2009

Department of Physics Newsletter: Spring 2009

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PHYSICS NEWSLETTER

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UMASS AMHERST

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College of Natural Sciences
and Mathematics

INSIDE

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REENTRY OF JULES VERNE AUTOMATED TRANSFER VEHICLE

David Sliski is currently a senior here at UMass Amherst, with a double major in Physics and Astronomy. Many of our juniors participate in research programs; David's took him away from Amherst, to Tahiti, and even off the earth. The project, under the direction of Ron Dantowitz, of the Clay Center Observatory, Brookline, MA, was to participate in a mission to image the reentry of a spacecraft, the "Jules Verne Automated Transfer Vehicle." The spacecraft was returning from a mission to bring supplies to the International Space Station. David was the youngest member of a crew flying in a NASA DC-8 aircraft full of NASA and European Space Agency scientists with their optical and spectroscopic instruments. The goal of the mission was to gain data to help in the modeling of heat shields for the next generation of space shuttles.

David's father, Alan Sliski, is one of our alumni; there was a note about him on page 13 of the spring 2006 newsletter. David has inherited one of Alan's characteristics: a strong interest in "doing it himself." At home, there is a complete wood shop and metal shop. He watched his father make everything from cameras used in searching for giant squid, to tables and couches, and this is where he developed the basic skills needed for design and assembly of his own equipment to image spacecraft reentry. Those skills include an understanding of the design process, how to keep an inventory of relevant parts, and how to make the solution cost effective.

Continued on page 9

NEW CHANCELLOR, DR. ROBERT HOLUB

Dr. Robert C. Holub became Chancellor of the University of Massachusetts Amherst campus on August 1, 2008. He succeeded Thomas W. Cole Jr., who performed admirably as Interim Chancellor after John V. Lombardi. Dr. Lombardi had strong feelings about the place of the Amherst campus within the University system, its potential as a great university, and was much liked by the faculty and students. He left to become President of the Louisiana State University System in 2007. Dr. Holub vows to continue the quest of his predecessors Cole and Lombardi to make "our university one of the nation's very finest public research universities."

Dr. Holub was born in 1949, received a degree in Natural Science from the University of Pennsylvania, and a PhD in German in 1979 from the University of Wisconsin Madison. He spent 27 years at the University of California Berkeley, where he served as chair of the German Department. Beginning in 2003, he became Dean of the 18,000-student Undergraduate Division. He left Berkeley in 2006 to become Provost and Vice Chancellor for Academic Affairs at the University of Tennessee, a school of 20,000 undergraduate and 6,000 graduate students.

Dr. Holub recognizes that UMass Amherst is at the center of a very special community here in the town of Amherst and in the Five College community. As he has said, "There's nowhere better in the country to engage in the life of the mind, and no location better suited to engage with scholars and students committed to making the world a better place now and in the future. It's a great place to live and learn."

When he came to Amherst, Dr. Holub was looking forward to things other than the current financial crisis that has hit our Commonwealth and the nation with a vengeance. A strain has been put on our university that depends on the Commonwealth for much of its operating expenses.

To address arising fiscal challenges, Chancellor Holub has convened a Budget Planning Task Force of faculty, staff, and students to respond to fiscal exigencies. He has also asked all units on campus to develop plans to deal with possible shortfalls. Under further consideration is the diversion of some capital construction monies to "critical one–time need areas." Provost and Vice Chancellor for Academic Affairs Charlena Seymour oversees the budget that accounts for about 70 percent of the campus' operating budget. She has also asked each department to develop plans for dealing with budget cuts of 6%, and possibly 9%.

The immediate future looks austere. But we have faced budget crises before. We are confident that under the leadership of our new Chancellor Holeb and his staff, our department and the campus community will emerge from the current fiscal situation with added strength in outreach, service, teaching, and research.

Comments

Comments about the newsletter, or information about yourself for our alumni news section, may be e-mailed to **newsletter@physics.umass.edu**, or sent to:

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University of Massachusetts Amherst
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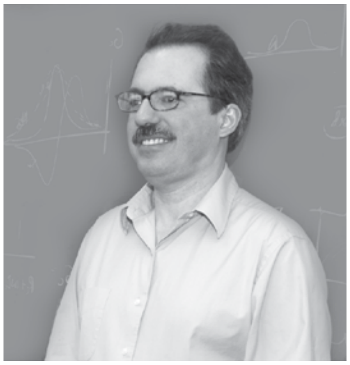
Phone:413.545.2545 Fax:413.545.0648

Our newsletter is sent to more than 1,300 of our alumni and alumnae who received degrees in physics from the 1900s to the present, and to current and former staff and faculty. For more information about our department, visit our website at **www.physics.umass.edu**. We look forward to hearing from you.



Dear Alumni and Friends of the Physics Department,

As I make my way through my second year as department head, I never cease to be amazed at the levels of activity and excitement characterizing our department, good budget times or bad: long-time colleagues departing, new faculty arriving, new buildings opening as others are put on the drawing board – and most important of all, the students we have come to know moving on to new challenges with bachelor's, master's, and PhD degrees as new ones take their places in our classes and labs.

Two long-time members of the department who many readers of this newsletter will remember well as teachers have moved on: Barry Holstein to retirement although he continues to be active in research and teaching here, and Bill Gerace to UNC Greensboro, where he has started a scientific education group continuing his very successful work at UMass Amherst.

I also note sadly the passing of Robert L. Gluckstern, who played the major role in creating the present physics and astronomy departments during the period 1964-1969. Bob Gluckstern's son Steven has established a Distinguished Professorship in Physics in his father's honor, and I expect to report the filling of that position in my next letter to you. In this way, the newest developments in the department tie back to the efforts of those who have come before.

I am delighted to report three new additions to the physics faculty this academic year: Ben Brau, a high-energy experimentalist; Lori Goldner, a biological physicist; and Andrea Pocar, who studies neutrino physics. The following articles profile their research activities.

I am sure you are wondering what the effect will be on the department of the current financial problems, which are felt by universities, businesses, families and individuals across the nation and around the world. Under current projections, we will be able to weather this storm by leaving two faculty retirement positions temporarily unfilled, and by modestly reducing the number of graduate teaching assistant positions. Of course, there is no guarantee that we have found the "bottom" of the crisis – but as we work to preserve our key teaching and research missions you can be assured that the generous support of our alumni and friends is needed (and appreciated) more than ever.

To conclude on a happier note, the beautiful new Integrated Sciences Building, across the street from Hasbrouck, has just opened with classrooms, teaching labs, and research labs (primarily in the life sciences). Plans are being finalized for another new science building (NSB-1) to be completed in 2012 and for a third science building (NSB-2) to be shelled out at the same time. It may seem strange that all this building activity is proceeding amidst a budget crisis, but it is a normal cycle to have lab and teaching space ready when we are again ready to start hiring faculty and staff.

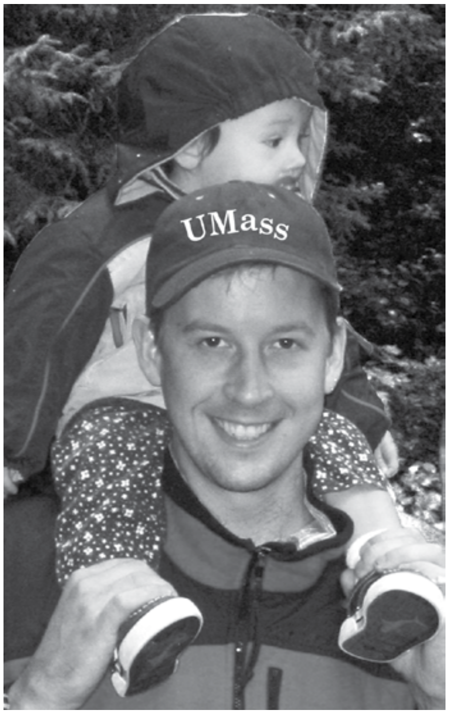
Sincerely,

Don Candela, Department Head
head@physics.umass.edu
voice (413)545-1940

New Faculty

DR. BENJAMIN BRAU

Dr. Ben Brau joined the department as an assistant professor in September 2008. For the past five years Ben has been a postdoc at the University of California Santa Barbara, working on particle physics at the Fermilab Collider Detector [CDF]. At UMass Amherst he will be working on the ATLAS experiment of the Large Hadron Collider (LHC) at CERN in Geneva. (For more on the ATLAS experiment, see the research article highlighting the work of Prof. Stephane Willocq and Prof. Carlo Dallapiccola in the 2007 newsletter.)



Ben Brau and Allison

Dr. Brau has an undergraduate degree from Reed College and obtained his PhD from MIT, where he studied particle-antiparticle oscillations of mesons containing a b quark. He worked initially on the BaBar experiment at the Stanford Linear Acceleration Center in California. Then he shifted his focus to the CDF experiment. This is a very large experiment at the Tevatron collider, involving a collaboration of about 500 physicists. AT CDF Ben was the convener of an "exotics" physics analysis group. In this context, "exotic", refers to the many hypothetical particles that have been proposed by theorists in the study of physics beyond the present Standard Model. In fact, Ben has also been convener of the subgroup looking at "very exotic" signals – the most far-out possibilities.

In his first semester of teaching, Ben taught the general education course on relativity. Ben incorporated you-tube videos and used other multimedia tools to help the students visualize the concepts. He said, "The students were great. The subject really fascinated them – Einstein always seems to capture the imagination, and seeing the students wrap their heads around the ideas of special and general relativity was really rewarding." Ben is looking forward to teaching the topic again.

And when he's not teaching and searching for exotic physics at colliders, Ben has several hobbies to occupy his spare time. He enjoys outdoors activities in general, and looks forward to exploring the numerous parks and recreational areas here in western Massachusetts. He also is a home-brewer, a hobby he began when he moved from Portland, OR to Cambridge, MA. His favorite beer styles are pale ales, porters, and winter ales. Ben also roasts his own coffee, and has been known to fire up the grill year-round, even through the harsh winters at Fermilab near Chicago.

