

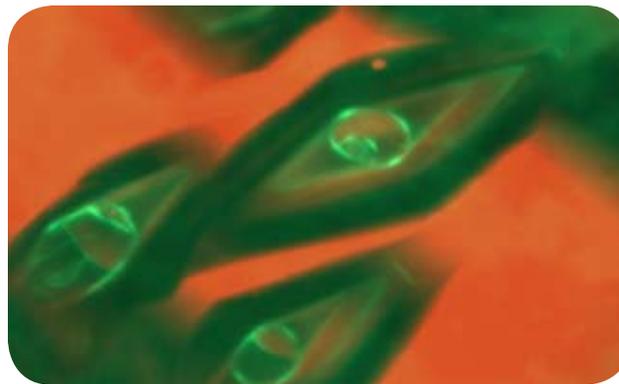
The Physics of Life at Ohio University

This article was jointly prepared by Peter Jung, David Tees, Alexander Neiman and Ido Braslavsky who joined the departmental faculty in 1997, 2001, 2003 and 2003 respectively. Please look at the departmental website for more information on these faculty members.

The concepts and methods of physics have been extremely successful in describing almost all aspects of the nonliving world, from atomic nuclei to the structure of the universe. In the last two decades or so, physicists have set out with much excitement to conquer the last frontier – life. Biological Physics is currently one of the fastest growing areas in physics, with ample opportunities for graduates, and research funding is available from a wide variety of sources. A number of the faculty in the department now have a part of their research effort that concerns some aspect of biological materials, medical physics or even astrobiology. In addition, four diverse research groups headed by Ido Braslavsky, Peter Jung, Alexander Neiman, and David Tees now specialize in this area with funding from the National Science Foundation, the National Institutes of Health, the American Heart Association, the Schlumberger Foundation, and Helicos Biosciences Corporation. In this article we briefly describe their ongoing research projects and interests.

The **Braslavsky** group is specialized in **experimental biophysics**. Projects include biomineralization and single molecule investigations of DNA protein interactions using fluorescence microscopy and microfluidic devices. Biomineralization, the study of proteins and other biomaterials that have evolved either naturally or by design to influence crystal growth, is a growing and exciting area of research. Nature has developed mechanisms whereby particular modes of crystal growth are suppressed while others are initiated and maintained, thereby controlling the growth of teeth, bones and shells. Among the variety of minerals that may be studied, ice is a particularly special and interesting case for the simple

reason that ice crystallizes directly from the solvent containing the biologically active substance. A number of proteins have evolved in some fish, insects, plants and other organisms to interfere with or modify ice crystal growth. These ice binding proteins (IBPs) pose interesting questions about basic mechanisms of crystal/protein interactions in general and are also potentially important in a host of health, geophysical, environmental, and industrial contexts. For example, IBPs may facilitate the cryopreservation of tissues, cells and oocytes, improve the texture of frozen food and ice cream, control ice slurries employed in the food industry, and improve the viability of organs for transplantation. In Braslavsky's lab, a new approach has been developed for investigating the activity of IBPs that relies on fluorescence microscopy and dynamic control of the solvent around ice crystals to resolve some of the key issues regarding the interactions between IBPs and ice. Braslavsky's group uses fluorescently labeled IBPs and is developing



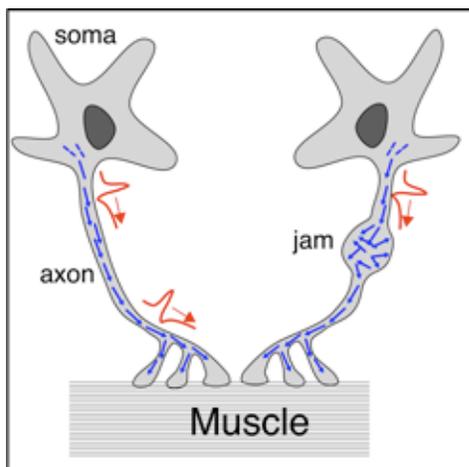
Antifreeze proteins marked with fluorescent tags bind to ice crystals and modify their growth.

novel techniques to monitor the activity of IBPs. The experimenters control the local environment of micron-size ice crystals by the means of microfluidic devices with precise temperature control which includes local melting with focused infra-red laser light and a temperature controlled stage. The use of fluorescence microscopy enables the gathering of unique dynamic information on the interaction between the IBP and ice. These new techniques will help us in understanding the activity of IBP



and will assist in developing new and better applications in cryobiology, agriculture and future nanotechnology where precise control of crystal growth is needed. See Ido's website: www.phy.ohiou.edu/~braslavs/ for photos and additional information on ice crystallization.

Jung's Computational Biology Lab employs computational modeling and mathematical analysis to address problems in cell biology and neuroscience. Projects include the role of glial cells in brain function and pathology; calcium signaling, one of the most important cellular signaling pathways; and slow axonal transport, a mechanism described below, which determines axonal shape and function.

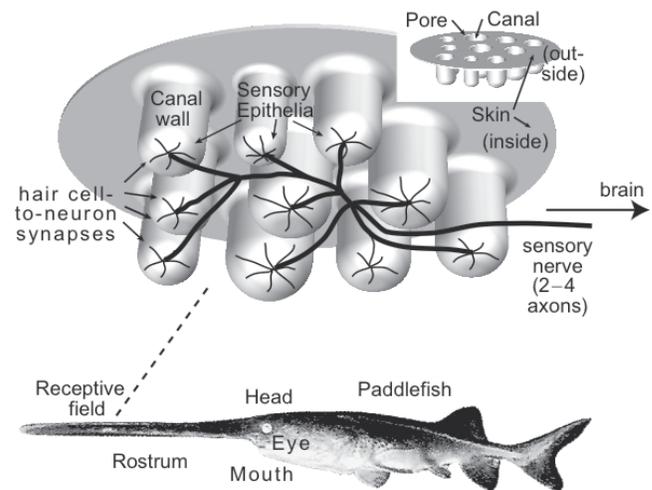


Schematic diagram showing the axons with and without a traffic jam.

