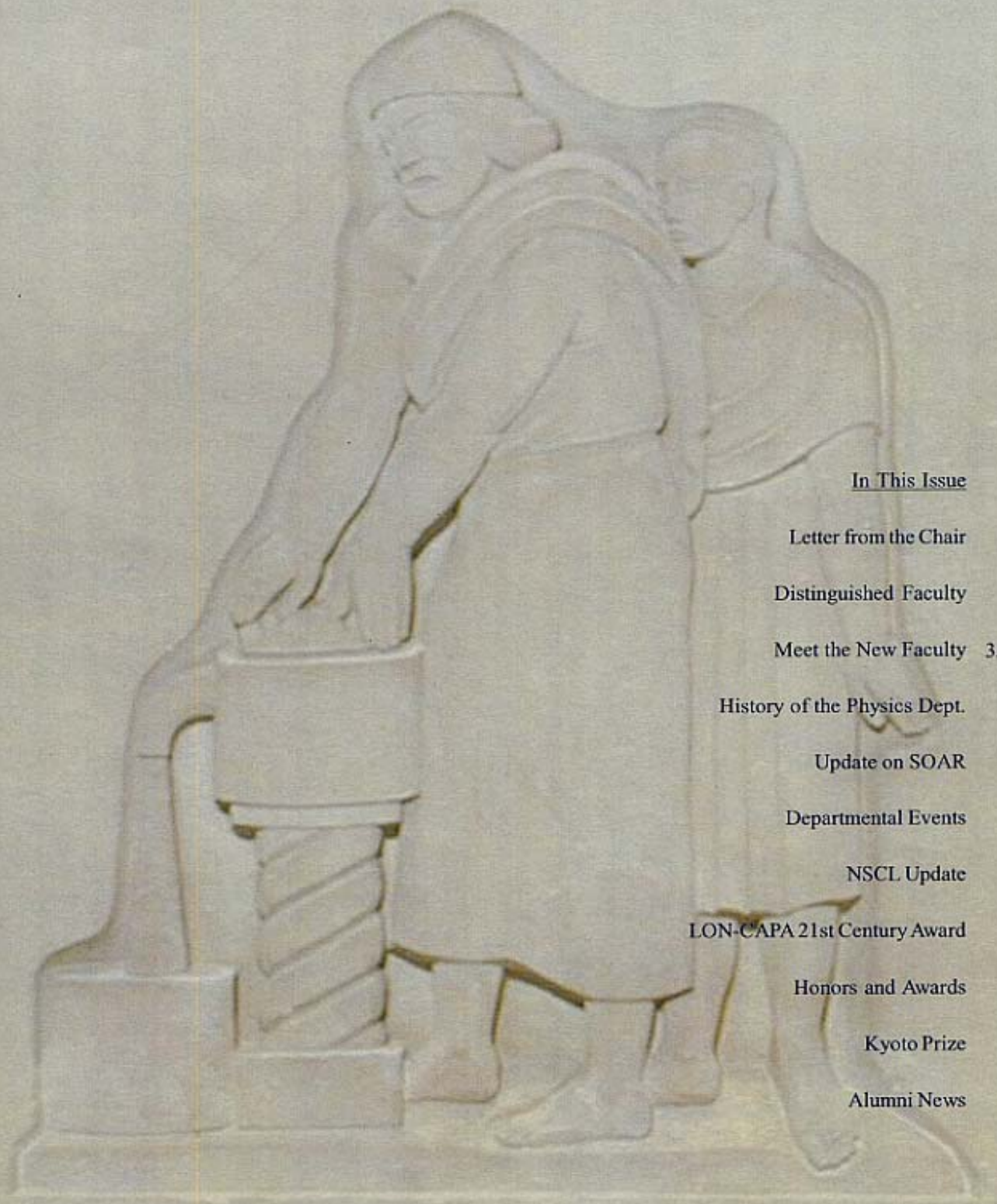
Physics and Astronomy

Michigan State University Fall 2003



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Newsletter
MSU Physics and Astronomy Department
Volume 5
Fall 2003

A Letter from the Chair

Dear Friends of the Department of Physics and Astronomy,

Wolfgang Bauer
photo courtesy of Erin Groom/IMC/MSU

Michigan State University's leadership subscribes to the "Perpetual Whitewater" theory of institutional management. What is implied by this motto is the assumption of constant change and the need to adapt, to take advantage of opportunities that present themselves, and to have contingency plans for potential setbacks. During the past year, our department experienced plenty of whitewater.

Like almost every other institution in higher education, Michigan State University was negatively affected by the state of our economy and resulting funding cutbacks. The State of Michigan was forced to reduce MSU's appropriations by more than 10%, and tuition increases were not able to make up for this revenue shortfall. Physics/Astronomy had its general funds budget reduced significantly, resulting in the layoff of several long-time members of our staff.

On the other hand, we were able to take advantage of new opportunities that presented themselves. Through various collaborations, we managed to hire several terrific new faculty members. Joining us from Boston University are Elizabeth Simmons and Sekhar Chivukula, both particle physics theorists in the rank of full professor. Elizabeth also has an appointment as the Director of MSU's Lyman Briggs School. Megan Donahue and Mark Voit joined us in the rank of associate professors in astronomy and astrophysics, leaving the Space Telescope Institute. The nuclear physics group also added four new members, assistant professors Filomena Nunes, Remco Zegers, and Kris Starosta, plus professor Stan Schribner, who left Los Alamos National Laboratory to work at our National Superconducting Cyclotron Laboratory.

The promises of our new *Biomedical and Physical Sciences Building* are paying off in the intended way, and we were able to hire Bill Wedemeyer into a joint appointment with the Department of Biochemistry. Bill and another newly hired assistant professor, Michael Feig, are now forming the nucleus of our College's interdisciplinary effort at the interface of the physical and life sciences. Their particular expertise is in the area of modeling of the protein folding process.

University Distinguished Professor Mike Thorpe retired from our faculty. We wish him luck in his future projects. But I am happy to report that Professors Brad Sherrill and Gary Westfall have now received the designation as University Distinguished Professors. It is very safe to say that our faculty and therefore the entire Department is much stronger now than it was a year ago.

