Cross Sections

DEPARTMENT OF PHYSICS AND ASTRONOMY
UNIVERSITY OF ROCHESTER
WINTER 2004

Message from the Chair

—Arie Bodek

As we enter the 21st century, while building on the traditional strengths of the department and the University, we are also moving in new directions. Because of the small size of both the department and the University, collaborative activities in research and education among faculty members in different subdisciplines within physics and astronomy, as well as in association with other departments, are growing steadily. For example, a new program was initiated in fall 2003 on a joint Ph.D. in physics and optics, and experimental and theoretical collaboration between the quantum optics groups in both departments are currently under way. The Deparments of Physics and Astronomy and Mathematics have initiated a collaboration in research in mathematical physics, and hold joint seminars. Members of our particle physics and nuclear physics groups are joining together on a program to investigate nucleon structure and neutrino oscillations by using electron scattering beams at Jefferson Lab (Newport News, Va.) and neutrino beams at Fermilab (MINERVA). Stephen Teitel won a bridging fellowship (in 2003) to the Department of Brain and Cognitive Sciences to venture into biological physics, and David Douglass won a bridging fellowship (in 2004) to the Eastman School of Music. We are proud of our programs in atomic physics (collaboration between the Departments of Physics and Astronomy and Optics) and plasma physics (involving the Departments of Physics and Astronomy and Mechanical Engineering and the Laboratory for Laser Energetics). This must be surely one of the reasons that the University of Rochester was ranked 6th nationwide in atomic physics/ plasma physics by *U.S. News & World Report* in 2003. We have recently also strengthened our program in chemical physics with the appointments of Esther Conwell and Lewis Rothberg as professors of chemistry and physics, and the addition of Mark Bocko as professor of electrical engineering and physics. In addition, we are working on new collaborative ventures with the medical school in the area of medical physics.

Several of our faculty and students have received awards during this past academic year. Steve Manly, our Distinguished Brugler Teaching Professor since 2002, was chosen by the Carnegie Foundation and the Council for the Advancement and Support of Education (CASE) as New York State Professor of the Year in 2003. Nicholas Bigelow and David Meyerhofer received the first Dean's Awards for contributions to graduate education in 2003, and Shaul Mukamel, professor of chemistry and physics was given the Ellis R. Lippincott Award from the Optical Society of America for 2003. For completeness, I must also mention that Arie Bodek was awarded the 2004 Panofsky Prize in Experimental Particle Physics from the American Physical Society.

Graduate Student Kam Wai Clifford Chan was awarded the University's Messersmith Fellowship, and our freshman major Siddharth Parameswaran won the University's Delno Sisson Prize in 2003. Over the years, we have given high priority to the training of our undergraduate and graduate students, and this attention has not gone unnoticed. In fact, in a nationwide survey of U.S. graduate students conducted in 2001, the department was ranked second in overall graduate-student satisfaction. As a result, our domestic applicant pool has been increasing and in fall 2003 we had a class of 35 superb entering graduate students.

We wish to take this opportunity to thank all our friends who have contributed so generously to the support of the department. By completing the form on the last page of our newsletter you can continue (or begin) that tradition of giving that will assure the future excellence of the department. Other ways to help our cause is to inform any promising students about our summer undergraduate research program (REU), and to encourage students interested careers in physics or astronomy to apply for graduate study at Rochester. Application material for all these programs is available on our Web pages (www.pas. rochester.edu). If you know of any exceptional undergraduates whom we should consider either for our REU program or for graduate studies, we would appreciate it if you would please send their names and e-mail addresses to Barbara Warren (barb@pas.rochester.edu), and we will contact them directly. Any help from our alumnae and alumni along these lines would be greatly welcomed.

Several years ago, the University initiated a tradition of hosting yearly Meliora Weekend reunions (see www.rochester.edu/alumni). I encourage all our alumnae, alumni, and friends to come and visit us in fall '04. For the latest news about the department, please visit our Web page, where you can also find the current and several recent issues of *Cross Sections* online.

Cross Sections

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On the Cover

August 25, 2003: Launch of the Space Infrared Telescope Facility or SIRTF (named the Spitzer Space Telescope on December 18, 2003) on a Delta rocket from Cape Canaveral, Florida. It's been a long wait, but our astronomers are finally going to get the data in the infrared spectrum (wavelengths of 3 to 180 μm) that are bound to have major impact on our understanding of the origin of galaxies.