The neuronal axon is a few micrometers thick and can be meters long. It is a key component of a neuron, that, like an electric wire, carries an electric signal to another neuron or to a muscle. Structural stability of a fully developed axon is provided by stiff, about $5\mu\text{m}$ long, *neurofilaments* oriented along the long axis of the axon. Neurofilaments are assembled in the cell soma and transported along tracks (microtubules) at the slow average rate of about $0.5\text{mm}/\text{day}$, hence the term *slow axonal transport*. Unlike water through a pipe, the flux of neurofilaments is not driven by a pressure gradient. Instead, each neurofilament is propelled along the tracks by attached molecular engines that convert metabolic energy into mechanical motion. In physics we call this an *active flow*. When this transport mechanism fails, neurofilaments form traffic jams. They pile up and cause swelling of axons leading to failure of conducting electric signals and hence the capability of the brain to control muscle motion (see sketch). This is a devastating and terminal disease, known as Amyotrophic Lateral Sclerosis (ALS) or Lou Gehrig's disease. Each year more than 5,000 people in the US are diagnosed with this disease. In collaboration with cell biologist Anthony Brown

from the Department of Molecular Neuroscience at Ohio State University, mathematical models for the transport of single neurofilaments have been developed based on life-cell imaging technology, that allow the accurate prediction of the transport of neurofilaments over weeks and months. The ultimate goal is to understand how neurofilaments form logjams and how subsequent axonal swelling develops, in order to look for mechanisms to prevent it.

Alexander Neiman and his group investigate the peripheral sensory system of vertebrates which is characterized by astonishing sensitivity and selectivity. For example, sensory auditory hair cells residing in the inner ear respond faithfully to hair bundle displacements of just a few nanometers and show extremely sharp resonances. Yet, auditory hair cells are capable of adapting to a wide range of sound intensities. Recent studies hypothesized that such sensitivity and selectivity of auditory hair cells can be due to spontaneous mechanical oscillations of their hair bundles. Another example of extreme sensitivity is electrosense, a sense absent in humans, but which is vital for many species of aquatic animals. Sharks and rays use electrosense to detect weak electric fields emitted by heart beats and muscle contractions of a prey hidden under the sand or in murky water. The structure of electroreceptors is similar to those found in auditory and vestibular systems, which makes electroreceptors an attractive model to study general principles of physiology and biophysics of sensory periphery.



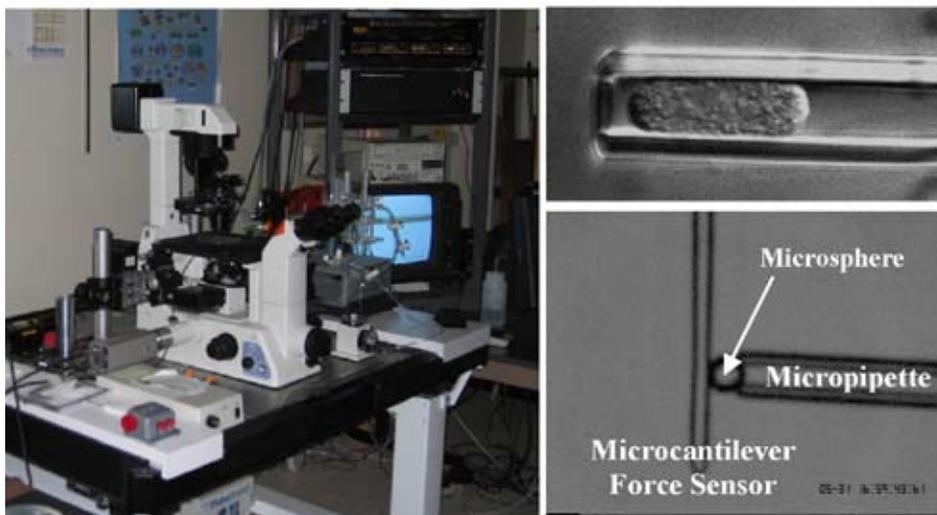
Details of the electroreceptor system in paddlefish.

Electroreceptors similar to those in sharks and rays were found in paddlefish, a native North American fish inhabiting the Mississippi, Missouri, and Ohio River systems. The paddlefish is distinguished by its big mouth and elongated front appendage, called a rostrum, carrying tens of thousands of electroreceptors. Vision is limited in the murky water of these rivers; and electrosense

substitutes for the lack of visual cues for feeding and for avoiding large objects in the water. Paddlefish feed on zooplankton, such as *Daphnia*, which emit weak electric fields.

Together with **David Russell** in Biological Sciences, Neiman and his group have discovered that electroreceptors are not passive sensors, but possess a rich oscillatory dynamics even when no external electric field is present. A single electroreceptor is comprised of two different types of oscillators, operating in distinct frequency bands. Problems addressed in Neiman's lab include the physical mechanisms of various rhythms observed in peripheral receptors and their functional significance and how paddlefish locate and track their prey. New insights into these questions will provide better understanding of how the peripheral sensory systems of vertebrates work.

David Tees and his group study the binding of biomolecules to one another (a nanometer-scale process) and how those interactions allow cells to form aggregates on the micrometer (and larger) scale. Bioadhesion, which plays a role in blood clotting, heart disease, cancer and inflammation, is made possible by proteins that bind non-covalently but highly specifically to other biomolecules. Tees applies piconewton-level forces to cells and the molecules that hold them together in order to understand the mechanical properties of adhesion molecules and how bonds behave under applied forces. One research thrust involves understanding how cells adhere in capillaries, the body's smallest blood vessels. Micrometer-scale glass tubes that mimic the size of capillaries are used as flow chambers for blood cells. Spherical white blood cells get compressed into a sausage shape during passage through capillaries and this increase in contact area with the vessel wall can lead to sticking if the right adhesion molecules are coated on the wall. The work has implications for treatment of infection. In another project, a millimeter-long, but only 3-micrometer-thick glass fiber (that acts as a highly sensitive spring) is used to pull interacting molecules apart. This microcantilever force sensor is coated with one type of adhesion molecule and microspheres are coated with another adhesion molecule that binds to the first type. Bonds form when the sphere and fiber are held in contact. The bond number depends on the density of adhesion molecules and it can be as low as a single



Microscope, image capture and micromanipulation equipment. (Top right) White blood cell in adhesion molecule-coated micropipette. (Bottom right) Ligand-coated microsphere adhering to receptor-coated microcantilever force sensor as part of a piconewton level forced unbinding adhesion assay. The sphere in the figure is 7.5 μm in diameter.

bond. When the microsphere is pulled away, the fiber deflects from its original position if a bond has formed. The amount of deflection is directly proportional to the force on the bonds. Forced unbinding gives information on activation barriers for unbinding and their behavior under applied forces. Such research is important for understanding the dynamic adhesion under flow seen in blood clotting and inflammatory reactions.

The department now affords a number of **Educational Opportunities in Biophysics**. A course in Cell and Molecular Biophysics will be offered for the fourth time in Fall 2008 for advanced undergraduates and graduate students. A Biophysics Seminar series has been instituted that brings in speakers and allows local biophysics researchers and graduate students to present their work to their colleagues. **Tees** and **Braslavsky**, in collaboration with faculty in Chemistry & Biochemistry, have acquired state-of-the-art equipment and developed project lab experiment modules for the department's Junior lab course and the Graduate Lab. A microscope, vibration isolation table and video equipment have been acquired and set up in Clippinger 352. Experiments so far include video microscopic studies of Brownian motion, that allow an experimental determination of Avogadro's number, and micromanipulation of particles using "laser tweezers". Upcoming experimental modules include experiences with microfluidics and fluorescence microscopy studies of the mechanical properties of DNA and the behavior of molecular motors.

