

2008

## Department of Physics Newsletter: Spring 2008

Bob Krotkov

Ken Langley

Gerry Peterson

Monroe Rabin

Hajime Sakai

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# PHYSICS NEWSLETTER

SPRING 2008  
Issue No. 8

University of Massachusetts  
Amherst

Department of Physics  
College of Natural Sciences  
and Mathematics

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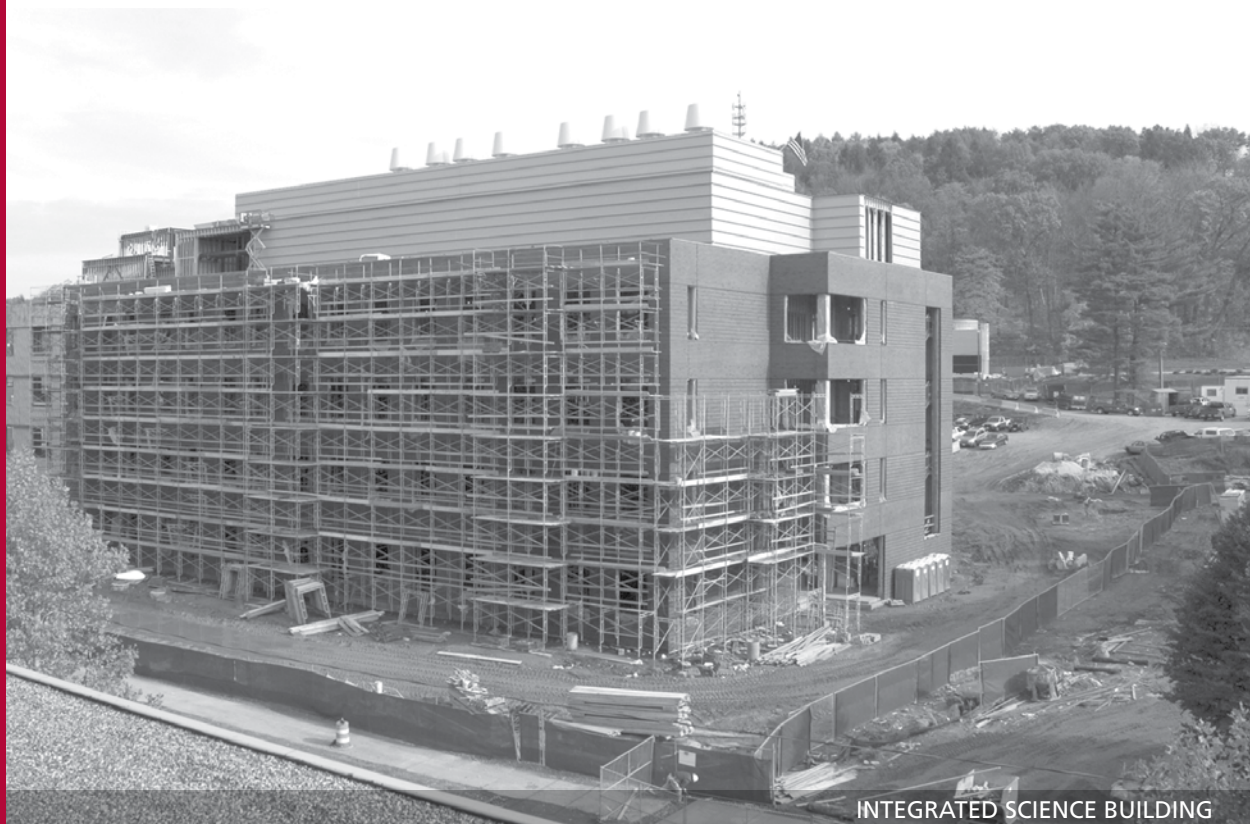
**Editors:** Bob Krotkov  
Ken Langley  
Gerry Peterson  
Monroe Rabin  
Hajime Sakai

**Design & Production:**  
Brigette McKenna

Website:  
[www.physics.umass.edu](http://www.physics.umass.edu)



THE COLLEGE of  
NATURAL SCIENCES & MATHEMATICS



INTEGRATED SCIENCE BUILDING

The University of Massachusetts Amherst has seen more than its share of change in the time since our last Newsletter. John Lombardi, our dynamic chancellor since 2002, left in August to become president of the Louisiana State University System, an excellent match to his experience and leadership qualities. His outspoken style and candor appealed to the LSU Board of Supervisors as they had to our faculty and students. While he was our chancellor, he started a \$1 billion-plus capital improvement campaign that includes many needed renovations as well as new construction. As shown above, across the street from our venerable Hasbrouck Laboratory, a new Integrated Science Building will soon be completed. On the next page we give the reader a brief tour of some of the other construction that is part of John Lombardi's legacy. He also initiated the Amherst 250 Plan to hire 50 new tenure-track professors each year over five years, and supported an effective plan for minority students. After retirement, he plans to live in nearby Pelham. Dr. Thomas W. Cole, former president of Atlanta Clark University, serves as interim chancellor until a permanent chancellor is appointed.

In our department, Jon Machta, who became head when Lombardi became chancellor, has returned to his teaching and research in condensed matter theory after five excellent years of service to the department. His successor, Donald Candela, is a condensed-matter, low-temperature experimentalist. Don is an expert in nuclear magnetic resonance studies and has a very active program in granular and soft condensed matter, and in quantum

super-fluids at very low temperatures. Don received a B.A. from Harvard in 1978, and a Ph.D. in 1983. After a postdoctoral position at Ohio State, he joined our department in 1986. He has been the Undergraduate Program Director and has served on many other committees. Among his notable departmental contributions is the development of a demanding, but well-liked intermediate laboratory course. We all look forward to Don's leadership!

### NEW DIRT



A view of new "apartment" dorms, taken from the top of the W.E.B. Du Bois Library, looking northward toward Leverett.



The new Studio Arts Building is almost finished. It is across North Pleasant Street from the Fine Arts Center, to your left in the view.



Start of construction on a new student Recreation Center across Commonwealth Avenue from the Mullins Center. This is taken looking east from the Mullins Center, toward Thompson and the Library.

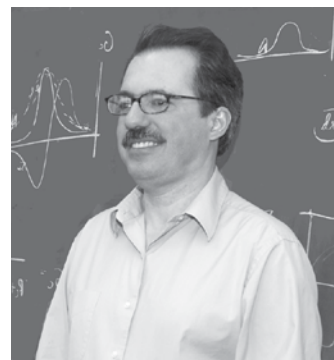


Architect's rendering of the Recreation Center.

On the Cover: New Integrated Science Building, under construction on old parking lot 63, across the street from Hasbrouck.

Dear Alumni and Friends of the Physics Department,

It is with great anticipation that I greet you in my new role as Department Head. After five years at the helm, Jon Machta has stepped down to devote more time to his research, but not before seeing through the addition to our faculty of four new assistant professors who are here teaching their first classes and setting up their research programs: Chris Santangelo in soft condensed-matter theory, Egor Babaev in hard condensed-matter theory, Jenny Ross in experimental biophysics, and Laura Cadonati in gravity-wave experiment. Elsewhere in this newsletter their profiles and research interests are highlighted. It's a delight to see so many fresh faces and so much new activity in the department. For this and many other accomplishments, I join the whole department in thanking Jon for a job well done.



Three longstanding members of the department have retired since our last newsletter. Ed Chang worked in atomic and molecular theory and served as head advisor for our majors. Mike Kreisler headed up our high-energy experimental effort for many years and built a distinguished record of service on and off campus. Po-zen Wong did research in experimental condensed matter, and taught several key introductory courses for our physics majors. We plan to keep in touch with our faculty 'alumni', and we thank them for many years of service to the department and to our students.

With several major new construction projects completed or nearing completion, and student enrollment and faculty size on the upswing, the campus has an air of excitement and progress that has hardly been matched during my twenty years here. Along the North Pleasant Street corridor, a major new dormitory complex has been occupied this year, a beautiful new studio arts building is ready for its grand opening, and most impressively, the massive Integrated Sciences Building is nearing completion. Corresponding to all this physical construction, departments across campus are building new programs in research and instruction. In Physics our long-planned expansion into the field of biophysics is finally firmly underway – our new faculty member Jenny Ross has put together a lab combining biological techniques for labeling and purifying proteins with physics-based advanced optical imaging techniques for detecting the motions of single bio-molecules. Additional searches are underway in biophysics, as well as in particle physics and condensed-matter physics.

As I step into the role of department head, I would like to make it my special mission to improve our communication with and responsiveness to you, the friends and alumni of our department. This is our eighth annual Physics Newsletter, and we intend to continue that tradition. But I look to you for feedback and ideas on how we can establish closer ties with you. Should we have reunion events on campus, and/or an electronic forum for alumni and friends to communicate with each other and with us? Should we distribute the newsletter electronically? Should we have funding drives so that gifts, whether large or small, can be tied more directly to specific activities in the department? I hope to hear from you, by email, letter, or phone. If you have ideas to share, or if you would simply like to let us know about your path in life since setting forth from the embrace of the department, I look forward to your communication.

