PHYSICS

Department of Physics Newsletter / Winter 2007–2008

WASHINGTON UNIVERSITY PHYSICISTS ANALYZE SOLAR WIND SAMPLES FROM GENESIS MISSION

The sun holds 99.9 percent of the solar system mass, saved in all original proportions after planets and meteorites formed. Analyzing the mix of hydrogen, oxygen, and noble gases found in the sun can answer one of the biggest questions of the universe: How did our solar system evolve?

Washington University scientists and a large team of colleagues sought to answer that question by examining samples of solar wind for neon and argon, two abundant noble gases. The work was published in the Oct. 19, 2007, issue of *Science*. These samples came from NASA's Genesis mission, which launched in 2001 and orbited the sun for more than two years, collecting samples of solar wind. In 2004, the soft landing planned for the craft went wrong, and Genesis smashed into the Utah mud, splintering into more than 10,000 pieces. Fortunately, these fragments were large enough to yield highly precise data for neon and argon.

Alex Meshik, Ph.D., lead author and research professor of physics, credits mission planners with preparing for every outcome long before launch. At the time, decisions to craft solar-wind-collection arrays in different thicknesses in case they were broken on landing likely saved all data. "The arrays are made of super-pure metals and diamonds deposited on sapphire," Meshik said. "There was no way to mark them otherwise. Now we can take a piece and know which array it came from."

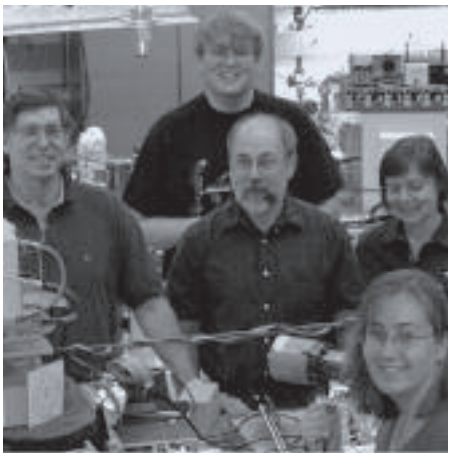
Genesis collected samples by deploying different arrays during three types, or flow regimes, of solar wind: low-speed, high-speed, and coronal mass ejections. Because solar wind streams at different velocities in different regimes, onboard instruments move the arrays to collect separate data for the different regimes. The abundances and isotopic composition of the noble gas from the regimes could in turn be used to understand how well the solar wind truly represents solar composition.

The isotopic composition of neon and argon in all three regimes was the same. So measuring solar wind means that you are sampling the solar corona, the place at which ions stream out of the sun. "This is likely true for future measurements of nitrogen and oxygen and other elements because if it's true for noble gases, it's true for other elements as well. This work gives scientists who design models of how the solar system formed the actual ground truth," said Charles Hohenberg, Ph.D., professor of physics. Differences in isotopic composition between the planets and the sun tell us about their evolution. Also, the team's ability to measure neon and argon with high precision helps other Genesis scientists calibrate data.

Although Washington University scientists won't be measuring oxygen—a critical element for planetary studies—their Genesis findings will help scientists make their measurements more accurate. "There are so many elements that other scientists would like to measure that are very difficult to measure because of their low abundance and high potential for contamination," Hohenberg said.

Even though Washington University scientists were able to extract valuable data from Genesis' broken pieces, the work required the design of new equipment and refinement of existing measuring devices. Both Meshik and Hohenberg stressed the team aspect that made and continues to make this project possible.

Five of eight authors on the current *Science* paper come from the University. In addition to Meshik and Hohenberg, fourth-year graduate student Jennifer Mabry, whose doctoral research is based on this work; senior research scientist Olga Pravdivtseva, Ph.D.; and Yves Marrocchi, Ph.D., who is now at Nancy-Université in France, worked on all aspects of the project. Also among the co-authors is a former student of Hohenberg's, Chad Olinger, Ph.D., who is at Los Alamos National Laboratory.



↑ (from left) Charles Hohenberg, Alexander Meshik, Olga Pravdivtseva (back:) Ben Thomas, front: Jennifer Mabry

Next, Washington University scientists will measure heavy noble gases from the solar wind samples—they've already redesigned two new mass spectrometers specially made for this effort. Unlike argon and neon, which are abundant enough for multiple measurements, the rarity of heavy nobles like xenon allow for only one or two attempts.

The Genesis mission was the first since the Apollo era to bring extraterrestrial material back to Earth, so the team wants the best measurement possible of the sun's xenon and krypton. Therefore, these measurements have been delayed while measurement techniques are optimized.

"If you look at meteorites, the argon that you measure is very close to what you see in the sun. That's not the case for xenon and krypton, and that's not the case for the atmosphere. Understanding how those things all fit together is important. Nobody really knows yet," Hohenberg said.

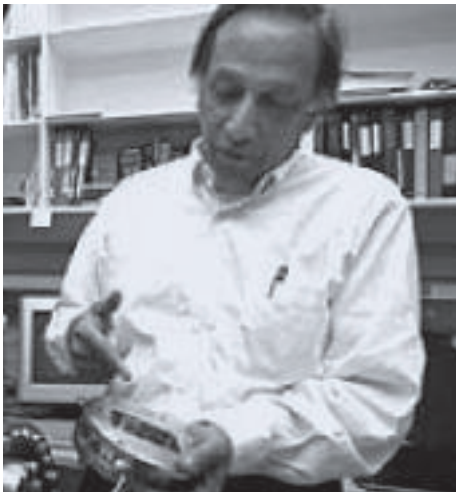
RAMANATH COWSIK NAMED DIRECTOR OF THE MCDONNELL CENTER

Ramanath Cowsik, professor of physics, has been named director of the McDonnell Center for the Space Sciences effective July 1, 2007. He succeeds Roger J. Phillips, professor of earth and planetary sciences, who is stepping down after seven years as director and who retired at the end of 2007.

Cowsik becomes only the third director of the center since it was established in 1975 by a gift from aerospace pioneer James S. McDonnell. The late Robert M. Walker, the McDonnell Professor of Physics, was its inaugural director.

Considered one of the world's pre-eminent astrophysicists, Cowsik has made several seminal and lasting contributions to neutrino physics, gravitation, and high-energy astrophysics. His relationship with Washington University began in 1975 when Walker invited him to serve as a distinguished visiting professor at the McDonnell Center. Cowsik then joined the physics faculty in 2002 as a professor.

He earned his bachelor's degree in physics, chemistry, and mathematics, with minors in English and Sanskrit, at the University of Mysore in India in 1958. He earned a master's degree in physics at India's Karnatak University in 1960 and then a doctorate in physics in 1968 from the University of Bombay.



↑ Ramanath Cowsik

Cowsik taught and did research for more than 40 years at the Tata Institute of Fundamental Research, where he served as director of the Indian Institute of Astrophysics (IIA) for 11 years.

Inducted into the National Academy of Sciences in 2004, Cowsik has received numerous other awards and honors, including India's Padma Shri Award, equivalent to the National Medal of Science.

Cowsik's scientific contributions span several decades and are in the fields of astronomy, astrophysics, cosmology, and non-accelerator particle physics; these are recorded in his 175 research papers. He established the highest observatory in the world in Hanle, Ladakh, in the Himalayas, at an altitude of 15,000 ft, for astronomy in the optical and infrared wavelength bands. He has contributed significantly to the understanding of highly energetic phenomena in astrophysics such as cosmic rays, pulsars, supernova remnants, gamma ray bursts, active-galactic nuclei and other such sources powered by accretion flows. He has studied both the diffuse nonthermal radiations that permeate all space and also the emission of such radiations from discrete astronomical sources. The "leaky-box" and the "nested-leaky-box" models invented by him are extensively used to interpret the observations of cosmic rays.

He has studied the virial discrepancy in the dynamics of clusters of galaxies and proposed

(continued on page 10)

ZINNER SYMPOSIUM

↑ The Zinner Impact

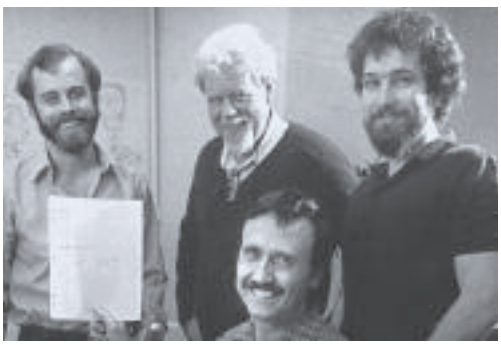
During February 3–4, 2006, the McDonnell Center for the Space Sciences hosted a symposium in honor of the 70th birthday of Ernst Zinner. Zinner came to Washington University when Physics had an experimental high-energy particle group, and his dissertation was on one decay mode of the charged kaon.

The subject of this special Symposium was SIMS in the Space Sciences: The Zinner Impact, and the presentations spanned the range of Zinner's interests. SIMS is the acronym for Secondary Ionization Mass Spectrometry (SIMS)/ Ion Microprobe—an instrument that Ernst has wielded to great effect.

Papers were presented by many luminaries such as Ed Anders (University of Chicago) and Don Clayton (Clemson University), as well as by some of the fourth-floor physics alums: Al Fahey (GR 88), now at NIST in Gaithersburg Kevin McKeegan (GR 87), now at UCLA Scott Messenger (GR 97), now at Johnson Space Center, Houston Larry Nittler (GR 96), now at the Department of Terrestrial Magnetism, Carnegie Institution of Washington.

Ghislaine Crozaz presented a broad review, and there were also presentations by former researchers who had worked on the 4th floor: Conel Alexander (Carnegie Institution), Jeff Taylor (University of Hawaii), Trevor Ireland (Australian National University), Meenakshi Wadhwa (Arizona State University); and Sachiko Amari and Frank Stadermann, who are both still at Washington University.

The range of topics was wide: chondrules; presolar graphite and SiC in meteorites; stardust; the application of SIMS isotopic and trace element measurements to nuclear safeguards; SIMS applications outside of the geological and space sciences; and early evolution of the solar system.



↑ (from left) Scott Sandford, Bob Walker, Kevin McKeegan, and Ernst Zinner in front, from an earlier time.

