

# PHYSICS

Department of Physics Newsletter / 2013

## DEPARTMENT SAYS GOODBYE TO THREE LONGTIME PROFESSORS

Before the end of the 2011-2012 academic year, a celebration was held to recognize the years of dedicated service from three distinguished Department of Physics professors. Faculty, students and staff gathered to honor the careers, contributions and achievements of these individuals and wish them well in their future endeavors.

### **Clifford Will**

*Delivered by John W. Clark, Department of Physics, Washington University, April 19, 2012*

There are so many dimensions to Cliff Will's contributions to the department, to science, and to the physics community that I hardly know where to start.

Cliff is a world-class physicist in all respects. Early in his career he established himself as the world authority on experimental tests of Einstein's general relativity, a mastery represented in print by his classic monograph, "Theory and Experiment in Gravitational Physics," and his acclaimed popularization, *Was Einstein Right*, published in at least 11 languages.

Cliff's theoretical analysis of data on the binary pulsar discovered in 1974, which provided definitive, though indirect, evidence for the existence of gravitational waves, earned him an invitation to Stockholm in 1993 to celebrate the Nobel award to co-discoverers Hulse and Taylor.

Will is also the grand master of post-Newtonian approximations to General Relativity, expertise he has applied to the dynamics of inspiraling and merging binary systems of neutron stars or black holes, developing templates for comparison with signals to be detected by laser interferometric gravitational wave observatories such as LIGO and the proposed Earth-orbit interferometer LISA. Cliff also has been a leader in the planning of these grand ventures, as well as chairing the Science Advisory Committee for NASA's Gravity Probe-B (since 1998), which has confirmed the geodetic and frame-dragging effects predicted by Einstein's theory.

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### **Pat Gibbons**

*Delivered by Ken Kelton, Chair, Department of Physics, Washington University, April 19, 2012*

I've known Pat and his wife, Jane, from before I joined the faculty at Washington University. Pat was the chair of the search committee that recruited me in 1985.

Pat and Jane were the first to welcome us into their home for dinner when my wife, Emily, and I visited St. Louis in April 1985 on a house-hunting trip. I've watched their kids grow into adults, as they have watched mine. "Miss Jane" was my oldest son's pre-school teacher. We became and remain good friends to this day. I notice that Jane; their daughters, Jennie and Katy; and grandson, Dominic, are here today, and I would like to welcome you to the celebration.

As a bit of history, Pat received his PhD from Harvard, working with Norman Ramsey, who won the Nobel Prize in 1989 for the invention of the separated oscillatory fields method and its use in the hydrogen maser and other atomic clocks. Pat was an assistant professor in physics at Princeton from 1971-1976 before joining the faculty at Washington University in 1976.

I remember meeting Pat when I visited WUSTL in late 1984; at that time he was located in Crow Hall, where Jim Schilling currently has his lab. Based on our shared interest in



↑ Cliff Will (left), Pat Gibbons (center), Charles Hohenberg (right)

### **Charles Hohenberg**

*Delivered by Martin Israel, Department of Physics, Washington University, April 19, 2012*

Charles Hohenberg has been a valued member of this department since 1970, two years after he received his PhD from the University of California, Berkeley.

Charles is a superb experimental scientist who built here one of the world's best rare-gas mass spectrometer laboratories. He developed laser systems for extraction of noble gases from micron-sized grains, a vital tool for the study of meteorite inclusions, which has been a hallmark of the research on the fourth floor of Compton. He refined and proved the I-Xe dating system and utilized it to trace the evolution of the early solar system. He discovered the decay products of extinct isotopes,  $^{129}\text{I}$  and  $^{244}\text{Pu}$  in lunar and meteoritic material, demonstrating that our solar system includes material created in

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# FROM THE CHAIRPERSON

On June 30, 2012, Professor Ken Kelton completed his five-year tenure as the 10th chair of the Department of Physics, and I took over as the 11th chair. I feel fortunate to be stepping into this position at a time when the department is flourishing, and there are prospects for significant growth over the next few years.

