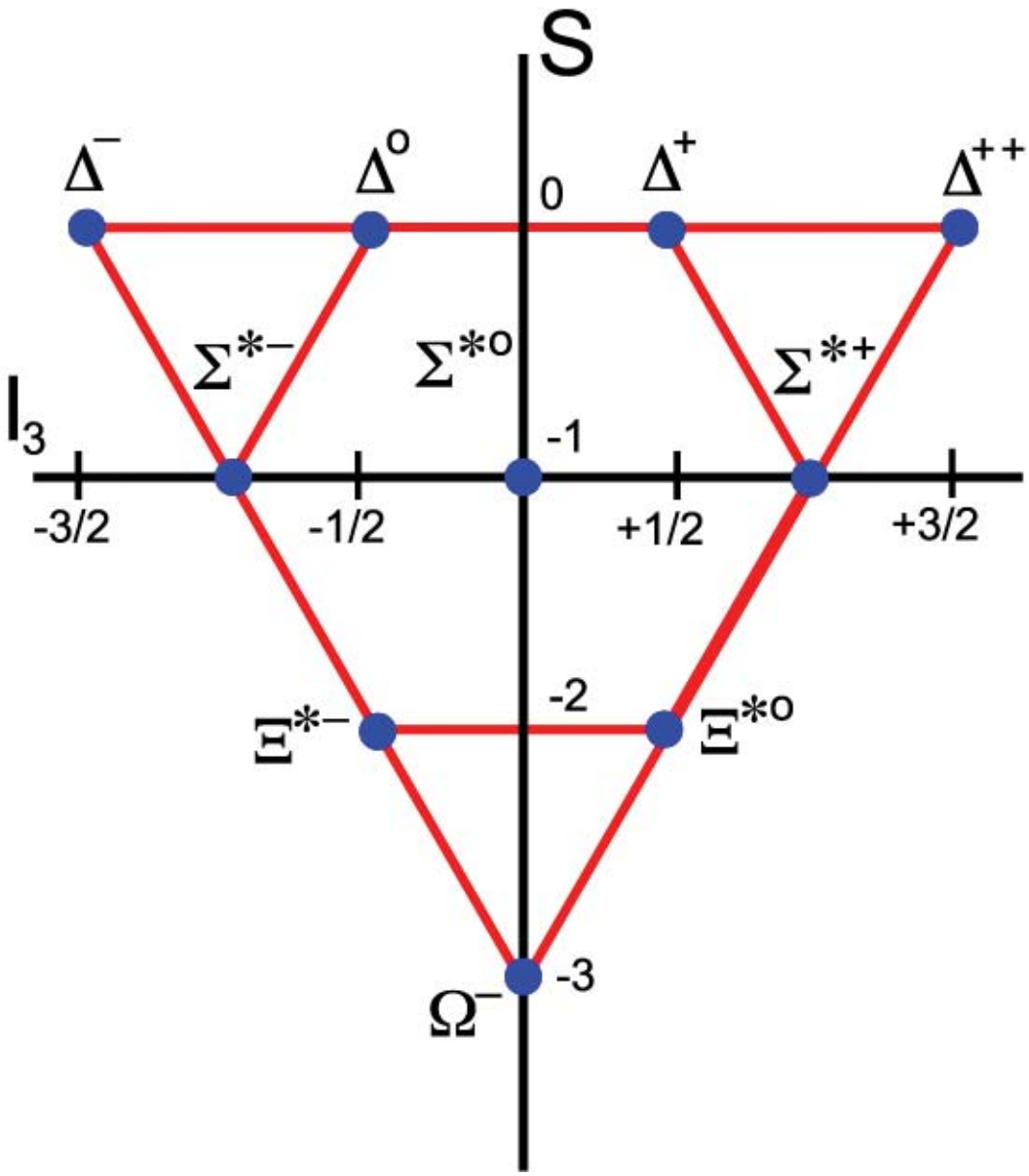
Cross Sections

DEPARTMENT OF PHYSICS AND ASTRONOMY
UNIVERSITY OF ROCHESTER
WINTER 2005



Message from the Chair

—Arie Bodek

I would like to thank all of our alumni who have contributed to the Mandel Endowment this past year. On

Meliora Weekend 2004, the new Mandel Conference Room was dedicated (for pictures, see the department news story of October 29, 2004). The Mandel endowment has reached the level of $100,000, and we hope that with additional contributions we will raise a similar amount in 2004–2005.

Several of our faculty and students have received awards during this past academic year. I will only mention a few of these awards and refer you to news stories on our department Web page for the others. Susumu Okubo was selected to receive the 2005 American Physical Society (APS) J. J. Sakurai Prize in Theoretical Particle Physics (see story on page 4). Okubo is the third faculty member of the high-energy physics group to receive an APS award in recent years. He joins Arie Bodek and Ed Thorndike, who were awarded the APS Panofsky Prize in Experimental Particle Physics in 2004 and 1999, respectively. Professor Arie Bodek was awarded the University Award for Excellence in Graduate Teaching.