Sincerely,

Don Candela, Department Head  
head@physics.umass.edu

## New Faculty

### DR. EGOR BABAEV

Egor Babaev received his Ph.D. in St. Petersburg Russia, and following a postdoc at Cornell, he joined our department in 2007. He is interested in theories of the “super” states of matter, such as those of superconducting electrons in metals,



*Egor Babaev*

of superfluid helium, of superfluid vapors of ultra-cold atoms in traps (“BEC’s”), and, possibly, of supersolid helium. Some of these exotic, aggregate, quantum mechanical states have many practical applications and have been known for a long time (e.g. the superconductivity of mercury was discovered by Kamerlingh Onnes in 1911). Others, such as supersolid helium, have been “discovered” only

recently and are controversial. His interests overlap that of others in our department, e.g., **Bill Mullin** has worked on the theory of Bose-Einstein condensates of ultra-cold atoms in traps, while **Bob Hallock** is well known for experimental work on superfluid helium – and may soon be even better known for an experiment underway on supersolid helium. **Nikolay Prokof’ev**, **Boris Svistunov** and coworkers have led the way to an understanding of how both Bose and Fermi particles can “get together” to form one of these exotic emergent states. (See page 5 of the Spring 2007 Newsletter.) Electron diffraction patterns from high  $T_c$  solids show striped modulation; **Stan Engelsberg** has some new ideas about why these stripes might be important.

Egor is interested in the question of whether or not there might be yet other, fundamentally new “super” states, particularly for hydrogen. One can show on symmetry grounds that if hydrogen at very high pressure is indeed a quantum liquid metal, then it may form two brand-new types of “super” states: a metallic superfluid and a superconducting superfluid. The pressure at which such states could form are extremely high (about four million atmospheres), but are thought to be achievable.

### DR. LAURA CADONATI

Laura Cadonati, originally from Italy, did graduate studies at Princeton, and came to us in 2007 from MIT, where she had been working on LIGO, the Laser Interferometer Gravitational Wave Detector. As has been described in earlier Newsletters, several in our faculty are doing gravitational research: **Jennie Traschen**, **David Kastor**, **Lorenzo Sorbo**, and **John Donoghue**. But Laura is the only one actually doing an experiment! She is not doing it by herself; LIGO is a large, cooperative project of many institutions, with 580 scientists from the US and 11 foreign countries. A long experimental run was completed in the fall, and Laura is analyzing the data in a search of signals from transient gravitational wave sources, such as exploding supernovae or colliding black holes.

Gravity is one of the fundamental interactions in our universe, and gravitational waves have long been predicted but only indirectly observed in the UMass Amherst Nobel Prize work of **Joe Taylor** and **Russell Hulse**. Direct detection of gravitational waves would lead to new tests of fundamental theories, and also provide a new window on the universe, leading, if history is any guide, to the discovery of previously unsuspected phenomena.

Gravitational waves are distortions of space-time and have to be described in a theory in which there is no Newtonian absolute space and time. However, the effect of a passing gravitational wave may be visualized as a “strain” in space such that the distance between free particles changes by an amount proportional to the distance between them. However, gravitational waves are weak: the dimensionless strain expected from astronomical sources is of order  $h \sim 10^{-21}$  – much smaller than strains measured in elastic distortions of material bodies.

In LIGO, the distances between hanging mirrors are measured using travel times of laser light. Two such mirrors and a beam splitter form a Michelson Interferometer in which the detector signal is a measure of the strain imposed by the gravitational wave. Since the distance between the beam splitter and one of the mirrors is 4 km, a strain of  $10^{-21}$  implies a mirror displacement of about  $4 \times 10^{-16}$  cm, or one-thousandth the size of a proton! It would seem impossible to measure something so small, but by using pairs of mirrors, such as those in a Fabry-Perot interferometer, to increase the effective arm length, LIGO is doing it! For reliable detection of such a weak signal, it is important to observe it at more than one place, so there are two LIGO observatories, one in Hanford, Washington, the other in Livingston, Louisiana.

Laura is interested in the search for “bursts” of gravitational waves from core-collapse supernovae, collisions of black holes, and from serendipitous sources that haven’t been predicted yet. Waveforms for these signals are unknown, so cross-correlations between data streams are used to find coherent transient signals in the detectors.

Research these days is multidisciplinary and typically involves many groups and projects. Laura is in tune with the times: she is also participating in the Italian Borexino experiment to detect low energy solar neutrinos.



*Laura with her children, Chiara and Byron, on a quilt which Laura made.*

Laura and her husband Nicholas have two children, who in the picture are sitting on a quilt that Laura made. She does not have the time to do much quilting now, but has made a New Year’s resolution to do Yoga every day! We’ll check with her next year about this.

## DR. JENNIFER ROSS

Jennifer Ross is a biophysicist whose interests include the physics of microtubules and motor proteins within cells. Before getting her Ph.D. at the University of California Santa Barbara, she obtained a double B.S. in Physics and Mathematics at Wellesley College, and spent a brief time as an International Research Assistant at Xinghua University in Beijing, China. A post-doctoral fellowship at the University of Pennsylvania Muscle Institute followed before Jennifer arrived in Amherst and began building her lab in newly renovated space on the third floor of Hasbrouck.

Filaments of the self-assembling protein tubulin are important in cell morphology and division. Microtubules can serve as

the long-range track in the transport of vesicles, proteins, organelles, and RNA. Special motor proteins, powered by energy from ATP, can bind to and literally walk along the microtubules to accomplish transport of materials. Part of Jenny’s research will address the ability of microtubules and motors to form non-equilibrium patterns, and assess what effect this has on the delivery of cargos in the cell. Advanced optical and microscopic techniques are used to observe single microtubules and motors.

Many of the experimental skills needed to prepare materials from living cells are standard in the world of biology or biochemistry, but not physics. In order to bring her graduate students up to speed on many of the laboratory techniques of biological sample preparation and analysis that they will need in their research, Jenny has started a two-week crash course, the “BioBootCamp.” She and two other Five-College professors, Pat Wadsworth from UMass Amherst Biology and Omar Quintero from Mount Holyoke Biology, have students with similar needs, so the three decided the most efficient way for their students to learn these essential skills was to organize an intensive traveling lab course that spends time at a variety of facilities around the Pioneer Valley. Jenny’s objective by the end of the course was to observe the protein filaments being pushed along by the motor proteins stuck to a cover slip surface. The project worked successfully, and the students were able to assess motor motion in the microscope.



*Jennifer Ross*

An introduction of Jenny would not be complete without mentioning her activities with the WMP (Women and Minorities in Physics). As is explained in the Mission Statement on the group’s website ([www.people.umass.edu/wmp](http://www.people.umass.edu/wmp)), the group aims at encouraging under-represented groups to study

and find employment in physics-related fields. It provides mentoring at all levels, from high school to professorial. There are monthly meetings and weekly coffee hours to foster informal communication. Monthly activities include information about academic vs. industrial employment, applying for grants and fellowships, obtaining the next position, and managing a family and career. Another goal is to bring together minority students and professors for

Continued/ **New Faculty**

mentoring both within the physics program and in active research groups.

Jenny and her husband Christian (see the following article) have a 17 month-old daughter, Aurora Joule Ross Santangelo. As a young gymnast, Jenny competed against Kerri Strug before Kerri went to the 1996 Atlanta Olympics. She says she can still do cartwheels, handstands, and handsprings and can do back flips on the trampoline.

## DR. CHRISTIAN SANTANGELO

Christian Santangelo joined our department in 2007. His research is in the field of soft condensed-matter physics, which deals with the behavior of complex soft materials including polymers and biological systems. After receiving his Ph.D. from the University of California Santa Barbara, as a postdoc at the University of Pennsylvania, he studied liquid crystals that are found in many modern television and computer displays. His research focused on liquid crystal phases whose order was frustrated by the intrinsic handedness of the molecules. The material resolves this frustration by creating a complex network of defects; he and his collaborators developed new theoretical methods to study the defect structure.



*Christian Santangelo*

His current interests lie in understanding and controlling self-assembly, the ability of some complex materials to organize themselves into small structures, such as the self-assembly of biological cells. The goal is to develop new theoretical tools to predict long-range structure from the molecular interactions, and eventually learn to design molecules that make specific structures synthetically.

On a more personal level, he was the first in his family to be born in the United States. (He comes from a small town in Italy that is slowly dying out.) He says he played a pretty mean guitar in high school, and in graduate school got around on a skateboard. He and another of our new faculty (Jenny Ross) are married and have a 17-month old daughter. He has been making wine with his parents for a few years now and plans to transport the operation to the Pioneer Valley. An excellent idea!

## Research

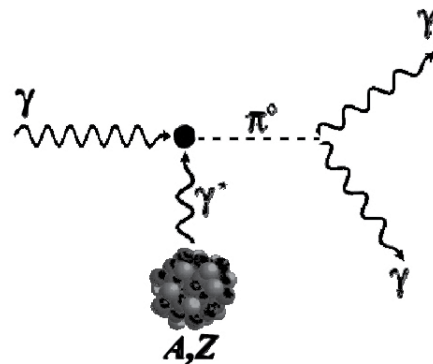
### THE PRIMEX EXPERIMENT AT JEFFERSON LABORATORY, NEWPORT NEWS, VIRGINIA

Rory Miskimen

Studies of the long-distance and low-energy structure of elementary particles continue to be an important avenue of research. The UMass Amherst experimental nuclear physics group has been working on an experiment to make a precision measurement of the lifetime of the neutral  $\pi$  meson, the  $\pi^0$ , which plays a key role in the binding of nuclei. Because of its low mass, the underlying symmetries of the fundamental Quantum Chromodynamics Interaction (QCD) can be utilized to predict the  $\pi^0$  lifetime without ambiguities or free parameters. A precision measurement of the  $\pi^0$  lifetime is probably the definitive low energy test of QCD.