WASHINGTON UNIVERSITY GRAVITATION GROUP HOSTS MIDWEST RELATIVITY MEETING AND CLIFFFEST

↑ Clifford Will

Last November, the Washington University Gravitation Group (WUGRAV) hosted the 16th Midwest Relativity Meeting (MWRM-16), as well as the Cliff Will Birthday Symposium on Gravitational Theory and Experiment—CliffFest—in recognition of Cliff's 60th birthday. Over 150 gravitational physicists from around the country and the world attended the events.

"What makes these regional meetings unique is that they are very informal and are geared toward talks by young researchers—graduate students and postdocs," said Will. "This gives them important experience and allows them to meet and talk to other researchers in the field. By having them regional, we make it possible for people to attend who might have been unable to afford the travel costs to a big national or international meeting."

The CliffFest symposium featured invited talks by five premier physicists in the field, including Nobel Prize-winner Joseph H. Taylor Jr., the James S. McDonnell Distinguished University Professor Emeritus of Physics at Princeton University. Taylor won the Nobel Prize in physics in 1993. Because of Will's work related to the discovery for which Taylor and Russell A. Hulse received the award, Will was invited to attend the Nobel ceremonies in Stockholm that year.

In addition to Taylor, the symposium speakers were Luc Blanchet, Directeur de Recherche, Institut d'Astrophysique de Paris; Francis Everitt, professor of physics and head of Gravity Probe-B at Stanford University; Bernard Schutz, director of the Albert Einstein Institute in Potsdam-Golm, Germany; and Kip S. Thorne, the Feynman Professor of Theoretical Physics at the California Institute of Technology.

"For 30 years, Cliff Will has been the leading scientist, worldwide, in probing whether Einstein's general relativity theory is correct," said Thorne, who was Will's thesis adviser when he was a doctoral student at Caltech. "He has provided the theoretical framework within which tests of relativity are carried out, he has invented tests that disproved competing theories, he has shown us how to use gravitational-wave observations to test relativity, and he has predicted in great detail the shapes of the gravitational waves that we should see from black holes and neutron stars orbiting each other.

↑ Cliff—young, with hair

Those predictions are crucial for the searches for gravitational waves now being carried out by LIGO, the Laser Interferometer Gravitational Wave Observatory."

Professor Wai-Mo Suen, together with other members of WUGRAV and ably supported by Sarah Hedley, coordinated the scientific events. A summary of the Midwest meeting and the CliffFest can be found at www.oakland.edu/physics/mog29/.

ROGER PHILLIPS COMPLETES 26 YEARS OF EXTRAORDINARY CONTRIBUTIONS TO WASHINGTON U.

Professor Roger J. Phillips demitted his office as the director of McDonnell Center for the Space Sciences in July 2007 after nearly a decade of extraordinary contributions to the Center, which was founded by Professor Robert M. Walker through a munificent grant from James McDonnell, known as "Mr. Mac." By the time Roger assumed office as the director, the endowments to the Center had been augmented substantially by generous contributions from the Danforth Foundation. The responsibilities of running the Center fell lightly on Roger's able shoulders as he continued to make pioneering and sustained scientific contributions to Earth and Planetary Sciences. One cannot but be impressed by the depth and scope of his contributions, not only to research but also to teaching, mentoring, and administration.

After graduating with a BS degree in Geology and Geological Engineering from the Colorado School of Mines in 1963, he went to the University of California, Berkeley, to obtain his M.S. and Ph.D. in 1965 and 1968, respectively. After a dynamic growth of scientific prowess and career advancement, which included a 12-year tenure at the Jet Propulsion Laboratory and the position of director, Lunar & Planetary Institute, Houston, Texas, he joined Washington University in 1991. In 1999, when Robert M. Walker decided to demit his office, he recommended Phillips as the director of the McDonnell Center for the Space Sciences, and Professor Edward S. Macias, dean of Arts & Sciences, prevailed upon Phillips to accept.

Roger is one of the world's leading exponents of gravitational, seismic, electrical, and magnetic techniques as applied to tomographic mapping of the Earth and planetary bodies and geodynamical modeling. His scientific

↑ Roger J. Phillips

contributions are extensive and pioneering; these include the first deep microwave sounding of the lunar crust as the team leader of the Apollo Lunar Sounding Experiment, the first Bouguer gravity anomaly determination of Mars, wherefrom he developed the gravity model including the stresses associated with lithospheric load due to the formation of Tharsis plateau on Mars. He was the principal investigator of the Gravity Experiment, Pioneer Venus Mission, co-investigator on the Magellan Mission to Venus, the Mars Global Surveyor, the MESSENGER mission to Mercury, ESA Mars Express mission—MARSIS Radar Investigation, and the U.S. team leader for SHARAD—Sounding Radar Investigation using the NASA Mars Reconnaissance Orbiter. His unfailing scientific and administrative judgment has led to his appointment to a number of important committees in NASA, DOE/ERDA, and National Academy of Sciences/National Research Council, Space Science Board. In recognition of his outstanding scientific contributions, he has been conferred with many awards and honors, which include election to Tau Beta Pi, Van Weelden Award, NASA Public Service Medal, G.K. Gilbert Award of the Geological Society of America, and election as a Fellow of the American Geophysical Union and of the Geological Society of America. He has moved to Boulder, Colorado, to continue his scientific activities at the Southwest Research Institute.

— Ramanath Cowsik

CARL BENDER NAMED THE WILFRED R. AND ANN LEE KONNEKER DISTINGUISHED PROFESSOR OF PHYSICS

Carl Bender has been named the Wilfred R. and Ann Lee Konneker Distinguished Professor of Physics in Arts & Sciences. A formal installation ceremony was held on November 27, 2007, in Holmes Lounge. Professor Bender's research is known across the world for its application of asymptotic analysis, differential-equation theory, and complex-variable methods to quantum mechanics and elementary particle physics. His research efforts include numerous studies: explaining the divergence of perturbation expansions in quantum field theory, originating the field of large-order behavior of perturbation theory, exploring the nature of low-dimensional quantum field theory, inventing the "delta expansion," (a new type of perturbation expansion for nonlinear problems in physics), discovering methods for solving operator differential equations, studying strong-coupling and lattice approximations in quantum field theory, and, most recently, originating the large and active field of PT-symmetric quantum theory.

Bender earned his A.B. degree from Cornell University and his A.M. and Ph.D. degrees in physics at Harvard. He was a postdoctoral fellow at the Institute for Advanced Study in Princeton before joining the faculty of the Massachusetts Institute of Technology as assistant and then associate professor. In 1977 he joined Washington University as professor of physics.

Wilfred R. Konneker earned bachelor's and master's degrees from Ohio University and his Ph.D. in physics from Washington University under Arthur Holly Compton in 1950. He worked on the Manhattan Project in World War II before founding Nuclear Consultants, the nation's first commercial supplier of radioactive isotopes for pharmaceutical purposes. Mallinckrodt bought Nuclear Consultants, and Dr. Konneker became vice-president of the diagnostics division. He then left to pursue cutting-edge technological company development. Ann Lee Konneker received a bachelor's degree in English from Ohio University. Together, they generously support higher education, particularly at Ohio and Washington Universities.

↑ Carl Bender

Bender's scholarly expertise is in mathematical physics and applied mathematics. Since the publication with S. Orszag of his book, *Advanced Mathematical Methods for Scientists and Engineers*, he has been regarded as an expert on the subject of asymptotic analysis and perturbative methods. He has devoted his professional academic career to using the methods of classical applied mathematics (asymptotics, perturbation theory, approximate methods, differential equations, combinatorics) to solve a broad range of problems in high-energy theoretical and mathematical physics. His most important work is in the areas of lattice approximations in quantum field theory; semi-classical, strong-coupling, and mean-field approximations in quantum field theory; path integral representations; the nature of perturbation theory in large order; and, most recently, new kinds of nonperturbative techniques for quantum field theory. Because of his strong background in applied mathematics, he is able to enter quickly into fruitful research collaborations with a wide variety of scientists, whose interests range from applied to theoretical.

Professor Bender's major research efforts in recent years have fallen into six main categories: (1) developing a new technique for obtaining nonperturbative information about a quantum field theory by expanding the Green's functions as series in powers of D, the dimension of space-time, (2) discovering a new and promising kind of continuum field-theoretic perturbation expansion called the delta expansion, (3) inventing methods for finding the analytical solution of operator differential equations, (4) studying strong-coupling and lattice approximations in quantum field theory, (5) originating the field of large-order behavior of perturbation theory, and (6) miscellaneous research projects. Bender's work is characterized by great originality and contributions that do not follow conventional trends. Measured by the number of people who have used the mathematical techniques that Bender has developed and have worked in areas of research that he has initiated, such as coupling-constant analyticity, large-order behavior of perturbation theory, and PT-symmetric quantum mechanics, many of Bender's papers have been seminal and have had and continue to have great impact in mathematical physics. Bender has over 250 published papers including 21 *Physical Review Letters* and his published work has over 10,000 citations. He is a fellow of the American Physical Society and the UK Institute of Physics. He has received Guggenheim, Fulbright, Lady Davis, Sloan, and Rockefeller Foundation Bellagio Fellowships. He was the Ulam Scholar at Los Alamos National Laboratory for the 2006-07 academic year. He is currently serving a five-year term as editor-in-chief of the *Journal of Physics A* and in the past he has served on the editorial boards for several other journals.

SATURDAY SCIENCE

Every fall semester since 1994, the Department of Physics has presented a series of four Saturday morning lectures aimed at the general public. The lectures, co-sponsored by University College, are given in the Hughes Lecture Room in Crow Hall. Each lecture series has an overall theme, and all lectures are given by members of our faculty. The response has been extraordinary—Crow 201 has 195 seats and the room is almost full every week. Since spring 2005, we have had lecture series in both the fall and spring semesters.

During 2007, the spring lectures were on *The Atomic Bomb—The Science, the People, and the Politics*. Speakers were Willem Dickhoff, "The Physics of the Bomb"; John Rigden, "Oppenheimer and American Nuclear Physics"; Michael Ogilvie, "The Bomb: From World War to Cold War"; and Michael Friedlander, "Post WW II."

The fall series was on *Physics in Medicine and Biology*. Lecturers were Anders Carlsson, "The Intelligence of Biological Cells"; James G. Miller, "Assessing the Quality of Medical Tests"; Ralf Wessel, "How Does the Brain Work?"; and Sandor Kovacs, "The Laws of Classical Physics Govern What Cardiologists See and Hear."