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Regina Demina Joins Our Effort in Particle Physics

It is often said that curiosity kills cats. Regina Demina, formerly with Kansas State, and now our new associate professor in experimental particle physics, does not wish to comment on such fatal issues, but claims that when she watches her two cats, they remind her of scientists. One of her cats is especially puzzled by the underlying principle of operation of their water fountain, and constantly tries to knock it to the floor, presumably in the hope of figuring out what makes it work. Regina maintains that this is the same method that particle physicists have also been using for over a century to study fundamental properties of matter. Inspired by Rutherford, smashing together particles in high energy colliders, she too hopes to learn the principles underlying the universe. She says that the puzzle that brought her to physics was the origin of mass. Closely related to this question is the mystery of electroweak symmetry breaking (EWSB). The Fermilab Tevatron, and shortly the CERN Large Hadron Collider (LHC), are collider accelerators that probe the EWSB energy scale, and are therefore the likely places where the discovery of the mechanism behind the EWSB will take place. That is why her research program for the next 10 to 15 years is focused on utilizing data from these machines. The mechanism of EWSB is unknown, and although the Higgs mechanism (with Richard Hagen one of its discoverers) is the most likely candidate, until it is proven through experiment, it is just one of the hypotheses. Models using strong dynamics (new quark degrees of freedom) also offer interesting alternatives. The idea of a possible role of the top quark in EWSB is especially intriguing. In the presence of a vast variety of models, an experimenter's task could become confusing. Luckily, most models predict similar signatures that rely largely on an experiment's ability to identify heavy quarks, e.g., the bottom or b-quarks.

Graduate student Elizabeth Groves along with Regina (right) next to the new probing station for checking properties of silicon microstrip detectors

Silicon-based tracking devices have proven to be highly effective for tagging heavy quarks based on the quark lifetimes. Regina's research program is therefore concentrated on the development of silicon detectors that can withstand high doses of radiation, algorithms that maximize the capabilities of these detectors, and analyses targeted at understanding the mechanism of EWSB. Regina started her research at Rochester by setting up our first silicon-detector facility (most of us have probably noticed the noise and dust on the 3rd floor!). Silicon tracking devices provide the highest precision available for measurement of track coordinates—at a level of few microns. These devices are used to measure lifetimes of subatomic particles that travel only a fraction of a millimeter

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John Howell—New Experimenter in Quantum Optics

As many of you know, John Howell joined our faculty as assistant professor of physics and quantum optics in February 2002. This was just after he completed his postdoctoral work at the University of Oxford at the Centre for Quantum Computation. His primary interests have been focused on experimental studies of quantum mechanics and the processing of quantum information. After moving into his labs in early 2003, his group has become engaged in several exciting experiments in these fields.

The processing of quantum information (or "QIP") is a relatively new field in physics. QIP exploits nature for developing capabilities such as sending secret messages, teleporting quantum states, cloning quantum particles, and gaining far more computing power in certain applications. One of the areas John's group has chosen to study is quantum cloning. Quantum cloning is concerned with how well characteristics of quantum particles can be copied. One of the simplest particles to clone is a photon. A photon can be characterized by its frequency, where it is located in space and time, its polarization, etc. The Howell group studied cloning of the polarization of photons. Polarization is just the orientation of the electric field, or a measure of how the electric field oscillates transversely during propagation. While it may seem trivial to measure the polarization of a photon, it is, in fact, impossible to do that without altering the polarization. Photon cloning involves the construction of an experiment that has one photon of unknown polarization

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SIRTF Is Launched

Early in the morning of Monday, August 25, the fourth of NASA's Great Observatory satellites, the Space Infrared Telescope Facility (SIRTF), was launched into its orbit around the Sun. It illuminated spectacularly and then punched through a nearby bank of clouds, soared along an arc through the clear summer sky, and for five minutes it outshone the other bright orange light in the southeast sky, Mars, as it neared its closest opposition in many millennia. Thus began the five-year mission of the centerpiece of NASA's Origins program, the 300th launch in the famous series of Delta rockets (see front cover), and the life of the final part of the constellation of satellite observatories that also includes the Hubble Space Telescope, the Compton Gamma-Ray Observatory, and the Chandra X-Ray Observatory. The launch was in many ways the culmination of two decades of work by three of our department professors, who are charter members of the teams that designed and built the observatory. And so all three found themselves watching and cheering as SIRTF's Delta II rocket blasted off from Cape Canaveral. Judy Pipher looked on from the end of a fishing pier about three miles south of the launch pad, surrounded by other members of the team that built SIRTF's Infrared Array Camera (IRAC). Half a mile farther down the beach, Dan Watson was in a crowd of fellow members of the SIRTF Infrared Spectrograph (IRS) team and their families, waving a camcorder and a champagne bottle as the rocket flew past. And, back in Rochester, Bill Forrest, who belongs both to IRAC and IRS, presided over a cheering group of graduate students, who were viewing a live NASA TV link as the central feature of their Ph.D. theses flew off into space.