The  $\pi^0$  decays into two photons, but there is no way to collect  $\pi^0$ 's in a container and watch them decay; other methods must be used to measure the lifetime. The technique used in our experiment was to bombard carbon and lead targets with a  $6 \times 10^9$  eV (6 GeV) photon beam, and then measure the probability for a  $\pi^0$  to be produced in this process. Figure 1 shows a diagram of the reaction.

One way to visualize this process is to consider the target nucleus as a source of short lived "virtual photons"; the incident photon then interacts with one of the virtual photons surrounding the target nucleus and forms a  $\pi^0$ . The  $\pi^0$



*Figure 1. Diagram of the Primakoff reaction*

lives only a very short time, approximately  $10^{-16}$  seconds, and then decays back into two photons. This reaction is called the Primakoff reaction and is named after Henry Primakoff who pioneered its study; we were led to christen our experiment PrimEx, short for Primakoff Experiment.

We built a detector to observe the two photons created when the  $\pi^0$  decays; its central region consisted of 1152 high-resolution lead-tungstate ( $\text{PbWO}_2$ ) detectors surrounded by 576 lead glass detector blocks arranged around the

outer periphery. The high Z lead converts the gammas into electron-positron pairs that produce Cerenkov light in the glass. Figure 2 shows the completed detector.

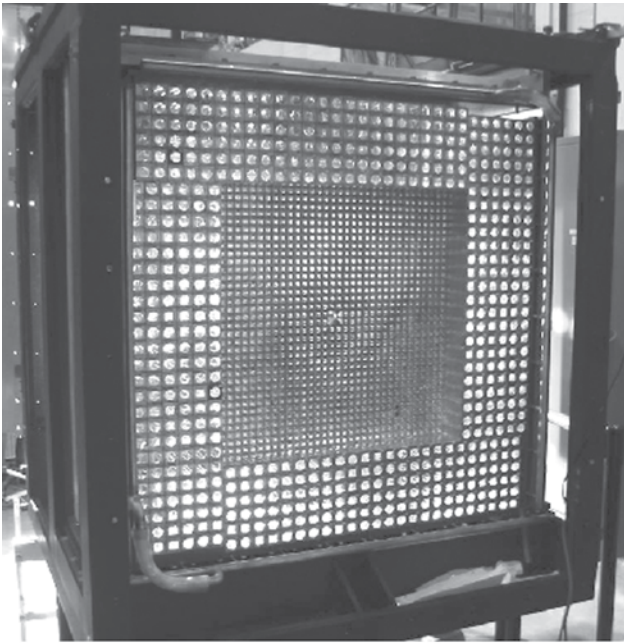


Figure 2. The fully assembled detector before installation in the experimental hall.

The PrimEx experiment took data in Fall 2004. UMass post-docs David Lawrence and Mike Wood, graduate student Eric Clinton, undergraduate research assistants Pjerin Luli, Phil Martel, and Dan Pomeroy, machinist Dick Letendre, and electronics technician Steve Svoboda all played important roles in the construction of the apparatus, the data taking, or in the data analysis. Eric Clinton led one of the three independent analyses of the data for part of his Ph.D. thesis, and is now a post-doctoral research associate at Duke University.

We have been able to achieve a five-fold decrease in the uncertainty of the  $\pi^0$  lifetime compared to earlier measurements. Although the analysis is not yet complete, the results indicate a preference for theoretical calculations that include the effects of quark masses, such as that of Holstein et al. as described in the next article. In the near future we are looking forward to a doubling of the accelerator energy to 12 GeV at Jefferson Lab, which will enable us to measure the two-photon decay rate of the next most massive “ $\pi^0$ -like” particle, the eta-meson, to provide the most sensitive measurements of the up and down quark masses. We believe that the physics and excitement to be generated with our new detector has just started.

## WHY PRIMEX?

Barry Holstein

Particle physicists believe that they have developed a successful theory that describes the interactions of the quarks which make up the strongly interacting particles (hadrons) such as the proton, neutron, pion, etc. This theory is called quantum chromodynamics (QCD) and has similarities to the very successful theory that describes the electromagnetic interaction—quantum electrodynamics (QED). Both theories describe the interaction of hadrons as being due to the exchange of massless particles. In the case of QED the massless particles are photons which couple to the charge of the hadron, while in the case of QCD the massless particles are called gluons and couple to hidden charges that are for simplicity called “color.” Unlike ordinary charge, which has only two types—positive and negative—there are six types of color charge. Another difference is that while photons are neutral, and therefore do not couple directly to one another, gluons carry color charge and therefore couple not only to the quarks but also to each other. The theory of QCD is thus inherently nonlinear, making it extremely difficult to solve. Even QED is challenging to solve, but the feature that the fundamental electromagnetic coupling  $\alpha$ —the square of the electric charge divided by fundamental constants—is small ( $\alpha \sim 1/137$ ) means that one can use perturbation theory in order to solve the theory to whatever accuracy is needed. However, the corresponding strong interaction coupling  $\alpha_s$ —the square of the color charge divided by fundamental constants—is large ( $\alpha_s \sim 1$ ), meaning that perturbative methods cannot be used for low energy QCD. So how can physicists test that QCD is the correct theory? One solution is to use basic symmetries of the theory.

The idea of the PrimEx experiment is to use the “chiral symmetry” of QCD. In the limit that quarks have no mass, the classical field theory can be shown to be invariant under interchanges of quark identities, which leads to chiral invariance. However, in quantum mechanics there can be a violation of the symmetry through something called an “anomaly.” An anomaly is said to occur when a theory which has a symmetry at the classical level loses that symmetry when quantized. The chiral symmetry is broken upon quantization and the result is what is often called the chiral anomaly. In classical physics the existence of chiral symmetry would lead to the  $\pi^0$  meson being a stable particle. However, the existence of the chiral anomaly means that the  $\pi^0$  is unstable and decays into a pair of photons. Also the underlying chiral symmetry means that it is possible to make an exact prediction for the rate at which this decay occurs, and therefore for the lifetime of the  $\pi^0$ .



*Continued/ Research*

It is this lifetime that the PrimEx experiment tries to measure and therefore this offers a beautiful test of QCD. The precision of this experiment means, however, that there is one additional wrinkle which must be dealt with, and that is that the light up and down quarks which make up the  $\pi^0$  are not really massless. They are very light, however—less than one percent of the proton mass—and therefore can be treated as a small perturbation in calculating the  $\pi^0$  lifetime. The effects of this small mass have been estimated by two groups—a UMass (Holstein), MIT (Bernstein), Hampton (Goity) collaboration, as well as a French group (Moussallam and Ananthanarayan)—and both predict a minor (~4%) decrease in the lifetime. In order to verify that this tiny shift is present, the PrimEx experiment needs to be performed to ~2% precision, an extremely challenging goal. Nevertheless, the collaboration appears to be up the task and the result will be a precision test of QCD.

## Teaching

### ETHICS FOR SCIENTISTS AND ENGINEERS

In spring '07 a new course called Ethics for Scientists and Engineers was taught by **Marc Achermann** (Physics) and Phil Nasca (Public Health), and supported by the Nanotechnology Innovation Program. Topics in both ethics and the conduct of research were addressed, such as scientific misconduct, plagiarism, conflict of interest, student-mentor relationships, communication with the public, and whistle blowing. It enabled students to recognize critical situations, identify stakeholders, and suggest possible specific actions against a background of rules and regulations. Complementary experiences in Public Health and Nanoscience provided the grounds for animated student discussions from different viewpoints in analyzing case studies. Marc will include several guest speakers as he teaches the course again this spring.

### ENERGY AND SOCIETY

The department has a long history of offering general education energy courses. In the early 70s **David Inglis** and **Norman Ford** taught such courses for students from a wide variety of majors, as the subject is inherently interdisciplinary. In fall 2007, **Mark Tuominen** taught a course called *Energy and Society* to some 80 students. In addition to problem sets, that are familiar to physics majors, the course required three written papers, an unusual feature in physics courses. Students picked topics for these papers from lists that covered a wide range of energy subjects

that included oil supplies in Saudia Arabia, hybrid cars, geothermal power, and China's energy strategy. **David Kastor** is teaching the course this spring, and comments that “such a course needs a home in the University, and the Physics Department is an ideal spot for it. After all, energy is at the root of our subject. Physicists have long experience teaching about energy in its many different forms. Beginning the first day in classical mechanics, we talk about kinetic energy and gravitational potential energy. Later on, we talk about electrical energy, nuclear energy, chemical energy, and light. If students are still listening, we'll happily tell them about the 70% of the contents of the universe, dark energy, that we don't understand at all. For those interested, materials for the course are posted on the website ([people.umass.edu/kastor](http://people.umass.edu/kastor)).”

The energy course is one of a growing portfolio of general education classes offered by the Department with the aim of introducing our subject to a wider audience. In addition students can take courses with titles such as *From the Big Bang to Black Holes*, *Seeing the Light* and *Einstein's Dice*. One sociology major taking the energy course said that it was the third physics gen. ed. class he'd taken.

### PHYSICS 490N (INTRODUCTION TO NANOTECHNOLOGY AND NANOMANUFACTURING)

This course, designed and taught by **Mark Tuominen**, will be offered for the first time during the spring of 2008. It is recommended for third and fourth year undergraduates and will provide an introduction to the “how” and “why” of nanotechnology – the methods for making and characterizing nanostructured material and devices, and the scientific and technological applications that use them. Nanotechnology is by definition an integrative, interdisciplinary science. Students will be introduced to chemical, physical, biological and engineering principles and approaches that are currently used in nanotechnology research and development. Reading and class assignments will be drawn from recent textbooks and articles. Prerequisites include introductory physics and general chemistry.