Our particle physics graduate students have also done well this past year. Graduate student Maria Florencia Canelli was awarded the URA-Fermilab Best Ph.D. Thesis Award in 2004. This is the third time that a University of Rochester student has been so honored since this award was instituted seven years ago.

Joe Eberly was elected as vice president (2004) and president (2007) of the Optical Society of America. Tom Foster was appointed to the prestigious NIH Center for Scientific Review (Radiation Therapeutics and Biology Study Section) in 2004.

The Board of Trustees recently chose a new president for the University of Rochester: J. Seligman, who is currently the dean of the law school at Washington University in St. Louis. Our own Nick Bigelow chaired the faculty committee that conducted this search.

Also in 2004, Rochester was selected as a Fusion Science Center of Excellence by the DOE. This center is to be headed by Professor Riccardo Betti.

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 are to inform any promising students about our summer undergraduate research program (REU) and to encourage students interested in 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 '05. 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

Editor: S. Rajeev and R. Demina

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—Webmaster, Steve Teitel

On the Cover

The cover shows the decuplet of spin 3/2 baryons. The Gell-Mann-Okubo mass formula (for which Professor Okubo was awarded the J. Sakurai prize this year) predicted the mass of the Omega minus. Its discovery was an early success on the way to building the standard model of elementary particles.

Important notices: Department phone: (585) 275-4344 and fax: (585) 273-3237.

If you change your mailing address, please contact Bob Knox with your new whereabouts (rsk@pas.rochester.edu). Also let him know your current e-mail address.

Boyd and Howell Use Quantum-Entangled Photons for Imaging

Quantum imaging entails techniques that can construct images that are sharper or more noise-free than those produced by conventional imaging techniques.

A laser beam excites a second-order nonlinear optical crystal, and through the process of parametric down-conversion, a pair of entangled photons is created. One of these photons illuminates an object, and a non-imaging detector (a "bucket" detector) registers the scattering of the photon from this object. The other photon of the pair is directed onto an imaging device, a photo-detector array. A coincidence circuit records the output of the imaging detector only when triggered by the bucket detector. In this manner, a sharp image of the object is obtained, even though the photons that fall onto the imaging detector have never interacted with the object to be imaged!

Recently Gatti and others have argued theoretically that coincidence imaging can be performed using classical correlations for an object at a known distance from the apparatus, but that quantum entanglement is required if one wants to obtain a sharp image of an object that might be either in the near or far field of the light source.

The Rochester team of Robert W. Boyd, Ryan S. Bennink, and Sean J. Bentley at The Institute of Optics, and John Howell of the physics department have put this idea to experimental test. And it works! These results can be understood from the point of view that, in the quantum case, the observer can wait until the photon pair is emitted before deciding whether to measure the position or (transverse) momentum of one of the photons. The analogous quantity for the other photon is then precisely determined.

EDFEST: A Symposium to Celebrate E. H. Thorndike's Contributions to Physics

The department hosted a symposium on Saturday, August 7, to celebrate Ed Thorndike's contributions to physics. Ed is the recipient of the Panofsky Prize of the American Physical Society for his discovery of the rare decays of the b-quark, and is one of the leading particle physicists in the world.

Thorndike received his A.B. in physics from Wesleyan University in 1956, his M.S. in physics from Stanford University in 1957, and his Ph.D. in physics from Harvard University—where he worked with Richard Wilson on nucleon-nucleon scattering at the Harvard Cyclotron Laboratory—in 1960. After a postdoctoral position at Harvard, he joined the University of Rochester faculty as assistant professor of physics in 1961 and was promoted to associate professor in 1965. He was made a full professor in 1972. Thorndike is the author of the book, *Energy and Environment, a Primer for Scientists and Engineers.* He held an NSF Predoctoral Fellowship from 1956 to 1960, an NSF Senior Postdoctoral Fellowship in 1970, and a Guggenheim Fellowship from 1987 to 1988.

Thorndike was director of the Rochester 130" Cyclotron Lab from 1965 to 1969. He was spokesperson of the CLEO Collaboration for three years from 1981 to 1984, for two years from 1990 to 1992, and co-spokesperson (with George Brandenburg) for two years from 1997 to 1999.

Rochester Center for Brain Imaging Opens

The goal of the Rochester Center for Brain Imaging (RCBI) is to provide researchers at the University of Rochester, as well as neighboring institutions, with access to a state-of-the-art 3T magnet for research using magnetic resonance imaging (MRI). Although the primary use of the Center will be to gather functional MRI data from the normal adult brain as participants perform a variety of tasks, it is capable of providing structural images of many anatomical structures. The RCBI also has a key educational mission and will offer courses, summer research experiences, and demonstrations for faculty, postdoctoral fellows, graduate and undergraduate students, and members of the greater Rochester community, including the physics department. Jianhui Zhong is teaching a related course, MR Imaging: from Spins to Brains, this fall semester.

