Kameshwar C. Wali was an influential theoretical particle physicist at Syracuse University, known for his contributions to the field and his deep appreciation for the arts and humanities. His work in particle physics, as well as his biographies of Subrahmanyan Chandrasekhar and Satyendranath Bose, demonstrate his broad interests and expertise.

Kameshwar C. Wali Lecture in Science and Humanities

Kamesh came from the Argonne National Laboratories to the Department of Physics in 1969. Here he headed the theoretical particle physics group until his retirement in 2000. In that role, he made important contributions to our understanding. Because of his outgoing personality and his genuine fondness for people, he has a wide circle of friends among his colleagues. That fondness was reciprocated and was demonstrated by a conference that was held to celebrate his 60th birthday in 1988.

Kamesh has broad interests in the arts and humanities as well as in physics. His biography of Subrahmanyan Chandrasekhar was widely acclaimed and he is now completing a biography of Satyendra Nath Bose. Kamesh reads widely, is a film buff, and enjoys the arts and music - he is working on a history of the violin. As a result, he has friends among his colleagues in the College of Arts and Science in these areas and, as well, in the University at large. But, Kamesh is not a passive person. If he has an interest, he wants to share it and to build on it. In the '70s he began a campaign to have an annual series of lectures sponsored by the University. When asked about how the series came about, he wrote

Dear Josh,

About my role in the University Lecture series. In 1975, I approached the then Chancellor Melvin Eggers and convinced him that the interaction between the university and the community at large should not be only through sports events. The university should be a cultural center and one of the services it could and should provide was a series of annual lectures by distinguished scholars in various disciplines. With strong support from Chancellor’s office, I formed an ad hoc committee with William Wasserstrom and Colleen Johnson. The series started in 1976. When Johnson left the University, Deborah Pellow became a member.

Lynn Margulis, biologist, educator, and author, although you have spent much of your career studying life at the most minute level, you think big... You have published a formal classification of all life on Earth, contributed to the Gaia theory of interconnectedness among all living things. ... We are pleased to recognize you for sheer mastery of your broad field...and for your commitment as a teacher to sparking the imagination of future scientists from middle school through graduate school.

Chancellor Nancy Cantor, May 10, 2008 in conferring her degree.

Lynn Margulis is a Distinguished University Professor in the Department of Geosciences at the University of Massachusetts, Amherst. She was elected to the National Academy of Sciences in 1983 and received the Presidential Medal of Science from President Clinton in 1999. She is the recipient of The Sigma Xi William Proctor Prize for Scientific achievement and Germany’s prestigious Alexander von Humboldt Prize. In 1998, the Library of Congress announced that it will permanently archive her papers.

Her publications span a wide range of scientific topics that include original contributions to cell biology and microbial evolution. She is best known for her pioneering theory of symbiogenesis, which challenges a central tenet of Neo-Darwinism. This theory posits that new cell organelles, new bodies, new organs and new species arise from symbiosis, in which independent organisms merge to form composites rather than from random mutations. According to this theory independent organisms merge to form composites that differ from their individual original components.

(continued page 2)
Kameshwar C. Wali Lecture con’t

During the following 13 years, we had lectures from such literary figures as James Baldwin, Carlos Fuentes, E. L. Doctorow, Francine de Plessis Gray; scientists such as Sheldon Glashow, Stephen J. Gould, Carl Sagan and S. Chandrasekhar; poets and philosophers like Andre Voznesensky, Czeslaw Milosz and Stanley Kunitz and William Gas; Joseph Papp, Germaine Greer, Emma Rothschild in public affairs and many others. The series ended in 1986, when Chancellor felt that during the intervening years, activity on the campus had increased. There was the Jeanette Watson Professorship with associated public lectures, the annual Exxon Foundation lectures and so on. He felt there was no need of the lecture series supported by his office. The final lecture was delivered by Angela Davis in 1986.

The University Lecture Series started again in a big way in 2001. I was a member of its advisory committee from 2001 – 2007. I have also been on the advisory committee of Syracuse Symposium of the College of Arts and Sciences, which organizes lectures, cultural events and exhibitions associated with specific themes such as Poetry, Beauty, Humor, Borders, Justice, Migration...

Kamesh

On September 25, 2008 the opening lecture will be given by Lynn Margulis of the University of Massachusetts at Amherst.

Honorary Degree for Lynn Margulis con’t

The fusion of genomes in symbioses followed by natural selection, she suggests, leads to increasingly complex levels of individuality.

Lynn Margulis is also well-known for her contributions to James Lovelock’s Gaia concept. First proposed some thirty years ago, Gaia theory postulates that the earth’s surface interactions among living beings, sediment, air, and water have created a vast self-regulating system.

From the beginning of her research career including her 22 years at Boston University, she has been a dedicated teacher. She is known to participate in hands-on teaching activities at levels from middle to graduate school. As if all this is not enough, she is also a first-rate writer being the author of numerous influential articles and books. The most recent include Symbiotic Planet: A new look at evolution (1998) and Acquiring Genomes: A theory of the origins of species (2002), co-written with Dorion Sagan. Indeed, over the past decade and a half, Professor Margulis has co-written a number of books with Sagan, among them What is Sex? (1997), What is Life? (1995), Mystery Dance: On the evolution of human sexuality (1991), Microcosmos: Four billion years of evolution from our microbial ancestors (1986), and Origins of Sex: Three billion years of genetic recombination (1986). Her work with K. V. Schwartz provides a consistent formal classification of all life on Earth and has lead to the third edition of Five Kingdoms: An illustrated guide to the phyla of life on Earth (1998). Their evolutionary classification scheme was generated from scientific results of numerous colleagues. The logical basis for it is summarized in her single-authored book Symbiosis in Cell Evolution: Microbial communities in the Archean and Proterozoic eons (second edition, 1993). The bacterial origins of both chloroplasts and mitochondria are established. At present she works on the possible origin of cilia from spirochetes.

Above taken, with permission, from the nominating letter of K.C. Wali.

Focus on the Staff—Arlene Johnston

Arlene was raised on a farm in Wisconsin and went to a one room school. It must have been a very good room to judge by the work she does here. When she and her husband moved to Syracuse, they bought a small farm so they could raise horses. They continued to raise horses and four children after Arlene came to work in the Physics Department as a Receptionist in 1996. Her skills were recognized when she became the Undergraduate Coordinator in 2000. In that role she meets and helps undergraduate students in Physics and Astronomy, and she directs lost students to the appropriate class rooms. She says that most students are very nice. But she recalls one rude student who left in a huff to seek higher authority because he could not get his way. The next day he returned meekly and was very nice thereafter. Last fall, she began an additional responsibility as Financial Assistant to Patti Ford. In this role she tracks the shop and SUSIL (see article by Britton Plourde) charges and prepares monthly reports for the research groups. Patti says that she couldn’t do her job without Arlene’s help. Happily, Arlene remains Undergraduate Coordinator.
With my first year as Chair coming to an end, it is an ideal time to look back upon what has been an eventful year for the Department.

There have been a number of changes in the Physics Faculty. Two new Assistant Professors joined the department in Fall 2007. Duncan Brown from Caltech is a numerical relativist who has brought enormous strength and vitality to the LIGO effort, already prominent thanks to the leadership of Martin B. Pomerantz Professor Peter Saulson. Brown has quickly attracted much positive attention to Syracuse for building the SUGAR computer cluster (p. 9). Richard Schnee joined us from Case Western Reserve and has given Syracuse a strong presence in the Cryogenic Dark Matter Experimental Search, an area that is acquiring increasing prominence in modern cosmology. Two new assistant professors will join the Department in Fall 2008: Martin Forstner, an experimental biophysicist from Berkeley, and Jay Hubisz, a theorist from Fermi Lab who works at the interface of particle theory and cosmology. Finally, Alan Middleton was promoted to Professor effective July 1, 2008.