"Aliveness Test"—first infrared image from SIRTF

Their first rewards for the long wait were not long in coming. Six days after launch, IRAC was turned on and immediately delivered SIRTF's first astronomical image (see photo), a field full of faint stars and galaxies captured by one of the detector arrays developed by Pipher and Forrest. And two weeks later, IRS provided SIRTF's first astronomical spectrum. All three astronomers were heavily involved in the three-month phase of in-orbit checkout and science-verification tasks needed to characterize the observatory, and compiled early observations for release at the initial SIRTF press conference and naming ceremony on December 18, 2003. (Other than the first-light image, all SIRTF data not released on December 18 will continue to be embargoed.) They reported that the observatory and its instruments are behaving flawlessly, and that performance has met or exceeded expectations in nearly all aspects. As Watson put it, "considering the complexity of the observatory and the risks of a rocket launch, it's better than we had any right to hope." SIRTF provides access to the full infrared spectrum, at wavelengths of more than 3 microns. In this range, star-formation regions, dusty circumstellar disks, and planets emit most of their energy. Extremely distant galaxies—those with redshift 5 or more—appear at their brightest. Objects that are always shrouded in dust, such as the black-hole-driven engines in the nuclei of active galaxies and quasars, appear without obscuration at these wavelengths. Most of these kinds of objects are very faint, but still well within SIRTF's reach: SIRTF can detect objects that are factors of 100–1,000,000 fainter than found using previous detectors. It is expected therefore that SIRTF will provide decisive contributions to our understanding of the origins and evolution of galaxies, and the origins of stars and planetary systems.

To achieve sufficient infrared sensitivity for these tasks, SIRTF must be deployed above the Earth's absorbing atmosphere, in a location where it can be cryogenically cooled and shaded from noisy thermal emission from Earth, Moon, and Sun. The satellite is therefore in an Earth-trailing heliocentric orbit, and arranged so that the observatory always lies in the shadow of its solar panels and radiation shield. Three cryogenic instruments based upon advanced solid-state detector arrays, for which the intrinsic noise is so small that the observatory's sensitivity is limited only by the thermal noise in the light emitted by interplanetary dust particles, are positioned in the telescope's focal plane. The telescope and its enclosure were cooled by radiation down to about 30 K during the first few weeks after launch, and then connected thermally to an onboard 360-liter reservoir of liquid helium to cool to its present temperature of about 5.5 K. IRAC is a camera for wide-field imaging in the 3–8 micron range. IRS is a combination of spectrographs that cover the 5.3–40 micron range at low and moderate spectral resolution. The Multiband Imaging Photometer (MIPS) for SIRTF is a camera for surveys, and images at 24, 70, and 160 microns. All were designed and built by consortia of university scientists, in collaboration with aerospace companies and NASA laboratories. Design of the telescope and its cryogenic assembly was led by SIRTF's management center, the Jet Propulsion Laboratory. The Rochester SIRTF members joined the project at its inception. Judy Pipher participated for several years in the initial planning of the observatory, and in 1983 became an original member of the team, with Giovanni Fazio (Smithsonian Astrophysical Observatory), former faculty member of our department, serving as the Principal Investigator of IRAC. Bill Forrest also joined the IRAC team at the very beginning, and Forrest and Pipher, already responsible for the first near-infrared array-based astronomical cameras, led the development of half of IRAC's focal plane detectors. Simultaneously, Forrest joined Jim Houck's (Cornell) IRS team, and began to work with Dan Watson, another original IRS member (while at Caltech). Five years later, Forrest and Pipher recruited Watson to join them on the Rochester faculty, giving Rochester a stronger presence in two of SIRTF's major efforts. The three astronomers went on to make many

contributions to the detectors, optics, and electronics of SIRTF, during two decades of design, development, and quite a few delays. Each instrument had to be redesigned several times, as NASA had to reduce SIRTF's scope and budget during the 1990s. A great deal of creativity had to be applied to assure that the resulting facility could still satisfy its scientific requirements.

Now that SIRTF is working and has a five-year supply of liquid helium to keep itself cold, the Rochester SIRTF investigators are re-tooling their research efforts to carry out the ambitious astronomical research they have planned in parallel with the development of IRAC and IRS. Watson and Forrest are the leaders of the IRS team's extensive guaranteed-time observing (GTO) program on the structure, composition, and evolution of protostellar, protoplanetary, and debris disks. Pipher and her group are spearheading the IRAC team's large GTO program on populations of stars and disks in recently formed stellar clusters. Several other programs arise from interests in such astronomical issues as gamma-ray bursters, brown dwarfs, and the origin of active galactic nuclei. It is now certain that SIRTF's data rate for these programs will be torrential, and we can confidently expect them to answer many of the outstanding questions of astronomical origins. SIRTF's huge leap forward in sensitivity means that the most exciting results from SIRTF may be those that are completely unanticipated. Stay tuned for five years of discovery!

