Alumnus Jonathan Reichert, the president of TeachSpin Inc., drove the entire distance from Buffalo, New York, with his wife, Barbara, to deliver personally on March 28, 2011, his newest advanced laboratory experiment, “Noise Fundamentals,” as a gift to the WU Department of Physics. That afternoon he spent several hours setting up the experiment in 302 Crow Hall and putting it through its paces for lab instructors Scott Handley and James Schilling. This experiment, first used in April in the “Advanced Measurement Lab,” found a very positive resonance with the students.

Reichert received his Ph.D. in physics from Washington University in 1962, having worked with Professors Dick Norberg and Jonathan Townsend in the then-new field of magnetic resonance. The photo to the left, taken from the 1957 departmental photograph now hanging in Compton Hall, shows Reichert as a graduate student in the late 1950s. Reichert came to know young Assistant Professor Michael Friedlander and fellow graduate student John Clark. This was a particularly lively period in the department’s history. Faculty was about half its present size, but blessed with such luminaries as Ed Condon, George Pake, Eugene Feenberg, “Uncle Henry” Primakoff, Rob Varney, Bob Sard, and Dick Norberg, not to mention Arthur Holly Compton as “Professor at Large.” Reichert’s lab was located in the subbasement, at that time the only area in Crow Hall with air conditioning. Graduate students shared unmatched good will and camaraderie among themselves as well as with a young and spirited faculty.

In those days, the Crow basement’s “Coke fund” sponsored the all-day Spring Picnic at Pere Marquette State Park. Reichert greatly appreciated the opportunity to be taught by Arthur Hughes (always known as ‘Mr. Hughes’) who succeeded Compton as chairman. Hughes, even after retiring in 1952, retained an office and lab in Crow Hall, coming to the department every day until well into his 90s. He was beloved by all. Reichert was one of the “ring-leaders” who saw to it that a portrait of Hughes was painted by art student Ruth Boles; this portrait today graces the Physics Library.

Reichert began a three-year postdoctoral fellowship at Harvard after graduating from Washington University. This fellowship resulted from a visit to Reichert’s WU lab by Nico Bloembergen, co-winner of the 1981 Nobel Prize. Bloembergen was so impressed by the quality of the apparatus Reichert had built for his Ph.D. project that he insisted Reichert be offered a fellowship.

After Harvard, Reichert went on to faculty positions at Case-Western Reserve followed by SUNY-Buffalo, as well as visiting professorships at Princeton, Middlebury, and the Stevens Institute. In 1992, he started his company, TeachSpin Inc. (www.teachspin.com) and built the first pulsed NMR designed specifically for teaching. He left SUNY in 1998. (continued on page 7)
Conventional proton MRI utilizes the magnetic moment from the spin $\frac{1}{2}$ hydrogen nucleus, in abundance in water-dense organs such as the human brain, to produce high-resolution images that are rich with detail. However, in an organ like the lung, for which tissue accounts for less than 20% of volume, conventional MRI is a less useful tool for medical diagnosis or scientific research. Not only is there less hydrogen MRI signal available, it has less diagnostic information content. Within the last two decades, however, MRI researchers have overcome this issue by employing another spin $\frac{1}{2}$ nucleus, $^3$He, to image the lung’s much more abundant airspace. $^3$He is relatively large gyromagnetic ratio and large spin relaxation times lead to unsurpassed levels of laser-generated polarization, and, since $^3$He is inert, non-toxic and insoluble in tissue, it is safe for human consumption. These unique properties make it the ideal candidate for in vivo human pulmonary MRI studies.

At the outset of $^3$He pulmonary research, $^3$He had another advantage: It was relatively inexpensive and abundant. While significantly more costly than its isotope brother $^4$He, the 1998 $100/L price tag was still a fraction of the cost of an MRI scan. The affordability was not a result of $^3$He’s natural abundance (only 1.37 ppm as a fraction of all helium), but rather the fact that it is a byproduct of the well-funded endeavor of maintaining nuclear weapons. Tritium, a key component of nuclear weapons, decays into $^3$He, which is then sold at auction to recoup some of the cost of tritium purification. Prior to 2001, the federal government’s weapons program produced more $^3$He than it was able to sell, and the $^3$He stockpile grew from 140,000 liters in 1990 to 235,000 liters in 2001. Up to this point, $^3$He was used in various, small-scale, scientific capacities, including neutron detection, low-temperature cryogenics, and porous medium NMR. Prior to 2001, the combined demand from all of these fields was less than 10,000 liters/year. However, in the wake of the 9/11 terrorist attacks, national security concerns skyrocketed, and tens of thousands of liters of $^3$He were employed in detecting nuclear material at U.S. borders and around the world. The demand continued to balloon until 2008, when it peaked at 80,000 liters/year.

The situation was exacerbated by the fact that the United States began drawing down their nuclear weapons program prior to 1990 and ceased tritium production in 1988. As tritium (with a half life of 12.3 years) decayed, the annual supply of $^3$He began to wane, decreasing from around 20,000 liters/year in 1990 to roughly 10,000 liters/year in 2002. The gradual decrease in supply, combined with the enormous increase in demand, had disastrous impact on the availability of $^3$He. By 2010 the U.S. stockpile of $^3$He had been reduced to roughly 50,000 liters, barely 20% of its 2001 size. $^3$He cost has subsequently increased by 500% ($600/L) in just the last few years, and, at times, it has not been available at all.

Adequate future allocation of $^3$He will undoubtedly require significant actions in dealing with both the supply and demand sides of the issue. In the past, the cost of $^3$He has, in effect, been subsidized by the nuclear weapons program, which bore the cost of tritium production. In theory, tritium could be produced for the sole purpose of producing $^3$He, but at a cost of between $11,000 and $18,000 per liter. However, tritium is also a byproduct of heavy-water nuclear reactors found in Canada, India, and elsewhere. In addition, helium is routinely extracted during purification of natural gas. Combined, these two sources could potentially produce over 35,000 liters of relatively affordable $^3$He each year (albeit, considerably more expensive than 1990s prices). There are also promising actions being undertaken to decrease $^3$He demand. The broad expansion of programs by the Department of Defense, National Nuclear Security Administration, and Department of Homeland Security to detect the transport of nuclear material by neutron detection using $^3$He by far accounts for the greatest demand. However, neutron detection can also be accomplished with other materials, such as boron trifluoride or lithium-loaded glass fibers. Considering $^3$He’s skyrocketing cost and depleted supply, it is likely that future deployments of nuclear material detectors will rely much more heavily on these alternate materials.

For our own part, we and the rest of the hyperpolarized gas MR imaging community are taking steps to ensure the continued advancement of pulmonary imaging research and continued availability of $^3$He for that purpose. Many hyperpolarized gas groups have renewed their research interest in another spin $\frac{1}{2}$ noble gas, $^{129}$Xe, and research thus far has shown promise that hyperpolarized $^{129}$Xe may one day be an adequate $^3$He substitute for ventilation imaging and simple short-range diffusion measurements. It is, however, also recognized that $^3$He plays an irreplaceable role in long-range diffusion measurements and detailed quantification of lung microstructure—two areas of research of particular interest to Washington University’s NMR group.

To ensure an adequate supply of $^3$He for current and future projects, the Magnetic Resonance research group has taken the lead

† Source: Adapted from Steve Fetter, Office of Science and Technology Policy, “Overview of Helium-3 Supply and Demand,” presentation at the American Association for the Advancement of Science Workshop on Helium-3, April 6, 2010
in developing a $^3$He recycling protocol and in helping ensure a flow of $^3$He for scientific research. Physics undergraduate Sean Lourette and visiting student Allan Che have investigated methods for the recapture, storage, purification, and recompression of $^3$He used in research. They estimate that nearly 99% of recaptured $^3$He could be available for reuse in future experiments. In addition, Assistant Professor Jason Woods has taken a leadership role in ensuring that the U.S. government allocates a sufficient amount of $^3$He to the international pulmonary imaging community in order to guarantee the continued progress of all ongoing and future pulmonary research. In 2009, when the scientific community’s access to $^3$He was shut off completely, Woods’ communications with the Department of Energy were instrumental in regaining access within months. As the president of the Hyperpolarized Media Study group of the International Society of Magnetic Resonance in Medicine, Woods also testified in May 2010 before the U.S. Congress and the White House about the importance of $^3$He to basic research in pulmonary disease and basic lung physiology. Most recently, Woods participated in a panel at the annual meeting of the American Association for the Advancement of Science to discuss the impact of the shortage on the scientific community as a whole. All of these efforts have helped ensure scientific access to the small but steady supply of this gas.

In spite of the $^3$He shortage crisis, these combined efforts will ultimately lead to ours and others’ uninterrupted progress in scientific research using $^3$He.

**FLUIDS AND PLASMAS**

Professor Jonathan Katz served on U.S. Secretary of Energy Steve Chu’s science panel, advising him on the Macondo (“BP,” “Deepwater Horizon”) oil well blowout in the Gulf of Mexico in May 2010. As the well remained out of control week after week, BP and the Department of Energy planned a procedure called “top kill,” in which a dense “mud” would be pumped into the top of the well. It was hoped that this “mud” (a suspension of dense minerals) would sink to the bottom of the well, building up enough pressure to stop the entry of additional oil.

Katz and another panelist, Richard Garwin, realized that top kill, as then contemplated, would likely fail. The reason: A phenomenon known as Kelvin-Helmholtz instability would disperse the dense “mud” into tiny droplets that would be swept out of the well by the upward flow of crude oil. Top kill works in wells that are not flowing, but it is much more difficult after a blowout. When top kill was attempted at the end of May, it failed, as they had warned.

Katz then realized that this failure might be prevented if a novel “mud” were used. By adding corn starch, a funny semi-fluid known to millions of children (and adults) as “oobleck” is formed that can flow slowly as a liquid, but turns stiff and elastic when flow is rapid. If an instability were to occur, this stiffness would stop it, and the novel “mud” would sink in the well, accumulating at the bottom until its pressure became sufficient to stop the leak. Unfortunately, this was not tried, and the leak was not stopped until mid-July when a cap was placed on top of the well.