We are very sorry that Mark Trodden, a cosmologist who had been co-leading (with Peter Saulson) an important initiative in Multi-Messenger Cosmology, has decided to leave Syracuse to join the Physics Department at the University of Pennsylvania. We wish Mark all the best and will miss him.

An important change in College leadership is taking place this summer. Dean Cathryn Newton has stepped down after eight years as Dean of the College of Arts & Sciences. Dean Newton has been a very strong supporter of all intellectual challenges and of the sciences in particular. The Physics Department has thrived under her strong and visionary leadership and we will miss her dearly. We look forward to working with incoming Dean George Langford, a distinguished neuroscientist, to build an even stronger Physics Department in the coming years.

It was a great year for our graduate program, with 13 students obtaining their PhD in 2007-08. A record number (9) were women, including Dr. Homin Shin (advisor Prof. Mark Bowick) who was awarded a doctoral prize from the Graduate School. I believe this is the first time in our department’s history that the women PhD’s greatly outnumber the men. Our alumni continue to make us proud. Two Syracuse doctoral graduates were elected Fellows of the APS this year: Gabriela Gonzalez, PhD 1995 with Peter Saulson, now Associate Professor of Physics at Louisiana State University, and Sufi Zafar, PhD 1991 with Eric Schiff, currently at IBM T. J. Watson Research Center, Yorktown Heights.

Our undergraduate majors also continue to excel. At the 2008 Commencement, we awarded 12 bachelors degrees (5 of them to women). Our total count of majors is presently 57 and all signs point to continued growth in this number. Key to the health of the program has been our thriving chapter of the Society of Physics Students, under the leadership of rising senior Jess McIver (p. 12). This active group meets every week. Their signature event this year was to host a public lecture by Bill Nye (“The Science Guy”) - a tremendously successful event attended by about 1500. Other stars of the rising senior class are Gavin Hartnett, who was awarded a Goldwater Scholarship, and Avi Hameroff, who was awarded an Astronaut Scholarship Foundation Scholarship.

Our faculty continues to distinguish itself both locally and internationally. Profs. Marina Artuso and Tomasz Skwarnicki, were honored this year with a Chancellor’s Citation for Faculty Excellence and Scholarly Distinction. Prof. Artuso was also elected Fellow of the American Physical Society, bringing to ten the number of physics faculty who currently hold this honor. Profs. Plourde and Vidali, with colleagues from chemistry, were awarded a Major Instrumentation award by the NSF that has been used to set up a state-of-art surface imaging facility (SUSIL p. 14).

Finally, the department continues to be deeply involved with the community through a wide array of outreach activities, ranging from the monthly Café Scientifique to Prof. Armendariz-Picon’s science program for Hispanic minority school children, from our strong participation in MayFest to numerous science shows for local K-12 children.

Looking over the contents of this issue, the variety of activities and the breadth of the research is apparent. There is a new endowed chair, the Martin A. Pomerantz Professor, there is increased membership and activity with SPS, there is a growth in Women in Science and Engineering, and there is greater interest in undergraduate research as well as the continued vigorous professional research programs. In this issue attention is brought to two aspects of astrophysics - one on interstellar matter and the other reaching into intergalactic space looking for gravitational waves. There is a description of the new Biomaterials Institute and the related workshop on complex matter. And there is much more.

The entire College of Arts and Sciences as well as the Department of Physics waits with pleasure for Lynn Margulis to deliver the first Kameshwar Wali Lecture.

The closing of the departmental library created some sadness and anxiety in those members of the department who like to hold a book in their hands. However, with access to journals through the internet, it was no longer cost effective to staff the small library.

Look over this issue, enjoy it, and let us hear from you about your lives and what you would like to see in the next issue. Send pictures. On the back cover there is a picture taken of graduate students around 1951. Can graduates from that time recognize anyone? (page 18)

If you like the looks of Physics Matters, it is due to the hard work and problem solving of Penny Davis.

From the Editor:

It is with some pleasure that correspondence with physics graduates continues to come in. People seem happy to hear from the department and I presume are pleased to read about the research and important happenings. This past year has been an active one and has resulted in an expanded issue. That is in part because in the last calendar year there were two issues, one in the spring of 2007 and one in the fall. We have decided that one issue to be distributed in the fall would cover the news of the year and inform about the research activities. Comments from you would be welcome. Would you prefer to hear from the Department twice a year with smaller issues or once a year with more content. With this issue, we will have published once each way. In any case, keep the news from you coming.

Looking over the contents of this issue, the variety of activities and the breadth of the research is apparent. There is a new endowed chair, the Martin A. Pomerantz Professor, there is increased membership and activity with SPS, there is a growth in Women in Science and Engineering, and there is greater interest in undergraduate research as well as the continued vigorous professional research programs. In this issue attention is brought to two aspects of astrophysics - one on interstellar matter and the other reaching into intergalactic space looking for gravitational waves. There is a description of the new Biomaterials Institute and the related workshop on complex matter. And there is much more.

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The Family of Martin A. Pomerantz endows a Professorship and Graduate Fellowship

"Syracuse is part of our family...he left here with a passion in physics and a passion for Molly Bernstein...been married to for 66 years...I'm a car guy."

Martin A. Pomerantz Jr., January 2008

At the 2007 Commencement at Syracuse University, Chancellor Nancy Cantor awarded an honorary degree to Martin A. Pomerantz, SU ’37 with the words "We are pleased to recognize you for your unwavering and ongoing commitment to the rigor of scientific discovery which fans the flames of wonder." During this commencement visit with members of his family, Dr. Pomerantz met with members of the Physics Department and was celebrated with a symposium in his honor (See Physics Matters V2). His memories of his undergraduate introduction to physics, the warmth of his reception by the department, and his strong impression of the research going on here led him to say, "I love the way the physics department at SU has developed...It's an atmosphere...a spirit for cutting edge research. It's wonderful to see that spirit at SU."

Now his spirit, vision and generosity will help further the development of a new era of astronomical research at SU. A combined $1.5 million in gifts to the College of Arts and Sciences from Pomerantz and his family will support an endowed professorship and a graduate fellowship in the Department of Physics. The Martin A. Pomerantz Professorship in Physics was awarded to Peter Saulson and the Molly B. Pomerantz Graduate Fellowship will support physics graduate students in their research.

Peter Saulson received his PhD at MIT in 1981 and took a postdoc with Rainer-Weiss to help carry out an engineering feasibility study of LIGO. That work eventually expanded into a large design effort spread across groups both at MIT and at Caltech. Saulson joined the SU Physics faculty in 1991, while Congress was debating whether to appropriate $300M to build LIGO. At Syracuse, he became the first physicist outside the Caltech and MIT core groups to be funded for LIGO-related research. From 2003 to 2007, he served as the Spokesperson of the LIGO Scientific Collaboration, the group of 600 scientists from the U.S. and 7 other countries who carry out LIGO's scientific program. Saulson is working with Syracuse gravitational-wave group postdoctoral research associate Josh Smith and graduate students Eiichi Hirose and Matt West. (See the article by Saulson and Brown.)

Portions of the above have been freely modified, with permission, from articles by Judy Holmes.

Outreach Grant

Allen Miller

The New York State Section of the American Physical Society has approved an outreach grant of $1,000 to the Physics Alliance of Central New York. The grant will be used exclusively for equipment purchases for a forthcoming make-and-take workshop for high school physics teachers to be held at the Physics Building of Syracuse University.

