle Physics*” Advisor: Prof. Cutts

**Miriam Klein ‘09** “*Spectroscopy of Lensing Cluster Galaxies*” Advisor: Prof. Dell’Antonio

**Noah Levin ‘10** “*Development of Photomultiplier Tube Detector Array for LUXcore Experiment*” Advisor: Prof. Gaitskell

**Michael Mak ‘08** “*Microrheology of F-Actin networks Using Optical Tweezers*” Advisor: Prof. Tang

**Taylor Newton ‘08** “*Duality in String Theory and N=4 Super Yang-Mills Theory*” Advisor: Prof. Spradlin

**Reshma Ramachandran ‘09** “*The Behavior of Ultra-Confined DNA Molecules*” Advisor: Prof. Stein

**Stefan Schaffer ‘09** “*Electronic DNA Analysis Using Solid-State Nanopores*” Advisor: Prof. Stein

**Michael Schwarz ‘08** “*Liquid Crystal Modeling*” Advisor: Prof. Pelcovits

**Aaron Weinstein ‘09** “*Development in LUXcore and the Search for Dark Matter*” Advisor: Prof. Gaitskell

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

## Galkin Fellowship - continued from page 2

To move closer to a cellular environment, Yongxing is now investigating how adding a second molecule to a polymerizing tubulin solution affects the pattern formation. Background molecules proteins can exert osmotic forces that enhance the tendency to form bundles. In addition, they can exert osmotic torques that can help align bundles. He and coworkers have seen dramatic effects on the stripe formation including complete quenching of it. More microscopically, they have observed thicker bundles. With continued work he hopes

to develop new intuition into how structures can form in multi-molecule system such as a cell.

During his Ph.D. studies, Yongxing participated in a number of scientific workshops and international conferences including the New England Complex Fluids Workshops (NECF) and American Physical Society Meetings (APS). He has also been awarded the Student Travel Grants from the Division of Biological Physics for the 2007 APS March Meeting.



OUTREACH

During the summer, the Physics Department began a new major outreach effort with the Providence Public School System. This program grew out of several existing efforts which demonstrated the effectiveness of outreach both for Brown students and the public school students.

For example, Prof. Greg Tucker ran a small NASA supported pilot program for three years which brought high school teachers into his research lab during the summer. During the school year Brown students visited two high schools each week and established after-school science clubs.

A dramatic increase in the scope of outreach was made possible by the award of a five-year grant from the National Science Foundation, which provides support for nine graduate student teaching fellows each year.



When starting in this program, fellows are already engaged in their thesis research. By having the fellows bring aspects of their research to the classroom and helping students to learn, the

goal is to have this experience enhance the graduate student research. To aid in this, the fellows participate in a multi-week training program during the summer prior to starting as fellows in the schools. The fellows learn about inquiry based methods of learning, along with other essential classroom skills.



The fellows are selected through a competitive application process. This year's GK-12 fellows from the Physics Department are Helen Hanson and John Macaluso, who have focused on working with teachers at nearby Hope High School. Other GK-12 fellows are working with a number of other high schools and elementary schools in Providence. 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 was established in collaboration with the Engineering Division and Department of Geological Sciences.*

STAFF NEWS



**Elizabeth Barlow** joined the Dept. of Physics as the Financial Administrator in February 2007. Liz came from the Dept. of Psychiatry and Human Behavior where she served as the Research and Financial Manager. Before joining the Brown community, Liz worked at Harvard Medical School in Boston in the Department of Neurobiology. She hopes to work with faculty, staff and students to streamline the seemingly endless paperwork and processes we face everyday. She is working toward ensuring that the needs of faculty, staff and students are met while still complying with funding agency requirements and Brown University guidelines. Liz is very happy to be adding the physical sciences dimension to her past experience in basic and clinical research.



**Susan Mattraw** began working at Brown in early 2004 and has held various technical positions in the departments of Chemistry, Engineering and CIS during that time. She has worked as DCC, Electronics Technician and Support Specialist in these departments helping to create and provide computing and hardware solutions for PCs and Macs through direct support, written documentation and podcasts. Prior to working at Brown she worked extensively as an R&D technician and support specialist throughout the Boston area for several audio product developers, helping to create and improve hardware, software and documentation for signal processors and synthesizers. In addition to this she has also provided technical support for touring music acts as well as being as a freelance recording engineer and musician. She began her technical career as a child when she was given a broken watch to play with and, through curiosity, somehow managed to repair it. As a result her family encouraged her technical interests and problem solving skills which have been a large part of her life since that time. She is very excited to be working as the System Administrator for the Department as she has developed a keen interest in the area of Physics.