The idea for Physics 490N came from MassNanoTech, the research institute for nanotechnology at UMass Amherst, which not only coordinates research on nanoscale materials, devices and systems, collaborates with industry, and advances nanotechnology commercialization, but also educates students, and fosters outreach activities. Mark has been very active (and successful) in collaborating with others to set up this program.

# Graduate Students

## OLD AND NEW

### Graduated 1987



*Christopher Arabadjis  
M.S. '87*



*Scott Cohen  
PhD '87*



*Ronald Marian  
M.S. '87*



*Thomas Piekenbrock  
M.S. '87*



*Englebert Quack  
M.S. '87*



*Robert Seaman  
M.S. '87*

### Entered 2007



*Left to right: Peker Milas, Martin Ries\*, Jared Vanasse, Ufuk Aydemir, Hao Wang, Burcu Yucesoy (front middle), Yipeng Yang, Kiyotaka Akabori, Marcelo Dias, Kristina Meyer\*, Rebecca Bremen\* (missing: Greg Farrell)*

*\*German exchange student*

## Outreach and Service

### BIKE PATH NAMED FOR ARTHUR SWIFT

The bike path connecting the Norwottuck Rail Trail to the University, has been named for Professor Arthur Swift who served the Physics Department for 36 years until his retirement in 2003. The connector was opened in 2002 and dedicated May 13, 2007. The 12-foot wide 1.7-mile paved path, running mainly on the east side of University Drive, was mostly funded with \$600,000 in federal and \$150,000 in state money.

Swift was instrumental in getting the bike path connector built, said Al Byam, the University's Transit Manager. "Art's eye for detail and his calm demeanor enabled him to work successfully with everyone involved...and helped him make sure the project didn't get mired down." Art routinely biked from South Amherst to the University through rain, snow, headwinds, and slippery pavement. An Amherst Select Board member commented that the 'Swift Connector' not only recognizes Art's commitment to cycling, but also serves as a symbol of cooperation between Amherst and the University.



*Art Swift with his wife Alice at the bike path ceremony*

## What do Professors do After Retirement?

### SERVICE BY RETIRED FACULTY

What do professors do after retirement? The answer seems to be: about what they did before retirement, with some activities dropped, and some new ones added. A favorite one to drop is committee meetings. A favorite one to keep is teaching. Most professors like to teach, and in any given semester the department usually needs people to fill in for faculty who are away on sabbatical, or not available for some other reason. A perfect fit!

The courses taught are often "gen-ed" courses, which are intended for non-physics majors. For example, this spring, Dick Kofler is teaching Physics 114 (Theory of Sound) and Gerry Peterson is teaching Physics 100, while in recent years, Bob Krotkov has taught the Weather Course and the writing course, our former chancellor, David Scott, gave a course on Science and Spirituality, and Hajime Sakai and Ed Chang have taught labs. Ed also serves as an adviser (see page 12 in this newsletter) and continues to help students in various ways, both formally and informally.

Here is a question for readers of this newsletter: if you are retired, did anything change? We'd love to hear from you: send an email to Bob Krotkov [krotkov@physics.umass.edu](mailto:krotkov@physics.umass.edu). When retired faculty were asked "What change (if any) do you see in today's students compared to those of many years ago?", a common response was that today's students are "computer literate" and are at ease with computer "learning packages" that may trouble faculty. They are good at text messaging and its abbreviated spelling, but they don't write longhand, and instead print. One retiree said that his students were more aggressive than they used to be in demanding good grades.

## People

**Janice Button-Shafer** was one of the original faculty members who built up the department's research in high-energy physics. Recently this picture of her appeared in APS News. We wrote to her and asked what she has been doing since she retired ten years ago. Here is her reply:

In 1965, at the urging of Physics Head **Bob Gluckstern**, I agreed to join Steve Yamamoto in heading a high-energy physics group. Over the years UMass Amherst colleagues (including **Dick Kofler**, **Stan Hertzbach**, and **Monroe Rabin**) and I engaged in many particle-physics experiments at Brookhaven National Laboratory. Around 1990 I joined **Gerry Peterson** and **Ross Hicks** in a series of electron-nucleus experiments at SLAC, the Stanford Linear Accelerator Center.

In late 1993, I became a member of an international collaboration to construct a detector ("BaBar") for a new SLAC electron-positron collider designed primarily for study of "CP violation." "CP" stands for the successive operations of charge conjugation and parity; C changes particle to anti-particle, and vice versa, and P reverses the sign of each spatial coordinate. The origin of CP-violation, first observed in the 1960s, has long been a mystery; its unraveling is essential not only for particle theory, but also for cosmology – to understand how matter came to dominate over antimatter in our universe.

For BaBar, our UMass Amherst high-energy group (Hertzbach, Kofler, and I) cooperated with many institutions in the mid-90's to design and build the "electromagnetic calorimeter," a large structure that required more than 6,000 cesium-iodide scintillation crystals. The first SLAC run for BaBar, from May to October 1999, produced nearly 1.5 million pairs of B and anti-B mesons. Additional BaBar runs over the last eight years, and similar work at the Japanese detector BELLE, have yielded the world's best measurements of CP-violation parameters as well as many observations of new phenomena.

In December of 1998, I returned to Berkeley, CA, where my mathematician husband and I had studied and done research before coming to Amherst. I became a "guest" physicist at the Lawrence Berkeley National Lab, where I was able to continue with BaBar activities.



APS Fellows (l to r) Janice Button-Shafer (Berkeley), George Trilling (Berkeley) and Elliott Bloom (SLAC) at a Bay Area Fellows reception in October, 2007. (This is the picture which triggered our request to Janice for an update on her activities.)

In recent years, I have contributed to two hardware projects: a synchrotron X-ray monitor for the low-energy (positron) ring used for BaBar collisions; and also a detector prototype for the proposed International Linear Collider. The latter involved studies at LBL of "Gas Electron Multipliers" in combination with pixel-chip readout, for use in track reconstruction; results will soon appear in the journal *Nuclear Instruments and Methods*.

Berkeley continues to have stimulating physics programs, e.g., weekly presentations for the LBL Institute of Nuclear and Particle Astrophysics, and campus lectures by distinguished physicists. My thesis advisor, Owen Chamberlain (antiproton discoverer) attended many events until his death in February 2006. The inventor of the maser, Charles Townes, is still active at well over age 90.

We frequently see our daughter and her family near Caltech (where she does space-physics research) and a son and his wife who have positions in Silicon Valley. Our other son, after thirteen years with Ford in Dearborn, MI, is looking into engineering opportunities in California. I also find many opportunities to play chamber music in the Bay Area.

## Retirements

### ED CHANG

**Ed Chang**, an atomic theorist, came to UMass Amherst in 1970. He collaborated extensively with local experimentalists, as well as those at NASA, UConn, Harvard-Smithsonian, in Germany and elsewhere, especially with regard to spectroscopic measurements and electron-molecule scattering. The work with Hajime Sakai led him to investigate the infrared radiation spectrum of the sun.

Ed was very active in our undergraduate program, serving as chief advisor for undergraduates, and for many years heading our Undergraduate Studies Committee. As advisor he helped students in choosing courses, and was creative in cutting through red-tape issues. In recent years he was Associate Dean for advising in the College of Natural Sciences and

Continued/ **Retirements**

*Ed and Natalie at the retirement lunch, May 2007*

Mathematics, which expanded his role from some 100 physics majors to 2000 students. Ed is very interested in helping students and has established scholarships for new and for transfer students to honor the success of new students and to enhance their recruitment. (See the “Chang Awards” on page 13 for this year’s recipients.)

## MIKE KREISLER

In May 2007, **Mike Kreisler** retired after more than 35 years on the faculty. He came to UMass Amherst in 1972, after several years on the faculty at Princeton. Mike started the UMass Amherst Spark Chamber group with Professors Dakin, Hartouni, Rabin, and Jensen, that was well-funded by the NSF. They studied both the weak and strong interactions at Brookhaven and Fermilab. To probe interactions at a new level of sensitivity, Mike led efforts to build a UMass supercomputer. He has published many research articles, and started the first collaboration in particle physics with Mexican physicists.



*Mike and Barbara Kreisler at the retirement lunch, May 2007*

Mike enjoyed teaching the introductory physics classes at UMass Amherst, whether for majors, pre-meds, or “poets,” especially when lots of demonstrations were involved. In the late '70s, he served as the Associate Dean of the Graduate School for Research, awarding Faculty Research Grants across the campus.

In 1994, he went on leave to serve as a Division Leader at the Lawrence Livermore National Laboratory. The Division played a significant role in the construction of

the B-Factory at Stanford, and in the PEREGRINE effort that has greatly improved the use of X-rays to treat cancer. Later, he became Science Advisor to the Office of Defense Science in Washington, where he was involved with the Rare Isotope Accelerator project and an international agreement with France to encourage unclassified research in fundamental science supporting the weapons programs in the two countries.

In 2004, Mike returned to full-time teaching and became the Graduate Program Director for the Department, again teaching the large introductory courses, while continuing his efforts at the NNSA as a consultant. After retirement, he plans to continue part-time work in Washington and hopes to finish some particle physics research.

## PO-ZEN WONG

In August 2008, **Po-zen Wong** retired after 20 years of service to the department. His experimental research had been centered on the study of porous materials and surface properties by means of X-ray and neutron scattering, conductivity, NMR, permeability, and electrokinetics. He taught a variety of courses ranging from upper level electricity and magnetism and laboratory courses for physics majors to the introductory course for life science and non-science majors.