Private donations and endowments keep flowing in, helping us to strengthen all of our programs and partially making up for other budget cuts. We just received a gift from George Brown for a second endowed chair in physics, after the Cowen Chair, which we received two years ago. Other particularly noteworthy gifts this past year were: the Foiles Undergraduate Award endowment, funded by the family and friends of our late colleague Carl Foiles; the Blosser/Muelder Distinguished Lectureship endowment donated by our friend and former vice president Dr. Milton Muelder; and a gift by MSU-PA alumnus Professor Eugene Parker, who received the Japanese Kyoto Prize and donated one quarter of it to our SOAR project. Dr. Muelder also made an additional large cash gift to SOAR, after donating his house to this cause last year. More funds for our SOAR telescope are needed, but we are confident that we will be able to attract those.

We continue to pursue the great science challenges that present themselves through the newly founded Institute for Quantum Science and the Michigan Life Science Corridor. The Joint Institute for Nuclear Astrophysics (JINA) is about to receive the first installment of the $10 million National Science Foundation grant that we will share with the University of Notre Dame and the University of Chicago. The National Superconducting Cyclotron Laboratory just went through a multi-million dollar expansion and a large increase in its annual operating grant from the NSF, cementing its standing as the premier US nuclear physics university laboratory. We are still pursuing the Rare Isotope Accelerator construction project, and we are looking forward to the dedication of our new SOAR telescope next April.

This is an exciting time, full of opportunities. We have invested in strengthening our faculty and infrastructure. This has been accompanied with a strong rise in the number of our undergraduate majors and a new astrophysics graduate program. And so, despite trying budgetary constraints, we believe that we have positioned ourselves to take advantage of these future opportunities and look ahead with confidence.

Best wishes,

Wolfgang Bauer

Wolfgang Bauer
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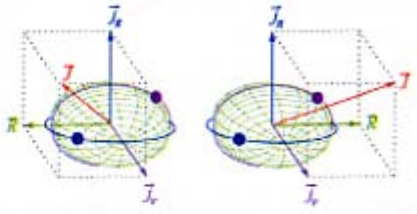
Meet Kris Starosta

Kris Starosta

Krzysztof (Kris) Starosta joined the experimental nuclear physics group in the Department and the NSCL laboratory in August 2003. He received his Ph.D. in 1996 from Warsaw University (Poland) and, after a short term at the Niels Bohr Institute (Denmark), he joined the Nuclear Structure Laboratory at SUNY Stony Brook. In the three years before coming to MSU, he was a Visiting Assistant Professor in the Stony Brook Department of Physics and Astronomy.

Kris' research is focused on three main challenges for our understanding of the structure of atomic nuclei. These involve the physics of systems with high proton-neutron imbalance and physics near nuclear drip-lines, interaction between single particle and collective nuclear degrees of freedom, and fundamental symmetries and spontaneous symmetry breaking in atomic nuclei. Kris' experimental work resulted in the first identification of excited states in a number of nuclei near the doubly magic nucleus ^{100}Sn. In that region, he studied a response to extremely fast rotation of nuclei with limited number of nucleons outside the core. Since spin of a nuclear state depends on the single-particle spins of its constituents, the limited valence space sets constraints on the structure of rotational bands; in particular the highest spin in the band has to correspond to the sum of all aligned single particle spins. Kris' studies showed a remarkably smooth transition between collective rotation of a whole nucleus at the low spin end of the band to extreme single-particle behavior at the other end, where the band reaches the fully non-collective state.

Another aspect of Kris' research is a novel study of chirality (handedness) in nuclear structure. It was first identified in odd-odd transitional nuclei in which triaxial deformation defines three mutually perpendicular directions along the principal axes of the mass distribution. Valence particles and holes in a triaxially deformed potential minimize their energies by aligning their angular momenta with the short or long axis, respectively; while the collective core rotation aligns with the intermediate axis which, for irrotational flow-like moments of inertia, is a preferred axis of rotation. These three mutually perpendicular angular momenta couple to form a total angular momentum vector which is tilted away from any principal plane, and thus, they can be arranged into a right-handed or a left-handed system as shown in the figure to the right. Doublet states of the same spin/parity and nearly identical excitation energy are formed for a given single particle configuration. Time reversal is a symmetry operator, which relates systems of opposite handedness. The peculiar features of this anti-unitary operator make nuclear chirality unique and different from other cases of spontaneous symmetry breaking.



Kris believes that new physics ideas require stringent tests, therefore, he enjoys sensitive experimental measurements. He has contributed to the development of experimental methods for nuclear structure physics with studies of angular correlations of polarized photons. He has used a variety of state-of-the-art techniques at prime facilities for gamma-ray physics in a number of leading US and foreign laboratories. Exciting opportunities are emerging right now in gamma-ray spectroscopic studies following advances in semiconductor detector segmentation and digital processing hardware. Kris is planning to take advantage of these techniques in his experimental work at NSCL as soon as possible. In his opinion, a unique combination of a high-class accelerator facility providing beams of exotic far-from-stability nuclei coupled with the largest array of segmented detectors in the US makes NSCL a very exciting place to be.

Our Newest Distinguished Faculty

Our two new UDPs, Gary Westfall (left), and Brad Sherrill (right), shown during the official award ceremony with Walter Benenson (center). Photo courtesy of Erin Groom/IMC/MSU.

On June 27 the Board of Trustees approved the title of University Distinguished Professor for two of our faculty members, Brad Sherrill and Gary Westfall. Both Brad and Gary are experimental nuclear physicists and are also members of the National Superconducting Cyclotron Laboratory. Brad uses the MSU cyclotron to study nuclear reactions that take place in various astrophysical environments. In particular he is investigating radioactive nuclei that play a key role in supernovae explosions. He is also active in the study of nuclei far from stability and, as an expert in radioactive beams, would be a leading user of the $900M RIA project, especially if we can attract it to MSU. Gary has also been a major researcher at the MSU cyclotron and has used it to investigate nuclear matter at extreme temperatures and pressures. In experiments at the Relativistic Heavy Ion Collider (at Brookhaven lab on Long Island) Gary plays a leading role in experiments in which nuclear matter is compressed to densities more than ten times normal. These extreme densities are similar to those that existed in the universe a few seconds after the Big Bang. In addition to their scientific distinction, Brad and Gary are both extremely popular and effective teachers. The well-deserved honor of UD Professorships reflects their overall contributions to the department, the college and the university, and is a high point of their very distinguished careers. We are proud of them!

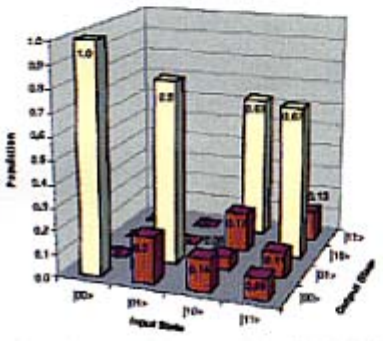
The designation of University Distinguished Professor (UDP) was only given to a total of 10 MSU faculty members, bringing the total number to 65 across the University. Brad Sherrill and Gary Westfall join Sam Austin (Emeritus), Walt Benenson, Henry Blosser (Emeritus), Konrad Gelbke, Ed Kashy (Emeritus), and Mike Thorpe (Emeritus) in the UDP ranks, making ours the most successful department on campus in this respect.