John Howell—New Experimenter in Quantum Optics

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entering a "black box" and two photons of identical polarization emerging. However, it is also known that it is not possible to start with an arbitrarily polarized photon and get out two photons with that initial polarization. The goal of the experiments has been to push the bounds of copying the polarization of photons. In a series of rather dramatic experiments, John's group has shown that cloning has a much broader perspective than many had supposed. In particular, they showed that it may not even be necessary to construct a "cloning machine," and all that is required is to produce interference between the input photon and another photon.

In collaboration with Bob Boyd's group, Howell is also studying the entanglement of continuous variables. Entanglement, used in this context, refers to a wave function describing two individual particles that is not just the product of their two separate wave functions. The notion of entanglement of continuous variables, i.e., physical quantities such as momentum or position of a quantum particle that can have continuous as opposed to discrete values, was introduced by Einstein, Podolsky, and Rosen (EPR) in their famous paper, which seemingly defied Heisenberg's uncertainty principle. They showed that if positions of two particles were entangled, then measuring the position of one particle would imply that the position of the other particle could be determined without further measurement. Entanglement in position implies entanglement in momentum, resulting from the Fourier transform, or conjugate relations, between position and momentum. Thus, once the momentum of one photon is measured, then the momentum of the other photon can also be determined without measuring the other photon. Although the particles are separated by a large distance, without any means to communicate with each other, the unmeasured particle must nevertheless be in definite position and momentum eigenstates. More simply, the position and momentum of the second (unmeasured) particle could, in principle, be known perfectly, leading to a violation of Heisenberg's uncertainty principle. The paradox is resolved if quantum mechanics is nonlocal.

John Howell's hardy group now consists of (left to right) Brian Winey, Irfan Ali Khan, John, Michael Pack, and Ryan Camacho (and more are flocking to join).

Using position and momentum-entangled photons, the group has recently demonstrated the first momentum-position realization of the EPR paradox. The position of one photon was measured, followed by the measurement of the position of the other photon. The uncertainty in the position of the second photon was also determined. The setup was then changed so that the momentum of the second photon could be determined based on a measurement of the momentum of the first photon, and the uncertainty in momentum also measured. Just as EPR predicted, the measured product of uncertainties was much smaller than allowed by Heisenberg's uncertainty principle for complementary observables (e.g., position and momentum) of a single quantum particle. In fact, the experimentally measured value was almost an order of magnitude smaller. The ramifications of this experiment are tremendous, because this means that entangled two-photon imaging can be performed well beyond the limit of classical diffraction (a limit that is, in fact, a manifestation of Heisenberg's uncertainty principle for non-entangled photons). Further, the group showed that, without being subject to Heisenberg's uncertainty principle, it is indeed possible to have a much larger depth of focus than for classical sources of light. This implies that a high resolution image of an object can be obtained, independent of where that object is located. Many other interesting experiments are now in progress to explore both the physics and the applications of continuous entanglement. It appears that John has truly hit the road running!

The Expanding PARTICLE Program

Now in its fourth year of operation, the PARTICLE program (Physicists and Rochester Teachers Inventing Classroom Experiments), an offshoot of the Quarknet venture supported by the U.S. Department of Energy, continues its mission of promoting research in high school settings. Led by Kevin McFarland, the program currently involves approximately 20 participating teachers from 17 schools in the greater Rochester and Syracuse areas. Six new teachers are trained each year during a three-week summer institute, at which they construct detectors to study cosmic-ray muons, develop classroom activities associated with these detectors, hear lectures on particle physics, tour lab facilities, and borrow equipment for eventual use in classrooms. Currently, the program has a dozen or so muon telescopes, an apparatus to measure the charge-to-mass ratio of muons, a cloud chamber, and laminated lead sheets in its expanding inventory of shared equipment. Interested graduate and undergraduate students assist with the development of equipment and computer programming through special internships provided by our department.

Teachers in action during a recent summer institute held at our department

High school students become involved through research performed at their schools or by participating through internships at the University. The expanding list of research topics for students includes determining the lifetime of muons, studying absorption of muons in lead and water, scattering and dependence of muon flux on variables such as barometric pressure, angle of incidence, and time of day. Students at Pittsford Mendon High School conducted a two-month experiment last fall to study the relationship between geomagnetic/solar activity and muon flux. This project should prove to be particularly interesting, given the unusually high level of solar activity during the last week of October 2003.