Okubo Wins the Coveted Sakurai Prize

The American Physical Society's J.J. Sakurai Prize in Theoretical Particle Physics was established to recognize and encourage outstanding achievement in particle theory. The citation for Susumu Okubo's award reads:

"For groundbreaking investigations into the pattern of hadronic masses and decay rates, which provided essential clues into the development of the quark model, and for demonstrating that CP violations permit partial decay rate asymmetries."

The Department of Physics and Astronomy hosted a reception in Okubo's honor on Thursday, October 21, 2004. The prize will be presented at the APS April 2005 meeting at a special ceremonial session. Okubo has also been invited to present a lecture at the meeting on the work for which the prize is being awarded.

The paper by Okubo, "Note on unitary symmetry in strong interactions" *(Prog. Theor. Phys.* 27:949–66, 1962), is one of the classics of particle physics.

It contains the celebrated mass formula for strongly interacting particles, now known as the Gell-Mann-Okubo mass formula. Gell-Mann had obtained a special case earlier, and at that time such higher symmetries were regarded as a mathematical exercise without any physical relevance by most particle physicists.

This paper helped change that view, with the first exposition of unitary symmetry comprehensible to particle physicists. The triumphant discovery of the Omega baryon exactly where predicted by the mass formula convinced even skeptics of the utility of such mathematical reasoning in physics.

Okubo has spent most of his career in physics at Rochester, starting as a graduate student in 1954. (Only Shirley Brignall can claim a longer association with the department!) After a brief stint in Europe, Okubo was all set to return to Rochester as a faculty member. Delayed due to difficulties in getting a visa to the United States, he spent some time at the University of Tokyo. This explains why both Rochester and the University of Tokyo are listed as addresses in this paper. Okubo and Sakurai were friends from the time they were both graduate students, Okubo at Rochester and Sakurai at Cornell.

In the 1950s and '60s chairman Robert Marshak assembled a remarkable collection of particle theorists at Rochester. The atmosphere was congenial and exciting, with new ideas being shared among all. E. C. G. Sudarshan, with whom Marshak discovered the V-A theory of the weak interaction of elementary particles, received his Ph.D. at Rochester. Faculty included Guralnik and Hagen, who discovered the mechanism for mass generation of particles (along with Kibble, Englert, Brout, and Higgs). Bunji Sakita, who discovered SU(6) symmetry, and Rabinder Mohapatra, who discovered a mechanism for neutrino masses, were both Marshak's students.

Okubo received his B.S. in physics (1952) from the University of Tokyo and his Ph.D. in physics (1958) from the University of Rochester. After a year of postdoctoral research, he left for the University of Napoli, Italy, and CERN, Switzerland, to extend his work in particle physics. He returned to the University of Rochester in 1962 as a senior research associate in the Department of Physics and was promoted to full professor in 1964. Okubo is the author of the book *Introduction to Octonion and Other Non-associative Algebras in Physics* (Cambridge Univ. Press, 1995). He was awarded a Nishina Prize in 1976 from the Nishina Foundation in Japan for his contributions to particle physics. He was a recipient of Guggenheim (1966) and Ford Foundation (1969) Fellowships. He is a fellow of the American Physical Society.

Joe Eberly Will Be President of the OSA in 2007

The Optical Society of America (OSA) has announced that its members have elected Joseph Eberly (www.osa.org/aboutosa/leaders/election_2004/Eberly.asp) as its 2005 vice president. By accepting the vice presidency, Eberly makes a three-year commitment to OSA's board of directors. As vice president, Eberly will automatically become president elect in 2006 and then the Society's president in 2007.

Joseph Eberly, Carnegie Professor of Physics and professor of optics at the University of Rochester and director of the Theory Center for Optical Science and Engineering, has written two textbooks: *Lasers,* written with Peter Milonni, is in its 14th printing, and *Optical Resonance and Two-Level Atoms,* with Les Allen, which has been translated into Japanese, Polish, and Russian.

Eberly's research interests have been focused on the quantum properties of optical radiation, the fundamental interactions of laser light and matter, laser propagation in resonant media, cavity QED, multiphoton and high-field processes in atoms, nonlinear quantum optics, and the dynamics of quantum entanglement. During his career at Rochester he has supervised more than 30 doctoral theses and published more than 300 research articles and reviews. In 2000, for his innovations in freshman-level instruction, he received the University's Goergen Award for artistry in undergraduate teaching.

Eberly, a fellow of OSA and APS, has been awarded the OSA Townes Award and senior fellowships from JILA and the Alexander von Humboldt Foundation and has been elected a foreign member of the Academy of Science of Poland. He was invited to give the Gilmore Lecture at Oberlin College, the first Asian Lecture of Korea University, the Smoluchowski Medal Lecture in Warsaw, the La Caixa Lecture in Barcelona, and the Journal of Physics B Special Lecture in Koscielisko. He has been a member of the advisory boards of the Max-Planck Institute for Quantum Optics, the Physics Division of Lawrence Livermore National Laboratory, the Kavli Institute for Theoretical Physics, and the Institute for Theoretical Atomic, Molecular and Optical Physics (ITAMP), and a member of the Triennial Committee of Visitors of the NSF Physics Division and of the Committee on Atomic, Molecular, and Optical Science (CAMOS) of the National Research Council of the National Academy of Sciences.