Po-zen was born in Shanghai and received his undergraduate education at The Chinese University of Hong Kong, and his Ph.D. from the University of Chicago in 1981. He was at the Schlumberger-Doll Research Center for six years where he worked on porous materials (of interest to the petroleum industry). In 2000, he became a Fellow of the American Physical Society. The citation was for studies of disordered magnetic systems, porous media, and random interfaces. His publications include review articles in *Physics Today*, a book on experimental methods in porous materials, and approximately 60 publications in refereed journals.

In retirement, Po-zen is actively following his interest in Chinese art, largely inspired by his love of the subject and his father’s art collection. The collection was dispersed during the time of the Cultural Revolution in China, so now Po-zen deals with the problem of correctly attributing and authenticating works of Chinese art, a subject made difficult because of the many copies, imitations, and explorations of the same styles, techniques, and subject matter. In the course of this work he has interacted with curators and experts in the art world and traveled with them on study excursions to the storerooms and exhibits of museums in China, England, and the US.

## UNDERGRADUATE AWARDS MAY 2007

### Chang Freshman Award

Sebastian Fischetti  
Keith Fratus

### Chang Transfer Student Award

William Barnes  
Fjordor Isla0maj

### LeRoy F. Cook Jr. Memorial Scholarship

Drew Von Maluski

### Kandula Book Awards

Dylan Albrecht  
Coleman Krawczyk  
Scott Munro  
David Ouellette

### Hasbrouck Scholarship Award

John Barrett  
Matthew Gratale

## GRADUATE AWARDS MAY 2007

### Quinton Teaching Assistant Award

Karen Balabanyan  
Philippe Martel

### Morton and Helen Sternheim Award

Stefan Dickert

### AAPT-T.A. Prize

Edgardo Ortiz

## COLLEGE/NATIONAL AWARDS MAY 2007

### Glover Studentship Award (awarded by APS)

Calla Cofield

### Barry M. Goldwater Scholarship (Honorable Mention)

John Barrett

## AWARDS LUNCH, PHYSICS DEPARTMENT, MAY 2007



*From left to right: standing: Coleman Krawczyk, Matthew Gratale, Philippe Martel, John Barrett, Fjordor Islamaj, Keith Fratus, Sebastian Fischetti  
sitting: David Ouellette, Edgardo Ortiz, Karen Balabanyan, Drew Von Maluski, Calla Cofield*

### FIVE-YEAR FELLOWSHIP AWARD

Assistant Professor **David Kawall** was awarded a five-year fellowship from the Japanese RIKEN organization (similar to our NSF), to carry out research at the Relativistic Heavy Ion Collider (RHIC) at the Brookhaven National Laboratory. Usually one fellow is appointed each year with the hope that the fellows would move on to faculty positions and promote RHIC physics topics more broadly.

### DISTINGUISHED TEACHING AWARD

In April of 2007 Professor **Guy Blaylock** received a Distinguished Teaching Award, the campus's most prestigious prize for classroom instruction. Previous winners in physics include Professors **Bob Hallock**, **John Brehm**, **Dick Kofler**, and **Bill Ross**. Then in September 2007, Guy was again recognized, this time by receipt of the College Outstanding Teaching Award.

### SAMUEL F. CONTI FACULTY FELLOWSHIP

**Nikolay Prokof'ev** was awarded the Samuel F. Conti Faculty Fellowship. (Conti was our first Vice Chancellor for Research.) It consists of a cash award and a year's leave of absence to encourage recipients to concentrate on activities related to scholarly attainment. Nikolay is spending the year at the ETH in Switzerland, where he is continuing his research on super-solids. He is also working on a new project in quantum computation and providing theoretical support for an international group of collaborators developing a special purpose quantum computer designed to simulate materials that are themselves governed by quantum mechanics.

## Staff

**Matt Libby**, after earning his B.S. from the department in 2003, spent a year and one-half with the Princeton Review teaching and tutoring full-time for tests ranging from the SAT and GRE, to the MCAT for medical school, and the LSAT for law school. When **Heath Hatch** began applying to law school, he ended up talking to Matt, who recognized Heath's name and, in January of 2005, Matt came back to the physics department to work in lecture demonstrations, freeing Heath to teach more classes.

Over the following year, Matt's position became full-time, though he continued to tutor and teach during the evenings

and weekends. During the summer of 2006 he taught Physics 100 for the department – then got married and spent his honeymoon in Iceland!

These days, Matt has his hands full. Many in the department may have heard about his twin sons, Jonah and Owen, who were born this past September and are doing very well. He also continues to train physics teachers for The Princeton Review and teach MCAT Physics,



*Matt with sons Jonah and Owen*

General Chemistry, and Biology. He has completed a project for the textbook division of Addison Wesley, in which he used a tablet PC to record flash videos of written and verbal explanations of all the example problems in their textbook *College Physics* by Young and Geller.

When he has moments of free time, Matt enjoys amateur photography, cooking and eating local food, and hiking in the woods and mountains of New England. In the fall of 2008, Matt will be leaving the department to attend medical school.



**Barbara Keyworth** now manages the fourth floor office in Hasbrouck. She came to us from the Astronomy department, where she had been since 1988. Our gain! In Hasbrouck 409 she does purchasing for grants, takes care of lost students looking for their lab, and

watch out!...she is the “building coordinator,” which means she is the one who decides when the heat goes on in the fall and off in the spring!

Barbara lives in Hatfield, across the river, and has one son, who now lives in upper New York State. She does lots of flower gardening, and she and her husband are avid followers of UMass basketball.

## In Memoriam

**Nellie E. Bristol**, age 87, head secretary for the Department of Physics and Astronomy for over 35 years, died October 12, 2007, at the Center for Extended Care in Amherst. She served under Department Heads Gluckstern and Cook when major expansions of the department were in progress. In the days before the computer was used as a word processor, she typed all of the manuscripts that were to be submitted for publication in hard copy, sometimes dealing with difficult-to-decipher handwriting. Typically there were no typing corrections to be made, although often she would point out mistakes on the author's part. Nellie was the consummate secretary. Older faculty members remember her juggling several tasks simultaneously, such as dealing with the Provost's Office, typing class notes, answering an undergraduate's question, etc., and often working overtime. Nellie epitomized the old New England work ethic. She will long be remembered.

**Jean Paul Mather**, 16th president of the University of Massachusetts Amherst, died June 21, 2007, in Lenox at age 92. Mather came here as provost in 1953 and was appointed president in 1954 at age 39, making him the youngest president in his era to lead a land grant university. He served until 1960 during a period of major academic restructuring and growth. During his tenure the College of Arts and Sciences was established, the Faculty Senate was organized, and more than 40 buildings were constructed, including the Morrill Science Center, Bartlett Hall, the Student Union, Machmer Hall, the Durfee Conservatory and Garden, and the Shade Tree Laboratory. Due to his efforts, bond issues and appropriations for new classrooms and equipment were three times the university's total capital spending in the preceding 91 years since it was founded in 1863 as the Massachusetts Agricultural College, university status being achieved only in 1947. Mather built a foundation for the university that grew from 4,300 students at the beginning



of his tenure, to 25,600 students today. More information about Dr. Mather multifaceted life may be found at the News Office web site

<http://www.umass.edu/newsoffice/newsreleases/articles/55050.php>

**Elizabeth (Betty) Orloski**, 89, a secretary in our department for over 25 years before retiring in 1982, died December 9, 2007. She and Nellie Bristol (see above) were our mainstay secretarial force in the era of typewriters. Betty had the job, among others, of placing purchase orders, a task especially important for the experimentalists. The university had multi-page purchase order forms with carbon paper between the pages, so that copies could be sent to as many as six different offices. Although typing speed was of value, accuracy was paramount. Betty had both qualities and carried out her job with efficiency and thoroughness.

Betty was born in nearby Sunderland on April 25, 1918. In WWII she served in the U.S. Navy, and after the war, as an officer in American Legion Auxiliary. She promoted many volunteer programs, such as those for the elderly, and the Girl Scouts. She was also an avid bird watcher and a Red Sox and Boston Celtics fan. She will be fondly remembered.

## Comments

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

Department of Physics  
University of Massachusetts Amherst  
710 North Pleasant Street  
Amherst, MA 01003-9337

Our newsletter is sent to more than 1,260 of our alumni and alumnae who received degrees in physics from the 1930s to the present, and to present and former staff and faculty. For more information about our department, visit our website at [www.physics.umass.edu](http://www.physics.umass.edu).



## Alumni News

**Calla Cofield** (B.S. '07) writes: As graduation rolled around in May 2007, most of my friends went off to grad school. I envied the structure they would have, and their chance to thoroughly explore a chosen topic; but it wasn't for me. I left UMass Amherst determined to put my physics degree to work in the world of writing. I was going to try to become a science writer. After four months of crashing on my parents couch, and around the time I was getting nervous that I'd be unemployed for the rest of my life, I landed what's turned out to be the most wonderful opportunity I could have asked for: I was off to College Park, Maryland, to do a science writing internship for the American Physical Society.

Three months later, I'm absorbing all I can. There's a lot to learn, but I get to learn by doing. Recently I've been sifting through abstracts for the APS March Meeting in New Orleans, where I'll help with press conferences and coverage for APS News.