- **Hiring.** Because of retirements, we are now seriously under-staffed. There will be a sustained push to hire new faculty to bring us back up to our target size of 29 tenured and tenure-track faculty.
- **Materials Institute.** A new Institute for Materials Science and Engineering (IMSE) is being established. It is a cross-disciplinary enterprise, involving the School of Engineering as well as the Departments of Physics and Chemistry, with Ken Kelton as its first director. The IMSE will accept its first graduate students in Fall 2013.
- **Building Renovation/Replacement.** The Department of Physics is significantly short of space. We need to hire five new faculty over the next few years who will be mostly experimentalists, but currently there is not enough space in the department to house their laboratories. In recognition of this problem, the university administration is already planning an Integrated Science Initiative (ISI). This is a projected re-organization of the Danforth Campus science buildings, with expansion and improvement of the physics and chemistry department buildings as one of its main goals. It is expected that a definite plan will be put into place by the middle of 2013.

With these long-term plans in mind, the department is also striving to better accomplish its core goals in more immediate ways. Dr. Kasey Wagoner, who was recently awarded his PhD after working in Professor Ram Cowsik's space science group, has joined our staff as a lecturer. He will overhaul our program of freshman physics laboratory experiments, which are a crucial component of our teaching but have remained unchanged for 30 years.

Professor Henric Krawczynski has agreed to step into the new position of director of undergraduate studies. His first task was to deal with a very welcome "problem": the rapid growth in the popularity of the physics major over the last few

years. Our average annual number of graduating seniors has grown from about 15 (pre-2008) to about 25, with fluctuations up to 30 or more. This puts a stress on our more advanced laboratory courses, and Henric is working to deal with the influx of physics majors.

Professor Claude Bernard has been appointed the new director of graduate studies. He is helping to introduce a new course, suggested and developed by Kasey Wagoner, that will give employment and career development training to graduate students, and lead them through the process of writing a grant proposal. The idea has been enthusiastically greeted by our graduate students, and we look forward to the rollout of this course in Fall 2013.

Our faculty have continued to be recognized for their contributions to science. Professor Stuart Solin and Professor Emeritus Michael Friedlander received an Outstanding Scientist Educator Award from the Academy of Science-St. Louis. Professor Ernst Zinner was elected fellow of the American Association for the Advancement of Science, and Professor Jonathan Katz was elected to the Fellowship of the American Physical Society. Zohar Nussinov was promoted to the rank of associate professor and Christine Floss to the rank of full research professor. One of our graduate students, Evan Groopman, received a NASA Earth and Space Science Fellowship.

On becoming chairman, I quickly learned the importance of the staff who run the department on a day-to-day basis. Many of them have been with us for decades. Two in particular — Stan Crone, demonstration technician, who builds and maintains demonstrations for our undergraduate courses, and Paul Dowkontt, electrical engineer and research associate, whose work is crucial to the cosmic ray group. They each received a silver platter from the chancellor in recognition of their 25 years of service. I feel very lucky that our staff have an ethic of helpfulness and diligence that matches their length of service.



↑ Mark Alford

Speaking of years of dedicated service, three valued members of the faculty have retired: Professors Charles Hohenberg, Pat Gibbons, and Cliff Will. Elsewhere in this newsletter there are full-length descriptions of their many contributions.

Very briefly, Charles Hohenberg joined the department in 1970 and put together a world-class research group in cosmochemistry, which studied samples of moon rock and interplanetary dust in order to understand the early history and origins of the solar system. He is also a major benefactor of the university: he endowed the Hohenberg Professorship of Experimental Physics, a position currently held by Professor Stuart Solin.

Pat Gibbons came to Washington University in 1976 and played an important role in the development of electron microscopy in the department. He collaborated closely in research with Professors Ken Kelton, Tom Bernatowicz, and William Buhro (chemistry), and became the guiding force behind our undergraduate education and outreach programs.

Cliff Will became one of our most prominent faculty members, a world authority on experimental tests of Einstein's general relativity, a member of the National Academy of Sciences and author of the highly popular book *Was Einstein Right? Putting General Relativity To The Test*. He was also department chairman from 1991 to 2002. All three will be greatly missed, although we hope that they will remain involved in department life.

Finally, the new opportunities and positive developments for the department in the year ahead are accompanied by some challenges. We depend heavily on income from research grants, and as I write this, there is great uncertainty about how much funding Congress will provide to government agencies. This will affect us regardless of how good our science is. Nevertheless, I am confident in the longer-term opportunities for renewal and growth of our department, both from a faculty and facilities viewpoint. I look forward with optimism and excitement to my five years as chairman of the department.

