Mark Bowick, Joel Dorman Steele Professor of Physics

Mark Bowick was appointed Joel Dorman Steele Professor of Physics in October, 2013. J.D. Steele was a graduate of Geneseo College, a precursor of Syracuse University. Geneseo College graduates were accepted as alumni of Syracuse University and Dorman Steele himself became active as an alumnus. He was a teacher and lecturer and the author of introductory books in various fields, particularly the physical sciences. His books can be found on Amazon. He was especially interested in physics so that when he died at the age of 50 in 1886, his wife, Esther Baker Steele, established the Joel Dorman Steele professorship in physics. The first appointment to the chair in 1888 was John D. Brown, who was Professor of Chemistry and Physics from 1872-1889. In time the funds could no longer support the chair and the title became dormant. The title, without funds, was reactivated in 1996 to honor Kameshwar Wali. In 1998 it went to Aiyalam Balachandran who relinquished the position when he retired in 2013.

Mark came to Syracuse University as an Assistant Professor in 1987 after four years of post-doctoral research in the Physics Department at Yale and the Center for Theoretical Physics at MIT. In 1983 he received his PhD from California Institute of Technology for a dissertation on Grand Unified Theories under the direction of Pierre Ramond. Syracuse can thus claim Mark as a “grand child” since Pierre had received his PhD in this department under the guidance of Balachandran. Mark came to Syracuse as a field theorist with an interest in string theory and symmetry breaking but gradually his interests shifted to condensed matter physics and soft matter in particular.

Mark was born on November 29, 1957, in Rotorua, New Zealand, a spectacular geothermal area. In the 19th Century Rotorua was the starting point for trips to see the world-renowned Pink and White Terraces. The Pink Terraces, or Otukapuarangi (“fountain of the clouded sky”) in Māori, and the White Terraces, also known as Te Tarata (“the tattooed rock”), were natural wonders of New Zealand. They were completely destroyed by the 1886 eruption of Mount Tarawera, being replaced by the Waimangu Volcanic Rift Valley. The Terraces were formed by geothermally heated water containing large amounts of silicic acid and sodium chloride from two large geysers. These geysers were part of a group of 40 geysers in the nearby area.

Mark’s paternal grandfather had a law and accountancy degree and eventually became Commissioner of Lands and Survey. Mark’s father was a residential builder and his mother was forced to leave school at the age of 12 to take care of four brothers. Mark skipped the even years of the 5 years of high school and finished the 7th form at age 15. During these years, he taught himself calculus and read books on the history of science, including descriptions of quantum theory and the books of George Gamow. In 1973 he entered the physics honors program at the University of Canterbury in Christchurch. On the basis of exams, he was able to skip the first year and to earn scholarships. Of particular interest, he co-authored a paper on the Exceptional Lie groups in 1977 with his physics professor and mentor Brian Wybourne. He graduated with the BSc (Hons.) First Class in Physics in November 1976, but had to wait until September 1977 to enter the California Institute of Technology (Caltech) with a fellowship.

At Caltech Mark worked with Pierre Ramond. His dissertation was on calculable masses in Grand Unified Models. When Ramond moved to the University of Florida in Gainesville in 1982 Mark spent a year as a visitor there while completing his thesis. In 1983, after receiving his PhD from Cal Tech, Mark went to Yale where he worked with fellow postdoc Rohana Wijewardhana as well as with Feza Gursey and Tom Appelquist on a wide variety of problems including some of the very earliest papers on fundamental string thermodynamics, chiral symmetry breaking in 2+1 QED, electroweak symmetry breaking and Technicolor and supersymmetric field theory. At Yale Mark also began a string of winning essays for the Gravity Research Foundation Essay competition. He won Fourth prize in 1985 and 1992, third prize in 1989, and first prize in 1986 with the essay Does string theory solve the puzzles of black hole evaporation. The latter essay was written with Lee Smolin, then an Assistant Prof. at Yale, and Rohana Wijewardhana. After a year at the Center for Theoretical Physics at MIT, Mark came to Syracuse University in the fall of 1987.

At Syracuse Mark continued to work on string theory and from 1987-94 he held a DOE award as an Outstanding Investigator for his work on “field theory, string theory, conformal field theory, matrix models, axionic black holes, and quantum hair on black holes.” In the early 1990s Mark began to write articles on the statistical mechanics of membranes and the formation of topological defects that were closer to condensed matter physics. Of particular note is a paper on The Cosmological Kibble Mechanism: String Formation in the Laboratory which appeared in the journal Science in 1994 with Eric Schiff, Ajit Srivastava and L. Chandar. While continuing to work on string and particle theory, Mark’s interests turned increasingly to soft matter - easily deformable systems characterized by the important role of entropic fluctuations. In the mid ‘90s, DOE cut off his research funding and he turned to the NSF for research support and a full-time career working on soft matter. Since then he has worked on a wide variety of problems using his knowledge of geometry and topology, statistical mechanics, field theory and spontaneous symmetry breaking. He was appointed Director of the Soft Matter Program in the Fall of 2011.

For his work since coming to Syracuse, Mark was elected Fellow of the American Physical Society (Division of Condensed Matter Physics) in 2004, awarded the Chancellor’s Citation for Academic Achievement in 2006, and the William Wasserstrom Prize for Excellence in Graduate Teaching and Advising in 2009. Joel Dorman Steele and Esther Baker Steele would be pleased with his selection for the named professorship.
From the Editor

This issue grew as I collected articles and information. There is so much activity in the Department that although I expected to have a 12 page issue, there are 14 pages of interesting information about research activities of faculty and students as well as of awards. Unfortunately, there are also two notices of deaths of people. One is that of John Fitzgibbons who was a lecturer for introductory physics in his retirement. The other is that of Martin Abkowitz who was a student of Arny Honig’s. He participated in our celebration of 50 years of Arny in 2010. There is also a description of a career in physics by Owen Lewis, ’73. Allen Middleton reviews faculty activity and other changes in the department. And you will find a poem by Erich Harth expressing his thoughts on the Higgs particle. Please keep news of graduates as well as descriptions of your lives in physics coming. We are very interested.

Meet the Staff—Linda Terramiggi

Linda Terramiggi came to the Physics Department in February, 2011. In her position as Budget Administrator, she assists the Budget Manager with financial reporting and tracking, is responsible for the Graduate Student and weekly payroll, and does the billing for the Machine Shop, along with other financial duties.

Linda first came to Syracuse University in 1997 to work in the College of Engineering and Computer Science. In the 14 years she worked there, Linda’s responsibilities included general office duties, support of research projects, graphics and technical typing for publications, student enrollment, payroll, and some financial duties.

Linda was born and raised in Syracuse, NY and graduated from Henninger High School. The first week after graduation her mother dropped her off on James Street, with bus fare home, to find a job in one of the professional buildings located there. Her first job was as a file clerk with an insurance company, she then moved up to the position of Insurance Rater, prepping policies for underwriters. For the next five years she held a secretarial position with Resort Leasing and Funding Co., and then as a subcontractor in Martin Marietta’s Sonar/Radar division doing electronic graphic conversions of their equipment/technical manuals. Linda’s father was a heavy equipment operator for the NYS Thruway, and owned his own heavy equipment. When he passed away in 1993, Linda’s mother let her use the equipment and she briefly tried her hand at paving driveways – even pushing the 100lb water filled roller. Throughout the years, Linda has also held the occasional second job, working part time as a short order cook, a bartender, and a waitress.