Ben and his wife Molly Moss have two daughters, Allison, who is 5 years old and just began kindergarten, and Sarah, who is 2 years old and anything but terrible! Molly is a librarian who has experience in public, research, and academic libraries, and is currently taking time off to stay home with Sarah.

DR. LORI GOLDNER

Dr. Lori Goldner comes to the department after 17 years at the National Institute of Standards and Technology in Gaithersburg, MD (NIST). While her current interests are in single molecule biophysics, Lori's background in physics is broad. She received her degree in 1991 from the University of California Santa Barbara. Her thesis centered on the use of nonlinear effects in the propagation of second sound in superfluid helium to probe the details of the critical transition to normal fluid. This work required precision thermometry for temperature stabilization at the nanokelvin level, for which she developed a He melting curve thermometer. Bolometry with unprecedented sensitivity was also required, and for this purpose she designed and developed a superconducting thin film bolometer.

In 1991, Lori joined the group of Nobel Laureate William D. Phillips at NIST on a postdoctoral fellowship. There she added atomic physics and laser cooling and trapping to her expertise, developing novel techniques to trap and manipulate atoms with light. In particular she demonstrated a technique for adiabatic manipulation of atoms with a light field that is now widely used in atomic beam splitters, an innovation necessary for the development of atom interferometers. Her development of a microwave trap for neutral atoms was a prototype for later experiments on quantum fluids and was widely reported in the popular science press.

Since 1994, Lori's work has centered on techniques for nanoscale optical characterization of materials, including biomaterials. She worked to make near-field microscopy a quantitative technique, specializing in careful measurement and modeling of contrast mechanisms and the development of a type of near-field polarimetry that permitted measurement of the retardance and attenuation of thin films with 50 nm resolution.

For the last 10 years, Lori's interest in nano-optical characterization has led her firmly into biophysics, and to the use of single fluorescent molecules as probes of biomolecular systems. The development of techniques to measure and manipulate single organic or biological molecules is facilitating new understanding of molecular interactions and dynamics in biophysics, cell and molecular biology, and in polymer science. In biophysics and molecular biology, the ability to identify, track, and measure the conformation and interaction of e.g., single proteins or RNA molecules, is leading to new insights in protein folding and RNA interactions and functionality, is helping to validate models of protein folding or molecular dynamics, and is leading to new insights in cell signaling and protein expression in living systems. The extension of single molecule techniques to track and measure individual biomolecules in living cells has the potential to revolutionize our understanding of cell signaling.

Lori Goldner

Single molecule measurements tend to fall into three categories: optical measurements (typically utilizing single molecule fluorescence or nonlinear spectroscopy), electronic measurements (e.g., single ion-channel measurements), and force measurements using optical or magnetic tweezers or microcantilevers. Techniques for manipulating single molecules might involve magnetic tweezers, optical tweezers, micro or nanofluidics, and bioMEMS (microelectromechanical systems) devices. Lori's "Single Molecule Biophysics" group specializes in the use of optical techniques for physical and spectroscopic measurements on single biomolecules. Her most recent innovation and the one that she is most excited about is the use of optically trappable water droplets to confine single biomolecules. Since the contents of these droplets can be easily mixed through fusion, their use should permit, for the first time, the observation of out-of-equilibrium or transient behavior on a single molecule or single molecular complex basis. For more information, her webpage can be found at people.umass.edu/lgoldner.

UMass Amherst boasts a large number of excellent researchers with expertise in biophysics and soft condensed matter physics. Lori's work is highly interdisciplinary – at NIST she worked with postdoctoral researchers and students with backgrounds ranging from biology, biochemistry and polymer science to hard condensed matter physics and optics – and she very much looks forward to collaborations with her new colleagues at UMass Amherst!

DR. ANDREA POCAR

Andrea Pocar, an experimental physicist, was born in Milan, Italy. A graduate in physics from the University of Milan, he first worked on silicon pixel detectors for the ATLAS experiment at CERN. After a brief period spent at the University of California Santa Cruz developing silicon strip detectors for the GLAST satellite, Andrea turned to neutrino physics at Princeton, where he completed his doctorate working on the Borexino solar neutrino experiment. He became a postdoctoral fellow at Stanford where he joined the Enriched Xenon Observatory (EXO) double-beta decay experiment. He will continue to work on both Borexino and EXO as he builds his laboratory in support of these activities on campus.

Neutrinos exist in three different "flavors," each associated with one of the charged leptons (electron, muon and tau). It was first observed a decade ago that neutrinos oscillate, that is, they spontaneously convert from one flavor to another, in violation of the lepton flavor number that was once thought to be conserved in particle interactions. Neutrino oscillations indicate that different flavor neutrinos have different masses, although they do not suggest an absolute mass scale.

One way to measure the absolute mass of neutrinos is to search for neutrinoless double-beta decay. Such decay, in which two electrons are simultaneously emitted without the accompanying neutrinos, violates total lepton number, and is possible only if neutrinos happen to be their

Continued/ ***New Faculty***

own antiparticles. Neutrinoless double-beta decay can be interpreted as an exchange of a massive, virtual neutrino. The half-life of the decay is inversely proportional to the square of the neutrino mass. Experiments to date have set lower limits on the half-life for such decay at 10^{22} years.

EXO is currently searching for neutrinoless double-beta decay of ^{136}Xe nuclei. The first phase of the experiment, EXO-200, uses 200 kg of liquefied, 80% enriched ^{136}Xe isotope. Ionizing decay events produce a flash of scintillation light measured by silicon diodes, and free electrons that are drifted to sets of crossed wires. Combined, the ionization and scintillation signals measure the energy released in each event. Through this process, neutrinoless double-beta decays would appear in a cumulative energy spectrum of all detected events, as a mono-energetic peak at the endpoint energy of the decay.

Andrea Pocar

The EXO-200 design is sensitive to a half-life of 6×10^{25} years. The greatest challenge is to minimize the residual background radioactivity that could cover the faint double-beta decay signal. To suppress cosmic ray background, the experiment is housed deep underground, in a salt mine in southeastern New Mexico. Each element in the detector is built with select materials that have been screened for residual radioactivity and then assembled and housed in a clean room. The first sets of data are scheduled to be taken in 2009.

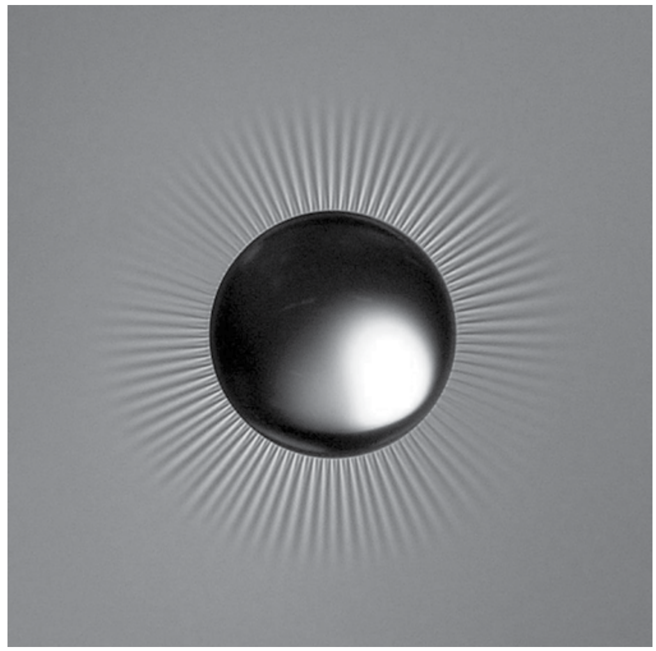
EXO is already preparing a larger detector with a few tons of enriched xenon. To reduce the radioactive background even further, the daughter isotope ^{136}Ba will be detected via optical spectroscopy in coincidence with ^{136}Xe decays. It is believed that this will boost the sensitivity of the experiment to 10^{28} years!

As rare as neutrinoless double-beta decay is believed to be, so is free time. Nonetheless, Andrea finds time to spend pursuing various outdoor sports and activities, and playing soccer the Milanese way. He is also a clarinetist who plays and performs chamber and orchestral music as often as possible.

Research

A NEW WRINKLE AT UMASS AMHERST

There is "soft" condensed matter, and "hard" condensed matter. "Soft" condensed matter is deformable, and the picture shows an example: a drop of water deforms a thin polystyrene film floating on pure water. Instead of just becoming smoothly concave, the film forms wrinkles of finite length. The picture was taken by Jiangshui Huang, a graduate student of Narayanan Menon, or Menon, as everyone calls him.



The deformation of thin films has been extensively studied. In many examples, "cusps" form, where the deformation is so large that strain is no longer proportional to stress; nonlinear effects become important. In Huang's experiments, the distortion of the film is everywhere in the linear regime and measurements can be used to infer elastic constants such as Young's modulus. (However, the mathematical theory is complex and highly "nonlinear.") The film tries to minimize the sum of three competing quantities: the energy of bending, of surface tension (a surface energy density), and of gravitational potential which arises because deformations of the film lead to displacement of water. Water does not wet polystyrene, but beads up, which has the effect of pulling up on the polystyrene film. Bulk polystyrene is compressible and bendable – but a thin film of it is in effect incompressible – it can bend, but will not stretch or compress; an imaginary circle drawn around the drop of water can bend, but will not change its length. (This is not just a property of polystyrene; it is true of all thin films.) As the imaginary circle is pulled in toward the water drop it cannot change its length, so it wrinkles instead.

Theoretical predictions have been made such as the rather unintuitive one that the number *N* of wrinkles should be proportional to $a^{1/2}h^{-3/4}$ where a is the radius of the drop and *h* the foil's thickness. Menon's group was able to control parameters well enough that they found a polystyrene film 51 nm thick develops 84 wrinkles to support a drop of radius 0.41 mm, while it takes 85 wrinkles to support a drop just a bit bigger: 0.42 mm. As the drop is made slightly bigger, the whole wrinkle pattern has to re-arrange itself. They have also observed hysteresis. Some of their work is described in a *Physics Today* article: Vol. 60 (10), 24, (October 2007), in a Science Perspective: *Science* 317, 605 (3 August 2007), and on their website: people.umass.edu/nmenon/.