– **Mark Alford**

Chair, Department of Physics  
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## OUTREACH COMMITTEE GETS KIDS EXCITED ABOUT PHYSICS

The 2011-2012 academic year was another busy and productive one for the Physics Outreach committee. We continued our involvement in a variety of programs and started a few new ventures. Our activities targeted a large and diverse audience. Once again we hosted a section of St. Louis' Women in Science Day with great success. We continued our association with the Young Scientists Program, participating in many of their activities. This year also brought the St. Louis Area Physics Test to Washington University for the first time.

Women in Science Day is a national event that promotes science of all disciplines to high school-age girls. For the past five years, Washington University has brought about 200 high school girls to campus to show them the possibilities that science holds. For the past four years, our outreach committee has participated in this event. Once again, the physics section was the favorite of the visiting girls!

The Young Scientists Program (YSP), run out of the medical school, aims to bring science to inner city students in the St. Louis area. YSP has a variety of innovative programs, many of which our volunteers provided support for over the past year. The Physics Teaching Team, headed by one of our volunteers, visited two different St. Louis city schools doing demonstrations and leading activities. In addition to the teaching team, our volunteers contributed to the Summer Focus and Teacher-Researcher Partnership programs.

Every year a group of St. Louis-area high school teachers produce an exam that is taken by more than 100 local students. The exam challenges students' physics knowledge outside



↑ Clayton High School won the team competition in the 27th Annual St. Louis Area Physics Test. Here they are pictured with their Mechanics and AP Physics teachers. Also pictured are David Schuster and Pat Gibbons. Schuster, an alumnus of our department, headed the committee of area high school teachers organizing the exam. Together with Schuster, Gibbons presented awards to the top-scoring students on behalf of the physics outreach committee.

of their normal classroom setting, with a set of peers larger than they are used to. In 2012 Washington University alumnus David Schuster joined the group of teachers organizing the exam. Schuster contacted our committee initiating an instant partnership, which brought the exam to Washington University from the metro-east area. The success of this year's exam is a promising sign, and we are hopeful that the increased involvement of our committee will allow the exam to grow to new heights.

In addition to the events and programs described above, our volunteers have participated in multiple one-time events. These events include demonstrations on topics that varied from renewable energy to thermal physics.

Our committee has laid the foundation for a strong outreach program. However, we feel that there is a lot of room to grow. We welcome the new leadership of Professor Jim Buckley and are excited about what the future holds with this combination of experience and new ideas. We have many interests we would love to explore, given time and volunteers. If you are interested or curious about our programs, please contact us!

## STAFF RECOGNITION

### 25 YEAR ANNIVERSARIES

Each year, Washington University takes special note of staff members who have been at the university for 25 years. In 2012, Stan Crone and Paul Dowkontt were honored. Stan is our demonstration technician in charge of the demonstration equipment used in many introductory courses. Paul is an electrical engineer and research associate in the Cosmic Ray Group. [news.wustl.edu/news/Pages/23713.aspx](http://news.wustl.edu/news/Pages/23713.aspx)

### ANNUAL A&S OUTSTANDING STAFF AWARDS

The following individuals from the Physics department have received this award:

John Epstein 2001-02

Christine Monteith 2007-08

Tony Biondo 2002-03

Debbie Barco 2007-08

Julia Hamilton 2004-05

Tim Smolar 2009-10

Sarah Jordan 2006-07

# GROUP REPORTS

## RHEOLOGY OF SUSPENSIONS AND SOFT MATTER

During 2011-2012, in collaboration with Professor James G. Miller of the Washington University Laboratory for Ultrasonics, Dr. Ben Johnson, graduate students Michelle Milne and Amber Nelson, undergraduate Hannah Sieber, and prospective graduate student Joel Groman, Professor **Jonathan Katz** began developing an experimental program in the rheology of suspensions and soft matter. This follows his work on the use of corn starch suspensions as possible oil well kill fluids (described in the 2010-2011 newsletter). A portion of this effort concerns the rheology of these suspensions. For example, we are trying to determine why aqueous suspensions of corn starch show the striking phenomenon of discontinuous shear thickening (familiar to children), while most other suspensions, including oil suspensions of corn starch, show shear thinning. This is being pursued with rheological measurements of oil suspensions, both confined and unconfined, to determine if the difference is a consequence of the different surface interactions of starch granules with oil and water. In addition, apparatus is being developed to measure the structure factor (spatial distribution) of granules in sheared suspensions using scattering of ultrasound, whose wavelengths are matched to the sizes and spacing of the granules. This microstructure determines the rheological properties of the suspensions and is difficult to probe in any other manner.

