PHYSICS Newsletter

DEPARTMENT OF PHYSICS AT THE UNIVERSITY OF MASSACHUSETTS AMHERST

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Women in Physics: Positive Strides at UMass

"Let's face it: Women are Hot. I don't mean that they are physically attractive; I mean that the topic of women, feminism, and their rights and status in the world is currently a politically 'hot' topic," says Associate Professor Jennifer Ross. From the floor of the United Nations, where the General Secretary of the United Nations, Ban Ki-moon, has declared that, "Women must be full partners of development," to the New York Times Best Seller, "Lean In," where author and COO of Facebook, Sheryl Sandberg, describes how women have been systematically held back in our society, the discussion of women's issues spans from surprisingly lengthy debates of reproductive rights on the floor of the U.S. Congress to Tom Brokaw's statement that the this century is the "Century of Women." Women and women's issues are all over the news media these days.

The Physics Department is making positive strides to increase the numbers of women in physics. Let's look at the numbers: The number of female faculty has risen dramatically over the past 7 years from 1 female physics professor in spring of 2006 to 6 female faculty members as of October 2013. Between 1966 and 1982 there was only one female faculty member in the combined Department of Physics and Astronomy, Janice Button-Shafer. An update from Janice, who retired in 1997, can be found in this Newsletter.

Our 34 member faculty is now 18% women, which is higher than the national average[1] of 14%, and shows that the department has made a concerted effort to attract women to faculty hires. UMass is, indeed, an attractive and family friendly place to work. We have some of the best maternity and paternity leave policies in the country. There are also policies encouraging spousal accommodations in hiring that have helped to attract and retain more female faculty members in the department. Our graduate students reflect a similar profile with 17 women out of a total of 80 in the graduate program or 21%, up from 15% in 2003. UMass reflects national trends in women studying physics. According to the American Institute of Physics, the fraction of women receiving PhDs in Physics in 2012 was 20%, whereas it was only 13% in 2003.

"Women in Science is a Hot Topic."

- Prof. Jennifer Ross
UMass Physics

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A Bright Future

The future looks bright for our Department. Increased research opportunities for all students and promising job prospects are just part of the reason we are seeing increasing numbers of students. Physics has a mathematical foundation that involves reasoning that can be tested by experiments that may have strong overlaps with engineering subfields, and physics is at the heart of all the hard sciences. The current generation of students recognizes these features, and realizes that studying physics is excellent preparation for encountering many of the world's problems. Furthermore, governments and funding agencies also are aware of the power of physics training and broadly support it. Compared to a decade ago, there has been a very significant increase in academically strong undergraduate physics majors who are provided research opportunities that are supported by your donations.

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UMASS AMHERST

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Portion of the sky in the constellation of Orion (The Hunter)
Photo credit NASA, ESA, and the Hubble Heritage Team (AURA/STScI)

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Dear Alumni and Friends of the Physics Department

This is my first newsletter as the Head of the Physics Department. First off, I want to thank and acknowledge Don Candela for the selfless service and leadership he provided as Department Head for the past six years. It will be a challenge to fill his shoes in the role of head, but thankfully Don will continue to be available to provide advice for the new cadre of leadership emerging in the Physics Department.

For the many who don't know me, I'll say a few words about myself. I came to UMass in 1986, and do research in experimental nuclear physics. I've worked at the electron accelerators at MIT-Bates and Jefferson Lab, and recently started working at the accelerator in Mainz, Germany. Quite a few undergraduate students have worked in my lab before going on to graduate programs in physics and jobs in industry. My favorite teaching assignment, and the class I've done the most teaching in, is the electronics course.

For an academic department like physics, its heart is in its faculty and staff. I'm very pleased to report that Michael Ramsey-Musolf from the University of Wisconsin joined our department last fall. Michael's research area is theoretical particle physics and cosmology, probing the standard model of particle physics. Michael has established a new research center on campus, the Amherst Center for Fundamental Interactions, ACFI for short, headquartered in remodeled offices on the 4th floor of LGRT. We look forward to seeing a steady stream of graduate students, post-doctoral researchers, and workshop attendees participating in ACFI activities.

On the subject of new "brick and mortar," there is plenty of exciting news to report. The New Academic Classroom Building under construction next door to Hasbrouck will see occupancy the fall of 2014. The building will house state-of-the art team-based-learning classrooms that we will utilize for our introductory physics sequence for physics majors. Planning is very far advanced for the new Physical Science Building, PSB, which will house laboratories for the nuclear physics, gravitational physics, and hard-condensed matter groups. Ground breaking for the PSB is scheduled for summer 2015 and occupancy in the fall of 2017. At that time approximately one-half of the department's faculty will be housed in a completely renovated West Experimental Station building to be moved adjacent to PSB.

Finally, I encourage you to consider making a donation to UMass and directing your donation to the Physics Department. State support for teaching laboratories has dwindled in recent years, and it is only through the generous donations of our alumni that we have been able to maintain laboratories for our physics majors, and introduce state-of-the-art instrumentation into our Intermediate Lab and Optics courses. The Physics Department will be participating in the Alumni Weekend from 2 to 5 p.m. on Saturday, June 7. I look forward to meeting you, and discussing these exciting times for UMass Physics. Stay tuned for details from the Alumni Association.

I wish you a productive and healthy 2014.

Sincerely yours,

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WOMEN IN PHYSICS: POSITIVE STRIDES AT UMASS

Despite the progress at UMass and nationally, the picture for women in Science, Technology, Engineering, and Mathematics (STEM) continues to be rocky. A recent article in the New York Times Magazine, "Why Are There Still So Few Women in Science?" highlighted physics in particular.[2] It pointed out continuing social and institutional pressures that women in science face, and stressed that social pressures tell everyone in society that women do not do hard sciences. Some women quoted in the Times article said they were worried that doing physics would be a turn-off to potential spouses. Many women are concerned how they could reconcile the demands of graduate school, and a career in physics with their personal desire to be married and raise a family. These are all commonly cited reasons for the lack of women in physics. The article also points out subtle cues that have higher impact on female students than male students, such as a lack of enthusiasm from mostly male mentors. When women are not encouraged to go to graduate school, they figure that their mentor's silence is a judgment that they are not capable of the work. Men are far more likely to try graduate school without encouragement or high grades. It may seem that women just have lower self-esteem, but who can blame them when controlled studies show that women are judged to be less competent than men with the exactly the same qualifications.[3] Interestingly, the objectivity required for scientific research does not prevent scientists from falling into these mostly unconscious biases.

Research has shown that engaging women and minority students in research has profound and long-term effects on their retention in STEM fields. At UMass, undergraduate physics majors tackle problems from high energy to biophysics. Here, we highlight the research of two senior undergraduate physics majors: Sarah Zuraw works with Associate Professor Laura Cadonati and Amanda Tan works with Associate Professor Jennifer Ross. Sarah is working on LIGO and was attracted to this research because it connects astronomy with fundamental questions in physics. Amanda works on the biological physics of nanoscale motor proteins moving along microtubules. She says, "My favorite part of doing research is being able to connect what I learn in class to what I do in the lab. There's also no better feeling than finally getting an experiment to work, and getting good results after struggling with it for some time. The best part about doing research, though, is getting to work with other undergrads, grad students, and postdocs. Everyone has something to offer, and it's been a really great experience getting to know and learning from everyone in the lab."

Upon arriving at UMass in fall 2007, now Associate Professor, Jennifer Ross began to organize the women in the Department for lunch and teatime. Activities of the Women and Minorities in Physics Group included lunch with women speakers, discussions with alumnae from UMass Physics, and panels of professional women who used their physics degrees to work in academia, industry, and government laboratories. The Women and Minorities Group became a regular committee assignment for faculty and is currently led by Professor Lori Goldner. Through informal gatherings, Ross discovered that women graduate students wanted more opportunities to present their research in one-hour sessions. Also they were unsure of how to apply for postdoctoral research positions, and in having a general knowledge about the process of seeking a career in academia. Ross established a student-only research seminar on Friday afternoons that is now student run.

At the college level, our College of Natural Sciences (CNS) has engaged female graduate students and helped them to organize the Graduate Women in STEM (GWIS) group. This group is led by Physics graduate student Jessica McIver. In addition to enabling the graduate students to organize, CNS has also started an initiative to foster women's leadership within the college. CNS Dean Steve Goodwin's initiative is led by Psychology Professor and Associate Dean Sally Powers. The women's leadership initiative has had several sessions featuring panels of successful women within the college.

Although we have highlighted a few of the women in the department, women cannot advance their cause alone. They need male allies as advocates and mentors. Luckily, many positive and helpful men who recognize the extra struggle of women and minorities currently populate the Physics Department. Overall, the future looks brighter for women in our department thanks to efforts from both female and male department members at all levels.

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1. AIP Statistics on the Status of Women in Physics: http://www.aip.org/statistics/trends/gendertrends.html

2. http://www.nytimes.com/2013/10/06/magazine/why-are-there-still-so-few-women-in-science.html?_r=0, New York Times Magazine online, October 3, 2013.

3. Moss-Racusin et al,"Science faculty's subtle gender biases favor male students" Proceedings of the National Academy of Science, USA 2012.

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A BRIGHT FUTURE

As we go to press with this issue, the University is completing the celebration of 150 years as an institution of higher learning. We were fortunate in the early years to have had a President, William Smith Clark, with the foresight and the ability to launch us in the right direction. Now we are under the guidance of Chancellor Kumble Subbaswamy, a physicist, who, by all accounts, is off to a splendid start after a year in office. Here are some examples of positive features of our Department and positive changes that are in the offing.

• The Department of Physics has nearly 200 undergraduate majors, more than a factor of two greater than just a decade ago. Many factors contribute to this very significant growth, but the good reputation of the faculty in teaching and research is surely among them.

• The Departments of Physics and of Chemistry will benefit from a Physical Sciences Building scheduled for completion in 2017.

• There are strong, well-funded faculty research programs in both experiment and theory.

• We are fortunate to be in a Five College Community, giving the opportunity for significant collaborations with our Five College colleagues, several who hold adjunct appointments in our Department.

• The Commonwealth Honors College is now housed in new first-rate quarters off Governor's Way. Physics is well represented.

• The Amherst Center for Fundamental Interactions has been established in our Department. Its mission is to advance research at the interface of the energy, intensity, and cosmic frontiers.

• Our outreach programs have been extended to the general public through the founding of two Science Cafes in the Amherst-Hadley vicinity.

• Our physics alumni hold major positions in academia, industry, and government.

• There is a greater participation of women in our Department at all levels: undergraduate students, graduate students, and faculty.

• Undergraduate physics majors are being provided with research opportunities as called for by the American Physical Society. Our advanced laboratory course provides an excellent start in this direction.

• Teaching innovations are being fostered by regularly scheduled workshops whose objective is to improve faculty teaching.

These developments, and the commitment of the Commonwealth of Massachusetts to our Department, are making us competitive with outstanding physics departments throughout the world. The future indeed looks bright!

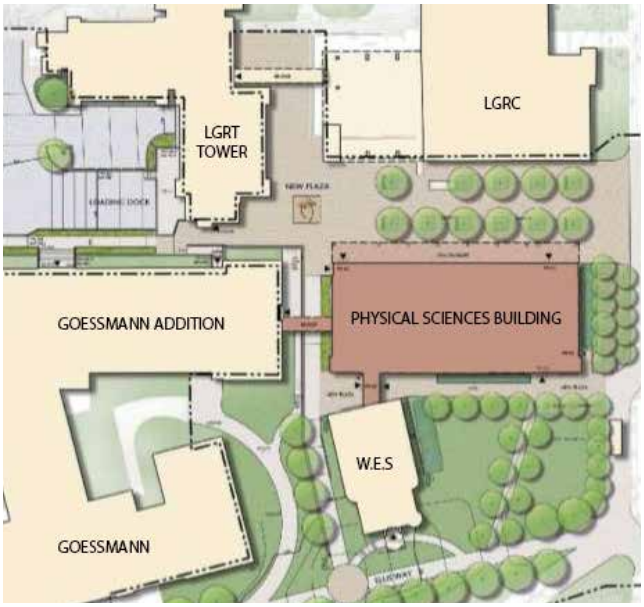
Fall 2013

Winter 2014

The New Academic Classroom Building constructed beside Hasbrouck will open for the 2014 fall semester. It has offices for faculty in other departments, and classrooms designed for group work called Team Based Learning (TBL), with large round tables and chairs instead of the usual classroom desks. A fuller description of TBL was given on page 10 of our Spring 2012 Newsletter.