Each spring, participating high schools can send a delegation of students to PARTICLE Day at the University, where students present the results of their research, display posters, hear lectures from our physicists, and tour lab facilities.

PARTICLE is turning into a highly successful hands-on experience in science for both teachers and students in our area. The word about the project has also been spreading nationally in presentations made by teachers at a meeting of particle physicists at Snowmass in 2002, at the National Science Foundation in 2003, and at meetings of the American Association of Physics Teachers in 2001, 2003, and 2004.

Regina Demina Joins Our Effort in Particle Physics

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from their birth to their decay. The detectors she is developing in her laboratory will be capable of working in the high radiation environment of the LHC. Silicon detectors are made of arrays of semiconductor diodes, no different than those used everywhere in the electronics industry, e.g., inside computers. Thus, by working with these devices, students are not only doing cutting-edge technological development for high energy experiments, but are also gaining insights into the operation of semiconductors—knowledge that is essential in many industrial applications. Based on the information provided by such silicon detectors, Regina's group is developing algorithms for identifying b-quarks (located within their subatomic B particles). These algorithms are then applied to study the properties of the top quark —the heaviest fundamental object known.

Preliminary results on the cross section for top-quark production at the Tevatron were reported at summer conferences in 2003, and more work is in progress to measure other parameters of the top quark using her techniques. Aside from the Tevatron, the LHC that is being completed in Geneva, Switzerland, is the next most likely place where physics of electroweak symmetry breaking will be uncovered through the possible observation of the hypothesized Higgs boson. The silicon detectors to be checked out and approved in Regina's laboratory will be installed in the CMS experiment, one of the two major all-purpose LHC experiments, and will be crucial for the detection of any possible Higgs bosons.

Manly is New York's Best Prof

On November 13, 2003, the Carnegie Foundation announced that Steve Manly, Mercer Brugler Distinguished Teaching Professor of Physics and associate professor of physics, was selected by the Carnegie Foundation for the Advancement of Teaching as New York State's Professor of the Year in 2003. Manly is the second Rochester faculty member to win this award. The first was Alfred Clark of the mechanical engineering department, who received it in 1994. The U.S. Professors of the Year awards, created in 1981, are the only national honors for excellent teaching in higher education. The Council for Advancement and Support of Education (CASE) and the Carnegie Foundation for the Advancement of Teaching make the selections. The Professors of the Year were honored at a luncheon at the National Press Club, followed by a reception on Capitol Hill.

Manly unconfusing an undergraduate student

Kimble Wins 2004 Lilienfeld Prize

Jeff Kimble (Ph.D. '78), William L. Valentine Professor of Physics at Caltech, has been awarded the 2004 Lilienfeld Prize of the American Physical Society for his pioneering work in quantum optics: "for his innovative experiments in single-atom optical experiments, and for his skill in communicating the scientific excitement of his research to a broad range of audiences." Jeff is a member of the National Academy, and is a great friend of the department, involved in the fundraising for an endownment in honor of his former thesis advisor Len Mandel.

Juan Estrada Wins First Tollestrup Award

Juan Estrada, presently at Fermilab (Ph.D. '02), was the first recipient of the Alvin Tollestrup Award, which is sponsored by the Universities Research Association (URA) that manages Fermilab. The Award is for best postdoctoral research (in theory or experiment) done on any project affiliated with Fermilab during 2002–2003. Juan was recognized for his recent precision measurement of the mass of the top quark that was based on a technique that he and colleagues Florencia Canelli (Ph.D. '04, currently with UCLA) and Gaston Gutierrez, a senior physicist at Fermilab, developed at the D-Zero Collider experiment. (Estrada also received our department's Lobkowicz Prize in 2002 for the best Ph.D. thesis in particle and nuclear physics.) As a postdoc at Fermilab, Juan extended the work he initiated in his thesis, which led to the Tollestrup Award.

Juan Estrada accepts his award from distinguished experimenter Alvin Tollestrup.

Don Lamb Elected to the American Academy

Donald Lamb, Jr, Louis Block Professor in Astronomy and Astrophysics at the Enrico Fermi Institute and the University of Chicago (Ph.D. '74) was inducted this past October into the American Academy of Arts and Sciences. He is the former Chair of the Department of Astronomy and Astrophysics at the University of Chicago, and renowned for his many contributions to resolving astrophysical problems ranging from the structure and evolution of degenerate dwarfs and neutron stars to the origin of X-ray and gamma-ray bursts.