It hasn't even been a year since I graduated from UMass, but it feels much longer. The rift between college and the working world is wide and deep. The people I work with keep saying that they remember when they were in my position: new to the field and feeling overwhelmed by all of the possible directions one could take. Everyone seems to have found his or



*Calla at Awards Luncheon May 2007*

her own unique path here, and now I'm finding mine. Grad school may still be on the horizon, or not. For now, I'm a professional intern. And to all my friends in grad school, I have one thing to say: they are paying me.

Of course, no job will ever beat being an editor for the UMass Physics Newsletter. If only every news staff knew how to have fun like those guys. Thanks Monroe, Hajime, Ken, Bob, and especially Gerry, for the jump-start.

Note from your editors: Calla has an article on page 5 of a recent edition of the American Physical Society News

(volume 17, No. 3, March 2008; available at <http://www.aps.org/publications/apsnews/index.cfm>)

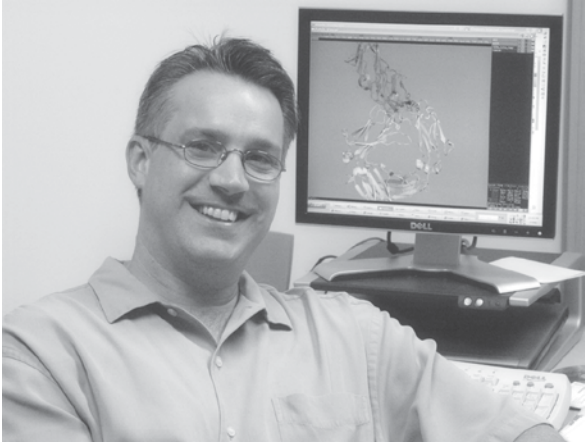
[calla.cofield@gmail.com](mailto:calla.cofield@gmail.com)

**Robert Deegan** (B.S.'92) writes us: I attended UMass Amherst 1990-1991. Po-zen Wong and Jennie Traschen were my most influential teachers and advisors. In particular, Po-zen convinced me to apply to the University of Chicago; without him I probably would not have discovered my passion for the physics in which I now concentrate. After a brief internship at Argonne National Laboratory in 1992, I went to the University of Chicago to earn a Ph.D. in Physics under the supervision of Sidney Nagel. My thesis was on the transport of solids in a drying drop; this is the effect that gives rise to the darkened border of a dried drop, like that seen on the remains of a spilled coffee. For my postdoc I went to the Center for Nonlinear Dynamics at the University of Texas at Austin to work with Michael Marder and Harry Swinney. There I primarily worked on dynamic fracture, where the main goal is to understand the physics that determines the speed and path of a crack. My first faculty position was in the Mathematics Department at the University of Bristol in the UK, and now I have returned to the US to a position in Physics at the University of Michigan. The dominant theme of my research is pattern formation, which is the study of how spatial and/or temporal structure emerges in non-equilibrium systems. In practice, I do experiments in hydrodynamic and elastodynamic systems. My most recent work is on the dynamics of vibrated drops (Phys. Rev. Lett. 99, 144501 (2007)), drop impact (Nonlinearity 21 C1-C11 (2008)), and vibrated shear thickening fluids (Phys. Rev. Lett. 92, 184501 (2004) & You Tube video: <http://www.youtube.com/watch?v=nq3ZjY0Uf-g>).

[rddeegan@umich.edu](mailto:rddeegan@umich.edu)

**John Desjarlais** (B.S. '87) writes: You might remember me as the Physics student (class of 87) that goofed around a little too much during class, together with my cohorts Joe Gallant and Gary Kolnicki. We had a good time, but we also studied hard together and did well throughout our four years in the UMass Amherst Physics program. It's hard to imagine those years without Joe and Gary, and of course Dr. Brehm. Much to their surprise, I began to develop an interest in biology during my senior year. I have no idea why or how this happened, but it was a gut feeling, and I quickly worked some biology classes into my curriculum. I

thank Dr. Brehm in particular for his open-minded support during that time. My change of discipline has ultimately worked out very well, as I am now Head of Research at Xencor, Inc. ([www.xencor.com](http://www.xencor.com)), a Biotechnology company in Monrovia, CA.



My transition into the life sciences was relatively graceful, given the existence of many graduate programs in Biophysics, including the one I joined at Johns Hopkins University. I studied and engineered protein-DNA interactions at JHU, and then went on to a postdoctoral fellowship at UC Berkeley, where I began to develop Fortran algorithms for the de novo design of proteins. This work, aside from being great fun, was the perfect marriage of my interest in biology and the skills I developed at UMass Physics. The idea was to use physico-chemical principles to design an amino acid sequence that would fold into a pre-specified three-dimensional structure. After Berkeley, I joined the Department of Chemistry at Penn State University as an Assistant Professor, where I continued my work in protein design. However, during my 4<sup>th</sup> year at Penn State, I was recruited by Xencor to lead their protein design group, narrowly escaping the inevitable pains of tenure time.

I don't do much Physics these days. Xencor has evolved to become a leader in antibody engineering, creating variants of therapeutic antibodies that more effectively interact with the immune system, to help it destroy tumors or other bad guys. That said, I still strongly feel that my physics training at UMass was the best thing that ever happened to me in my scientific development. I learned to think quantitatively and analytically, of course. But most importantly, I learned to solve problems, and that good problems take hours, days, or months to solve. In my work at Xencor, the players are different – B cells, natural killer cells, antibodies, etc. – but problem solving persistence is still the name of the game.

On a more personal note, I met my wife Christine (also a scientist) at Berkeley, and we have two beautiful children: James 5, and Elise 3. In my small amount of spare time, I'm learning to play the conga drums. I suppose Feynman would appreciate that. I think fondly of my days at UMass, and a lot of names come to mind: Kreisler, Dubach, Golowich, Soltysik, Machta, Donoghue, and of course Joe, Gary, and Dr. Brehm. My Mom still lives in South Hadley, so I might pop in and see some of you from time to time.

[jrd@xencor.com](mailto:jrd@xencor.com)

**David Huse** (B.S.'79), a Professor of Physics at Princeton University, gave a Condensed Matter seminar on November 1, 2007. He is well known for his work on phase transitions, magnetic ordering, vortices, and mixed states in superconductors. (See the note from David on page 11 of the 2003 Newsletter.) At the seminar he spoke about his current theoretical work on two-species Fermi gases, which can be experimentally studied using cold atoms. Fermi particles have half-odd-integer spins and usually can be thought of as repelling each other, because two such particles cannot occupy the same state. However, at temperatures low enough that the deBroglie wavelength is comparable to the spacing between the atoms, a gas of Fermi atoms can form Cooper pairs and “condense” into a quantum mechanical “super state.” (See the Condensed Matter Theory article on page 5 of the 2007 Newsletter.) David discussed a particularly rich phase diagram in which the Cooper pairs in one of the phases have non-zero center-of-mass momentum, an effect that can be enhanced by putting the system into a one-dimensional optical lattice. Such exotic phases had been previously predicted for electron systems, but it has not been possible to verify the predictions experimentally. David's work on atoms in optical lattices provides a new avenue for experiments.

Note from your retired editor: he used old-fashioned view-graphs, not that new-fangled Power Point. Good for him!

**Cheng-Ju Stephen Lin** (Ph.D. '01). Greetings from California. I still remember receiving a phone call about 13 years ago from Gerry Peterson who was then on the graduate student admission committee. Soon afterwards, I entered the graduate program in physics at UMass. Many things have happened since then: I got my Ph.D., finished a postdoc at Fermilab, married, started a new job at Berkeley, and am now the father of a happy 3-year old boy.

*Continued/ Alumni News*

I have fond memories of my years at UMass Amherst. Early on in my graduate training I joined the High Energy Physics (HEP) experimental group, where I worked with Dick



*Cheng-Ju with his wife and son.*

Kofler, Stan Hertzbach, and Janice Button-Shafer. We were involved in a project to construct a new experiment, called “BaBar” at the Stanford Linear Accelerator Center (SLAC), to study the properties of the  $B^0$  meson. It was there I saw at first hand how a big particle physics experiment was built from the ground up. The UMass group was involved in the testing and installation of over 5000 CsI crystals (each crystal is about 30 cm long) for the experiment. The group grew steadily with the arrival of new faculty members Guy Blaylock (who became my thesis advisor) and Stéphane Willocq. When it was time to begin thesis analysis, I worked closely with Guy and Stéphane to search for a bizarre phenomenon “ $B_s$  oscillation”, using data from the SLD experiment (also at SLAC). The  $B_s$  meson is composed of a bottom and an anti-strange quark. It was expected that this particle could change identity and oscillate back-and-forth between being a particle and an anti-particle. We looked but came up empty. Incidentally, it took another 6 years before this phenomenon was finally observed in a different experiment.

After finishing my degree at UMass, I moved to Illinois to begin a postdoc position at the Fermi National Lab (Fermilab). At Fermilab I was involved in the “CDF” experiment to collide protons and anti-protons at extremely high energy. From the collision debris we can study the basic building blocks of nature and look for hints of new physics that cannot be explained by current theoretical understanding. It was an exciting time to be at Fermilab. As an added bonus, I also got an office with a nice view of the buffalos. In particular, the rambunctious baby buffalos are hilarious to watch.