In her time away from SU, Linda manages and schedules events for the Chris Terra Band. The band, which plays the blues, is led by her husband, Chris Terramiggi. This quiet, reserved person in the Physics office has had a variety of experiences which have been of value in her present position.
Chair Message—Alan Middleton

Taking the sun to be fixed, the earth has traveled nearly 1 billion kilometers since I wrote to you last. During this orbital period, people in the department have had many notable accomplishments and there has been a remarkable amount of change at SU. I would like to share some of this news with you and also give you a preview of an event scheduled during the next 0.3 billion kilometers of travel: the reassignment of an historic building with a beautiful old telescope to the purpose of teaching astronomy.

Since I last wrote, we have a new Chancellor, Kent Syverud. He has announced that education, built around a foundation in a strong College of Arts and Sciences, and research excellence are his top two priorities. We have a new Dean of the College, Karin Ruhlantd, a chemist who is serving as Interim Dean while a search for a permanent Dean is underway. These leadership changes have opened up a deep examination of goals and structure across the university. Many faculty, staff, and students are working in groups to plan for the future. Given the success of the Department of Physics and its potential, I believe this examination will open up exciting opportunities for our department.

Over the past year, our students have been well recognized for their academic achievements and contributions to science. Shiladitya Banerjee was awarded the American Physical Society Division of Biological Physics PhD dissertation prize. Dylan Hsu was selected as a Syracuse University Scholar, only one of 12 graduating seniors recognized by SU. We had many students participate in research experiences over the summer in Europe and across the US and at SU.

Our faculty has been recognized in many ways. Lisa Manning has been awarded the prestigious Sloan Foundation Fellowship for her accomplishments, research potential, and academic leadership. She was one of only 23 physicists in the US and Canada to be so recognized this year. Cristina Marchetti was named a fellow of the American Association for the Advancement of Science. Paul Souder was co-awarded the Jefferson Science Associates nuclear prize. He also was a coorganizer for PAVI 14, a conference on nuclear physics, held near Syracuse at Skaneateles, and was recognized with an accompanying symposium organized by his colleagues. I could list many other important publications and recognitions.

Despite tough budgetary times and increasing competition for grants, we have had a record year for spending on sponsored research. The future is challenging, but promising. New grants that are just starting are two new prestigious National Science Foundation CAREER grants for young faculty (Lisa Manning and Stefan Ballmer), strong funding for Britton Plourde’s work on quantum computing, extensive support for computing and networking for gravitational wave astronomy (LIGO), many medium size grants for individual investigators (including the first NSF grant for new faculty member John Laiho), and a large ($5.2M) grant to build an upgrade tracker for the LHCb experiment at CERN. The interdisciplinary IGERT program, directed by Cristina Marchetti, continues to grow in size and reach, with many engineering, biology, chemistry, and physics participants.

And now for some exciting news about astronomy: I am very pleased to inform you that Holden Observatory, the second building built on campus and the home of an historic Alvin Clark telescope, will be renovated and made available for use for teaching. This is a story in progress: please stay tuned for the official announcement by Syracuse University. The renovation is the result of a generous gift by a donor and the encouragement of Duncan Brown, who has taught astronomy quite successfully. The Department has worked closely with the University and architects to design a space that will reflect the wonders of astronomy and inspire students. The historic nature of the building is in itself compelling. The antique Alvin Clark telescope in the tower will be available for community and student events. In the fall, Syracuse University will be seeking funds for other improvements to astronomy teaching coupled with this renovation. Under the new administration, funds have already been obtained for significant equipment purchases to modernize teaching laboratories.

I hope that your past year has also been interesting and successful. If you are formerly of Syracuse, do please let the Department know how you are doing. The Department has grown in size and in accomplishment. There remains a great deal to achieve in even further improvements in undergraduate education, including in the classroom, in research experiences, and in expanding the program further, and in training PhD students for careers in industry and academia. These goals are achieved by people working in the Department, often with the support of those who have graduated from Syracuse through scholarship and research support. If you have left the Department and would like to come back to visit, to share your experience with students and faculty, do let me know. May your next 0.9 billion kilometers around the sun treat you well.
Undergraduate Research Day 2013

Lisa Manning

On November 9th, 2013, the Physics Department hosted the eighth annual Syracuse University Physics Undergraduate Research Day and Open House (URD 2013). This event is geared towards physics majors at schools within a few hours driving distance from Syracuse, and provides them with a forum to present their research and meet other physics undergraduates, as well as introduce them to the Syracuse Physics program. This year’s event attracted 62 students and faculty from eight colleges and universities across New York State, including 12 undergraduate students from Syracuse University.

Throughout the day, the students participated in a series of seminar sessions. There were 13 student talks and two from SU students (Manu K. Arul: “Engineering and Implementing Nanopore Technologies” and Peter Nelson: Electrical Properties of Thin Film Zinc Oxide”). There was also a poster session, which included 18 student posters, representing research in a diverse range of topics from quantum optics to astrophysics to biophysics with three from SU students (Joelynn Frascatore: “Removal of long-lived Rn-222 daughters by electropolishing thin layers of stainless steel”; Christopher Nedlik: “Ion-Induced Afterpulsing in the Neutron Multiplicity Meter’s Photomultiplier Tubes”; and Almir Alemic: “Detector Characterization for Advanced LIGO”).

In addition, there were tours of five Syracuse Physics laboratories (led by Ray Mountain, Francisco Rouxinol, David Kelley, Antonio Perreca, Matthew Ware, Avinash Thakur, and Aaron Wolfe) and four 25 minute lectures delivered by SU researchers (Cristina Marchetti, Steve Blusk, Jedidiah Isler, and Matt LaHaye) which served to outline the diversity of research topics and graduate research opportunities in the Syracuse Physics Department. Students also received important information about career options in physics from the opening talk of the day, which was delivered by a faculty member from the Department of Physics at SUNY Oswego, Prof. Caroline Illie.

This year’s event, which was organized by Lisa Manning, Matt LaHaye, and Richard Schnee, appeared to be a great success. From conversations with the attendees and from observing the day’s activities, we can say that students’ enthusiasm for the event was very high: their talks and posters were, without exception, top-notch; and their participation during question and answer periods after each of the talks was highly engaging and catalyzed informative discussions. Many of these discussions were with current SU physics graduate students who volunteered their time: Brian Maynard, Matthew Kelsey, Michael Bowles, Stephanie Hathaway, Sven Wijtmans, Thomas Massinger, Wei Jiang, Yu Chen, Hugo Hao, Kyle Lawlor, and Craig Fox. Overall, we think that all of the participants left with a sense of excitement about physics and a positive impression of the Syracuse Physics Department.

UNIVERSITY SCHOLAR

Dylan Hsu was selected as a Syracuse University scholar. This honor is bestowed on only 12 graduates each year across the entire University’s graduating class (not just Arts & Sciences).