FROM THE CHAIRPERSON

The Times They Are a-Changin' (Bob Dylan)

On July 1, I began my term as the 10th chair of the physics department. Francis Nipher was the first chair, appointed in 1875. He was followed by Lindley Pyle (1908), Arthur Holly Compton (1919), Arthur Hughes (1923), George Pake (1953), Edward Condon (1956), Dick Norberg (1961), Cliff Will (1991), and John Clark (2002). This is an impressive list to follow! I feel a bit like Linus must have felt as he inherited the leadership of the Church following the Apostles Peter and Paul.

I inherit an excellent department, crafted through the hard work and vision of my predecessors and my colleagues and staff. The department has 27 tenured and tenure-track faculty with four research faculty. All of our faculty are dedicated to high standards of teaching and research. We have two members of the National Academy of Sciences, Ramanath Cowsick (2004) and Clifford Will (2007). Our external research funding is $4.6 million, down a little from 2006, but still quite strong, especially in this time of declining government support for research. There are currently 41 declared undergraduate majors; 14 graduated in 2007. The graduate program is strong with 93 Ph.D. students, 38 percent of whom are women, well above the national average of 19 percent. All entering students receive University Fellowships (or other "non-teaching" fellowships) for their first year.

The physics community is witnessing significant changes with growing activity at the traditional boundaries with other disciplines. We have worked hard to preserve balance between moving into new interdisciplinary areas while maintaining the strength of our core. We are focusing primarily on three areas:

- Biological/Medical Physics
- Condensed Matter/Materials Physics
- Astro/Particle Physics

We are hiring new faculty members to complement existing strengths. Recently, a new biophysics experimentalist (Yan Mei Wang) and two condensed matter theorists (Zohar Nussinov and Alex Seidel) joined our faculty. We have recently added a theoretical physicist to our ranks in order to bridge our existing experimental astrophysics and theoretical high-energy activities.

↑ Ken Kelton

There are many exciting changes in the department. We are introducing ways to increase the cohesion between our undergraduates and to increase their interaction with other members of the department. We are finding ways to increase undergraduate research experiences. We are planning new undergraduate majors that bridge to other departments within the School of Engineering. We are increasing our cooperation with other departments within Arts & Sciences and with the Schools of Engineering and Medicine in both teaching and research.

Educating and engaging the public in the central role of science in our society is essential to the strength of our discipline and of our nation. To this end we teach undergraduate courses such as "Physics and Society," and "How Things Work." We are expanding our outreach activities, building on our past successes, including the Saturday Morning Seminar Series, organized by Mike Friedlander, and outreach to secondary teachers and students, led by Pat Gibbons. Our graduate and undergraduate students are enthusiastically participating in these new activities.

Centers play a fundamental role in the interdisciplinary activities of departments at Washington University. Two centers, the McDonnell Center for the Space Sciences and the Center for Materials Innovation (CMI), are particularly important in our department.

- The McDonnell Center, established in 1975 under Bob Walker's directorship by an endowment from the McDonnell Foundation and strengthened by a later major contribution from the Danforth Foundation, has a current membership of approximately 100, including 45 faculty. The current director is Ram Cowsik (Physics). The center stimulates work on fundamental interdisciplinary problems in Space Sciences and Astro-Particle Physics, supporting professorships (currently four in Physics and four in the Department of Earth & Planetary Sciences), fellowships, visitor programs, providing seed funds for innovative research, and fostering international collaborations.
- The Center for Materials Innovation (CMI) was inaugurated in September 2003 under the directorship of Stuart Solin (Physics) to build interdisciplinary educational and research activities focused on the creation, study, and utilization of materials. It also enables the buildup of Washington University research infrastructure that benefits the campus community as well as industry and government entities in the St. Louis region and beyond. The interdisciplinary research activities of the CMI include 35 faculty who span eight departments in three schools.

A successful department hinges on the quality of the staff. Our staff is the best on campus. They are critical to making the physics department a smoothly running and friendly place for our students, faculty, scientists, and visitors. Cary McConnell, who has served as the departmental administrator for over 10 years, retired at the end of March 2008. I thank him for his service and wish him all the best for the future. Our new departmental administrator, David Hall, joined the department on February 1, 2008. I look forward to working with him as plans for improvement and change unfold in the Department of Physics.

It is an exciting time. I will keep you informed of future developments and accomplishments. In the meantime, please feel free to drop me a note or e-mail message anytime. I'd love to hear from you.

– Ken Kelton

Arthur Holly Compton Professor in
Arts & Sciences
Chair, Department of Physics
kfk@wustl.edu

FACULTY NEWS

Mark Alford

alford@wuphys.wustl.edu

Mark Alford spent the late fall of 2006 in Tokyo, as a visiting scholar at the physics department of Tokyo University. The considerable expense of traveling and living there was covered by a fellowship that he received from the Japanese Society for the Promotion of Science. Alford, his Japanese wife, and three-year-old son spent two months living in an apartment situated within walking distance of Tokyo University, near the Yushima shrine in the Ueno district. During the stay, as well as enjoying intensive discussions with members of the hadronic physics group at Tokyo University, Alford was able to spend a week at a conference at the Yukawa Institute in Kyoto and was also invited to visit other universities in Japan, such as Sophia (Jouchi) University, Saga University, and the KEK accelerator complex in Tsukuba. Alford's son spent each weekday in a Japanese preschool and quickly became fluent in the language. A year later he is still speaking Japanese with his mother and enjoying the videotapes that they recorded of Japanese children's TV programming.

During the rest of the year, Alford was invited to several international conferences. In June 2007 he spent a week at the EXOCT astrophysics conference at Catania in Sicily, followed by a week at the QCD@Work strong interaction conference in Bari, Italy. Because this year is the 50th anniversary of the Nobel-prize-winning "BCS" theory of superconductivity, and Alford works on a form of superconductivity in quark matter, he was also invited to give presentations at two major anniversary conferences: the Gordon Research Conference on superconductivity in Les Diablerets, Switzerland, and the BCS@50 conference in Urbana-Champaign, Illinois. The rest of Prof. Alford's summer was spent working with colleagues at MIT and North Carolina State University on a long review article, commissioned by *Reviews of Modern Physics*, about their field of research.

For two months this fall, Alford was in the happy position of having two postdoctoral researchers working with him. His first postdoc, Andreas Schmitt, received a tempting offer from the University of Vienna, and decided to accept it, but thanks to startup funding that he received from Washington University, Alford was able to delay Andreas's departure until the end of October, two months after his new postdoc, Andrei Kryjevski, arrived. Kryjevski received his Ph.D. from the University of Washington in Seattle, and the two postdocs were able to make substantial progress in a joint research project during their overlap period.

Finally, in late October, Alford received the ultimate invitation: to address a group of gifted 7th-grade students at Holman Middle School in St. Ann, Missouri. He spent 50 minutes answering questions about the big bang, black holes, the structure of the universe, and string theory. After this he returned to the simpler task of drafting lectures on quantum field theory for his graduate student class.

Carl M. Bender

CMB@wustl.edu

Carl M. Bender returned to Washington University in September 2007 after being on leave for the past year as the Ulam Scholar at the Center for Nonlinear Studies, Los Alamos National Laboratory. [The Stanislaw M. Ulam Distinguished Scholarship is an annual award that enables a noted scientist to spend a year carrying out research at the Center for Nonlinear Studies (CNLS) at Los Alamos. Professor Bender contributed to the research program at the CNLS; to other groups in the Theory Division, including T-8, T-13, T-6; and also to other groups at the Lab, such as P-23, P-25, and CCS-3. He was selected as the Ulam Scholar by the CNLS Executive Committee in a competitive process from among a distinguished group of scientists. His qualifications and appointment as the 2007 CNLS Ulam Scholar were reviewed and approved by Alan Bishop (director, Theory Division), Terry Wallace (ADSR), Tom Bowles (CSO), and Robert Kuckuck (laboratory director).]

During the past few months, Bender has given invited plenary talks on his research at six international conferences: A Meeting of the American Mathematical Society (University of Arizona, Tucson, April), the "Ninth Workshop on Non-Perturbative QCD" (Institut d'Astrophysique de Paris, June), the conference "Nonlinear Evolution Equations and Dynamical Systems" (L'Ametlla de mar, Spain, June 2007), the "Seventh International Conference, Symmetry in Nonlinear Mathematical Physics," (Kiev, Ukraine, June 2007), the "Sixth International Workshop on Pseudo-Hermitian Hamiltonians in Quantum Physics," (London, July 2007), and the "VTH International Symposium on Quantum Theory and Symmetries," (Valladolid, Spain, July 2007).

Bender is a member of the International Organizing Committee for the "Seventh International Workshop on Pseudo-Hermitian Hamiltonians," to be held in the Benasque Center for Science, Spain, in July 2008. This is the seventh international conference entirely devoted to a field of research (PT quantum mechanics) that Bender originated in 1998. Bender is also organizing a small meeting in Paris.

Bender presented many invited talks at various universities and laboratories in the past few months. In addition to giving talks at Los Alamos Laboratory, he has spoken at Cornell University, Northeastern University, University of North Carolina, University of Kansas, University of Arizona, and University of Buenos Aires.

Bender's graduate student, Jun-Hua Chen, received his Ph.D. from Washington University in June 2007 and is now a postdoc at the Czech National Academy of Sciences in Prague. Chen published six papers with Bender while he was a graduate student.

Bender was the keynote speaker in August 2007 at the convocation for incoming freshman students at Washington University.

Bender is continuing in his position as editor-in-chief of the UK *Journal of Physics A: Mathematical and Theoretical*. He also holds a visiting professorship position in the Mathematics Department of Imperial College, London. Bender was selected as a judge for the St. Louis Kevin Kline Theatre Awards. This means that he regularly attends various theater performances in St. Louis and after each performance he files a judging report. In January 2007 he moderated a post-performance audience discussion of scientific issues at the Studio Theatre in St. Louis.

Ramanath Cowsik

Cowsik@wustl.edu

Ramanath Cowsik has been honored by the M.P. Birla Institute of Fundamental Research and the M.P. Birla Planetarium in Kolkata, India. He has received the 2007 M.P. Birla Memorial Award, given biennially "for exceptional achievement in the fields of astronomy, astrophysics, particle physics, and applied disciplines." As part of the award ceremony, Cowsik delivered the M.P. Birla Memorial Lecture, speaking on "Ten Outstanding Questions in Fundamental Physics and Astrophysics—and My Efforts to Answer

One of Them." Cowsik's "one" is the problem of dark matter.