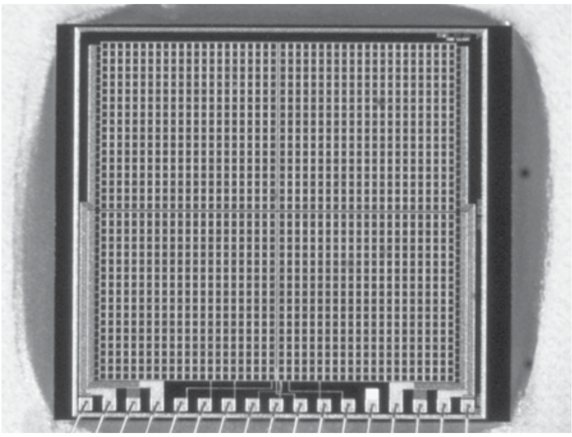
The work is a collaborative effort with Benny Davidovitch and Chris Santangelo in our department, and Tom Russell in Polymer Science and Engineering. (See the articles on Benny and Chris in the 2007 and 2008 Newsletters.) Undergraduate Megan Juszkiewicz has also participated.

Menon has other research projects with his graduate and undergraduate students, e.g. studies of packing and flow in granular media such as grains of sand in an hourglass, and of the liquid-glass transition, where he hopes to understand more fully the relative importance of density and temperature. His wife, Shubha Tewari, is also a soft condensed matter physicist and works on foams and emulsions. She is presently helping our department by teaching the 300-student General Physics 151.

BUILDING THE PERFECT PHOTODETECTOR FOR NUCLEAR AND PARTICLE PHYSICS EXPERIMENTS

The photomultiplier tube (PMT) has been the workhorse detector in nuclear and particle physics experiments for many decades. Photomultiplier tubes are complicated devices that are sensitive to individual photons. Despite remarkable technological development, they suffer from limitations that are intrinsic to their design. For example, the PMT is sensitive to magnetic fields, can be destroyed by helium gas, is unsuitable for low temperature applications, and typically requires voltages in the awkwardly high range of 1 to 2 kV. Furthermore, PMTs and their associated voltage dividers are bulky, fragile, and expensive.

Professor Rory Miskimen is collaborating with Radiation Monitoring Devices Inc. in Watertown, MA to develop a semiconductor photodetector with the potential to replace PMTs in many applications. These detectors, called solid state photomultipliers (SSPMs) are arrays of tiny Geiger avalanche cells, each made using the same kind of semiconductor technology ("CMOS") as is extensively used in digital logic circuits. (In a Geiger counter, an incident particle triggers an avalanche in a strong electric field.) The photo shows a 2024 cell SSPM with overall dimensions 3 mm x 3 mm; each individual Geiger cell is about 50 µm x 50 µm. A typical photomultiplier has a photocathode diameter of two inches.



Measurements at UMass Amherst have shown that the SSPM operates very well at temperatures as low as 5 K; our nuclear group is working on experiments that require this capability. Another application is the use of SSPMs to replace the PMTs of the Jefferson Lab PRIMEX calorimeter, previously described on page 6 of the 2008 Physics Newsletter.

Because the SSPM operates at low voltage (30 V), costly high voltage supplies and cables will no longer be required. For data analysis, the voltage pulse from a photomultiplier must be converted to a digital signal, a process requiring separate analog-to-digital converters and kilometers of signal cable. The group plans to incorporate a high frequency analog-to-digital converter within the SSPM unit, eliminating the need for this expensive and fragile auxiliary equipment. This work is supported by the Small Business Industrial Research Program in the Department of Energy.

A LIFE IN PHYSICS

Gene Golowich

I recall, as a sophomore physics major, being terribly confused about the difference between atom, molecule, electron, proton, neutron and the like. But I wasn't a complete doofus - I knew my ice creams and could easily distinguish between vanilla (my favorite), chocolate, strawberry, pistachio and black raspberry (another favorite). Maybe the microworld was too far from my immediate senses back then. So it comes as an irony that I have spent my professional life as a particle physicist, but perhaps no surprise that I have a reputation as an expert in something called flavor physics.

Continued/ **Research**

Let's go back a step. My commitment to particle physics began in graduate school at Cornell. They demanded that entering grad students make a research choice even before taking classes. So I chose experimental physics. A week later, I changed to theoretical physics. I often think how my life has been guided by a few personal `lessons', and my graduate path is an example of Lesson 1: try to avoid things not suited to your talents or likes (in my case, I have always been a concept guy and not much of a tinkerer).

I came to UMass Amherst in 1967. The town has not changed all that much over the years and if you haven't been back for a while, you will still recognize it. The same is pretty much true for UMass Amherst, except a new Studio Arts building greets you as you enter the campus from Amherst Center, and across from Hasbrouck Lab is a hulking new Integrated Sciences building. I began a career based on teaching and research. My first teaching assignment was graduate Electromagnetism, a task made easier by having the famous book by Jackson to lean on. It was a while before my research took off. For my PhD, I had worked on strongly interacting particles (hadrons) like the proton and neutron. This wasn't so easy because there was no underlying theory (no analog of 'Jackson'). Fortunately, in my early years at UMass Amherst it became increasingly clear that all hadrons were bound states of point-like quarks. I succeeded in research because I was able to adjust quickly to this reality. This is an example of Lesson 2: the world is ever changing and you must be willing to absorb and apply new findings.

In one way or another, my research has involved the physics of quarks. There are six of them (six flavors) - from lightest to heaviest: family 1 has the up (u) and down (d), family 2 has the strange (s) and charm (c), and family 3 has the bottom (b) and top (t). We do not yet know why Nature uses three families. In recent years I have worked largely with charm, which is odd given my rocky introduction to this quark. I happened to visit one of the places where charm was discovered, the Stanford Linear Accelerator Center (SLAC), a few weeks after the discovery. As I drove into SLAC there was a bunch of people at the entrance. I figured "Wow - still celebrating - these Californians are such party animals." Then they started beating on my car with placards. They were not celebrating; they were on strike for more money! Charm has proved to be really hard to work on, so my first impression proved an omen of things to come.

Many people think that science is a serious or even grim subject, but you can often find humor. For example, there was a time when the heavier quarks had estimated masses s:c:b::0.5:1.5:4.5 in GeV/c^2 units. A number of theorists (some quite famous) looked at this pattern (there is an evident factor of three, right?) and wrote papers predicting the top quark mass as 4.5 x 3 = 13.5. After many years of subsequent effort, the top quark was discovered to have a mass of 170 GeV/c^2. After having suckered so many theorists (but not me, thank goodness), you can imagine the smile on Mother Nature's face.

Any theorist would love to make a profound prediction, but we are not all Einsteins (actually I have never met anyone remotely comparable). I have benefited greatly from my own Lesson 3: work closely with experiment. In this approach, called phenomenology, there are always things to do and you are constantly dealing with the real world, which for me is the great attraction of physics over mathematics. With many contributions from experiment, the community of particle physicists has built over the past fifty years a truly successful theory called the Standard Model. With my colleagues John Donoghue and Barry Holstein, I even wrote a book about this, titled *Dynamics of the Standard Model*. It has 564 pages and almost 2000 equations.

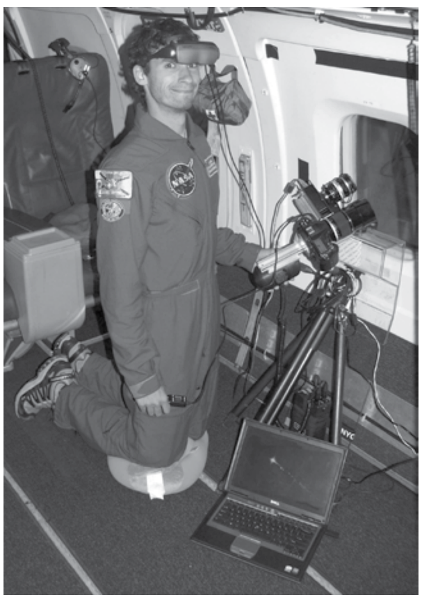
Of all my years doing research, this is the most exciting time. Many feel the Standard Model is about to be supplanted by some as yet unknown "New Physics". This is because some underlying problems with the Standard Model should manifest themselves at an energy scale of about 1 TeV (10^{12} eV) and a new experimental facility called the Large Hadron Collider (LHC) will soon have head-on proton-proton collisions at 14 TeV.

Although one way to probe New Physics is with violent collisions at the highest energies, it is not the only way. New Physics can also occur virtually via intermediate states in low-energy physical processes. So it is that in recent years I have worked with collaborators at Wayne State University, Stanford University and the University of Hawaii to study how various models of New Physics affect processes involving the charm quark. Why charm? Because in many instances the Standard Model contribution is tiny and so New Physics has a chance to dominate. Our recent work has attracted some attention and our collaboration has been invited to give talks at international conferences. Working with collaborators is part of my final Lesson 4: always try to establish positive relationships because people are so important and can be a source of great fulfillment. This has certainly been the case for our Physics Department, and its local community of students, staff and faculty. Being able to work on a job I love with people I esteem makes me truly lucky. In particular, having had quality students like Vishwa Kapila, Bill Ponce, Tom Sotirelis, Mark Windoloski, Erick Roura and Pablo Marerro enriched my life in many ways.

Finally, a word about what has motivated my own life in physics. It is a deep desire, present since early childhood, to understand about reality, why "all this" exists. After many years of learning about both the fundamental particles and their interactions as well how our Universe evolved, I must admit to still not having an answer to the question I started with. But I gain some solace from the words of T.S. Eliot:

> *We shall not cease from exploration,*
> *And the end of all our exploring,*
> *Will be to arrive where we started,*
> *And know the place for the first time.*

Continued/ ***Cover***



David Sliski ready to take pictures of reentry.