LADD

As Ladd marked its 116th year of operation, we have been fortunate to have an unusually high number of clear evenings. Most recently, Comet Holmes, which brightened by a factor of more than a million over the span of weeks, captured the imaginations of the more than 400 visitors over the course of several of those clear nights. They peered through our telescopes to view what one visitor described as a “translucent blue jellyfish” move slowly from night to night across the background field of stars.

Halloween is an especially appropriate holiday for Ladd. Science fiction/ fantasy/horror writer H.P. Lovecraft’s first love was astronomy, and he spent years volunteering at Ladd. Our 2nd annual Halloween celebration drew a crowd of more than 200 excited little ghosts and goblins. After scaring them with skeletons in the Transit Room, giant spiders, and ghosts in the clock vault, we calmed them back down with treats, including free star maps and glimpses of Comet Holmes through the 12” Brashear refractor.

Our commitment to outreach continues to grow, as we seek funding for new projects that make Ladd a beacon for science education in the community. Over the last year Ladd has received two grants- one from the Champlin Foundation for \$59K and, as of November 25, another grant

from the Rhode Island Historical Preservation and Heritage Commission, of \$47K. The Champlin grant is being used to enhance our outreach efforts to the Providence Public Schools, and the RIHPHC grant will be used to upgrade the Transit Room and its instruments that once provided time signals via telegraph to the region.

The number of people who have signed up for our Listserv just passed the 500 mark. Francine Jackson’s witty articles about the sky and astronomy have drawn rave reviews. To sign up for our newsletter and other news related to astronomy, the sky, and upcoming events at Ladd, go to: <http://www.physics.brown.edu/physics/commonpages/ladd/>



*Kenneth F. Kinsey, '55, Warwick, using transit at Ladd Observatory to observe stars crossing meridian. Button in hand activates chronograph.*

2007 FACULTY ACHIEVEMENTS



**Professor Meenakshi Narain** has been elected a Fellow of the American Physical Society. She is also selected as one of the 2008 Career Award Winners by the ADVANCE program at Brown.

**Professor Xinsheng Sean Ling** has been awarded a NHGRI grant for his research in Hybridization-Assisted Nanopore DNA Sequencing.



**Professor Vesna Mitrovic** has been selected as an Alfred P. Sloan Research Fellow.

**Professor Jay Tang’s Research Team** - Selected to Receive a Research Seed Funding Award & Discover The Strongest Natural Glue Known To Science.

**Professor Humphrey Maris** has been awarded the 2007 Phonon prize.



**Graduate student Michael Stewart and Professor James Valles** discover the existence of Cooper Pairs in Insulators.

**Professor Greg Landsberg** has been elected Physics Coordinator for the US CMS Collaboration.



**Professor Marcus Spradlin** has been awarded the 2008 Salomon Award & DOE Outstanding Junior Investigator Award.



**Professor Anastasia Volovich** has been awarded the 2007 NSF Career Award.



**Professor Chung-I Tan** received the President’s Award for Excellence in Faculty Governance.



## INSTITUTE FOR MOLECULAR AND NANOSCALE INNOVATION

In 2007 President Simmons and the Brown Corporation approved plans to establish the Institute for Molecular and Nanoscale Innovation (IMNI) on the Brown campus. IMNI was conceived as a “polydisciplinary” organization dedicated to team R&D involving faculty participants centered in physics, chemistry, and engineering, but also including representation from over nine departments in the physical, life, and social sciences. The Institute represents an expansion of the proposal a year ago from the departments of physics and chemistry and the division of engineering for a new Center for Nanoscience and Soft Matter (CNSSM).

IMNI is charged with promoting and coordinating research and education in the area of molecular and nanosciences. It focuses on three major research themes: Center for Advanced Materials, Center for Nanoscience and Soft Matter (CNSSM), and NanoHealth Working Group. The Institute will be located in the Metcalf complex, centrally located between the Barus & Holley building and the new life sciences cluster. IMNI will support team building, proposal preparation, block grant management, seminars, special functions, and nanoscience course offerings across campus. The Institute will also help Brown researchers and students link to the outside world, and includes a partnership with the NanoBusiness Alliance, which represents over 250 innovation-based companies in the U.S. nanotechnology sector.

Materials science is one of the most exciting and broad fields of research involving cross-disciplinary collaborations. The primary aim of CNSSM is to promote frontier research and to foster the development of collaborations and intellectual exchanges between faculty in chemistry, engineering, physics, and other departments such as biology. Brown physics, chemistry, and engineering faculty have already begun to expand their research efforts in the nanoscience direction. Recent faculty hires in the area of nanoscale soft condensed matter include Professors Derek Stein in Physics, Shouheng Sun in Chemistry, and Thomas Webster in Engineering. These new faculty have substantially increased opportunities for on-campus collaborations among Brown chemists, engineers and physicists.