Having suggested the addition of corn starch to drilling “mud,” Katz organized an experiment to test the hypothesis that the modified “mud” would have the properties needed to prevent instability and achieve top kill of blown-out oil wells. He and a team he assembled constructed a model oil well in the Lawrence Livermore National Laboratory. The model consisted of a six-foot length of transparent plastic tube filled with a clear oil. They poured a surrogate corn starch “mud” into the top of the oil column, and observed that, as predicted, the instability was suppressed. The surrogate dense “mud” rapidly sank through the oil to the bottom of the tube. Had this been a real oil well, top kill would have been achieved.

Some of the results are shown in the accompanying figures. Figure 1 contrasts the breakup into small globules of a surrogate “mud” that does not contain corn starch to the orderly sinking of a slug of “mud” that has been stabilized with corn starch. Even a thin filament can trickle downward without breaking up. Figure 2 shows a pattern of “globules on a string” that is found for a thin trickle of “mud”; even when there is only a slow trickle, the corn starch holds the “mud” together. These results were reported in a paper published in Physical Review Letters and in press releases from the American Physical Society and American Institute of Physics as socially relevant physics. This paper was a Highlighted Article February 4, 2011, discussed in a Physics Update in the February 2011 issue of Physics Today, the subject of comments in Physics V. 4, p. 9 and La Recherche Avril 2011, a Nature Research Highlight, and reported on NPR.

![Figure 1](image1.png)

1a shows the breakup of a dense fluid without corn starch. 1b shows how the addition of corn starch permits the descent of a coherent slug of dense fluid. 1c shows how a slower flow descends as a smooth unbroken stream if stiffened by corn starch.

![Figure 2](image2.png)

Deep within the oil column a thin filament of fluid stiffened with corn starch makes picturesque “beads on a filament,” but the starch prevents the filament from breaking.
NANOSTRUCTURES RESEARCH GROUP

Professor Li Yang’s group focuses on two ongoing research directions: optical properties of nanostructures and designing novel materials for renewable energy applications with the aid of first-principles simulations.

I. π and sigma electronic states usually show substantially different symmetry (as shown in Figure 1) and the corresponding optical activities involved in both types of electronic states have been rarely studied. However, we find a strong optical absorption from electronic transitions between these π and σ states in graphene, a single-layer graphite. Moreover, these π and σ electrons form enhanced electron-hole pairs as shown in Figure 2. This is the first prediction of nearly bound electron-hole pairs in two-dimensional semimetals. These predicted electron-hole pairs have a relatively long lifetime, which is of importance for optoelectronic applications.

II. A bottleneck in the performance of photovoltaics is the separation efficiency of photon-excited electron-hole pairs. We have demonstrated a great potential to tune the separation of electron-hole pairs in core-shell nanowires by controlling their electronic band offsets. As shown in Figure 3, when the axial strain is varied, the band offset of heterojunctions in SiGe core-shell nanowires can be tuned in a wide range. This permits optimization of the efficiency of solar cells based on nanowires because the separation of electron-hole pairs is decided by the band offset values of such staggered band lineups in heterojunctions.

Figure 1
The top view of the electronic charge distribution of graphene: (a) a typical π state; (b) a typical σ state.

Figure 2
Exciton charge distributions of two bright exciton states of graphene. The electron charge density is plotted given that the hole is fixed at the black spot. The distributions have been averaged along the direction perpendicular to the graphene plane: (a) is the plot of a nearly bound exciton; (b) is a typical non-bound resonant exciton.

Figure 3
Band offsets of four strained SiGe core-shell NWs (nanowires). (a) SiGe core-shell NWs with a core diameter of 1.2 nm and the whole diameter of 2.5 nm. (b) SiGe core-shell NWs with a core diameter of 1.7 nm and the whole diameter of 2.5 nm. (c) GeSi core-shell NWs with a core diameter of 1.3 nm and the whole diameter of 2.5 nm. (d) GeSi core-shell NWs with a core diameter of 1.8 nm and a whole diameter of 2.5 nm.

COSMIC RAYS
From Heavy Nuclei to Electrons, From Hundreds of MeV/Nucleon to ~10^{19} eV

The cosmic ray group lead by Research Professor Bob Binns and Professor Marty Israel is actively involved in four projects.

The project taking most attention right now is Super-TIGER, which will extend the successful TIGER measurements on rare nuclei heavier than iron that were made in balloon flights in 2001 and 2003. Super-TIGER will be four times larger than TIGER. Its first Antarctic flight is planned for December 2012. The project involves several people, including a new postdoc in our group, John E. Ward, who joins us from the University of Dublin where he received his Ph.D., working with our Professors Jim Buckley and Henric Krawczynski and others on VERITAS; graduate student Ryan Murphy; and a substantial part of the effort of the superb technical staff of our high-energy-astrophysics group, Paul Dowkontt, Richard Bose, Dana Braun, Phil Moore, Marty Olevitch, and Garry Simburger. This project is in collaboration with scientists at NASA Goddard Space Flight Center (including Georgia de Nolfo, WU, Ph.D. 1997).

We continue to work with our colleagues at the University of Hawaii and several other institutions on the ANtarctic Impulsive Transient Antenna (ANITA), which is being prepared for its third balloon flight in December 2013. With its first two flights, ANITA placed stringent upper limits on the flux of 10^{19} eV neutrinos and demonstrated the first successful radio-pulse observation of 10^{19} eV cosmic rays.

Recently we were funded as part of a group of U.S. scientists from Louisiana State University (including John Wefel, WU, Ph.D. 1971), NASA Goddard Space Flight Center, and University of Denver who are working with the instrument design and ultimately data analysis of an instrument under principal investigator Shoji Torii of Waseda University in Tokyo: the CALorimetric Electron Telescope (CALET). This instrument is being built in Japan, with hardware contribution from Italy. It is planned to be placed on the International Space Station in 2013. CALET has as its primary objective precise measurement of the energy spectrum of cosmic-ray electrons up to ~10^{12} eV, covering a range where there have been hints of evidence of dark matter. It will also be observing gamma rays and cosmic ray nuclei. The project involves a new postdoc in our group, Brian Rauch, who received his Ph.D. here in 2008 working on TIGER, as well as Buckley and Krawczynski.
Laboratory for Ultrasonics

Graduate students recently completing their Ph.D. dissertations in the Department of Physics Laboratory for Ultrasonics under the guidance of Jim Miller and Mark Holland include Chris Anderson and Chris Lloyd, both of whom have accepted permanent positions at MIT-Lincoln Labs, and Joe Hoffman, who joined the laboratory for Ultrasonics as a research associate. Hoffman and graduate student Ben Johnson and Amber Nelson each gave an oral presentation June 2011 at the 36th International Ultrasonic Imaging and Tissue Characterization Symposium in Washington, D.C.

Michelle Milne has joined the Laboratory for Ultrasonics as a research associate after completing her Ph.D. under the direction of Mark Conradi. Milne brings added expertise in Magnetic Resonance Imaging (MRI) of tissue properties that complement the laboratory’s continuing research in ultrasonic tissue characterization. The affiliation of Jonathan Katz with the lab adds a strong theoretical component to widely recognized experimental expertise that has characterized the Laboratory for Ultrasonics for many decades. Phil Levy, a neonatologist, has recently joined the lab, further enhancing the pediatric collaboration that Holland initiated many years ago. Sandor Kovacs, Ph.D., M.D., continues to be an active collaborator on research projects involving adult cardiology as well as a guest lecturer in “Physics of the Heart” (Physics 314) and “Advanced Ultrasonics Seminar” (Physics 589/590). Enrollment in “Physics of the Heart” continues to grow, with 89 students registered for the spring 2011 class. Other active research collaborations include joint publications with groups in Kyoto and Paris.

Mark Holland and Jim Miller continue to be very active in both the American Institute of Ultrasound in Medicine (AIUM) and the American Society of Echocardiography (ASE). They were invited to serve as physics representatives to an ASE Technology Summit designed to generate a road map for the evolution of echocardiography during the next five years. Miller and Sanjiv Kaul, M.D., president of the ASE, served as co-chairmen of the summit, which brought together 15 of the nation’s leading scientists, physicians, and engineers in this rapidly expanding field.

Materials Physics Group

Professor Ken Kelton’s research group is making unprecedented structural and thermophysical property studies of equilibrium and supercooled liquids. In August 2010, led by Nick Mauro, they spent three weeks at the Advanced Photon Source (APS) gathering structural data on 78 different liquid alloys using WU-BESL, a facility for studies of electrostatically levitated liquids that Mauro designed and constructed. Mauro received his Ph.D. in May 2011 for his work on WU-BESL, the title of his thesis is “Structural and Thermophysical Property Studies of Metallic Liquids and Glasses Using the Beamline Electrostatic Levitation Technique.” He is now working with graduate student Kevin Derendorf to lead an effort in the design and construction of a new facility that will allow elastic and inelastic neutron scattering studies of liquids to be made at the Spallation Neutron Source, located at Oak Ridge National Laboratory. James Bendert, another graduate student in Kelton’s group, has developed techniques for measuring accurately the densities of levitated liquids, and he is obtaining new data that may explain why some metallic liquids easily form glasses. In addition to these studies, Kelton has four planned experiments on the International Space Station, working with colleagues from NASA and ESA (European Space Agency). These experiments are aimed at obtaining better thermophysical property data and testing a new model for crystal nucleation developed in Kelton’s group.

Physicists Continue to Reach Out

A small group of graduate students started the Washington University Physics Outreach Committee in early 2008. Tasked with overseeing and ensuring the smooth running of all physics outreach ventures, the committee is comprised of three faculty members (Patrick Gibbons, Anders Carlsson, and Yan Mei Wang), one postdoctoral associate (Kasey Wagoner), and three graduate students (Benjamin Burch, Sarah Thibadeau, and Jennifer McKnight). Additionally, many graduate and undergraduate volunteers have helped plan and execute activities.

Since its inception, the committee has participated in numerous activities and events. During this past year, physics outreach continued its work with the university’s Science Outreach, which hosts the ExxonMobil Bernard Harris Summer Science Camp. This two-week program immerses middle school students in science. During the physics portion, students learned about light and energy through the use of pinhole cameras and about the construction of solar-powered cars. The past three years a large number of student exit surveys showed that the physics component of camp was the favorite!