THE NEW PHYSICAL SCIENCES BUILDING

Planning is well underway for the new Physical Sciences Building (PSB) that will house experimental laboratories for the Physics and Chemistry Departments as well as a new state-of-the-art nanofabrication facility. The PSB will be located between Goessmann Chemistry Laboratory and North Pleasant Street, which places it between current Physics offices and labs in the Hasbrouck Building and the Lederle Graduate Research Center Towers. The PSB is projected to cost approximately $112 million and is scheduled for completion in fall 2017.



The PSB will house the research groups of eleven Physics faculty members in Nuclear, Gravitational, and Hard Condensed Matter experiment, including labs as well as offices for faculty, students, and postdocs, and meeting and support space. The eleven groups will include all of our current faculty in these areas as well as abundant space for three future hires.

An interesting feature of the PSB complex will be the incorporation of a renovated West Experiment Station (WES) for faculty and student offices. The WES is a beautiful brick building in the Queen Anne style, complete with tower and turret and many chimneys, built in 1885 as an agricultural testing laboratory. The WES will be moved a short distance onto a new foundation and basement level and connected by a two-level bridge to the main PSB, making it universally accessible and giving convenient access to the physics labs on the bottom two floors of the PSB.

The laboratory spaces in the PSB will have many special features geared toward the planned research. The top two floors will house Chemistry labs, enabling synthetic chemistry research to move out of outdated space in Lederle, while the lower floors of the PSB will be dedicated to Physics labs and the nanofabrication facility. Some of the Physics labs will be located entirely underground, resulting in extremely low vibration and electromagnetic interference levels. Many of the labs will have very high ceilings, accommodating apparatus up to 25 feet tall. These "high bay" spaces are needed both by nuclear and particle experimentalists for detector assembly, and by condensed-matter experimentalists for low-temperature apparatus and superconducting magnets. The nanofabrication facility or "clean room" will provide an remarkably clean and dust-free home for instruments to create nano-scale electronic and physical devices for basic science and next-generation information technology.

In addition to creating many new research opportunities for students and faculty, the PSB should be a big step toward bringing our somewhat spread out Physics Department closer together. Nuclear and condensed-matter experimentalists, at present in separate enclaves in Lederle and Hasbrouck, will have laboratories and offices literally next door to each other. Office space for research students and postdocs will be a few steps away from the faculty offices. Finally, by consolidating eleven faculty offices on the first floor we will surely draw many undergrads not yet involved in research into an exciting new research facility.

THE UNDERGRADUATE COMMONWEALTH HONORS COLLEGE

This part of the UMass Amherst baccalaureate program enriches the undergraduate experience. High entrance standards were set for the 3000 students in the program. About half live in the six Commonwealth Honors College (CHC) residence halls near the Boyden Gymnasium, and half live elsewhere.

Once admitted, the student is assigned an advisor committed to the program. The CHC Curriculum offers a progressive series of courses designed for critical analysis, that fulfill the General Education requirements, and are restricted to 25 students per course. The intent is to have student engagement with faculty and peers so as to foster critical thinking through in-depth readings, oral presentations, and group projects. Students can select from a wide range of topics taught by faculty from many different departments, and embark on undergraduate research. Each major has different tracks, for example, in physics there are three baccalaureate tracks: BS Professional Track, BS Applied Track, and BA General Track. The honors curriculum has advanced courses in

appropriate tracks. Approximately one-third of the undergraduate physics majors (61 out of 191) have been admitted into the CHC compared to an average of about one-seventh of other majors. Most students pursue the honors track in their major. Upper-level honors coursework concludes with the Capstone Experience summarizing a particular project.

Within the CHC, a scholarship advising office helps students apply for national and international scholarships and fellowships, such as the Rhodes, Marshall, Fulbright, Goldwater, Truman, and Gates-Cambridge. This office also helps students apply for postgraduate study and travel awards.

Negative criticism has been voiced that an organization such as CHC that uses public funds is elitist, and its activities should be relegated to our "private colleges." But the private colleges are not truly private, as they must comply with federal and Commonwealth regulations to be eligible to receive funds. On the other hand, the public institutions are not truly public, as independent funds are required beyond those provided by taxpayers. For example, the new Integrated Science Building was funded privately, and the science community has partnerships with industry to exchange ideas, provide student internships, and furnish the cutting-edge laboratory equipment. What constitutes public versus private higher education is now a blended mix. UMass Amherst remains competitive in undergraduate education by offering intensive education through CHC.

At the initiation of the Sesquicentennial Celebration on April 26 & 27, 2013, Dean Steve Goodwin, College of Natural Sciences, hosted a science alumni reception in the atrium of the Integrated Science Building on April 27th and welcomed one of its benefactors, Robert Mahoney '70, who spoke on the meaning of being a part of the massive project to plan, construct, and shepherd this building complex to completion. Brothers Robert '70, Richard '55, and William '55 were all chemistry majors. Margaret McCarthy G'77 represented the Physics Newsletter Committee.

Photo credit: Jim Ricci

NEW MUON *g*–2 EXPERIMENT

Last summer, a barge traveled down the Atlantic coast and up the Mississippi carrying a very unusual load - a 50-foot in diameter, 17-ton ring-shaped superconducting electromagnet. This was part of a 3200-mile odyssey for the magnet, built at Brookhaven National Laboratory in Upton, New York in the 1990s, on its way to a new home at Fermilab, just west of Chicago. By the time the magnet reached Fermilab in July 2013, hundreds of curious onlookers were lining the streets to see the giant UFO-like ring crawl by on a custom built trailer.

Magnet on the barge passing St. Louis. (Credit Fermilab)

The magnet is a key part of an experiment called "muon *g*–2", which ran at Brookhaven from 1997 to 2001. The magnet is used to trap muons, fundamental particles similar to electrons, but 206 times more massive, and which only live for a few microseconds before decaying into an electron and 2 neutrinos. Why trap muons in a magnetic storage ring? Because these short-lived muons are sensitive to new fundamental particles whose existence would revolutionize modern particle physics.

This sensitivity comes from examining the magnetic properties of the muon. Like electrons, muons have a magnetic moment, and behave in some respects like a little bar magnet or compass needle. The strength of this magnet is characterized by a number *g*. In 1927, future Nobel Laureate Paul Dirac predicted that g should be identically equal to 2 for a bare fundamental particle.

To study muons, we trap them in a circular magnetic storage ring in which they race around like cars around a track, but very close to the speed of light.

When the muons first enter the ring, their internal compass-needle points in the direction the muons are traveling. As the muons go around the storage ring magnet, their internal compass needles rotate as well, and

Magnet coils with support structure after removal from Brookhaven. (Credit Brookhaven)

continue to point in the direction the muons are traveling, almost, but not exactly. In fact, after one turn of the muon around the ring, the internal compass needle has turned an extra 12 degrees. We call this extra amount "*g*–2" because if g were identically equal to two, the compass needle would rotate at the exactly the frequency that the muon travels around the ring, and it would always point exactly in the direction the muon was going. Why should g be different from two? Was Dirac wrong? No. Dirac's theory described a bare particle, but quantum mechanics tells us that particles are never bare, even in vacuum. They are always "dressed" by ghostly particles that appear and disappear out of the vacuum. These virtual particles affect the interactions of the muon with the magnetic field and effectively make *g* different from 2. The amount by which g deviates from 2 can be predicted precisely as long as we include the effects of all possible types of particles. This is where it gets interesting. We can predict *g*–2 by including the influence of all the particles we know about

Magnet makes its way through a tollway in Illinois. Only 6" of clearance on either side. (Credit Fermilab)

(even the famous Higgs boson makes a tiny contribution to *g*–2). However, the measured value of *g*–2 includes the influence not only of all the particles we know about, but also the ones that exist but are undiscovered! The reason for the great interest in the muon *g*–2 value: "Is there is difference between the prediction and value measured at Brookhaven?" This could indicate the existence of an entirely new class of fundamental particles.

As an aside, in an experiment at Harvard, G. Gabrielse trapped a single electron for months and measured g–2 of the electron. In fact g of the electron is the most precisely measured quantity in all of physics. Still, we prefer to do the g–2 experiment on muons because if there are new ghostly particles, they will make a change to g–2 of the muon which is about 40,000 times larger and easier to detect than the change the same new particle would make to g–2 of the electron. Mostly this occurs because the muon is more massive than the electron and the effects typically grow with the mass squared. This makes muons more sensitive to new physics in this particular case.

The muon g–2 magnet outside Wilson Hall at Fermilab after arrival in late July 2013. (Credit Fermilab)

Because the difference between the prediction and the measurement at Brookhaven is inconclusive, the muon g–2 experiment will be redone with 4 times greater precision at Fermilab. At Fermilab it will be possible to inject more muons into the ring more frequently compared to Brookhaven, yielding greater statistical precision. In addition, the new experimental hall built to house the magnet has a more stable floor and much better temperature stability, both required to improve the precision. Many other improvements are planned to reduce the uncertainty on g–2 to 140 parts-per-billion.

UMass has significant ties to both the old and the new experiments. Associate Professor Dave Kawall worked as a postdoc on the Brookhaven experiment for the late Vernon Hughes of Yale University. Vernon was the original spokesperson and driving force behind the Brookhaven g–2 experiment, and is well known for his many lasting contributions to physics. Kawall now works as a leader of the team responsible for measuring the storage ring magnetic field with a precision of 70 parts per billion. Magnet reassembly at Fermilab will take about a year. First data are expected around 2016. Look for updates and our results in a future newsletter.

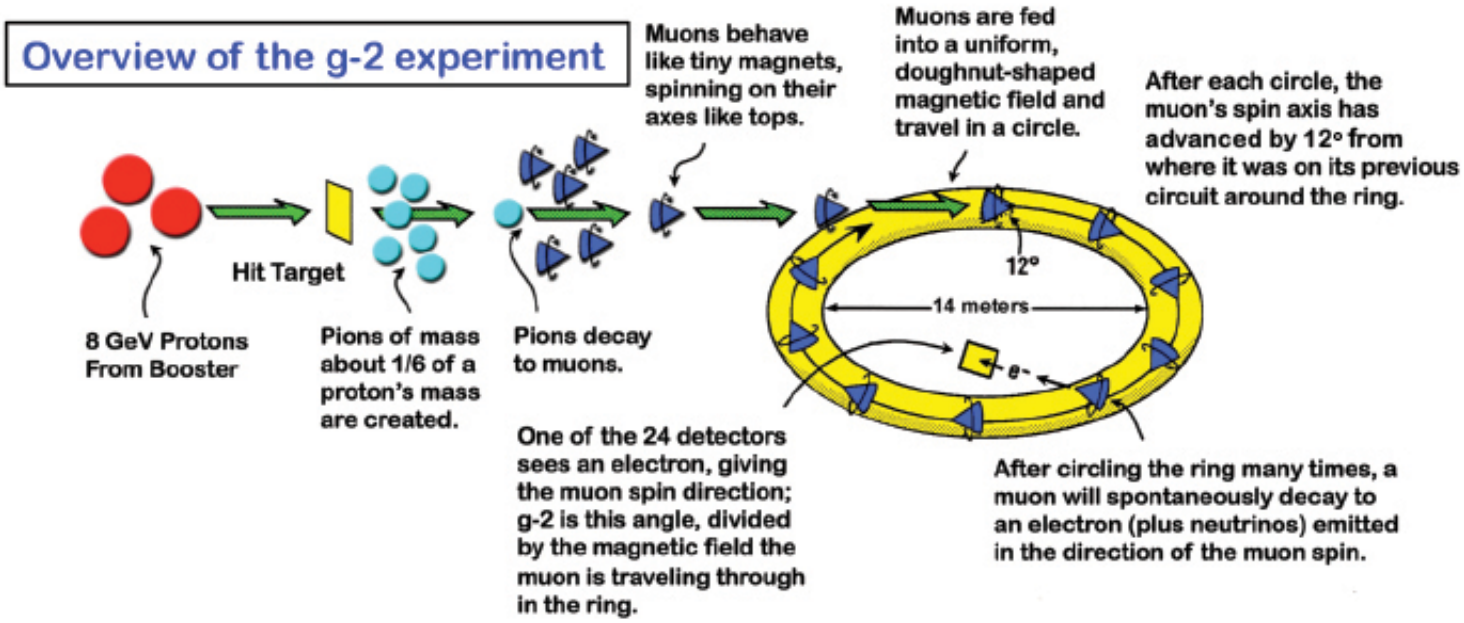


Illustration of the muon g–2 experimental technique. (Figure adapted from Brookhaven National Laboratories)

AMHERST CENTER FOR FUNDAMENTAL INTERACTIONS

With the arrival of Prof. Michael Ramsey-Musolf, the Physics Department has launched the Amherst Center for Fundamental Interactions (ACFI) with Ramsey-Musolf as its director. The ACFI mission is to advance theoretical and experimental research at the interface of "three frontiers" of fundamental physics: the High Energy frontier, the high sensitivity or "Intensity" frontier, and the Cosmic frontier. The Center seeks to become an internationally recognized hub for this physics at the interface, providing an environment where UMass, national, and international scientists will draw connections between studies at each of the three frontiers, develop new directions and new opportunities for synergies between them, and identify priorities for the future.