In this workshop, the teachers will construct a demonstration that will be used to illustrate a physics principle to their classes. The equipment will be permanently owned by the high school. The workshop is part of a series of Saturday morning workshops that have been held at Syracuse University for the past fifteen years. Allen Miller, who has coordinated the workshops along with Sam Sampere, wrote the proposal for the grant.

For the past ten years, together with undergraduate, graduate students, and visiting scientists, I have been studying how molecular hydrogen is formed in the interstellar regions of our Galaxy. The key lies in the 1847 observation by the astronomer Struve that the space between stars, the interstellar medium or ISM, is filled with a thin gas of dust particles smaller than the width of a human hair. Interstellar dust, now understood to be made of silicates and carbonaceous material, has long been considered a nuisance, since it obscures regions of the sky, such as those toward the center of our galaxy, the Milky Way. There is one speck of dust per $10^{12}$ atoms in the gas, which is made in large part of hydrogen, yet these tiny specks of dust are responsible for the very existence of the universe as we see it now.

For someone living on Earth, it might come as a surprise that the most abundant element in the universe is hydrogen. This is the stuff stars are made of. The hydrogen atom is the lightest and simplest atom. Put two hydrogen atoms together and you have the lightest, most abundant, and simplest molecule among the other 140 plus molecules that have been detected in space. It plays three important roles in the interstellar medium. First, it helps the formation of stars by carrying away some of the heat that is produced when gas rushes towards the core of a future star. Second, molecular hydrogen, either in neutral or ionized form, intervenes in most reactions producing other molecules. Third, through the observation of its excitations, molecular hydrogen reveals the conditions of astrophysical environments.

But, how does molecular hydrogen form in interstellar space? We know that molecular hydrogen doesn’t form by a chance encounter of two hydrogen atoms because the process requires that the proto-molecule make a spin-forbidden transition to the ground electronic state. Therefore, this way of making molecular hydrogen is very unlikely to occur.

My research builds upon a series of landmark theoretical papers by Edwin Salpeter and his student David Hollenbach of Cornell University. They proposed that hydrogen atoms land on the surface of a grain, diffuse on the grain, and form a molecule (the “recombination” process). The so-formed molecule leaves the surface of the dust grain due to the heat released in the reaction.

This model hadn’t been tested until ten years ago, when my group at S.U. and a collaborator form the University of Catania planned a series of experiments. We decided to reproduce in the laboratory, as closely as technically possible, the conditions under which molecular hydrogen is formed in space, i.e., low kinetic energy of hydrogen atoms, low temperature of dust grains (10-20 K) and low background pressure (low $10^{-10}$ torr range, corresponding to the gas density in a dense cloud). We used atom beamlines (where molecular hydrogen gas is split into atoms), ultra-high vacuum equipment, and low temperature techniques. Because the dissociation of molecular hydrogen is imperfect (although as high as 90%) a few molecules are sent along and eventually land on the sample surface. Thus it is impossible to know whether molecules formed on the surface or came with the beam. To overcome this problem, we built another line for deuterium, the heavier isotope of hydrogen, and looked for the formation of HD, hydrogen deuteride.

Because no sample not embedded in a meteorite has been analyzed (though some have been collected by NASA’s Stardust probe), we chose a reasonable analogue of a dust grain. We used first a piece of terrestrial olivine, a polycrystalline silicate. But in space, most material is in amorphous form, so eventually we studied reactions on amorphous carbon, amorphous water that coats grains in dense clouds, and amorphous silicates. The more we studied this reaction, the more theorists and modelers of interstellar cloud evolution wanted to know.
We were in for some surprises. Begun as a study to answer a simple question (how quickly does molecular hydrogen form?), this work drew us deeper into fundamental questions of processes occurring in conditions hardly explored in ordinary experiments in physical chemistry or surface physics. The main surprise from analyzing our experiment was that the mechanism by which hydrogen atoms diffused on dust grains was not only by tunneling, as previously thought, but also by thermal activation. This discovery is also important to our understanding of other chemical reactions occurring on grains, since most molecules formed on dust grains are products of hydrogen addition reactions.

Recently we began to study the formation of molecules in Titan’s atmosphere, Titan being the largest satellite of Saturn. Despite some obvious differences from Earth’s atmosphere (at the surface, the pressure is one and a half time ours and the temperature is 90 K), the study of Titan’s atmosphere might give us clues about the early Earth. On Titan, it is thought that hydrogen and hydrocarbon molecules important to the origin of life form on aerosol particles that make up the orange haze we see from Earth. Carl Sagan was one of the first to produce in the lab analogues of these particles, which he called “tholins” (mudlike). One aspect of our research is to see how molecules are made on these tholins.

Through our work, we showed that it is now possible to study in the laboratory processes occurring in astrophysical environments. With collaborators from the Hebrew University, we developed theoretical tools to simulate the formation of molecules in the ISM and planetary environments. Our experiments on hydrogen recombination on analogues of interstellar grains have shown that we can gain a new perspective about this important reaction. This information has been incorporated in models of the evolution of dust clouds in the ISM. Other experiments exploring the formation of molecules in/on ices that coat dust grains in molecular clouds are planned in conjunction with researchers at other universities (University of Hawai’i) and at NASA astrobiology centers (NASA – Ames).

For pictures, details and updates, see: http://physics.syr.edu/astro

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**eProfessor Ed Lipson**

In the Fall of 2007, Ed Lipson was appointed for 2 years as a Kaufmann “eProfessor” under the Syracuse Campus-Community Entrepreneurship Initiative (SCCEI; http://eninitiative.syr.edu) grant to Syracuse University from the Ewing Marion Kauffman Foundation of Kansas City, MO.

This 5-year, $3M grant project is a multi-campus initiative aimed at seeding entrepreneurship in academic environments. Under the program, Ed is involving students in creative projects using electronic and software tools for applications in environmental and energy systems and in assistive technology for individuals with physical disabilities. Lipson is a partner in two companies, MindTel LLC and SenSyr LLC, both affiliated with the CASE Center at SU, that have been active in these and other technology areas. eProfessors serve 2-year terms and receive $20,000 from the grant to support their projects.

**Goldwater Scholarship Award**

On March 28, it was announced that Physics major Gavin Hartnett had been awarded a 2008 Goldwater Scholarship. This scholarship, awarded in a rigorous national competition, pays up to $7,500 of Gavin’s expenses during his senior year. In addition to his coursework as a Physics major and Honors Program student, Gavin has performed research in cosmology with Prof. Mark Trodden and in the gravitational wave detection lab of Prof. Peter Saulson. He is currently carrying out research for his Honors Capstone project with Profs. Mark Bowick and Cristina Marchetti.

The Barry M. Goldwater Scholarship and Excellence in Education Program was established by Congress in 1986 to honor Senator Barry M. Goldwater, who served his country for 56 years as a soldier and statesman, including 30 years of service in the U.S. Senate. The purpose of the Foundation is to provide a continuing source of highly qualified scientists, mathematicians, and engineers by awarding scholarships to college students who intend to pursue careers in these fields.
Mayfest is a day off from class for students and faculty to show off their interests and accomplishments. Demonstrations and poster talks take place at various locations around the campus. In the late afternoon and evening, parties take place on and off campus. On this beautiful April 22, all along Euclid Avenue there were open parties through which one could wander and share in the refreshments. It was a day to broaden one's learning and enjoy being with other students.

In Stolkin Auditorium, Sam Sampere entertained students in three one hour sessions from 10 to 3 with demonstrations. For one particularly interesting skit, he held up two identical iron spheres. One was a magnet, the other was not. How can you tell? Sam held up a copper sheet at an angle and a young assistant from the audience let identical looking spheres roll down. Which rolled faster?