Physics Family Funday, a series of events geared toward bringing families to the department, is another venture. More than 25 attendees attended the second Funday last fall. Both Fundays have received positive feedback from the attendees and requests for more events. Based on this success, the committee is seeking external funding to expand this program.

The committee also has been involved in several smaller projects. Each year a group of 150 female students from the St. Louis area comes to Washington University to celebrate women in science. During the physics section, students participate in activities involving liquid nitrogen, illuminating some aspects of temperature-related phenomena. This year, as in the past three years, the physics section of Women in Science was among the most popular with the students. Physics outreach volunteers also have become more active in the Young Scientists Program, an externally funded program run through the School of Medicine. In the last calendar year, physics outreach volunteers have done demonstrations in more than five St. Louis area schools.

The past year has been extremely fruitful for physics outreach. The Physics Outreach Committee expects to have many more positive interactions with young students in the form of Physics Family Funday and an increased number of trips to local schools in hopes of continuing to work toward bringing the fun of physics to school-age children.
Dear Alumni and Friends,

As we start the fall classes, I am delighted to report that the Department of Physics continues on a path to excellence. Members of our faculty have received prestigious awards, served on important national and international committees, made new and exciting research discoveries, and strengthened undergraduate and graduate teaching. These are evidence of a growing prominence of the department, due entirely to the hard work of dedicated faculty, staff, and students.

I feel that we have the best staff of any department on campus. Some have served the department for many years. This year Julia Hamilton celebrated 40 years of service; Tony Biondo, 35 years; and Denny Huesman, 20 years. Over the past year, there have been some changes in the faces around the department. In January 2011, Mairin Hynes joined the department as a lecturer. She assumed the duties of Becky Trousil (who left the department in July 2010), including teaching a section of our popular introductory physics course (Physics 197/198).

Our graduate and undergraduate programs continue to attract exceptional students, making for a vibrant intellectual atmosphere. Eighteen of our undergraduate majors matriculated in May 2011. Seventeen of our graduate students have received their Ph.D.s since our last newsletter. Our chapter of the Society of Physics Students continues to thrive under the direction of faculty mentor Francesc Ferrer. One example is a recent visit to Fermilab, followed by a night of fun in Chicago.

Our faculty members are constantly sought out to give keynote and plenary lectures, as well as to organize workshops. Many have received awards for their teaching and research over the past year. I am honored to have received the International Symposium on Metastable, Amorphous and Nanostructured Materials (ISMANAM) Senior Scientist Award. Claude Bernard won the Outstanding Faculty Member by a vote of the Class of 2014. Research Professor Mark Holland was recently named a Fellow of the American Society of Echocardiography. We also celebrate the election this past year of two former graduate students, Scott Sanford (GR 85) and Rhonda Stroud (GR 96), as Fellows of the American Physical Society.

Outreach remains strong. Activities include celebrating Women in Science, participating in the Young Scientists Program, and co-hosting the ExxonMobil Bernard Harris Summer Science Camp. The popular Saturday Science lecture series attracts a large audience each week that nearly fills our largest lecture room in Crow Hall. The McDonnell Center for the Space Sciences hosted Astronaut Lt. Col. Dr. Robert Behnken and Professor Rocky Kolb (University of Chicago), who both gave popular as well as technical lectures. As part of his popular presentation, Dr. Behnken presented to Chancellor Wrighton a photograph of the late James S. McDonnell that had traveled to the International Space Station.

One of the primary purposes of a newsletter is to keep old contacts alive. I hope that you enjoy the stories and reminiscences of former colleagues and alumni of the department in the Alumni News section of the newsletter. These folks show an amazing bond with the department. A prime example is Jonathan Reichert, the president of TeachSpin Inc., who drove all the way from Buffalo, New York, to personally give his newest laboratory experiment as a gift to the department for use in our advanced laboratory course. We are touched by this demonstrated commitment. I thank Pat Gibbons and Mike Friedlander, who serve as points of contact to former colleagues and alumni, enabling us to keep in touch.

I would like to take this opportunity to especially acknowledge Mike Friedlander’s many years of service to the department. As many of you know, Mike joined the physics faculty in 1956 and became professor emeritus in January 1999. He and Anders Carlsson produced the first edition of our newsletter in 1993, and Mike has continued to play a central role in its production each year. He was central in starting the Saturday Science series in 1994 and has since been the key figure in organizing and promoting this series. His past and continued service and devotion to the department are exemplary and very much appreciated, serving as an inspiration to us all.

Sadly, since the last newsletter, some colleagues are no longer with us. Frank Stadermann, senior research scientist in the Laboratory for Space Science; Manfred Ristig, frequent visitor and close collaborator with Professor John Clark; T. Alexander Pond, a member of the faculty (1953–1962); Robert Varney, a member of the faculty (1938–1964); Dan Bolef, a member of the faculty (1963–1983); and one of our alumni, Ron Menendez (Engineering Physics, 1971) all passed away during the past year. They are deeply missed.

This is the last year that I will be writing this letter. I will be stepping down as chair at the end of June 2012. It has been a wild ride, and a lot has happened during the past five years. The economic downturn in 2008 provided unique problems and opportunities that continue to reverberate. While we were forced to curtail our budget, we successfully weathered the storm and indeed managed to make good headway, improving our undergraduate and graduate programs, increasing funding in the department, and making new collaborative inroads with other departments. On July 1, 2012, Professor Mark Alford will become the chair of the Department of Physics. Mark is a theoretical physicist of the highest rank, working in particles and fields, which is one of the most fundamental areas of study within physics. Mark has the best interests of the department at heart. He is extremely dedicated, organized, and interested in moving the department to greater heights. He will make a great chair, and I look forward to working with him.

– Ken Kelton
Arthur Holly Compton Professor in Arts & Sciences
Chair, Department of Physics
kk@wustl.edu
to devote himself full time to this unique company, whose mission has always been to build rugged, reliable, hands-on laboratory apparatus for advanced experimental physics instruction.

Since then TeachSpin Inc. has grown, now consisting of a staff of 12 with an office/laboratory/factory space of 10,000 square feet. In the summer of 2000 Reichert’s wife, Barbara, left her teaching position to become the company’s director of marketing. Its instruments are now in every major, and most small, colleges and universities in the United States and Canada, as well as in most of the best-known institutions in Europe, the United Kingdom, Korea, and many other Asian countries. Today TeachSpin Inc. is contributing significantly to experimental physics education all over the world.

Reichert wrote an editorial titled “What Happened to the Advanced Lab?” for the November 2006 edition of the American Journal of Physics. He described the concern voiced by many teachers regarding the general lack of attention to and funding for the advanced lab. He also made a proposal in the last paragraph of this editorial that has received a very positive response: “I propose a dedicated professional association, created under the joint umbrella of APS and AAPT and supported by the NSF, which would put the advanced lab back on the map of the physics profession.”

An organizational meeting was held at the 2007 APS March meeting, and the Advanced Laboratory Physics Association (ALPhA) was launched. Shortly thereafter, Harvey Leff, then president of AAPT, initiated the Advanced Lab listserv. For the first year, TeachSpin provided seed money and in-kind secretarial support. Thanks to NSF support, in summer 2011 ALPhA held its second round of “Advanced Laboratory Immersions” at which participants, sharing an apparatus with only one partner and with the help of an experienced mentor, spent three full days learning a new advanced laboratory “well enough to teach it with confidence.” At the January 2008 AAPT meeting, Reichert and his wife, Barbara, were given a joint Distinguished Service Citation in recognition of their contribution to advanced laboratory education.

The WU physics department is fortunate indeed to have an alumnus like Jonathan Reichert who has made significant contributions to both physics research and teaching.

**Advanced Laboratory Education (continued from page 1)**

**APS NEWS**

It is our pleasure to note that two of our alumni have been elected Fellows of the American Physical Society.

**Scott Sanford (GR 85)** was cited for “significantly advancing our understanding of the chemical makeup of extraterrestrial materials and their interstellar heritage at the most basic and fundamental level.” Scott is at the NASA Ames Research Center at Moffett Field, California.

Scott tells us that much of his recent work has been centered on some spacecraft missions, in particular with the Japanese Hayabusa Asteroid Sample Return Mission, which recently successfully returned microscopic samples from asteroid Itokawa. “Reentry of the sample capsule in Australia went perfectly. In March, they presented our initial results in a special session at the Lunar and Planetary Science Conference. Several thousand grains were recovered in the 1-200 µm size range, and the properties of these grains are consistent with Itokawa, which is an S-class asteroid, being linked to the LL Ordinary Chondrite class of meteorites.” Scott is also involved in long-range planning as a co-investigator and Science Team member for a mission that would visit an asteroid in 2020 and return a sample to Earth in 2023.

Scott was a member of Bob Walker’s group working on the Compton lab’s 4th floor. He has graciously noted that “since the WashU Physics Department had a lot to do with getting me where I am today, I can safely say I owe the honor to WashU in all sorts of ways!”

**Rhonda Stroud (GR 96)** is being honored for her research in quasicrystals, spintronics, and stardust research. Rhonda is currently serving as head of the Nanoscale Materials Section of the Materials Science and Technology Division of the Naval Research Laboratory. Her research focus is the relationship of structure and composition to materials properties and formation conditions. Recent projects include the investigation of short-range order in magnetic thin films and structure-isotope studies of the remnant organic materials from the formation of the solar system. Rhonda was a member of the Kelton–Gibbons research group.
This was an exciting year for Professor Mark Alford and his work on nuclear matter in neutron stars (“Astronomers discovered a heavy neutron star, twice the mass of our sun,” see http://tinyurl.com/384t8b3). The fact that such an object can exist means that many theories of nuclear matter are now ruled out. Alford joined with some of the discoverers of the heavy neutron star in writing a paper, now published in The Astrophysical Journal, showing how the discovery constrains the properties of high-density quark matter.

Alford traveled inside and outside the United States to present his research work to professional audiences. He spent three weeks as an invited visitor at the Goethe University in Frankfurt, Germany, and took the opportunity to give seminars in Darmstadt, Heidelberg, Munich, and also at Surrey University in Guildford, United Kingdom, the town where he grew up. Alford gave invited presentations at conferences in Bari, Italy, and Phoenix, Arizona, as well as a special one-hour seminar as part of an international workshop at the Yukawa Institute of Kyoto University in Japan.