Eberly received his bachelor's degree from Penn State and his master's and doctoral degrees from Stanford.

An Exciting Time in Particle Physics

by Susumu Okubo

I have been awarded the 2005 Sakurai prize for two pieces of work I have done between 1958 and 1963. The first one is concerned with decay rates of a particle and its antiparticles, while the second deals with developments and applications to the unitary symmetry group SU(3).

After the momentous discovery of the violation of parity, i.e., reflection symmetry (P), and the particle-antiparticle (C) symmetry in 1957, it had been noted by Pauli that the product PCT (the combination of C, P, and time reversal) must be preserved in any reasonable theory (to be precise, any relativistic quantum field theory). One consequence of this theorem is that the masses of a particle and its antiparticle must be the same.

Okubo in a jolly mood at the Adrian Fest, 1999

In 1958 I showed that a partial decay rate of a particle may not be the same as the corresponding decay rate of its antiparticle, unless C or at least CP is conserved by its interactions. This is despite the fact that the PCT theorem requires that the total decay rates must be the same for a particle and its antiparticle. This observation was utilized quickly by Andrei Sakharov (who is famous for his peace activities but was also the father of the Russian hydrogen bomb) to explain why the present universe has much more matter than antimatter.

The second topic of unitary symmetry is intimately related to the modern theory of strongly interacting particles (called hadrons). In late 1950 and 1960 many new particles had been discovered. As Henri Poincaré once said, "A pile of stones does not make a cathedral." There was an urgent need to make some coherent explanation for all these particles. The situation was perhaps similar to the late 19th century when Mendeloff gave order to the many chemical elements by arranging them in the periodic table.

The first attempt was by Sakata (1956), who postulated that the proton, the neutron, and the Lambda were the fundamental particles and all other hadrons are their bound states. Subsequently, Ikeda, Ogawa, and Ohnuki, and—independently—Yamaguchi (in 1959), suggested an SU(3) symmetry for hadrons, the (p,n,Lambda) forming a fundamental triplet. This could explain the pseudo-scalar octet as baryon-antibaryon bound states. But this scheme failed because it could not account for several baryons known as Sigma and Xi. In 1962 Gell-Mann and Ne'eman independently proposed a more abstract version of SU(3) in which the Sigma and Xi particles were accorded equal status with (p,n,Lambda) to form an octet. Whether there was a "fundamental triplet" was not addressed; certainly the proton, etc., could not be part of such a triplet. (Only in 1964 did Gell-Mann and Zweig independently suggest fractionally charged particles—now called quarks—as the fundamental particles of which all hadrons are made: thus beginning the modern era of elementary particle physics.)

Back in 1962, there was not yet much experimental evidence for either the Gell-Mann-Ne'eman or the Sakata models. I could derive a formula connecting the masses:

2[M(n)+M(Xi)]=3M(Lambda)+M(Sigma)
for the the baryon octet and another
M(Omega)-M(Xi^*)=M(X^*)-
M(Sigma^*)=M(Sigma*)-M(Delta)
for the so-called baryon decuplet.

All the particle masses except that of Omega were known then, so we could predict not only that there is such a particle but also its mass using this formula (known now as the Gell-Mann-Okubo mass formula). The Omega was discovered soon after and was predicted to boost the reliability of the theory. Later in 1963 I could explain a rather vexing behavior of the nonet of mesons in the theory initiated by J. J. Sakurai (after whom the award is named): some of the particles lived longer than they should. It was noted by Zweig and Izuka that my explanation is intimately related to the quark model. Now it is known as the OZI quark-line rule.

Since that exciting time, I have been working mostly on applications of group theory in particle theory and in mathematical physics.

Emil Wolf Honored Yet Again!

On Monday, October 11, Professor Emil Wolf was honored by a daylong Symposium on Coherence in Physical Optics: 50 years of the Wolf Equations, given as part of the Optical Society of America (OSA) 2004 Annual Meeting at Rochester. (See www.osa.org/meetings/annual/program/agenda/#11.)

The afternoon finished with a Joint Plenary Session of the Frontiers in Optics and the Laser Sciences where Wolf opened with a lecture on coherence theory followed by New York State Senator Hillary Clinton's address on the status of science funding in the United States.

Wolf is the recipient of so many awards (including the Ives Medal of the Optical Society of America and the Max Born Award) that we have given up on listing all of them. (Previous editions of this newsletter have noted some of the more recent honors.) Every graduate student in physics and optics is familiar with the classic text *Principles of Optics,* known simply as Born and Wolf. The statistical theory of light—the study of coherence—has always held a special fascination for Wolf. The year 2004 marks the 50th anniversary of the Wolf equation, which governs the propagation of coherence, providing a unified physical framework for statistical optics. Applications from microscopy to quantum optics were covered in the symposium held by the Optical Society of America to mark the occasion.