Dylan was one of 10 seniors nominated by the College, based on their academic achievements at the highest level for the University-wide SU Scholar award.

Over the last four years, Dylan has demonstrated exemplary academic achievement and scholarship in both physics and mathematics, and has been engaged in the performing arts at a very high level. He has also been a tremendous contributor in the department. Dylan has been working in the HEP group for the almost four years, and Marina has been his research mentor for most of that time. He has shown great creativity and abilities in number of areas, and has made great contributions to the group’s research efforts.

He is in great company of other Syracuse scholars from physics, including Ryan Badman (2013), Gavin Hartnett (2009) and Jeremy Chapman (2007) [Jeremy & Ryan also conducted research in the experimental HEP group].

PHI BETA KAPPA INDUCTION

Samantha Usman

Goldwater Scholarship Honorable Mention

Samantha Usman was listed as Honorable Mention as a Goldwater Scholar. Samantha is majoring in physics and mathematics and participates in the Renée Crown University Honors Program. At the end of her freshman year, Usman became involved with the Laser Interferometer Gravitational Wave Observatory (LIGO) and began working with Duncan Brown, associate professor of physics. Within the lab’s research Usman analyzed and helped to interpret data. She continued her work with LIGO this year as a research assistant and took an independent study course to learn more of the theoretical ideas behind gravitational waves.

“This combination allows me to focus on two main aspects of the project: understanding the theoretical physics driving the experiment and the process by which observations work,” says Usman. “In the research portion of my work, I focus on data analysis and how to improve the algorithms being used. In my independent study class, I explore the physics behind the project. This combination allows me to improve my overall understanding of LIGO and help increase my contribution to the project’s scientific goals.” She is working on a paper for future publication.
The Subatomic Poltergeist—Mitch Soderberg

In 1956 Clyde Cowan and Frederick Reines installed Project Poltergeist next to a nuclear reactor in South Carolina. As the name implied, they were searching for a ghost. The apparition they were after was not of the sort found in horror stories, but rather a sub-atomic particle hypothesized more than two decades earlier by Wolfgang Pauli as a “desperate remedy” for perplexing results emerging from studies of radioactivity.

Pauli and others were troubled by evidence from experiments conducted in the 1910’s and 1920’s that suggested the radioactive decay of a neutron into a proton and an electron, a process known as beta decay, violated energy conservation. In the prevailing picture of beta-decay with only a proton and electron in the final state, the electron should emerge with a specific energy as dictated by conservation laws. Instead, experimentalists observed that the electron possessed a broad range of energies. This situation had led some physicists, including Niels Bohr, to suggest abandoning conservation of energy as a law of nature. Pauli’s remedy was to suggest that a third particle must be emitted in beta-decay, thus providing the desired wiggle room for the electron to take on the observed range of energies. He knew his hypothetical particle must be neutral, to conserve electric charge in beta-decay, and that it must have a vanishingly small mass to fit within the experimental data that was observed. He claimed to have done a “terrible thing” in postulating a particle so minuscule as to surely never be accessible to experimentalists.

Cowan and Reines placed their experiment next to a nuclear reactor since these facilities are the source of copious amounts of decaying neutrons, and hence should be glowing with Pauli’s hypothesized particle. If Pauli was correct, these particles would pass right through the walls of the nuclear reactor and then through the Project Poltergeist detector, which was a simple vat of water surrounded by a light collection system. Occasionally, one of them should interact in the water and produce a double-flash of light with a characteristic delay between the flashes. Indeed, Cowan and Reines observed such double-flash signatures, and also confirmed that when the nuclear reactor was shut off the rate of these signatures dropped to zero, further proving they were observing particles originating from the reactor. They had experimentally confirmed Pauli’s particle in a direct measurement, and for this work Reines would later be honored with the 1995 Nobel Prize in physics. The elusive particle they discovered in their experiment is now called the neutrino, an Italian term coined by Enrico Fermi which translates to “little neutral one”.

Fast-forward to the present day and neutrinos have continued to be the source of exciting surprises. We now know there are three different flavors of neutrino (electron neutrino, muon neutrino, and tau neutrino), along with their antineutrino counterparts. A neutrino produced as one flavor can transmute into another as it travels, a quantum-mechanical phenomenon known as flavor oscillation. Neutrinos are ghostly indeed, able to pass unfettered through light-years of lead with very little probability of interaction.

Given this extraordinary meekness, it is quite impressive that we know so much about these particles, and interest in them has continued to grow since the pioneering work of Cowan and Reines. There are a wide array of experiments around the globe, in locales ranging from under the ice of the South Pole to deep underground in a mine in northern Minnesota, that are focused on studying neutrinos. The reason for this worldwide interest is that there is still much to learn about neutrinos and what role they may have played in the evolution of the universe. Modern experiments are trying to clarify the picture of how neutrinos oscillate in flavor as they travel, and whether neutrinos and antineutrinos behave in the same manner. If neutrinos and antineutrinos behave differently, violating Charge-Parity (CP) symmetry, this could help explain how our universe came to be dominated by matter. Experiments to study neutrinos have continued to evolve since the days of Project Poltergeist. Detectors that use a vat of liquified argon, as opposed to water, offer attractive capabilities for this research. The liquid argon (a cryogen almost as cold as liquid nitrogen) is outfitted with sense wires and photomultiplier tubes to look for the tell-tale flashes that occur when a neutrino interacts with an argon atom. These detectors can provide crystal-clear pictures of neutrino interactions, and they have the added advantage that they can be scaled to very large sizes. Scalability is a necessity in neutrino physics, since the paltry interaction rate of neutrinos means you need to either have a very intense source of them, or a very large detector, if you want to accumulate a respectable sample of interactions to study.

At Syracuse we are working on experiments that utilize liquid argon detectors to study beams of neutrinos created at Fermi National Accelerator Laboratory (Fermilab) near Chicago, IL. Among these is the MicroBooNE experiment, which features a cryostat the size of a semi truck trailer and holds 150 tons of liquid argon. MicroBooNE sits in the path of a neutrino beam at Fermilab, and will begin taking data late this year. Numerous components for MicroBooNE’s sensitive detectors were built at Syracuse, and group members helped to construct the detector at Fermilab. To search for CP violation with neutrinos will require a massive experiment holding tens of thousands of tons of liquid argon. To put that in context, the desired amount of liquid argon in this experiment will occupy a volume approximately the size of the Physics building. This experiment will be located deep underground in a mine where ethereal neutrinos can easily penetrate but other particles can’t reach. It will be used to search for CP violation, and also to look for astrophysical phenomena such as core-collapse supernovae which produce a burst of neutrinos.

The neutrino may be the shyest member of the subatomic particle world, but its impact has been remarkable.
**Faculty News**

**Stefan Ballmer** gave two talks; one “Commissioning Advanced LIGO to the 1st lock” at the National Astronomical Observatory of Japan and “The Promise of Future Gravitational-Wave Interferometers”, *Workshop on Frontiers of New Physics: Colliders and Beyond*, Trieste, Italy.

**Simon Catterall** was plenary speaker at the meeting “Non-perturbative quantum field theory”, DESY, Hamburg, Germany and was invited to speak at colloquia in Darmstadt, Purdue, MIT, and Columbia University.