Alford was also active in outreach to the general public. In October 2010, he gave one of the physics department’s Saturday Science lectures for the general public. Talking on “Accepting the Weirdness: Quantum Mechanics and Reality,” he described the most challenging paradoxes of quantum mechanics in language accessible to a non-specialist. Alford’s communication skills were further tested two days later when he was invited to address a group of gifted 7th-grade students at Holman Middle School in St. Ann, Missouri. He spent an hour answering their surprisingly insightful questions about the big bang, black holes, time travel, the structure of the universe, and string theory.

Twelve years ago, Professor Carl Bender published a Physical Review Letter with graduate student Stefan Boettcher that originated a new area of research called PT quantum mechanics. In the past year, Bender published two more Physical Review Letters on PT quantum mechanics and gave over three dozen invited talks at universities and international conferences.

The field of PT quantum mechanics is growing and evolving rapidly. There have been more than a dozen international conferences totally dedicated to PT quantum mechanics. The most recent conferences were held in Hang Zhou, China (2010); Prague (March 2011); Dresden (June 2011); and Heidelberg (September 2011). The next conference will be held in Paris (June 2012). A conference in Spain (July 2012) also is being planned. Over two dozen Physical Review Letters and several Nature Physics articles have been published on PT quantum mechanics.

The most exciting development in the past year is that, for the first time, Bender’s theoretical calculations are being confirmed in laboratory experiments. Late in 2009, a paper entitled “Observation of PT-Symmetry Breaking in Complex Optical Potentials” was published in Physical Review Letters that reports the first experimental observation of the PT phase transition predicted in his theoretical research [A. Guo, G.J. Salamo, D. Duchesne, R. Morandotti, M. Volatier-Ravat, V. Aimez, G.A. Swiloglou, and D.N. Christodoulides, PRL, 093902 (2009)]. The reported experimental data are in close agreement with predictions. One of the authors, G. Salamo, presented a colloquium here in the spring of 2010.


Experiments are being done now in Heidelberg by M. DeKieviet that appear to verify Bender’s work on the PT quantum brachistochrone that he published in 2007, “Faster than Hermitian Quantum Mechanics,” C.M. Bender, D.C. Brody, H.F. Jones, and B.K. Meister, Physical Review Letters, 040403 (2007). DeKieviet may have seen the PT brachistochrone effect in atomic beam experiments.

In November 2010, Bender taught an intensive master’s-level 15-lecture course on mathematical physics in the Perimeter Scholars Inter-

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**FACULTY AWARDS AND RECOGNITION**

The Class of 2014 named Professor Claude Bernard the Outstanding Faculty Member at the April 20, 2011, Freshman Finale ceremony. This award is for a faculty member with the greatest positive impact on the freshman class.

William E. Buhro, the George E. Pake Professor in Arts & Sciences and chair of the Department of Chemistry, received the St. Louis Award from the American Chemical Society (ACS). This award is presented to an individual who has made outstanding contributions to the chemistry profession.

Research Professor Mark Holland recently was named a Fellow of the American Society of Echocardiography (ASE) and continues in his role as an elected member of the Board of Directors of the American Institute of Ultrasound Medicine.

A new book that Professor Ken Kelton wrote with Professor A. Lindsay Greer from Cambridge University, United Kingdom, *Nucleation in Condensed Matter—Applications in Materials and Biology*, was published in May 2010 by Elsevier under the Pergamon imprint. Kelton received the 2010 ISMANAM Senior Scientist Award at the 17th International Symposium on Metastable, Amorphous and Nanostructure Materials (ISMANAM) meeting held in Zurich, Switzerland, July 4–9, 2010. Professor James Miller continues to serve as vice-president of the Basic Science and Instrumentation section of the American Society of Echocardiography (ASE) until 2013, when he will begin a two-year term as president.
national program at the Perimeter Institute in Waterloo, Canada. During the past year, he also made extended visits to Imperial College, London (where he gave a series of five lectures on his research) and to the Benasque Institute for Science, Spain, and the University of Heidelberg, where he also gave several series of lectures. (Bender is a joint professor of physics at the University of Heidelberg.)

The Department of Energy research grant that supports Bender’s research at Washington University was renewed for another three years. Bender also received a grant from the Leverhulme Foundation that provides additional support for his research.

Professor Claude Bernard is an organizer of a month-long workshop at the Galileo Galilei Institute for Theoretical Physics in Florence, Italy, September 2012. The workshop, “New Frontiers in Lattice Gauge Theory,” is designed to further lattice research into the strong dynamics relevant to the physics of the Large Hadron Collider (LHC) at CERN, Geneva. This includes strong interactions in Quantum Chromodynamics as well as possible new forces that may be discovered at the LHC.

Professor Willem Dickhoff co-organized with Thomas Aumann (GSI), Carlo Barbara (RIKEN/Surrey), Filomena Nunes (NSCL/ Michigan State), and Jorge Piekarewicz (Florida State) a workshop at the European Center for Theoretical Studies in Nuclear Physics and Related Areas, April 6-10, 2011, in Trento, Italy. The workshop was entitled “Reactions and Nucleon Properties in Rare Isotopes,” and it attracted 46 participants representing many different countries. New developments related to the emerging field of radioactive beam physics and the study of exotic nuclei were discussed. Robert Charity (research professor in chemistry) and Seth Waldecker (graduate student in physics) presented new material related to their research of the dispersive optical model.

Earlier that year, Dickhoff attended and spoke at the ICHOR-EFES International Symposium on New Face of Spin-Isoospin Responses (SIR2010) at the University of Tokyo. In September 2010, he was one of the keynote speakers at a workshop entitled “Self-consistent Green’s Function Methods—From Solid State to Nuclear Physics: Modern Challenges and Bridging to Energy Density Functionals” at the CEA Saclay near Paris. In July 2010, Dr. Helber Dussan joined Dickhoff’s group as a postdoctoral associate to work on the challenging project of treating realistic nucleon–nucleon interactions in many-body calculations of finite nuclei. Dussan received his Ph.D. shortly before joining the group at the University of Indiana, working with Professor Charles Horowitz on the physics of neutron stars.

Jonathan Morris represented Washington University at the Gordon Research Conference on Photnuclear Reactions in Tilton, New Hampshire, August 1-6, 2010. Morris is a graduate student working in the nuclear physics group under Dickhoff. Morris presented his work on dynamic pion exchange, as well as work of other group members on depletion of the Fermi sea. The talk was entitled “Influence of Short-Range Spatial and Long-Range Dynamic Correlations on One- and Two-Body Properties in Matter.” Graduate student Waldecker works with Dickhoff on the extension of the dispersive optical model for the study of exotic nuclei. During 2010, he attended and spoke at the ECT*, Trento (Italy) workshop co-organized by his advisor. Waldecker also received a travel grant from the Japan–U.S. Theory Institute for Physics with Exotic Nuclei (JUSTIPEN) to do collaborative work at the RIKEN institute in Tokyo. Waldecker spent the month of May at RIKEN working with Barbieri (a former graduate student in the group), who in the meantime accepted a position of senior lecturer at the University of Surrey. In addition, Waldecker gave a seminar talk about his research. He also regularly visits the National Superconducting Cyclotron Laboratory at MSU to collaborate with the group of Professor Filomena Nunes on the application of the dispersive optical model to the description of nuclear transfer reactions.

In addition to teaching undergraduate physics students, Professor Patrick Gibbons participated in presentations about effective teaching of science to K–12 teachers. At Interface 2010, a meeting for Missouri K–12 teachers, Gibbons, John F. (Jack) Wiegers, and Ann McMahon, both from Washington University’s Science Outreach office, presented two workshops on teaching current electricity. In July 2010, Gibbons and Wiegers hosted a three-day workshop in Compton for middle and high school teachers of physics. Jesse Herman, David Beier, and Lainie Ives from School Specialty Science presented activities using equipment available from their company. In October 2010, Gibbons, Wiegers, and McMahon presented workshops for middle and high school teachers of science on light and on force and motion at a National Science Teachers Association regional meeting in Kansas City.

Professor Jonathan Katz organized a session, “Deep Water Drilling,” for the April 2011 meeting of the American Physical Society and presented an invited talk, “Viscoelastic Suppression of Gravity-Driven Counterflow Instability.” 2011 marked the 25th anniversary of Katz’s publication in the Journal of Geophysical Research (V. 91, pp. 10412-10420) of a theory of brittle fracture of heterogeneous materials (like rock). Initially intended to explain the well-known Richter-Gutenberg law of earthquake magnitudes, it failed at that task, but was subsequently popularized by the late Per Bak as “Self-Organized Criticality.” Under that name it is applied to a broad range of problems—not only in physics, but also in distant related subjects such as biology and economics. Hundreds of papers describing “SOC” models are published every year.

Professor Jason Woods gave an invited talk at the Pulmonary Functional Imaging Meeting and colloquia at Rhodes College and the University of Reims, and a course of lectures at the Politecnico di Milano, all on the subject of lung imaging with hyperpolarized helium-3. The rapidly growing use of this technology has led to the prospect of a shortage of this rare, generally mammade, isotope. He reviewed the possible consequences and solutions in an invited talk at a meeting of the American Association for the Advancement of Science, the largest scientific society in the United States.

During April and May 2010, Professor Ernst Zinner spent five weeks as the Merle A. Tuve Senior Fellow at the Department of Terrestrial Magnetism of the Carnegie Institution of Washington, D.C. There he collaborated with previous Washington University students Larry Nittler and Frank Gyngard, and with previous postdoc Conel Alexander. During his visit, he presented the Tuve Lecture. He also presented a lecture at the National Museum of Natural History, Smithsonian Institution of Washington, D.C. In July 2010, Zinner presented a series of lectures at the WE-Heraeus Summer School on Nuclear Astrophysics in the Cosmos in Darmstadt, Germany. Following this, he
attended the 11th International Symposium on Nuclei in the Cosmos in Heidelberg, Germany. He served on the International Advisory Committee of the conference. Subsequently, he attended the 73rd Annual Meeting of the Meteoritical Society in New York City.