A Note from the Chair — Joe Shields



Greetings to friends and alumni of the Department of Physics and Astronomy at Ohio University. We're pleased to provide you with an update of news from the department and from our alumni. While the demands of being Department Chair can be time consuming and not always pleasant, I take great satisfaction in working in an intellectually vibrant environment with enthusiastic students, faculty, and staff. As Chair I have also enjoyed meeting a number of our alumni for the first time during the past year, and several of these individuals have visited campus recently, as discussed elsewhere in this newsletter. If you have an opportunity to return to Athens, I certainly encourage you to do so, and to let us know so that we can arrange for you to meet some of our current students and faculty while you're here.

During the past year we have had a further outstanding addition to our faculty: **Justin Frantz** has joined our department as an Assistant Professor. Justin is a native of Pennsylvania, and completed his undergraduate studies at Harvard University and PhD at Columbia University. His research is in experimental nuclear physics, with most of his work to date based on results from the Relativistic Heavy Ion Collider at Brookhaven National Lab. Prior to joining us this fall, Justin was a postdoctoral researcher at Stony Brook University.

Several of our continuing faculty deserve mention for notable professional achievements during the past year. **Alexander (Shura) Nieman** was promoted to Associate Professor with tenure, and **Arthur Smith** was promoted to Full Professor, reflecting their high level of performance in teaching, research, and service to the university. **M. Prakash** received the Distinguished Mentor Award from the Honors Tutorial College, in recognition of his outstanding work with HTC undergraduates. To date, eight of our current faculty have been recognized as outstanding teachers and mentors with awards from the College of Arts and Sciences and HTC.

Assistant Professor **Douglas Clowe** received national recognition when he was named a 2008 Alfred P. Sloan Research Fellow. Sloan Fellowships are awarded to outstanding early-career faculty in selected subfields of science, with 118 awards currently made each year. Doug is joining an elite group: since the program inception in 1955, 34 Sloan Fellows have gone on to win Nobel Prizes. Doug is the *first faculty member at Ohio University* to be named a Sloan Fellow, and we are very proud of this achievement. Doug's research specialty is in astrophysics, and his ground-breaking work on Dark Matter was featured in last years' Physics & Astronomy Newsletter.

The department routinely has many visitors, but during summer 2008 we were especially busy with guests attending two international conferences on campus. The first conference, *Workshop on Statistical Nuclear Physics and Applications in Astrophysics and Technology*, was held July 8-11 and drew an international audience of approximately 50 researchers. The Local Organizing Committee consisted of **Carl Brune, Steve Grimes, Tom Massey, Andreas Schiller, and Alexander Voinov**. The second was really two conferences in one: the joint meeting of *Nanoscale Spectroscopy & Nanotechnology 5 (NSS5)* and *Spin-Polarized Scanning Tunneling Microscopy 2 (SPSTM2)*, brought to Ohio University July 15-19 through the efforts of faculty members **Saw Hla** and **Art Smith**, respectively. Other members of the Local Organizing Committee were **Nancy Sandler** and **Sergio Ulloa**, and the Conference Coordinator was **Mala Braslavsky** from our staff. Both *NSS* and *SPSTM* are international, biennial conferences with changing venues that in past years have included Italy, Japan, and Germany. Approximately 110 scientists attended the joint conference this year.

Both the *Workshop on Statistical Nuclear Physics* and *NSS5/STM2* were held at Ohio University's new Baker Center (see photo), which opened in 2007. The presence of these meetings in Athens is testimony to the international visibility of our program. The beauty of the campus was evident in July, and many of the participants commented on the attractive setting as well as the stimulating content of the meetings.



New Baker Center as viewed from Emeriti Park next to Clippinger (photo by Christine Smith)

Scientific research and discovery is an expensive business, and the vitality of our department's research enterprise is reflected in continuing success in competitive grant funding. In the fiscal year that ended in June 2008, the department set a record with over \$3.8 million in external grants awarded to its faculty, from primarily federal agencies such as the National Science Foundation, Department of Energy, and National Aeronautics and Space Administration. Current research funding is broadly distributed across the different research areas represented in the department.

The department's increased grant support has made it possible for us to grow our educational activities. We have expanded our graduate program, such that 74 graduate students are enrolled as of Fall 2008. We are also continuing our efforts to make research opportunities available to all of our undergraduates who are interested in this experience. During summer 2008, 40% of our undergraduate majors remained on campus conducting research under the supervision of our faculty, with stipend support.

An important point to note is that private donations to our endowed funds such as the Mark Grimes Memorial Fund, Edward Sanford Astronomy Fund, and Department of Physics and Astronomy Fund play an important role in our ability to financially support undergraduate researchers, who would otherwise need to find summer employment in a nonacademic setting. Support from these funds also gives us the means to support trips by undergraduates and graduate students to major research facilities such as the Thomas Jefferson National Accelerator Facility in Virginia, and the MDM Observatory at Kitt Peak, Arizona. Private contributions to the department's scholarship funds additionally play a critical role in aiding our students to meet the costs of a college education. For all those who donated to the department over the past year, please accept my sincere thanks.

When you were at Ohio University, did you receive support from the department to carry out research, or to help pay your tuition bill? If so, please join your fellow alumni who are already donors in helping our current generation of students benefit in the same way, by sending a contribution in the enclosed envelope. Please also send us your news: we are always interested to hear what our alumni are doing in their lives and careers.

A Note from the Editor — Louis E. Wright

During the past year we have been fortunate in having a number of our alumni return to campus and present a seminar or colloquium about their work. **Arnie Aronson** (BS 1953) visited the department on October 29, 2007. While on campus he met with students and faculty and presented a Special Colloquium entitled *Current Problems in Nuclear Reactor Physics*. Arnie joined Brookhaven National Laboratory in 1960 and after forty-eight years continues to work in the Energy Sciences and Technology Department. It was great to hear about Ohio University and the department from a student of the early fifties and was inspiring to talk with a graduate still active fifty-plus years after graduation. In June 2008 we were fortunate to have another of our graduates, **Carl A. Alexander** (MS 1956), Chief Scientist of the National Security Division at Battelle Memorial Institute in Columbus, Ohio, return to campus for a belated induction into Sigma Pi Sigma, the physics honor society. Dr. Alexander (PhD from Ohio State) gave a very interesting presentation on the future of nuclear power at the induction ceremony. Carl's impressive career and accomplishments were featured in the October 8, 2008 issue of the Columbus Dispatch under the title, *Top-secret service, After five decades of working on spaceships, nuclear fuels and such, Battelle scientist says he'll retire — in a couple of years.*





In the Figure, Carl Alexander joins the other 2008 Sigma Pi Sigma inductees: Jennifer Drerup, Daniel Hoy, Paul Ingram, Heath Kersell, Tyler Peery and Steven Rogers.