Shirley Brignall Celebrates Her 50th Year

On October 18 Shirley Brignall celebrated 50 years in the department. The department honored her with a reception on October 19. Six of the eight department chairs that Shirley served under joined in the celebration. More than 100 people attended with well-wishes to Shirley. If you would like to send your wishes to Shirley, her e-mail address is shirl@pas. rochester.edu.

The strength of the Department of Physics and Astronomy at the University of Rochester has a solid foundation in staff as exemplified by Shirley Brignall. Due to the longevity of the staff, we have been able to maintain ongoing contact with each of our alumni. We welcome you to visit campus anytime during the year. This past year we had several visitors in the summer and over Meliora weekend.

Shirley Brignall and some of the department chairs with whom she served. From left to right: Hugh van Horn, Adrian Melissinos, Arie Bodek, Shirley, Bob Knox, Harry Gove, and Paul Slattery.

Mandel Room Dedicated; Endowment Fundraising Continuing

A reception was held in the newly refurbished Mandel Conference Room to dedicate the Mandel Room. Many former students and colleagues of Mandel were present to share in memories with Jean Mandel and the Mandel children and grandchildren. We appreciate all those who attended.

We are excited about the those participating in the Mandel Endowment Fundraising for the endowment supporting an optics graduate student. We are almost to the $100,000 mark.

We would like to raise an additional $400,000, which would fully support a graduate student and his or her research. Help us meet our goal by completing the contribution section in the back of this newsletter and mailing it to the department.

The Department of Physics and Astronomy is pleased to have received a $10,000 grant for the Leonard Mandel Endowment fund from the Oliver S. and Jennie R. Donaldson Charitable Trust. The contribution from the Donaldson fund was received in a letter on September 2, 2004, from the fund's vice president Carolyn Larke.

The Oliver S. and Jennie R. Donaldson Charitable Trust is a New York–based foundation that supports a large number of educational activities as well as cancer research conducted in hospitals, universities, and liberal arts colleges. Members of the Donaldson Board of Trustees include Dr. Marjorie Atwood, Dr. William E. Murray (chairman), Pamela A. Curtis (vice chairman), and Linda R. Franciscovich (managing director).

Impact on Physics and Astronomy by the New Biomedical Engineering Building (BME)

Since the early 1930s physics has had operations in two one-story buildings at the edge of the main campus. Initially they housed an early cyclotron that was used by University professors and students to conduct research. With the growth of large federally funded labs the cyclotron became obsolete, and the building was converted to the "Shop," or the Sidney W. Barnes Research Laboratory. As of winter 2005, the cyclotron building will be no more. As space on river campus becomes more cramped, the cyclotron will be torn down to make way for new research and teaching space for biomedical engineering and The Institute of Optics. As a result, all physics operations that were previously housed there will be moved to Bausch & Lomb Hall, which will be totally occupied by physics and astronomy and the "Shop."

Department Welcomes First Marshak Postdoctoral Fellow

The department was delighted to welcome the first Robert Marshak Postdoctoral Fellows in High Physics this year. Theorist David Rainwater and experimentalist Veronique Boisvert joined the department on August 1, 2004.

The Marshak Fellowship has been established to honor the distinguished career of legendary former department chair Robert Marshak and to offer young scientists the opportunity to pursue innovative research at the University of Rochester in the fields of particle and nuclear physics.

Fellows receive, in addition to full salary support, a supplemental salary stipend as well as a research expense fund to be used at their discretion. The fellowships are meant to give the department an advantage in recruiting the very best and brightest candidates on the market.

David Rainwater, or Dave, as he prefers to be known, has joined Lynne Orr's phenomenology group in particle theory.

After receiving a Ph.D. from the University of Wisconsin at Madison, Dave held postdoctoral positions in the theory groups at Fermilab and at DESY, in Hamburg, Germany. He describes his work in particle phenomenology as "how to dissect the workings of theory and show how it can be proved or disproved in real experiments.'" In particular, Dave has made a career out of showing how

David Rainwater with plane

to squeeze information on the Higgs boson out of the CERN Large Hadron Collider (slated to begin operation in late 2007). It was well known that the LHC could discover the Higgs boson, but Dave showed how its properties could be measured as well.

Dave is not only a fan of classical music, but also an accomplished cellist. He is also an avid airplane pilot, as are Frank Wolfs, Doug Cline, Sergey Korjenevski, and others in the department.

Our other Marshak fellow, Veronique Boisvert, is currently working with Kevin McFarland on the CDF experiment at the Fermilab TeVatron. Veronique completed her undergraduate work at Université de Montreal, in the city where she was born and raised. She received her Ph.D. from Cornell University, where she was a collaborator of Ed Thorndike's on the CLEO collaboration ("the first B factory," Veronique notes) and worked on the precise determination of the probability for the bottom quark to decay into an up quark. This measurement sheds light on the consistency of the Standard Model in the area of CP violation and is related with the asymmetry of matter over antimatter in the universe. In Ithaca, N.Y., she practiced her home country's favorite sport and joined the Ithaca Sirens, a women's hockey team.