Cowsik is the director of Washington University's McDonnell Center for the Space Sciences; before joining the Department of Physics, he was the Vainu Bappu Distinguished Professor at the Indian Institute of Astrophysics in Bangalore.

Michael Friedlander

mwf@wuphys.wustl.edu

Although he retired in January 1999, Friedlander has retained many connections on campus, in addition to compiling the alumni news for *Physics News*. He has been the organizer of the Saturday morning lectures (see separate news item) and he serves on a number of University committees.

Over many years, Friedlander has had an interest in archaeoastronomy—the scientific study of ancient structures, such as Stonehenge, in which astronomical alignments have been incorporated. A prime archaeological site is close to St. Louis—the Cahokia Mounds State Park where, a thousand years ago, the peak population was around 20,000. The inhabitants built earthen mounds of many different sizes, but most have been destroyed. The largest surviving mound is Monks Mound. Excavations in this area, conducted since the 1960s, have revealed traces of circles that were marked by wooden posts, with some aligned on the sunrise directions on the equinox and solstice dates.

The site has been described in publications by archaeologists, but the full quantitative details have never been included. With the encouragement of the late Warren Wittry who discovered the circle remnants, Friedlander has carried out a full analysis of the dimensions and astronomical alignments. The critical sunrise directions are accurately marked out. Unfortunately, damage to the site destroyed the sector where sunset directions would have been marked.

All of this is described in his paper that has now been published in the *Wisconsin Archaeologist*, Vol. 88 (1), pp. 78–90 (2007).

Pat Gibbons

PCG@wustl.edu

Pat Gibbons and co-teacher John F. "Jack" Wiegers presented a three-week summer workshop for science teachers in 2007 and continue with one full-day meeting per month in the 2007–2008 academic year. These meet in the Hazelwood School District, the second largest in the greater St. Louis area, and still growing rapidly—the district opened four new middle schools last year. They decided to replace the 9th-grade physical science course with a physics first course, a full year of physics to be taken by every 9th-grade student. The former physical science teachers need to master more physics and become certified to teach physics. About half of them are working on this with Gibbons and Wiegers.

Gibbons and Jack Wiegers presented Education 6011 in University College in the spring of 2007 and Education 6011 in University College in the fall of 2007. In these courses, "Hands-On Physical Science for In-Service Elementary Teachers," teachers participated in laboratory experiences, discussions, and lectures designed to prepare them to implement or strengthen hands-on science teaching in grades K–8 or in informal science institutions. The teachers in both courses received classroom sets of some of the materials they used in the courses and paid a reduced tuition, thanks to funding from the Howard Hughes Medical Institute.

Gibbons, Wiegers, and Ann P. McMahon presented workshops at Interface 2007, a February meeting held annually for Missouri science teachers, on the courses described above and on a similar course about astronomy. In March they made similar presentations at the annual convention of the National Science Teachers Association, which was held in St. Louis. In October Gibbons and Wiegers described their work with 9th-grade teachers of Physics First at the fall meeting of the Missouri Association of Physics Teachers.

Jim Miller

James.g.miller@wustl.edu

In news from the Laboratory for Ultrasonics, Professor Jim Miller was named a Scholar in Residence at the United States Food and Drug Administration in Silver Spring, Maryland, under National Science Foundation sponsorship. This NSF grant will permit Miller and his graduate students to spend blocks of time at the FDA conducting collaborative research with FDA scientists. Chris Anderson was the first graduate student to take up residence at the FDA, followed by Allyson Gibson.

In other developments, Miller was named co-chairman of the International Symposium on Ultrasonic Imaging and Tissue Characterization. Miller had served on the Technical Program Committee for that meeting for almost three decades prior to assuming the co-chairmanship at the 32nd annual meeting. Miller organized an all-day session on ultrasonic investigations of bone, and chaired two sessions at the Joint Meeting of the Acoustical Society of Japan and the Acoustical Society of America in Honolulu. He also chaired sessions at the 22nd Annual Advance in Contrast Ultrasound and Atherosclerotic Imaging meeting in Chicago, the American Institute of Ultrasound in Medicine meeting in New York City, and IEEE Ultrasonics Symposium in Vancouver.

At last year's IEEE Ultrasonics Symposium in Vancouver, Matt O'Donnell, an alumnus of the Laboratory for Ultrasonics who began his association with ultrasound as a postdoc in 1976, summarized the career of Miller, who was awarded the IEEE Ultrasonics, Ferroelectric, and Frequency Control Society's Achievement Award, the Society's highest award. At this year's meeting their roles will reverse, with Miller highlighting the career of O'Donnell, who is receiving the Achievement Award. O'Donnell, who had been chairman of the Department of Biomedical Engineering at the University of Michigan, recently became the dean of the School of Engineering at the University of Washington.

Mark R. Holland presented papers describing work in the physics of pediatric ultrasonic tissue characterization at the American Institute of Ultrasound in Medicine Annual Convention in New York, the 32nd International Symposium on Ultrasonic Imaging and Tissue Characterization in Washington, D.C., and the18th Annual Scientific Sessions of the American Society of Echocardiography Meeting in Seattle. In addition, Holland was invited to present an overview of his recent research at the Midwest Pediatric Cardiology Society 31st Annual Scientific Sessions and at the Memphis Biomedical Imaging Symposium.

In addition to the eight peer-reviewed manuscripts published thus far in 2007 by members of the Laboratory for Ultrasonics, graduate students Todd Krueger and Adam Bauer presented talks at the Acoustical Society of America meeting in Salt Lake City; Allyson Gibson and Chris Anderson presented talks at the Ultrasonics Imaging and Tissue Characterization meeting in Washington, D.C.; Chris Anderson and Karen Marutyan presented posters at the Maximum Entropy Conference in Saratoga Springs, New York; and Joe Hoffman was awarded an opportunity to present a poster at the Memphis Biomedical Imaging Symposium.

Recent Ph.D. graduates from the Laboratory for Ultrasonics include Karen Marutyan, who has taken a position with the Department of Radiology at the Washington University School of Medicine to continue his study of Bayesian techniques, and Min Yang, who has taken a position with CGGVeritas in Houston, where she is developing acoustic methods for oil exploration.

Clifford Will
CMW@wustl.edu

Clifford Will was one of 72 members and 18 foreign associates elected in May to the National Academy of Sciences (NAS). Election to the NAS is considered one of the highest honors accorded a U.S. scientist or engineer.

Elected from Washington University along with Will were Wayne M. Yokoyama, professor of medicine, pathology, and immunology in the School of Medicine; and Aaron J. Ciechanover, visiting professor of pediatrics at the School of Medicine and professor of biochemistry at Technion–Israel Institute of Technology. "It is an incredible honor for Washington University to have these three impressive scientists inducted into the National Academy of Sciences," Chancellor Mark S. Wrighton said. "Professors Will, Yokoyama, and Ciechanover are extremely deserving of this recognition."

Will is a theoretical physicist whose research interests encompass the observational and astrophysical implications of Einstein's general theory of relativity, including gravitational radiation, black holes, cosmology, the physics of curved spacetime, and the interpretation of experimental tests of general relativity.

He earned a B.Sc. in applied mathematics and theoretical physics in 1968 from McMaster University and a Ph.D. in physics from the California Institute of Technology in 1971. He joined the physics department in 1981 and is a member of the McDonnell Center for the Space Sciences; he served as department chair from 1991–1996 and 1997–2002.

↑ Clifford Will and Friend

Will's *Was Einstein Right?* (1986) won the American Institute of Physics Science Writing Award, and his *Theory and Experiment in Gravitational Physics* (1981, 1993) is considered the bible of the field. A Fellow of the American Academy of Arts & Sciences and of the American Physical Society, Will was named a J. William Fulbright Fellow and a John Simon Guggenheim Fellow in 1996–97. He recently completed a three-year term as president of the International Society on General Relativity and Gravitation.

The Washington University Gravity Group (WUGRAV) hosted a meeting in February entitled "Numerical Relativity meets 3PN: A Workshop." The 60 attendees included many of the leading researchers in the fields of numerical relativity, post-Newtonian theory, and gravitational-wave data analysis. The purpose of the meeting was to bring these researchers together in an effort to stimulate progress at the important interface between these fields. The ultimate scientific goal is to develop a complete picture of the inspiral, merger, and ringdown of binary systems of black holes or neutron stars, and to determine the precise gravitational wave signal in a form that can be used in data analysis at laser interferometric gravitational-wave observatories, such as LIGO in the United States.

The workshop was organized with a set of invited talks each morning, designed to probe the central questions and problems with ample time for discussions. Each afternoon started with a small number of short contributed talks followed by an open-ended working/discussion session focused on a different topic each afternoon. The workshop program can be found at nrm3pn.wustl.edu/, and a summary of the workshop can be found at www.oakland.edu/physics/mog30/mog30.pdf.

STUDENT NEWS

GRADUATE STUDENTS

We had 17 students graduate since the last newsletter. They are listed below, along with thesis title and major advisor, as well as their current place of employment. The department now has 93 graduate students.