Meet Carlo Piermarocchi

Carlo Piermarocchi

Carlo Piermarocchi joined the Condensed Matter Group in the Department in August 2002. He was previously a postdoc at the University of California San Diego and received his Ph.D. in December 1998 at the Ecole Polytechnique Fédérale of Lausanne (EPFL) in Switzerland. Carlo is a theorist and his research focus is quantum optics of materials. He strongly believes that quantum mechanics is going to play a dominant role in the technology of the near-future. In this perspective, semiconductor nanostructures represent ideal systems where the electronic and optical properties can be controlled and engineered at the quantum level. When photons are absorbed in a semiconductor material, excitons (i.e. bound electron-hole pairs) are created. In his research activity, Carlo has studied the properties of excitons in semiconductor nanostructures as quantum wells, quantum wires, and quantum dots.

The strong quantum nature of the excitons in semiconductor quantum dots naturally leads to applications in quantum computing devices. Carlo is a fellow of the MSU Institute of Quantum Sciences, a leading institution in the new exciting field of quantum information. Carlo has proposed a new scheme for the realization of logical quantum gates using excitons in charged quantum dots. He has also provided theoretical support to the experimental group of Prof. Duncan Steel at the University of Michigan where the control of two qubits (the "bit" of information for a quantum computer) in a quantum dot has been recently proved. By controlling two qubits a logical quantum gate has been realized. Just as for the classical AND NOT and OR gates, a simple set of quantum gates can be used to build quantum circuits of arbitrary complexity.



from X.Li, et al Science 301, 809 (2003)

The figure shows the truth table for this quantum logic gate realized using excitons in a quantum dot. It gives the output states for the two bits (indicated by |00>, |01>, |10>, and |11>) as a function of a given input state. Since we are dealing with quantum mechanics and the system is not completely isolated, we can only have a finite probability to realize the wanted transformation, but the fidelity (precision) of the realized quantum gate is the highest ever obtained within a solid state system. This result sounds very exciting, however in order to have a real quantum computer we need to figure out how to assemble and control many of those quantum logic units in well defined quantum architectures. This is one of the toughest challenges in quantum optics.

Meet E. Simmons and R. S. Chivukula

R. Sekhar Chivukula (top), Ari, age 12 (left), Anand, age 4.5 (right), Elizabeth Simmons (right)

R. Sekhar Chivukula and Elizabeth H. Simmons joined the high-energy physics group in the Department in August 2003. Simmons will split her time between the Physics Department and the Lyman Briggs School, where she will serve as Director.

Chivukula was previously a Professor of Physics at Boston University from 1989-2003, and a postdoc in that department from 1987-1989 after receiving his Ph.D. from Harvard University in 1987. At Boston University, Chivukula served as Associate Chair for High-Energy Physics Research and Project Director of the BU DOE high-energy physics grant. At BU, Chivukula taught courses in graduate quantum mechanics and mathematical physics, general relativity, and particle physics as well as introductory mechanics.

Simmons was previously a Professor of Physics at Boston University from 1993-2003, and a postdoc at Harvard University from 1990-1993 after receiving her Ph. D. from Harvard in 1990. At Boston University, Simmons served as Associate Chair for Undergraduate Studies and as director of LERNET, a resource center for Boston University educational and enrichment activities for middle-school and high-school students. Simmons has been extensively involved in efforts to increase the participation of women in mathematics, science, and engineering. At Boston University, Simmons taught courses in graduate and undergraduate mechanics and mathematical physics, introductory mechanics and electromagnetism, as well as a course for non-scientists.

Chivukula and Simmons's research in theoretical elementary particle physics addresses the origins of mass. They study the causes of electroweak symmetry breaking (responsible for the masses of the W and Z particles that transmit the weak nuclear force) and the mechanisms responsible for the diverse masses of the quarks and leptons, the elementary constituents of matter. While the Standard Model of particle physics can accommodate massive particles, it does not explain the dynamics through which mass arises. Hence, Chivukula and Simmons seek to advance the understanding of the origins of mass by exploring physics that lies outside the Standard Model. They employ techniques ranging from field theory to model-building to computer simulation.

With the continuation of the Fermilab Tevatron program over the next few years and the initiation of the experimental program at the Large Hadron Collider at CERN in 2007, the dynamics of electroweak symmetry breaking will be thoroughly explored in this decade. Chivukula and Simmons look forward to working closely with both theoretical and experimental high-energy physics colleagues at MSU to facilitate these important discoveries.

History of the Physics Department - 1916 - 1949

This is part two in a series of articles outlining the building history of the Physics Department. The NSCL and the Astronomy Department will be covered separately. The first article appeared in the Summer 2002 issue of the Physics and Astronomy Department Newsletter and covered the years 1857 through March 1916.

Forestry 1945. The building looked similar in the late 1920s. The façade is no longer slate, but has been bricked and there was a small annex added after Physics left.

Forestry Building (1916-1928) Built in 1900 for $15,000, it still stands on the circle near Linton Hall and is currently called Chittenden Hall. A recent tour of the building has shown that it has changed very little since the Physics Department was housed there through the late 1920s. The few remaining photographs of the building interior show the women's physics laboratory in the basement which, shockingly, is easily identifiable today. Under close inspection, the building still contains some nearly original lighting, wiring, transoms, woodwork, and many other features that leave you with the feeling of stepping back in time. Sadly, this building is no longer being used and is closed to the public.

Women's physics class held in the basement of the Forestry Building, circa 1920s

The original structure was 64x70 feet, two stories high, with a basement and an attic for storage. The Physics Department moved there after a fire destroyed the old Physics and Engineering Building in March of 1916.

There were four faculty members teaching physics, one Professor and three Instructor positions. To the credit of the department, around 1919 they hired a woman to teach physics. S. Elizabeth Morrison was given the title of "Assistant in Physics". Her duties included teaching the women's physics classes, setting up lab experiments, and maintaining the laboratories, classrooms and equipment. The records indicate she remained with the department, under the same title, well into the 1940s and possibly beyond.