**Jay Hubisz** gave an invited talk, “Dilaton Phenomenology” at LHC - The First Part of the Journey, KITP, UC Santa Barbara and seminars on “A Light Dilaton and a Suppressed CC Without Fine Tuning” at Penn State University and the University of Pittsburgh.

**Alan Middleton** was invited to speak at the Santa Fe Institute Workshop on Deep Computation in Statistical Physics, on “How Far Can You Go With Polynomial Time Algorithms?” He also spoke at the New York University Symposium Statistical Physics of Disordered Systems on “Which Measures of Spin Glass Overlaps are Informative?”

**Liviu Movileanu** gave an invited talk, *Telluride Workshop on Biophysical Dynamics*, at the Telluride Science Research Center, Telluride, Colorado. He also gave the keynote lecture, “Engineered Nanopores for Challenging Tasks in Biosensor Technology”, *The Third International Conference on Analytical and Nanoanalytical Methods for Biomedical and Environmental Sciences, ANMBES 2014*, Transylvania University of Brasov, Brasov, Romania.

**Scott Watson** was an invited visitor, DAMTP, Cambridge University and gave talks on supersymmetry and dark matter there, in Trieste and at several universities in the US. At the direction of NSF and DOE he participated in two groups to identify the direction the future of physics should take and to communicate the results to the funding agencies.

**Eric Schiff** was awarded a National Science Foundation grant of $163,000 over three years for a “Fundamental Research on Physics of Instability of Organic Solar Cells: Collaborative Research”. He gave talks on solar cells at Seton Hall and Rutgers Universities. At the Spring 2014 Meeting of the Materials Research Society in San Francisco, he presented a half of a day-long tutorial, “Thin film silicon and related materials for solar cells and displays.”

**Peter Couvares** attended HTCondor West 2014, Madison, WI both as a speaker, “Scaling Condor on XSEDE for LIGO”, and as a moderator. He was appointed to be the Computing Architecture Lead for the LIGO Scientific Collaboration, as well as the interim Data Analysis Computing Manager for the Advanced LIGO project.

**Kameshwar Wali** reached out to the local community with a two hour talk: *From Indestructible Atom to Invisible Quark: Is there an End to Physics?* in Warsaw, Poland he gave a talk on Metric Theories of Gravity with Torsion confined in an Extra Dimension.

**Allen Miller** organized meetings of the Physics Alliance of Central New York on Saturday morning, October 26 and again February 8, in which twenty to twenty five physics high school teachers participated, at the Physics Building.

**Sheldon Stone** gave an invited talk on the q anti-q or four-quark nature of scalar mesons at the Division of Particles and Fields meeting in, Santa Cruz, CA. He with L Zhang published an article in PRL and he was quoted in an NBC news story saying, “This is the place to look for new physics. The NSF granted $396,900 for a project is to design and build the central core of the Upgrade Tracker for the LHCb experiment at CERN in Switzerland.

**Kenneth Foster** gave seminars “The traveling waves that provide the thrust of cilia” at the Cilia Journal Club of Upstate Medical University, Syracuse and at the Biology Department, Syracuse University on “Why sperm tails are tapered and other tales”.

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Apart from giving a lecture on Gravity from Order and Number: Causal Sets at Imperial College in London, **Rafael Sorkin** gave several lectures abroad and in this country on fundamental questions in physics. He spoke on the nature of black hole entropy, raised questions about the cosmological constant, and lectured on quantum measure theory.

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“Disordered” materials are made up of objects such as atoms, molecules, grains, or cells that are all jumbled up—they do not lie in neat orderly patterns. Disordered materials often have interesting mechanical properties—for example, mayonnaise starts out as a fluid-like mixture of two liquids, but becomes stiff when the oil droplets inside the water pack tightly together.

Many disordered materials, including bulk metallic glasses and some types of polymers, are exceptionally strong and tough, and they are very good for making precision objects because they do not change their shape when they cool down. However, they cannot yet be used in industrial applications because they are prone to failure. My research group is searching for the defects in these materials, which self-organize to form crack-like fissures called shear bands. The hope is that once we understand the behavior of these defects, we can design materials that do not fail as easily.

Our group is conducting research under a new NSF Faculty Early Career Development (CAREER) award entitled “Flow, failure and migration in disordered materials”, which provides $450,000 over the next five years.

Although defects in a crystal are easy to spot, because that’s where the crystalline order breaks down, one might think the idea of a defect in a disordered solid is an oxymoron. However, our group has recently shown that defects—localized regions that are more likely to deform under stress—do exist, and govern the behavior of disordered materials under applied stress. Physicists have searched unsuccessfully for decades to find an order parameter that characterizes defects, and so we have chosen a different approach: analyzing the linear response, or sound modes. It turns out that inside disordered solids, sound waves vibrate in a special, universal way. Most of the time, the very lowest frequency modes look like plane waves, but sometimes they vibrate strongly around a defect. We have used those strong vibrations to successfully identify defects in disordered solids for the first time.

Now, with the support of the NSF CAREER grant, my group will characterize these defects, answering questions such as: What is the density of defects? How do they interact with one another? How do their properties change with the pressure, temperature, and material preparation? Currently, our group is developing a new method that adds an artificial potential to a solid to remove the plane wave background and isolate localized excitations (i.e. defects). In addition, our recent theoretical investigations have shown that a new class of random matrices leads to useful models for the dynamical matrix of a solid, which describes the solid’s linear response. Specifically, we have found that most of the sound modes in disordered solids are identical to those in this class of random matrices. In addition, the random matrices have no plane waves and localized modes at low frequencies, and this could help us understand the origin of low-frequency quasi-localized excitations in disordered solids. We are exploring these random matrices to see if we can calculate from first principles why the defects exist in the first place, and how many defects there are.

Understanding disordered solids also has important applications in biology, because disordered arrangements of cells exist in many biology tissues, including developing embryos, wound healing, and certain cancers. The geometry of cells in tissues look almost identical to that in foams or emulsions, although the cells have additional types of mechanical interactions. And although biologists understand single-cell movements, it is not clear how cells move through dense tissues, where a cell has to push its way through its neighbors.

Recently, my group has published several papers demonstrating that cells really do have difficulty moving through a dense tissue, and we’ve developed a new framework for modeling cell migration in dense tissues. See Figure 2.

This framework allows us to answer exciting questions. For example, we are using the model to study how developing embryos set up the left-right body axis, which has recently been shown to depend strongly on mechanical interactions between cells. In addition, recent experimental work has suggested that aggressive cancer cells tend to be softer and yet more contractile than other cells. Our new theory and simulation should allow us to predict and verify whether this precise combination of mechanical properties allows a cancer cell to move more quickly through the surrounding tissue and metastasize.

A goal of the grant’s educational component is to increase diversity and retention in STEM (Science, Technology, Engineering and Mathematics) disciplines. Through SU Project Advance, I am developing tutorials for high school juniors and seniors to earn college credits. Using research by Economics Professor Jerry Evensky, I am developing an open-source online physics-math tutorial to “tune-up” students’ math skills. I am also working with physics education expert Scott Franklin from the Rochester Institute of Technology to develop a course and curriculum for graduate teaching assistants (TAs) and undergraduate learning assistants (LAs) who guide students in workshops/recitations.
The World without the Higgs

The world waits eagerly to learn
The latest thrilling news from CERN:
The Higgs did finally arrive.
The Standard Model is alive!