David's design called for two cameras. One was a Nikon D200 with a high power, 180 mm lens, while the other was a small video camera to record the spectrum produced by a grating in front of the camera. With the camera package compete and the approval of the safety officers, David and the rest of the crew traveled to Tahiti. After final tests, they flew further west to image the approximate four minute reentry. David says that "it was one of the most beautiful things I have ever seen; it looked like a suspended shooting star with every color of the rainbow."

Now back at UMass Amherst, David is helping to reduce the data and finish the project. He feels that though part of the project was to develop and use equipment, one of the main benefits was working together on a team with many different people from many different places to achieve the goal of getting data. David notes that he wishes that other students could also get the hands-on shop training that he obtained at home.

Teaching

ADVENTURES IN EDUCATIONAL TECHNOLOGY

It used to be chalk on a blackboard, then magic marker on whiteboard, now it's writing on a tablet PC which projects what you have written onto a screen which could be on the other side of the world. In the picture Heath Hatch uses it in front of a large class in Hasbrouck 20 to emphasize points on a slide he is discussing. New educational technology at UMass Amherst is described in an article which has been posted on the physics department website, **http://www.physics.umass.edu** (Click on "Newsletter")

Past editions of the Physics Newsletter always had articles on teaching, one leg of the triad of research, teaching, and service. This edition does not. It was decided to put the teaching article on the web because of its length, and was based upon reducing the costs of this edition in these difficult economic times.

The editors

Graduate Students

OLD AND NEW

Graduated 1988

Edward Ayoub

Wit Bucko

Ki Min Eum

Ali Fatehi

Anne Guerro

Yeu-Chung Lin

James Morgan

Douglas Smith

German Valencia

James Valles

Entered 2008

Back row, L to R: Adam Blomberg, Moritz Kiehn, Richard Buckman, Luis Cajamarca, Rukshan Thantirige, Selcuk Yasar (at end of back row).
Front row, L to R: Jessica Cook, Tulin Varol, Xinhang Xu, Daniela Ullrich, Sarah Stahl, Leslie Upton, Yucel Altundal, Nesrin Senbil, Drew Von Maluski (extreme right)
Not in picture: Mahshid Pourmand, Jon Wexler, Maxim Lakin.

Outreach and Service

AIMS PROGRAM

Retired Professor Arthur Quinton teaches classes in the "Academic and other Initiatives for Maximum Success" (AIMS) program in the Amherst-Pelham public schools. It endeavors to boost the math skills and academic self-confidence of African-American students. Small classes meet Saturday mornings and some weekday afternoons. Arthur reports promising results: some high school students are just about ready for calculus. He is delighted to find that now and then even he is learning something new! [Sample problem: how do you find the sum of the first n odd numbers (1+3+5+... +2n-1)?]

INTERNATIONAL POLAR YEAR SUMMER INSTITUTE

UMass Amherst is playing a large role in the research and educational aspects of the fourth International Polar Year (IPY), a large and diverse scientific program focused on the Arctic and Antarctic regions. This program extends from March 2007 to March 2009 in order to provide full annual cycles of both regions, and involves scientists from over 60 countries. The earlier programs were in 1882-3, 1932-3, and 1957-8.

Professor Emeritus Morton Sternheim, director of the Science, Technology, Engineering and Mathematics Institute (STEM), is the Principal Investigator of the NSF funded IPY STEM Polar Connections program. It is developing IPY curriculum materials and will offer a one-week summer institute for teachers again in 2009. Geoscientists Julie Brigham-Grette (co-PI) and Ray Bradley provide the teachers with the latest research findings. Other staff members include geosciences graduate student Beth Caissie, retired teachers Rob Snyder and Holly Hargraves, post-doc Kate Devlin, and STEM Ed project manager Marie Silver.

Polar research involves a wide range of physical, biological, and social science problems. In addition to Brigham-Grette and Bradley, who focus on climate change, several other faculty members from other departments are involved in both Arctic and Antarctic research programs. For example, Craig Nicolson (Natural Resources Conservation) uses computer models to understand impacts on reindeer and whales.

The summer institute highlights some of the more striking results of recent polar research. Ice core data show that current atmospheric carbon dioxide levels are higher than at any time in the past 500,000 years or more. This work involves mass spectrometer measurements of the CO_2 levels in tiny air bubbles trapped when the snow was compressed into ice. Temperatures derived indirectly from the ratio of the ^{16}O and ^{18}O stable isotope abundances track closely with the CO_2 levels.

Temperature changes are happening more rapidly in the Polar Regions than in temperate zones. One reason is that the albedo is decreasing: as snow and ice melt and are replaced by water or tundra, more light energy is absorbed. The widely reported increased melting of the Arctic ice is one manifestation of this rapid temperature rise. More generally, plant, animal, and human populations are already being impacted in varying degrees.

The interdisciplinary nature of polar research makes it relevant to teachers of varied science subjects. Last summer's institute attracted 32 teachers from 11 states and Canada. In addition to the presentations, it featured a variety of hands-on experiments and computer resources. The institute web site features a large menu of PowerPoint presentations, flash videos with the PowerPoints plus an audio track, and student and teacher handouts. The grant covered the teachers' stipends, housing, meals, a materials allowance, and travel costs. It also provides funds for teachers to present curriculum materials at professional conferences.

Links to the project web site can be found at www.umassk12.net/stem. There are also links to other STEM Ed programs, including a nanotechnology summer institute offered in cooperation with physicist Mark Tuominen and the Center for Hierarchical Manufacturing, the STEM RAYS afterschool science program, Saturday Science and Engineering Seminars, and the Noyce scholarships for future science and math teachers.

Awards

DISTINGUISHED FACULTY AWARD

Professor Robert Hallock not only is a key member of our department, but is also an alumnus of UMass Amherst (BS '65). Both aspects were recently recognized by the UMass Amherst Alumni Association when they awarded Prof. Hallock the Distinguished Faculty Award. Prof. Hallock has done it all at UMass Amherst, from his undergraduate days here, to joining the faculty, to serving as Department Head and Acting Dean. His research in superfluids won him the Chancellor's medal in 1992. He was chosen for

Continued/ ***People***

Dean George Langford, Norma Hallock, and Bob Hallock

the Distinguished Teacher Award in 1998, and the College of Natural Sciences and Mathematics Dean's Leadership Award in 2005. The present award is a cumulative recognition of his service to UMass Amherst.

GRADUATE STUDENT WINS ISENBERG AWARD

Nikhil Malvankar (MS '07) recently has been honored by an Isenberg Award from a program established here at UMass Amherst by Ronnie and Eugene M. Isenberg in 2002 which uses an integrative approach to catalyze interdisciplinary work in management, engineering and science.

Technology, innovation, and entrepreneurship are used as complementary crosscutting themes to involve faculty and students from the Isenberg School of Management, the Colleges of Engineering and Natural Science & Mathematics, and other schools and colleges.

Nikhil's thesis, under the direction of Mark Tuominen, will be on microbial fuel cells, and is part of an interdisciplinary collaboration between physics and microbiology. The geobacter bacterium lives in sediments at the bottom of Chesapeake Bay, and also as a biofilm on one of the electrodes in Nikhil's fuel cells, where it produces electrical power, driving an electrical current through any load connected to the two electrodes of the cell. As a PhD student, Nikhil is studying the physics of the process. Living things take in nutrients and eject waste products. For the geobacter, one of the "waste" products is electric charge. It may be waste to the bacterium, but it is useful to us, and that has intrigued a number of entrepreneurs who have proposed ways to use the bacteria as a commercial power source.

The Isenberg Program has an "Innovation Challenge" which promotes innovation based on technology conceived by faculty, students and alumni of UMass Amherst. The competition is limited to technology-based businesses, and is meant to encourage science and engineering students in cooperation with management students, to think of commercial applications of their work. The goal is for interdisciplinary teams to conceptualize a product's scientific and technological design, and then create a business plan for its commercialization. Nikhil and a group of fellow students submitted a plan to have "Bug Power" both clean up wastes in portable toilets and also provide enough electrical power to drive an exhaust fan. It won first prize.

A description of the Isenberg Program may be found at http://www-unix.ecs.umass.edu/innovation/, and one describing "Bug Power" at http://www.businesswest.com/details.asp?id=1842. There also have been articles on UMass Amherst websites and the Springfield Republican.

Congratulations, Nikhil and your team!

NEWLY MINTED APS FELLOWS

Two physics faculty were named Fellows of the American Physical Society in November 2008. This is an honor conferred on less than one-half of one-percent of the APS membership.

Professor Eugene Golowich was cited for "extensive contributions to the development and understanding of the Standard Model, particularly through the calculations elucidating the interplay of the strong and weak interactions and the application of chiral and dispersive methods."

Professor Boris Svistunov was cited for his "pioneering contributions to the theory and practice of Monte Carlo simulations for strongly correlated quantum and classical systems, the invention of the worm algorithm and diagrammatic Monte Carlo techniques, and fundamental theoretical results on superfluid phenomena in quantum gases, liquids, and solids."

Congratulations, Gene and Boris!