Recently I accepted a scientific staff position at the Lawrence Berkeley Lab (LBL). I am now involved in the Particle Data Group and the Dayabay neutrino oscillation experiment. The lab is new to me but the faces are not. The first time I walked into my office I saw a photo of a crystal scanner on the wall. I remember saying to myself “that looked similar to something that we built a number of years ago at UMass”. As it turned out, that was the apparatus that we built at UMass. By chance, I am sharing an office with Janice Button-Shafer (UMass Professor Emeritus, 1997) who is now spending part time doing research at LBL. Yury Kolomensky’s office (UMass Ph.D., 1997) is just a few doors down the hall. It is a small world after all! There are no buffalos here at Berkeley but I do get a scenic view of the Golden Gate Bridge and the San Francisco Bay from my office. I am sure I will get plenty of chances to reminisce over the Midwest plains and the rolling hills of Massachusetts with my former UMass colleagues here.

CJSLin@lbl.gov

**Melissa Motew** (B.S. '03) writes: It’s hard to believe that five years have already gone by since my time at UMass Amherst. As a freshman music major, my career pointed to a path in the arts, and I would have laughed if you told me I’d be changing to physics two years later. But indeed, a change of heart called me down a new path in science. People often talk about the connection between music and science. I’m not sure exactly what it is, but I suppose I am proof of it. I made the jump from one to the other my junior year and found the physics department to be the perfect place.

In addition to some great classes (Modern I with Professor Dufresne sticks out as a favorite for me), my most memorable endeavors as a physics student came through undergraduate research in Guy Blaylock’s particle physics group and in Tony Dinsmore’s condensed matter research group. Those experiences prepared me for a job in what I refer to as professional problem solving.

Since UMass Amherst, I’ve been working at MIT Lincoln Laboratory, primarily doing systems analysis on a number of different sensor technologies. It’s been fun not specializing in any particular field (since I’m not one to do anything for too long anyway). I’ve gotten to work in a number of different subjects, from optics to acoustics to RF technologies. Sometimes I find myself in the lab taking real data; other times I’m modeling on the computer. I’m also fortunate enough to be surrounded by accomplished scientists



Hiking in the White Mountains

from a number of disciplines. This keeps me constantly learning on the job, which is what I like to do best.

As for the future, who knows? Although I enjoy my work at Lincoln and still play my trumpet, it is not impossible that I could go in an entirely new

direction at some point, like my original switch from music to physics. Potential avenues of exploration include environmental work as well as yoga, my latest newfound love. I also wouldn't mind making my way back to western Massachusetts at some point, since I love that area so much.

mmmotew8486@yahoo.com

**Patricia Rice** writes: I arrived at UMass Amherst as a 27-year old single parent with no science or math background. I had been a legal secretary and also co-owned a restaurant with friends. But in the undercurrent of my life was a compelling urge to go to college. My English SATs were good, but my math score was low, so I was surprised by the acceptance letter from UMass. It was one of the happiest days of my life.

I struggled the first year, taking a three-month "review" course in algebra, analytical geometry, and trig, and classes in English, zoology, anthropology, and chemistry. I did well, getting mostly A's, surprising both me and my mother, who thought I should have remained a secretary.

It was on a dare that I took the now legendary honors physics course with Prof. Dick Kofler. The dare took place in a particularly boring political science class with a middling teacher. I turned to a seatmate one day and told him I thought it was way too simple. He said, "Try honors physics." Oka-ay.

After the first week, I was ready to run. I couldn't understand a thing Dick said. We were expected to work and work hard. But Dick, one of the best professors I had at UMass, gave as much as he expected of us. We had weekly one-hour quizzes. Our open-book exams sometimes lasted six hours. The open books were no help. You had to know what you were doing before you walked into the test room.

My joy in that class grew, as I began to discover in myself a strong left brain. The fact that mathematics could describe physical reality was startling to me. It was the first time in my life I realized I was a science geek, not a secretary, after all.

The Physics Department at UMass was exceptional. The teaching was top-notch. I particularly remember a brilliant statistical thermodynamics course taught by Stanley Engelsberg, and a thought-provoking course led by Robert Guyer, who taught us how to think in physics, as if it were a language all its own.

I am now a science and environment journalist, living in Berkeley, where I have been a teaching assistant in both physics and astronomy, and have taught physics to middle and high school teachers at San Francisco's Exploratorium, a hands-on science museum created by Frank Oppenheimer, J. Robert's brother.

I am an environmental activist, who is very concerned about the world we are making. I write a newsletter for Health Care for All Colorado, a group that is seeking reform of health care in the state, and was program manager for the Rocky Flats Citizens Advisory Board which advised the Department of Energy on the cleanup and closure of Rocky Flats, a Cold-War era nuclear weapons plant. (Rocky Flats is now becoming a national wildlife refuge.)

Physics taught me how to think. And even now, in my home writing and research business, I constantly use the tools I was taught at UMass Amherst.

parice@msn.com

Continued/ *Alumni News*

**Robby Siegel** (B.S. '80) sent us this: During my years at the University, I double-majored in physics and math, but officially graduated in math, though there were stronger emotional ties to physics. Someone recently turned up a photograph of me, Pat Rice, and Scott Chase sitting together at graduation, and I had to smile.

I should've known that I'd wind up a software engineer. I was once sitting in the computer room in the 10<sup>th</sup> floor GRC, writing software that simulated an electronic Spirograph (superimposing two circles with variable radii and spin rates) and displayed the twirling results on the ghostly Tektronix screen. Professor Byron walked in and quietly watched what I was doing. Oh, I'm in for it now, I thought. "Excuse me," he boomed. "Yes?" I meekly offered. "That's absolutely fascinating," he said. "How are you doing that?"



*Rob Siegel with UXO detection equipment*

After graduation, I found a position at GEO-CENTERS in Newton doing what has turned into my life's work – unexploded ordnance detection. Formerly-used military properties having dud munitions left over from training exercises exist in all 50 states, and while these items aren't land mines – they don't blow up if you walk or drive over them because they are not sensitively fused – you wouldn't want to hit one with a backhoe during construction. Initially I specialized in data analysis (magnetostatic modeling of UXO), but I soon became more involved in the systems engineering aspects, and am still developing technology for UXO detection.

Last year I was privileged to be involved in planning a 30<sup>th</sup> reunion of our physics 171/172 class with Professor Dick Kofler (see the spring 2007 newsletter). The important things in life are about feeling like you belong to something, and 30 years later, many of us felt that this class, with its remarkable instructor and its six-hour open-book exams, was among the best, most challenging experiences we had at UMass. What was especially gratifying was learning that Professor Kofler remembered this particular class well – this was the year he was between research assignments and threw himself into teaching, and was the only year he taught the honors section of the class. Along with a magical Complex Variables class taught by Sam Holland, and a spectacular Modern and Contemporary Poetry course taught by Paul Mariani (both of which had only five students), Kofler's class remains one of my core experiences, generating fighting words when anyone tries to diss a UMass Amherst education. I also have wonderful memories of classes with Guyer and Brehm, and remember wondering if the inside of Golowich's pockets were a disaster, a Dorian Grey-like natural consequence of trying to locally decrease entropy on the blackboard with those beautiful four-color lectures.

robbsiegel@yahoo.com

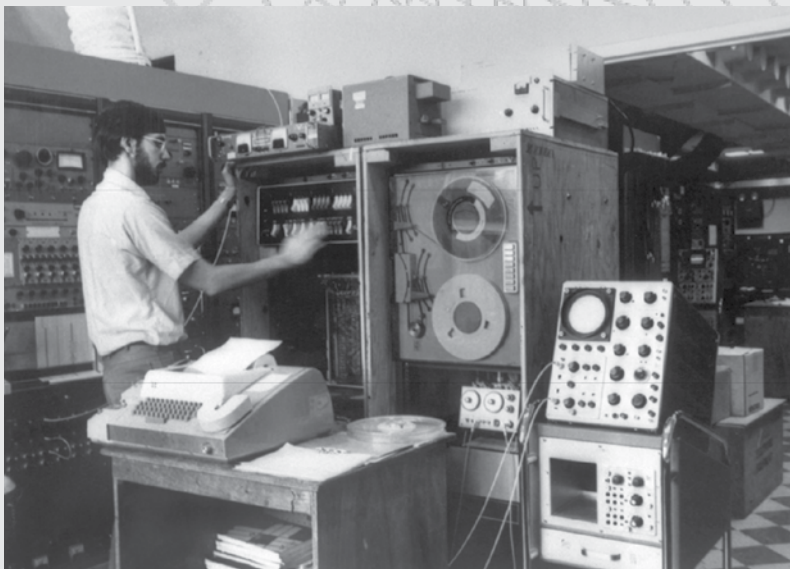
**Jim Valles** (Ph.D.'88) got his degree with Bob Hallock; his thesis was on thin films of  $^3\text{He}$  -  $^4\text{He}$  mixtures. Since then he has been doing interesting work at Brown University and recently was co-author of a paper in *Science* which presented experimental evidence that even insulators can have Cooper pairs! In a cold, metallic insulator such as bismuth at a low temperature, pairs of electrons bind to form Cooper pairs, and a current of Cooper pairs flows with zero resistance, making the bismuth a superconductor. In the work at Brown, a thin layer of bismuth was perforated with so many holes that it became an insulator – there was no more supercurrent, the layer was no longer superconducting – but the Cooper pairs were still there! The experimental evidence for this was that the measured (non-zero) resistance varied periodically as an external magnetic field was applied. The period should depend on the charge of the current carriers, and was measured to be just that expected for Cooper pairs. Observation of this "boson insulator" is expected to further explore the odd kinship between insulators and superconductors.

The work is described in *Physics News* at <http://www.aip.org/pnu/2007/split/849-1.html> – which gives the reference to the *Science* article. For more on Jim Valles, see page 14 of the Spring 2004 Newsletter.