But, if you’d ask me to withdraw
A single universal law,
I’d say \textit{inertia} is a pain
Like hurricanes, like acid rain.
I ask you, do we need molasses
To gum up space and slow down masses?

Rocks in your path to stub your toes on
Because of that accursed boson.
Without the Higgs the rock would fly
Light as the wind into the sky
Beyond the clouds and out of sight,
Already at the speed of light.

Erich Harth

Tribute to Joe Schechter

December 14, 2013 the physics department held a dinner honoring Professor Joe Schechter for 48 years of service to the department and to wish him well on his retirement. After receiving his PhD under the supervision of S. Okubo at Rochester he did a postdoc with the Noble Prize winner Y. Nambu before choosing Syracuse as his academic home. Joe was a popular teacher and seminar speaker who always brought a straightforward clarity to his presentations. As a thesis advisor he was in much demand and mentored over 20 graduate students and numerous Post-docs who went on to illustrious careers, on several continents, in academia and industry.

Joe’s research spanned the gamut of elementary particle physics especially the weak and strong interactions. Joe is particularly impressed by the role of symmetry in nature. His most cited work is on neutrinos, ghost like particles that fill the universe, which are crucial for radioactive decays and as to may hold the clue why there is matter in the Universe. Joe and collaborators were particularly concerned with the patterns and implications of neutrino masses well before the masses were discovered and his work increased in relevance over the years.

The theory of strong interactions, QCD, is notoriously difficult to solve. Joe pioneered the use of effective field theories for describing the results of QCD at low energies. The effective theories incorporate all the phenomenological implications of the symmetries of QCD. These theories have proven enormously useful and influential. Joe also did important work on supersymmetry and solitons. Most recently Joe revisited a nagging problem in hadron physics for which he proposed the existence of states with more than the standard quark anti-quark pair.

Joe published over 200 papers which have 10,000 citations! Even though he is retired he is still active in research and continuing to publish. We wish him continued success. - Carl Rosenzweig

Departmental Teaching Awards 2013-2014

\begin{center}
\begin{tabular}{|c|c|}
\hline
\textbf{Fall 2013} & \\
\hline
Duncan Brown: & Matt LaHaye: \\
AST 101 & PHY 216 \\
\textit{Dinner} & \textit{Dinner} \\
\hline
Steve Blusk: & Sheldon Stone: \\
PHY 424 & PHY 568 \\
\textit{Lunch} & \textit{Lunch} \\
\hline
Cristian & Jen Schwarz: \\
Armendariz-Picon & PHY 831 \\
PHY 567 & \textit{Lunch} \\
\textit{Lunch} & \\
\hline
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\begin{center}
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\hline
\textbf{Spring 2014} & \\
\hline
Mitch Soderberg: & Lisa Manning: \\
PHY 212 & PHY 211 \\
\textit{Dinner} & \textit{Dinner} \\
\hline
Jen Schwarz: & Paul Souder: \\
PHY 216 & PHY 300— \\
\textit{Dinner} & \textit{Lunch} \\
\hline
Jay Hubisz: & Matt LaHaye: \\
PHY 885 & PHY 651 \\
\textit{Lunch} & \textit{Lunch} \\
\hline
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In addition to being identified as one of the 143 Outstanding Referees of the Physical Review and Physical Review Letters journals, the research accomplishments of Cristina Marchetti have received recognition from two major organizations. The American Association for the Advancement of Science elected Cristina a Fellow of the AAAS for her “pioneering work on statistical mechanical systems far from equilibrium, ranging from vortices in high temperature superconductors to self-organization in biological systems.” The American Academy of Arts and Sciences elected Cristina to membership. This highly selective honor recognizes Cristina’s numerous influential contributions to the physics community.

Cristina’s research on the “Self-organization of dense active matter” was awarded a grant of $405,000 over three years by the NSF. It will support research on the collective properties of active matter, which is composed of many interacting self-driven particles, such as swarms of swimming bacteria, self-propelled colloidal particles, and cell colonies or tissues.

The Alfred P. Sloan Foundation has recognized Lisa Manning for her work with a 2014 Sloan Research Fellowship. She will receive $50,000 to further her research on understanding the mechanical properties of biological tissues and non-biological materials (see page 7). “The Department of Physics nominated Lisa because of her outstanding accomplishments, future promise as a scientist and her leadership abilities,” says Alan Middleton, department chair. “She brings energy and depth to many activities—she has pioneered new technologies in the classroom and has great enthusiasm for teaching. In her research, she uses computers and sophisticated theoretical methods to study experiments on both cell migration and granular—sand-like—materials.”

Britton Plourde had a very busy year. He gave talks at various institutions in Cambridge, MA, Bremen and Saarbrücken in Germany, Benasque in Spain, and at Physics Institutes in Germany, Switzerland and the United States. He also spent a month as Visiting Professor of Physics at the University of the Saarland in Saarbrücken, Germany. Recently, the Army Research Office awarded him $2,250,000 over 36 months as lead PI for a new project titled “Scalable Readout of Superconducting Qubits with Novel Superconducting Amplifiers and Metamaterials”.

Jedidah Isler, a Chancellor’s Faculty Fellow, is a co-PI on a NASA Fermi Guest Investigator grant for $200,000 over two years. This work will focus on blazars (active galactic nuclei with relativistic jets) and will use optical/infrared telescopes for studying blazar flares.

Martin Forstner is a co-Principal Investigator on a National Science Foundation grant of $459,014 to purchase a fluorescence activated cell sorter. The machine will be rather impressive: it will use four lasers to sort cells of many types, large and small, at rates up to 70,000 cells per second with high accuracy. The cell sorter will be used to be used for projects in several departments with Dacheng Ren (ECS) the PI and are Rebecca Bader (ECS) and Katharine Lewis (BIO) are also co-PIs.

Duncan Brown is PI or co-PI on three grants received from the NSF related to research with LIGO.

One is a grant of $385,442 from the NSF as part of a three year Collaborative Research project with numerical relativists (Caltech, Cornell), nuclear astrophysicists (U. Washington), and gravitational-wave observers (Syracuse) to explore core-collapse supernovae and the properties of stellar remnant, to understand electromagnetic transients and gravitational-wave phenomena in compact objects; and to reveal the dense matter equation of state.

Another is a proposal on “Gravitational Wave Astrophysics with Advanced LIGO” in the amount of $360,000 over three years. The third is a grant on LIGO workflow development in the amount of $300,000 which will be applied to work on making workflows “metadata-aware” that will make scientific results easier to share, reuse, and reproduce. This approach will be applied to LIGO data and will be shared with a larger community. Finally, Duncan is also co-PI on a grant of $498,452 to improve the communications among the components of the campus computing pool that is used by people in many departments.

Tomasz Skwarnicki led the data analysis that confirmed the existence of a four-quark particle. The PRL editor spotlighted the LHCb article for exceptional research. He was interviewed by VOA on the subject.