UNDERGRADUATE AWARDS MAY 2008

Chang Freshman Award
- Karthik Prakhya '11
- Patrick Rogan '11

Chang Transfer Student Award
- Shaina Rogstad '09

LeRoy F. Cook Jr. Memorial Scholarship
- Yitzhak Calm

Kandula Book Awards
- Thomas Brown '00
- Collin Lally '09
- Peter Mistark '09
- Andrew O'Donnell '09

Hasbrouck Scholarship Award
- Keith Landry '09
- David Quellette '09
- James Schneeloch '09

GRADUATE AWARDS MAY 2008

Quinton Teaching Assistant Award
- Kathleen McNamara
- Preema Pais

Dandamudi Rao Scholarship in Biological Physics
- Jamie Hutchison

AAPT Teaching Assistant Prize
- German Colon

COLLEGE/NATIONAL AWARDS MAY 2008

21st Century Leaders Award
- John Barret '08

Youngren Award
- Keith Landry '09

AWARDS LUNCH, PHYSICS DEPARTMENT, MAY 2008

Front row, L to R: James Schneeloch, Karthik Prakhya, John Barrett, Jaime Hutchison, Yitzhak Calm, Shaina Rogstad, David Ouellette.
Back row, L to R: Kathleen McNamara, Thomas Brown, Patrick Rogan, Preema Pais, German Colon, Collin Lally, Andrew O' Donnell, Peter Mistark, Keith Landry

People

DISTINGUISHED PROFESSOR

Professor William Gerace left the Physics Department to become the first Helena Gabriel Houston Distinguished Professor for Science Education at the University of North Carolina Greensboro. Drs. Ian Beatty and William Leonard, who worked with Bill here at the Scientific Reasoning Research Institute, are joining him as members of the UNCG faculty, in the Department of Physics and Astronomy. They will work with the faculty in the College of Arts & Sciences and the School of Education to improve science education from kindergarten through the undergraduate level.

In 1969 Bill came from Princeton to the University of Massachusetts Amherst as Assistant Professor of theoretical nuclear physics. Bill directed the PhD research of many graduate students in theoretical nuclear physics and in science education research; he has published about 40 papers in nuclear physics, and over 60 papers on teaching, learning and problem solving. He also served as both undergraduate and graduate program director for a number of years. In 1991, he became the director of the Scientific Reasoning Research Institute. In addition, he has presented dozens of invited workshops and talks, and established many collaborations in the US, South Africa, Scotland, Argentina, Puerto Rico, and Cyprus. In the course of his career, he has served as principal investigator or co-PI on research projects that have received about $8 million in grant support.

HOLSTEIN RETIRES

Professor Barry Holstein has retired after 37 years at UMass Amherst. He grew up in Youngstown, Ohio, and went to nearby Carnegie Mellon University in Pittsburgh for both his undergraduate and graduate studies. He was a student of Lincoln Wolfenstein and wrote his thesis using methods of current-algebra to predict the properties of $K \to 3\pi$ decays in terms of experimental $K \to 2\pi$ data. In August of 1969, he took a postdoc at Princeton with Sam Treiman. There he studied second-class currents in semi-leptonic weak processes, work that led to interactions with nuclear experimentalists that continues to this day. In the fall of 1971 he accepted an assistant professor position in our high-energy theory group, which consisted of Gene Golowich, John Brehm, and Art Swift, and continued his research on weak interactions.

Barry's first graduate student was John Donoghue, a Notre Dame graduate, who wrote an outstanding thesis on nuclear parity violation in 1976. John later took a postdoc position with Barry's former advisor, Lincoln Wolfenstein, at Carnegie-Mellon. In 1977 Barry started a two-year stint in a "rotator" position with the NSF in Washington, handling grants in particle and nuclear theory. This was an exciting job where he had the opportunity to meet nearly every important figure in the field. After his time at NSF he returned to Amherst as a full professor.

While in Washington, Barry continued his weak interaction research, including work with John Donoghue. Together with John and a French physicist, Bertrand Desplanques, a paper on nuclear parity violation was written that has become a seminal work in the field. In 1980 nuclear theorist John Dubach came to UMass Amherst, and John Donoghue returned as a faculty member. Thus began a long series of collaborative work. With John Dubach nuclear theory papers were written on hadronic parity violation and on hypernuclear weak decay. With John Donoghue (and often with Gene Golowich) a variety of papers in particle physics were written, including finite temperature field theory, CP violation, quark model calculations, etc. In 1988 Barry took a sabbatical at Amherst College and performed a calculation with John Donoghue on what is now called chiral perturbation theory. John had just returned from his own sabbatical, during which he learned the powerful methods in this subject from the two gurus of the field — Juerg Gasser and Heiri Leutwyler. Thus began a decade's work in this field that put UMass Amherst in the forefront. In 1992, Barry together with John Donoghue and Gene Golowich, combined their knowledge to produce *Dynamics of the Standard Model*, a book still in print.

In 1993 Barry was slowed by a heart attack and bypass, but was able to continue after a year's recovery. In 1997 he received a Humboldt Fellowship that enabled him to spend a year in Germany at Juelich, and visit the Neils Bohr Institute in Copenhagen to learn about effective gravity work, which had been pioneered by John Donoghue.

During the past fifteen years Barry has organized various programs at the Institute for Nuclear Theory in Seattle, spending four semesters at the University of Washington. He has been consulting editor of the *American Journal of Physics*, and is now the editor of *Annual Reviews of Nuclear and Particle Physics*. Still other national service jobs included serving on the program advisory committees of JLab, TRIUMF, Bates, and others. He has also taught most of our courses and was a good departmental citizen serving on many committees. During this time he had the opportunity to meet and sometimes to work with many of the really significant figures in physics. Besides Treiman and Wolfenstein, this included Feynman, Goldberger, Gell-Mann, Weinberg, Henley, Primakoff, and many others. Notwithstanding, Barry thinks it is time to make the many opportunities

Continued on page 16

In Memoriam

Professor Robert L. Gluckstern (1924-2008), head of the Department of Physics and Astronomy from 1964 until 1969, died on December 17 of lymphoma at his home in Baltimore. More than anyone else, he is responsible for the form that our department takes today, with its nationally recognized research programs. A skilled administrator, he achieved this by gaining the support of the administration, which encouraged him to expand the faculty dramatically and to develop an associated graduate research program.

Photo from Special Collections and Archives, W.E.B. Du Bois Library, University of Massachusetts Amherst.

Bob was raised in Brooklyn, N.Y. At an early age, in a letter to Albert Einstein, he demonstrated his mathematical originality with a "new" theorem. Einstein wrote back, expressing his pleasure at seeing it, and while he had no memory of it himself, he doubted it had "escaped the attention of former generations." After graduating from high school at the age of 16, he attended City College of New York and was awarded a degree in electrical engineering in 1944. He served in the Navy for two years and then went to M.I.T. to study physics. By 1948 he had earned his PhD with thesis advisor Julius Stratton. The title of his dissertation, *Power Loss for a Charge Distribution Moving Parallel to a Surface of Finite Conductivity* suggests the origin of his career-long interest in applications of classical electromagnetic theory.

A postdoctoral appointment at Cornell resulted in the publication of Bob's first paper, *Neutron-Deuteron Scattering at High Energy*, co-authored with the renowned H.A. Bethe. He continued his studies in nuclear physics for the following fourteen years at Yale in association with Gregory Breit. It was in that period that his interest in accelerator design developed. In a collaborative effort with Berkeley, he designed the beam transport system for a heavy ion linear accelerator. Two identical such machines were constructed, one at Yale and one at Berkeley. Their successful operation depended heavily on his contribution to the theory of strong focusing, a recent discovery at that time. Towards the end of his tenure at Yale he moved away from nuclear physics into the field of particle physics.

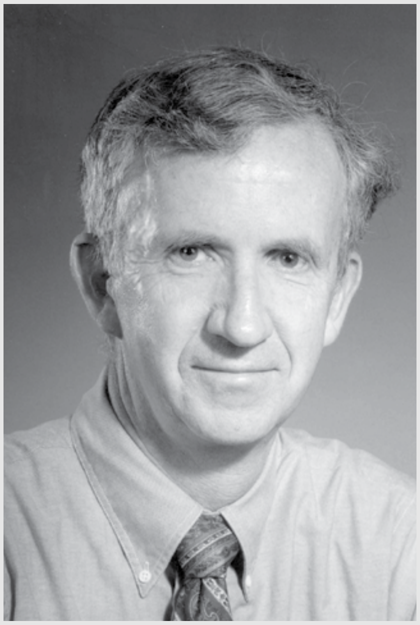
His success as our department head did not go unnoticed; in 1969 he was named associate provost. The following year he became provost and vice chancellor for academic affairs, an office he held until 1975. That year he was appointed chancellor of the University of Maryland. In 1982 he returned to teaching and research full-time. Upon his formal retirement in 1997 he was named president emeritus.

A remarkable feature of Bob Gluckstern's career as a successful administrator was his ability to continue and indeed expand his research in accelerator theory while holding office. Overall he coauthored over 120 scientific papers with approximately 70 devoted to charged particle beam transport. Numerous reports stem from his service as a consultant to Los Alamos, Brookhaven, CERN, and the Fermi National Accelerator Laboratory.

His connections to the University of Massachusetts Amherst were maintained to the end. In 2001 the Robert L. Gluckstern Distinguished Professorship in Physics was established in his honor by a gift from his son Steven. He was awarded an honorary doctor of laws degree in 2005 in recognition of his service to the University.

-Arthur R. Quinton

IN MEMORIAM



We are sad to report that Professor Arthur Swift passed away at age 70 on February 5, 2009, due to complications from Alzheimer's disease. Art was born in Worcester, MA in 1938, graduated with a BA from Swarthmore and a PhD from the University of Pennsylvania. He was a postdoc at Cambridge in England and joined our faculty in 1967. In his 36 years in the department, he played many vital roles. He was known as a clear, caring and rigorous teacher, leading courses from the most introductory freshman courses to the highest level graduate courses. His research in particle theory and his mentoring of graduate students were well known. He was a respected and thoughtful voice in the faculty. In his later years he made a mission of enhancing the graduate program by serving as the Director of Graduate Studies for many years, until he took on the role of Associate Department Head. He also served the Town of Amherst in many ways – as Town Meeting member, on many town committees, as a Boy Scout leader and as a bicycling advocate. He was a fine colleague and mentor, and he is already missed.