Chemistry Laboratory Building (Chem. Fort) (1928-1949) Physics offices moved back to this Building in Sept.1928. This was a two story building and physics occupied the remodeled north wing. On the ground floor were two offices and a sophomore lab for general physics. There were special labs for light, x-ray, quartz spectrometer for radio work, two storerooms, general shop and a student shop. On the second floor, two offices, main lecture room for 200 students, an auxiliary lecture room for 100 students, a library, a heat lab, lab for electrical conduction through gas, two quiz rooms and two dedicated research labs.

2nd floor lab in the Forestry Building, circa 1920s. The women's physics lab doing a specific heat lab.

Chem Fort, North view of the building after the neon sign was replaced. circa 1940s

The 1930's were productive years for the Physics Department. In 1932 S. Elizabeth Morrison and her father were co-authors of the laboratory manuals used in the women's household physics and the men's physics laboratories. According to the 1933-1934 Annual Report, these manuals "have raised the standards of physics".

In 1933, Physics applied for and received Federal Emergency Relief Administration funds to design and construct a vacuum arc for photographing the short end of the ultraviolet spectrum usually absorbed by the atmosphere; improve the recording interferometer and physical optical experiments; and hire one student to assist in grading laboratory notebooks. The Physics Department also installed one of the first neon signs, bearing the word "PHYSICS" in block letters, on the north door of the building. It served two purposes; one, to identify the Physics Building and two, to demonstrate the conduction of electricity through gases. This sign was considered "an eye sore" by some of the more conservative faculty in other departments. During the early 1940s the sign was mysteriously destroyed by several soldiers sent to M.S.C. for training. According to existing records, the military offered to replace the neon sign, but the College kindly refused their offer citing the "boys will be boys" defense. This building was demolished in 1955.

***All photos courtesy of** Michigan State University Archives and Historical Collection*

Meet Megan Donahue

Michaela Voit, age 8 (left), Megan Donahue (center), and Sebastian Voit, age 6 (right)

Megan Donahue joined the astronomy group in August 2003. She was previously on the research staff of the Space Telescope Science Institute in Baltimore, MD. Megan was an undergraduate in physics at MIT and got her Ph.D. in astrophysics in 1990 from the University of Colorado, Boulder. There she met and married another member of the astronomy group, Mark Voit. She spent three years as a Carnegie Fellow at the Observatories of the Carnegie Institution of Washington, in Pasadena, CA. In 1993, Donahue moved to Baltimore to be an Institute Fellow at the Space Telescope Science Institute, then joined the research staff in 1995. Her observatory responsibilities primarily involved Hubble Data Archive, most recently as the branch chief for the archive support group.

She is interested in the intergalactic gas in clusters of galaxies. Clusters of galaxies are the largest gravitationally bound systems in the universe, and as such they occupy something of a privileged place in the hierarchy of cosmic structure formation. In our current picture of how structures form in the universe, clusters are the last to form, and are still growing, albeit slowly today. The rate of cluster formation and distribution of cluster masses are sensitive to parameters such as the mean density of the universe and the normalization of the initial density fluctuation spectrum. Clusters are also thought to be "closed box, representative" systems, whose gravity is strong enough to retain all the matter originally associated with them. Thus, quantities like the ratio of baryons to dark matter and the ratio of iron to hydrogen in clusters are probably representative of the universe at large. Most of the baryons in the universe are in the form of intergalactic gas. Clusters are the only places where a large fraction of these baryons can be detected, through X-ray observations of their free-free emission, allowing the ratio of baryons to dark matter to be measured. Furthermore, because the iron in the universe is created in the cores of massive stars and released by the violent explosions known as supernovae, studying the contents of clusters can reveal the history of massive star formation in the universe.

During the last 10 years, Megan has devoted much of her effort to making X-ray observations of clusters. She would like to continue to assemble the pieces of the story of the universe and the assembly of the structures such as clusters and galaxies by detecting even more distant clusters, by improving the understanding of the physics at work in clusters, and by measuring the properties of the nearby clusters. She is also interested in detecting the intergalactic "web" of baryonic material that links clusters to one another. Donahue currently uses the X-ray telescopes NASA's Chandra and the Hubble Space Telescope. She plans also to use the new SOAR telescope to study the physics of clusters of galaxies, to discover new distant clusters, and to characterize the supernovae rates in a sample of clusters.

Meet Filomena Nunes

Filomena Nunes joined the Nuclear Theory group at the NSCL in March 2003. Her previous position was at University Fernando Pessoa in Porto, Portugal, where she taught physics to engineers. During her Ph.D. (92-95) and post-doc (95-96) at the University of Surrey (UK) she developed structure models for light unstable nuclei, the so called halo nuclei.

Filomena Nunes

Halo nuclei are nuclei with a large proton or neutron excess, display extended wavefunctions and very low binding energies compared to neighboring nuclei. Consequently, they fall apart very rapidly. Why would you want to study these systems? Well, many of these systems are important to Astrophysics and, as they have long extended tails of very low density, they represent the best laboratory to test low density matter. In addition, they introduce exotic features that link to other fields of physics. As an example there are the Borromean nuclei, nuclei that can be modelled as three body systems and only stay together when all three particles are present. This same intriguing property can be found in other fields, and is illustrated through the Borromean rings. In these systems, as soon as ring is removed, the other two fall apart. Often it is not enough to think of these nuclei as few-body systems, composed of an inert core (a stable nucleus) and added nucleons. In her research, Filomena developed a model that includes core degrees of freedom in the few-body formalism, predicting some of the main nuclear properties.

Borromean rings

In her post-doctoral position, she applied these few-body models to the calculation of Astrophysical capture rates and breakup reactions. Her interest in the last few years has been mainly in reaction models that incorporate the exotic features.

Most of these nuclei, produced in beams such as those developed in the NSCL, can only be probed through reactions. Her collaborations with the Surrey theory group have been constant, but she also has a long history of collaborations with theorists in Lisbon and Seville. Filomena has worked actively with experimentalists, providing the theoretical input required for analyzing experiments. For many years she visited Notre Dame during the summer to participate in their nuclear research program; she is working together with Texas A&M and Oak-Ridge experimenters on nuclear reaction measurements with connection to Astrophysics. Her present work at the NSCL also involves a strong link to the local experimentalists.

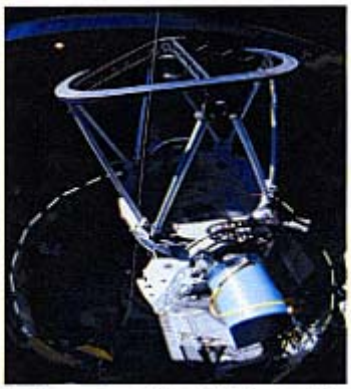
Even if her accent may be misleading, Filomena has many typical Portuguese traits. She does not like early mornings, enjoys talking to people, feels the nostalgia of the Portuguese fado, and loves the sun and beach. It is not clear how she will cope with the Michigan Winter.