Demonstrations and poster talks took place in the Dome. The Physics students and faculty had 16 posters set up. The topics ranged over gravitational waves and black holes, dark matter, superconductivity, nuclear magnetic resonance, p-n junctions, a protein found in e-coli, and "What is hysteresis?".

Outside on the quad, students from SPS put water in a tub with corn starch. The mixture will flow like a fluid. However, with enough corn starch, it becomes possible to walk across the water. If you jump onto the mixture, it feels like a hard floor. This was a very popular demonstration.
Excitement runs high in the gravitational wave research group of Profs. Duncan Brown and Peter Saulson as they help us enter the age of gravitational-wave astronomy. Together with their colleagues in the LIGO Scientific Collaboration (LSC), they are poised to study two of the most dramatic predictions of Einstein’s theory of general relativity: gravitational waves and black holes. Just as accelerating electric charges generate electromagnetic waves, accelerating masses generate gravitational waves. Gravitational waves show up as ripples in the curvature of spacetime which carry information about the changing gravitational fields of distant sources. However, to generate gravitational waves strong enough to be detectable with current technology needs extremely dense, massive objects, such as black holes and neutron stars, moving at very high speeds. By measuring gravitational waves, we hope to detect properties of systems that cannot be observed with electromagnetic radiation. Gravitational waves can penetrate regions these waves cannot, thus allowing us to observe directly black holes and other massive objects in the distant Universe. Since the gravitational waves we will observe are generated by very strong gravitational fields, precision measurements of these waves will also allow us to perform unprecedented tests of the general theory of relativity.

In October 2007, the Laser Interferometer Gravitational Wave Observatory (LIGO) achieved the remarkable goal of recording one year’s worth of data from its three gravitational-wave detectors, all operating at design sensitivity. This data is being analyzed for the first direct observation of gravitational waves. In parallel, upgrades to double the sensitivity of the detectors are under way. Following a long data-taking run with these enhanced detectors, an ambitious upgrade of the detectors to Advanced LIGO will begin in 2011. This will extend the range another factor of ten. The volume of the universe visible to LIGO will thereby increase a thousand-fold or more. At that level of sensitivity, detections of gravitational wave signals should become common, and the new field of gravitational wave astronomy will begin in earnest.

LIGO’s gravitational-wave detectors are built around the classic Michelson interferometer, but implemented on a scale never contemplated by A. A. Michelson. Each Michelson interferometer (LIGO has three, two at Hanford, WA and the other at Livingston, LA) is contained in an L-shaped vacuum system with arms 4 kilometer long. Inside, a beam-splitting mirror at the vertex directs two halves of an 8 W infrared laser beam down the two arms, to high-reflectivity mirrors at the ends. Each arm is actually a resonant Fabry-Perot cavity, trapping the light for effectively ~50 round trips in the long arms. When the light finally emerges after its several milliseconds in each arm, the beams from the two arms are superposed at the beam-splitter. A sensitive photo-detector looks at the recombined light, and is able register phase differences as small as about 10^{-10} radians. This allows one to see differential motions of the two end mirrors as small as one-thousandth of the diameter of an atomic nucleus, corresponding to a fractional length change of about 1 part in 10^{21}. This is a true tour de force of experimental physics.

Why is this a good way to detect gravitational waves? The mirrors that define the interferometer arms aren’t bolted down as were Michelson’s, but are hung as 1Hz pendulums.

As they are free to respond to gravitational forces above 1 Hz, they are approximately freely-falling test masses. A gravitational wave is a transverse distortion of space-time that moves test masses equal and opposite amounts in two orthogonal directions, by an amount proportional to their original separation. This explains the need for two orthogonal arms for the detector. That much sounds straightforward, but here is the catch: the strongest gravitational waves to arrive in any given year are unlikely to have strain amplitudes even as large as 10^{-21}, more likely, 10^{-22}. Hence, the need for the huge facilities, and also the need for the Advanced LIGO upgrade. Peter Saulson, together with Syracuse gravitational-wave group postdoctoral research associate Josh Smith and graduate students Eiichi Hirose and Matt West, are currently working on the characterization of data from the LIGO detectors and developing the technologies that are necessary to realize the Enhanced and Advanced LIGO detectors.
**Gravitational Wave Astronomy con't**

In conjunction with the maturing of gravitational-wave detector science, there is evidence that gamma-ray bursts (brilliant flashes of gamma rays at random times) are due to the collision of neutron star binaries. As a neutron star binary is formed from the collapsed remnants of massive stars orbiting each other, it consists of two very small astronomical bodies, each with a radius of roughly ten kilometers, but with a mass comparable with that of the sun. The neutron stars orbit each other, they lose energy by emitting gravitational waves, and the binary's components spiral together. When the neutron stars finally coalesce, they are believed to produce a powerful burst of gravitational waves prior to the gamma-ray emission. Neutron star binaries have also observed using radio observations; this, in addition to gamma ray burst observations, provide strong evidence that binary coalescences are occurring in the nearby Universe.

The astrophysics of gravitational waves from neutron star and black hole binaries is the subject of the research of Duncan Brown, SU gravitational wave group postdoctoral research associate Andy Lundgren and graduate students Collin Capano and Larne Pekowsky. Brown is one of the leaders of the LSC's effort to analyze its data for gravitational wave signals. The Syracuse group collaborates with their colleagues in the LSC to develop algorithms that sift through gravitational-wave detector noise for inspiral signals and to study the relativity and astrophysics that can be obtained from a detection. This is a challenging endeavor presenting three major challenges: Firstly, the waveforms of the gravitational wave signals being sought are complicated. Templates waveforms for the gravitational waves radiated by binary neutron stars are well known, but we are only beginning to explore the waves emitted by two black holes in a binary. As the black holes orbit around each other with velocities close to the speed of light, the approximations used to compute neutron-star waveforms fail, and we must turn to a full solution of the non-linear Einstein equations. Secondly, the first signals to be found are likely to be buried in detector noise, and so sophisticated signal processing techniques have to be used to extract the signal. Finally, the detection of a signal is only the beginning for gravitational-wave astronomy, and we must be ready to understand and explore what the waves are telling us about the Universe.

To help solve these problems, the group has constructed a new supercomputer, called SUGAR (SU Gravitational and Relativity Cluster). SUGAR has 320 CPU cores and over 250 terabytes of disk space, used to store data from the LIGO detectors and the results of numerical simulations of colliding black holes. Capano has been using SUGAR to search for gravitational waves in the year of data recently recorded by LIGO. Brown and collaborators from the Caltech-Cornell project "Simulating eXtreme Spacetimes" have been simulating the violent merger of black holes on SUGAR. Pekowsky has been using the computer to determine how to improve the current search techniques.

They are aided by Dan Kirkpatrick, the physics department research computing administrator, and gravitational-wave group research associate Ping Wei who help manage the complicated software needed to store and understand the LIGO data.

Support for such high-risk/high-payoff research has been a hallmark of the Physics Department at SU for many years. Now, this particular bet looks like it will soon pay off in a big way. Stay tuned for more news from this exciting frontier of physics.
This has been a very busy year for the Women in Science and Engineering (WISE) group, co-lead by Marina Artuso, professor of physics, and Shobha Bhatia, professor of civil engineering. This program was started in 1999 by Bhatia with Cathryn Newton, then chair of the earth science department. It was originally designed to improve the recruitment and retention of talented women faculty active in these fields that so far have eluded true diversity. Now, almost a decade has gone by, and WISE has blossomed into a very multifaceted program, addressing needs and interest of women in science and engineering disciplines in the whole university community, with activities specifically targeted towards undergraduate and graduate students, as well as addressing the needs of its core faculty. In particular, 2008 has been a very busy year for WISE!