In November 2010, Zinner, along with his colleagues Sachiko Amari, Kevin Croat, Christine Floss, and graduate student Evan Groopman, attended the Annual Workshop on Nucleosynthesis and Presolar Grains at Clemson University. This was the 20th anniversary of the first workshop organized by Don Clayton at Clemson University. In subsequent years, the workshop alternated between Clemson and Washington Universities and, since 2003, includes the University of Chicago and the Carnegie Institution of Washington, D.C. The workshop in St. Louis in 1996 resulted in the book *Astrophysical Implications of the Laboratory Study of Presolar Materials*, edited by Professors Tom Bernatowicz (Washington University) and Zinner in 1997.

SATURDAY SCIENCE

Our popular lectures continue to draw loyal and enthusiastic audiences. Our largest lecture room in Crow Hall (with close to 200 seats) is almost full every week.

In the 2010 fall semester, the theme was *Revolutionary Theories: How Do We Test Them?* During the first quarter of the 20th century, physics was revolutionized by the new theories of relativity and quantum phenomena. Drastic changes were required to break away from long-held views of space and time, of particles and waves. New theory was needed to describe the structures of atoms and nuclei. Application of the new theories on the much larger scales of stars, galaxies, and even cosmology has led to yet more challenges to accepted ideas. How are new theories produced and tested? How can they be examined, rejected or modified, and perhaps accepted to become the new orthodoxy? The October lectures examined this topic:

John Rigden: “The Scientific Method”  
Michael Friedlander: “E = mc²”  
Michael Ogilvie: “Cosmic Inflation: More than a Theory”  
Mark Allford: “Accepting the Weirdness: Quantum Mechanics and Reality”  
Carl Bender: “What’s the Evidence for Quantum Mechanics? Why is Classical Mechanics Inadequate?”  

The 2011 spring theme was *Nobel Laureates Whom We Have Known: Scientists and Citizens.* Faculty members in the Department of Physics have had close professional associations with several Nobel Laureates. The lectures began with descriptions of the laureates’ scientific backgrounds and the significance of their work in physics. The faculty also discussed the laureates’ personalities, interests, and activities outside of physics.

John Rigden: “Isidor Rabi (1944) and Edward Purcell (1952)”  
Carl Bender: “T.D. Lee (1957)”  
Ramanath Cowisk: “C.V. Raman (1930) and Subramanyan Chandrasekhar (1983)”  
Michael Friedlander: “C.F. Powell (1950) and P.M.S. Blackett (1948)”

In addition, Lee Sobotka gave two special lectures on the Fukushima nuclear reactor accident. On April 1, he served on a panel with Henry Royal, WU Department of Radiology, and on May 28, he gave a special lecture as part of our regular Saturday Science series. In both lectures, Sobotka described the construction of the reactors and the ways in which the combination of earthquake and tsunami damaged them, causing the release of large quantities of radioactive debris.

THE McGONNELL CENTER FOR THE SPACE SCIENCES

On October 21, 2010, Astronaut Lt. Col. Dr. Robert L. Behnken (EN 92) presented a lecture entitled “Missions to the International Space Station” for the 2010 Robert M. Walker Distinguished Lecture. During his lecture, Behnken presented a photograph of the late James S. McDonnell to Chancellor Mark Wrighton. The chancellor received this portrait, which had been taken to the International Space Station and which has inscriptions and signatures of the various astronauts, on behalf of the McDonnell Center for the Space Sciences.

The 2011 McDonnell Distinguished Lecturer was Professor Rocky Kolb from the University of Chicago. Kolb delivered a physics colloquium on March 30 (“Taking Sides on Dark Energy”) and a public lecture on March 31 (“Mysteries of the Dark Universe”). In these lectures, he presented in very accessible language the research that cuts across the disciplines of astrophysics, space sciences, and cosmology. These lectures also bear importantly on more general issues like the origins of life. His webpage, http://astro.uchicago.edu/~rocky/, provides an overview of his research interests.
GRADUATE STUDENTS

Since the last newsletter, 17 of our students have received their Ph.D. degrees. They are listed below, along with their thesis titles, faculty advisors, and current positions.

Christian Anderson, “Physics of Ultrasonic Wave Propagation in Bone and Heart Characterized Using Bayesian Parameter Estimation,” August 6, 2010 (Professor Miller), Lincoln Laboratory, Lexington, Massachusetts (technical staff)

Wenli Bi, “Studies in Magnetism and Superconductivity under Extreme Pressure,” May 27, 2011 (Professor Schilling), position status not known

Maitrayee Bose, “Isotopic and Elemental Compositions of Stardust and Protosolar Dust Grains in Primitive Meteorites,” May 4, 2011 (Professors Bernatowicz/Floss), Arizona State University (postdoctoral fellow)

Joseph J. Hoffman, “Ultrasonic Characterization of Human Coronary Arteries and Atherosclerotic Plaques,” October 29, 2010 (Professor Miller), Washington University–Department of Physics (postdoc)

Kathryn Mairin Hynes, “Microanalytical Investigations of Presolar SiC Grains as Probes of Condensation Conditions in Astrophysical Environments,” September 30, 2010 (Professor Bernatowicz), Washington University–Department of Physics (senior lecturer)


Christopher Lloyd, “Enhancing Nonlinear Ultrasonic Methods for Laboratory Clinical Applications,” July 26, 2010 (Professor Miller), Lincoln Laboratory, Lexington, Massachusetts (technical staff)

Nicholas Mauro, “Structural and Thermophysical Property Studies of Metallic Liquids and Glasses Using the Beamline Electrostatic Levitation Techniques,” April 22, 2011 (Professor Kelton), Washington University–Department of Physics (postdoc)

Michelle Milne, “Exploring Tissue Microstructure in Healthy and Diseased Lung Tissue,” August 11, 2010 (Professor Conradi), Washington University–Department of Physics (postdoc)


Peter H. Ronhovde, “Physical Models in Community Detection with Applications to Identifying Structure in Complex Amorphous Systems,” September 27, 2010 (Professor Nussinov), Washington University–Department of Physics (postdoc)


David Shane, “NMR Study of Borohydrides for Hydrogen Storage Applications,” July 26, 2011 (Professor Conradi), Lansing Community College (adjunct faculty member)

Rebecca Shane, “Asymmetry Dependence of Correlations in Exotic Nuclei,” April 26, 2011 (Professor Sobotka), National Superconducting Cyclotron Laboratory–Michigan State University (visiting research associate)

Leonid Shmuylovich, “Kinematic Modeling of the Determinants of Diastolic Function,” July 23, 2010 (Professor Kovacs), Washington University School of Medicine (M.D. student)

Brian R. White, “Developing High-Density Diffuse Optical Tomography for Neuroimaging,” August 16, 2010 (Professor Culver), Washington University School of Medicine (M.D. student)

Jian Wu, “Frustrated Magnetism in Distorted Triangular Lattice Materials, and Extraordinary Electroconductance in Metal-Semiconductor Hybrid Structures,” October 1, 2010 (Professor Solin), ASML/Brion Technologies, Inc. (senior engineer)

2011 Seniors

Eighteen seniors graduated in May 2011. Future plans for these new graduates are indicated when known.

Reed Essick—MIT: Physics

Matthew Gregg

John Hakala

Lionel Johnnes

Puneet Kollipara

Ariel Leonard

Sebastian Loh

Sean Lourette

Alyssa Moller—Ohio State University: Medicine

Joshua Moloney

Uriel Morone

Charles Munson—University of Michigan: Chemistry

Laura Rayhel

Samuel Robinson

Joel Sleppy—Cornell: Applied Physics

Stephen Washburn

Timothy Wiser—Stanford: Physics

New Graduate Students

For the 2010–11 academic year, the department admitted 15 new graduate students:

Nathan Brown (Oberlin College)

Thomas Crockett (Texas A&M)

Dong Ding (University of Science and Technology of China [USTC])

Jennifer (McKnight) Gewin (Vanderbilt University)

Mark Johnson (University of Minnesota)

Jonathan Kessler (Southeast Missouri State University)

Javad Komijani (University of Tehran)

Anthony Kovacs (Vanderbilt University)
Josiah Lewis (Covenant College)
Satyanarayana Kumar Mallaverapu (University of Mysore, India)
Michael Nadeau (Southeast Missouri State University)
Ryan Soklaski (Saint Louis University)
Bo Sun (University of Science and Technology of China [USTC])
Vy Tran (University of St. Thomas)

STUDENT AWARDS

Barry M. Goldwater Scholarship
Alex G. Anderson, a junior majoring in mathematics and physics, and Suchita Rastogi, a junior majoring in molecular biology and biochemistry, received the 2011–2012 Barry M. Goldwater Scholarships. This scholarship is considered one of the most prestigious awards for undergraduates planning careers in the sciences, engineering, or math. It covers as much as $7,500 annually toward tuition, fees, and books in the junior or senior year.

Putnam Competition
Each year there is a national Putnam Mathematics Competition for undergraduate students. The university’s 2010 team consisted of junior Alex Anderson, sophomore Ari Tzenz, and senior Tim Wiser. The team placed 19th out of 442 teams from colleges and universities across the United States and Canada. The students prepared for the competition with weekly problem sessions coached by Professor Richard Rochberg, Department of Mathematics, and Professor Carl Bender, Department of Physics.

Missouri Collegiate Mathematics Competition
Two university teams participated in the 16th annual Missouri Collegiate Mathematics Competition taking both first and third place. About 34 teams from 17 colleges and universities across Missouri took part. The team of junior Alex Anderson, senior Stephanie Higgins, and sophomore Tom Morrell took third place.

Departmental Awards to Students: May 2011
Each year, the department awards prizes for outstanding performance.