*Continued/ **People/ Holstein***

that our department offers available to someone new, even though he hopes to contribute at whatever level he can. As a concluding remark, he said, "Besides John Donoghue, I have had the good fortune to direct the theses of Lorenzo Delatorre, Thomas Hemmert, Geoff Feldman, Mike Musolf, Yeu-Chung Lin, Phil Gribosky, Germar Knoechlein, Prasad Venugopal, and have helped with the work of Eusoo Na and Andi Ross. In this activity, I concur with Lincoln Wolfenstein—I have learned much more from them than they have received from me. Thanks to all!"

Alumni News

Paul S. Bourgeois (BS '91, PhD '05) writes: After completing my PhD, I continued teaching as the Physics Teaching Fellow at Amherst College. In October 2006 I married Tamara Stanton and in August 2007 Tami and I had our first child Meghan. She is the love of our lives. About that time I started a post doctorate with the University of California, Riverside. My appointment was with the PHENIX collaboration at Brookhaven National Laboratory (BNL) on Long Island, NY. My specific research was studying the origin of the spin of the proton. After a year at BNL, I had the opportunity to return to Amherst College as a visiting assistant professor. I'm happy to be back in Western Mass where I am teaching again and I can be with my wife and beautiful daughter. I am currently working on a second paper about the MIT-Bates Virtual Compton Scattering experiment with my advisor **Rory Miskimen**. We hope to publish this spring. Here is our family picture. *pbourgeois@amherst.edu*

Robert Dufresne (BS '78, PhD '87) writes: I first came to UMass Amherst when I was 18, and with the exception of two-and-a-half years that I spent working for the Johns Hopkins University Applied Physics Laboratory, UMass Amherst has been a major part of my life ever since. Initially I wanted to major in biochemistry, but after an introduction to relativity and quantum mechanics, I switched to physics, and stayed on to do graduate work, my PhD thesis focusing on the spontaneous breaking of chiral symmetry in QCD. Then I joined Bill Gerace and Jose Mestre to work in the then young research field of physics education in their Physics Education Research Group (*http://srri.umass.edu/perg*). I remained with the group until this past August, when I retired from UMass Amherst to work with my wife Michele in our family publishing company, Pioneer Valley Books (*http:// PioneerValleyBooks.com/*), which we started more than 11 years ago. We design books that help young children learn to read. Our books are sold all across the country, and at present we have 14 employees. Our main office is in Shutesbury, just outside of Amherst.

How does one get from studying quarks to publishing books that help children learn to read? The answer starts with Michele, who has been teaching reading for almost as long as we have been together (now married 32 years). Her passion and hard work have made a tremendous contribution to education in western Massachusetts. In her role as a Reading Recovery Teacher Leader *(http://www.readingrecovery.org/)* she realized there was a need for books written specifically for the struggling reader. Michele went to work writing books, and with a lot of sweat and tears, Pioneer Valley Books was born. At this point in our lives, Michele and I are committed to making a significant difference in education through Pioneer Valley Books. Our oldest son, Nick, is a computer programmer and takes care of all our business computing needs -- when he is not out competing in the triathlon world. Our son Matt who is a philosopher and aspiring acupuncturist does his best to keep the family grounded. Perhaps some day I will find my way back to physics. Until then, my thoughts about physics are left to the late night hours. *bob@pvep.com*

Juan Pablo Fernández (PhD '04) writes: It was quite a pleasant surprise to have the chance to go back to UMass Amherst to teach last fall, five years after I got my PhD under Prof. Bill Mullin. I came full circle in many ways: the 'invitation' to teach came from Bill; my direct supervisor was Prof. Monroe Rabin, who had been my academic advisor before; and the class I taught was Physics 381, *Writing in Physics*, for which I was TA during my very first semester on campus and TA'd a few more times in later years, including once under Bill. I had the usual serving of students which those who ever TA'ed may remember: a large, diverse group, where a few students that do not care too much about the class coexist with others that love to learn new crafts and that produce superb work. For the most part, the class was taught long-distance: I changed commuting hours for late nights reading and writing email, and grading, grading, grading. The interested reader can visit *http://issuu.com/mauress/docs/intelligent_designs* to see one of the projects that resulted from the course.

Part of the thrill of going back to my alma mater was seeing at first hand the changes mentioned in this newsletter and elsewhere. The parking lot across the street from Hasbrouck disappeared. I guess that is good news, since the lot has been replaced by a nice new building, but I wonder where graduate students park after 5:00 P.M. nowadays. It was great to see the human evolution of the department: faces I saw every day for years, graying slightly at the temples like me, alongside accomplished new faculty; the comforting and helpful presence of Ann, Mary Ann, Jane, and colleagues, of Jeff, Tony and Heath. There are even some grad-student friends of mine from five years ago that will be leaving soon but were still here.

I myself have not ventured too far from Amherst. Right after defending my thesis I moved up to Lebanon, New Hampshire, to a house that I still inhabit but which I shall vacate next year when I move to Boston. Shortly after that I got married (during a blizzard) to Paula Kuzontkoski, then a genetics grad student at Dartmouth and now a postdoc at Harvard. I made a living translating for the UMass Amherst Translation Center until I got cabin fever from spending 24 hours a day in the same house. The Upper Connecticut Valley is not exactly full of jobs for low-temperature theorists, and sometime early in 2005 I found myself a graduate student again, this time at the Thayer School of Engineering at Dartmouth, and certain that one PhD is more than enough. I've heard from some people that I'm the first person they know who got a Master's and a PhD in the wrong order. Writing and defending a second thesis was not too cool, and neither was retaking the GRE, but jumping from Master's student to postdoc, without having to go through the doc stage, has much to recommend it. Contrary to what I thought, engineering is not any easier than physics.

It is a bit amusing that I had not heard of my current field of research until the day before I first interviewed here, and yet the field -- identification and discrimination of unexploded ordnance, or UXO in military parlance -- was featured in last year's edition of this very newsletter. My only disagreement with Robby Siegel, last year's author, is that where he says 'detection' I say 'identification and discrimination.' The sensors that we use -- essentially fancified metal detectors, like the one in Robby Siegel's picture -- easily detect UXO; the problem is to distinguish between buried dangerous objects and buried nails and beer cans (and innocuous exploded ordnance). The field is based on low-frequency electromagnetics, a subject

Continued/ ***Alumni News***

closer to magnetostatics than to radiation physics, where H, not B, is what occurs and matters, and Faraday's law is literally the law of the land.

Meanwhile, I have continued to pursue a teaching career. I have taught physics and Spanish at Lebanon College, a small college located a few blocks away from my home — and to which I walked during a blizzard to take the GRE. I have continued translating on and off. There are some writing projects that may come to fruition as early as next year. And, to sum everything up and come full circle, I taught writing for physics majors at UMass Amherst.
juanf@physics.umass.edu

John Guerra (BS '76) writes: "I attended the university from '72 to '76, receiving my BS in Honors Physics. I appreciated then, and even more so now, the excellent education I received, not only from what was then the Dept. of Physics and Astronomy, but in all disciplines. It has served me well.

My introduction to the physics program was in Dr. Brehm's mechanics lectures. His famous calm, cool, methodical approach followed through even when I jumped up one day and ran out of the classroom. I had neglected to tell him that I was on the student volunteer fire force and was responding to the campus steam whistle alarm. As I ran out I heard him quietly ask, "Was it something I said?"

Ready for the sun! In Nanoptek's instrument, light focussed on a photocatalyst converts water into hydrogen. The figure on the right is Andrei Ursache, a recent PhD from the UMass Amherst physics department.

Dr. Mike Kreisler taught my favorite subject, Electricity and Magnetism, and then gave me a summer job working in high-energy physics. Well, okay, I was polishing light-guides, fixing BNC connectors, and making high voltage supplies, but it was at least in support of high-energy physics, and I loved every minute. I even got to spend some time at Brookhaven Laboratory, where I remember some very late pizza suppers with my fellow students, doctoral student Jeffrey Jones, and of course Mike, laughing ourselves almost to tears after stressful and tiring days trying to get ready in time for the experiment window.

In the Honors Program, the classes were often very small. I remember a wonderful course in Quantum Physics taught by Dr. Cook, who at the time was also Department Head, and there were only three of us! Although not in the Dept. of Physics, Dr. George Armelagos in Anthropology supported my trying to reconstruct the vocal tract of a male Neanderthal using clay and fossil replicas so that we might hear what his voice sounded like. Similarly, Hasbrouck Lab provided an intimate learning environment and was my second home. There were many prestigious guest lecturers that graced Hasbrouck Hall, but I was most impressed with the lecture series given by Dr. Eugene Wigner, not only a megastar physicist, but Einstein's brother-in-law as well, and only a few feet away!

I was in the Five College Astronomy Club, and still remain in touch with good friends from that club. We worked hard refurbishing the 20-inch scope on Orchard Hill, and gave lots of star parties. For a while my 12-inch scope was used as a substitute while the 20-inch mirror was sent out for recoating. We even organized a Solar Energy Conference for which my future wife Suzanne Gaudette designed the logo and flyer.

Speaking of coating mirrors, inventing vacuum deposition coating for telescope mirrors and optical thin film coatings in general were just a few of Dr. John Strong's many accomplishments. Although as Professor Emeritus he was no longer teaching, he agreed to be my senior thesis advisor. He even paid me (I would have paid him) to work at the Astronomy Research Facility (ARF) over two summers, the second one for which I even pushed off my start date at Polaroid. The talented ARF crew of Ta-Chun Li, Bill Dalton, Ray Smartt, and Pete Hansen could not have been kinder to me or more generous in their time and support, and we also had a lot of laughs, even when I had to paint the inside of the "big tube" used for long path length atmospheric spectroscopy. My thesis was *Atmospheric Radiometric Observations at 2.2 Microns*, which is the water band (and got stuck in many places) for observations of post-sunset peaks in the light scattered from the zenith at that wavelength. After graduation, my wife Suzanne and I developed a warm friendship with Dr. Strong and his wife Bethany, and we cherish that friendship that continued until his death.