A five-year seed-funding commitment from the University will enable a number of activities designed to further the ACFI mission: a program of targeted topical workshops; an enhanced seminar series; support for visiting students and researchers; and innovative "in-house" research. The workshops will each bring 10-15 researchers to campus and, together with UMass physicists, will focus on specific forefront problems for approximately three days each. In spring 2014, the workshops cover the three frontiers: "Hadronic Probes of Fundamental Symmetries" (Intensity frontier); "Lambda and Quasi-Lambda" (Cosmic frontier); and "Unlocking the Higgs Portal" (Energy frontier).

The visiting scholar program will enable training and mentoring of PhD students and post-docs from around the world, with the first student scholars from Australia and China arriving in 2013-2014. Looking further to the future, in spring 2015 the ACFI will host the International Workshop on Baryon and Lepton Number Violation, a meeting that recently has drawn roughly 100 physicist participants.

While the ACFI ultimately hopes to secure significant external funding through peer-reviewed competitions, in the end it is about the scientific quest. ACFI research, workshops, and visitor programs address important, open questions such as: Why is there more matter than antimatter in the Universe? What additional forces beyond the known interactions were active during the first moments after the Big Bang? How are the building blocks of the present Universe (protons and neutrons) assembled from more fundamental degrees of freedom?

For details about this scientific quest and the ACFI activities designed to address them, please refer to the website: www. physics.umass.edu/acfi/

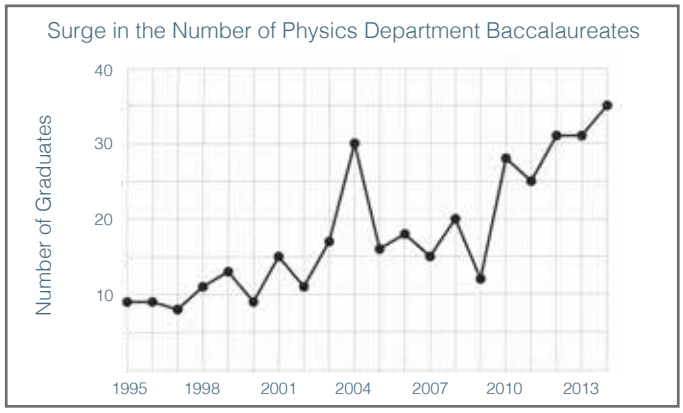
Participants in the ACFI-Jefferson Lab workshop on Hadronic Probes of Fundamental Symmetries, the inaugural workshop in the ACFI workshop series, held March 6-8, 2014, at UMass Amherst.

teaching

SURGE IN PHYSICS MAJORS

The number of Bachelor's Degrees conferred each year by the Physics Department for students who have majored in physics has risen from about 10 to about 30 over the 20- year period from 1995 through 2014, while the total UMass undergraduate pool remained approximately the same over the same period. The percentage change in physics majors enrolled here is greater than the national rise. There was also an improvement of student quality that may have resulted from an increase in the number of high school graduates that peaked in 2011.

At a December 2013 meeting for freshmen in the College of Natural Sciences (CNS), enquiries were made as to why 52 responding freshmen decided to come to UMass and major in physics. Overwhelmingly the students were from Massachusetts. The biggest influence on their decision to select UMass came from their parents and/ or their guidance counselors. Low tuition fees were an important factor. In guiding the students toward physics as a course of study, the Department website, the CNS website, and the spring and fall student orientations were influential. The solid reputation of the Physics Department and excellent science resources were motivating factors in the choice of the physics major. Other influencing factors were the Department's support of summer research, the Society of Physics Students, and student conferences, thus keeping the student on track toward a career in physics. (These activities are supported by your donations to our Department.) Typically the students were also accepted at other highly rated undergraduate institutions.



In rating the UMass experience from September to December for academic rigor in CNS classes, the first year students' response drifted between neutral and somewhat rigorous. No one seemed overwhelmed by the course work so as to migrate to another major at this point. The personal attention component in CNS was somewhere around neutral with no complaints.

The students were asked what two things have gone well since their arrival on campus. For that age cohort, the dining services and good friends were often mentioned. Positive statements about quality course work were interspersed. Contrast these with things that did not go well: getting organized, unpleasant roommates, and the new on-line assignments. These are typical normal adjustment points for any first-year student, not specific to physics majors.

There is a relationship to the Commonwealth College (see article) as many of the physics majors are qualified and choose to reside there. Some of the students who are qualified for residence in Commonwealth College choose to live in a northeastern location with students other than physics science majors. Not only is there a draw with university options, but there is retention through a sustained, supporting contact with the undergraduates.

PHYSICS TEACHER WORKSHOPS

For the past few years the Department has been holding Physics Teacher Workshops prompted by several junior faculty who asked about mentoring of their teaching. In response Guy Blaylock and Heath Hatch started holding meetings every few weeks to discuss and strategize the challenges and successes they were having with their teaching. After several years of these informal meetings, Jennifer Ross acquired a Mellon Mentoring grant from the UMass Center for Teaching to provide for the cost of the lunch meetings, and to bring in people from other universities to share with us their own experiences. These twice a month teaching workshops were so rewarding, that many of the senior faculty asked if they could also join in the discussions. As a result of this interest we opened the workshops to the entire faculty. After the Mellon grant expired, the Department has continued to financially support these workshops. There have been many lively discussions on topics such as "flipped" classrooms,* teaching large lectures, new grading and testing techniques, and even a discussions on using positive psychology in teaching. Our new faculty, and even our most successful senior faculty members, have benefited from the workshops. The Physics Teacher Workshops demonstrate that the Physics Department recognizes the central importance of excellence in teaching.

**The teaching methodology of "flipped" classroom or "reverse teaching," is a form of learning by which students learn new content before class by guided critical learning. The lecture component is viewed through video and online assignments at home with no traditional lecturing in the classroom. Assignments are completed through problem solving in class under the watch of the instructor. This putative procedure is considered guided critical thinking by offering a more personalized guidance and interaction with students.*

INTERMEDIATE PHYSICS LABORATORY (ILab): PHYSICS 440

For many of us who can look back through the years, high quality advanced laboratories in physics and astronomy were for graduate students. Now the American Physical Society recognizes the importance of quality laboratories for undergraduates, and calls upon the nation's colleges and universities to provide undergraduate physics and astronomy majors with access to significant research experiences. Here is a draft policy statement from the APS: "Research experiences provide students with skills in problem definition, project design, open-ended problem solving, use of modern instruments and techniques, data collection and analysis, analytical and computational modeling, and communication of evidence-based technical arguments. These skills are of great value to students as they go on to engage in future scientific enterprises and positively impact the overall economic and social well-being of the nation. Participation in research has been shown to increase retention in STEM degree programs, support students' decisions to pursue STEM careers, and enables students to more effectively transition from the classroom to professional practice."

At UMass Amherst, in addition to providing summer research experience for undergraduates (see page 25 of the Spring 2013 Physics Newsletter), we have a special undergraduate laboratory course, Physics 440, developed over many years, which abundantly meets the APS criteria. Recent instructors include Professors Don Candela, Lori Goldner, David Kawall, and Jenny Ross. In addition to having access to first-rate modern equipment, students who take this course should be prepared to step into original research problems with confidence.

Currently the course has 16 experiments including:

- High-T_c superconductivity by four-wire resistance and by magnetic susceptibility
- Torsion-balance measurement of the universal gravitational constant G
- Deterministic chaos in an electrical circuit
- Single bubble sonoluminescence and acoustic resonance
- Quantum entanglement of photons
- Building a microscope with CCD camera readout + extensions

More experiments are being planned, especially in nuclear and particle physics. Students work in groups of two to four in two three-hour sessions each week and are expected to complete four experiments during the semester.

For each experiment, the timeline is the same:

Day 1: Students get acquainted with the experimental literature, equipment, and perhaps try to understand and even assemble the equipment for some "preliminary data."

Day 2: One student from the group does an initial 10-minute presentation describing the goal of the experiment, how the equipment is set-up and used, the theory behind the experiment, and what data the group thinks it will be able to obtain.

Days 3-5: Students perform the experiment. They take data, analyze data, and assemble a final presentation.

Day 6: A second student presents a 20-minute final presentation on the results of the work, and must still go through motivation, theory, and data, as well as the uncertainty of the measurements.

One week later the third student of the group writes a manuscript.

The students switch groups for each experiment and switch roles within the group, so that after three experiments, every student has performed an initial presentation, a final presentation, and written a manuscript.

This year, the final experiment of the semester required a 1000-word blog entry as the initial presentation, and a poster presentation for the final presentation. The first "draft" was a first submission to the "editor" (the instructor) of a journal. The students had to send the instructor a complete manuscript that they all had edited. The students also had to write a cover letter, as you would to a journal, describing the experiments and requesting it be sent for review.

Then other students , not from their lab group, serve as peer reviewers. The instructor and the teaching assistant also write reviews. The students not only had to alter the manuscript based on the reviews, they also had to write a response to reviewers to address each concern of the reviews and where they corrected the manuscript. The response to reviewers was graded, as well as the final manuscript.

Working in a research group is like being in a research family, and ILab has that flavor.

iCONS PROGRAM

How can students learn to use their knowledge and skills to solve the complex, real-world problems currently faced by society? Who, if not the next generation of scientists and engineers, will have the grit to tackle the world's unsolved problems? The Integrated Concentration in Science (iCons) program at the University of Massachusetts (www.cns.umass.edu/icons-program/), now in its fourth year, provides undergraduate students a problems-based education, focusing on compelling issues such as energy, water, climate change, and biomedicine. iCons is not a subject major, but rather a concentration program built on top of a major—an additional set of interdisciplinary, context-rich courses integrating students from fields across the sciences, engineering, and public health. Students in the program take an iCons course during the spring semester of the first, second, and third years and complete a yearlong independent research project during their fourth year. Almost immediately, students get their hands dirty (sometimes quite literally) working to solve messy challenges of the real world. Working in interdisciplinary teams, the students combine skills and knowledge learned from their respective major degree courses with research and problem-solving strategies learned in iCons.

Although assessment of the effectiveness of iCons will be collected for several years to come, preliminary data reveal that the impact on students is quite astounding. Austin Barnes, an undergraduate physics major now in his fourth year of the renewable energy track of the iCons program, remarks: "The problems we face in the iCons program are multi-faceted and require the knowledge, skill set, and thinking of scientists from many disciplines. When we are first faced with a problem, we start from a broad point of view and narrow in on different aspects of the problem. On the other hand, in physics courses, typically, problems are solved by starting from first principles, and building up new theories. Depending on the complexity of the problem, both approaches are necessary."