In 1993, **Dr. Russell Hulse** (Ph.D. '75) shared the Nobel Prize in Physics with his thesis advisor Joe Taylor. In April 2008, the University of Massachusetts at Amherst celebrated the one hundredth anniversary of our graduate school and Russell came back for a visit. He presented a colloquium on “Science, from Nobel to Neighborhoods”. Ed Chang (pictured on page 12) was at the talk and remembered Russell as one of his best students in classical mechanics. (He got an A.)

Russell told us about the discovery of the binary pulsar by using the the Arecibo radio telescope in Puerto Rico. Pulsars are rotating neutron stars that emit intense “searchlight” beams of radiation. The signature of a pulsar is a train of very uniformly spaced pulses, and the original goal of the research was to find new pulsars. Surveys had been conducted before (about a hundred pulsars were already known), but his survey was to be much more sensitive; to analyze the data he had a state-of-the-art computer. It was programmed by using punched cards and the size of the memory was 16 Kbytes! (That’s K not M!)

Of the 40 new pulsars found, one of them (PSR 1913+16) was surprising in two ways. First, its period was itself changing periodically, indicating that the pulsar was in orbit around another neutron star with the variation in period caused by the Doppler shift. Second, the energy of the orbit was decreasing. The major discovery of the research was that this decrease in energy is exactly that predicted by Einstein’s theory of General Relativity (which is really a theory of gravity). In this theory the energy is carried off by gravitational waves and the behavior of the binary pulsar was the first evidence that such waves really existed. (See the article on Laura Cadonati on page 4 of this newsletter for more about research on gravitational waves. There is also an article on Hulse and Taylor on page 7 of the 2001 newsletter.) Russell showed us pictures of his lab notebook where he recorded and analyzed data. There it all was, the first indication of gravitational waves.



*UMass Amherst graduate student Russell Hulse in his lab at Arecibo in 1974. The computer was a MODCOMP, the tape drive had a capacity of 1 Mbyte and the scope used vacuum tubes - all state-of-the-art for the time.*

Russell also showed pictures of the Nobel ceremony in Stockholm. The dinner afterward (for 1300 people) was impressive. Prizes were awarded in the order in which subject areas were listed in Nobel’s will. Physics came first. H is before T in the alphabet, so on all the ceremonial occasions Russell was the first! At dinner he sat next to the queen.

He is now Regental Professor at the University of Texas at Dallas and is active in promoting science education. Students learn about science through courses in middle school, high school and college – but there is another very important though more informal way, and this is “socially”: for example at home, in science museums and in “hands on” programs at libraries. In our society there is a lot of competition for attention from various media. Children are naturally curious, but high tech and an urbanized society do not encourage hands-on experience. It is easier to press a button and watch a simulation than to put together an experiment from things found in the basement.

Russell is engaged in a number of projects to encourage community-based science education and “free-choice learning”. Among these is a proposal for a new \$150 million Museum of Science and Industry in Dallas Texas, and many “contact science” projects at a community library, where visitors can check out microscopes, build robots with “Lego Mindstorm” and grow microbes found on their own hands in “Microbe Mania”. The goals are to get people interested, help them maintain that interest in a family and social context, and then to disseminate what has been learned.

# New Alumni

Degrees awarded since Spring 2007 Newsletter

## B.S. Degrees

Dylan J. Albrecht	James E. Ferguson	Fjodor Islamaj	Adam M. Plumb
James Barber	Joshua Gervin	David Kuchinsky	Timothy R. Prisk
Nicholas S. Botchan	Justin R. Groot	Jo Ann Kwong	Brooke J. Purinton
David A. Chardo	Christine M. Harrington	Sunit Madjumder	Jordon K. Samari
Calla Cofield	Kathryn Healy	John J. McColgan	Christopher A. Serino
Ashley M. DaSilva	Matthew S. Hebert	Eric H. Miller	Scott Tezlar
John T. Debardeleben	Jaime C. Hopkins	Eoin A. Moore	
Jesse M. Dugan	Glenn A. Howe	Keith D. Otis	

## M.S. Degrees

Barbara Capogrosso-Sansone	Kan Du	Liquan Pei	Xinyu Wang
Stefan Dickert	Nikhil Malvankar	Sebnem Gunes Soyler	Yanbo Wang
Xuan Ding	Andrew Meade	Emily Thompson	Yanzhen Wang

Ph.D. Degrees	Thesis Title	Advisor
Karen Balabanyan	Superfluid and Superconducting Transitions in Low Dimensional Systems	Prokofiev
Eric Clinton	A precision measurement of the neutral pion lifetime via the Primakoff Effect	Miskimen
Koushik Dutta	Frontiers in Gravitational Physics	Donoghue
Colin Fredericks	Patterns of Behavior In Online Homework For Introductory Physics	Gerace
Tarek Halabi	Multi-Criteria Optimization with Dose-Volume Criteria	Rabin/ Bortfeld
Xuanzhong Li	Observation of CP Violation in the Two-Body Decays of B Mesons to Charged Pions and Kaons with the BaBar Detector	Dallapiccola
Xiaotao Peng	Random Photonic Materials: Fabrication and Characterization of Light Propagation	Dinsmore
Andreas Ross	Inflationary Dynamics and Quantum Gravity at Long Distances	Donoghue
John Savage	Melting and Freezing of Two-Dimensional Colloidal Crystallites with Short-Range Attractive Interactions	Dinsmore
Andrei Ursache	Arrays of interacting nanoscopic elements: ferromagnetic and superconducting cases	Tuominen
Yuning Yang	Structures and Behavior of Amorphous Phase of Polymers in Various Applications	Hsu/PSE
Jing Zhou	Contact Forces and Angles in Disordered Materials	Dinsmore

# Honor Roll

This Honor Roll lists those who contributed to the Department of Physics from January 1, 2007, to December 31, 2007. We apologize for any omissions and request that you bring them to our attention.

Bruce Armstrong  
 Karen Armstrong  
 Michael Azure  
 Guy Blaylock  
 Elizabeth Brackett  
 Herbert Brody  
 Francis Canning  
 Mengshe Cao  
 Siu-Kau Chan  
 Scott Chase  
 Theodore Coletta  
 Raymond Connors  
 Christopher Davis  
 Edward Demski  
 Laurence Dutton  
 Ronald Eckhardt  
 Jon Eisenberg  
 David Ekholm  
 Christopher and Carol Emery  
 Juan Fernandez  
 Fabrizio Gabbiani  
 Robert Galkiewicz  
 Robert Gamache  
 Philip Gregor  
 Robert and Nancy Hallock  
 Leroy Harding  
 Marion Hauptert  
 Evan Heller  
 Robert Higley  
 Roger and Donna Howell  
 Pamela Houmere  
 Russell Hulse  
 Robert and Mrs. Huffman  
 David Jagodowski  
 Neal Kalechofsky  
 Philip Kan  
 Paul Kendra  
 Grace Kepler  
 Per and Linda Kirstein  
 John Kudukey  
 Richard and Denise Lammi  
 Margaret Latimer  
 David Lawrence  
 James Leas  
 Phillip Ledin  
 Roger Legere  
 Mark Leuschner  
 Andrew and Janet Lombardi  
 Gregory Loring

Margaret Loring  
 Theodore Lundquist  
 William Mann  
 Jonathan Maps  
 John Martin Jr.  
 Charles Mayo  
 Donald McAllaster  
 Evelyn McCoy  
 Leonard Mellberg  
 Barbara Merrill  
 Jan Miller  
 John and Joyce Mistark  
 Steven Moore  
 Thomas and Jean Munro  
 Steven Newton  
 Anthony Papirio, Jr.  
 Marti Peltola  
 John Polo Jr.  
 John Pribram  
 Arthur and Rose Quinton  
 John Rahn  
 Shari Richardson  
 Francesc and Kathleen Roig  
 Thomas and Mary Ann Ryan  
 Hajime and Sachiko Sakai  
 Edwin Sapp  
 George Schmiedeshoff  
 Sara Schulman  
 Benjamin Scott  
 Ker-Li Shu  
 Arthur Signorella  
 Stephen Silverman  
 Thomas Silvia  
 Scott Simenas  
 Mary Skinner  
 Thomas Slavosky  
 Alan Sliski  
 Peter Smart  
 Peter and Kathryn Smith  
 Mort and Helen Sternheim  
 William Tiernan  
 Jorge Uribe  
 James and Elaine Walker  
 Lijuan Wei  
 Edward Weinberg  
 Deborah Welsh  
 Xiaoyu Yang  
 Lynn Yeslow-Finn  
 Eric Zeise

## MATCHING GIFTS

Exelon Corporation (Leroy Harding)  
 Lockheed Martin (Ker-Li Shu)  
 Raytheon (Scott Simenas)  
 Fidelity Investments (Keith Quinton)  
 Tyco (Marti Peltola)  
 3M Foundation, Inc. (Robert Galkiewicz)

## THANK YOU!

Your generous contributions to the Department are greatly appreciated and are vital to our programs. The days are long past when we could carry out our mission by relying only on state and federal funding. Private giving by our friends and alumni is essential for us to maintain and improve the quality of our teaching and research.

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Donation questions specific to our Department may be directed to the Head's Office at 413.545.2545.





*Beginning of construction on what was once Lot 63 parking lot, across N. Pleasant St. from Hasbrouck. At the end of construction sometime in 2008, we will have a new Integrated Science Building.*



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University of Massachusetts Amherst  
710 North Pleasant Street  
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