We have engaged undergraduate students in a variety of activities, including advising and mentoring, and more informal gathering to create a sense of community. Our strong commitment to research excellence makes the “Norma Slepecky Prize” for undergraduate research the key event in the year. This Prize has been endowed by her family, friends and colleagues to honor Professor Norma Slepecky who died in 2001. Norma was a very distinguished auditory neuroanatomist. She was also passionate about research and a great mentor for many undergraduates seeking research experience.

Each year we celebrate her legacy by awarding a research prize during an event that always includes a prominent speaker, who shares her views and experience as a leader in some scientific or technological discipline with young scientists and the WISE community at large. This year the event was dedicated also to the memory of Karen Hiiemae, Professor of Bioengineering and Neuroscience at Syracuse University and Visiting Professor in the Johns Hopkins Department of PM&R, who passed away last summer. A renowned scientist, Dr. Hiiemae was a wonderful colleague and mentor and will be deeply missed. She worked hard to start this annual event three years ago, and she was really keen in ensuring the highest standards throughout the selection process. This year four students were the finalists and the award for best research was given to Ms. Lindsay Avery, who performed her research work with chemistry professor Nancy Totah.

Prof. Norma Slepecky

The Norma Slepecky Memorial Lecture was given by professor Valerie Davidson, the University of Guelph. Valerie is a senior faculty member and her career to date includes industrial, academic and administrative experiences. Since joining the University of process control and decision-support systems. In addition, Valerie is an active member of the Women in Engineering Leadership Institute (WELI) which is a network of women academics in engineering across North America.

This year has seen a considerable increase in the level of activities targeted towards graduate students. Several workshops have been offered, exploring career planning, both in academic and industrial settings. In February, we offered a very lively workshop on the theme “Balancing personal and professional life.” The four engaging and definitely very busy panelists were Patricia Conklin, associate professor of biology at SUNY Cortland, Andria Costello, associate professor of environmental engineering, Kelly Donaghy, assistant professor of inorganic chemistry and chemical education at SUNY ESF, and Ashley Spring, graduate student in the department of biology at Florida Institute of Technology.

“I cannot believe that everybody is struggling with the same issues that are part of my daily life!” was a comment repeated over and over among those gathered at this event, who are all trying to squeeze in some family life and some personal time in their very busy schedule. In general, workshops and seminars are a great way to build a community where people realize that there are several people sharing the same issues and concerns, and that solutions can be shared and improved through collective wisdom.

Following the tradition initiated by WISE since its inception, this year a very outstanding scholar (Myriam Sarachik) came to speak to WISE faculty and to the university community in April. Professor Sarachik is a distinguished experimental condensed matter physicist who received NYC’s Mayors Award for Excellence in Science and Technology in 1995, the 2005 Oliver E. Buckley Prize in Condensed Matter Physics, and was named the For Women in Science 2005 L’Oreal/UNESCO Laureate for North America. In addition to sharing her professional expertise in a very engaging physics colloquium, she lead a panel discussion on issues relevant to gender and science in a WISE evening event.

Now we are looking forward to the start of a new phase of the WISE program at Syracuse University, as we believe that the time is right to expand the capacity of WISE to meet the range of existing needs of the undergraduate, graduate and faculty women in science and engineering disciplines. So much more is yet to come!
More than 80 people attended the semiannual workshop that was started in 2005 by Mark Bowick (Syracuse) and Itai Cohen (Cornell). Its aim is to facilitate communication and foster interaction amongst researchers in the broad area of soft condensed matter physics, complex fluids, biological physics and chemical engineering.

The meeting consists of one keynote address, four 30 minute invited talks and roughly forty 3 minute sound-bites.

Soft matter, like a polymer melt, is characterized by the ease with which it deforms. The properties of such a system must take into account not only the energy cost of deforming but also the large number of low energy microscopic states close to any given state. The most likely macroscopic state of soft matter systems is frequently determined by the features of these easily accessible deformations.

We all know materials expand on heating. But use a hair dryer to heat an elastic band that is fully stretched by a weight hanging from one end. It will shrink, pulling the weight up against gravity! Why? Imagine the elastic band is a chain of molecules like a strip of stamps. There is only way to stretch out the entire elastic chain, corresponding to unfolding all the stamps. But there are millions of ways to arrange the chain in crumpled spaghetti like shapes, corresponding to folding some stamps back on top of their neighbors. These coiled configurations are easily accessed by thermal fluctuations of the elastic band. The band shrinks as it is heated because its shape is on average crumpled and not straight.

Another feature of soft matter systems is a very rich space of possible phases or states of matter. A favorite example, enjoyed by SU undergraduates, 5th graders and experienced researchers alike, is a dense solution of cornstarch, from the kitchen shelf, in water. What phase of matter is this? Pour it over your hands and it flows much like any fluid. Case closed? Now hit it hard with a spoon. It is hard as a rock. Make a pool of dense cornstarch solution and you can bounce on the surface and walk on water (see http://www.youtube.com/watch?v=f2XQ97XHjVw). Is it solid then? It is both! Linked cornstarch molecules in solution take a certain characteristic time to get out of each other’s way. The solution thus flows like a fluid over longer times than this characteristic time but is solid over shorter time scales. This multifaceted phase behavior defying pigeonholing is another signature characteristic of soft matter.

Materials like this that flow but have some strength and structural rigidity are extremely versatile and employed frequently in the biological world. Take the lipid bilayer which is the key component of the plasma membrane of essentially every cell in your body. Its molecules are fluid with individual lipids flowing from one part of the 10 micron-scale membrane to far away parts in the same membrane in the course of minutes. But the long-chain molecules that make up lipids can also line up in the same direction. This is an ordered liquid crystalline state (the nematic state) exploited in your digital watch display. The nematicordered lipid bilayer has a cytoskeleton attached to it as well and the whole structure is flexible yet strong. Perfect for separating the inside from the outside in the watery world of the cell. Red blood cells are seen to flicker in the microscope and this was once viewed to be evidence that cells have some special life-like essence. But soft matter experiments and theoretical analysis by the French scientists Jean Francois Lennon and Francoise Brochard in the 1980s showed that the flickering is the result of light scintillating off the rapidly changing shape of the fluctuating red-blood cell membrane in the same way light flickers when watching ripples on a lake on a sunny day.

The properties of crumpled surfaces like this fluctuating membrane were the subject of the talk of our distinguished keynote speaker Tom Witten from the University of Chicago.
This year thousands of people on SU’s campus cheered for physics.

On March 19 2008, in a sold out Goldstein Auditorium, 1,500 SU students and Syracuse community members gave a standing ovation to Bill Nye the Science Guy, an event planned and sponsored by the Society of Physics Students at Syracuse University, otherwise known as SPS. As part of their community outreach, SPS wanted to reach members of the campus and surrounding community who would not normally be interested in physics. Bill Nye educated and entertained a huge, diverse crowd about the wonders of space travel and told the audience to go out and “do something” about global warming. He earned 3 standing ovations and took many questions afterwards. It was great to hear students and the public cheer about science and even physics.

The SPS at SU was re-chartered in 2000 by SU physics alum Josh Smith, a current post-doc in the gravity wave group at SU. The student organization has been growing and extending science volunteer service to the campus and community ever since. Its counterpart, Sigma Pi Sigma, the National Physics Honor Society, has also inducted several SPS members from SU’s chapter over the last two years.

Last year, as its main community outreach event, SPS held a public showing of the film "An Inconvenient Truth" followed by a panel of experts leading a discussion on global warming. Hundreds of people attended, asked excellent questions and learned more about the scientific basis of global warming and its impact.