The iCons program, complemented by the degree in a major field, strives to meet the call for a more comprehensive, hands-on form of education. Notably, the program is scaffolded (see next paragraph) so that students are in the driver's seat of their own education. The iCons learning activities are driven largely by the students' own interests, with faculty guiding this learning from an overarching four-year framework. To underscore the importance of interdisciplinary teamwork, the iCons program is managed and taught by faculty from a broad range of departments from the College of Natural Sciences. To date, Physics Department Professors Anthony Dinsmore, Courtney Lannert, and Mark Tuominen have all contributed to the program through teaching, advising, admissions, program steering, and fund raising.

In the first-year iCons course, "Global Problems, Scientific Solutions," students use a case study approach to develop problem-solving skills, and then focus on unsolved problems of global significance. Students learn a strategy that follows a series of steps (scaffold): inception, engagement, research, creation, and reflection. After identifying and thoroughly researching a problem, students try to find ways in which science and technology could provide a pathway toward a solution. Students find that social and economic dimensions of a real-world problem are integral factors in the effectiveness of a potential scientific solution. They also learn the educational power of reflection—looking back on a project to evaluate what worked and what could be improved, and also in thinking about what they learned. iCons students find themselves applying these techniques in other classes and other situations. The iCons program strives to cultivate a student's communication, leadership, and teamwork skills. Barnes comments, "iCons provided me with skills in teamwork and collaboration within a diverse group of students of different science backgrounds. In order to collaborate effectively, communicating ideas and concepts clearly and 'jargon-free' was essential."

In the second and third year of iCons, the students have moved into specific topical tracks—currently renewable energy or biomedicine—and tackle a number of hands-on real-world challenges using their existing strengths while developing new skills and knowledge. Barnes continues, "Part of what the program tries to get at is implementing creativity and logical thinking simultaneously. In traditional science lectures and even labs, the type of thinking is exclusively logical. In iCons we are designing unique experiments (requiring creativity and logic) to find solutions to problems in which the answers are still unknown. This type of learning I think is the most fulfilling because it requires creativity and other important skills to be a better scientist, but also an overall better human being."

Mark Tuominen teaches the third-year iCons Renewable Energy Discovery Lab course. He remarks, "I feel that iCons students really hit their stride in the third year. At this point, they have two years of experience under their belts--in synthesizing solutions to unsolved real-world problems and in working effectively in interdisciplinary teams. In the third-year Energy Lab course, the students assemble into effective self-managed teams: they dream up, design, and build amazing research experiments." This includes projects such as the development of "artificial leaf" solid-state materials for making hydrogen fuel from water using sunlight, a study to grow algae biofuel using nutrients from wastewater, an investigation to harvest useable energy from waste heat or vibration, and many other examples. The iCons program cultivates a mindset in students to be curious, to be resourceful, and to simply go ahead and try things. Tuominen continues, "The iCons students are innovative and in charge. If there is one key lesson I've learned from the iCons program, it's this: It's essential to get students involved in real-world creative work right away, in their freshman year. That way, by the time they are seniors, they are undaunted and unstoppable."

Hear the iCons students themselves describe the program:

www.cns.umass.edu/icons-program/event-galleries/2013-12-31/the-icons-experience-video

graduate students, old and new

GRADUATED IN 1993

Gustavo Burdman

Qi-Zhong Cao

Gary Kleiman

Kyong Sei Lee

Sandor Molnar

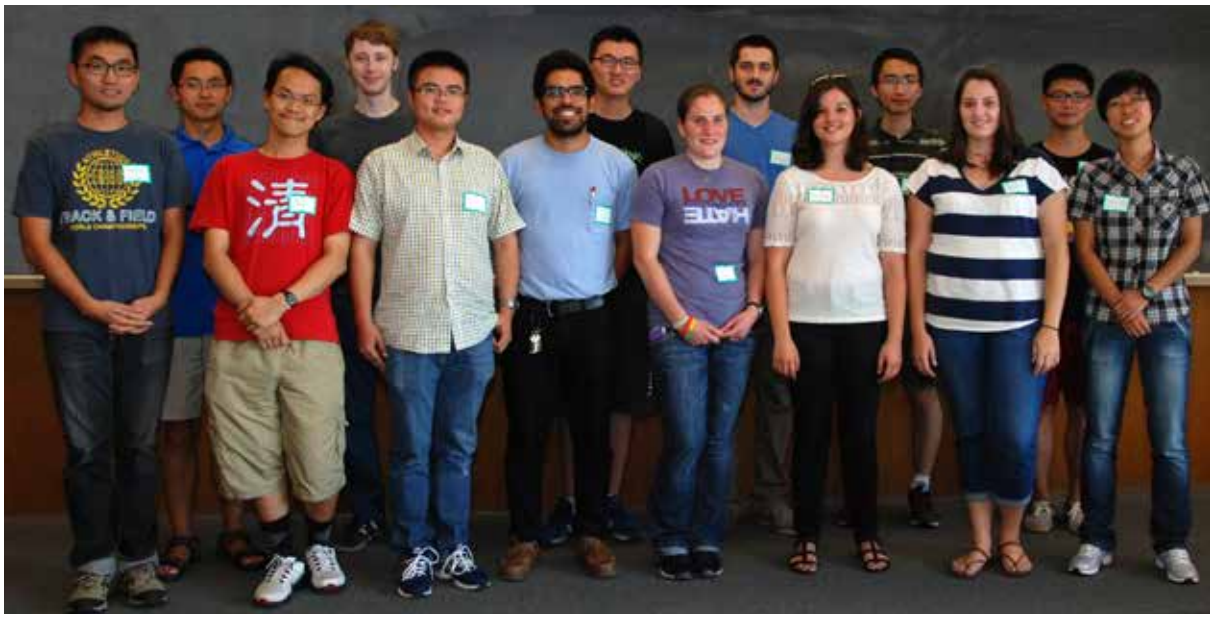
Erik Nelson

Donald Sprague

Jorge Uribe

1993 MS and PhD graduates not pictured: Glenn Driscoll, Robert Farrell, Peter Kleinschmidt, Kyriacos Markionas, Elizabeth Praton, Xiaoqun Zou

ENTERED IN 2013



Left to Right: Shao-Yu Chen, Huaike Guo, Chien Yeah Seng, Henry Byrd, Peijian Wang, James Sainz, Zhou Xu, Margaret Lutz, Zachary Meadows, Alissa Monte, Haolin Li, Megan Talley, Buqin Wang, Wanting Xie
Not shown: Christopher Olson

SOCIETY OF PHYSICS STUDENTS

The Society of Physics Students (SPS) strives to add a sense of community for undergraduates who are interested in physics. There are approximately 60 voting members from departments including, but not limited to physics, astronomy, and engineering. The SPS builds on opportunities for academic and professional development.

The most popular meetings deal with topics in undergraduate research: what are current students actively doing, and how can new students become involved? The SPS encourages its members to consider research with UMass professors, and to explore opportunities at other universities through REUs, or Research Experiences for Undergraduates. The REU program is funded by the National Science Foundation to sponsor summer internships at universities across the country and abroad. For some meetings, the SPS hosts professionals from technical fields for "Choc Talks," where we eat chocolate and ask questions. Speakers often share their research and other experiences in achieving their goals. This year, we had talks by Chancellor Subbaswamy, who is a physicist, and by Professor Maria Kilfoil, a biophysicist. We also invite people from outside UMass to speak about their work in engineering and other fields, so as to inspire interest in both academia and industry.

The SPS also provides weekly homework help sessions primarily for underclassmen. Organized by SPS officers Zak Fox and John Karlen, this gives freshmen and sophomores the chance to seek physics help from peers who have excelled in the same courses in the past.

Left to Right: Jasmine Abdollahi, Josh Flieder, Fred Coburn, Chris Bert, Adam Zec, Kirsten Randle, Arthur Kurlej, Boris Stanchev, Gary Forster, Amy Vinciguerra, Dana Brown, Julie Flowers

Undergraduate physics students from UMass and elsewhere have opportunities to attend scientific conferences, a phenomenal networking experience, and a way for UMass to be represented among other universities. The SPS advertises these conferences and organizes trips to them. In January of 2014, four students traveled to Stony Brook University for the APS Conference for Undergraduate Women in Physics. Additionally the SPS events coordinator, Adam Zec, has arranged for club members to present research at the Northeast Undergraduate Research and Development Symposium (NURDS). This year, the UMass chapter of the Society of Physics Students will host the SPS Zone 1 meeting of New England SPS chapters. President Kirsten Randle and Treasurer Arthur Kurlej are playing huge roles in balancing the schedule and budget for this exciting event.

The SPS extends helping hands in all directions, and even enjoys the outdoors together when weather permits. Secretary Jasmine Abdollahi upkeeps the blog with announcements, photos, a roster, the club calendar, and other resources at blogs. umass.edu/umasssps.

Jasmine Abdollahi, Secretary

STEM'S "LITTLE WOW" PROGRAM

Improving Science, Technology, Engineering, and Mathematics (STEM)education at all levels, from elementary through university, is the ambitious goal of the UMass STEM Education Institute directed by Emeritus Professor Morton Sternheim. Their newest program, Little Wow, is a minigrant program for schools and organizations that serve students in the three western counties of Massachusetts. It provides students with meaningful STEM experiences that might otherwise not be available without funding assistance. Support up to $1,000 per request is offered for STEM events or field trips, preferably those with a high student to dollar ratio.

Examples of suitable programs include:

- Visits of K12 students to colleges, businesses, military bases, museums, and other places with engaging STEM activities.
- Visits of college student groups to classrooms to offer hands-on STEM activities and to serve as young role models.
- Attendance of school groups at events that feature hands-on STEM activities and career information, and at career fairs and similar events.

Imaginative ideas for stimulating interest in STEM fields are reflected in the wide range of proposals that have been funded by the Little Wow program. Approximately 750 students were served by two rounds totaling 18 awards over the fall and spring of 2012-2013. An additional 800 students will participate in the third cycle of minigrants awarded this past fall. Matching funds provide a significant fraction of the awards.

Holyoke Catholic High School students participate in a forest and stream ecology study at Noble View Outdoor Center

Here are some examples of events that have been funded:

- Scholarships for Holyoke High School Students to attend UMass Engineering and Computing Day.
- Four visits by Springfield students to the Springfield Art Museum for investigations as part of "the Science of Art" Program.
- 82 High School Juniors came to UMass to learn about Nuclear Energy.
- A butterfly exploration program at Magic Wings in Deerfield by elementary after school participants.
- 28 High School Students from Pioneer Valley, Franklin Tech and Turners Falls attend a Construction Career Day and the AMSD Materials Experience at WPI.
- Biology student field trip to Boston Aquarium and Whale Watch.
- Participation in a forest and stream ecology study at Noble View Outdoor Center for 70 students.
- 160 Students from Springfield high schools participated in an all day Engineering and Chemistry immersion offered through Baystate Medical Center and UMass, including a campus tour and a career guidance session.
- Bus costs for three schools attending the fall 2013 session of ***Science Quest at UMass***.

Student feedback was enthusiastic:

"This event gave me a new perspective of health care; it doesn't only involve one subject."

"It motivated me a lot because I got to hear from college students about their experience here in college."

"This really inspired me to aim to go to a great school like UMass and get an amazing education – and be successful."

SCIENCE CAFES

A 10-year-old girl walks into a bar. She sits next to a particle physicist and asks, "So if the universe is expanding, does the Higgs field also expand to fill it up?"

Don't hold your breath for the punch line. There isn't one. This oft told tale actually happened at a science café in Amherst.

Science cafes are a kind of grassroots science outreach that attempts to explain scientific and technical topics to the general public, including children, in the informal atmosphere of a coffee shop, avoiding the sometimes-stodgy academic scene.