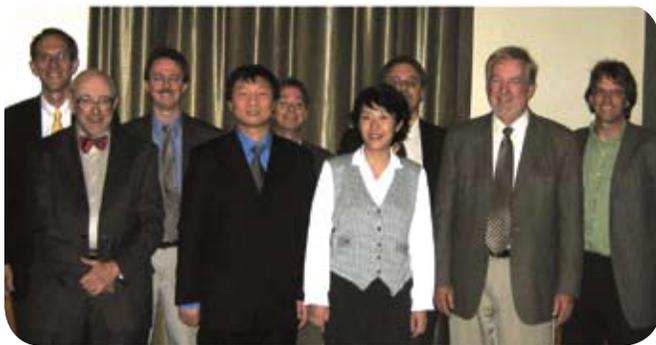
A more recent graduate, **Venki Ramakrishnan** (PhD 1976) was chosen to receive an Outstanding Alumni Award by the College of Arts and Sciences for 2006. He was unable to attend the ceremony in the Fall of 2006, but was able to visit campus on May 22, 2008 to receive the award, renew acquaintances and present a Special Colloquium entitled, *The Ribosome: The cell's protein factory and how antibiotics sabotage it*. Venki received his PhD in condensed matter theory working with **Tomo Tanaka** and then switched to biochemistry. He and his students and post-docs have made major advances in deducing the structure and functions of the Ribosome and his research contributions have been widely recognized. Venki is a Fellow of the Royal Society and a member of the National Academy of the United States. He currently leads a research group at the MRC Laboratory of Molecular Biology associated with Cambridge University in the United Kingdom. His special colloquium was attended by faculty from a broad spectrum of science departments and it was a great pleasure for us to renew our relationship with one of our most outstanding graduates. **Dean Ben Ogles** of the College of Arts and Sciences presented the Outstanding Alumni Award to Venki at the beginning of the Colloquium. David Drabold, who is on sabbatical at Cambridge, just informed us that Venki has been elected to Fellowship in Trinity College.



Venki poses for a photo with retired faculty member Ron Cappelletti (now at NIST) in front of Clippinger.

A more recent graduate, **Xiaodong Zhang** (PhD 2001) returned to campus this September to receive the College of Arts and Sciences Distinguished Alumnus Spirit Award—given to graduates with significant achievement within 15 years of their graduation. After receiving his Ph.D. in theoretical condensed matter physics working under the direction of David Drabold, Xiaodong worked for Motorola before joining a research group in medical physics at the University of Texas M. D. Anderson Cancer Center in Houston as a programmer. His abilities were soon recognized and now he is a tenure-track Assistant Professor in the Department of Radiation Physics at M.D. Anderson. He has produced over 75 publications since 1994, including 22 articles and 23 abstracts in the past five years. Xiaodong followed his wife **Xiaochun (Spring) Wang** (PhD 2001) to M.D. Anderson. Spring received her Ph.D. in experimental nuclear physics at Ohio University working under the direction of Jack Rapaport and took a postdoctoral position at the University of Richmond. She then followed her group leader to M.D. Anderson where she is now also an Assistant Professor in the Department of Radiation Physics. Both Xiaodong and Spring returned to campus for the award ceremony and met with many physics faculty and students. Xiaodong gave a Special Colloquium on Thursday, September 25 entitled, *Radiation Therapy Treatment Planning Using four-dimensional Computed Tomography Images*. Spring met with the Women in Physics and Astronomy for lunch, and she and Xiodong met with the nuclear experimentalists. Spring and Xiaodong are the proud parents of a 3-year old daughter Sonia and a son, Raylen, born in July.

It might be of interest to note that two of our other alumni, **Ramesh Tailor** and **Congjun Wang**, are on the faculty in the Department of Radiation Physics at M.D. Anderson and **Yixiu Kang** is a research scientist in the same department.



Xiaodong Zhang and Spring Wang pose with some faculty from the department. They are from left to right: Joe Shields, Steve Grimes, Art Smith, Xiaodong, Ken Hicks, Spring, David Ingram, Louis Wright and Carl Brune.

Department News

An interesting letter appeared in the February, 2008 issue of *Physics Today* where a reader (Douglas Robertson of the University of Colorado) challenged a statement made in a feature article in the February, 2007 issue of *Physics Today* by the authors Michael Marder, Robert D. Deegan, and Eran Sharon. The article was entitled, *Crumpling, buckling, and cracking: Elasticity of thin sheets* and began by discussing some practical work by Carl Friedrich Gauss in which he carefully measured the angles of a triangle connecting three peaks in Hanover to check out the effects of the earth's curvature (both overall and local) on the sums of the angles of triangles. The result for a perfect sphere had been worked out by Legendre, but Gauss wanted to investigate effects arising from the earth not being a perfect sphere. Gauss generalized Legendre's result to arbitrarily curved surfaces, but found the effects, apart from being on a spherical earth, to be so small that they could not be measured at his site. The authors said that some people believe that Gauss was interested in finding out if *three dimensional space itself was non-Euclidian*, but that in Gauss' paper he made no reference to any such question. In the *Physics Today* article, the authors reference a paper by **E. Breitenberger**, as the basis for their historical discussion of Gauss. In response to the February, 2008 letter from Douglas Robertson, the *Physics Today* authors Marder, Deegan, and Sharon reply: "Many people, including Douglas Robertson, believe that Gauss performed his mountaintop measurement to check whether three-dimensional space itself is Euclidean. **Ernst Breitenberger** (our reference 1) persuaded us to the contrary. From 1821 to 1825, Gauss spent many months in the field, mapping Hanover with a heliotrope, an instrument he had invented. The mountain peaks

forming the corners of his great triangle were base stations; he measured and plotted 26 smaller triangles between them. The edges of all those triangles were assumed to be great circles, projected down to sea level.

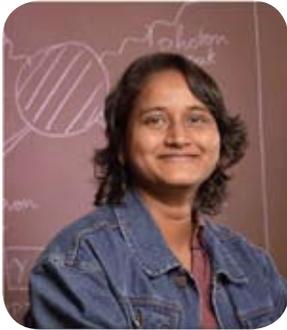
Inconsistencies in the measurements were minimized with a global least squares adjustment, a method Gauss had invented, and he projected them onto flat surfaces with conformal maps, also his invention. The purpose of the great triangle between Hohehagen, Brocken, and Inselberg was to check the results he had obtained by patching together the 26 smaller triangles. He wanted that check both to ensure the map's accuracy and to measure deviations of Earth's shape from a perfect sphere. For the latter task he needed to invent differential geometry. Perhaps amid his phenomenal exhibition of creativity, Gauss also wondered whether space itself was Euclidean, but the great triangle is easily justified without invoking that question, and **Breitenberger** cites much evidence against it."