Matt LalHaye received NSF grant of $260,000 over two years to work on a project titled “MaterIals World Network: investigations of Quantum Fluctuation Relations Using Superconducting Qubits”. This award will support joint work with Frederico de Brito and Amir Caldeira of Brazil on theoretical and experimental work on how micro- and nanoscale systems exchange energy with their environment, which affects mechanical efficiencies at the nanoscale and quantum-assisted sensing and quantum
BICEP 2

The polarization of gravitational waves expands lengths in one direction and contracts lengths in the orthogonal direction, its tensor property. Many experiments have been set up to measure the change in length by observing a laser beam that has been split, travels in two equivalent orthogonal directions and then recombined to interfere. Syracuse University has been involved in the LIGO collaboration which has two such sites in Louisiana and Washington (see PHYSICS MATTERS v3, September, 2003). LIGO is looking for effects from binary combinations of neutron stars and black holes as well as from supernovae. The last observing run (through 2010) looked out to the Virgo cluster, but no signal was detected. Improvements are being installed so that within the next 3-6 years detection is expected. Advanced LIGO will be able to search the sky ten times farther out than the Virgo cluster. Thus, it will examine a volume a thousand times larger.

Gravitational waves were also produced in the interaction of matter in the big bang origin of our universe. These waves are too weak to be measured directly at the Earth. However, the contraction and expansion of space produced by the gravitational waves has an effect on the black body cosmological background radiation - a useful tool for examining the distribution of matter. One uses the direct look-back to the surface of last scattering, at gravitational lensing, and, for more detail, at the polarization of the CBR. These tools have been used to study the distribution of matter, including dark matter, in the galaxies as well as the density of dust along the journey to Earth. In particular, the distribution of dust produces a shift in the direction of polarization. Any gravitational effect has been too small to be seen.

However, over roughly the last ten years, efforts have been made to measure the polarization of the CBR out at the beginning of time. The gravitational effect one is looking for is quite subtle. One expects that at the time of the big bang there was a burst of gravitational radiation as well as electromagnetic. As the electromagnetic field radiates, it moves through the undulating space-time produced by the gravitational waves. Current cosmological theory calls for a period of rapid expansion of the physical space. This rapid expansion produces the apparent isotropy and uniformity of the distribution of the matter. It also expands the wave length of the gravitational waves that jiggle the charged plasma of electrons and other charged particles. By the time the radiation reached the surface of last scattering, the wave length of the oscillating space-time was of the right order to have a measurable effect on the scattering of the CBR by the plasma. This effect shows up in the polarization of the CBR. The tensor property of the gravity waves produces two distinctive effects. One is electric type and the other magnetic – E mode and B mode. The E mode is linear while the B mode is like a curl. It produces a rotation of the polarization. See figure 1. The polarization produced by the scalar field of inflation is E mode and that produced by lensing and is mainly E mode. Therefore, to identify a gravitation interaction with the CBR, one must see a significant B mode effect. And that is what now is claimed to have been measured.

In 2005, a consortium called BICEP 1 reported a null result from data taken with a 26 cm aperture telescope located at the South Pole. In 2010 observations were renewed with an upgraded telescope. Data collection ran through the 2012 observing time. In March, 2014 the consortium announced a positive result. The result is given as a ratio of B mode to E mode, r=2. See figure 2.

It is believed that E mode can be converted to B mode by dust traversed by the radiation from the early universe and also by gravitational lensing. The BICEP 2 consortium claims that neither effect changes their result based on lensing results and the available knowledge about the density of dust in the space intervening the galaxies. However, there are skeptics who await a better estimate of the density of dust. Also, in the next few years measurements from other consortia will be reported as more data is collected. The BICEP 2 result will be upheld or denied.

In the meantime, this is a very exciting and important event. First of all, if true, two physical predictions are verified. One is the existence of gravitational waves and the other is the verification of that there was a strong inflationary period shortly after the big bang. The study of the details of the B mode polarization gives cosmologists and astrophysicists a tool to investigate the beginnings of our universe and possibly of the multiverse.

More information can be found in the following references:
L. Krauss, Peering Back to the Beginning of Time, Physics 7, 64 (2014)
D. Lindley, Theorists Weigh in on BICEP2, Physics 7, 65 (2014).
https://www.youtube.com/watch?v=4IlBNJhCzfk
These two results unfortunately are in disagreement and therefore a clear observation cannot be claimed. However, the search continues with both light blue area predict WIMPs with masses of a few GeV/c²; generic WIMP models (dark blue area) predict larger masses of hundreds of GeV/c².

A simplified plot that shows the predicted WIMP-nucleon scattering cross section as a function of WIMP mass. Asymmetric dark matter models con blocks in which to see an interaction with the dark matter particles. When a wimp hits a silicon atom an electron is set free and the atom jiggles. The existence of matter in the universe that interacts gravitationally, but very weakly, if at all, through other fields is required to explain the rotation curves of the stars in the Milky Way as well as gravitational lensing by galaxies and the polarization properties of the black body radiation.

Because the particles making up the dark matter interact weakly with particles of the standard model, they are referred to as wimps.

Shortly after this celebration, the Department of Energy announced support for Paul’s proposal titled “Spin Dependent Phenomena in Medium Energy Physics”. This award is in the amount of $1,173,000 and will allow Paul to continue his work in this area for three years.

PAVI14 is sponsored by Associazione Romana per le AstroParticelle (ARAP), Thomas Jefferson National Accelerator Facility (Jefferson Lab), and Welch Allyn.

Dark Matter Observed?

The existence of matter in the universe that interacts gravitationally, but very weakly, if at all, through other fields is required to explain the rotation curves of the stars in the Milky Way as well as gravitational lensing by galaxies and the polarization properties of the black body radiation. Because the particles making up the dark matter interact weakly with particles of the standard model, they are referred to as wimps.

In the past year, two experimental groups reported on their ongoing observations. Richard Schnee is an active member of the Cold Dark Matter Search (CDMS) group in the Soudan Mine in Minnesota (see PHYSICS MATTERS, V4, September, 2009). This experiment uses cylindrical silicon blocks in which to see an interaction with the dark matter particles. When a wimp hits a silicon atom an electron is set free and the atom jiggles. The electron is detected and the jiggling warms the silicon which is held at temperature of 40 millikelvin. This group claims to have seen three events of correlated electron capture and temperature change.

The other experiment is the Large Underground Xenon (LUX) experiment in South Dakota. This experiment uses a cryostat filled with 370kg of xenon from which they currently use the innermost 118 kg to search for dark matter. Liquid xenon is an excellent scintillator: Any particle interaction results in a prompt flash of light that is observed by an array of photomultiplier tubes. Application of an electric field allows the detection of the ionization generated by the interaction, too. Just like in CDMS, analyzing these two signals allows experimentalists to discriminate between electronic and nuclear recoils. Although LUX is more sensitive than CDMS, they did not see any evidence for wimps.

These two results unfortunately are in disagreement and therefore a clear observation cannot be claimed. However, the search continues with both experiments and others using different observation techniques and other interactions.