2011 marked the 25th anniversary of the publication of a paper by Katz in the *Journal of Geophysical Research* (V. 91, p. 10412) that introduced a model for brittle fracture that has since been applied to a broad range of scientific problems under the name “Self-Organized Criticality” (a name given by Per Bak, a later worker on this problem).

In 2012 Turyshev, et al. of the Jet Propulsion Laboratory confirmed (*Physical Review Letters* V. 108, p. 241101) the explanation of the “Pioneer Anomaly” (a mysterious acceleration of the Pioneer spacecraft) as the effect of recoil of the momentum of thermal radiation emitted by the spacecraft. Professor Katz offered this hypothesis in 1999 (*Physical Review Letters* V. 83, p. 1892).

## RESEARCH IN JAMES SCHILLING'S GROUP

Former student James Hamlin accepted a tenure-track assistant professor position at the University of Florida beginning Fall 2012.

Former student Shanti Deemyad accepted in January 2010 a tenure-track assistant professor position at the University of Utah. In June 2012, she attended the Gordon Conference on “Research at High Pressure” and was elected by the 140 participants present to chair this meeting in June 2016 and will become vice chair in 2014 — quite an honor for such a young researcher.

Graduate student Wenli Bi defended her PhD thesis in May 2011, had a baby in August 2011 and began a postdoc position at the APS synchrotron in the Argonne National Labs in November 2011.

Graduate student Narelle Hillier presented a poster at the Gordon Conference on “Research at High Pressure” in June 2012.

Postdoc Neda Foroozani presented a poster at the M2S 2012 Conference on “Materials & Mechanisms of Superconductivity.”

Professor **James Schilling** gave an Invited Talk at the M2S 2012 Conference on “Materials & Mechanisms of Superconductivity.”

## METALLIC LIQUIDS TO GLASSES — RESEARCH IN KEN KELTON'S GROUP

Over the past four years Professor **Ken Kelton's** group has developed a novel facility (a Beamline Electrostatic Levitator, or BESL) that enables X-ray diffraction studies to be made on high temperature liquids without the requirement of a container for the liquids. Working with this facility at the Advanced Photon Source, they have collected diffraction data as a function of temperature from more than 100 different equilibrium and supercooled liquid alloys. Over the past three years, they have extended the capabilities of BESL to allow measurements of the liquid densities, thermal expansion coefficients, and viscosities. These data are being correlated with the diffraction data to gain a deeper understanding of the connection between liquid structure and physical properties. Supported by an NSF-MRI grant, Kelton's group is constructing a neutron levitator (NESL) that will be installed at the Spallation Neutron Source located at Oak Ridge

National Laboratory. NESL will provide new structural information and will allow chemical ordering and atomic mobilities to be probed. Developing a better understanding of glass formation and crystal nucleation is a central theme in this group. They have measured the first correlation between high temperature liquid expansivity and glass formability; these data have also led to a deeper understanding of the energy landscape of liquids and a concept called liquid fragility. To measure other liquid properties and the coupling of diffusion in the liquid to crystal nucleation, Kelton has two experimental alloys that will be studied on the International Space Station in 2014. The ground-based work for those experiments is under way.

This research activity is supported by a large group of graduate students, post-graduate research scientists and collaborators. Members of Kelton's research group are Dr. Anup Gangopadhyay and Dr. Nick Mauro; graduate students James Bendert, Matt Blodgett, Kevin Derendorf, Jennifer Gewin, Mark Johnson, Chris Pueblo, and Adam Vogt; and undergraduates Walter Fu, Zack Markow, Corrie Miller, and Sirish Veligati. Collaborators include Professors Pat Gibbons, Zohar Nussinov, and Li Yang from Washington University; Dieter Herlach (DLR, Cologne, Germany); Takeshi Egami (University of Tennessee and Oak Ridge National Laboratory); Alan Goldman (Iowa State University); Robert Hyers (University of Massachusetts, Amherst); and Evan Ma (Johns Hopkins University).