The SOAR Telescope approaches First Light…

by Ed Loh and Jack Baldwin

SOAR's 4m diameter primary mirror being lowered onto its active support system, in preparation for the final acceptance tests now underway.

The birth of any major new telescope is celebrated as its "first light", and for SOAR this event is right around the corner, in early 2004. The dome and mount are finished and have been under test at the site in Chile for almost a year now. The mirror systems, including the 4m-diameter primary mirror, the ~1m secondary and tertiary mirrors, and their computer actuated "active optics" control systems, have been completed and are now undergoing final checkout at the factory in Connecticut. SOAR's primary mirror is one of the best telescope mirrors ever fabricated, with an rms wavefront error of only 17 nm (3% of the wavelength of light). This will ensure that SOAR can achieve the exceedingly high image quality that is offered by its location on Cerro Pachón, one of the best astronomical sites in the world.



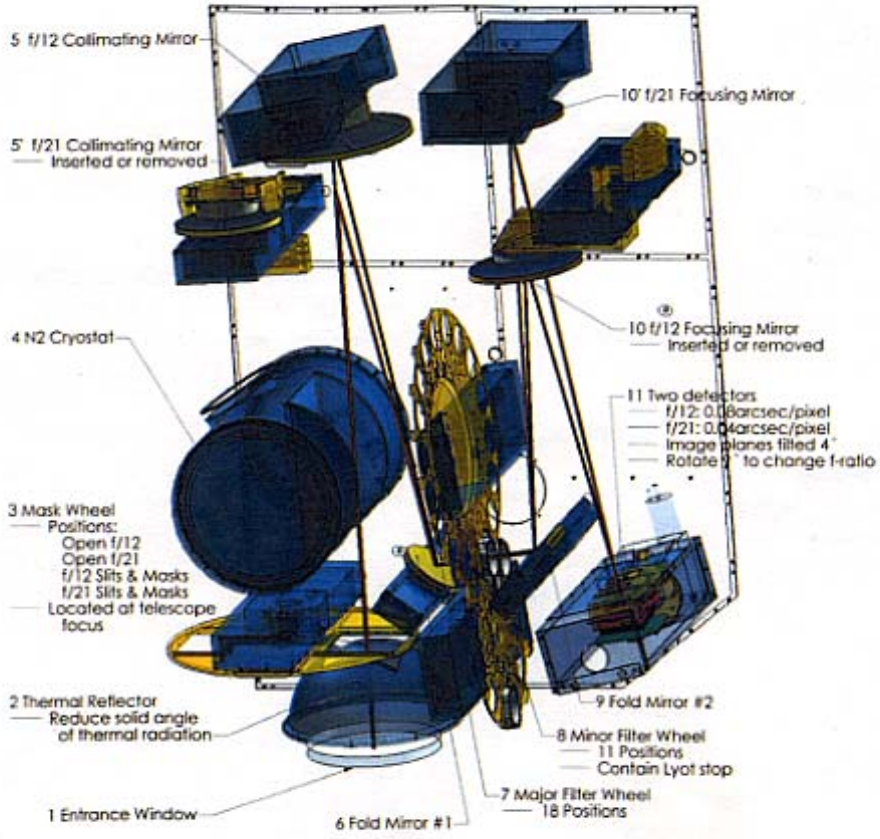
Fish-eye view of the SOAR mount, in its enclosure in Chile.

We expect to take delivery of the optical system at the factory in October, and to have it at the telescope site in Chile by early December. The formal dedication of SOAR as a major new research tool is will be on April 17, 2004.

…with major progress on MSU's Spartan Camera as well.

Telescopes concentrate the light of distant objects and deliver it to a focal plane, but then specialized instruments are required to analyze that light in order to actually do the science. MSU's first contribution to the suite of world-class instruments that will be mounted on SOAR is the Spartan Infrared Camera, an innovative imager with an unprecedented number of detector pixels covering a large area of the sky at high angular resolution. Since SOAR's sharpest images and therefore its highest performance will initially be achieved at near-infrared wavelengths (1-2.5 microns), the Spartan camera will be SOAR's leading-edge instrument.

The drawing below shows the interior details of the Spartan Camera, illustrating that although this is a complex opto-mechanical system that must work at liquid-nitrogen temperatures, there is an underlying elegance and simplicity to its design that is a harbinger of good performance to come. The camera contains two alternate sets of optics, providing a choice of two magnifications covering either the largest possible field of view at slightly lower angular resolution, or a two-times smaller (in diameter) field of view at SOAR's maximum angular resolution of 0.04 arcsec. Incoming light from the telescope is collimated and then refocused by pairs of convex mirrors, onto an array of four 2048x2048 pixel² HgCdTe detectors. This will be the largest infrared detector array that is available anywhere in astronomy. Because of the great scientific appeal of the Spartan Imager, our Brazilian SOAR partners and the NSF have already funded a $850k upgrade to provide the final two detectors. The camera is now 80% complete, and is taking shape as a real piece of hardware. This project is on budget ($2M), and is on course for delivery in March 2004.



The Spartan Camera's cryo-optical box being installed into its vacuum enclosure (left). Initial cryogenic test of the Spartan Camera (right).

Meet Remco Zegers

Remco Zegers

Remco Zegers started working at the NSCL in February 2003. He came to MSU after spending three years in Japan; the first two years as a Science and Technology Agency Fellow and the remainder as a visiting senior scientist at the Research Center for Nuclear Physics (RCNP) in Osaka. Remco received his Ph.D. at the Kernfysisch Versneller Instituut (KVI), part of the University of Groningen in the Netherlands.

Remco's research has focused on nuclear and nucleon resonances. His main interest is in charge-exchange excitations of nuclei. During his Ph.D. he focused on the subject of isovector monopole giant resonances. Extensive experimental efforts at the Indiana University Cyclotron Facility (IUCF) and the KVI using the (^{3}He,t) charge-exchange reaction were needed to define the experimental procedures and extract information of the isovector monopole resonances.

During his time in Japan, Remco continued his work on charge-exchange excitations and by refining the experimental methods used, was able to extract detailed information about the these resonances from data taken at RCNP. Besides the fundamental interest of collective excitations at high excitation energies, the results provide an important test for microscopic model calculations with effective nucleon-nucleon interactions.