In other community outreach, SPS volunteers help judge the annual GSSSF fair sponsored by the MOST. For two years in a row, SPS has supervised "The Cornstarch Demo: A Non-Newtonian Fluid" led by Sam Sampere. Imagine an entire wading pool of cornstarch mixed with water (in a particular ratio) and people running across the mixture but not sinking into it because it's acting as a solid. It was very easy to entice people walking by to play with the stuff and teach them about non-Newtonian fluids. This year one person ran across the pool and then launched into a flip. Wow!

SPS holds weekly meetings to get to know each other, plan service and outreach and often host speakers within the SU faculty. SPS’s main goal is to expose SU physics undergrads to research opportunities on and off campus, as well as foster a supportive community among undergraduates.

The group also has annual social events, most notably the end-of-year Senior BBQ. Among food, fun and celebration, senior gifts are presented by the current officers. Last year SPS, sponsored by the physics department, took several undergrad and grad physics students on an educational trip to Boston where they visited the Museum of Science and the Boston Aquarium. This year SPS also traveled to the University of Rochester in April to attend the SPS Regional Zone 2 Meeting and Symposium, where talks and posters were presented by undergraduate from all over the state. The group also regularly attends and provides free rides to Café Scientifique each month to give students the opportunity to learn about breakthroughs in other fields besides physics.

With the closing of the Physics Library (p. 17), SPS will have a meeting room. This development fits with plans to welcome many new members in hopes of creating a stronger undergraduate community in the department, getting more undergraduates involved in research, and increasing undergraduate retention. Please be on the honor roll of contributors to the Department who help furnish the meeting room.

SPS plans to attend the SPS National Council at Fermilab, IL, Nov. 6-9, 2008 to make connections with physics undergraduates across the nation and to hear cutting edge physics research talks. Future projects include creating an SPS alumni network and using the proceeds from Bill Nye the Science Guy to sponsor other student-oriented science events and speakers for the SU campus and community.

None of SPS’s success would be possible without the hard work and dedication of the members and the officers, in particular. Last year’s officers were Jessica McIver, President, Matt Turner, Vice President, Gavin Harnett, Treasurer/Secretary, and Carl Goodrich, Program Coordinator. This year’s officers are Jessica McIver, President, Carl Goodrich, Vice President, Gabby Savaglio, Treasurer, Herbie Germain, Secretary, and Tom Goldstein, Program Coordinator.

All of these officers, and the advisor/webmaster Jen Schwarz, must be graciously acknowledged for their contributions.

Buy an SU Physics T-Shirt!

SU Physics T-Shirts: T-2008 has “This is why I'm hot!” on back and “SU Physics 2008” on the front. The t-shirt design can be ordered ($12 plus shipping) through the SPS web page at http://phy.syr.edu/~sps/shirts.htm. These t-shirts can be ordered in both short and long sleeves. See the SPS webpage for pictures and prices past t-shirts.
In Fall 2007 Syracuse University launched a new initiative to foster research in the areas of biomaterials and smart medical devices, a field with potential for explosive growth in the coming years. Key to this has been the formation of the new Syracuse Biomaterials Institute (SBI, http://biomaterials.syr.edu/), a highly interdisciplinary center that will foster interactions between a number of department and schools, including engineering, biology, chemistry and physics. With the help of a $750,000 faculty development grant from the New York State Foundation for Science, Technology and Innovation (NYSTAR), SU recruited Pat Mather, a noted researcher in polymeric biomaterials, most recently on the faculty at Case Western Reserve University in Cleveland, to lead the SBI. Mather has joined the faculty of Syracuse University’s L.C. Smith College of Engineering and Computer Science in Fall of 2007 as the inaugural Milton and Ann Stevenson Professor of Biomedical and Chemical Engineering. Cristina Marchetti, William R. Kenan Professor and Chair of Physics, was appointed associate director of the SBI.

Syracuse currently has strong research efforts on the properties of biological and biocompatible matter in biology, chemistry, physics and engineering. The study of biological matter and the design of biocompatible materials does, however, necessitate dialogue between experts across a range of disciplines. The center will both lead new directions of research and serve as a catalyst for efforts currently underway in science and engineering departments across the SU campus. The strength of the institute will derive from the ability of scholars from these different disciplines to collaborate and interact.

Several key hires in each of the science and engineering departments involved in the study of biomaterials are planned in the next few years to bring cohesiveness to the initiative. Three new assistant professor were hired this year in the general area of biomaterials, one in Biomedical Engineering, one in Chemistry and one in Physics. The SBI will be housed in part of Bowne Hall. Renovations are expected to start in Fall 2008 and to be completed in Fall 2009. The new space will include a variety of shared experimental facilities that will be accessible to both faculty and students working on biomaterials.

One of the first initiatives of the SBI has been to offer a number of Graduate Fellowships in Biomaterials to students working across the sciences and engineering. The first crop of Biomaterials Fellows was a group of six highly talented graduate students from biomedical engineering, physics, chemistry and biology. Among these was Luca Gioni, one of our physics doctoral students working with Prof. Mark Bowick. The Fellows meet monthly to exchange ideas and update each other on research progress.

Finally, an annual off-campus meeting for biomaterials researchers and collaborators, as well as a regular seminar series—the Stevenson Biomaterials Lecture Series—to bring renowned researchers to campus, are already in the works. The inaugural Stevenson Biomaterials Lecture was delivered on November 16, 2007, by Prof. Kristi Kiick of University of Delaware. Prof. Kiick’s inspiring talk entitled, “Tailoring Macromolecular Interactions through Designed Multivalent Architectures,” was attended by over 100 faculty, staff, guests, and off-campus visitors.

**Syracuse Biomaterials Institute**

**M. Cristina Marchetti**

**Astronaut Scholarship Foundation Award**

Physics major Avi Hamenniff has been awarded a Scholarship by the Astronaut Scholarship Foundation. This is a remarkable achievement: only 19 such scholarships are awarded nationally each year. As part of this award, an astronaut will visit the campus in the Fall to present the award and give a public lecture. The lecture will be coordinated through the Soling Program. Avi is in his senior year at Syracuse.

The Astronaut Scholarship Foundation consists of more than 70 astronauts from the Mercury, Gemini, Apollo, Skylab, and Shuttle programs who are helping the United States retain its world leadership in science and technology by providing scholarships for college students who exhibit motivation, imagination, and exceptional performance in the science or engineering field of their major. To date, the foundation has awarded nearly $2.5 million in scholarships to 226 deserving students.

**Classical Charged Particles**

The third edition *Classical Charged Particles* by Fritz Rohrlich was published in early 2007, forty years after the first edition. The main revisions concern time reversal and the new equations of motion of a charged particle that replace the old Lorentz-Abraham-Dirac equations. The revisions are contained in a separate Supplement to the new edition.
SUSIL
Britton Plourde

The ability to characterize and manipulate surfaces down to the nanoscale is crucial for many scientific disciplines. A new Major Research Instrumentation grant from the National Science Foundation has enabled the acquisition of state-of-the-art equipment for building the Syracuse University Surface Imaging Laboratory (SUSIL) in the Physics Department at Syracuse University. The facility will be used for analyzing surfaces with multiple techniques over a wide range of length scales. The proposal was submitted by Profs. Britton Plourde and Gianfranco Vidali (Physics) and Profs. Tewodros Asefa and Karin Ruhlandt-Senge (Chemistry). The development of novel thin-film superconducting devices, the synthesis of various nanomaterials, the study of new precursor molecules for chemical vapor deposition of perovskite materials, and the investigation of molecule formation on simulated interstellar dust grains (in the Vidali research group) are only a few of the active areas of research on campus that benefit from this new facility. An atomic force microscope (AFM), capable of multiple imaging modes in several different environments with the highest possible resolution, was installed by Pacific Nanotechnology in January 2008. The AFM scans a sharp probe above a sample surface to produce topographic images at the nanoscale by detecting the interactions between atoms on the sample surface and those at the end of the probe. In February, a surface profilometer from KLA-Tencor was installed with three-dimensional scanning capabilities, useful for imaging samples with larger surface features and wider areas than is possible with the AFM. The profilometer resolves surface steps by scanning a sharp stylus across a sample and detecting the deflection of the stylus. These two instruments join a scanning electron microscope (SEM) from JEOL, recently acquired by the Physics Department. The SEM produces images by raster-scanning a focused beam of electrons and measuring the secondary electrons produced from a particular location on the surface. Sam Sampere provides unique expertise for supervising the new facility.