It was probably Dr. Strong's recommendation that got me into Polaroid in Cambridge, where I spent the next 24 years in the Optical Engineering Dept. with another alum, Dr. W. T. (Bill) Plummer. The cutting edge work, workplace freedom, and chance to work with so many very smart people that Dr. Land was famous for assembling, many of them becoming good friends of mine, calmed any desire for a higher degree. I did however get my P.E. license in mechanical engineering, and to this day I'm not quite sure if I'm an engineer or a scientist.

I left Polaroid in 1999 to become VP of Technology at Calimetrics, a California startup developing high-density optical recording. I was fortunate to have my own lab and talented team in Bedford, where we worked on high-density near-field optical recording that was an offshoot of the photon-tunneling microscope that I had developed while at Polaroid, and that Calimterics had licensed.

Funding dried up for Calimetrics post 9/11, and after closing down their "East Coast" lab I decided to start my own company, a dream that had been deferred by the offer to join Calimetrics. So in 2002 I started and incorporated Nanoptek (a contraction of "nano-optical technology") and worked out of my basement making and selling photon tunneling microscopes with a license from Polaroid. But a grant from NASA for producing hydrogen from water and sunlight with a band-gap engineered titania photocatalyst got us back into the solar energy path that I had first started way back on campus. After a subsequent Phase II grant, followed by funding from the DOE and from the Massachusetts Renewable Energy Trust, Nanoptek was off the ground. Last year we received our Series A funding and now enjoy a larger team and great new lab and pilot manufacturing space in Maynard, Mass. Two of my team are University alumi: Dr. Andrei Ursache (physics, Amherst), and Dr. Amol Chandekar (chemistry, Lowell). We also had a UMass Dartmouth student as a summer intern last year.

I hope to hear from old friends who may read this. I live in Concord, MA with my wife Suzanne, and our daughter Merli, who is at Mt. Holyoke, our son John, who is in high school, and Chip, the golden retriever. *jguerra@nanoptek.com*

Margaret E. McCarthy (MS '77) writes us: After getting a PhD in Environmental Science, I continued to teach physics courses to technology students at Springfield Technical Community College in Springfield, MA. After a sabbatical leave, I am now returning to the Department

Jim, Margaret, Yoshi, and Jon in a Tokyo restaurant.

Chairmanship in Physics. During my leave, my husband Jim Ricci (BS'72) and I went to Sapporo, Japan, to take an intensive Japanese language course at Hokkaido University. While there we traveled south to Tokyo and on to Nagoya, where we met our son Jon, and Yoshiyuki (Yoshi) Sato. Jon is an Information Technology specialist from Long Beach, California, who worked for the Nuclear Physics Group for three summers in the early 2000s. One summer he helped construct a large detector for use at the Stanford Linear Accelerator Center (See page 5 of the spring 2001 Newsletter). Two other summers were spent at the MIT-Bates Linear Accelerator in Middleton, MA. Yoshi was a PhD student from Tohoku University who was in the Nuclear Physics Group at UMass Amherst, and who along with Paul Bourgeois (PhD '05), worked at MIT-Bates on the virtual Compton scattering experiment under the direction of Prof. Rory Miskimen.
mem@schoolph.umass.edu

Continued/ ***Alumni News***

Ryan Stewart McWilliams (BS Physics, BS Astronomy, '01) completed his PhD in Earth and Planetary Science at the University of California Berkeley in May 2008. His dissertation research was conducted under mineral physics professor Raymond Jeanloz, and in collaboration with the Physical Sciences Directorate at Lawrence Livermore National Laboratory (LLNL). He studied the properties of solid condensed matter — such as diamond and quartz crystals — during ultra-fast application of high-pressures and high-temperatures, using shock-waves generated with high-power laser systems. For postdoctoral work he will be working at Washington State University at the Institute for Shock Physics under director Yogi Gupta. In the near future, he will participate in the first experiments on the National Ignition Facility, the most powerful laser ever built. He will be studying the basic building blocks of planets and stars — hydrogen, helium, and iron — as these materials are subjected to the extreme pressures and temperatures of planetary and stellar cores. *stewartmcwilliams@gmail.com*

Mahesh Patel (BS '80, MS '82) writes: In my first year of undergraduate work at UMass Amherst in the physics department, I took the honors physics course with Dr. Richard Kofler that most of us who participated in fondly remember. It included some of the rather wild and eccentric, if not brilliant, students he seemed to attract. The timeless open book exams, his constant availability for questions in his office, and the physics demonstrations were virtually legendary. This probably helped direct me towards physics as an undergraduate degree. Having access to the physics lounge at any hour of the day was one of the nice perks of the department, and a great hangout. After this, I went on to work with Dr. Ken Langley in his biophysics laboratory on laser light scattering of DNA fragments to ascertain their diffusion properties when binding to a chemotherapeutic agent. Little did I realize that over a decade later, I would be writing a review article on diffusion and perfusion imaging of the brain in a major radiology periodical of MRI Clinics, and elaborate on the fundamental random walk model from my first year statistical mechanics course.

After an industrious undergraduate program, I settled into a graduate degree at UMass Amherst with Ken, which was mostly lab work, with some intermingled course work. During my later time at UMass Amherst, I became more involved with various UMOC (UMass Outing Club) activities, particularly having been introduced to the Cabin by David Degrand. This was an even more eclectic group of adventurers. My first week at the cabin saw people being tied up and dragged underneath tables in the spirit of entertainment. On the other hand, the white water canoeing expeditions were always quite enjoyable, and I have done several trips with Al Howcroft, where the organization has been amazing.

From white water canoeing, I now give lectures to residents in Radiology on white matter diseases. Before finishing my Master's degree at UMass Amherst I entered medical school at Boston University (I finished the MS the following summer) and then did a medicine internship at what was once the Carney Hospital in Dorchester. I did radiology training at the University of Connecticut Health Center in Farmington, and then at Tufts University Medical Center. I went on to additional training in cross-sectional imaging at Mass. General Hospital, and neuroradiology at Tufts Medical Center. I then joined the junior staff at the Beth Israel Deaconess Medical Center in Boston, and went on to become as assistant professor. My physics and computer background was useful for bringing to fruition a manuscript on functional neuroimaging of epilepsy with MR techniques. I had hit a stumbling block in data analysis, and had to collaborate with an eccentric, brilliant cardiologist, in addition to doing my own UNIX shell script programming using some of his data analysis tools. After writing my first R01 NIH grant on functional MR imaging of epilepsy, which failed to get funded, I decided it was time for a change. On my way back from a trek in Nepal in the Khumbu region, I interviewed in the Northern California area.

I joined a group private practice in radiology in the San Francisco Bay Area. When this group divided, I went to the teaching hospital group covering Santa Clara Valley Medical Center in San Jose, where I am now. I bought a fix-me-upper house, and renovated it with a 3.7 kW rooftop solar photovoltaic system and a solar hot water system. These work well in California, but I suspect would not be as useful in New England. I have been playing flute in a symphonic band when I have the chance, and have been actively hiking in the Bay Area. Recently, I went on a river trip through Big Bend National Park with the now retired Ken Langley, who knows more about rivers in the New England area than I thought possible. He was able to replace Clint Eastwood as a sheriff in our low budget video production at a movie set that we encountered on the way. To all the folks that remember me, greetings; come visit if you are out this way. As far as an undergraduate and graduate education goes, UMass Amherst had a phenomenal

amount to offer in a wonderful part of the country without needing to incur debt. I think that during my formative years, the Physics department and Outing Club, together with the Pioneer Valley and its special character, offered more than I could imagine for any other institution or place.
mpatel0@gmail.com

Jason Stevens (BS '92) writes us: "I am currently the Physics 152 lecturer at UMass Amherst. As some readers may know, that course introduces predominantly engineering and chemistry majors to the basics of E & M and thermodynamics. Being part of the Physics Department and working with undergrads has been a great experience. There is certainly a lot to learn from both my colleagues and my students.

Since graduating from UMass Amherst, I have for the most part remained in Amherst and worked as an educator for elementary, high school, and college students. During the mid 90s I lived with Winfried Teizer (PhD '98), who did dissertation research with Bob Hallock. Other highlights from the past 17 years include that I twice bicycled across the United States, played a fair share of ultimate Frisbee, and annually don a polar bear costume to jog as the mascot for a winter road race in Northampton, MA.

My wife, Lace, and I have a 4.5 year old son named Carter. Currently the main thing Carter knows of physics is that I keep lollipops in my office."
jasons@physics.umass.edu

Bill Tiernan (PhD '92) writes: I've been a physics professor at Mesa State College in Grand Junction Colorado for the last 12 years. Mesa State is a mid-sized state institution with a small but active physics program. It has been a very rewarding and interesting place to work; teaching at a smallish college has suited me very well. There is a lot of teaching, and research is not easy, but overall a good mix is possible.

Grand Junction is on the western slope of Colorado and the beginning of the Colorado plateau, that huge expanse of southwest high-desert. There are wonderful opportunities for outdoor activities of all sorts: great skiing in the winter, and hiking, fishing, biking, and boating in other seasons. Nancy and I would welcome a visit from any of our physics alums.

I've been on sabbatical at UMass Amherst for the fall semester 2008, working in Bob Hallock's low temperature lab. Bob is still going strong and has a very interesting experiment in solid helium underway. Working in Bob's lab brings back memories, as there are many relics of past experiments still around.
wtiernan@physics.umass.edu

Sidney Topol (BS'47, Honorary Dr. of Science '85) is a distinguished alumnus of our department who has had a successful career in telecommunications. He grew up in Dorchester, Massachusetts and entered Massachusetts State College at the age of 17. He learned of America's entry unto World War II over the radio, listening to the news of the bombing of Pearl Harbor. In 1943, at age 18, he volunteered for the Army Air Corps and was trained first in meteorology, and then in radar. At the war's end, he was sent to Tokyo to help set up military microwave radio links, which turned out to be his first step into the wide-open field of wireless communications. He came back to UMass Amherst to complete his BS degree in physics in 1947. After a brief stay in the Naval Research Laboratory in Washington D.C., and in the master's program at the University of California Berkeley, he went to work in the antenna design department at Raytheon in Newton, Massachusetts. In 1960, he and his team at Raytheon built the first global-scale "earth stations" satellite dishes for NASA's Lunar Surveyor program, and in 1971 he became the chairman of a small Georgia telecommunications company, Scientific Atlanta. At Scientific Atlanta he succeeded in making his company a national leader in microwave satellite communication technology. Over 19 years the company's sales increased from $16 million to $600 million.