Yulin Chang, "NMR Studies and Applications of Perfluorocarbon Gases," August 4, 2006, (Professor Conradi), Children's Hospital, Philadelphia (postdoc)

Haochen Li, "Statistical Modeling of Nuclear Properties and Merging of Single-Particle Levels in Finite Fermi Systems," December 12, 2006, (Professor Clark), Dartmouth College Medical School (postdoc)

Scott B. Hughes, "Observations of the Active Nucleus Markarian 421 with the First Two VERITAS Cerenkov Telescopes," January 22, 2007, (Professor Krawczynski), Stereotaxis, Inc., (research scientist)

Karen R. Marutyan, "Causal Dispersion Relations Applied to the Measurements on Soft and Hard Biological Tissue," February 23, 2007, (Professor Miller), Washington University School of Medicine—Radiology (postdoc)

Junhua Chen, "Classical and Quantum PT-Symmetric Theories," March 29, 2007, (Professor Bender), Doppler Institute, Prague, Czechoslovakia (postdoc)

Tae Ho Kim, "Structural Study of Supercooled Liquids and Metallic Glasses by High-Energy X-Ray Diffraction and Reverse Monte Carlo Simulation," April 16, 2007, (Professor Kelton), University of Utah, Salt Lake City (postdoc)

Jon Bailey, "Staggered Baryons," April 24, 2007, (Professor Bernard), Fermi National Lab., Chicago (postdoc)

Youtao Shen, "Transient Nucleation and Local Structure in Zr-Based Metallic Glasses," April 25, 2007, (Professor Kelton), Washington University (postdoc)

Le Yang, "Energetics and Dynamics of Actin Filament Bundling and Escape from Potential Wells," April 26, 2007, (Professor Carlsson), Washington University (postdoc)

Thomas Mitchell, "Motions of Self-Gravitating Bodies to the Second Post-Newtonian Order of General Relativity," April 26, 2007, (Professor Will), UCLA (postdoc)

Min Yang, "Elastic Moduli and Ultrasonic Scattering Properties of Myocardium," May 2, 2007, (Professor Miller), VERITAS, Research Associate (Professional)

Charles Chung, "Kinematic Characterization of Ventricular Elastic and Viscoelastic Attributes," May 11, 2007, (Professor Kovacs), University of Arizona, Tucson (postdoc)

Kristopher Allen Wieland, "Extraordinary Optoconductance in III-V Metal Semiconductor Hybrid Structures," May 24, 2007, (Professor Solin), University of Toledo (postdoc)

Alfred B. Garson III, "Optimizing the Design of the EXIST Mission and Its Potential for Gamma Ray Burst Discoveries," May 25, 2007, (Professor Krawczynski), Washington University (postdoc)

Yue Shao, "Effect of Transfer Printing on the Crystallinity of Pentacene (PN) Thin Film on Plastic Substrates; and Physical Contribution to the Signal to Noise Ratio (SNR) and Sensitivity of Extraordinary Magnetoresistance (EMR) Quantum Well Structure," June 8, 2007, (Professor Solin) UCLA (postdoc)

David Schuster, "69,71Ga and 14N Nuclear Magnetic Resonance of Amorphous Gallium Nitride," August 9, 2007, (Professor Conradi), Webster Groves High School (teaching physics)

Han Wang, "Gravitational Radiation Reaction: Spin-Spin Effects in the Inspiral of Coalescing Compact Binaries," October 24, 2007, (Professor Will), Theoretical Physics Institute, Friedrich Schiller University, Jena, Germany (postdoc)

The department gained 18 new graduate students this academic year. They are listed below, along with their schools and countries of origin:

Mark Burnett—USA, University of Missouri–Kansas City

Shawn DeCenzo—USA, Washington & Jefferson

Michael DeSantis—USA, Brandeis University

Ryan Dickherber—USA, University of Missouri–Columbia

John Flavin—USA, University of Missouri–Columbia

↑ Maitrayee Bose and Adam Hajari attempting to defy gravity at the Forest Park ice skating rink.

Grant Gelven—USA, Missouri State University

Patrick Johnson—USA, University of Dayton

Albert Mao—USA, Washington University School of Medicine

Christopher Markle—USA, Mankato State, MN

Jerrad Martin—USA, Southwest Missouri State

Steven McArthur—USA, DePauw University

David Morton—USA, University of Missouri–Kansas City

Sarah Thibadeau—USA, Boston University

Nilushi Fonseka—Sri Lanka, University of Peradeniya

Dandan Hu—PRC, USTC

Shouting Huang—PRC, USTC

Simin Mahmoodifar—Iran, University of Tehran

Zhenyu Zhou—PRC, Peking University

Ben Johnson was the 2006–2007 recipient of the Franklin B. Shull Prize. This departmental award recognizes outstanding performance by graduate teaching assistants. Ben has served as a teaching assistant both in the introductory physics labs and the upper-level biophysics laboratory. He grew up in Dayton, Ohio, and received his undergraduate degree from the University of Dayton, where he majored in physics and mathematics. He is currently a third-year graduate student working for Professor Jim Miller doing research on ultrasonic imaging of the heart.

UNDERGRADUATE STUDENTS

The 2007 Robert N. Varney Prize for best student in the introductory physics course was awarded to **Katlyn B. Sullivan**. Katie Sullivan is a sophomore mechanical engineering major, and hails from Milwaukee, Wisconsin. She feels extremely honored to have received such a prestigious award. Katie is currently working with the Washington University Nanosatellite team to develop a working satellite, which she and a team of seven will test in microgravity this coming summer. Katie hopes to minor in aerospace engineering and also plans on earning a minor in French. In addition, over her first three semesters at Washington University, Katie has been regularly performing with the oldest co-ed a cappella singing group on campus, Mosaic Whispers.

The competition for the Varney prize was particularly stiff this year, resulting in six honorable mentions: **Jenna F. Borkenhagen**, **Jeremy C. Diepenbrock**, **Michael F. Fahey**, **Susan E. Garverick**, **Christine E. Hansen**, and **Jonathan M. Mueller**.

The Greg Delos Summer Research Fellowship for 2007 was awarded to **Alex Drlica-Wagner**. The Delos Fellowship was established to provide funding to support a student working with one of the research groups during the summer. It honors the memory of Greg Delos, who passed away during his junior year at Washington University in St. Louis.

Hoopes Fellowships for 2007 were awarded to **David Ebby**, **Nozomi Nemoto**, **Aubrey Scott**, and **Huajia Wang**. The Hoopes Fellowship helps to fund summer research in any field of life science.

Andrew Newman and **Ilija Zeljkovic** shared the Senior Prize for 2007. Winners of the Senior Prize are selected based on performance in physics courses and are chosen by the department's major advisors.

The Undergraduate Program

There were three changes of note this year:

First, an upper-level Biophysics lab, Physics 360, was added to the existing Electronics, Optics, and Physical Measurements labs.

Second, students are now required to take at least one course in quantum mechanics, to be chosen from Physics 217, 318, and 471. This change was implemented after determining that every physics major who had graduated in the previous few years would have satisfied this requirement.

Third, the requirement that physics majors take two semesters of General Chemistry, including the labs, was broadened to a requirement that majors take at least three courses from a list that includes courses in Chemistry and Computer Science, with one of the courses being a semester of General Chemistry or of Physical Chemistry.

Each of these changes gives a major more options to tailor a major to her or his particular interests.

RAMANATH COWSIK NAMED DIRECTOR OF THE MCDONNELL CENTER — *continued from page 2*

the idea of weakly interacting particles as constituting the "dark matter" that is responsible for the formation and the gravitational binding of galaxies and clusters of galaxies. Assuming thermodynamic equilibrium in the early hot and condensed state of a big-bang universe, he calculated precisely the number density of the relict neutrinos, and thence derived a strict upper bound on the masses of the neutrinos—the "Cowsik-McClelland bound." His work, especially in the area of cosmology, is interdisciplinary in character and connects laboratory physics with the large-scale phenomena of the Universe. Accordingly, he has set useful bounds on the radiative instability of neutrinos and on baryon number, non-conserving proton-decay, and neutron-antineutron oscillations. He developed a new method of deriving the age of the Universe from studies of the isotopic anomalies in presolar grains of aluminum oxide found in meteorites.

Non-accelerator particle physics refers to the study of fundamental particles and their interactions without using huge accelerators like FermiLab. Cowsik performed the first detailed calculations on the fluxes of neutrinos generated by cosmic-ray interactions in the atmosphere and discussed their observation in detectors placed deep underground—a study that later led to the discovery of neutrino oscillations at Kamiokande in Japan. At Washington University, he and his colleagues measured the longest radioactive half-life ever, of the double beta decay of Te-128, as 7.7 x 10exp24 years. This long lifetime, in conjunction with the shorter lifetime of Te-130, implies an upper bound of ~1 eV on the Majorana mass of the neutrino, and strict bounds on Majorana couplings. Most recently, with a highly sensitive torsion balance he and his students have successfully observed the "finite temperature" corrections to the Casimir forces which come into play at large separations.

His current efforts are primarily directed toward building an extremely sensitive torsion balance to probe possible violations of the inverse square law of gravity at submillimeter scales that are predicted by "string-motivated" theories. This is a follow-up of his longstanding interest in constructing sensitive torsion balances and using them to study Einstein's equivalence principle and search for new fundamental forces. He is also interested in several problems in high energy astrophysics, dark matter, and cosmology, and encourages students to join him in this exciting research enterprise.

The McDonnell Center for the Space Sciences is a consortium of Washington University faculty, research staff, and students from the departments of Earth & Planetary Sciences, Physics, Chemistry, and the School of Engineering. The Center exists to encourage collaborative research efforts among scientists working on space science problems and projects that span traditional departmental lines. The "Mac Center," as it is called, fosters this type of endeavor through the sponsorship of cooperative research and through formal activities such as the Visiting Scientist Program.

Space science, broadly defined as the study of the Universe and our relationship to it, is the province of multiple disciplines. Understanding the formation and evolution of the solar system is equally the task of the chemist who measures isotope effects in meteorites, the astronomer who observes planetary atmospheres or interstellar dust, and the theoretical physicist who studies gravitational collapse in the formation of a planet and then its subsequent thermal and mechanical evolution.

Faculty and students of the McDonnell Center belong to one of the traditional science departments, yet overlap in their research work. They enjoy the stimulation provided by the diversity of research being conducted and consider the eclectic nature of the Center to be one of the most important aspects of the space sciences program at Washington University.

This generation's initial probing beyond our planet with unmanned spacecraft and human explorers is a major turning point in history, fundamentally changing the boundary conditions of human existence. We have taken only the first small steps; the exploration of space will continue as long as humanity exists.

The first American in space and the first American in Earth orbit made their flights in spacecraft designed and built in St. Louis. The McDonnell Center is privileged to help carry on this tradition of space exploration.

IN MEMORIAM

Joel Snow (GR 67), one of Ed Jaynes' earliest students, passed away in May 2006. At that time, he was professor of electrical and computer engineering at Iowa State University.

He had a distinguished career as a science administrator. After leaving Washington University, he was at the National Science Foundation for eight years, starting as a program director for theoretical physics and later becoming head of the Office of Interdisciplinary Research. For a year, he was senior analyst at the Office of Science and Technology Policy (OSTP), and then was in the Department of Energy for 11 years, most of that time as director of Science and Technology Affairs. This was followed by five years at Argonne National Laboratory as associate vice president for research. His final move, in 1993, was to Iowa State as director of the Institute of Physical Research and Technology.