There are two science cafes near UMass Amherst: One is the SciTech Café that meets at the Amherst Brewing Company just south of campus at 10 University Drive, and the other is the OEB (Organismic and Evolutionary Biology) Café that meets at the Esselon Café at 99 Russell Street, Route 9, in Hadley. The National Science Foundation supports the SciTech café through various grants, and the Massachusetts Academy of Sciences and the UMass Natural History Collections support the OEB Café.

At the December monthly meeting of the SciTech Café, chicken wings and pizza slices were served free of charge, but other foods could be purchased if you had a seat at a table. The audience of roughly 170 included people of all ages and occupations, but with a common curiosity about the science to be discussed. There were high school teachers, retired college faculty, girl scouts, local physicians, young college faculty, and whole families. Dr. John Brady of the Smith College Department of Geosciences gave the presentation: "Reading the Earth Beneath our Feet," that lasted somewhat more than an hour. Questions were asked throughout, including very relevant ones from some of the children. The informal atmosphere really brought science to the public in a fun-filled and very approachable way. Other presentations at the SciTech Café have included Black Holes, The Higgs Boson, Surface Tension, Seeing the Nano Scale, and Bits and Bytes: the Future of Data Storage. At the OEB café, topics have included Climate Change, the Sense of Smell, and The Mechanics of Jumping Frogs. If you are in the vicinity, you might enjoy stopping in for a free science café presentation.

Kathy Aidala, Associate Professor of Physics at Mt. Holyoke College and an Adjunct Associate Professor in our Department organized the SciTech Café, and Sarah Goodwin, a graduate student in biology organized the OEB Café. Kathy also recently gave a very well attended presentation for the Tuesday STEM seminar series entitled, "Why Aren't More Women in Science?"

student awards

KELLY MALONE WINS PRESTIGIOUS UNDERGRADUATE AWARD

Senior Kelly Malone is one of four 2013 "Rising Researchers," a new campus-wide program to honor students whose achievements exemplify the quality of research, scholarship, and creative activity conducted by UMass Amherst undergraduates. Kelly, a physics and astronomy major, has worked on the enriched xenon observatory (EXO) experiment with Prof. Andrea Pocar since her sophomore year. Her Capstone project focussed on programming the computer control system of a radon abatement system for the EXO-200 experiment in New Mexico.

MORGAN OPIE RECEIVES PRESTIGIOUS SCHOLARSHIP

Senior Morgan Opie, a physics minor and math major, was awarded one of 14 scholarships offered by the Winston Churchill Foundation for outstanding American students to pursue graduate studies at Cambridge University in the UK.

Opie was also one of four fall 2013 recipients of the UMass Rising Researcher awards, and she was runner-up for the Alice T. Schafer Prize, a national prize for excellence in mathematics by an undergraduate woman.

BEN GAMARI AWARDED ICB3 OPEN SOURCE SOFTWARE PRIZE

Graduate Student, Ben Gamari, was awarded the Open Source Software Prize from the Institute for Computational Biology, Biostatistics, and Bioinformatics (ICB3) for his work on open-source hardware and software for photon timing and analysis.

JESS MCIVER AWARDED A DISSERTATION RESEARCH GRANT

Graduate student Jessica McIver has been awarded a Graduate School Dissertation Research Grant (from the UMass Graduate School) for her thesis work on the LIGO project. The award sponsored an extended visit to the LIGO Laboratory in Louisiana in January 2014.

faculty awards

TENURE FOR SANTANGELO

Christian Santangelo was awarded tenure and promoted to associate professor. He does research in several areas of theoretical soft matter physics with an emphasis on the interplay of geometry and material properties. His research includes the theory of origami folding that may have important applications in the self-assembly of materials. Congratulations to Chris!

TENURE FOR ROSS

Jennifer Ross was awarded tenure and promoted to associate professor. She carries out research in experimental biological physics using advanced microscopy techniques to study microtubules, which are the skeleton of cells, and the dynamics of motor proteins that travel along microtubules and constitute the transportation system in cells. Keep up the good work, Jenny!

TENURE FOR DAVIDOVITCH

Benny Davidovitch was awarded tenure and promoted to associate professor. He does research in soft matter physics with an emphasis on pattern formation. Using methods of "extreme mechanics," he is working on how thin sheets develop complex morphologies when nonlinear effects become important. Our hardiest congratulations to Benny!

PROMOTION FOR DINSMORE

Anthony Dinsmore was promoted to full professor. He is a soft matter experimentalist. He is known for his work on colloidal systems and solid particles in membranes. The latter topic is crucial to understanding proteins in cell membranes. Tony also serves as the undergraduate program director. Our best wishes, Tony!

PROMOTION FOR DALLAPICCOLA

Carlo Dallapiccola was promoted to full professor. He works on the ATLAS experiment at the CERN Large Hadron Collider and is part of the team that discovered the Higgs boson. His work includes the search for the production of mini-black holes in proton-proton collisions, which are predicted in some string theories. Carlo also serves as graduate program director. Congratulations, Carlo!

ROSS WINS NSF INSPIRE GRANT

Jennifer Ross won a prestigious four-year, $800,000 INSPIRE award from the National Science Foundation to uncover and establish the laws for the fundamental workings of cells, which form the basis of tissues in plants, animals and humans. She will partner with cellular biophysicist Margaret Gardel of the University of Chicago in the research, which offers endless possibilities for discovery in both life and physical sciences.

MACHTA WINS NSF INSPIRE GRANT

Jon Machta won a prestigious three year $600,000 INSPIRE award from the National Science Foundation to study the onset of spatial synchrony in ecological systems. He will collaborate with UC Davis ecologist Alan Hasting and physicist Andrew Noble. By applying the theory of phase transition to dynamical models of spatial extended ecosystems, the project will uncover the mechanism by which cycles in ecosystems extend over large distances despite having short range interactions.

KASTOR NAMED APS FELLOW

David Kastor has been named Fellow of the American Physical Society in November 2013. This is an honor conferred on less than one half of one percent of the APS membership.

His citation reads: *For his influential work on a broad span of topics in gravitational physics, ranging from the formal definition of conserved quantities in General Relativity through new exact black hole solutions all the way to brane architectures relevant for string theory.*

physics student awards

UNDERGRADUATE AWARDS MAY 2013

Chang Freshman Award
(freshman, academic excellence)
Mitchell Negus

Chang Transfer Student Award
(transfer student, academic excellence)
Morgan Opie

LeRoy F. Cook Jr. Memorial Scholarship
(involvement in outreach or teaching)
Thomas Ledoux
Michael Cowell

Kandula Sastry Book Award
(academic excellence and versatility)
Ryan Horton

Hasbrouck Scholarship Award
(junior, academic excellence)
Kyle Vanderwerf

Richard Kofler's Class of '76-'77 Scholarship
(strong intention of career in Physics)
Henry Byrd
Mark Lodato
Kelly Malone

GRADUATE AWARDS MAY 2013

Quinton Teaching Assistant Award
(outstanding teaching assistant)
Nathan Bernard
Drew Von Maluski
Wenlong Wang

Kandula Sastry Thesis Award
(presentation of outstanding thesis)
Michael Ray

Dandamudi Rao Scholarship
(research in biological physics or closely related area. In memory of Kandula Sastry)
Mustafa Selcuk Yasar

Morton & Helen Sternheim Award
(educational outreach and/or teacher preparation)
Anne Dominique Cambou

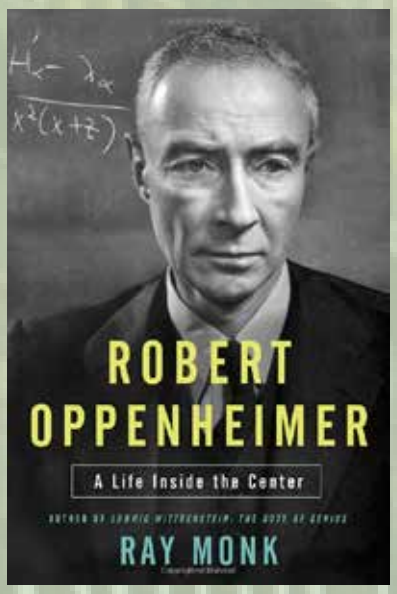
AWARD RECIPIENTS, PHYSICS DEPARTMENT, MAY 2013

Left to Right: Mustafa Selcuk Yasar, Michael Ray, Henry Byrd, Kelly Malone, Mark Lodato, Kyle Vanderwerf, Thomas Ledoux, Nathan Bernard, Drew Von Maluski, Wenlong Wang, Ryan Horton, Ann Dominique Cambou

BOOK REVIEW

Robert Oppenheimer: A Life Inside the Center
by Ray Monk. Doubleday 2013

A book review has not been a feature in the Newsletter until this issue. But we would like to bring to your attention a rather special work. Author Ray Monk of the University of Southampton in England has presented us with a superb exposition of the life of one of America's most influential and important physicist of the twentieth century.



Julius Robert Oppenheimer's childhood was spent on the Upper Westside of New York City, raised in a wealthy, cultured German-Jewish family. Somewhat remarkably his Jewish roots were not a big factor in his upbringing or indeed throughout his life. His friend Isidor Rabi saw this as a continued problem of self-identity for JRO. His education was at the Ethical Culture School in Manhattan where he formed a lifelong friendship with one of his teachers.

At Harvard he was initially a chemistry major. He certainly took full advantage of Harvard's rich offerings, but we learn that his mathematical training had some omissions. So eventually we have an outstanding physicist sometimes not able to provide the support for his ideas with the required mathematical techniques. But fortunately this was not true of his graduate students. However in his published papers some errors occur which seem to indicate a lack of careful checks of the calculations.

But dwelling upon this weakness should not obscure his strengths. At Cambridge and Goettingen he mixed with the leaders of the emerging field of quantum physics. Especially from his mentor Max Born, he absorbed the great ideas and there developed in him a consuming ambition. He decided that he would wrest the leadership of theoretical physics away from Western Europe and move it to the USA. This was not a drive coming particularly from personal ambition, but by patriotism and his great love of the USA. These traits, nicely treated by Monk, have not been previously emphasized.

Oppenheimer was a leader. He established a great school of theoretical physics at Berkeley in the 1930s, where he was able to attract first-rate students and research associates. The book makes it clear that this was the time when, in retrospect, we see him making the political mistakes that cost him dearly in the post WWII era. In his own words he supported every leftwing organization on the West Coast, without, it seems, becoming a member of any of them. It is no surprise to learn that he remained loyal to his communist friends without ever sacrificing his loyalty to his country.

But it was the WWII Los Alamos phase of his career that made him so widely known including, for example, Time Magazine coverage. A particularly interesting aspect of this period was the remarkable cooperation between the Professor (Robert Oppenheimer) and the General (Leslie Groves). Here we have two unlikely collaborators working closely together to bring the nuclear weapons program to a successful conclusion by August 1945. Groves was a genius to recognize that, despite some political negatives, Oppenheimer was the man for the job. Oppenheimer turned out to be a brilliant administrator. They had great respect for one another as competent professionals. Again we learn that patriotism was a strong motivator for both men.

Robert Oppenheimer loved the Southwest. But in the years immediately following the war he became increasingly involved with political affairs in Washington. The issues were security and his opposition to the development of the hydrogen bomb. Agents of the FBI had investigated him thoroughly while he was at Berkeley and Los Alamos. Security leaks there were, but the agents were looking in the wrong place! Because of the work of the investigating committees, he lost his security clearance. Of course the hydrogen bomb was built. The last twenty years of Oppenheimer's life were spent as director of the Institute of Advanced Study at Princeton. Again he was an effective leader but without any scientific output of his own. Perhaps this is the real tragedy of the life of a great man.

people

ANN CAIRL RETIRES

Ann Cairl, the Office and Personnel Manager of the Physics Department since October 1987, retires in June. Ann came to UMass in 1974. Before joining the Physics Department, she worked three years in the Department of Civil Engineering under Bill Heronemus, followed by three years in the Library reference section, and seven years in the Whitmore Data Processing Center.