After getting her Ph.D., Veronique held a two-year CERN fellowship and joined both ATLAS and RD50. Back in North

America, Veronique joined the CDF collaboration working closely with the Rochester group. Moving up from the b quark, her interests now involve the top quark. In order to establish the top quark on firmer grounds, she plans to measure the electric charge of the top quark. On the theoretical side, Veronique is collaborating with Lynne Orr from Rochester as well as David Rainwater. Since she joined Rochester, she has revived the weekly CDF Rochester group lunch, and to help her young CDF colleagues she is in the process of setting up a database of former CDF members now working outside HEP. Veronique is still deciding whether to get her hockey skates sharpened!

Tom Ferbel at the U.S. Department of Energy

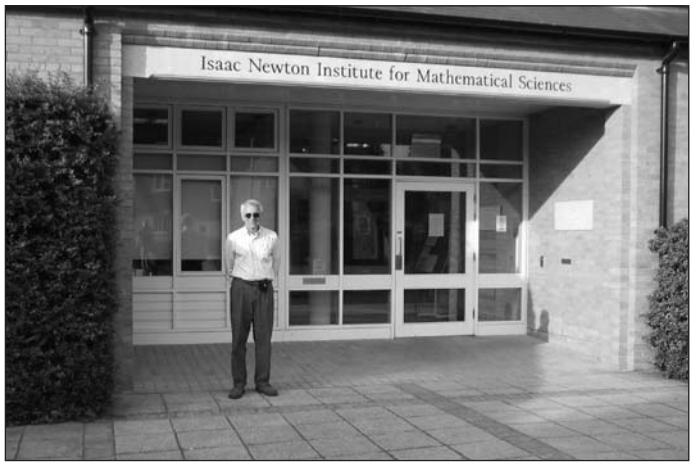
Professor Tom Ferbel (editor of the last issue of Cross Sections) will be spending most of the next two years (September 2004–August 2006) at the Germantown office of the Department of Energy (DOE) on an IPA assignment from the University of Rochester.

During this time, Ferbel will be responsible for all managerial responsibilities for the U.S. program at the Large Hadron Collider (LHC), which is being constructed at the CERN complex in Geneva, Switzerland.

Ferbel will oversee the contributions from both the DOE and the National Science Foundation. Jim Whitmore, currently with the NSF, will serve as deputy manager.

Jack Thomas Is Visiting the Newton Institute

John H. Thomas, professor of mechanical and aerospace sciences and of astronomy, is spending the fall semester in Cambridge, England, as a Senior Visiting Fellow of the Isaac Newton Institute for Mathematical Sciences. Thomas is participating in the Institute's four-month research program on Magnetohydrodynamics of Stellar Interiors. He gave two one-hour invited lectures on the physics of sunspots during the opening workshop in September, which doubled as a summer school for graduate students and postdocs under the sponsorship of the Marie Curie Foundation. Thomas will be giving other talks in the Newton Institute and at St. Andrew's University, as well as a public lecture sponsored by the London Mathematical Society at its traditional "Spitalfields Day" conference in December. The Newton Institute program enables Thomas to continue his collaborative research program on sunspots with Nigel Weiss (Cambridge), Steve Tobias (Leeds), and Nic Brummell (Boulder), who are also participating in the program. Eric Blackman (Rochester), who also collaborates with Thomas on work in astrophysical MHD, will join the Newton Institute Program for three weeks later in the fall.



This is Thomas's third long-term stay at Cambridge University. He was a NATO postdoctoral fellow there in 1966–67, in the Department of Applied Mathematics and Theoretical Physics (DAMTP), and he returned to DAMTP for six months in 2002 when he was also a Visiting Fellow of Clare Hall, one of the Cambridge colleges. He has kept his ties with Clare Hall, and he and his wife, Lois, are now living in the college again as returning Life Members.

Dan Koltun Retires

After 42 years at the University of Rochester, Daniel S. Koltun, professor of physics, retired from the teaching faculty at the end of the spring 2004 semester.

Koltun received his A.B. from Harvard (1955) and his Ph.D. in physics from Princeton (1961). After serving as instructor, then research associate, at Princeton, he was a Visiting Fellow at the Weizmann Institute of Science (Israel) as well as at the Niels Bohr Institute. He joined the University of Rochester as a research associate in 1962, was promoted to assistant professor of physics in 1963, to associate professor in 1968, and to professor in 1974. He has served as visiting research associate (1969–70) and visiting scientist (1984) at MIT, visiting professor at Tel Aviv University (1976–77), and Lady Davis Visiting Professor at the Hebrew University, Jerusalem (1985). He has been awarded an NSF Postdoctoral Fellowship, Alfred P. Sloan Research Fellowship, and John Simon Guggenheim Memorial Fellowship, and is a Fellow of the American Physical Society.