Snow served in the U.S. Navy at the rank of lieutenant. **Rich Ferguson** (GR 67), a close friend in grad school, recalls Snow's shock at the news of the sinking of the nuclear submarine, *Thresher,* in April 1963. Snow had taught nuclear physics at the submarine school in New London, Connecticut, when he was in the Navy before coming to Washington University. Many of his students were lost in that disaster.

STAFF NEWS

Two long-term staff members retired this year. After 36 years as 117/118 lab manager, **Dave Tanner** decided it was time to retire. As everyone knows, the freshman course associated with this lab accounts for most of the undergraduate enrollment in physics. Over this period, Dave had close contact with all of the graduate students who worked as TAs for the freshman physics course. Each year he was responsible for bringing the new TAs up to speed on all of the experiments so that a smooth transition would take place in the fall, assuring that undergraduate students taking the course would get the help they needed in the laboratory. With several hundred students taking the freshman course each year, this was no small task. Over the years Dave also had contact with most of the faculty, who relied on him to keep the laboratory running without a glitch. Dave's excellent performance and dedication to this job took a great deal of the burden off the faculty, allowing them more time to prepare and deliver good lectures.

Dave had a great deal of talent in electronics, optics, and mechanical design as well as a solid understanding of the physics principles behind the experiments, making him uniquely qualified for the job as lab manager. He continually took it upon himself to make improvements and upgrades to the lab experiments. This also required making the experiments rugged and "student proof" so that the equipment would survive each semester. For this, and in many other ways, the physics department was very fortunate to have Dave as the freshman lab manager.

On a personal side, Dave was known for being an avid cyclist and swimmer. For over two decades in good and bad weather, he rode his bike to and from work each day. He also took longer rides on weekends to explore the countryside around St. Louis. We thank him for his many years of dedicated service to the physics department and wish him the very best in retirement.

Dave Tanner was replaced by **Daniel LaBrier**. Dan was hired in August 2007 to manage the introductory physics laboratories. One of his primary tasks will be the integration of computerized data acquisition tools to the current laboratory format, while developing new experiments to complement the current curriculum.

Dan comes to Washington University after spending the past three years teaching lecture and laboratory courses at the University of South Alabama. A native of central Illinois, Dan received his B.S. in physics at Illinois State University in 1995, and proceeded to earn his M.S. (also in physics) at Indiana State University. Upon finishing his thesis in nuclear physics, LaBrier took a position at Argonne National Laboratory as a scientific associate in the Advanced Photon Source division. After four years at ANL, he returned to school to pursue another of his passions, astronomy, earning a second M.S. (in astrophysics) from Northern Arizona University.

Dan and his wife, Jen, are enjoying getting to know the greater St. Louis area. Both enjoy hiking through the nearby park areas, traveling to one of the many local wineries, and catching an occasional Cardinals game at the new Busch Stadium.

Pranoat Suntharothok-Priesmeyer retired this past June 30 after 38 years of exceptional service to the faculty of this department. She began working in the main office but soon moved to a separate room on the third floor of Compton, where she became a one-person publication team. She prepared manuscripts using a typewriter, a device that has gone the way of the slide rule. She also was the department's illustrator, drafting the figures that accompanied our published articles and proposals, using pen and ink, and drafting tools. When computerized word-processing came into use, she became an expert in composing professionally laid-out manuscripts on the computer both for camera-ready copy of articles and for proposals, mastering a bewildering variety of software packages.

In recent years she was the person on whom many of the faculty depended for preparing proposals—text, figures, budgets, and "wet noodles" (CV, current and pending support, etc.). She taught us that "wet noodles" should be prepared and gotten out of the way early in the proposal preparation process, so the inevitable last-minute rush would involve dealing with substance and not those simple things that were easily prepared before the rush. She often juggled many proposals and manuscripts at the same time, under unpredictable circumstances, but always managed to give each one the special attention it needed. Not long ago preparing proposals for submission meant working with printers to produce 20 bound copies, and boxing them up for an early-evening run to the FedEx office. More recently it meant learning the intricacies of online "paperless" submission of proposals, and she led the way in mastering this process.

Those of us who worked with Pranoat appreciated her loyalty to the department, her devotion to the aims of our research and our graduate education, and her outspoken opinions about what was right and what was wrong with how we were doing things. She could always be counted on to stick with a job until it was done, even if that meant working well into the evening on a day when she had started work before sunrise. Her outstanding standards of quality set an example for all of us. She was a unique feature of this department. Life here will not be the same without her.

Pranoat Suntharothok-Priesmeyer was replaced by **Iris Peper**. Iris was born in the Netherlands and lived in Germany and Canada prior to moving to St. Louis. She danced professionally with Ballet Midwest, American Dance Company, and the Louisville Ballet before receiving her bachelor's degree from Washington University. Peper began her career at Sponsored Projects Accounting (SPA) as the Personnel Activity Report (PAR) Coordinator where she oversaw the University's effort reporting system. After a year and a half she was promoted to the position of Government Grants Specialist where she was responsible for federal agency financial reporting and individual fund reporting. While in SPA, she gained valuable experience in grant compliance and knowledge of the Federal and the University allowable cost policies.

She and her husband, Ron, had their first child in mid-January.

ALUMNI NEWS

Your responses to these newsletters are always interesting. We may have to do some editing, usually for length, but do let us know if this has introduced any errors. Please continue to send us your news, and also alert us to other alumni whom we may contact. Google can be used to try to locate alums, but personal clues are best. Until now, I have collected and edited all news of alumni. Pat Gibbons has agreed to help in future newsletters, as he is familiar with alums of recent years; we overlap for an earlier period. Please, therefore, send your communications to either Pat (pcg@wuphys.wustl.edu) or to me.

Michael Friedlander

This newsletter is perhaps the main link between you, our alumni, and the current department. In collecting your news, many fascinating tales emerge, but probably none has been as remarkable as this one. It is a departmental tradition to have an annual photo taken of everyone (faculty, students, staff, and pet dogs). Many of these photos are displayed in the main hallway of Compton lab; the oldest photo dates from 1923 and shows Arthur Compton and colleagues in front of Eads, the physics home in those days. Eads, constructed in 1901, was one of the original campus buildings on the Hilltop Campus (now the Danforth Campus). Crow Hall opened in 1933 and Compton lab in 1964.

Some months ago, we were visited by Dr. Hsueh-Yuan Pao of Lawrence Livermore National Laboratory, whose father **Chia Shan Pao** (GR 43) had been a student here. Our secretary Sarah Hedley helped our visitor find the photos from 1940–41 and 1941–42: there was "C. Pao." Ms. Hedley got the photos scanned, and Dr. Pao was given copies. Dr. Pao has sent us a copy of the notice for his father's final oral exam, on May 6, 1943. He was a student of Professor Arthur Hughes and his research topic was "Conduction of Electricity in Highly Insulating Liquids."

After graduating, Dr. Pao's career was unique. He joined the MIT Radiation Laboratory and was involved in the development of radar, one of the major technical advances in WWII. He held a patent for radar antenna systems, and his work was documented in Vol. 10 of the famous MIT Rad Lab series of handbooks. (That volume does not identify all of the contributing authors. It does, though, list Julian Schwinger and H.A. Bethe.) After the war, he worked briefly for the Sperry Company at Long Island, New York. He returned to China in 1946 and was professor and later head of the department at Nankai University in Tienjin. Subsequently, he moved to National Central University and then Nanjing University in 1949 as department head. His final move, in 1983, was to Shanghai University. He was born in the 1st Year of the Republic, 1912, and passed away in 2003.

The years after Professor Pao returned to China were tumultuous, especially during the Cultural Revolution. As, Dr. Pao tells us, his father "was put in jail for a couple of years.... He never retired." How did he come to be a student at Washington University?—Dr. Pao tells us that his father "had been a student at Yenching University (now Beijing University). The president of the university was Dr. Lincoln Stuart, a missionary who was born in China and later served as the last U.S. ambassador to the old China. Dr. Stuart recommended him to Washington University and found the scholarship for him."

Rob Varney was a member of our physics faculty from 1938 to 1964, with time away in the U.S. Navy during the War. Rob writes that "I do remember Pao—he got his Ph.D. under A.L. Hughes and actually did very well with the exception that his complete lack of experimental experience in China caused Hughes a lot of worries. Hughes had developed the fact that a certain isooctane (I think it was trimethyl pentane) had the highest resistivity of any yet known substance, I think it was in the range of 10(exp 20) ohm cm. Since in those days 10(exp -15) amp. was about the weakest current that could be measured, voltages of the order of 7000 volts were necessary for measuring the resistance—a peculiar mixture of weak currents and high voltages, and Pao was forever frightening ALH that Pao was going to kill himself with the high voltages."

One of many alumni who tell us that they enjoy these newsletters, **Tino Ahrens** (GR 52) retired from Georgia Tech at the end of '91. His book *From Dirac to Neutrino Oscillations* was published by Kluwer in 2000. With some regret, he notes that "I can't afford it—too expensive." (Ed. note: Kluwer is one of several publishers whose books are well-known for their investment-quality.)

Manuel Bretscher (GR 54) writes that he held faculty positions at Auburn University, 1954–1956 and at Valparaiso University, 1956–1967, where he developed an undergraduate subcritical nuclear reactor training program. He spent several summers at the Oak Ridge National Laboratory and at Argonne National Laboratory, with a sabbatical year at Rice University (during 1966–67). From 1967, he was at Argonne National Laboratory until he retired in 2004. His work during those years concerned calculation of performance criteria for research and test reactors using non-weapons-grade Uranium fuel; he consulted with and assisted research staff at international nuclear sites planning to use non-weapons-grade fuel in their research and test reactors.

When we last heard from **Henry Valk** (GR 57), he had already retired from Georgia Tech where he had been on the faculty since 1970 and had served as dean for a dozen years. But he keeps busy; as he writes: "I have continued to teach courses for the School including quantum mechanics, mathematical physics, and the physics of music. Most recently, I've been working on a musical acoustics book based on the approach of one of our earlier Washington University physics graduates, the late Art Benade, but having a content more appropriate to quantitatively oriented science and engineering students." (Editorial note: **Art Benade** (LA 48, GR 52) did his graduate work in Bob Sard's cosmic ray group, and was on the faculty at Case Western for many years. Art wrote a well received book on the physics of musical instruments: *Horns, Strings and Harmony* [Anchor Books, 1960].)