Many of you will recognize the name **Ernst Breitenberger** who was a Professor in the department from 1963 through 1994—the last three years being on "early retirement". Ernst taught many graduate courses and special topics courses, and served as Chair of the Graduate Committee and as first year graduate advisor for many years. He played a major role in creating and monitoring the graduate program procedures of the department which helped greatly in establishing our excellent record at the graduate level. Ernst lives in Athens and is active in the Rotary Club.



Professors Breitenberger and Rollins along with Alumnus Peter Hoffmann-Pinther (PhD 1973) at the reception for Venki Ramakrishnan. Roger Rollins, former Associate Dean of Arts and Sciences, is teaching on the early retirement program for the last time in the Fall Quarter of 2008. Peter retired from the University of Houston three years ago and now makes his home in Athens, where he is an Adjunct Professor in the department. He recently played a major role in revising a number of experiments in the Physics 250 series labs.

The American Physical Society has initiated a new recognition of reviewers of papers submitted for publication. Distinguished Professor **Steve Grimes** was one of the Outstanding Referees chosen during the first round and received the award at the April meeting (2008) of the APS. He was one of about 500 chosen from the pool of 42,000 referees. Steve has joined the ranks of those on early retirement. His formal teaching is in Winter Quarter but he still directs doctoral students and holds several research grants in collaboration with other faculty in low energy experimental nuclear physics.



Winner of the Outstanding Dissertation in Nuclear Physics

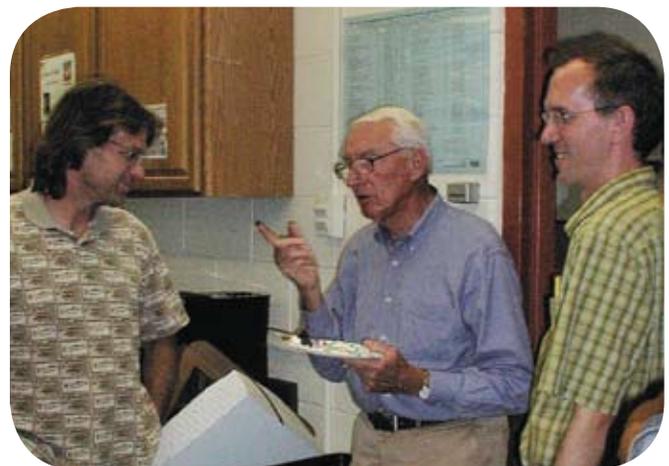
The PhD dissertation of **Deepshikha Choudhury** (PhD 2007) was selected by the American Physical Society as the best in the nation in nuclear physics. Choudhury, who tied for the honor with a Stanford University student, has developed a new theory for how scientists can measure important properties of the neutron, a basic building block of matter. A scientist at Duke University will test Choudhury's theory by blasting high-energy gamma rays at a sample of Helium-3. Deeshikha gave an invited talk on her research at the April 2008 meeting of the American Physical Society. Deepshikha did her doctoral research under the direction of Daniel Phillips and she is currently a postdoctoral researcher at George Washington University.

Four high school science teachers from Ross, Adams and Brown counties in southern Ohio traveled to Ohio University's MDM Observatory in June of 2008. Their visit was part of a program, funded by the Smithsonian Astrophysical Observatory and organized by Astrophysical Institute of Ohio University, that aims to offer teachers firsthand experience in conducting astronomical research. The trip to MDM was led by **Mangala Sharma**, a Research Assistant Professor in the department, and the department chair, **Joe Shields**. Mangala specializes in public outreach which includes her work on Ohio University's BEEFS (Building Exemplary Elementary Foundations in Science) program for area educators. Through an existing Smithsonian grant to Joe Shields, Sharma was able to secure additional funding for the teachers to participate in a series of workshops on multi-wavelength astronomy (called *Stretching the Rainbow*) and to travel to MDM in Arizona and to the National Radio Astronomy Observatory facility at Green Bank, West Virginia. The four teachers: **Melissa Whitley-Huff**, **David Pentecost**, **Randall Dunkin** and **Judith Gardner** were attracted by the opportunity to conduct research at a world-class observatory on Kitt Peak. The teachers said that the experience will be useful in teaching lessons on astronomy and helping their students meet state and federal requirements for science testing next school year.

The Department was pleased to celebrate the 80th birthday of Professor **Folden B (Burt) Stumpf** on August 13, 2008 with cake and refreshments. In addition to Burt's significant contributions to the department as noted in last year's Newsletter, Burt was the editor of the Newsletter for 19 years. His many friends among the faculty and students enjoyed celebrating his 80th birthday with him.



Mangala Sharma, Melissa Whitley-Huff, David Pentecost, Randall Dunkin, Judith Gardner, and Joe Shields at the MDM Observatory.



The birthday boy, Burt Stumpf, makes a point with Carl Brune and Joe Shields.

Transitions



Jim Dilley

The department lost one of our longtime faculty with the death of Professor Emeritus **James (Jim) Dilley** (February 19, 1934--April 28, 2008). Jim was a native Athenian who received a A.B. degree in mathematics from Ohio University in 1955 and then an M.S. in physics in 1956. Jim was in the Air Force from 1956-59 assigned to Wright Patterson Air Force Base where he worked on development of a nuclear powered airplane (the military likes to investigate all possibilities). In 1959 Jim enrolled in the doctoral program at Syracuse and received a Ph.D. in elementary particle theory in 1962. After holding a post-doctoral appointment at the University of Colorado for one year, Jim joined the Physics Department faculty in September of 1963. Jim was a theorist in high energy physics and during his first fifteen years at Ohio University published actively and trained several Ph.D. students in this field, including **Jerry Clark** (1965), **David S. Chung** (1968), **Tom Gibbons** (1971) and **Sudhir Kaiker** (1977). As his interest in planetary physics increased, Jim used a research leave at the University of Arizona to prepare himself for research in this new field, which he concentrated on for the rest of his career. In addition, he developed an introductory course in planetary physics where he utilized the newly available videos and photos from NASA to interest thousands of Ohio University students in the exploration of the solar system. Jim's switch to planetary physics was very helpful in the department's move into astronomy which led to the

hiring of a number of faculty in astronomy and to change of our name to Department of Physics and Astronomy in 1982. Jim was a very active member of the department for over 30 years, especially the graduate program. He went onto "early retirement" in 1996 and then fully retired in 2004. As is evident from the photograph, Jim was an avid hiker, mountain climber, and outdoorsman. In addition, Jim and his wife Berry Dilley were very supportive of many international students in Athens and he will be greatly missed.