## LABORATORY FOR ULTRASONICS

Ben Johnson recently completed his PhD dissertation under the guidance of **Jim Miller**, **Mark Holland**, and Jonathan Katz. The subject of Ben Johnson's dissertation was the ultrasonic properties of shear thickening aqueous suspensions of corn starch, media that Katz has identified as a possible component of a fluid to plug runaway oil wells. Johnson, remaining in the laboratory as a postdoctoral scientist, continued his experimental effort using ultrasonic scattering to determine the internal structure of these suspensions and will study their flow into other fluids. In a project to determine why aqueous suspensions of starches have the familiar and remarkable property (known to schoolchildren) of discontinuous shear thickening, undergraduate Hannah Sieber measured the properties of oil suspensions of corn starch and prospective

graduate student Joel Groman measured the shear thickening of aqueous suspensions of a variety of starches with differing grain sizes. Graduate student Amber Nelson and research associate Michelle Milne each gave oral presentations at the 37th International Ultrasonic Imaging and Tissue Characterization symposium in Washington, D.C. Amber Nelson and Mark Holland gave oral presentations at the IEEE International Ultrasonics Symposium in Orlando. Michelle Milne, Phil Levy and Mark Holland gave oral presentations at the annual American Institute of Ultrasound in Medicine convention in Phoenix. Jim Miller and Amber Nelson each gave oral presenta-

tions in Hong Kong at a joint meeting of the Acoustical Society of America and several Asia-Pacific Acoustical Societies. Mark Holland presented an oral presentation at the annual Scientific Sessions of the American Society of Echocardiography meeting in June 2012 and gave an invited seminar describing the group's cardiovascular research efforts at UCSD in April. Alumnus Joe Hoffman, who stayed on with the Laboratory for Ultrasonics as a research associate after completing his PhD thesis in 2011, has joined Volcano, Inc. as a staff scientist working on the physics of intravascular ultrasound. Sandor Kovacs, PhD, MD, continues to be an active collaborator on research projects as

well as a guest lecturer in Physics of the Heart (Physics 314) and the Advanced Ultrasonics Seminar (Physics 589-590). Enrollment in Physics of the Heart continues high, with 69 students registered for the Spring 2012 class. Mark Holland and Jim Miller continue to be very active in the American Institute of Ultrasound in Medicine (AIUM), with Mark Holland completing his term in 2012 as an elected member of the Board of Directors. Jim Miller began his two-year term as chair of the Basic Science and Instrumentation section of that organization.

## CLIFF WILL — *continued from page 1*

Certainly, Cliff's organizational contributions to the wider physics community, especially in astrophysics and astronomy, have been prodigious. He has served on dozens of working groups and committees, notably for NAS/NRC, NSF, NASA, APS, and AAPT. Importantly, he has served on a sequence of NAS committees charged with assessing and planning research development in gravitational physics and astrophysics, most recently the ASTRO 2010 Decadal Survey. A salient early example is his national service during the mid-'80s as chair of the committee on Accuracy of Time Transfer in Satellite Systems for the Air Force Studies Board and NRC — you can guess that his expertise in relativistic effects made him an ideal choice.

Cliff's superb writing skills also make him a natural choice for editorial responsibilities, which have been numerous, involving the most prominent of physics journals: *Physical Review Letters*, *Reviews of Modern Physics*, *Physical Review D* and *Annals of Physics*. Currently, Cliff is chair-elect of the APS Division of Astrophysics, serving a four-year term on the chair line. Previously, he was chair of the APS Topical Group on Gravitation.

I think we can all appreciate why Cliff achieved the supreme honor of election to the National Academy of Sciences — among many other high marks of recognition.

Cliff is unsurpassed as a lecturer who can enthrall both sophisticated physics audiences and the public. During the World Year of Physics in 2005, Cliff was virtually ubiquitous in spreading excitement for physics and Einstein's world view. In effect, he also spread the word that Washington University must be a great place if it has someone like Cliff on its faculty and that WUSTL is not in D.C. or in Washington State. I may not exaggerate if I say that Cliff is responsible for several upticks on WUSTL's ranking on the Shanghai evaluation of world universities.