Alex Elwyn (GR 57) is now retired from Fermilab; previously he had been at Argonne. As he tells us, "At Argonne, I did accelerator-based basic research in nuclear physics using neutrons, charged particles, and gamma rays to study nuclear structure, reaction mechanisms, and applications to fusion and astrophysics. At Fermilab I switched to neutron, photon, and muon radiation detection at a high-energy accelerator, radiation survey measurements, dosimetry studies, shielding and dose calculations, and general applied health physics activities associated with radiological protection."

After retirement, the Elwyns moved to Chicago, "with a great 12th-floor view of Promontory Point, the lake, and the Museum of Science and Industry in Hyde Park. I have been volunteering with a group at the Oriental Institute at the University of Chicago, building a database of ancient (and not so ancient) Middle East landscapes—maps, satellite photos, airplane photos"

Alex has a major interest in photography, now completely digital. He enjoys uploading the photos to a Mac and using Photoshop. "For my books I use Adobe InDesign...then upload the file to a site, sharedink.com, that prints and binds the hardcover books. I am having a good time with this."

Last year, we heard from **Bashir Syed** (GR 60) too late to include more than a brief mention before we went to press. Bashir described a very busy 2006 with travel (Beijing, China, end of May, and Dresden, Germany, at the end of September) to attend Renewable Energy and Photovoltaic PV Conferences and Exhibitions to develop international contacts for acquiring necessary materials or components for our renewable energy business. His company set up a facility to assemble their own Photovoltaic PV or Solar Modules in Karachi, Pakistan, in 2005, and in January 2006 he went to inaugurate a seminar to train science teachers. Unfortunately, both had to be closed, as there were many problems. For example, there has been a worldwide shortage of silicon, and giant companies have acquired more than 75 percent of the market share in solar and wind technologies.

NASA's Advanced Technologies group (of which he was a part) was able to assist his company in testing electronic systems simulating the space-like environment for high energy protons, gamma radiation, and neutrons. He still hopes to move forward in the solar PV business, which he considers is the only way to reduce not only global warming, but also to provide electricity.

The University of Missouri–St. Louis started in 1968 and **Jake Leventhal** (EN 60) has been there since then. He is now Curator's Professor of Physics. His graduate work in low energy nuclear physics was carried out at the University of Florida, where he obtained his Ph.D. in 1965. Before coming to UMSL, he spent several years at Brookhaven National Laboratory. He came here to establish the UMSL Atomic Physics Laboratory and, as he tells us, "I have no plans to retire." He is a fellow of both the American Physical Society and the Optical Society of America. Jake and **Charlie Burkhardt** (GR 85) wrote *Topics in Atomic Physics* (Springer, 2006) and when we reached him, he and Charlie were working hard to meet their deadline for revisions. Charlie is a professor of physics at the St. Louis Community College at Florissant Valley. (Ed. note: older alums are probably not familiar with the Community College system. There are four branches: Meramec, Forest Park, Florissant Valley, and Wildwood. The system dates from 1962 and is a vibrant part of the college scene in St. Louis, with 65,000 students enrolled each semester.)

We heard from **John Dahlquist** (GR 62), who was a student of Rob Varney.

John went to the Lockheed Research Lab in Palo Alto and has worked in industry ever since, with his last position at Measurex, a process control company acquired by Honeywell about 12 years ago. John worked in the Sensor Development (Physics) section of Measurex, developing sensors and instruments as inputs for process control. He retired nine years ago after 23 years with Measurex.

John and Mary celebrated their 51st anniversary this last summer. They have three married children, all living within 50 miles of them. John keeps busy with travel, photography, woodworking, and a little volunteer work. He writes that they are good friends of **Arden** (GR 59) and **Lois Sher** and **Rob and Rita Varney**, all living in the Bay Area. They plan to help Rob celebrate his 97th birthday in early November.

Tom Wilheit (GR 67) left after completing his A.M. degree to go to MIT to pursue research in plasma physics. He got his doctorate there in 1970 and worked for NASA/Goddard Space Flight Center for about 20 years. He then took up a faculty position as professor of meteorology at Texas A&M. As he writes, "I've never taken any course in meteorology, but I did spend 20 years at NASA developing instrument concepts for weather satellites. Now I'm half time and don't teach any classes or advise graduate students. I work on my research and mentor young faculty (maybe the young faculty think the proper verb is "annoy.")

One of the most interesting e-mails we received this year came from **Penny (Stephanie) Moore** (LA 68), who wrote that she is married to a zoology major/artist whom she met at the University of New Mexico.

"Had a very good time teaching the beginning E&M physics labs at UNM, took my time getting an M.S. in Physics with a thesis in optics. .... Not a good time for physics employment, so I went over to the geology department for a year and picked up a B.S. with an emphasis on geophysics, doing some work for my geophysics professor in his research.

"A now-defunct oil company hired me as a geophysicist and I spent a few years in Texas and Louisiana, lastly being transferred to Alaska, where I have spent the past 30 some-odd years ... left ARCo—and stayed in Alaska ... Absolutely splendid place...about 10 miles north of Anchorage, located 3/4 of a mile uphill from the town center on four acres with lots of trees and the occasional moose and bear.

"I have been left ample time for 20 years of breeding and driving Siberian and Malamute sled dogs; gardening; and, more lately, water gardening: I am the area's pre-eminent grower of hybrid hardy and tropical water lilies. With my husband, I developed the stained glass studio Sacred Art in Glass."

We received a long e-mail from **Bob Guernsey** (GR 68) who has been with the IBM Academy of Technology, of Garrison, New York, for many years.

"Before joining IBM, I was doing basic research in superfluids including He3 at mK temperatures. At IBM Research I turned to 'applied science' and engineering—at first on a superconducting computer project that used Niobium tunnel junctions as logic switch elements and quantized flux as memory bits. I led the cryogenic engineering work."

After a few years, Guernsey moved from Research to Development—first in packaging technology and later in mainframe server systems. There he led the development of a thin film wiring structure for the top surface of multichip modules used in mainframe processors.

In the early '90s, Bob led technical analyses of how to build CMOS-based high performance servers. This provided the underpinnings of IBM's decision to move its mainframes (System 390's) to CMOS. As he describes it, "In general, I led 'look ahead' work on future server systems." In 1997, Bob was elected president of the IBM Academy of Technology—"a full-time two-year job and the only executive position in IBM to which one can be elected instead of being appointed. The Academy is IBM's internal 'think tank,' made up of about 300 of IBM's top engineers and scientists from around the world. It is an independent organization that is expected to be a technical conscience for IBM. It conducts studies, workshops, and conferences and advises senior executives on technical aspects of important business decisions. Members do these projects in addition to their regular jobs." Bob considers the Academy to be a unique strength of IBM.

Also in 1997, he was awarded the title "Distinguished Engineer." This is the highest engineering level in IBM and is an executive position. It is somewhat parallel to IBM Fellow, but not as prestigious. After his Academy president term, he became director of Silicon Technology Strategy at the Semiconductor Research and Development Center.

In 2004, Bob moved back to Research to join a new Next Generation Computing Systems and Technology initiative. This work included defining server systems utilizing the processor technology in the Play Station 3 (Cell Broadband Engine Technology) and defining new server systems that exploit massive parallelism.

Bob tells us that, for the past two years, he has had significant interaction in China, especially with institutes of the Chinese Academy of Sciences (CAS). His last activity was to organize

a joint CAS/IBM symposium in Beijing on utilization of Cell Broadband Engine technology on the China National Grid. This has been an ongoing collaboration between CAS and IBM.

Bob tells us that he has "enjoyed many interesting activities in my IBM life—but no pure scientific work. However, my background in physics has been an important asset in all that I have done at IBM. Now, in my emeritus role, I continue to stay in touch with the entire IBM technical community and have easy access to IBM labs and facilities worldwide. I have a visitor office at IBM Research Watson Lab in Yorktown Heights, New York, and now I have time to take in seminars and lectures and enjoy lunch with my colleagues."

It is with great pleasure that we note that **W.E. Moerner** (LA 75, EN 75) has been elected to the National Academy of Sciences. For his graduate studies, Moerner went to Cornell where he obtained his Ph.D. in 1982. He has had a distinguished career, first at IBM Almaden Research Center, San Jose, then at University of California, San Diego, for three years, and, since 1998, at Stanford. His Web site lists his research interests as: chemistry and physics of individual molecules in solids, on surfaces, and in proteins probed by far-field and near-field optical spectroscopy and microscopy; photochemical, transport and photophysical processes in photorefractive polymers and nonlinear optical materials.

After holding a postdoctoral fellowship at the University of Texas in El Paso, **David Fenner** (GR 76) was briefly on the faculty at Kalamazoo College, Michigan, then on the faculty at Santa Clara University in California from 1981 to 1990, rising to associate professor with tenure. From 1987 to 1990 while on a sabbatical leave, David was a visiting scientist studying silicon surface technology at the Xerox Palo Alto Research Center. From 1990 to 1996, he was with Advanced Fuel Research, Inc. in East Hartford, Connecticut, where he led a small R&D team developing new electronic materials and devices. In 1996 and 1997, he ran his own consulting company, Fenner Engineering, and developed a startup concept company, VVV Instruments. From 1998 to 2003 he was chief scientist at Epion Corp. in Billerica, Mass., where he led the R&D effort on a novel form of ion-beam surface processing for microelectronics and photonics manufacturing, and positioned Epion for a successful sale in 2000 to a major telecom company. In late 2004 he joined a start up, Verionix, Inc. of Wilmington, Massachusetts, as chief scientist. A year later, he joined Physical Sciences Inc. in Andover, Massachusetts, where he works in the photonics and biomed technology areas. Since 1993, he also has been an adjunct (gratis) research professor in physics at University of Connecticut, Storrs.

It seems as though each year we report another award given to the Shodor Foundation, established and directed by **Bob Panoff** (GR 85). Shodor's mission is to improve math and science education through the effective use of modeling and simulation technologies. In October 2007, Shodor was named a grand prizewinner in the nonprofit category of the Cisco Growing with Technology Awards 2007, "for its innovative use of technology to improve math and science education nationally." (For more information, see www.shodor.org.)