Ann was hired by Bob Hallock, the Department Head at the time. Bob recalls: "Two candidates emerged as the most qualified. Ann was one of those. It was not an easy or immediate decision, and I made it as I was driving to an APS sectional meeting in Vermont. To contact Ann I stopped the drive and called her from a phone booth along I-91. She accepted on the spot, which made the rest of the drive that much better." Bob continued, "When asked to reflect on the things I did and decisions I made during the nearly nine years that I was Department Head, the decision to hire Ann is right there on top of the list. And, when asked to think about things I have most enjoyed about my time with the Department, working with Ann is again right there on top of the list."

In addition to Bob Hallock, Ann worked for Department Heads John Dubach, John Donoghue, Jon Machta, Don Candela, and current Head Rory Miskimen. All of these Heads commented on how much they appreciated working with Ann. Her consistently great attitude, good judgment, ability to get many things done simultaneously and her terrific sense of humor made the job of Head much easier and more enjoyable.

Ann has been responsible for many of the activities that make the Department run smoothly and happily. As personnel manager she prepares documentation and is involved in many other aspects of hiring, promotions, and other personnel actions for faculty, staff and student employees. As office manager one of her roles is to be the face of the Department, receiving visitors and fielding phone calls. Her wisdom, calm presence and good humor made her ideal for this job whether the caller or visitor was a reporter, a parent, or a prospective student.

Ann has always done her job above and beyond the call of duty. If personnel cases were backed up, she stayed late or came in on weekends. If the Department was engaged in a special initiative, it was often Ann who carries the ball administratively. A notable example was "Science Days," an initiative that ran for several years soon after Ann was hired, during which thousands of Massachusetts high school students visited campus to hear lectures and tour sciences labs. It was a huge success, but also a huge logistical nightmare, and Ann was right in the middle of it. She created schedules, made contacts, arranged the lunches, reserved rooms for lectures, arranged faculty for tours and lectures, and printed and distributed the advertising. Without her exceptional effort "Science Days" would not have happened. And, of course, she did all of this while at the same time carrying on with all of her "regular" duties.

Ann lives with her husband Rob in Sunderland. Her parents and her two grown children live in the area. In retirement, Ann is clear about not staying home all day, and is looking forward to being more physically active, spending more time with family and doing some volunteer work.

She loved working in our department, and her advice to the next person who has her job is to be patient, have a tough skin, and smile. We wish her well in her post retirement endeavors. She will be missed!

Finally, our congratulations to Ann, as the winner of the 2014 College of Natural Science Staff Award.

from Janice Button-Shafer, Emerita

After a decade spent in particle-physics research at the Lawrence Berkeley Lab as a guest retiree, I took an apartment in a Pasadena senior-living complex near my physicist daughter and her family. I have retained the Bay Area home where my mathematician husband died, and have been spending two to four weeks there every three months to continue contacts with physicists, musicians – and my two grown sons (engineer and computer scientist). Following lengthy involvement with the LBL group pursuing research with the SLAC "B-factory," I had spent the years 2005-2008 with a few other LBL physicists in table-top experiments on special GEM (gas electron multiplier) devices for readout of particle detectors at the hoped-for International Linear Collider. (The GEM foils came from CERN, and our electronics derived from the LBL-designed pixel detector for the ATLAS experiment at CERN.) During my decade at LBL, I enjoyed learning about astrophysics, especially from seminars of the Institute for Nuclear and Particle Astrophysics, often presented/attended by past or future Nobel Prize winners.

In October 2011, I was asked to present two lectures, for the 200+ residents of my senior complex, on physics leading to dark matter and dark energy; these were to follow a series of Teaching Company DVD presentations by a young theorist. I managed to construct two lectures entitled "Nuclear Physics to Astrophysics: Observations of an Experimentalist." I had fun assembling pictures and historical accounts of people and apparatus that covered a century of physics – with emphasis on the contributions of women (M. Curie, I. Curie, Meitner, Wu, Rubin…).

Last month, with some misgivings, I again gave a physics talk for seniors. This dealt with the Higgs Boson: the ideas presented fifty years ago, and the ATLAS and CMS experiments at CERN's Large Hadron Collider that led to this year's Nobel Prize in Physics for Higgs and Englert.

Last spring I invited my daughter, a researcher in space physics at Caltech, to present our seniors with a discussion of her work. Christina (Mae Shafer) Cohen spoke to our residents on "The Sun, and Space Weather" and was enthusiastically received. Among the half-dozen offspring of our residents who have presented special lectures here, Chris has been the only scientist AND the only woman.

Happily, I have been joined in my residence complex by two women scientists in the past couple years. One, now over 90 years of age, did research in condensed-matter experiments, and was professor and administrator at Calstate L.A. Another closer to my age is a chemist who came from Brazil, the widow of a Caltech professor, she taught chemistry for many years at Calstate and at a private high school. I occasionally attend Caltech physics colloquia, and have managed to take friends to a JPL lecture.

Chamber music (piano), as well as German study, I find very rewarding. I have been fortunate to play with professional string-players for casual sessions and more formal ones. However, I do miss greatly the interactions with eager students and the stimulating conversations with faculty colleagues that I enjoyed for thirty-two years at UMass.

jbs@mailaps.org or jbuttonshafer@gmail.com

Faculty Emeritus Ross Hicks discussing string theory with ***Camelus dromedarius*** in the outback of Australia. One hundred years ago, transcontinental paths now replaced by the railroad, the Ghan, originated by Afghans, hence the name, with camels traversing in a sunburned country down under. Ross took early retirement in 2004 after advancing through the ranks to Full Professor and Principal Investigator in Medium Energy Nuclear Physics. He returned to Victoria in his native Australia and lives near the ocean where he keeps 10 alpacas and sometimes goes camel riding. He doesn't especially miss the harsh weather of New England, but the dry weather down under and the consequent fire hazards, creates its own set of problems and opportunities. He lives in an ecologically sound straw-bale house, but has installed a fire-survival bunker of prefabricated concrete. The bunker is below ground and maintains a cool temperature appropriate for a wine cellar. So if the big one comes, a calming glass of Riesling can be sipped while observing the inferno through a glass porthole. The alpacas will have to fend for themselves. On the other hand, there is an opportunity. Ross now drives a big red fire truck, only a dream of most boys! hicks.lavers@activ8.net.au

in memoriam

Stanley J. Engelsberg

It is with regret that we report the death of Stanley Engelsberg, Professor Emeritus of Physics at the University. He died unexpectedly in October of last year in the Bay State Medical Center in Springfield, Massachusetts. He was 79 years of age.

Professor Engelsberg grew up in the New York City area. After high school he entered MIT where he was awarded the BS in 1955. He followed up with a PhD in 1961 at Harvard. The title of his thesis was "Energy losses of fast particles: collective excitations." His advisor was the Nobel Prize winner Professor Julian Schwinger. He published this work as the sole author in the Physical Review in 1961.

In 1960 he began his studies in the field of condensed matter physics. By 1966 he had established for himself a reputation as one of the outstanding young theorists in this field in that era. Firstly he was a Research Associate at the University of Illinois, followed by four years at Princeton as an instructor and lecturer. During this time and later, he enjoyed good relations with leaders in the field at Bell Telephone Laboratories. In 1966 and again in 1968 he was a Visiting Fellow at Imperial College of London University. His progress was so rapid that he supervised two PhD theses at Princeton. Publications over these years include papers coauthored with prominent physicists such as W.F. Brinkman and Nobel lauriates J.R. Schrieffer and P.W. Anderson.

Stanley joined us at UMass in 1966 as an associate professor, the first condensed matter theorist in what turned out to be a strong group. He published in his career 21 papers, for 8 of which he was the sole author. The most cited work is on spin fluctuations with S. Doniach (484 citations). His work was characterized by an outstanding appreciation for mathematical technique, including especially Green's functions.

As time progressed, he tended to work and publish alone. "I thought of him as my best friend on the physics faculty" writes Arthur Quinton. "For years we played tennis together, but always singles." Stan tended to be a loner both at work and play and it even showed up in his tennis, where he said he would be uncomfortable playing with a doubles partner! He enjoyed displaying his cooking skills when he entertained in his condominium. He had a keen eye for photography with impressive displays of his work both at home and in Hasbrouck. He kept fit with his love of social dancing, but more significantly, with his excursions on his bicycle. He enjoyed his bike so much he kept it in perfect condition in his living room. However living alone was not really by choice. He had yearned for a family life but this was somehow denied him. His Airdale dog was of some compensation for a few years.

Around about 1990 his career took a somewhat surprising turn. Both in his teaching and research he thought more and more as an experimentalist. For example he wrote a manual for the electromagnetism lab course that he was teaching. And he obtained a grant from the Research Corporation for his experimental research work on High Temperature Superconductivity.

His idea was to build a series of complex superconducting compounds based upon the copper oxides. Over time he synthesized over one hundred such compounds, incorporating the elements lanthanum, barium and calcium in complicated molecular structures. The search for new high temperature superconductors showed promise but was never successful. His work on the copper oxides was published in the journal "Physica."

He is survived by his sister Joan Feldman.

Norman C. Ford

Retired Professor Norman C. Ford passed away suddenly at his home in Amherst on August 25, 2013. He came to UMass in September 1965 as one of the founding members of the Robert Gluckstern-led era department with its emphasis on becoming a modern first-rate research oriented institution. During those years, over 30-research faculty were hired by the department while UMass grew from a primarily teaching university of about 12,000 students to about 25,000, of which 6,000 were graduate students. We like to observe that the university grew by the equivalent of one Amherst College each year, every year, for about ten years. Norman played a major role in establishing our graduate program practices of admissions, course structure, qualifying examinations, and thesis requirements.

Norman's first research project at UMass was to establish the Laser Light Scattering Laboratory. The research focused on exploring the behavior of simple fluids near the liquid-vapor critical point where many of the physical properties, for example the compressibility, diverge to infinity. A year after his arrival he was joined in this effort by Professor Kenneth Langley. Together they directed the laboratory as the applications of laser light scattering expanded to encompass the diffusion of small particles and macromolecules in liquid solution and the flow of components inside living cells. It became clear that many of the applications are relevant to biology and to polymer science. This led to extensive collaborations with colleagues in other departments of the university. For example, with "Skip" Fournier in biochemistry, pioneering work on the changes in the shape of transfer ribonucleic acid molecules as they bind to specific protein molecules under different solution conditions was accomplished. With Frank Karasz, of Polymer Science and Engineering there were many studies of the properties of polymer molecules in solution. To accompany these lines of research, Norman developed and taught the first Biophysics course to be offered in the physics department. He also authored most of the biophysics material incorporated in the early editions of an introductory physics textbook for life science majors; later editions of the book are still in print in several different languages. Norman was always talented at inventing experimental apparatus and developed much of the instrumentation used in his research. In 1976, along with Kenneth Langley, he founded Langley Ford Instruments with the objective of designing, building and distributing a commercial version of the instrumentation used in the laser light scattering lab. It is interesting to recall that at that time the University of Massachusetts played no active part in fostering or encouraging the commercial exploitation of ideas generated at the university. Their attitude was that commercial development by faculty was tolerated, as long as no university space, time, equipment or facilities were utilized in the process. What a contrast to the university's attitude of today!

After Langley-Ford Instruments was absorbed by a large instrumentation company in 1983, Norman stayed on as the director of research for a few years. During that time he directed the development of a light scattering instrument that became the heart of a blood analysis machine that is still in use today in every middle to large size hospital in the country. Later on he left to become cofounder of a succession of companies that developed applications as diverse as improving the efficiency of delivering inhaled atomized pharmaceuticals, and determining the molecular weight of the molecules as they come from the output of a column chromatography device. In his last few years Norman made use of his business experience to consult for a company that makes racing snowshoes and another that builds wooden frame bicycles.

In addition to holding many research grants and spending sabbatical leaves in Sweden, Germany, and England, Norman Ford was honored by a Guggenheim Fellowship. He held about a dozen patents including a key early patent on the use of photon correlation. He will be remembered at the University of Massachusetts Amherst for his early devotion to the modernization of the physics department, his dedication to, the encouragement of, and the high standards he set for his students and himself.