In order to broaden his scope, Remco also joined the Laser-Electron-Photon group at SPring-8 (LEPS). The research at this facility is focused on strangeness production off the nucleon using photon-nucleon reactions. Remco worked in particular on spin-observables in K^+-photon production off the nucleon. The results are important for understanding nucleon resonances that are predicted in quark models but so far have not been observed experimentally. Remco also was part of the team that first observed a penta-quark particle (afterwards named q$^+$).

With his move to MSU, Remco is again focusing his attention fully on nuclear reactions and intends to continue his work on charge-exchange reactions and spin-isospin modes of excitation. Although fully intent on making use of possibilities present at NSCL to further the investigation into isovector giant resonances, he wishes to expand the scope of his research into charge-exchange reactions to excitations that are important from an astrophysical point of view. First candidates are Gamow-Teller transitions whose properties are important to understand stellar evolutions and supernovae explosions.

Excellent conditions to perform such experiments are present at NSCL. The possibility to produce a secondary radioactive triton beam of sufficient intensity opens the way to perform (t,^{3}He) experiments. More challenging, but certainly not less interesting, are charge-exchange reactions in inverse kinematics with radioactive isotopes.

Meet Mark Voit

Mark Voit

Mark Voit joined the Department's astronomy group in August 2003. He came to MSU from the Space Telescope Science Institute, where he was a member of the research staff and a specialist in public outreach. Voit earned his Ph.D. at the University of Colorado in 1990 and was a research fellow at Caltech and a Hubble Fellow at Johns Hopkins before joining the Institute's staff. His research focuses on the baryonic side of cosmology and particularly on how the disruptions wrought by quasars and supernova explosions affect the formation of stars and galaxies.

One of the major puzzles in cosmology is why only about 10% of the universe's baryons have formed stars. The remainder are thought to be scattered throughout intergalactic space. Many of these "missing" baryons may once have been part of newly forming galaxies. However, the process of galaxy formation can release enormous amounts of energy, as supernovae explode and giant black holes grow through accretion of matter within these young galaxies. This vast liberation of energy is likely to inhibit further star formation, in part by driving outflows that carry away many of the baryons originally associated with a galaxy. In the coming decade, NASA will be devoting significant effort to finding these "missing" baryons, measuring their temperature, and determining their chemical makeup.

Much of Voit's recent research has been devoted to theoretical modeling of the feedback processes triggered by galaxy formation and the impact they have on intergalactic space. Clusters of galaxies are particularly useful laboratories for testing these ideas because they are the only locations where we can observe all of the intergalactic baryons. A cluster's gravity is strong enough to retain all of the baryons ejected by its member galaxies and drives those baryons to X-ray emitting temperatures through hydrostatic compression, allowing them to be studied with X-ray telescopes like the Chandra observatory. In partnership with his wife Megan Donahue, also a new department member, Mark is combining theoretical ideas with X-ray observations to look for clues in present-day clusters that reveal the past history of supernova explosions and quasar-driven outflows and the ways in which they regulate galaxy formation.

Voit also has a strong interest in education and public outreach. Along with Megan Donahue, he is a co-author of the astronomy textbook The Cosmic Perspective. He is the project scientist for a Smithsonian Traveling Exhibition on the Hubble Space Telescope, entitled Hubble Space Telescope: New Views of the Universe and is author of the eponymous popular book of Hubble pictures based on the exhibition. And, he was also behind the development of HubbleSite (hubblesite.org), NASA's public information source on the Hubble Space Telescope.

Meet Kirsten Tollefson

Kirsten Tollefson

Kirsten Tollefson joined the high energy physics group in April 2002 after completing a postdoc on the Collider Detector at Fermilab (CDF) experiment. She received her Ph.D. from University of Rochester in 1997 and accepted a postdoc at M.I.T. After a year, her boss decided to leave Bean Town and join the faculty at University of Rochester. So despite her efforts to break away she ended up back at Rochester. Kirsten was led to high energy physics by Carl Bromberg who supervised her one summer in MSU's REU program. Carl swayed her away from her first love, astrophysics, by telling her tall tales of the Standard Model and the new Superconducting Super Collider (SSC) accelerator being built in Texas. During that summer she spent her time building a prototype scintillating fiber calorimeter for the ill-fated SSC and deciding that high energy physics was at least as cool as cosmology.

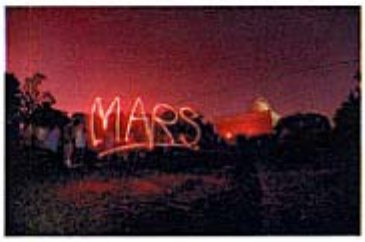
By the time Tollefson entered graduate school she had heard about the on-going search for the elusive top quark. This fundamental particle was predicted to exist by the Standard Model as the weak isospin partner of the bottom quark, which was discovered at Fermilab in 1977. The top quark eluded particle physicists until 1995 when both the CDF and D0 experiments at Fermilab announced its discovery. Kirsten's interest in top quark physics began when she played a role in its discovery at CDF and later measured its mass for her thesis. Despite the Standard Model's successful prediction of the existence of the top quark, it could not predict its mass. Why the top quark was able to escape detection for almost 20 years was due to its gigantic mass, "weighing in" at approximately 175 GeV it is more massive than a gold atom. The fact that the top quark's mass is so large, 35 times greater than its bottom quark partner, gives it a unique role in the Standard Model.

CDF Detector

Unfortunately, only a small sample of top events was collected during Run I (1992-1995) which caused all top measurements to be statistically limited. Last year CDF started taking data again and expects a 100-fold increase in the top event yield than in Run I. Tollefson's current research is focused on improving the precision of the top quark measurements in hopes of answering questions about the generation of mass and if there is new physics beyond the Standard Model. In 2007, the next generation of accelerators, the Large Hadron Collider (LHC), will begin running at CERN in Geneva, Switzerland. The LHC will be a true top factory delivering 8 million top events to each of its two experiments, ATLAS and CMS, in just its first year. Kirsten is considering joining her fellow MSU colleagues on ATLAS but still secretly harbors a desire to try her hand at astrophysics or at least high energy astrophysics.