Koltun is coauthor, with the late Judah M. Eisenberg, of the books *Theory of Meson Interactions with Nuclei* (1980) and *Quantum Mechanics of Many Degrees of Freedom* (1988). He has served as associate editor of *Physical Review C* and of *Physical Review Letters,* and on the Scientific Advisory Board of the Space Radiation Effects Laboratory (Newport News). Long associated with the scientific program of the Los Alamos Meson Physics Facility (LAMPF), he was a visiting staff member for 18 years and served on its Program Advisory Committee.

Koltun's research interests and activities have been in theoretical physics, largely connected with nuclear structure and reactions at intermediate and high energy, as well as with many-body theory. The experimental data for this subject has come from the Rochester 130" cyclotron; meson "factories" such as LAMPF, TRIUMF, and SIN (PSI); and electron accelerators such as SLAC, BATES, and more recently the Thomas Jefferson Laboratory. The theoretical motivation has been to understand the dynamics of nuclei as many-body systems, and the role of subnucleon constituents in this problem. The constituents of special study have been mesons, particularly pions, and more recently, quarks. Recent work has included the connection of inelastic response of nuclei to nuclear structure and mesonic interactions, the study of one-dimensional integrable many-body models for quark systems as well as other physical systems, and applications of chiral perturbation theory. In addition to being a leader in the meson physics community, Koltun is well known in the electron scattering community for what is called the "Koltun Sum Rule" for the scattering of electrons from nuclear targets.

Dan Koltun has many friends and colleagues at the University, who have benefited from his sage advice and enjoyed his wonderful sense of humor. They are pleased that he will remain in Rochester and continue his affiliation with the University as professor emeritus.

Staff News

Staff members Judy Mack and Thang Nguyen celebrated 25 years at the University of Rochester this year.

Longtime engineer, Tom Haelen, of the High Energy Physics and Barnes Shop passed away January 19, 2004, after a two-year struggle with cancer. Tom had retired in November 2003 after 47 years of service to the Department of Physics and Astronomy.

Bruce French Remembered

The Bruce French memorial lecture was delivered by Boris Altschuler of Princeton University on September 29.

Classical dynamical systems can be separated into two classes—integrable and chaotic. For quantum systems this distinction manifests itself, e.g., in spectral statistics. Roughly speaking, integrability leads to Poissonian distribution of the energies, while chaos implies Wigner-Dyson statistics of the levels, which are characteristic for the ensembles of random matrices. Bruce French, who was professor in the department for more than 40 years, was one of the pioneers in the application of random matrix theory to explain nuclear energy levels. Altshuler briefly discussed the problem of Anderson Localization from the spectral statistics point of view and demonstrated that the onset of the chaotic behavior for a rather broad class of systems can be understood as a delocalization in the space of quantum numbers that characterize the original integrable system. He illustrated this conclusion by a number of examples and made an attempt to describe the chaotic nature of the nuclear spectra within the framework of these ideas.

Joe Rogers Obituary

Joseph T. Rogers (Ph.D. '87), associate professor of physics at Cornell University, died May 25 of neuro-endocrine cancer, diagnosed in July 2003. He was 46.

Born in Chicago, he lived for most of his childhood in the western suburb of Glen Ellyn. His parents were artists who had studied at the Art Institute of Chicago. He attended the State University of New York at Stony Brook, earning a B.S. in 1980. After working as an engineer for a laser optics company for two years, he returned to school, earning his Ph.D. in physics from the University of Rochester in 1987. His dissertation, "Limits on the Electromagnetic Coupling and Density of Galactic Axions," was directed by Adrian Melissinos. For part of 1987, he and his wife, Rene, lived in Frascati, Italy, near Rome while he was a visiting scientist at the Italian national laboratory Istituto di Fisica dello Spazio Interplanetario. He was a postdoctoral research associate at the University of Rochester from 1987 to 1989 and associate physicist at the National Synchrotron Light Source at Brookhaven National Laboratory on Long Island, N.Y., from 1989 through 1992.