Walt Schalick (LA 86) was awarded his M.D. (1995) and Ph.D. (history of medicine) in 1997, and held a joint appointment between the Department of Pediatrics in our School of Medicine and the Department of History in Arts & Sciences. In fall 2007, he moved to the University of Wisconsin, where he again holds a joint appointment spanning interests in medical history; bioethics, orthopedics, and rehabilitation; and history of science.

Phil Sabes (LA 89) tells us that "after leaving Washington University in 1989, I went to Cambridge (Trinity College) on a Marshall Scholarship, and earned a second B.A. in math in 1991. I then went to MIT where I earned a Ph.D. in the Department of Brain and Cognitive Sciences in 1996. I then did a joint postdoc between Caltech and the Salk Institute, and finally joined the faculty at University of California–San Francisco in 2000."

"UCSF is a graduate-only medical and biomedical campus of the UC system (essentially a medical school and a very large biosciences research campus). I'm in the Department of Physiology and the Neuroscience Graduate Program (along with the Biophysics and Bioengineering programs). This past summer I was granted tenure and promoted to associate professor.

"On the personal side, things are going well. My wife (Jennifer Henderson Sabes) and I had our first child, Jacob, in July 2005. We are expecting a second this January."

When we wrote about **Peter S. Shawhan** (LA 90) last year, he was completing seven years at Caltech, working on LIGO, the Laser Interferometer Gravity-wave Observatory. Take a look at his article in the July–August 2004 issue of *American Scientist*. In Chicago, he worked on a particle physics experiment called KTeV (Kaons at the TeVatron). He is now on the faculty at the University of Maryland–College Park and continues working with LIGO.

Jia G. Lu (EN 92) went on to Harvard where she received her Ph.D. in Applied Physics in 1997. Since graduating, she has followed an academic career, starting with a year as postdoctoral fellow at the University of California–Berkeley. In 1998, she joined the faculty of the Department of Electrical Engineering at Washington University. Then she moved to the University of California–Irvine in the Departments of Materials Science and of Electrical Engineering. Currently she is at the University of Southern California in the Departments of Physics and of Electrical Engineering.

Jia has won several awards: Presidential Early Career Award for Scientists and Engineers, 2004; National Science Foundation Career Award, 2002–2007; and, at UC Irvine, the Maseeh Best Faculty Research Award in 2005.

Her research interests include the investigation of the properties of nanoscale structures and the exploration of their applications in electronic, magnetoelectronic, and optoelectronic devices. Currently her research takes two directions: 1) Semiconducting, magnetic and superconducting nanowires, and nanoparticles and 2) spin injection, transport, and dynamics in low dimension heterostructures.

After receiving his Ph.D., **Stefan Boettcher** (GR 93), held postdoctoral positions at Brookhaven National Laboratory, the University of Oklahoma, the Center for Nonlinear Studies (CNLS), and Los Alamos National Laboratory. In 1998 he joined the Department of Physics at Emory University, first as lecturer, and since 2003 as assistant professor.

During those years, he became increasingly interested in the dynamics of nonequilibrium processes and their analytical and numerical study, such as in self-organized critical (SOC) systems. Based on that experience, Stefan proposed a method which finds ample use in engineering and operations research. In recent years, his work concerned large-scale simulations of spin glasses. And, as he notes, "as an antidote to numerics, I nostalgically return to asymptotic expansions."

Scott Oser (LA 94) is in his fifth year as an assistant professor at the University of British Columbia in Vancouver. His research is in the area of experimental neutrino physics, and he leads a group working on the Sudbury Neutrino Observatory (solar neutrinos) and the T2K experiment (accelerator-based neutrino oscillation studies in Japan). Scott reminds me that "I wrote a paper on the solar neutrino problem when I was a student in your astrophysics class in 1991–92, which was what first got me inter-

ested in this line of research. Most of my research time is split between data (and especially statistical) analysis for SNO and detector design and construction for T2K. On the teaching side I'm currently teaching a graduate-level course in data analysis for the physical sciences, which has a heavy dose of Ed Jaynes-style Bayesian techniques. I thought people at Washington University might find that of interest."

After a few years on the faculty at George Washington University, **John Balbach** (GR 94) is now teaching at Georgetown Preparatory School. John writes that "I am teaching chemistry and physics. Prep is a Jesuit-run high school with a reputation for turning out terrific students. It was founded in 1789 (as a part of Georgetown College) but the high school was split from the University in 1921, after it moved to its current campus just north of Washington. I have never had more fun teaching. I am teaching the 'regular' physics class, which is taken by students who do not plan to take more physics, either in high school or in college. Since it is the last course they will likely see, I want to introduce them to a variety of 'cool' topics that they might not ordinarily learn about, like nuclear physics and special relativity. My classes are small (10 to 12 students) which allows me to do things with the class that I was never able to do in a large lecture setting."

Bill Weeks (EN 94) completed his Ph.D. in electrical engineering at the University of Illinois, Urbana-Champaign (UIUC), where he worked on full-surface data-storage devices, devices where data are stored on a 2-D optical page. "During my time at UIUC, I had the rare privilege of working with Jim Russell, who was largely responsible for development of the CD-ROM at Sony. I did some consulting work for his start-up company, iOptics, which was developing full-surface data-storage devices during the late nineties.

"After completing my Ph.D., I took a position as an assistant professor at the University of Missouri-Rolla (UMR) where I had the opportunity to conduct further research into full-surface data storage and develop innovative teaching methods that involved semester-long team activities. I taught classes in cryptography, information theory, coding theory, probability theory, and communication theory."

Bill left UMR in 2005 to take a position in Kansas City, Missouri, in the quantitative research division of American Century Investments. Bill says that he has "been fortunate to be able to apply my analytic skills to problems of mathematical modeling of the stock market, automated investment strategies, and algorithmic development."

As a student of Jim Miller, **Joel Mobley** (GR 98) started his research career with ultrasonics. He subsequently held positions as postdoctoral fellow at the Oak Ridge National Laboratory, 1997–2003 and as Research Physicist at the U.S. Army Research Laboratory in Adelphi, Maryland, during 2004–2005. He is now an assistant professor at the University of Mississippi. In a paper that appeared in the *Physical Review Letters* in September 2007, Joel reports on his experiments using ultrasound pulses shorter than a millionth of a second. The experimental results show that, in a suspension of microscopic spheres in water, sound can exhibit group velocities faster than the speed of light. This might seem contrary to a basic postulate of Einstein, but Joel has shown how this result can be understood, as detailed in an earlier paper (JASA, July 2007) that includes animations that show how the effect is compatible with causality. Joel and his wife, Mary Beth, have two boys, and (as he says) "enjoy living in Oxford, Mississippi, a true college town about 70 miles from Memphis." They see **Brent Hoffmeister** (GR 95) and **Ann Viano** (GR 96) occasionally—both on the faculty at Rhodes College, Memphis, where Brent is department chair and Ann has also been awarded tenure.

Doug Cannon (EN 99) completed his Ph.D. in Materials Science at MIT four years ago and is working for a computer hardware company north of Boston. At MIT, he worked in Lionel Kimerling's lab, where the focus was on photonic materials. "Using ultra-high-vacuum chemical vapor deposition we deposited single-crystal Ge epitaxially on Si directly on a Si substrate. Post growth annealing has shown the ability to significantly reduce the dislocation and point defect density in the films, increasing the carrier lifetime and collection efficiency of photodetectors made from them. The difference in thermal expansion coefficient between Ge and Si results in a tensile strain in the films when cooled from elevated growth temperatures. The tensile strain shrinks the direct band gap of Ge and increases absorption of wavelengths attractive for long-haul telecomm communications (1550nm). By alloying small amount of Si, we can tailor the band edge for selective absorption."

Doug is currently working for Amphenol TCS as a product manager for new products coming out of development. He is working on backplane electrical connectors for use primarily in high-end servers and is involved in development, supply chain, global manufacturing, and marketing. On a personal note—Doug tells us that he will be getting married on December 29th.

Karl Kehm (GR 00) is still teaching at Washington College in Chestertown, Maryland. They adopted their first child, Fantaye Kehm, in March 2007. She's 19 months old. Karl has recently been teaching courses on the Atmosphere, Ocean, and Environment and Earth and Planetary Systems Studies.

After graduating, **Vikram Kodibagkar** (GR 02) joined the University of Texas Southwestern Medical Center at Dallas as an instructor in radiology to work on Magnetic Resonance Imaging and Spectroscopy of animal models of cancer. In fall of 2005 he was promoted to assistant professor, and he continues to apply MR physics to image the tumor microenvironment. His current funding comes from the DOD Breast Cancer Initiative to investigate the potential of paramagnetic CEST agents to probe breast tumor vasculature. UT Southwestern is notable for having four active Nobel laureates, more than any other medical school in the world.

Tim Larson (LA 02) is a graduate student in physics at Stanford University.

Rok Roskar (LA 03) is currently in his fourth year of Ph.D. studies in astronomy at the University of Washington, working on N-body Smooth Particle Hydrodynamics models of disk galaxy formation. His particular interest, and the topic of his dissertation, is the formation and evolution of outer disks.

Since graduating, **Steve Brady** (GR 05) has been working at Boeing in St. Louis doing non-destructive testing research and development, concentrating mostly on graphite/epoxy composite materials and metals. "My wife, Sharon, and I now have three sons—four years old, two years old, and six months old."

Last year, we noted that **Aaron Mertz** (LA 06) has started his graduate studies at Yale. This year, it is our great pleasure to tell you that Aaron was awarded a Rhodes Scholarship and is now in Oxford. We think that he is the first physics alum to win this prestigious recognition.

Compiled by Michael Friedlander
mwf@wuphys.wustl.edu

Washington University in St. Louis
Arts & Sciences

Department of Physics
Campus Box 1105
One Brookings Drive
St. Louis, MO 63130-4899

NONPROFIT ORG.
U.S. POSTAGE
PAID
ST. LOUIS, MO
PERMIT NO. 2535

DEPARTMENT OF PHYSICS NEWSLETTER / WINTER 2007–2008

↑ The Department of Physics, 2007

Newsletter Editor

Cary L. McConnell, Ph.D.
Physics Academic/Business Administrator

(314) 935-6281
clm@wustl.edu