“Research in the Stein group applies the tools of nanotechnology, including solid-state nanopores and nanofluidics, to study individual bio-molecules in detail. The goals are to understand the fundamental science of nano-biological systems, while also exploring exciting technological possibilities, like single-molecule DNA sequencing.”

In 2007, IMNI held a workshop in Providence on Nanomaterials and Living Systems attended by researchers from Brown, MIT, Yale, and the Marine Biology Laboratory at Woods Hole. The Institute also held the Small Forum, a workshop for regional nanotech companies to explore collaborations with Brown researchers. A weeklong symposium as an official kick-off for IMNI is planned for early May 2008.

“Professor Gang Xiao has been recently appointed as the Director for the Center of Nanoscience and Soft Matter (CNSSM). His research focus is currently on magnetic nanoscale structures and devices. He has been studying electron transport and nanomagnetism in magnetic multilayers and tunneling junctions. Devices based on these structures exhibit giant magnetoresistance that has had significant impact on the information storage industry.”



## ALUMNI: WHERE ARE THEY NOW?

Three undergraduate Physics alumni of the class of 2000 who went on to earn Ph.D.’s in Physics have become very involved with science policy on a national level. Don Engel, who earned his Ph.D. from the University of Pennsylvania in 2006 served as the American Physical Society’s Congressional Fellow for 2006-2007. He worked with Congressman Rush Holt, one of two Ph.D. physicists in Congress. Don was succeeded in the APS Congressional Fellow position by another alum of the class of 2000, Matt Bowen, who will serve in the office of the Senate Majority Leader, Harry Reid (Matt was featured on the cover of the APS News magazine this past October). Matt earned his Ph.D. from the University

of Washington in 2006. Don is continuing his policy work this year as the APS’ in-house Senior Science Policy Fellow. But there’s more!

Yet another member of the class of 2000 is engaged in prestigious science policy work. Lawrence Lin, who earned his Ph.D. from the University of California at Santa Barbara in 2006, is serving this year as an Executive Branch Fellow for the American Association for the Advancement of Science (AAAS). Congratulations to our very successful alumni who are providing a great public service by bringing their knowledge of physics and science to our government.

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# Physics at Brown

Physics at Brown Newsletter  
Department of Physics  
Box 1843  
Brown University  
Providence, RI 02912

## ALUMNI, WE'D LIKE TO HEAR FROM YOU!

NEWS? COMMENTS?

PLEASE WRITE TO THE ABOVE ADDRESS OR E-MAIL US AT [JODIE\\_GILL@BROWN.EDU](mailto:JODIE_GILL@BROWN.EDU)

*Alumni - Where are they now?- continued from page 11*

**A**nthony Aguirre, Brown '95, went on to receive his Ph.D. at Harvard University in 2000. As Assistant Professor of Physics at the University of California, Santa Cruz, he performs research in Theoretical Cosmology, the study of formation, nature, and evolution of the universe.

**J**ohn Austen McGreevy, Brown '97, originally from Staten Island, New York, is currently an Assistant Professor of Physics at MIT, working on string theory. He completed his thesis work at the University of California, Berkeley, and Stanford. Prof. McGreevy joined the MIT Department of Physics in July 2006.

**M**argaret Lise Gardel, Brown '98, continued to receive her Ph.D. from Harvard University in 2004. Currently she is an Assistant Professor in the Department of Physics, focusing on Experimental Biophysics, in the Institute for Biophysical Dynamics, the James Franck Institute, and the College at the University of Chicago. She is a 2008 Sloan research fellowship recipient.

**S**ylvia Smullin, Brown '98, is currently an Associate Research Scholar at Princeton University in the Department of Physics, as a member of the Romalis Group. Her research focus is using atomic physics to probe fundamental symmetries.

**J**ames Battat, Brown '01, received his Ph.D. at Harvard University and is a 2008-2011 Pappalardo Fellow at MIT. His current research includes efforts to understand the nature of dark energy and dark matter which dominate the mass-energy budget of the Universe.

**J**essie Thaler, Brown '02, went on to obtain his Ph.D. at Harvard University in 2006. As a Miller Fellow, Dr. Thaler will continue his research in particle physics at the Miller Institute, University of California, Berkeley until 2009.

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*Would you like us to include your update in our next newsletter? Do we have your current address?  
Email all updates to [Jodie\\_Gill@brown.edu](mailto:Jodie_Gill@brown.edu). Please be sure to include your full name and date of graduation.*

Physics Department Chair: Chung-I Tan  
Co-Editors: Meenakshi Narain and Beverly Travers  
Layout Editor: Jodie Gill

Address: Physics Department, BOX 1843, Providence, RI, 02912  
Phone: (401) 863-1434 or (401) 863-2641  
Email: [Jodie\\_Gill@brown.edu](mailto:Jodie_Gill@brown.edu)

Website: <http://physics.brown.edu>