Departmental Events

The **American Physical Society Division of Nuclear Physics** meeting, with approximately 600 attendees, was held at the Kellogg Center, the NSCL, and the BPS building last fall, marking the first time that our new building was used for a scientific conference. In April, the **APS Ohio Section** held a combined Ohio-Michigan sectional meeting at the BPS building, with over 150 attendees. The focus of this meeting was quantum computing, highlighting the work of our new Center for Quantum Science. Other scientific meetings held on our campus were the **7th International Computational Accelerator Physics Conference**, with over 100 attendees, and the **STAR Collaboration Meeting**, for which more than 130 high-energy nuclear physicists congregated in our BPS building. Our new **Astronomy for All** outreach program had a tremendous start, with its Mars viewing nights at the observatory drawing more than 3,000 astronomy buffs eager for a look at Mars during the time of its closest approach in recorded human history.



Mars Viewing Night

Carl E. Bruch Wins CNS Alumni Award

Carl Bruch

Carl E. Bruch (BS, '89) visited MSU in April to receive the College of Natural Science Alumnus Award. After his BS degree and graduate work in physics, he shifted direction and completed a law degree. He is at the Environmental Law Institute in Washington, DC where he is a senior attorney, a co-director of their Africa Program and, from what we gather from him, having the time of his life. While on campus he visited the department, met with several members of the faculty as well as with the undergraduate physics and astronomy majors. At a reception for him he gave the undergraduate group his view about how a degree in physics can lead to any one of a variety of careers.

Happy Birthday, Milt Muelder!

Shown is Milt Muelder (left), major donor to the PA dept. & SOAR telescope, and friends, among them former provost John Cantlon (2nd from right). PA faculty gave Milt a private Mars viewing night for his 95th birthday present. Just this year, Milt has added another large cash gift for SOAR to his already very sizeable donation, and he has given an annual endowed lectureship to the department. He wanted it named in honor of Henry Blosser, and Henry insisted that Milt's name should be part of the title. So we compromised and the lectureship will henceforth be officially called the *Dr. Henry (Hank) Blosser and Dr. Milton E. Muelder Endowed Lectureship.*

NSCL Addition Adds Needed Space

by Orilla McHarris

The most visible development at the NSCL recently is the completion of an MSU-funded addition at the northwest corner of the building. This addition will relieve the congestion of the past few years by providing 36 offices, 2 conference rooms, and 2 secretarial areas. Construction was completed in February 2003, and NSCL personnel were relocated soon after that. Some of the vacated offices in the original building have been converted back to much-needed laboratory space, some are now offices for the expanded staff needed to run the coupled-cyclotron facility, and four of them have become offices for external users and other visitors.

The photo on the left shows a side view of the glass curtain wall soon after it was completed last winter. The lobby just inside was finished in March. Machinists in the Cyclotron Lab Machine Shop made a metallic version of the NSCL logo to decorate the lobby wall, and an MSU interior decorator chose lobby furniture. The Cyclotron Lab's front door (with a handicapper-accessible automatic opener) is now in the new wing.

The "nuclear conference room" is a nice feature of the new wing. Around the conference table are connections for six laptop computers, and a video switch which will allow any one of the users to project images on the wall screen. Natalia Andreeva, wife of Alexander Volya (former post doc, now at Florida State University), donated two of her own paintings to the Cyclotron Lab, and these have been hung in the conference room.

A sidewalk has been constructed from the south door of the new wing, so that Cyclotron Lab staff can walk across the courtyard to the BPS Building. MSU, whose experts move trees as easily as most people move chairs, shifted two big spruces slightly to one side to make room for the southern sidewalk.

Plans are now being made to renovate the Theory Wing south of the center stairwell. The offices in that wing will get new ventilation, paint, ceiling tiles, and ceiling lights. The southern stairwell will also be renovated.

Jesse J. Chvojka Receives Carl L. Foiles Award

Carl L. Foiles

The family of Professor Carl Foiles, who passed away suddenly in 1997, made a generous donation to the University for the purpose of endowing the "Outstanding Graduating Senior in Physics or Astrophysics" award. The guidelines for this annual prize state that it should be given for excellent achievement with strong consideration for research participation as well as for academic performance. Carl Foiles received his Ph.D. in experimental condensed matter physics from the University of Arizona in 1964. He was first appointed as an Assistant Professor at MSU in 1966. 2003 was the first year that the award was given.

Ruth Ann Foiles (left), Jesse J. Chvojka (center), and Allen Foiles (right)

The 21st Century Achievement Awards

Wolfgang Bauer (left), Merritt Lutz (center) and Guy Albertelli (right)

There is great news to report from our LON-CAPA (Learning Online with CAPA) project. It received the Computerworld Honors 21st Century Achievement Award and was "Judged best IT application in the world in Education & Academia", beating out nominees from around the world. Accepting the award on behalf of the LON-CAPA team were Wolfgang Bauer (left) and Guy Albertelli (right), during a black-tie Oscars-style award ceremony in the National Building Museum in Washington, D.C., in June. Shown with them is MSU-alumnus Merritt Lutz (center), of Morgan Stanley, during the post-award celebration party. The picture on the left shows Ed Kashy and wife Marilyn during a preceding event in San Francisco, where LON-CAPA was announced as one of the award finalists and received a gold medal. The Principal Investigator of the LON-CAPA project is Gerd Kortemeyer, an MSU-PA Ph.D. graduate.

Edwin and Marilyn Kashy

Physics & Astronomy Awards for 2002/2003

Bruce VerWest Award to **Laura M. Chapan** and **Steven R. Kecskemeti**; Thomas H. Osgood Award to **Erik A. Strahler** and **Kathleen A. Grove**; Outstanding Teaching Assistant Award to **Joel Piper**; Sherwood K. Haynes Graduate Assistant Award to **Emil Bozin**; Outstanding Faculty Teaching Award to **Vladimir Zelevinsky**; Outreach Award to **Thomas Glasmacher** and **Hendrik Schatz**; Distinguished Staff Award to **George J. Perkins**; Thomas A. Kaplan Award to **A. J. Rader** and **Sergei Urazhdin**; Thomas H. Osgood Memorial Faculty Teaching Award to **Gene Capriotti** and **Jack Bass**; Carl L. Foiles Award to **Jesse J. Chvojka;** Lawrence W. Hantel Endowed Fellowships to **Laura Chapin , Jesse Chvojka, Alfredo Estradevaz, Mike Santonocito** and **Erik Strahler.**

Alumni News

It's been a quiet year at MSU Physics-Astronomy as far as news from alumni is concerned. Is anyone out there reading our newsletters or logging on to our alumni web pages? We certainly hope so. There is much information there. If you want to know who was awarded the Osgood Award for the outstanding senior(s) of the year this year or, say, in 1989, log on to http://www.pa.msu.edu/alumni/awards/pa.html.