Instrumentation for Undergraduate Labs
Britton Plourde

In recent years, the Intermediate and Advanced Experimental Physics Courses have seen an approximate tripling in student enrollment, due in part to the growth in the number of Physics majors at Syracuse. Prof. Britton Plourde has been developing new projects to accommodate the increased number of students and to provide opportunities for exploring new areas of experimental physics. In 2007 the department purchased a pulsed Nuclear Magnetic Resonance (NMR) apparatus from TeachSpin, a Buffalo-based company specializing in the fabrication of advanced educational lab equipment. Many groups of students at Syracuse have now worked successfully on this project in 2007 and 2008. The system allows students to explore multiple exciting aspects of pulsed NMR in liquids, including spin echoes and measurements of relaxation times, with a unique, hands-on approach. The department also recently placed an order for a Modern Interferometry apparatus, again from TeachSpin. This system will be delivered in the summer of 2008 and will provide an optical breadboard arrangement where students can directly investigate various interferometer configurations, including Michelson, Sagnac, and Mach-Zehnder arrangements, and perform sensitive measurements, such as determining the index of refraction of gases and detecting magnetostriction in a nickel rod. Both of these systems were purchased using generous funding gifts to the department from alumni.
The Award for Faculty Excellence and Scholarly Distinction is targeted toward faculty who are collaborators in work of intellectual richness which has the potential for future impact. This work should offer possibilities for synergy both within the University and outside in partnership with others.

...your contributions to research in elementary particle physics and your collaboration with world experts in particle detection and identification have provided extraordinary opportunities for graduate students to participate in high energy physics experimentation.

Chancellor Nancy Cantor

Two faculty members in the high energy physics experimental group, Marina Artuso and Tomasz Skwarnicki, were awarded the Chancellor’s Citation. The group’s work is aimed at discovering the basic forces in nature and measuring their properties. Some of the measurements are pointed toward finding New Physics, the indirect effects of as yet undiscovered but often speculated upon phenomena. The award was based on work they did with the CLEO experiment, located at the CESR accelerator at Cornell University. CESR collides electrons with their anti-particles, positrons, and produces many other kinds of particles, pions, kaons, protons, etc. Using a new technology based on Cherenkov radiation, we can identify every particle. In the past we had to guess at their identities. This permits much more sensitive analysis and has allowed us to make many important measurements.

Prof. Artuso was the first CLEO physicist to take the lead in constructing a particle identification system. She started a very fruitful collaboration with the world’s experts in such devices at CERN, (the major European laboratory in Geneva, Switzerland). While she worked with them on detector tests and successfully transplanted the necessary knowledge to Syracuse, Marina did not agree with their scheme for the readout electronics, and decided to design her own. For our detector, RICH, (Ring Imaging Cherenkov Counters), the electronics are the most difficult and crucial element. To detect the creation of about 10 photons emitted by the charged particles traversing the detector, the electronics must be extremely low noise with little room for failure. To compound the problem there are 230,400 electronic channels imposing severe spatial, assembly, cabling and testing constraints.

Her design concept for this detector electronics was novel. She started by collaborating with a company in Oslo, Norway to produce circuits that they jointly designed. She took charge of the enormous job of electronics development and testing for the RICH. With about 10% of the manpower typically used for such enterprises, Marina completed the detector which met its specifications and still had 98% of the channels functioning after 8 years of data collection. This work was recognized in 1997 by an “Award for brilliant activity in high energy physics detection techniques,” at the Frontier Detectors for Frontier Physics, 7th Pisa meeting in Elba, Italy.

Marina has also made outstanding contributions in data analysis. For example, as a result of her work on charmed quark decays, she was asked to participate in a world wide effort to codify and understand the parameters describing these decays. She was a reviewer for the Particle Data Group and then was part of the “Heavy Flavor Averaging Group.” This work was widely recognized and is important in our new collaboration, LHCb, an experiment at the new LHC collider at CERN.

Tomasz contributed to the RICH project in two very different ways. First of all he was responsible for the first module construction phase; a difficult task, where the individual pieces were required to fit together precisely, and be flat to a few thousands of an inch. He also was responsible for producing the complete software package that took the raw data from the device and translated the signals into identities for all the particles traversing the detector. Tomasz accomplished this remarkable task with just one or two people helping him whereas comparable efforts elsewhere needed about ten times as many people. This software incorporated brilliant ideas concerning the specific algorithms used for reconstructing the parameters needed for particle identification.

After the device was installed and calibrated (the tools necessary were provided in the software) Tomasz turned his efforts towards making important physics measurements. Together with graduate students Hajime Muramatsu and Jamila Butt he made many important measurements of quark-antiquark interactions - bottom and charm quark interactions.

Before the era of the RICH, Tomasz produced perhaps the most important physics result by any experiment studying heavy quark decays - the process where the b-quark decays by emitting a high energy gamma ray and transforms into an strange quark. This is the first example of a truly “rare” decay. These decays are so infrequent in the “Standard Model,” that any unknown processes, called, New Physics, can easily affect how often they are seen. We expect to see such New Physics effects at the new collider being built at CERN, the LHC.
New Faculty:

Dr. Martin Forstner received his PhD from UT Austin in 2003, working with Prof. Joseph Käs. As a postdoc at UC Berkeley in the lab of Prof. Jay Groves, he studied the role of membranes with various lipid anchors and bilayers as well as the design of a microscopy platform using dual color internal reflection and fluorescence correlation spectroscopy. He will set up a biophotonic lab to study the physical and biochemical properties of cell membranes, both in vitro and in vivo.

Dr. Jay Hubisz received his PhD at Cornell in 2006 under the guidance of Csabi Csaki. Following a postdoctoral fellowship at the Fermi National Accelerator Laboratory, he was awarded the prestigious Director’s Postdoctoral Fellowship at Argonne National Laboratory where he began work in January 2008. His goal is to continue exploring the phenomenology of physics beyond the standard model throughout and past the upcoming LHC era.

Undergraduate Research Day
Liviu Movileanu

General methods and established physical techniques can be learned in laboratory classes, but the thrill of making a new discovery comes first from carrying out an independent research project. In particular, undergraduate research is one of the best ways for bright students to build a solid foundation in experimental and theoretical science, providing a smooth transition to more advanced graduate studies. On Saturday, December 1st, 2007, our department organized the 2nd Annual Undergraduate Research Day & Open House. This event, geared towards undergraduate physics majors from schools within a few hours driving distance from Syracuse, was a great success with over 30 students from 10 different institutions attending. The meeting provided a forum for these undergraduates to present a summary of their research projects, offered them a unique opportunity to meet other undergraduate physics majors, and also introduced them to cutting-edge research in the Physics Department at Syracuse University.