Another Major Tribute to Emil Wolf

We are very used to the many tributes given over the years to our own Emil Wolf. This time, it was the SPIE—the International Society for Optical Engineering—that honored Emil at its 48th Annual Meeting this past August at San Diego with a special two-day symposium devoted to his impact on physical optics and engineering. Emil spoke at one of the sessions on the influence of Young's interference experiment on the development of the theory of optical coherence, and at the SPIE banquet, where he reminisced about his former mentor and colleague, Nobel Laureate Max Born.

Bodek Wins the 2004 Panofsky Prize

Arie Bodek will receive the 2004 W. K. H. Panofsky Prize of the American Physical Society that honors outstanding contributions in the field of Experimental Particle Physics. He is cited "for his broad, sustained, and insightful contributions to elucidating the structure of the nucleon, using a wide variety of probes, tools, and methods at many laboratories. The prize will be presented at a special ceremonial session of the APS at the "April" 2004 meeting in Denver, Colo. (May 1–4, 2004), where Bodek will also present a lecture on the work for which the Prize is being awarded. Arie is a veritable dynamo, and, beside chairing our department, has a very strong program at CERN, Fermilab and at the Jefferson Lab (Newport News, Va).

Bodek's major contributions include experimental and phenomenological investigations of parton density functions (PDFs), and elucidation of the EMC (European Muon Collaboration) effect of nuclear matter on parton densities in nucleons. Over his career, he has conducted a variety of experiments, involving electron and neutrino scattering from nuclear targets, and proton-antiproton collisions. Bodek has had a continuous love affair with the structure of the nucleon, and, he confesses that "The structure of the nucleon has always been dear to my heart."

Bodek is the second faculty member in our department to have received this prestigious award. The first was Ed Thorndike, who won the honors in 1999 for studies of the bottom quark at the CLEO experiment (at Wilson Lab in Ithaca, N.Y.).

OTHER DEPARTMENT NEWS

Robert Forties and Jesse Chvojka Receive Grants

Robert Forties, president of our chapter of the Society for Physics Students (SPS) received a grant from the New York State Section of the American Physical Society (APS) to construct "Physics Museum Demonstrations" as part of our chapter's participation in the APS Celebration of the World Einstein Year of Physics in 2005. The project will be carried out in consultation with Arie Bodek and David Douglass, the current SPS advisor. Jesse Chvojka, a graduate student in particle physics also received a grant from the New York State Section of the APS for a project titled "Particle Physics High in the Sky: Outreach through Remote Cosmic Ray Measurements from an Airplane." This will be carried out in consultation with Kevin McFarland and the PARTICLE outreach program at Rochester that was initiated by Kevin. These grants were announced at the NYS APS meeting at Brookhaven Laboratory in October 2003. Last year, graduate student Adam Harrington also won a grant from the New York Section of the APS under the auspices of the PARTICLE program.

J. D. Jackson—Watch Out!

Ashok Das has been especially prolific in his writing over these past two years. Besides his dozens of articles, he has just published three books: *Lectures on Quantum Mechanics*, *Introduction to Nuclear and Particle Physics* (2nd Ed.) with Tom Ferbel, *Lectures on Electricity and Magnetism*, and he is finishing his fourth book titled *Advanced Topics in Integrable Models*. He is particularly proud of his treatise on E&M, which arose from his teaching of our graduate course on electromagnetism. For years, the scene has been dominated by David Jackson's popular classic on the subject, but wait and see when the word gets out about Ashok's version!

Eric Blackman

In November 2003, Eric Blackman was elected for a three-year term as a member at large of the executive committee of the APS Plasma Astrophysics Unit, where he will join Ethan Vishniac, currently a distinguished member of Johns Hopkins University, and one of our former undergraduates (B.S. '76).

Honors for Sid the Chennai Kid

Siddharth Parameswaran, normally referred to as Sid, is our latest gift from India. It would be difficult to tell from his list of current classes, which include mainly graduate- and senior-level undergraduate courses, that Sid is a just a physics sophomore. He excels in everything! Sid won the 2003 Iota Book Award (Phi Beta Kappa), which recognizes outstanding scholarly achievement, humanistic values, co-curricular activities, and leadership potential in first-year undergraduates. The selections are made by the College's deans. Sid also won the University-wide Delno Sisson Prize in 2002–2003. In addition, Sid was chosen as this year's recipient of the Physics Honors Prize, awarded annually by the department to the sophomore student with the best academic record in the honors physics introductory sequence. Finally, and surely most impressive, is that Sid is a member of the University of Rochester's Quiz Bowl Team, which placed third at the National College Tournament in April 2003, in Philadelphia, Pa.!

Joseph Eberly

This past fall, Joseph Eberly was elected divisional councillor of the APS Division of Laser Science, and is serving on the APS Council. He is also a member of the Governing Board of the American Institute of Physics.