A memorial service for Norm was held on Saturday, Sept. 21, 2013, at the UMass Campus Center in the Marriott Suite on the 11th floor. Family, friends, and colleagues gathered to speak of his accomplishments and personality. With the backdrop of images from his life and in full view of the campus, all paid tribute to honor his memory.

Robert L. Gray

It was with great sadness that the Physics Department learned of the passing of one of our legends, Robert Gray, on March 18, 2014, at the age of 82. Bob started working in the Department (then Physics & Astronomy) in 1962 as an Instructor/Lecturer. At the time, he taught what is now Physics 151 & 152. He was the author of the first departmental proposal to seek federal funds to assist in the modernization of the freshman physics laboratories. The proposal was successful, and the funds which were obtained provided for the purchase of much needed modern electronic equipment for use in the labs. When Physics & Astronomy moved into Lederle in the 1970's, Bob did all of the initial space planning. He remained involved in day-to-day teaching activities until 1980 when he was appointed as the department's Business Manager. He was a model department and university citizen and cared deeply about UMass and the people he worked with. In 1988, he was honored as the recipient of both the campus-wide and state-wide Outstanding Employee Award. Quite an honor, and much deserved! Bob retired in 1993. This was a man who truly made a difference in the lives of many and who

will be remembered as lecturer, employee, and mentor extraordinaire. Rest in peace, Bob.

David Stephen

David Stephen, MS '67, PhD '70, passed away on May 3, 2013, at age 69. He was born in Hong Kong, graduated from St Paul's College in 1961, and then left for Montreal to study at Sir George Williams University, where he completed a BSc in 1965, before coming to UMass Amherst. Along with Shu-bon Chan, Hal Haselton, Justus Koch, Tony Mann, and Bob Ponte, David was a graduate student in the UMass Amherst High Energy Physics Group during the Department's Gluckstern Era (1964–1969). Bubble chamber experiments were carried out at Brookhaven National Laboratory, and the scanning of images and data analysis was made in the Hasbrouck Lab using a homemade scanning machine and computer program. After receiving his PhD, he returned to Montreal, where he taught physics at Vanier College.

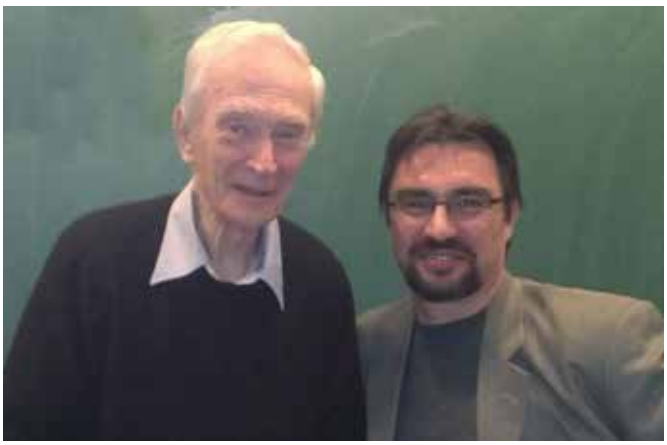
David Stephen, UMass

In 2008 David was diagnosed with Amyotrophic Lateral Sclerosis (ALS or "Lou Gehrig's Disease"). At that time, his disease had already progressed to the point where he walked with extreme difficulty and could no longer use his right-hand. Nevertheless, he was still in great spirits. He didn't seem too worried about what would inevitably happen next. Toward the end, although he could no longer use his fingers to type, he would still send emails and jokes by using a trackball keyboard with his foot. This was reflective of his strength, determination, and courage. David is survived by his wife Luisa Ong-Stephen and son Vincent Stephen-Ong. David requested that those who knew him spend a few minutes reflecting upon memorable times you shared with him.

(Condensed from an article by Shu-bon Chan, PhD '70)

alumni news

Yury Kolomensky (MS '94, PhD '97), Professor of Physics at the University of California Berkeley, returned to our department on October 16 to give a colloquium lecture about the search for neutrinoless double beta decay in the CUORE (Cryogenic Underground Observatory for Rare Events) experiment jointly supported by Italy and the United States at Italy's Gran Sasso National Laboratory. If the neutrino is its own antiparticle, i.e., a Majorana fermion, then neutrinoless double beta decay could take place and provide strong evidence for the role of neutrinos in generating the matter-antimatter asymmetry in the early universe, as well as setting the scale for neutrino masses. ("Coure" is Italian for heart. Yury's colloquium title was "The Coldest Heart in the Universe.")



Gerry Peterson and Yury. Gerry was Yury's advisor during his association with UMass.

Yury and Alexey Petrov (MS '94, PhD '97) came to UMass in January of 1992 for six months along with other exchange students from the Technical University in St. Petersburg, Russia, as well as an accompanying KGB agent. (Alexey is a Full Professor in the Department of Physics and Astronomy at Wayne State University in Detroit. There is an article about Alexey in our 2011 Newsletter.) Yury and Alexey returned to UMass in August of 1993 to begin graduate studies in physics. After completing the requirements for the PhD before his 24th birthday in 1997, Yury went to Caltech as the Robert A. Milliken Postdoctoral Scholar in Physics. In 1998 his UMass thesis won the American Physical Society Thesis Award in Nuclear Physics. In 2001 he accepted an Assistant Professorship at UC Berkeley where he is now a Full Professor and a Fellow of the American Physical Society.

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Life After UMass Physics: Pursuing the American Dream

by Shu-bon Chan

I earned my PhD in High Energy Physics in 1970, alongside five other classmates in the UMass Physics Department. Although I have remained in Massachusetts all these years since graduation, I had not been back to Amherst until yesterday, when I returned to attend Professor Norman C. Ford's memorial service.

I was surprised to find that although over 40 years had passed, the college town has not changed much at all. Upon arriving in Amherst, I was welcomed and comforted by the familiar sights of Grace Church, Lord Jeffery Inn, and Amherst Common, a view that I once took in daily on my walks back and forth from campus to the boarding house on Spring Street where I lived for many years.

Hasbrouck Laboratory, where I spent countless hours, and the small pond behind it are both just the way I remembered. At Dr. Ford's memorial service, I was fortunate enough to run into many of my former professors, including Dr. Quinton, Dr. Sternheim, Dr. Kofler, Dr. Langley, and Dr. Jones, all of whom looked exactly as I remembered them.

Revisiting Amherst after all these years brought back many fond memories. It inspired me to take a moment to reflect upon my time at UMass and share some of my life experiences after graduation.

In 1957, when I was just a high-school student in Hong Kong, Chinese-born American physicists, Chen Ning (C.N.)Yang and Tsung-Dao (T.D.) Lee, were jointly awarded the Nobel Prize for their work on the so-called parity violation in weak interaction which led to important discoveries regarding the elementary particles. This news sparked my interest in Physics, which I later chose as my undergraduate major at National Taiwan University.

After teaching high-school Physics in Hong Kong for two years, I received a scholarship for graduate studies at UMass and came to the United States to pursue the American dream. My goals were both ambitious and simple. I wanted to become a successful physicist like C.N. Yang and T.D. Lee, and I wanted to live a comfortable life in America.

I entered the UMass Physics Department in 1965, during the so-called "Gluckstern Era" when Dr. Robert Gluckstern was expanding and transforming the department through the recruitment of many top physicists of the time. In my first year, I attracted Dr. Gluckstern's attention through my achievements in several introductory graduate courses and he asked me to become his teaching assistant. (As an aside, I have always been grateful for Dr. Gluckstern's mentorship and in 2009, I traveled from Boston to Maryland to attend his memorial service.)

In the summer of 1966, I worked as a summer student at Brookhaven National Laboratory (BNL). I was thrilled about this opportunity as BNL was where C.N. Yang and T.D. Lee first worked together in 1956 to interpret particle decay in the Cosmotron and conducted research to support their theory on parity violation.

While at BNL, I worked in Dr. Rosenbaum's research group, and had the opportunity to use many of BNL's fine facilities, including then state-of-the-art computers. This was when I first learned computer programming in FORTRAN.

When summer ended, Dr. Gluckstern offered me a ride with him in a private jet from Long Island to Amherst. Flying high in the sky, I saw a bright future in front of me. Dare I say I was on Cloud Nine?

That fall, after I passed the qualification exam and officially became a PhD candidate, I joined the High Energy Physics (HEP) group. At the time, the group consisted of Drs. Janice Button-Shafer, Steve Yamamoto, Dick Kofler, Stan Hertzbach, Gerry Meisner (a post-doctoral fellow), and six

Tony Mann

David Stephen

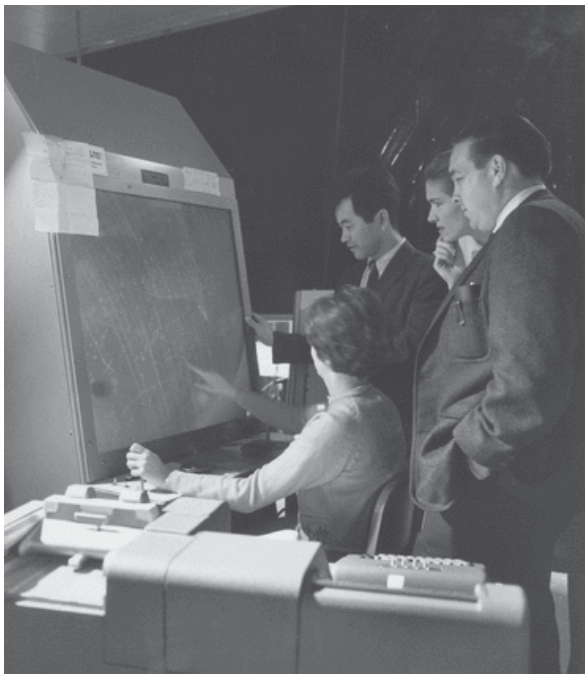
Hal Haselton

Justus Koch

Shu-bon Chan

graduate students: Tony Mann, David Stephen, Bob Ponte, Hal Haselton, Justus Koch, and myself.

We collaborated with Dr. William Willis at Yale University and conducted our elementary particle experiment in the bubble chamber at Brookhaven National Laboratory. The group captured the particle images from the bubble chamber, scanned, and analyzed the images using a homemade scanning machine and computer programs.



Dr. Yamamoto, Dr. Shafer, and Dr. Gluckstern, in front of the scanner.

I still recall my daily task of carrying trays of punched cards to the computer center and picking up the results the following day for further analysis. This continued for a period of approximately four years until I finished my thesis and received my PhD in 1970.

Under the excellent advisement of Dr. Janice Button-Shafer, my thesis involved the study of Y(1520) decay into Y(1385) π for the verification and calculation of the SU(3) singlet/octet mixing angle. Dr. Shafer taught me how to approach basic scientific research, allowed me considerable freedom in exploring my thesis topic, and always knew when and how to offer guidance.

After earning my PhD in 1970, I searched diligently for a post-doctoral fellowship or teaching position. After nearly a year of unsuccessful job searching, I was finally forced to give up on that life path. This was a very discouraging period of my life; however, the immigrant spirit within me refused to give up on the American Dream.

Recognizing that there are alternative pathways to success, I began looking into other fields for opportunities. At the time, computer technology was in its infancy. I had been using computers for more than five years while working on my thesis research and I decided that was a viable career path for me.

After studying computer science for one semester at UMass, I landed a job as a programmer at American Optical in Southbridge, Mass. That was the springboard for a 40-year career in Information Technology (IT).

Looking back, I still have mixed feelings about this career change. Although I was disappointed to leave Physics, a field to which I had devoted most of my academic life, I was also fortunate to be entering a new and rapidly growing field of Information Technology at a time in which it offered seemingly endless opportunities and challenges.

Over the years, I worked my way up from a programmer, to Systems Analyst, to Project Leader, to Project Manager, to IT Manager, to IT Director, to V.P. of Information Systems, and finally to Chief Information Officer (CIO). My industry experience spanned the areas of manufacturing, software, biotechnology, government, and healthcare. My technical knowledge of a rapidly changing field and business administration skills advanced as I moved up the corporate ladder; however, as my administration responsibilities expanded, I realized that I could no longer depend purely on my scientific background.