Sixteen students gave presentations. They came from SUNY Binghamton, SUNY Potsdam, LeMoyne College, SUNY Oswego, Colgate University, Syracuse University, University of Rochester, University of Buffalo, and SUNY Environmental Science and Forestry. Their very exciting talks covered a broad range of topics from biological and condensed matter physics, through cosmology, particle and high-energy physics, and nanotechnology. From Syracuse, Carl Goodrich gave a talk on Studies of the performance of silicon detector modules for the Vertex Locator used in high energy physics, Jessica McIver spoke on the Audio Analysis of gravitational wave data, and Matt Turner spoke on a Spectral-Wavelet Algorithm for Solving Maxwell’s Equations.


The 2nd Undergraduate Research Day concluded in the evening with a dinner organized at Goldstein Alumni & Faculty Center. In the future, we want to continue this initiative by strengthening the exposure of our department to undergraduate physics majors, both locally and regionally. This is a unique opportunity that we believe will have a very positive impact on the future of our department and the university as a whole. In the fall 2008, we look forward to another exciting research undergraduate day, and hope that more undergraduates from Syracuse and other schools from Central New York will be able to attend.
The first PhD in Physics graduated in 1951, but the Physics Library was begun while Physics and Mathematics formed a joint department in Steele Hall. By 1946 Physics and Mathematics had separated and the library occupied a large room on the west end of the first floor of Steele Hall. In the present Physics Building, which opened in 1968, the library occupied two large rooms at the east end of the second floor - one for shelves of books and the other for journals. In Steele Hall there were no tables or carrels. In the Physics Building there were tables in the front room for quick reading and there were carrels for serious quiet work along with the journals. Students took advantage of this quiet retreat for study. Faculty and graduate students made extensive use of the journals and advanced texts. New books and recent journals were on display for easy examination.

With the arrival of networked personal computers and electronic databases and as more and more journals became available on-line, use of the library decreased. Thinking about closing the library began in November 2005 in a meeting of Ed Lipson, Physics Chair, with Dean of Libraries Suzanne Thorin and Dean of Arts and Sciences Cathryn Newton. In 2006, the journals were moved out to the Science and Technology Library and that room became a meeting room for undergraduate majors in physics. The number of undergraduate majors in physics has increased and they need a space to meet. This is reinforced by the activities of the Student Physics Society (SPS) and its honors affiliate Sigma Pi Sigma. SPS has become an active part of student life in the department. It creates activities which are open to all students on campus.

As use of the library continued to dwindle, the books in the front section of the library were also sent to the Sci-Tech library. On May 15, 2008, the last books were returned and checked out from the library and the sign THE PHYSICS LIBRARY HAS CLOSED was posted. This room will be used as a meeting and seminar room.

The space for an undergraduate lounge will be preserved and furnished as funds become available from the budget and contributions. We all hope that the bust of Jay Dorman Steele, which looked down on library users, can be returned to a place of honor in one of the two rooms to watch over future generations of physics students.

Janet Pease came to the Physics Department as secretary to the particle theory group in 1978 and, in 1994, became the manager of the physics library while having other subject responsibilities, including nutrition and food science and nursing (Nursing became health and wellness when the nursing school closed in May 2006). Judy Sweenie staffed the library the longest time, about 25 years, and is now working at Onondaga Community College. Laura Lesswing was the last one on duty in the library. While here, Laura studied Art History and will go to Williams College for her MA.

PHYSICS LIBRARY Goodbye

PHYSICS LIBRARY Goodbye

PHYSICS LIBRARY Goodbye

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**Correspondence from Alumni:**

**Dick Bulova, BS 1962**

Thanks for finding me and sending Volume 2. Interested enough to look up Vol 1. Keep 'em coming!

Now then, would you please identify the four gentlemen on the back page. They seem familiar, even with the passage of many years. The one on the right looks a lot like Arny Honig. *(Editor's note: from left to right: Giancarlo Moneti, Josh Goldberg, Kamesh Wali, Arny Honig)*

**David Robinson, PhD 1969**

Just to let you know that I have received the latest issue of Physics Matters. Interesting to read the SU news. I particularly enjoyed the picture of "the wisdom of the aged" on the back.

**Harry Berger, MS 1951**

Josh: I enjoyed Volume 2 of Physics Matters -- many good things going on. I was happy to participate in your call for news of Syracuse Physics people. I admit that I didn't recognize any of the other correspondence people -- most of them way after my time at Syracuse. I should have known Milt Fisher from the dates of his degrees but since he came back to the campus to do a degree in math-- my memory fails me.

**Jianchun Wang (Research Assistant Professor, SU Physics)**

I went to United Arab Emirates last week for a conference. To my biggest surprise I met 5 of our former students there. They wanted me to pass their greetings to you all. They are doing quite well. Sherif Moussa & Salah Nasri work in University of UAE as our local hosts. Baris Tonguc works in a Turkish institute, Sakarya Univ. near Istanbul, Hachemi Benaoum in a Saudi Arabian university, and Waled Emam in Ecole Polytechnique near Paris.

**Al MacRae, PhD 1960**

I enjoyed wandering around the Physics Building three weeks ago and having brief conversations with Josh and Arnie late in the morning…I have enjoyed the two issues of "Physics Matters." It is a great idea….I owe a lot to the faculty of the Physics Department for contributing to my enthusiasm for physics and science….I was treated both within and outside the department as a physicist.

**Eric Alan Schiff (Professor, SU Physics)**

I wanted to say that the newsletter looks great. Thanks for your work on this.

**Bill Lehmann, PhD 1951, with Barbara**

After I left AFIT…I went to the AF Secretary's office, then to Director of Air Force Research and then the Air Force Weapons Lab. I couldn't hold a job so I retired and went to Chief Scientist of the Army Combat Development Center and then the University of New Mexico and the Air Force Scientific Advisory Board. Syracuse really helped me get a good sound understanding of physics,

**Robb Thomson, PhD 1953**

…Alice slipped away in August after her 10 year long bout with Alzheimers. At a certain point, life with that disease is no longer worth living, and that point came long ago for her.

**Mystery alumni on back cover.**

*Left to right: Herman Gummel, Robb Thomson, Bill Lehman, Barbara Lehman*  
(Alice Thomson Photography)
Degrees Granted—2008

Doctor of Philosophy:
- Aphrodite Ahmadi, Assistant Professor, SUNY Cortland
- Hachemi Benaoum, Professor, Prince Mohammad University, Saudi Arabia
- Taviare Hawkins, Mount Holyoke Fellow & Visiting Assistant Professor
- Catalina Renata Jora, Post-doc, University of Rome
- Berta Rodriguez-Milla, Scientific Coordinator, LSU Center for Computation Technology
- Shabana Nisar
- Babar Qureshi, Post-doc, Dublin Institute for Advanced Studies
- Roberto Salgado, Visiting Assistant Professor, Mount Holyoke
- Homin Shin, Post-doc, University of Massachusetts, Amherst
- Alessandra Silvestri, Post-doc, MIT
- Nasra Sultana
- Weining Wang, Post-doc, University of Arizona, Tucson
- Hongwei Ye, Toshiba Medical Systems, Chicago

Undergraduate Commencement Awards—2008
- Neil F. Beardsley Prize—Stephen R. Hermes
- Paul M. Gelling Scholarship—Matthew A. Turner
- Award for Academic Excellence—David A. LoVullo, Carolyn Stern

Tell us about yourself!

Mail us at the Department of Physics, Syracuse University, 201 Physics Building, Syracuse, NY 13244-1130
or email us at physmatt@phy.syr.edu

Here is my news: _________________________________________________________________________________________
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Address _________________________________________________________________________________________________
Home phone ______________________  Work phone__________________________  Email ____________________________

Contributions 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.

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

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

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

_____ General Department Gift Fund

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.
Physics Matters

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