Our emeritus faculty and staff with long associations with Ohio University will remember **Wesley Paul Unruh** (September 9, 1933--May 17, 2008) who was a member of our faculty from 1964 - 1970. Wes died following a courageous five-month battle with acute leukemia. Wes received his PhD from the University of Kansas and worked at Bell Labs before joining our faculty. He was a talented experimentalist, and had a significant role in building the Solid State group that was the forerunner to our current Condensed Matter/Nanoscience enterprise; members of the Solid State group from that era include Ron Cappelletti, Earle Hunt, Roger Rollins, and Ed Sanford. A photograph showing all of these individuals (including Unruh) is on display in the Common Room in Clippinger. During his tenure at Ohio University, Wes directed three doctoral students: **Jerald Lee** (1966), **Thomas Lick** (1969), and **Lowell Nelson** (1973). Wes also had significant involvement in planning lab space for the department in Clippinger during its construction. Wes left Ohio University in 1970 to join the faculty at his PhD alma mater, and in 1985 he moved to Los Alamos National Lab where he spent the remainder of his professional career, returning to Kansas upon his retirement. Our department Chair, Joe Shields, took a class taught by Wes while he was an undergraduate at the University of Kansas, and renewed his acquaintance after he joined the faculty at Ohio University. Joe reports that Wes always had complimentary things to say about our department and fond memories of his years in Athens.

Physics Major Scholarships

Due to the generosity of alumni, faculty and friends, our majors have access to a number of scholarships which assist them in achieving their educational goals. We are very grateful for your previous support of these scholarship funds and we would encourage you to be as generous as you can in providing continuing contributions. Scholarship recipients for 2007-2008 and funding sources are: **Jess Wilhelm** (Distinguished Professor Drabold), **Daniel Hoy** (Distinguished Professor Grimes), **James Ralston** (Shipman), **Yuri Marmorstein** (Stocker), **Terry Caston** (Edwards/Ewers), **Laura Hooks** (Stocker), **Anna Opitz** (Edwards/Gecsy), **Sean Elling** (Huwe/Stocker), **Paul Ingram** (Edwards/Stocker), **Jennifer Drerup** (Gecsy/Huwe), **Kayla Fultz** (Edwards), **Steven Rogers** (Ewers/Gecsy), **Tyler Perry** (Edwards), **Kyle Grupenhof** (Edwards/Stocker), **Kyle Baldosser** (Shipman), **Daniel Bergman** (Shipman), **Thomas Connor** (Shipman), **Alicia Gooding** (Shipman), **Chris Korman** (Shipman), **Joshua Shenk** (Shipman).

Alumni News

Previous Graduates

Please let the Editor know what is happening in your career, with your family, or with any other item of interest to your fellow alumni and friends of the Department of Physics and Astronomy at Ohio University. Send information to wright@ohiou.edu or use the enclosed form and envelope to let us know what is going on in your life. You are important to the Ohio University Department of Physics and Astronomy family.

2000-present

Serge Nakhmanson, PhD 2001, is a staff member at Argonne in the Materials Science division working primarily in theory of ferroelectrics. Serge did his doctoral research in condensed matter theory with David Drabold.

James (Jim) Oldendick, PhD 2002, has accepted a postdoctoral research position at Rush University in Chicago. He will be working on Single Photon Emission Computer Tomography (SPECT) for imaging the heart. In SPECT, the patient is injected with a gamma-radioactive isotope, and scintillators detect the decay of the isotope. Jim did his doctoral research in nuclear experimental physics with Steve Grimes.

Murat Durandurdu, PhD 2002, is on a tenure-track appointment at the University of Texas at El Paso. Murat works on simulations of phase transitions in complex materials and did his dissertation research in condensed matter theory with David Drabold.

Russell Ryan, BS 2002, recently completed a PhD in physics with a specialty in astrophysics at Arizona State University. He currently has a postdoctoral research appointment at the University of California, Davis.

Yixiu Kang, PhD 2002, is a Research Professor at the University of Texas M D Anderson Cancer Center. Yixiu did her doctoral research under the direction of David Ingram.

Hamad Al-Brithen, PhD 2004, is an Assistant Professor in the Physics & Astronomy Department of King Saud University. Hamad Al-Brithen obtained his PhD in Art Smith's group in fall 2004 and went directly into a tenure track assistant professor position at King Saud University, Saudi

Arabia. Hamad is active in the nanoscience efforts at King Saud and is working to build up research efforts there. He has returned to Athens in three consecutive summers beginning in 2006, to continue some research activities with Smith's group and to attend the international nanoscience conference hosted by the NQPI group in Athens in July 2008. During 2008, Hamad also took up a mini sabbatical post at MIT.

John Dulka, MS 2004, has taken a position with the United States Patent and Trademark Office as a patent examiner.

Andreas Weichselbaum, PhD 2004, is a postdoctoral fellow at the Ludwig Maximilian University (LMU) of Munich and is working on his Habilitation. He is still in condensed matter theory, but moved to the somewhat more challenging field of strongly correlated systems, specifically, numerical renormalization group (NRG, Wilson, 1975) and density matrix renormalization group (DMRG, White, 1992). He said that this field was new to him, so it took a while to get productive in it, but now he has built an excellent toolbox for these types of calculations and his research is progressing well. Andreas greatly enjoyed the international atmosphere here in Athens during his studies. He recently married. He met his wife, who is from India, in Athens where she was studying computer science. Andreas did his doctoral research under the direction of Sergio Ulloa.

Americo Salas Bacci, PhD 2004, has left his teaching position in Bolivia to take a research position at Los Alamos National Lab. Americo received his PhD in experimental nuclear physics working under the direction of Steve Grimes.

Costel Constantin, PhD 2005, is an Assistant Professor in the Physics Department of Seton Hall University. Costel obtained his PhD in Art Smith's group in the fall of 2005. He took a postdoctoral position with Professor Randy Feenstra at Carnegie Mellon University at the end of 2005, where he stayed for one year. After that, Costel began a tenure track assistant professor position at Seton Hall University, New Jersey, beginning in Fall 2007. Costel continues to be interested in research and is setting up his own lab at Seton Hall. He also continues to collaborate with Smith's group in Athens on selected topics. Costel commutes back and forth to the Boston area in order to spend

time with his family, as his wife, **Anca Constantin**, (PhD 2004 in Astrophysics under the direction of Joe Shields) is employed at Harvard University as a postdoctoral research associate.