Following his graduation from Rochester several years ago, **John Larkin** (Ph.D. '00) became assistant professor at Augustana College in Sioux Falls, S.Dak. This past year he accepted a position as assistant professor of physics at Whitworth College in Spokane, Wash.

Since 1997, **Sheldon Stone** (Ph.D. '72), professor of physics at Syracuse University, has been the co-spokesperson for BTeV, a major Fermilab experiment involving more than 30 universities and laboratories. This experiment will have sensitivity that is orders of magnitude better than any other current effort with objectives of measuring the properties of the bottom quark. For his many contributions to scholarship and improvement of academic life at Syracuse, Sheldon has been presented with the Chancellor's Citation for Exceptional Academic Achievement.

Gerald C. Blazey, our former research and senior research associate is doing quite well indeed. He is the current co-spokesperson for the D-Zero Collaboration at Fermilab, involving over 600 scientists and over 80 institutes worldwide. He is professor of physics and Presidential Research Professor at Northern Illinois University, and director of the Nothern Illinois Center for Accelerator and Detector Design.

Michele Migliuolo (Ph.D. '88) is President and CEO of Verimetra, Inc. in Pittsburgh. The company manufactures blood velocity sensors embedded at the tip of very small catheters used in cancer treatment procedures. Michele's brother **Stefano Migliuolo** (Ph.D. '77) left MIT several years ago and joined Raytheon Network Centric Systems Company, where he is currently the head and senior principal systems engineer developing the so-called Vigilance of the Amazon air-traffic control system. He has even learned Portuguese as a result of his many trips south.

Eric Prebys (Ph.D. '90), who recently joined the Fermilab Beams Division, is now the head of the Proton Source Department, which includes the Linac and Booster accelerators. His main responsibilities are overseeing upgrades and optimizations needed to deliver the high flux of protons required for experiments on neutrino scattering, one of the most important research programs at the Lab.

Nikos Varelas (Ph.D. '94) has been promoted to tenure as associate professor of physics at the University of Illinois at Chicago. He is also in charge of searches for the Higgs boson at the D-Zero experiment at Fermilab.

Special Showing of *Copenhagen* Arranged by SPS

This past fall, our chapter of the Society for Physics Students (SPS) arranged special rates for a performance of the play *Copenhagen* at Rochester's Geva Theatre. The story is about the great theorists Werner Heisenberg and Niels Bohr, who revolutionized atomic physics before the onset of World War II. By 1941, these two friends were polarized by the politics of the Second World War. The nuclear future of the globe rested in the hands of Heisenberg, Bohr, and their colleagues. One thing is certain, and that is that Heisenberg visited Bohr in Copenhagen in 1941, but it is less clear what exactly was discussed. Winner of the 2002 Tony Award for Best Play, *Copenhagen* is a riveting exploration of differing recollections of the conversation that might have taken place that day, a conversation that may have altered the trajectory of the entire world. Unfortunately, in the very first few minutes of the special performance, one of the leading actors fell off the stage, and the show was canceled! The SPS took immediate action, and rescheduled the attendance at Geva. According to all those that could make it on the second round, the evening was a great success, leaving much to think and talk about, both in and out of class.

Thank You

We gratefully acknowledge recent donations of alumni and friends to the University. Those whose gifts were contributed directly to the department are indicated by an asterisk (*). If you intended your donation for the Department of Physics and Astronomy, and your name does not have an asterisk, please let us know so that an account adjustment can be made. Every effort has been made to ensure the accuracy of this list. If you find an error or an omission, please let us know by calling us at (585) 275-4344, or by an e-mail to shirl@pas.rochester.edu. If you change your postal or e-mail address, please contact Bob Knox with your new whereabouts (rsk@pas.rochester.edu).

Appelera Corporation*
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Bayer, Joan
Beale, Carol
Chu, Steven*
Garvin, Hugh and Shirley*
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Guertin, Robert Powell*
Hertz Foundation
Heurtley, John C.*
Holroyd, Edmond William*
Jacobsen, Edward*
Kaminstein, Joshua*
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Kernan, Warnick*
Klein, Myron
Koehler, Peter*
Kozikowski, Derek M.*
Lamb, Donald Q.*
Lev, Naomi B.*
Lichtin, Harold H.*
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Wolf, Emil and Marlies*
Zou, Xingyu*

Need Your Help

Bob Knox is searching! Maintaining an updated list of former colleagues and students in the department is not an easy task, and often thankless. Nevertheless, being of stout spirit, Bob has done a splendid job over the past several years to assure that each edition of *Cross Sections* makes it through to most of you. Now Bob needs your help. It seems that we have lost contact with some of our friends, and Bob is terribly concerned and cannot sleep at night because of this. Can you look at the partial list of former students with a degree in physics or physics and astronomy given below, and if you know how to reach any of these individuals, please alert them or send an e-mail to Bob (rsk@pas.rochester.edu) so that he can rest easy.