A simplified plot that shows the predicted WIMP-nucleon scattering cross section as a function of WIMP mass. Asymmetric dark matter models (light blue area) predict WIMPs with masses of a few GeV/c²; generic WIMP models (dark blue area) predict larger masses of hundreds of GeV/c² or more. Parts of these parameter regions have been probed and excluded by current experiments (red area). The signal excess of the CDMS experiment points towards relatively light WIMPs (green area). However, the absence of a signal in the LUX experiment is in tension with this result.

Most of the expected parameter space could be probed in the near future, until a background from coherent neutrino-nucleus scattering (yellow area) becomes relevant, interfering with possible dark matter signals.
Kameshwar C. Wali Lecture in the Sciences and Humanities

Diane Ackerman was the sixth lecturer in the Kameshwar C. Wali Lecture in the Sciences and Humanities. She spoke on EVERYDAY HEROISM: The Subversive Power of Compassion. Her lecture was based on research for her book, The Zookeeper's Wife (2007), which tells the story of how Jan and Antonina Zabinski gave refuge at the Warsaw zoo to hundreds of Holocaust refugees, and which speculates broadly on the human relationship with nature. The book received the Orion Book Award, which honored it as “a groundbreaking work of nonfiction in which the human relationship to nature is explored in an absolutely original way through looking at the Holocaust.” A film based on the book is presently in pre-production. Ackerman’s most recent book, One Hundred Names for Love is about her life with her husband following his disabling stroke. It was a finalist for the Pulitzer Prize and the National Book Circle Critics Award.

Diane Ackerman, as the sixth K. C. Wali lecturer, followed Lynn Margulis, Janna Levin, George Packer, Ian Shipsey, and Arthur Zajonc. She has written two dozen volumes of nonfiction and poetry, including A Natural History of the Senses.

Prof. Wali’s family and friends endowed a fund for the annual lecture to honor his 80th birthday in 2008, and the lecture receives additional university support from the Syracuse Humanities Center and the Department of Physics.

Doctoral Prizes

Shiladitya Banerjee has won the Award for Outstanding Doctoral Thesis Research in Biological Physics. This very competitive prize is given by the American Physical Society’s Division of Biological Physics. The award includes a $1,500 prize for Shiladitya and additionally $500 to support his travel to the 2014 APS March Meeting in Denver where he presented his work. Shiladitya will also organize an invited session for March 2015 based on his area of thesis work. Shiladitya’s defended his thesis, completed with Prof. Cristina Marchetti, in April, 2013 and is currently a postdoctoral scholar at The University of Chicago in the James Franck Institute.

Chancellor’s Faculty Fellow Jedidah Isler was selected for the Roger Dossy Travel Prize from the American Astronomical Society. This annual dissertation prize is awarded competitively based on submitted thesis abstracts. This year, 10 prizes were awarded, which is about 10% of submitted abstracts. The award included full travel funding and registration at the annual meeting and recognition in the Society’s newsletter. Jedidah defended her thesis, completed at Yale University, in October.

Graduate Awards

Aarti Veernala and Jayanth Neelakanta were selected as recipients of Outstanding TA Awards for this academic year. This award is presented by the Graduate School to “Teaching Assistants who have made distinguished contributions” through instructional activities. Graduate students are nominated for the award by their departments, and the selection is made by a university-wide committee of faculty recognized for their teaching excellence. The Outstanding TA Award is given to approximately the top 4% of all TAs campus wide.”
Passing Thoughts...

**Martin Abkowitz**

Martin Abkowitz was hit and killed, January 30, 2014, while walking on Holt Rd. near his home in Webster, NY. The driver of the automobile, who was under the influence of alcohol and drugs, was charged with manslaughter.

Martin was a student of Arnie Honig’s and came back in the spring of 2010 to celebrate 60 years of condensed matter physics. CM60@SU: 60 years of condensed matter research at SU that also celebrated over 50 years of Arnie Honig. Martin received his PhD in 1964, spent one year as a Postdoc at the University of Pittsburgh and then spent the next 33 years at the Xerox research laboratory in Webster, New York. He had the title of Principal Scientist at Xerox where his research interests included: injection and interfacial phenomena, electronic transport and the dielectric properties of amorphous semiconductors and disordered molecular and composite materials. In addition, Martin participated in the design of polymer based electronic and transducer devices including imaging receptors. He also served as Adjunct Professor of Physics at the University of Rochester and has been an Industrial co-principal Investigator at the NSF Science Center on Photoinduced Electron Transfer at the University of Rochester.

**John David Fitzgibbons**

April 20, 1930 – April 27, 2014

John David Fitzgibbons (b. 4/20/1930) passed away after a brief illness on 4/27/2014. We knew him as Fitz, but was also affectionately known as Doc by many. Fitz joined AAPT in 1956, and attended his first national meeting just a few years after in Chicago. Fitz was extremely active in physics education at the local, state, national, and international levels.

Fitz began his teaching career after serving in the military as a radio operator between the Korean and Vietnamese Wars. He served as a physics education consultant to the New York State Department of Education. Fitz retired in 1992, and along with Joe Drenchko, took over the lecture demonstration and instructional labs at Syracuse University for a year, then graduated to become the world’s oldest TAs. Together, they taught physics to hundreds Syracuse University students over the next ten years. Fitz was a co-founder of the Syracuse University High School Physics Teacher Saturday Morning Workshops, which started in 1993 and continue today.

Fitz’s accolades in AAPT are numerous…

- 2001-2003 Committee on International Education
- 2003-2005, 2008 Nominating Committee
- 2001-2007 Inter-American Council
- 2003-2005 Chair of Committee on International Education
- 2008-2011 Membership and Benefits Committee
- 2002-2009; 2011-2014 NY Section Representative
- 2002 Homer Dodge Distinguished Service Citation recipient
- 1993 NYSS-AAPT Distinguished Service Award
- 1988 Woodrow Wilson Institute

Fitz was a participant in the second class of PTRAs (Physics Teachers Resource Agents) in 1986, and remained active in that program. Since then, he has gone on to co-lead dozens of workshops for hundreds of physics teachers, the last during the Spring 2014 NYSS-AAPT meeting in Rochester.

Since attending his first national meeting, he missed only a few due to other AAPT related activities. He was intimately involved in the creation of the Physics Video Classics set, was a member of the AAPT/NSF consortium that traveled to Denmark in 1996 to study physics education in a European context, and was a 50 year participating member of GIREP, attending many of those conferences (Together at GIREP, Fitz and Drenchko were known as Laurel and Hardy. Who was Laurel and who was Hardy is still unknown.).

**Sam Sampere**
Owen Lewis, ‘73

… I have this "oh, I need to remember my roots but the day-to-day tends to overwhelm me" every so often…Doc’s death, and all the swirl surrounding his memorial efforts by Paul Norton and Doc’s other grad students, and my own pending retirement (moving to halftime and giving up the reins of PRA) are slowly making me pay more attention to the SU part of my life. Indeed, I’m in the process of updating my will and will be adding a small contribution to SU/Physics Dept.