Undergraduate Students
Varney Prize: Named to honor Robert Varney, a member of our faculty for many years. Varney and Dick Norberg taught an introductory course, then named “Engineering Physics,” Physics 211/212. Awarded to one or more outstanding students in introductory physics courses:
- 2009–10: Mason Yang
- 2010–11: Se-in Kim, Kranti V. Peddada, Benjamin D. Pollack

Graduate Students
During the 2010–11 academic year, three graduate students were recognized for their exemplary teaching skills: Shawn DeCenzo received the Dean’s Award for Teaching Excellence. This university-wide award recognizes superb performance by a graduate teaching assistant in the instruction of Arts & Sciences undergraduates. DeCenzo is a fourth-year Ph.D. student who taught introductory physics laboratory during his first year and has since served as the head laboratory TA for three semesters. He not only strives to create a

PHYSICS departMental AWARDS

2010–11: Timothy D. Wiser
Greg Delos Summer Research Fellowship: Endowed by his family in memory of Greg Delos, an undergraduate who passed away during his junior year. Awarded to one or more outstanding undergraduates for summer research in physics:
- 2010–11: Daniel Cole

Undergraduate Research Fellowships in Physics: Awarded to seven undergraduate students who proposed outstanding summer research projects:
- 2010–11: Brian Clark, Mitch Eagles, Marieke Jager, Wei Jia Ong, Nicholas Orlofsky, Jordan Raisher, Mark Sholte

SOCiETY OF PHYSiCS STUDENTS

During February 2011, Washington University’s Society of Physics Students pulled off its biggest event of the semester: a road trip to Fermilab for a private tour, followed by a night out in Chicago. Twenty SPS students gathered at the clock tower—bright and early on the morning of Saturday, February 19, to drive to the Windy City for the opportunity to see a particle accelerator.

After making some stops for breakfast and lunch (there’s nothing like watching the sun rise from a table at Waffle House), the group met up at Fermilab’s Wilson Hall, where we spent a few minutes taking in the beautiful architecture and landscaping. The whole complex is sort of a shrine to science—even the power poles were artistically designed to resemble pi.

The group was eventually shown to a private classroom, where one of Fermilab’s leading physicists, Dr. Erik Ramberg, explained some of the basics of what kind of research is done at the lab, as well as related some interesting history of particle accelerators in the United States and Europe. We had the chance to ask lots of questions, and the discussion ranged from dark matter to the politics of science. Our docent then took us to the upper level of Wilson Hall, where we were led around various exhibits and models. There was a great view of the Tevatron, Fermilab’s large circular particle accelerator, from the upper-story window. Next we were led to the linear accelerator complex where we saw some of the internal workings of the accelerator. We passed several other interesting offices along the way—from the neutron therapy cancer research center to the control office where Fermilab interacts with CERN.

Eventually the tour came to an end, and our tour guide wished us good-bye, giving everyone lots of goodies to bring back. We then drove to our hotel in Chicago, passing some of the herds of buffalo that graze on Fermilab’s fields. After a fun night of deep-dish pizza and sightseeing, we returned to the hotel and headed back to St. Louis the next morning.

† Society of Physics Students at Fermilab in Chicago
Applying these physical principles correspond to actual, validated properties of the heart such as its stiffness, viscosity, and response to load. This physics-based approach allows model-based, observer-independent, objective characterization of diastolic function and has already provided a way to discover “new” cardiac physiology.

**NEWLY ELECTED SPS MEMBERS**

Six students were elected to Sigma Pi Sigma, the national physics honor society, in April 2011: Michael Dango, Reed Essick, Joshua Moloney, Robert Perkins, Joel Sleppy, and Timothy Wiser.

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**STAFF NEWS**

Congratulations to our staff members for receiving awards recognizing their years of service to Washington University: Julia Hamilton, graduate admissions coordinator, 40 years; Tony Biondo, senior machinist, 35 years; and Denny Huelsman, machinist, 20 years.

When Julia joined the staff of the department, she worked as a microscopist (“scanner”) in the cosmic ray group. Cosmic ray observations were carried out using high-altitude balloons that carried special photographic films to record the cosmic ray particles. After these films had been developed, they were scanned by the microscopists. There were four scanners, working in Room 258 of Compton Lab. They kept detailed records of the cosmic ray ‘tracks’ so that faculty and graduate students could later identify the cosmic ray particles. The use of photographic film was discontinued during the 1970s when other methods were used for particle detection. Julia then moved to front office administration, serving as secretary to Professors Norberg and Will when they were department chairpersons. In her current position as graduate admissions coordinator, Julia is one of the first department members to welcome new students and one of the last to wish them well when they complete their studies. Along with shop supervisor Todd Hardt, Tony and Denny make up the machine shop staff.

This group is vital to the success of research projects, such as Super-TIGER (Trans-Iron Galactic Element Recorder), and the design and construction of a new facility that will allow elastic and inelastic neutron scattering studies of liquids to be made at the Spallation Neutron Source, located at Oak Ridge National Laboratory. Among other responsibilities, they are involved in research and development; fabrication of parts; and project coordination with PIs, research staff, and external collaborators. Tony also teaches the student shop course for the department, and Denny is the Bridgeport EZ Trak (computer controlled mill) specialist.
IN MEMORIAM

Frank J. Stadermann
by Professor Ernst Zinner

Frank J. Stadermann, senior research scientist in the Department of Physics and member of the Laboratory for Space Sciences and the McDonnell Center for the Space Sciences at Washington University in St. Louis, died on October 4, 2010, from a cerebral hemorrhage at age 48. Frank directed the Washington University NanoSIMS and the Scanning Auger Nanoprobe Laboratories, and he was a very important member of our extraterrestrial materials research group.

Frank’s scientific research concentrated on the detailed isotopic, elemental, and structural analysis of small extraterrestrial samples, including meteorites, interplanetary dust particles (IDPs), presolar grains (stellar condensates), Antarctic micrometeorites, and cometary materials. He was selected to be on the scientific advisory board for the analysis of cometary material brought back by the STARDUST mission to comet Wild 2 and, as the head of the preliminary examination team at Washington University, he was the first to detect true stardust, i.e., condensates from other stars in the cometary material.

Other noteworthy scientific results in which Frank played an essential role include the discovery of presolar silicates in IDPs, primitive meteorites, and Antarctic micrometeorites; the isotopic characterization of presolar spinel grains; carbon and nitrogen isotopic studies in IDPs and identification of isotopically primitive IDPs; correlated isotopic and TEM studies on presolar grains mounted on TEM sections; identification of a new type of SiC as subgrains within presolar graphite grains; isotopic analysis of “presolar grains within presolar grains” from supernovae, tiny TiC grains embedded in graphite spherules; and the first identification of presolar corundum and SiC in IDPs.

Frank was always looking for new ways to analyze small grains. He recognized the potential of Auger spectroscopy for this purpose and managed to raise funds for the acquisition of a Scanning Auger Nanoprobe. This instrument makes it possible to determine the elemental composition of sub-micron presolar grains and resulted in the identification of presolar ferromagnesium silicates from various primitive meteorites. He also pioneered the use of the atom probe to analyze the elemental and isotopic compositions of tiny extraterrestrial samples on an atomic scale, with the ultimate goal of better understanding the origin of the enigmatic nanodiamonds.

Frank was born on May 1, 1962, in Schwerte/Ruhr, Germany. At the Max-Planck-Institut für Kernphysik in Heidelberg, Germany, he worked on 40Ar-39Ar dating of lunar rocks from the Fra Mauro region, for which he received a master’s degree from the University of Heidelberg. For his Ph.D. research, he joined the research group of Robert Walker, director of the McDonnell Center for the Space Sciences at Washington University in St. Louis, in 1988 for two years and used the IMS 3f ion microprobe to determine the isotopic and trace element compositions of IDPs. For this work, which led to the discovery of large nitrogen isotopic variations in IDPs, he received his Ph.D. degree from the University of Heidelberg. After his return to Germany as a postdoctoral fellow at the Max-Planck-Institut für Kernphysik in Heidelberg, he studied micrometeoroid impacts and satellite surfaces in order to evaluate the contributions from IDPs and space debris. From Heidelberg he moved to the Technical University of Darmstadt, where he established an ion microprobe laboratory for materials science while continuing his research on extraterrestrial materials.

Fortunately, Frank returned to Washington University with his wife (and scientific collaborator!), Christine Floss, and their two-year-old daughter, Amanda, in 1996. Frank was instrumental in the purchase and installation of the first NanoSIMS instrument, a new type of high-resolution, high-sensitivity ion microprobe. As director of the NanoSIMS laboratory, he was responsible for many technical improvements and made Washington University’s SIMS Laboratory one of the premier facilities in the world.

Concentrating only on Frank’s technical and scientific achievements, however, would not do justice to his personality. I don’t know anybody who was as willing to help as he was—no matter how big or small the problem. And he always did it cheerfully. His pleasant personality and positive attitude provided the glue for a happy research group. Frank, Christine, and I ate lunch together every day, and most of the time we were joined by colleagues and students on the floor. Those common lunches were a happy time for Frank—and also for me. Almost every day, he brought two slices of Christine’s homemade cake (Christmas stollen) to satisfy his sweet tooth—one slice was for him and one slice was for me.

With Frank’s passing, we lost an esteemed colleague and a dear friend. His abrupt absence left a big crater on the fourth floor of Compton Hall.

Frank is survived by his wife, Christine; their daughter Amanda; stepdaughters Alisha Hillam and Ashley Heavilon; granddaughter Minnie Hillam; his parents, Günter and Margarete Stadermann; and his sister, Kirsten Stadermann.

Dan I. Bolef
by George Mozurkewich
(Gr 81), Energy Policy Consultant

Dan I. Bolef, professor emeritus of physics at Washington University in St. Louis and social activist, passed away on September 29, 2011, at his home in North Huntingdon, Pennsylvania, after an extended illness.

Dan was born on June 10, 1921, in Philadelphia to immigrant parents, earned degrees from Penn State and Columbia University, was a staff scientist at Westinghouse Research Laboratories from 1953 to 1963, and served as a professor of physics at Washington University from 1963 to 1983. His scientific career centered
on nuclear acoustic resonance, an outgrowth of nuclear magnetic resonance of which he was co-inventor and principal practitioner. Concurrently and subsequently Dan was heavily engaged in societal issues, including arms control, nuclear proliferation, anti-war, civil rights, and environmental campaigns. He was an early president of the Coalition for the Environment and served on its board for many years. The Dan Bolef Papers, housed at Olin Library on Washington University’s Danforth Campus, are a major source for information about peace activities during the Vietnam War.