Do you want to see your name and the names of those who received the BS degree in the year "XXXX"? Go to http://www.pa.msu.edu/alumni/bs/menubs.html, or if it's the MS degree that you received go to http://www.pa.msu.edu/alumni/ms/menums.html, etc. Is there a name that is absent from any degree listing that you know should be there? Let us know and we'll check it out. If you spot any errors in the information about your degree, point out to us what needs correction. For news that you'd like passed on to other alumni send the information to kovacs@pa.msu.edu.

Below is information that we have collected since a year ago.

Richard Peterson (MS, '66, Ph.D. '69), Professor of Physics at Bethel College, took office at the beginning of the year as vice president of the American Association of Physics Teachers. Peterson is one of the many graduates of the University of Wisconsin at River Falls to complete a Ph.D. in Physics at MSU. **Robert G. Ponzini** (Ph.D., '67) retired in July from ITT, which bought out his former employer, Kaman Nuclear in Colorado Springs, CO, a few years ago and where he was employed since he left MSU. **Tim Murphy** (BS, '69; MS, '77) has retired as School Superintendent in Sandusky, MI and is enjoying teaching physics again, now at the University of Detroit Jesuit High School. **Matthew Miller** (Ph.D., '98) is Senior Engineer at Medtronic, the world's largest manufacturer of implantable cardiac pacing systems and defibrillators. His wife Lori is full-time domestic engineer caring for their 3-year old triplet daughters. **Steve Cantley** (BS, '87), at Johnson Space Center, continues doing Mission Control for the International Space Station. **Christopher Hanley** (BS, '96) is still at Hubble Space Telescope Institute in Baltimore. He is a Senior Software Engineer currently working on the second Guide Star Catalog, to be used by HST and future space-based observatories to find their positions in the sky. He has recently married. **Csaba Balazs** (Ph.D., '99) has recently started on a postdoctoral appointment at Argonne National Laboratory. **Chris Ramsell** (Ph.D., '00) is in the semiconductor industry as an application engineer for KLA-Tencor in Portland, Oregon. He says he can be contacted at chris.ramsell@KLA-Tencor.com. At Marietta College in Ohio, **Stanley Radford** (BS, '76) is now the chair of the Physics faculty, and **Dennis Kuhl** (MS, '93; Ph.D., '96) has joined that department after a postdoctoral appointment at Tufts University and a stint on the faculty at Bridgewater State in Massachusetts. **Catherine Mader** (Ph.D., '93) was promoted to Associate Professor of Physics with tenure in 2000 at Hope College. **Bao An Li** (Ph.D., '91) has been promoted to Associate Professor with tenure at Arkansas State University. **A. J. Rader** (Ph.D., '02) informed us that at the University of Pittsburgh, where he is a post-doc at the newly formed Center for Computational Biology and Bioinformatics, he is doing research on structure-function relationships of biological molecules and on the way to being a full-fledged biophysicist.

Eugene Parker (BS '48) Awarded Kyoto Prize

Physics-Astronomy alumnus Eugene Newman Parker

Why does the gaseous tail of comets always point away from the sun? A solar wind, a pervading supersonic flow from the solar corona, was Gene Parker's answer in 1958, even though at that time the corona was thought to be bound.

The prediction of the solar wind and his work on magnetohydrodynamics led to a fundamental change in the view of the space between stars. For these advances, Gene will receive the 2003 Kyoto Prize for Basic Science (www.kyotoprize.org).

"Prof. Thomas Osgood and the physics department taught courses that gave me a very sound foundation in physics," says Gene of his education in the department. He is currently the Emeritus Chandrasekhar Professor of Physics & Astronomy at the U. Chicago. He is a member of the National Academy of Science and the 1989 recipient of the National Medal of Science.

The ionized gaseous tail (at 2:00) and the dust tail (1:00 - 1:30) of a comet

Gene has long-standing ties with MSU. His maternal grandfather, Fred McNair, was a professor of physics and mathematics in the 1890s, daughter Joyce Parker teaches in the Division of Math & Science Education, and son-in-law Ed Loh is on the faculty in the P-A department.

In Memoriam

We have learned that **Fred L. Petrovich** (MS, '66; Ph.D., '71) died on September 25 at Duke Medical Center while undergoing chemotherapy. He was on the faculty of Florida State University for 30 years and was active in nuclear theory research up until his recent illness. He came to MSU in 1964 from Clarkson College and was one of the early Ph.D. Students of Hugh McManus. **Dorothy (Johnson) Burgess,** many will recall, was the department secretary for many years from the early 50s until her retirement in the mid-70s, spanning the tenure of several department chairpersons. Mrs. Burgess died May 23, 2003 at the age of 89. We have been informed that **William Johnson,** who was on the faculty and at the NSCL from the early '60s until the mid-'80s, died on October 3. He began his employment in the physics department as an Associate Researcher in January 1962. He then was appointed as an Assistant Professor in 1963 and later promoted to Associate Professor with tenure in 1968. He is credited with being one of the four builders of the K50 cyclotron — the others being Henry Blosser, Morton Gordon, and Martin Reiser. He resigned in 1969 to go to the University of Maryland where Reiser had gone to head up the cyclotron effort there. He then returned to MSU in 1978 when Henry Blosser asked him to help build the superconducting cyclotrons, and he was the head of the Electronics Department at the NSCL until 1984.

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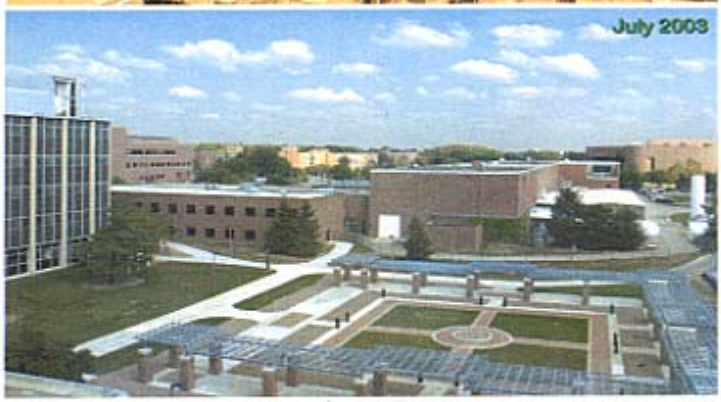

Congratulations Walt and Maris!

On September 2nd, we had reason to celebrate two very special anniversaries. Walter Benenson (left) had his 40th anniversary as an MSU-PA faculty member, and Maris Abolins his 35th. The occasion was celebrated with a cake during a regular faculty meeting.

e-mail: newsletter@pa.msu.edu
url: www.pa.msu.edu/alumni.htm