Muhammad B. Haider, PhD 2005, is a Postdoctoral Fellow in the National Institute of Nanotechnology/Physics at the University of Alberta, Edmonton. Muhammad received his PhD in fall 2005 in Art Smith's group. Following graduation, Muhammad took a postdoctoral position at the University of Alberta, Edmonton, working in the group of Professor Robert Wolkow, internationally recognized expert in scanning tunneling microscopy and Chair in Nanoscale Information and Communication Technologies. Muhammad has continued his work in Canada, and soon hopes to find a more permanent position.

Raymond Atta-Fynn, PhD 2005, is a Research Assistant Professor at the University of Texas-Arlington working on electronic structure of actinides. Raymond did his dissertation research under the direction of David Drabold.

Hang Liu, PhD 2005, following a postdoctoral position at Michigan State University, has accepted a staff position at the Texas Advanced Computing Center (TACC) in Austin. Hang earned his PhD in nuclear theory under the direction of Charlotte Elster.

Muhammad Maqbool, PhD 2005, became a tenure-track Assistant Professor at Ball State University in Muncie, Indiana in September 2008. He joins three other alumni of our department on the faculty at Ball State: **Mahfuza Khatun**, PhD 1985, **Md Saiful Islam**, PhD 1986, and **Yong Suk Joe**, PhD 1992. Maqbool performed his doctoral research under the direction of Marty Kordesch.

Rong Yang, PhD 2006, is an Associate Professor at the National Center for Nanoscience and Technology, Beijing, China. Rong Yang graduated with her Ph.D. in summer 2006 in Art Smith's group and subsequently became a postdoctoral position in the group of Professor Chris Palmstrom, at the University of Minnesota, within the Chemical Engineering and Materials Science Department. One year later, Rong and her family returned home to Beijing, China to begin a new life there. In early 2008, Rong was appointed to a faculty position within the National Center for Nanoscience and Technology in Beijing, where she is currently employed and very happy.

1990-1999

Congjun (Chester) Wang, PhD 1993, is a faculty member at the University of Texas M D Anderson Cancer Center. Chester did his doctoral research in surface science with Marty Kordesch.

Frank X. Lee, PhD 1993, is Graduate Advisor in the Department of Physics at George Washington University and last year won the Bender Award for the Use of Innovative Technologies in Teaching. Frank currently works in lattice gauge theory which is a change from his dissertation research on theoretical pion photo-and electro-production under the direction of Louis Wright.

Rodney Michael, PhD 1995, is teaching physics at Ashland University in Ohio. Rodney's research in experimental nuclear physics was directed by Ken Hicks.

Stephen Weppner, PhD 1997, is a tenured associate professor of physics at Eckert College in St. Petersburg, Florida. Steve came to our graduate program from SUNY-Geneseo and did his doctoral research in nuclear theory under the direction of Charlotte Elster.

Jianjun Dong, PhD 1998, is a tenured Associate Professor at Auburn. His research in the theory of materials has been funded by DOE and the NSF, and he recently graduated his first PhD student. Jianjun did his doctoral research under the direction of David Drabold.

1980-1989

Ramesh C Tailor, PhD 1983, is an Assistant Professor in the Department of Radiation Physics at the University of Texas M.D. Anderson Cancer Center in Houston. Ramesh carried out his dissertation research in experimental nuclear physics with Jack Rapaport.

Majid Sawtarie, PhD 1984, has been elected Vice President and President-elect of the Appalachian Section of AAPT. Majid is a professor at Bethany College and he presented a paper at the AAPT Appalachian Section on October 27, 2007 at West Virginia Wesleyan College. Majid did his doctoral research in condensed matter theory with Tomo Tanaka.

Cornelius Bennhold, PhD 1987, is chair of the Department of Physics at George Washington University (GWU) and last year won GWU's Bender General Teaching Award. Cornelius did his dissertation work on theoretical kaon photo production under the direction of Louis Wright. In addition to **Frank Lee** mentioned above who has an Ohio University connection, our former faculty colleague in experimental nuclear physics, **Allena Opper**, is now on the faculty at George Washington University and is currently serving as an NSF Program Director with responsibilities in nuclear physics and particle and nuclear astrophysics.

1970-1979

Kerry McCalla, AB 1970, is retired from BellSouth and lives in Franklin, Tennessee.

Lawrence Crum, PhD 1967, is on the Medals and Awards Committee of the Acoustical Society of America and contributed to a technical committee at the Paris 2008 Meeting of the Society. His doctoral research was done in acoustics with Burt Stumpf.

Tim Golian, BS 1971, is currently Vice President for Advanced Technology in the Energetics Division of the Titan Group. He started his career working for a small engineering/testing lab in Houston. After seeing better opportunities in the petroleum industry, he joined Dresser Atlas in their Ballistics Engineering department. After working in the engineering group for several years, he transferred to the Technical Services department which involved extensive world-wide travel, visiting company sites to train personnel, troubleshoot problems, and visit with customers. He also became involved in explosives safety and regulatory affairs. During that period the United States was converting explosives regulations to be compatible with the United Nations regulatory system. Tim had a unique opportunity to make several trips to Geneva, Switzerland, to work with the United Nations Group of Experts on Explosives, re-writing international explosives regulations. Tim left the large corporate environment after 17 years, to join a small company that specializes in the manufacture of perforating systems. That turned out to be great career move, as the company's growth has been phenomenal. As well as assisting in the explosives production and engineering areas of the company, Tim is involved in business development and management and has had the opportunity to co-author three technical papers, make several trips to Canada, Europe and Russia to expand business in addition to representing his company in industry associations, and continue working on regulatory and safety issues. The growth of the company resulted in the out-growing of the explosives plant. That gave Tim the opportunity to design and build a totally new, state-of-the-art facility. Tim says, "*While my degree was in physics, obviously my career has been very slanted towards*

engineering, management and business. I have always felt that my physics degree has given me a different, and beneficial, perspective over engineers. While engineers are very good at applying engineering principles and formulas, I feel that my physics background gives me a stronger understanding of the science behind the engineering. That allows me to apply strong science knowledge as well as engineering principles to technology and problem solving."

David Robinson, BS 1973, visited the department in August and was treated to a tour of the John E. Edwards Accelerator Laboratory by Steve Grimes. Accompanying Dave were his wife (Katie Robinson, BA Education '73) and his sister (Shirley Williams, wife of Dr. Robert Williams of Engineering). In the spring of 1973, Dave made a model of the accelerator facility, which is still used to orient visitors. After graduating from Ohio University, Dave and Katie both attended the University of Wisconsin, where they received their MS Industrial Engineering and MA Classical Languages degrees, respectively. Dave and Katie live in San Clemente, CA, where Dave is the Director of Information Development for Unisys Corporation and Katie teaches Latin at Harbor Day School, a private pre-K thru 8th grade.