Ron Menendez
by Michael Friedlander, Professor Emeritus

Ron Menendez (EN 71) passed away in Summit, New Jersey, August 2010. He pursued his graduate studies at the University of Illinois, where he obtained his Ph.D. in electrical engineering in 1977, with his research on mag-lev trains. For 33 years, Ron worked at Bell Labs (now Telcordia) in New Jersey, working on fiber optics and telecommunications. Rather than accept opportunities to enter management, he preferred to continue his research path and was awarded the title Master Scientist. Ron and his wife, Cathy, had a son whose graduate degree was in computer science and a daughter and his wife, Cathy, had a son whose graduate degree was in computer science and a daughter with a major in biology. He was an active volunteer in many activities, especially with the Unitarian Church where he was a member of the Board of Trustees and advisor to the youth group.

T. Alexander (Alec) Pond
by Michael Friedlander, Professor Emeritus

Our former colleague, T. Alexander (Alec) Pond, passed away at his home in Vermont on August 29, 2010. He was 85. In our department, Alec was an assistant professor (1953–1958) and associate professor (1958–1962). Alec also served as secretary of the Faculty Senate and member of its Executive Committee (1960–1962). He moved to the State University of New York-Stony Brook (now the University of Stony Brook), becoming the first chairman of its new Department of Physics. Alec chaired the SUNY department until 1968, building the department with strong faculty, including the early appointment of C.N. “Frank” Yang, 1957 Nobel Laureate.

Alec’s administrative abilities were recognized when he was appointed executive vice president of SUNY-Stony Brook in 1967 and later served as acting president. In 1982, Alec moved to Rutgers, The State University of New Jersey, as its executive vice president and chief academic officer, remaining there until his retirement in 1997.

Alec was born in Los Angeles, California, in December 1924. His studies were interrupted during 1943–1946 as he served in the U.S. Naval Reserve. He returned to Princeton, receiving his Ph.D. (1953) as a student of Robert Dicke. His research centered on triplet positronium formation, positron annihilation processes, and parity conservation in weak and strong interactions. He supervised a dozen graduate students.

Alec was highly regarded, especially by the students in his junior E&M courses, Physics 421-422. Alec and colleague Ed Lambe were Princeton products—button-down shirts, khaki chinos, pocket protectors, and bow ties. For the last day of class one semester, all of the students in his E&M course arrived in his Ivy League uniform.

We were fortunate to have Alec as a member of this department.

Manfred L. Ristig
by John Clark, Wayman Crow Professor of Physics

It is with great sadness that we report the passing of Professor Manfred L. Ristig on January 24, 2011, in Cologne, Germany. Fred’s association with our department began as a research associate in 1969 when he joined the many-body theory group of Eugene Feenberg and myself. In 1997, he was appointed to our adjunct faculty as honorary professor. Over the years, he visited the department many times (including several sabbaticals) to continue his collaboration with me, which has resulted in 55 co-authored papers and two co-edited books.

Fred was born on January 27, 1935, in Erfurt, Germany. His study of physics at the University of Jena in East Germany was interrupted in 1958 when he and several freedom-loving classmates were arrested for circulating political pamphlets and sentenced to factory labor at Bautzen, where other dissidents were imprisoned. On his release in 1961, he escaped from East Germany just before the Berlin Wall was completed. He resumed his studies of theoretical physics at the University of Munich under the direction of Peter Mittelstaedt, accompanying him to the University of Cologne and completing his doctorate there in 1966. At Cologne, he was promoted to docent in 1974, professor (C3) in 1980, and universitätsprofessor in 1987. He became emeritus in 2000 and served as vertrauensdozent of the German Scholarship Foundation (SDV) from 1988 to 2004.

A leading figure in the quantum many-body theory community for decades, Fred was responsible for important advances in ab initio microscopic theories of quantum fluids. Among these were the development of Fermi Hypernetted Chain Theory with Eckhard Krotscheck (then his student) and Correlated Density Matrix Theory with Washington University physics alumni Charles Campbell and Gerhard Singer. He remained highly active in research after his official retirement, even venturing into experimental physics with neutron-scattering projects on liquid para-hydrogen at the Grenoble and Rutherford facilities.

Fred’s death was all the more devastating to his family and many friends as it was due to complications following hip-replacement surgery. He is survived by his wife, Edeltraud; sons Florian and Joseph; daughters Maria and Sophie; and one grandchild. Fred’s life was celebrated at a funeral mass in the magnificent Cologne Cathedral, and his remains were laid to rest in Cologne’s Melaten cemetery.

Fred will be greatly missed by his family and by all who knew and worked with him.

Robert N. Varney
by Michael Friedlander, Professor Emeritus

Robert N. Varney, a longtime member of our faculty, celebrated his 100th birthday in November 2010. The celebration lunch was attended by Rob and Rita, their family and some old friends, including his student John
As we do each year, we accumulate news about our alumni—from conversations, emails, and announcements. We receive many compliments on our program—course content, quality of teaching and advising, the range of courses offered, and research opportunities for both undergraduate and graduate students. We are also finding that our mailing lists have errors and omissions. If you hear of alumni who do not receive these newsletters, let us know by sending us their current email and postal addresses. Please continue to send us information. Many thanks—Michael Friedlander (mwf@wuphys.wustl.edu) and Patrick Gibbons (pcg@wuphys.wustl.edu).

Following the death of Dick Norberg, we received a number of condolence messages from our alumni, and we have relayed them to the family. One of these emails came from Alden Mead (Chem GR 57), whom some older alums will remember. A graduate student in the Department of Chemistry, he was often in Crow Hall—with NMR research under the direction of Sam Weissman and with close collaboration with the physics NMR group. Alden was a student in Henry Primakoff’s graduate quantum courses, and he recalls how stimulating it was and how he “learned a lot about magnetic resonance (of course), but also a lot about quantum mechanics in general.” Alden was a member of the Department of Chemistry at the University of Minnesota, 1958–1993.

John Roeder (LA 62) has been teaching at the Calhoun School in New York City for many years. He writes to tell us about a course that he devised: “The Uses and Misuses of Scientific Evidence in Policy Making.” He required his students to discuss the role and function of science, especially in the public arena. For the part on “how science is supposed to work,” John writes that he decided to use Michael Friedlander’s book, At the Fringes of Science.

Bill Sutherland (LA 63) received his Ph.D. in 1968 at State University of New York at Stony Brook, where he was a student of C.N. Yang. Bill held a postdoctoral position at the University of California-Berkeley during 1969–1971, then joined the University of Utah where he remained until his retirement in 2004.

In reminiscing about his time as an undergraduate in Dick Norberg’s NMR lab, Wiley Kirk (LA 64) continued to use the techniques used then at SUNY-Stony Brook, the University of Florida, and Texas A&M, where he “investigated a variety of low-temperature effects...
primarily in quantum fluids and solids." He "eventually evolved away from these subjects and organized one of the first centers in the nation focused on growth of nanostructures by molecular beam epitaxy and quantum device fabrication in semiconducting materials at Texas A&M University."

He tells us that he “moved this program to the Dallas-Fort Worth Metroplex around 1990 and served on the Electrical Engineering faculty at the University of Texas at Arlington for about ten years. About two years ago I left that faculty, releasing my tenure appointment for a younger person and joined the Materials Science and Engineering Department at the University of Texas at Dallas as a Research Professor. I’m very busy with several research topics, some involving aspects of nanotechnology and others based around surface science effects and transport behavior in small-scale systems. We’ve recently hired a new young professor in the Materials Science department whom I’m mentoring to take over my molecular beam epitaxy system and to continue its useful life when I really have to retire! I constantly draw on the physics I learned so many years ago at WU.”

Mike Crisp (GR 68) has retired from the U.S. Department of Energy Office of Science where he managed the General Plasma Science program in the Office of Fusion Energy Sciences (OFES). Before coming to OFES, Mike was executive assistant to the director of the Office of Energy Research during the Reagan administration. Previously he spent two years as a postdoctoral student at Columbia University and then was a research scientist working on glass lasers for Owens Illinois Inc. After seven years, he was awarded a Congressional Science and Technology (NST) discussion groups sponsored by the Optical Society of America. He worked for U.S. Senate Republican Leader Howard Baker. Following that, he became a professional staff member of the U.S. Senate Committee on Commerce, Science and Transportation. Mike and Will Smith (GR 70) worked for the Senate Energy Committee and then the Senate Armed Services Committee.

In his retirement, Mike accepted the position of guest scientist at the National Institute of Standards and Technology (NIST) in Gaithersburg, Maryland, where he is associated with the Atomic Physics Division and will also be at NIST part-time.

Bill Hitchens (EN 68) describes what may be a common experience: sorting through old papers and finding “boxes of old books and school records—threw out about 80% of the old stuff and only kept the work I’m really proud of or textbooks that still are useful. Brought back a lot of good memories from WU. I couldn’t believe the quality and complexity of some of the work that I did (particularly ESm, QM, QED, and Plasma Physics), because I’ve pushed all of that out of my mind after 35 years of semiconductor physics & processing, materials science, and engineering. It also reinforced my belief about the solid foundation I got at WU. WU Physics undergrad program managed to strike a very careful balance between academic rigor and allowing students to have fun while learning, and I still look back at those 4 years as among the happiest years of my life.”

Bill writes that he started “singing again and rediscovered how much fun it is, particularly when compared to struggling with the violin and the piano. I still consult.”

We had a long email from Art West (LA 69) with many recollections. He was a student in the early years of Physics 117/118 (1964–1965) and was in our introductory astrophysics course a couple of years later. He also remembered working for Joe Klarmann as a work-study student in the cosmic ray group. Another recollection was being in one of the Professor–Student (P–S) discussion groups sponsored by the Campus Y in 1964–1965 with his wife, Ellen. P–S groups constituted an interesting experiment to have informal faculty–student discussion groups in the dorms on the South 40.

Art got his Ph.D. at the University of Maryland. The degree was in physics, but the research was statistical mechanics and thermodynamics applied to muscles. This was followed by four years in the Air Force at the Aerospace Medical Research Lab doing research on the effect of high acceleration stress on human performance. He and Ellen moved to Seattle where they have been ever since. Art writes that he found “I loved teaching even more than research and spent the bulk of my teaching career in community colleges. Until I retired last year, I was professor of physics and astronomy at Shoreline Community College in Seattle. So now I’m professor emeritus—a grand title that I would enjoy even more if I ever had a good reason to use it.”