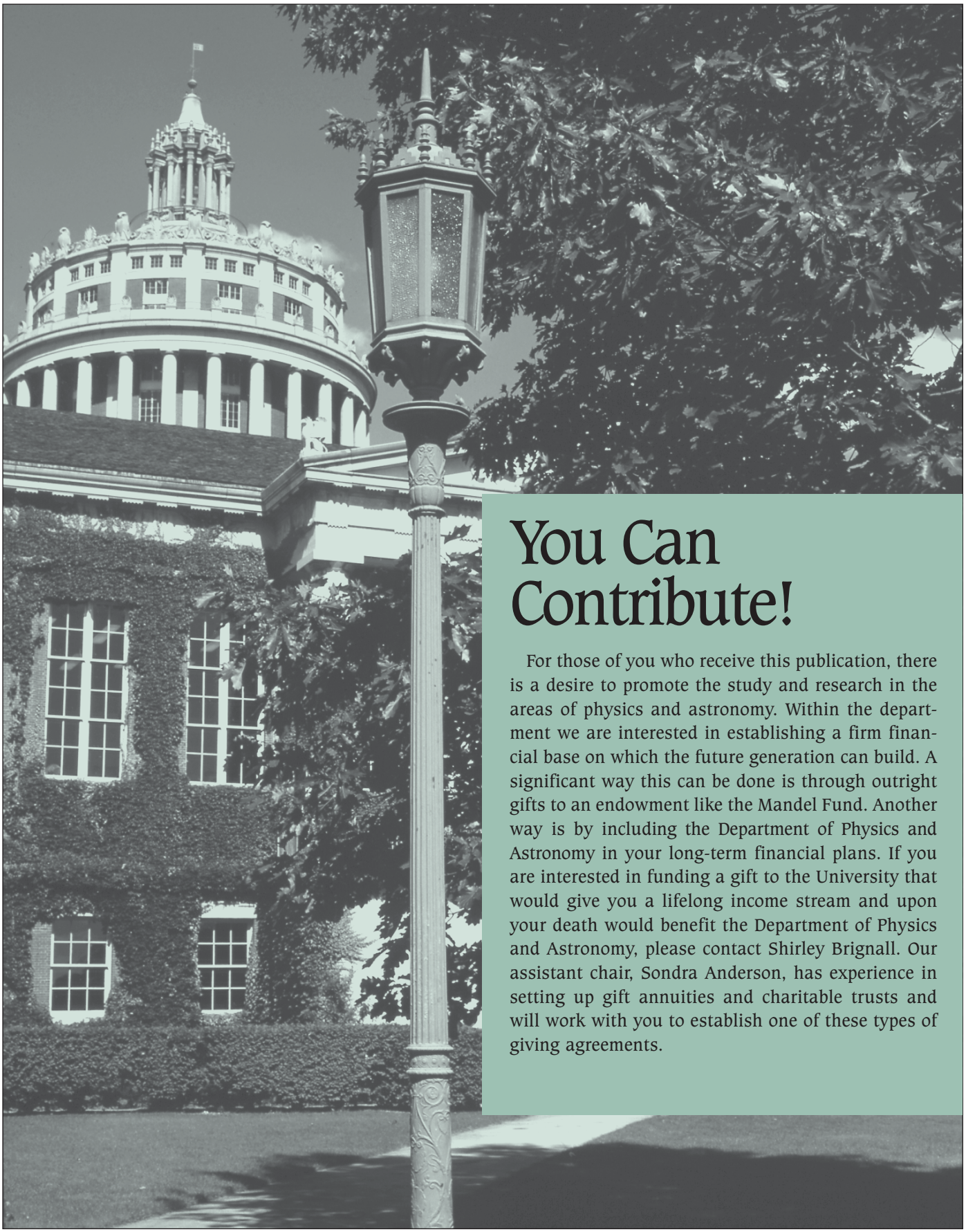
His research focused on the physics contributing to the design of future high-energy particle accelerators and tuning and exploitation of existing accelerators, such as Cornell's Wilson Synchrotron Laboratory. Particular research areas included computational physics for particle beams; collective instabilities in particle accelerators due to electromagnetic fields, particularly those of background ions and electrons; the beam-beam interaction; accelerator feedback systems; and diagnostic instrumentation, as well as physics pedagogy. He was a National Science Foundation Young Investigator 1993–98 and a member of the American Physical Society and the American Association of Physics Teachers. He served as director of Undergraduate Studies in Physics in 1998, 1999, and 2000 and subsequently on the graduate admissions committee.

He is survived by his wife and two young sons: David, 4, and Michael, 6 months. He also is survived by his father, Joseph W. Rogers, and brother, Steven Rogers, both of Glen Ellyn, Ill.

Memorial contributions can be made in his name to the Sciencenter in Ithaca or to the David and Michael Rogers Education Fund, c/o Sandy Grooms, Tompkins Trust Co., P.O. Box 460, Ithaca, NY.

A Montreal Reunion of Rochesterians

A happy minireunion of alumni of the department's graduate program took place in late summer. Shown in the Bonaparte Restaurant of Old Montreal are, left to right, Su Lin ('90), Fauzia Ali, Phyllis Unger ('67), Judy Kalman, Twareque Ali ('74), Calvin Kalman ('70), Myrta Knox, Bob Knox ('58), Bob Schweitzer ('93), and Stan Unger ('68). The Knoxes and Lin were attending the 13th International Congress on Photosynthesis, while the others are current residents of the Montreal area. The Knoxes celebrated their 50th wedding anniversary on the occasion.



You Can Contribute!

For those of you who receive this publication, there is a desire to promote the study and research in the areas of physics and astronomy. Within the department we are interested in establishing a firm financial base on which the future generation can build. A significant way this can be done is through outright gifts to an endowment like the Mandel Fund. Another way is by including the Department of Physics and Astronomy in your long-term financial plans. If you are interested in funding a gift to the University that would give you a lifelong income stream and upon your death would benefit the Department of Physics and Astronomy, please contact Shirley Brignall. Our assistant chair, Sondra Anderson, has experience in setting up gift annuities and charitable trusts and will work with you to establish one of these types of giving agreements.

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 _____

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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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