…I did not start Photon Research Associates (PRA). But I can say with some pride that my joining moved it to increase in size by a factor of four and ultimately positioned it to be purchased by Raytheon about 10 years ago. And I have held the title of “President” for the last 15 years. In any case…

SU was part of my life from when I entered as freshman physics major in 1962 until I left the Syracuse area in 1974, after doing a post-doc in the EE department. Throughout, my focus was more device/gadget oriented than many of my peers. Indeed, as I think about it now, while at SU, I can claim to be the first person ever to record Edison cylinders using lasers; pioneered measuring thin film depositions (and have an equation describing the process of updating my will and will be adding a small contribution to SU/Physics Dept.

But more memorable were the teachers and grad students who helped me find my way into the physics profession, with the most significant person in my SU days being a giant in infrared detection systems, Henry Levinstein. He was my undergrad advisor (and who introduced me to a fellow undergrad who later became my wife), gave me a part-time job in his research lab and, when in grad school, "hired" me to help him with his (in)famous physics of toys course.

After finishing my post-doc, I joined Xerox in Rochester. There I worked on the then-new color xerography machines, but soon decided that this was not the right career path (particularly since I’m color blind!). For reasons I still don’t quite understand, another fellow SU grad, Dave Brown, got me to apply for a position, through General Electric, at the newly formed Laboratory for Laser Energetics at the University of Rochester, working on laser fusion. I soon found myself at the cutting edge of high power laser system development, routinely working late into the night, burning my protective goggles with high power Yag illuminators and blowing up large laser power amplifiers. But as everything was new, no one minded as long as we learned from our mistakes…and we did, patenting a number of bleeding edge concepts.

After a couple of years being a grad student with an industrial salary, I was approached by the Department of Energy to move to DC and take over leadership of fusion laser system development across the country, including the National Lab programs. I couldn’t refuse the opportunity to “play” with these even bigger toys! But after a few years at DoE, I realized that the quest for laser fusion would be multi-generational, and having been approached by the CIA to help them understand other nation’s capabilities in strategic weaponry (lasers, missiles, etc.), I joined the Agency. As one would expect, I can’t talk about this phase of my career, other than to say I developed and fielded a number of special collection systems.

My Agency work prepared me for the next step in my career, being the first Intelligence Community lead for the just formed Strategic Defense Initiative Organization (SDIO, and now renamed as the Missile Defense Organization). But while an exciting job, it was more bureaucratic than I could accept, and so soon fled the government to go to a small company, Photon Research Associates (PRA), that specialized in physic-based modeling of observables related to missiles, aircraft and space systems. With my background, I helped PRA rework its mission such that it quadrupled in size and were ultimately bought by Raytheon about 10 years ago (I have served as PRA president for the last 15 years).

During my years at PRA, we developed the first optical discriminates used for determining ballistic missile threats from non-lethal objects; deployed a very sensitive OE/IR space system (MSX) to measure the infrared space background, particularly near the earth’s limb; pioneered the use of multi-static radars for use in the missile defense mission; and were in the lead in showing how the sensor systems on the Predator and Reaper UAV’s could be repurposed to detect/track/discriminate ballistic missiles, leading to an entirely new class of sensors for the MDA. Also during this period, I chaired a number of government/industry organizations including IRIS and MSS missile defense focused groups, and am very proud to have founded and nurtured the only joint missile defense Intelligence Communities technical coordination group, MDICI.

So while I still don’t want to throw in the towel quite yet, I do look back and conclude: I’m indebted to SU Physics for preparing me for a career where I could contribute to the national good and still have a lot of fun along the way!

Thx, Owen
**Degrees Granted—2013-2014**

**Doctor of Philosophy:**
- Eleni Degaga
- Justin Garofoli
- Bilas Pal
- Jyothish Vidyadharan

**Masters:**
- Nicholas Baxter
- Michael Bowles
- David Kelley
- Liaming Liu
- Xu Ma

**Bachelors:**
- Almir Alemic
- Manu Arul
- Samantha Blatt
- Diamond Breland
- Lena Deb
- Sean Dunfield
- Anna Fadeeva
- Daniel Goldman
- Dylan Hsu
- Chad Kilmer
- Marcel LaChance
- Peter Nelson
- Deborah Noble
- Jonathan Raad
- Paige Samblanet
- Robert Stout
- David Tagg
- Andrew Tenney
- Neill Warrington

**Undergraduate Commencement Awards—2013**
- Neil F. Beardsley Prize—Neill Warrington, Daniel Goldman
- Paul M. Gelling Scholarship—Dylan Hsu
- Award for Academic Excellence—Almir Alemic

**Contribution can be made to the following:**

- **Henry Levinstein Fellowship Fund**—this graduate fellowship is to foster graduate student research with members of the Physics faculty, based on academic excellence of the nominee and promise of excellence in research.

  Henry Levinstein (1919-1986) came to Syracuse University in 1947 and established a laboratory to study the properties of various lead salts sensitive to the infrared spectrum. He introduced a once a week lecture course on the Physics of Toys which was oversubscribed and overfilled Stolkin Auditorium. Much loved by his students, the Henry Levinstein Fellowship Fund was established by them.

- **William Fredrickson Fund**—this undergraduate fund was established to provide a partial tuition scholarship for an incoming freshman who indicates an interest in physics.

  William R. Fredrickson came to Syracuse University in 1928 and was Chairman of the Physics Department from 1939-65. With the end of World War II, he began to build the department by choosing a faculty with strong interests in research. He was admired for his warmth and consideration of both the students and faculty. For his 75th birthday, former students, faculty, and university colleagues contributed funds for the William R. Fredrickson Scholarship Fund.

- **Neill F. Beardsley Prize**—an award to an undergraduate physics major, based on outstanding academic achievement and contributions to the department.

  Niel F. Beardsley was not a student at Syracuse University. He was both the monitor at Wright Patterson Air Force Base of some of the research carried out in Henry Levinstein’s laboratory and a contributor to that research. When he died in 1962, friends and colleagues raised the funds to establish the Neil F. Beardsley Memorial Award whose undergraduate awardee would be selected by the Syracuse University Physics faculty.

- **Paul M. Gelling Fellowship Fund**—a memorial scholarship fund made to an outstanding undergraduate physics major based on outstanding achievement.

  Paul Gelling was a long time jack-of-all-trades in the department from 1949-84. He set up the demonstrations, printed laboratory manuals, constructed laboratory space, and generally took care of the building. When he died in 1984, his children, Paul D. and Susan Gelling and Mary Gelling Merritt, recognized Paul’s identification with and devotion to the department by establishing the Paul M. Gelling Fellowship.

- **General Department Gift Fund:** At the discretion of the Chair, funds are used to support teaching, research, travel and other general departmental needs.

Checks should be made out to *Syracuse University* with an indication of the selected fund, and sent to: Chair, Department of Physics, Syracuse University, 201 Physics Building, Syracuse, NY 13244-1130.
On November 18, 1887, classes were suspended at this fledgling university so students and faculty could attend the dedication of the Charles Demarest Holden Observatory. The main speaker on that occasion was Dr. Simon Newcomb of Washington DC; his talk was entitled “The Place of Astronomy in the Sciences.” Also, undergraduate Henry Sibley, class of 1889, wrote a poem to celebrate the dedication:

Hurrah, hurrah for Syracuse!
Ye winds repeat the story.
Sing in thy loftiest strains, my muse,
Our new Observatory.