Here at home, Cliff built a thriving group working in both analytical and numerical general relativity (WUGrav), putting Washington University on the map as a major international node of gravitational theory. His scientific progeny, and those of his colleague Wai-Mo Suen, have spread the influence of WUGrav throughout the worldwide network of gravity research. Sadly, with Cliff's departure, our department's future in this vital area of physics is uncertain.

My own interactions with Cliff were strongest during the period 1996-2002. Having completed the first of two five-year terms as chair of our department, Cliff took a sabbatical leave in 1996-97, during which I filled in for him as chair. I thought, just one year — it can't be all that bad.



↑ John Clark (left) and retiree Cliff Will (right)

And it wasn't all that bad. Thanks to Cliff's vastly superior organizational skills (vastly superior to mine), most aspects of the department's affairs operated smoothly without much worry on my part, and I could focus on moving forward toward the ambitious goals of the planning document *Physics 2000* that Cliff had fostered. Most importantly, this involved working with then Dean Ed Macias toward faculty renewal during a period of numerous retirements, an activity with which I continued to be engaged with Cliff and others during Cliff's second five-year term as chair, and afterwards during my own term as chair starting in 2002. During this extended period, I came to appreciate the profound and lasting impact of Cliff's dedicated efforts toward raising the stature of our department to a qualitatively higher level. For this he deserves both our admiration and out lasting gratitude.

It should be no surprise that the University of Florida was happy to give Cliff Will an offer he couldn't refuse (but a benevolent one). So Cliff is departing from us for pastures that may not be greener (except in the color of the dollar) but are certainly sandier and sunnier, and with grandchildren nearby in the bargain. We wish you and Leslie well, and we will miss you. Thank you for all the good things you have done for us these 30 years!

## FACULTY AWARDS AND RECOGNITION

**Jonathan Katz** was elected to Fellowship of the American Physical Society in the Forum on Physics and Society, “for his significant and wide-ranging physics analyses at the interface of science and society, including nuclear weapons policy and the killing of oil-well blow-outs.”

The Academy of Science-St. Louis presented the 18th Annual Outstanding St. Louis Scientists Awards on April 19, 2012. **Michael Friedlander** received the Science Educator Award and **Stuart Solin** received the James B. Eads Award.

“For more than four decades, Michael has played a major role in science education. Since 1994, each semester he has organized a series of four Saturday Science public lectures. Beyond the region, Michael has been an influence for science understanding nationally with five books published, all well written for the general public. The two published by Harvard

University Press describe the history of the study of cosmic rays and what is now known about these energetic particles — an area of astrophysics to which he has contributed significant original research.”

“Professor Stuart Solin is internationally recognized for his significant discoveries in Condensed Matter Physics and the Nano sciences. As inventor of the Extraordinary Magnetoresistance (EMR) sensor device concept, he has seeded a hugely important area of research that has now been taken up extensively by industry around the globe. This work was selected by the American Physical Society as one of the most important research achievements in physics in 2002. It has the capacity to revolutionize high density data storage and retrieval in computers as well as a number of other disciplines and technologies. Professor Solin has already developed nano arrays of his new sensors for biological and medical applica-

tions such as ultra high resolution imaging of cancer cells. He and his Washington University medical collaborator Professor Sam Wickline have co-founded a Chicago-based start-up company, PixelEXX Systems, Inc., to market these nano arrays for clinical applications. Professor Solin has published over 270 peer-reviewed scientific articles and is a co-inventor on 17 U.S. and international patents.”

In November 2011 **Ernst Zinner** was elected fellow of the American Association for the Advancement of Science (AAAS) for his “pioneering cosmochemical work in discovering and characterizing presolar grains, particles formed in the outflows of evolved stars and found inside primitive meteorites.” He received a certificate and a blue and gold rosette in February 2012 during the AAAS Annual Meeting in Vancouver, Canada. See [news.wustl.edu/news/Pages/23104.aspx](http://news.wustl.edu/news/Pages/23104.aspx)

### PAT GIBBONS — *continued from page 1*

electron microscopy, and with help from Bob Walker, the founder of the McDonnell Center for the Space Sciences, we convinced the dean of Arts & Sciences to purchase a JEOL 2000 FX Transmission Electron Microscope (TEM), which is located in Compton 156. This TEM has been and continues to be a key instrument for condensed matter research in the physics and chemistry departments, both on terrestrial and extra-terrestrial materials. It served as a catalyst for my 20-year-plus collaboration with Pat on the structures of quasicrystals.