“Six years ago Ellen and I went to China. We made contacts at several universities and later decided we wanted to spend a year living in China, teaching instead of being tourists. We spent the 2005–2006 year teaching English to English majors at Zhejiang University in Hangzhou. It was an intense and fascinating experience. After we were back home, I asked for a year’s leave without pay, and we went back, this time to Guangdong University of Technology in Guangzhou. We’re back in the U.S. now but not yet for good. In a few weeks we will be moving to Queretaro, Mexico, to teach English there for a while. “My education at WU was a broad classical education, so I have a strong understanding of English. In 2006, the provincial government of Zhejiang province awarded me the annual Westlake Friendship Award, which is described as ‘… the award at the highest level presented by the Provincial Government for foreign experts, which is to complement those who have made special contributions to the province’s growth in economy, technology, culture and education.’”

Art has written a “tutorial guide” (http://YourOwnPrivatePhysicsTutor.com) about how to learn physics, explaining how to approach the course and how to make the most effective use of the time and effort invested.

Congratulations to Moon Nahm (LA 70, MD 74) who has been elected a Fellow of the American Academy of Microbiology. Moon obtained his M.D. at Washington University, and he remained here for his clinical training in internal medicine and pathology as well as research training in microbiology. He was later at the University of Rochester before taking up his position at the University of Alabama in Birmingham, where he currently is a professor in pathology with a secondary appointment in microbiology.

In his research laboratory, Moon studies immune responses to pneumococcal polysaccharide antigens, bacterial pathogenesis, diagnosis of bacterial infections, and vaccines against bacterial infections. In addition, his laboratory serves as the Bacterial Respiratory Pathogens Reference Laboratory for the National Institutes of Health and the Pneumococcal Serology Reference Laboratory for the World Health Organization. Moon also works with physicists at the National Institute of Standard and Technology in Gaithersburg, Maryland.

Bob Joseph (GR 71) remains active and mobile in his ‘retirement’. “We had a month-long trip to New Zealand in January, partly for a choral festival organized every year. We performed the Haydn Nelson Mass and a second work composed by our conductor Jonathan Willcocks, A Great and Glorious Victory, which was commissioned for the second centenary
of the Battle of Trafalgar." Then the annual pilgrimage to Europe. Bob’s unusual activity (for seven years) was “teaching astronomy at the women’s prison—every Monday afternoon. I also gave a series of lectures on the history of cosmological thought in western civilization in the Osher Lifelong Learning Institute, a part of the Outreach College of the University of Hawaii. This is the fourth summer I have given a lecture course in this program. It is a group of intelligent and engaged retired people and I enjoy them immensely.” Bob is still singing with the Honolulu Symphony Chorus.

Last October, Alcatel-Lucent announced that **Andrew Chraplyvy (LA 72)** was one of their scientists from their research arm, Bell Labs, being honored for their inventions by the New Jersey Inventors Hall of Fame. The scientists were inducted into the Hall of Fame for significant contributions to optical networking technology and, in particular, for their invention of a high-capacity optical fiber for Wavelength Division Multiplexing (WDM). This invention laid the foundation for recent breakthroughs in optical networking such as the 100-gigabit-per-second system Alcatel-Lucent introduced to the market earlier this year and the 100-petabit-per-second, world-record transmission data rate Bell Labs achieved in lab demonstrations at the end of 2009.

After WU, Andy obtained his Ph.D. at Cornell University. He is director of Lightwave Systems Research at Bell Labs, Lucent Technologies, a Bell Labs Fellow, a member of the National Academy of Engineering, and a Fellow of the Optical Society of America. In 2003, he received the John Tyndall Award “for pioneering research on optical fiber nonlinearities and their dispersion management, and leading wavelength-division-multiplexed fiber transmission systems beyond terabit/second capacities.”

**Lawrence J. Altman (EN 73)** received the Warren Welliver Award from the Missouri Bar’s Missouri Lawyers Assistance Program in October 2010. He was honored for his volunteer work with the Missouri Bar.

**John Goebel (GR 74)** tells us that his NASA job continues while he is also working on projects at Stanford. John had worked on NASA’s Gravity Probe B, which had been designed to test two predictions of Einstein’s general theory of relativity. It was launched in 2004 and decommissioned in December 2010. The spacecraft will continue to circle the Earth in a polar orbit at an altitude of 642 km (400 mi). The experiment used four ultra-precise gyroscopes to measure the geodetic effect, which is the warping of space and time by a celestial body like Earth. It was also designed to measure frame-dragging, which is the amount a spinning object like Earth pulls space and time with it as it rotates.

Since leaving WU, **Kerry Bernstein (AB 78)** has been at the IBM Thomas J. Watson Research Center. Kerry was a keynote speaker at a Particle Physics Conference in Chicago this summer. His current work involves the development of post-CMOS computer technologies and architectures, using alternative tokens such as frame-dragging and gyroscopic feedback.
as spin, plasmons, polaritons, and magnetic fields, in addition to charge.

**George Mozurkewich (GR 81)** writes that he is no longer at Ford. He took an early retirement "during their downsizing frenzy—an 'offer one can't refuse' that turned out not to be a figment." Since then, he "has been consulting on energy policy when I can find clients and, when not, trying to develop IP for what I dream will become a start-up venture."

George also writes about his family—one son in college and the other in middle school. His wife, Ellen, who has her M.D. from Northwestern, is on the faculty of the Department of Obstetrics and Gynecology of the University of Michigan.

George is "intensely engaged in his project to make liquid fuel from air and water, and its rate of forward progress seems to be increasing, though it is plagued by regular retrogression." He is proud of "having got his first deer, a five-pointer. (Unfortunately, the car repair bill was a bit out of proportion to the gastronomic pleasure!)"

Noting Dick Norberg's passing, **Boris Venet (GR 81)** tells us that he was the TA for Norberg's undergraduate solid-state course. "From my perspective, I always thought of Dick Norberg and Frank Shull together, as different kinds of key pillars of the department." Boris is a senior scientist at MZA Associates Corp.

**Bruce H. Raup (EN 87)** has research interests quite unlike any of our other alumni: glacier dynamics and mass balance, and application of remote sensing techniques to their study. He is the primary designer and curator of the GLIMS Glacier Database and the GLIMS website. Bruce is also one of leaders of the programmer’s group.

After graduating from WU, Bruce received his M.Sc., Geological Sciences, at the University of Colorado at Boulder in 1995, with a thesis on "Implementation of Inter-Element Stress Coupling in a Finite Element Glacier Flow Model." For four years, he was a remote sensing research specialist, U.S. Geological Survey, Flagstaff, Arizona. Since 1999, he has been at the National Snow and Ice Data Center, University of Colorado, Boulder. In 2010, Bruce had a paper listed among the Top 50 Most Cited Articles in Computers and Geosciences, 2005-2009. Last year he received a Cires Outstanding Service Award (as part of Searchlight Team) and in 1989 the Mitutoyo Engineering Excellence Award. In 1987 he held a fellowship at the Inter-University Center for Japanese Language Study.

**Jeffrey N. Rouder (LA 88)** has been at the University of Missouri since 1999. Jeff and his wife, Becky Martinez, are professors of psychology and women studies, respectively. They have three children: Ben (age 12), Tomas (age 10), and Emily (age 7). The family enjoys traveling and camping. Jeff's research centers on statistical modeling of human memory and human perception, and his specialty is the development and application of Bayesian nonlinear mixed models. Most recently he has been advocating Bayes factor for inference and has received media attention for his Bayes-factor-based critique of claims of extrasensory perception. Jeff traces his current orientation in modeling to his physics training at Washington University.

**Patrick Len (LA 90)** went on to obtain his Ph.D. from the University of California-Davis in 1997. He has taught at UC-Davis, Sonoma State University, and Cosumnes River College. Since 2003, he has been teaching introductory astronomy and physics at Cuesta College, San Luis Obispo, California. His wife, Heather McElroy, is working as a research associate at Santa Cruz Biotechnology in Paso Robles, California. Patrick tells us that he is a guest moderator for the Center for Astronomy Education “Astrolrmer” listserv, a discussion group for improving college-level astronomy teaching and learning. http://astronomy101.jpl.nasa.gov/teaching-strategies

**Saveez Saffarian (GR 03)** and **Shanti Deemyad (GR 04)** are both assistant professors at the University of Utah. Saveez works on enveloped virus budding, while Shanti's research is in high-pressure phenomena in condensed matter.

**Christopher Aubin (GR 04)**, student of Professors Michael Ogilvie and Claude Bernard, has recently begun a tenure-track position as assistant professor at Fordham University in New York. He previously held postdoctoral research positions at Columbia University and the College of William and Mary.

**Yulin Chang (GR 06)** was a graduate student with Professor Mark Conradi, working on hyperpolarized-gas MRI of the lung. He is currently a scientist in the Department of Radiology at Washington University’s School of Medicine. He recently developed a model to quantify gas exchange in the lung, which explains the dynamics of dissolved hyperpolarized-xenon signals in lung tissue and blood. By fitting magnetic resonance data to this model, one can simultaneously quantify important lung parameters, including surface-area-to-volume ratio, air-blood barrier thickness, gas-exchange time constant, hematocrit, and capillary transit time of blood in the lung. This work is described in a preprint on arXiv (arXiv:1008.3961).

**Jon Bailey (GR 07)**, student of Professor Claude Bernard, has started a five-year position as a research scientist at Seoul National University in Korea. He was a postdoctoral researcher at Fermi National Accelerator Laboratory from 2007 to 2010.

**Manavi Jadhav (GR 09)** obtained her degree for her work on presolar graphite grains and worked for one year as a postdoc with Professor Ernst Zinner in the WU Department of Physics. She left at the end of August for a postdoctoral position at the University of Hawaii.

**Mew-Bing Wan (GR 09)** got a postdoctoral position in APCTP, Pohang, South Korea, working on numerical relativity. She spent one year in China as a postdoc before moving to Korea.

**Xining Du (GR 10)**, student of Professor Claude Bernard, has begun a postdoctoral position at the Laboratoire de Physique Subatomique et de Cosmologie (LPSC), Grenoble, France.

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