Dr. Shafer and Shu-bon Chan during a visit to her Kensington, California home in 2010, exactly 40 years after his graduation.

I decided to enroll in Northeastern University's MBA program and spent the next seven years earning my MBA through evening classes while working full-time and while my wife and I were raising two young daughters. It proved to be worthwhile as the management training that I received from the program combined with my scientific knowledge helped me successfully navigate the business challenges that I encountered across many different industries.

Over the years, I have implemented many IT systems, but two in particular stand out in my mind because they addressed real-world problems and resulted in a positive impact on society. The system that I am most proud of is the real-time dispatch system that I implemented for a large city's public safety department. It accepts 911 calls and silently dispatches calls directly to police cars or fire engines equipped with wireless devices and GPS units, which speeds up the resolution of emergency calls and provides additional protection to public safety personnel. The city's crime rate has fallen significantly since the implementation of this system.

The other system that has resulted in a positive impact to society is the Medical Record Management (MRM) system that I implemented for several health centers. The MRM system provides healthcare providers with real-time diagnosis and record keeping capability, which improves the quality of their services to patients.

Working as the IT Director for large international companies provided me with many exciting opportunities for global travel, and thanks to this career path, I was fortunate enough to be able to send my two daughters to Cornell University (I call them my "Cornell twins"), and then to Bentley University and Harvard University for their advanced degrees.

In 1965, with a scholarship from UMass, just a few dollars in my pocket, and "no speaking the English," I came alone to the United States. But I was not afraid because I had a dream, an American dream.

Part of my dream, to live a comfortable life in America, has come true. The other part of my dream, to become a Nobel Prize-winning scientist, may not have been fulfilled. Oh well. I will have to pass that dream on to my grandson, Connor, who, at age two, knows how to use more iPad apps than I do. Perhaps he will be the Nobel Prize winner for our family.

Shu-bon teaching his grandson Connor one of his favorite summertime activities, clam digging at his summer house on Cape Cod.

Although technically retired, I still maintain my full-time title of CIO (Chief Infant-care Old-timer) taking care of my grandson, Connor. Out of all of my jobs, I enjoy my current job the most. There is nothing more fulfilling than playing with my grandson all day and teaching him everything I know.

Students educated in the UMass Physics Department enter the real world equipped with substantial scientific knowledge as well as problem-solving and critical-thinking skills. These invaluable skills can be applied to real-world problems and result in meaningful achievement in one's career, even if that career ends up being outside of the field of Physics.

My message for recent graduates out there trying to land a job in these trying economic times is this: Rest assured that life might not end up exactly the way you had envisioned, but remain determined, work hard, and you will fare just fine.
shu-bon.chan@comcast.net

Steve T. Churchwell (PhD '98) writes: I had been at Canterbury University in Christchurch, New Zealand, for several years, and had worked on the Ice Cube and RICE experiments at the South Pole (See page 12 of the 2004 Physics Newsletter), but then joined a small start-up company in designing a hand-held anthrax detector which would be used by first responders to "white powder spill incidents." Several patents resulted from this work. With the downturn in the New Zealand economy in 2010, I went back to the University, but Christchurch was hit by a 7.1 earthquake in September of 2010, followed by several large aftershocks, one of which killed 185 people in February of 2011. I remember it well enough to tell you that it happened at 12:56 PM on 22 Feb. 2011. (The Japanese Tohoku earthquake, the huge tsunami, and the Fukushima-Daiichi nuclear meltdown followed in a little over two weeks.) The university suffered severe damage. Since then I went to the rapidly expanding University of Sussex in Brighton, UK, where I have a position that involves a combination of some of the duties of a United States department head, a business manager, a teaching professor, and a researcher. In that latter sliver of time, I've been working on the DEAP3600 experiment looking for dark matter interactions using a large tank of liquid argon at SNOLAB, a laboratory located 2 km underground near Sudbury, Ontario, Canada. I would very much like to hear from those of you who overlapped with me at UMass.
s.t.churchwell@sussex.ac.uk

new alumni

Degrees awarded since the Spring 2013 Newsletter

BS and BA Degrees

Fabien Ahmed	Thomas Ledoux
Ashley Berner-Potts	Jackei Li
Nathan Brunetti	Mark Lodato
Jamie Budynkiewicz	Joseph Lyons
Michael Cowell	Thomas MacRae
Daniel Eno	Cameron Mackeen
Dax Feliz	Kelly Malone
Kyle Gaudet	Joshua Pringle
John Howard	Mary Whitebirch

Left to Right: Prof. Rory Miskimen, Mark Lodato, John Howard, Kelly Malone, Henry Byrd, Prof. Andrea Pocar, Daniel Eno, Kyle Gaudet, Thomas MacRae, Christopher Lirk, Thomas Ledoux, Jackei Li, Prof. Jon Machta, Prof. Carlo Dallapiccola

MS Degrees

Luis Cajamarca	Sereres Johnston	Jinhua Mu	Jiayue Tong
Candace Harris	Basem Mahmoud El-Menoufi	Ning Ouyang	Drew Von Maluski
Daniel Hoak			

PhD Degrees	Thesis Title	Advisor
German Colon	Search for TeV-Scale Gravity Signatures in Final States with Leptons and Jets with the ATLAS Detector at sqrt(s) = 8 TeV	Dallapiccola
Jessica Cook	Gravitational Wave Production through Decay of the Inflaton into Intermediary Fields during Slow Roll Inflation	Sorbo
Jaime Hutchison	The Effect of Vesicle Shape, Line Tension, and Lateral Tension on Membrane-Binding Proteins	Dinsmore
Huajie Ke	Fabrication, Characterization and Analysis of Patterned Nano-sized Material with Large Magnetic Permeability at High Frequency	Tuominen
Andrew Meade	W/Z + Jets Cross Section Ratio, and its Implications for New Physics at the ATLAS Experiment	Brau
Bo Peng	Theory and Simulations of Polyelectrolyte Complexes	Muthukumar (PSE)*
Craig Versek	Charge Transport Studies of Proton and Ion Conducting Materials	Tuominen
Yanbo Wang	Computer Simulations of Polyelectrolyte Stretching and Translocation	Muthukumar (PSE)*
Burcu Yucesoy	Replica Exchange Monte Carlo Simulations of the Ising Spin Glass: Static and Dynamic Properties	Machta

*Polymer Science & Engineering (PSE)

Last year a luncheon was held at the University Club to celebrate the endowment of the Teaching Assistant Awards that came about from a generous donation by Keith Quinton. In the photograph he is accompanied by Julie Stubbs of the Development Office, Professor Emeritus Arthur Quinton, former Head of the Department Don Candela and Dean Goodwin of the College of Natural Sciences.

THANK YOU!

We send a big sincere thank you from the entire Department for your continued interest and generous gifts during the past year. Many of our important activities were enabled by your contributions and could not have been funded by monies received from the Commonwealth or the Federal Government. In the past year the largest project for which we used the gift account was turning the Lederle Graduate Research Tower fourth floor machine shop into a second Intermediate Lab and Optics Teaching Lab. Renovations, new equipment, and some additional furniture totaling $5000 were provided. We also use gift funds to pay for a part time Research Assistant position to enhance the Department's social media presence and do outreach to our alumni and other constituents. The Department is now on Facebook and Twitter as well as the Physics website. Ongoing support is given to the Society of Physics Students, and the Science Outreach Club, as well as for teaching faculty to attend AAPT conferences. Biweekly Physics Teachers' Workshop lunches are also supported.

WE WANT TO HEAR FROM YOU

Is there anything that you would like to share with us? Send us a note. Pictures are more than welcome. Also we appreciate comments about what you want to read about in our newsletter, or thoughts about how it could be improved.

You can reach your newsletter editors easily through e-mail. Our address is newsletter@physics.umass.edu.

MAILING ADDRESSES

Has your address changed? If so, please keep the physics department current by sending your new address to newsletter@physics.umass.edu.

In addition, if you are an alumnus or alumna, update the University Development Office by going to www.umass.edu/giving/contact/contactform/ and filling out the change of address form.

We appreciate your help in keeping our department, and the university, up to date to ensure you continue receiving copies of the Physics Newsletter, and other university publications.

This list represents those who contributed to the Department of Physics from January 1, 2013, to December 31, 2013. We apologize for any omissions and kindly ask that you bring them to our attention.

Anonymous
Alice L. Argon
Robert Balaban &
Irene Dondley
James J. Barber
Michael G. Belanger
David A. Bloore
Arthur K. Bonney
Paul S. Bourgeois
Elizabeth M. Brackett &
Thomas D. Radcliff
Aaron A. & Lisa Brissette
Robert M. & Judy L. Buckley
Joanne & James Budynkiewicz
Joanne K. & Nelson J. Burke
Kevin A. Butler
Cary Chang
Scott B. Chase
Dansong Chen
Barbara S. Christie
Patricia K. Colagiuri
Theodore J. Coletta
Raymond F. Connors
Laurence G. Cote
Alison Danzberger &
Donald J. Stump
Christopher A. Davis
Edward F. Demski
Lorraine I. Dikant
Thomas A. Dundon
Klaus D. Eisenbach
Jon K. Eisenberg
Ki M. Eum
Howard B. Foster
Janice & Maurille J. Fournier
Fabrizio Gabbiani
Robert K. Galkiewicz
Robert R. Gamache
Suzanne E. & Alfred S. Gibney
Frank C. Glazer &
Christine M. Bestrup
Harris A. Goldberg
John C. Golden, Jr.
Eugene & Joan R. Golowich
Margaret G. Gralenski
John M. Guerra
Robert B. & Norma E. Hallock
Harold P. Hatch
Ann L. Hollingworth
Duane C. Holmes
Pamela D. Houmere
Pamela & Mark L. Howell
Rogert W. & Donna M. Howell
Robert L. & Kristina E. Huffman
Russell A. Hulse
David W. Jagodowski
Phillips R. & Ereda L. Jones
Philip T. Kan
Paul W. Kendra
Joseph R. Kinard, Jr.
Per & Linda Kirstein
John D. Knapton
Yury G. Kolomensky
Donald E. Kuhn
Brian C. Lamore
Margaret W. Latimer
David Gregory Bentley Lawrence
James M. Leas
Phillip E. Ledin
Ge Liu
Margaret Loring
Theodore Lundquist
Jonathan Maps
Donald R. McAllaster
Katherine R. McCall
Margaret E. McCarthy &
James B. Ricci
Evelyn J. McCoy
Michael F. McGurrin &
Gena E. Cadieux
Edward & Claire Montgomery
Alexander J. Nemtzow
Zachary A. Nemtzow
Steven A. Newton
Jennifer L. Niedziela
Elizabeth M. Nuss
Moshe Oren
Ramona Osborn
Michael A. Palecki
Karen Parker
V. Adrian Parsegian
Igor Pavlin
Martti A. Peltola
Gerald & Doris Peterson
Satish C. Prasad
John K. Pribram
Joseph G. Protola
Brooke J. Purinton
John & Dorota Rahn
Janice D. & James Ratner
William N. Reynolds
Nadia & Steven Richman
Mary Ann & Thomas Ryan
Hajime & Sachiko Sakai
Edwin R. Sapp
Harsheel D. Saraiya
Eric J. Saunders
Leslie & Stephen Saunders
Andrew J. Scheff
Ker-Li Shu
Thomas R. Silvia
Mary Skinner
Thomas & Martha Slavkovsky
Kim R. Smith
Peter L. & Kathryn M. Smith
Harold W. Solomon
Morton & Helen Sternheim
Christopher & Joan Stockwell
Richard R. Strange
Jay Stryker
Michael T. Takemori
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Change Service Requested

String theory with broken symmetry. The jam band plays at the Department Holiday Party.
John Donoghue on his homemade 8-string octave mandolin, Ken Langley on the recorder, 2nd and 3rd from left, respectively.