Here at UMass Amherst, we greatly appreciate his many contributions. During the '80's and '90's the campus had microwave dishes with his company's name, Scientific Atlanta. He was the motivating force behind the establishment of TIMe, the Telecommunications Institute of Massachusetts at UMass and has established a Distinguished Lecture Series in Telecommunications. His professional papers have been donated to the university archives and lately he and his wife, Lillian, have established the Sidney and Lillian Topol Scholarship Fund for Diversity in the Natural Science.(http://www.umass.edu/giving/news/article/24/). His career has been described in UMass Magazine (http://www.umass.edu/umassmag/archives/1998/spring_98/spg98_f_topol.html).

On October 31, the department had the pleasure of a visit by Dr. Joan Centrella (BS '75) of the NASA Goddard Space Center. She gave a seminar on numerical solutions of General Relativity and discussed the merger of two black holes, which could lead to one of the brightest sources of gravitational waves in the universe. The Laser Interferometer Gravitational Wave Observatory (LIGO) is searching for such events. (For information on LIGO, see Prof. Laura Cadonati's profile in the 2008 newsletter.) The merger of black holes is too non-linear for ordinary analytic methods; numerical methods are needed. However, until recently computer codes have been plagued by instabilities causing them to crash well before the merging black holes could complete even a single orbit. Dr. Centrella described recent advances that reveal new potential for discoveries when these sources are observed by LIGO.

Dr. Centrella joined NASA in 2001 in order to form a numerical relativity group, motivated in part by the potential of future space-based experiments to detect gravitational radiation. She was awarded the 2008 John C. Lindsay Memorial Award for Space Science, along with Dr. John Baker of her group at Goddard. As noted by the director of Goddard's Astrophysics Science Division, Dr. William Oegerle (Astronomy PhD '77), "Theoretical work is rarely honored by the Lindsay Award; most of the awards are presented for observational discoveries made with NASA missions."

Mohamed Anber, Lorenzo Sorbo, Joan Centrella, Laura Cadonati, John Donoghue. All interested in gravitational studies.

New Alumni

Degrees awarded since Spring 2008 Newsletter

BS Degrees			
Timur A. Alperovich	Michael A. Bozza	Maxim Lakin	Julia N. Tilles
Demitri Balabanov	Daniel T. Brosnan	Mikhail Okrochkov	Drew C Von Maluski
William F. Barnes	Richard Earl Nuckman	Peter A. Slepchuk	Julia M. Kumpf (BA)
John P. Barrett	Matthew D. Gratale	K. Neal Taylor	

MS Degrees				
Margerita Abe	Dong Chen	Jingshui Huang	Zekun Shi	Chuan Zeng

MS Degrees with Thesis	Title	Advisor
Christian Reuschle	A Neural Network Based Background Suppression Technique Applied to VHE Gamma Ray Data Coming From the Crab Pulsar	Blaylock

PhD Degrees	Thesis Title	Advisor
Barbara Capogrosso-Sansone	Quantum Monte Carlo study of ultracold bosons in optical lattices	Prokofiev
Chao Huan	NMR Experiments on Vibrofluidized and Gas Fluidized Granular Systems	Candela
Deniz Kaya	Pattern Formation and Phase Separation Kinetics of Flexible Polyelectrolyte Solutions	Muthukumar
Nicholas Franklin Pereira	Evaluation of Image Quality Using Human and Numerical Observers	Rabin/King
Sourya Ray	Investigation of Symmetries and Conserved Charges in General Relativity	Kastor/Traschen

Honor Roll

This Honor Roll lists those who contributed to the Department of Physics from January 1, 2008, to December 31, 2008. We apologize for any omissions and kindly ask that you bring them to our attention.

Halsey Allen
Emmanuel Annan
Anonymous
Karen Armstrong
Michael Azure
Michael Belanger
James Bellefeuille
Michael & Cheryl Armitage Bergeron
David Bloore
Matthew Bonn
Michael Bozza
Herbert Brody
Walter Buchwald
Joan Centrella
Craig & Suzanne Cervo
Siu-Kau Chan
Edward Chang
Scott Chase
Raymond Connors
Christopher Davis
Edward Demski
Paula Dion
John Donoghue
Christopher & Carol Emery
Kevin Fowler
Stephen Fuqua
Fabrizio Gabbiani
John Gorecki
Robert & Nancy Hallock
Leroy Harding
Marion Haupert
Robert Higley
Pamela Houmere
Robert & Kristina Huffman
Russell Hulse
Julie Johnson
Phillips & Ereda Jones
Philip Kan
Shuhui Kang
Donald Kaplan
Paul Kendra
Grace Kepler
Per & Linda Kirstein
John Knapton
Christopher Koh
Donald Kuhn
Richard & Denise Lammi
David Lawrence
James Leas
Roger Legare
Margaret & John Lereau
Mark Leuschner
Gregory Loring
Margaret Loring
Theodore Lundquist
Anthony Mann
Jonathan Maps
Donald McAllaster
Evelyn McCoy
Leonard Mellberg
George Millman
Joyce & John Mistark
Steven Moore
Melissa Motew
Steven Newton
Elizabeth Ouellette
Michael Palecki
Karen Parker
Marti Peltola
Gerald & Doris Peterson
Alexey Petrov
John Polo
Satish Prasad
John Pribram
Stanley Pulchtopek
Hao Qi
Francesc & Kathleen Roig
Frederick Rowland
Mary Ann & Thomas Ryan
Hajime & Sachiko Sakai
Edwin Sapp
Andrew Scheff &
Faye Goldberg Scheff
George Schmiedeshoff
Benjamin Scott
Ker-Li Shu
Arthur Signorella
Thomas Silvia
Scott Simenas
Mary Skinner
Thomas Slavkovsky
Peter Smart
Douglas Smith
Kathryn Smith
Peter & Kathryb Smith
Jay Stryker
Mark & Carol Taylor
George Theofilos
Albert Tucker
Jorge Uribe
James Valles
Jonathan Wainer
James & Elaine Walker
Lijuan Wei
Sharon Woods
Xiaoyu Yang
David & Linda Zaff
Eric Zeise
Jing Zhou

MATCHING GIFTS
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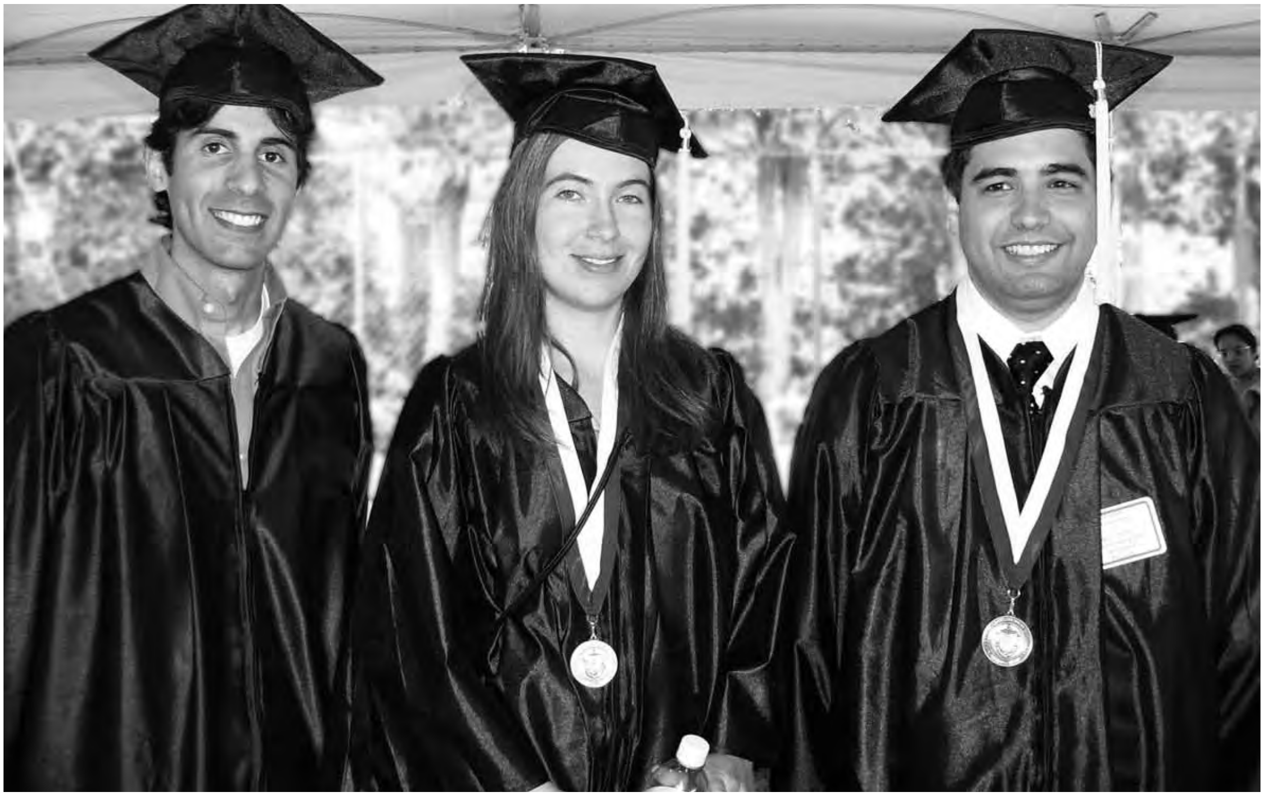

At the graduation ceremony, May 2008, new alumni (left to right) Matthew Gratale, Julia Tilles, Coleman Krawczyk.

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