Shiv Dutta, PhD 1978, after working for 18 years at a Canadian energy utility in Toronto, returned to the U.S. to work at IBM in Indianapolis in 1999. More recently he has taken a position in Austin Texas where he is Solutions Relationship Manager working as he says, "to lure customers to IBM platforms". Shiv did his doctoral research on theoretical models of nuclear fission under the direction of David Onley.

1900-1969

Arnie Aronson, BS 1953, as noted above, visited the department last October and continues as a staff member at Brookhaven National Lab. His work focuses on nuclear reactor analyses pertinent to safety issues for existing reactors, and design and operation aspects of future reactors.

Thomas Listerman, PhD 1965, is an emeritus professor at Wright State University. Tom's research mentor in condensed matter physics was Ed Sanford.

Douglas Humphrey, PhD 1965, is an emeritus professor at Western Kentucky University. His research mentor in experimental nuclear physics was Roger Finlay who now lives in Dataw Island, South Carolina.

Albert Frasca, PhD 1965, another doctoral student of Roger Finlay is an emeritus professor at Wittenberg University in Springfield, Ohio.

Philip Chute, PhD 1969, is Professor Emeritus at the University of Wisconsin-Eau Claire. Phil has moved on to a second career as a berry farmer and President of the Eau Claire Farmers Market. Phil's doctoral advisor was Charles Chen.

Gifts to Ohio University

Please consider designating the Department of Physics and Astronomy when you give your gift to Ohio University. The Department needs money for scholarships, books, travel funds for students, recruitment of students, and paying the expenses of visiting speakers. In this list, the greatest need is for undergraduate major scholarships. Since the level of state funding does not allow us to address these needs adequately, your support helps us provide added excellence. For this support, we are very appreciative. Our major endowment funds include:

- John Edwards Scholarship Fund—Distinguished Professor John Edwards left a bequest of approximately \$300,000 to endow this scholarship fund. The Scholarships are given to majors who have financial need and have demonstrated some initial success at Ohio University (that is, rising sophomores, juniors and seniors).
- Robert Gecsy Scholarship Fund—Endowed by Jeanette Grasselli-Brown in memory of her brother who was a physics student.
- Darrell Huwe Scholarship Fund—Endowed by family and friends in memory of Professor Darrell Huwe. The scholarship is preferentially given to students from a rural background with financial need.
- James Shipman Scholarship Fund—This fund was initiated by Professor Jim Shipman and Will Konneker (MS 1947) in the 1970s and has been supplemented greatly since then by Jim Shipman using money generated from his very successful physical science textbook, *An Introduction to Physical Science* by Shipman, Todd and Wilson, which is currently in its 11th edition. It provides our primary support for incoming freshman majors.
- Abhishek Singh Scholarship Endowment—This endowment has been launched with gifts from faculty, staff and students of the department along with contributions from friends of Abhishek to honor his memory.
- Mark Grimes Memorial Fund—Created to honor Mark Grimes and his interest in the undergraduate physics program. The purpose is to provide enrichment of the undergraduate experience of physics majors.
- Edward R Sanford Astronomy Fund—Created to honor Professor Sanford, the income from this endowed fund is used in support of the astronomy program in the department.
- Department of Physics and Astronomy Fund—A general endowed fund with major contributions from Professors Wright and Rollins. The funds generated can be used at the discretion of the department Chair for support of the educational programs of the department.

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News from Alumni

Please fill out the form below and return it in the enclosed envelope. It will help us in the department to renew contacts with you and will also let our alumni and your friends to know more about you and your career. We are very interested in hearing from you. In particular if there are any changes or new developments in your career or in your family that you wish to share, please return this form. Also, if you have information about other Department of Physics and Astronomy Alumni, please add it at the bottom of the form. We are hoping to hear from you.

Name _____

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Items for the Newsletter and Comments:

Information on Other Departmental Alumni:

Recent Graduates

Danda Pani Acharya, PhD 2007 worked with Saw Hla and is a postdoc at Brookhaven National Lab.

Justin Finke, PhD 2007, worked with Markus Böttcher and is a postdoc at the Naval Research Lab.

Saima Khan, PhD 2008, worked with Marty Kordesch and is a postdoc in Engineering at Ohio University.

Ting Lin, PhD 2008, worked with Charlotte Elster. She joined her husband in Boston and is exploring possibilities.

David Rafferty, PhD 2007, worked with Brian McNamara and is a postdoc at Penn State University.

Laura Rafferty, PhD 2007, worked with Brian McNamara and is a postdoc at Penn State University.

Kizilgul Serdar, PhD 2008, worked with Ken Hicks and is a postdoc at the University of Illinois.

Shaleen Shukla, PhD 2008, worked with Steve Grimes and is now a part-time faculty member at George Washington University.

Somali Basu, MS 2008 project with Markus Böttcher, is studying finance at the University of North Carolina.

Young Eun Choi, MS 2008 thesis with Ido Braslavsky, is in the doctoral program in our department.

Swati Ramanathan, MS 2008 thesis with Eric Stinaff, is in the doctoral program in our department.

Joel Vaughn, MS 2008 thesis with Marty Kordesch, is in the doctoral program in our department.

Ru Zhang, completed an MS 2008 thesis with Eric Stinaff and Liwei Chen of the Chemistry and Biochemistry Dept.

Terry Caston, BS in Engineering Physics, is in Mechanical Engineering graduate school at Georgia Tech.

Laura Hooks, BS in Astrophysics with minors in math and art.

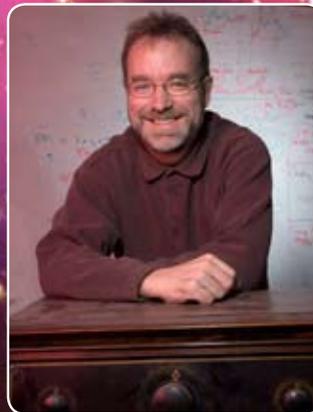
Daniel Hoy, BS with Honors Thesis supervised by Marty Kordesch, is teaching English in Spain.

Paul Ingram, BS in Engineering Physics with Honors Thesis supervised by Ido Braslavsky, is continuing in military service .

Heath Kersell, BS in Physics, is a graduate student in our department.

Colin McCrone, BS with Honors Thesis supervised by Prakash, is taking a year off before architecture school.

Jess Wilhelm, BS with Honors Thesis supervised by Doug Clowe, is studying International Affairs at the University of Pittsburgh.



Clockwise from top right: Deepshikha Choudhury, PhD 2007; astronomy instructor George Eberts; Distinguished Professor David Drabold; Nanoscience faculty Nancy Sandler, Saw-Wai Hla, Art Smith, and Sergio Ulloa; and graduate student Andrew DiLullo.



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