1964
Frankel, Ira

1965
Batt, John
Landau, Robert

1966
Aldins, Janis
Barmanroy, Binoy
Beach, Steven
Gregory, Mitchell
Kazi, Rafik A.

1967
Dell, Jeffrey
McClung, David

1968
Bahnsen, Axel
Chanda, Rajat
Nagai, Yoshikazo
Perlman, Stanley
Shen, Ming-Liang
Shibut, Dennis
Rosenberg, Fred

1969
Becherrawy, Tamer
Bhargava, Raj K.
Parekh, Amala
Oyanna, Gabriel
Rehler, Nicholas

1970
Lalor, Sean Eamon
Lawson, James
Maasha, Ntungwa
Najmabadi, Farzaneh
Subba Rao, Jandhyala

1971
Charlu, Srinivas
Endal, Andrew
Frederick, Robert
Maa, Yeou-Wei
Smith, Barham
Smith, Charles A.
Trost, David

1972
Chen, Jen-I
Giray, A.
Mukherjee, Avijit
Schurmann, H. K.

1974
Bass, Ronald
Magde, John
Nti, Kofi O.
Prasad, Mahendra

1975
Kim, Jihn Eui
Manare, Abraham
Morshedzeh-Tehrani, M.

1976
Kern, Bruce
Khare, Vijay
M-Tehrani, Shahin

1977
Bayley, Cynthia
Ginsberg, Charles
Goto, Tetsuya
Trahern, Charles
Weinstein, Rita

1978
Christman, Sue
Gulkok, Yusuf
Presicci, Manny

1979
Dranchak, M. B.
Elliott, Friedrich
Pandey, Akhilesh
McLaughlin, Michael

Meliora Weekend

Rocky Kolb of the University of Chicago and Fermilab wowed a packed Hubbell Auditorium during Meliora Weekend with his unmatchable sense of humor and his remarkable insights into the nature of the Cosmos. He even impressed our provost, Charles Phelps, who asked Rocky to autograph a copy of Blind Watchers of the Sky, *one of Rocky's many contributions to spreading science to a general audience.*

Departmental Funds

The department has established several funds that greatly benefit departmental activities. They are:

The David L. Dexter and Elliott W. Montroll Lecture Fund. Established in the 1980s in memory of Professors Dexter and Montroll, these funds support an annual lecture by an outstanding scientist as part of either the Dexter Lecture or the Montroll Lecture Series.

The Robert E. Marshak Memorial Fund. This fund will be used to support the newly created postdoctoral Robert E. Marshak Research Fellowships, intended to attract the most talented young nuclear and particle physicists to continue their research in the department.

The C. E. Kenneth Mees Observatory Fund. Established in 1977, this fund is for the discretionary use of the director of the University's Mees Observatory in support of observatory activities, such as the upgrade to the facility.

The Physics and Astronomy Alumni Fund. Established in 1968, this fund is for the discretionary use of the chair of the Department of Physics and Astronomy in support of departmental activities.

The Leonard Mandel Endowment Fund. This will fund the Leonard Mandel Faculty Scholar Award in Optical Science at the University of Rochester and be used to support one graduate student.

Contributions from alumni and friends are the dominant source of income to these funds. If you would like to support the department, please mark the appropriate box on the form below and send it with your contribution. Donations may be tax deductible, and donations of appreciated securities may also carry tax advantages. The department is grateful for any help you give.

I wish to contribute to the following fund:

- ❑ *The David L. Dexter and Elliott W. Montroll Lecture Funds*
- ❑ *The Robert E. Marshak Memorial Fund*
- ❑ *The C. E. Kenneth Mees Observatory Fund*
- ❑ *The Physics and Astronomy Alumni Fund*
- ❑ *The Leonard Mandel Endowment Fund*

My contribution: $_____

❑ Check enclosed ❑ VISA ❑ MasterCard Card # _____ Exp. Date _____

Name _____

Address _____

_____

Year/Degree _____

If donating by check, please make sure your check is payable to the "University of Rochester," and indicate that it is for the "Department of Physics and Astronomy." Be sure to check the specific fund to which your donation should be applied. Gifts of appreciated securities are also gratefully accepted. Please return this form to:

Chair, Department of Physics and Astronomy
University of Rochester
P.O. Box 270171
Rochester, NY 14627-0171 USA

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