Pat is a good friend and collaborator. He has wide-ranging interests and loves to work with others. Together, we worked to develop a world-class effort in the study of the structure of quasicrystals, a novel phase of condensed matter reported in late 1984 by Dan Shechtman. Dan was awarded the Nobel Prize in chemistry for that discovery. Pat and I jointly organized and hosted at Washington University the 4th International Conference on Quasicrystals in 1992. While my research is no longer centered on quasicrystals, Pat continues to attend some of my group meetings, engages in discussions of our current studies of amorphous metals and helps my students when they run into problems. Over the years he has also collaborated closely with Tom Bernatowicz on extra-terrestrial materials, with Bill Buhro (chemistry) on nanoparticles and nanostructured materials, and with Jim Buckley and Dan Leopold, with whom I understand he may be developing a new collaboration.

Pat has also always been keenly interested in the question of how best to teach physics. He designed, developed, and taught our undergraduate electronics lab in the late 1970s. For years he has worked with secondary school teachers to strengthen their understanding of science and to help them learn how to convey the excitement of science to secondary school students. He has written several articles on this topic and has a book on study keys to physics. When I noticed the graduate student interest in outreach during my first year as department chair, I knew who to turn to when I wanted to create an outreach committee. As usual, Pat was more than willing to step up to the plate; his efforts have been central in creat-



↑ Retiree Pat Gibbons (left) and Ken Kelton (right)

ing the vibrant outreach effort that we now have. This is not only important for helping secondary teachers and students, but also for teaching our graduate students how important it is to share their enthusiasm for science and to share science with the public.

Pat is a helper, a facilitator, and a mentor. He plans to continue this, helping with undergraduate mentoring and advising for example. For over 10 years, Pat has participated in Habitat for Humanity, working on the site and co-leading new building efforts. Next year, he will be a co-leader for the construction of a new house just north of Olive Boulevard in University City, working as always to help others.

Pat — thank you for your many years of service. Your presence in the physics department has helped to develop and build it into what it is today. On behalf of the department, I want to give you this gift as small memento of our appreciation for your many years of service.

## SPECIAL EVENTS IN THE PAST YEAR

### Saturday Science

The Department's Saturday Science series of popular lectures continues. We have a loyal and enthusiastic audience of 150 to 200 every week. As usual, our speakers included colleagues who have lectured many times as well as some who were new to this series.

### Fall 2011: The Fundamental Constants in Nature

Physics has made progress through the discovery of laws that describe many processes in nature. The mathematical shape of each law is based on experiments and describes the ways in which various quantities are related. For example, Newton's law of gravitation describes the force of attraction between two masses and their distance apart. We need the gravitational constant "G" to complete the law. What about other "constants" that we use in other laws? Why are these constants fundamental? How have they been measured? How do we know that the values of these constants do not change over time?

Cliff Will: Big G: The constant that controls the universe, and why it's so hard to measure

Alexander Seidel: Planck's constant — The constant that quantized the world

John Rigden: The Universal and Mysterious Fine Structure Constant

Francesc Ferrer: "c" — More than just a speed limit: the glue between space and time

### Spring 2012: Great Experiments in Physics

The two parallel avenues for progress in physics continue to be the experimental and the theoretical. At some times, courageous theories yield predictions for experiments that can disprove or can validate those theories or perhaps prove indecisive. At other times, the sequence is the reverse — unexpected discoveries lead to theories that often require fundamental re-thinking of our ideas of order in the universe. Some experiments are well known outside physics, but this semester's lectures will cover experiments that are less well known.

Martin Israel: The Discovery of Cosmic Rays and What They Are

Michael Ogilvie: The LHC and the Search for the Higgs

John S. Rigden: The Lamb Shift: A Great Experiment With Consequences

Ramanath Cowsik: The Ingenious Experiments of Baron Roland von Eötvös

### McDonnell Center for the Space Sciences

The 2012 McDonnell Distinguished Lecturer was Professor Clifford M. Will, Department of Physics, Washington University in St. Louis. Will delivered a colloquium on Wednesday, April 1, 2012, "Testing General Relativity in the Strong-Field Dynamical Regime" and a public lecture on Thursday, April 12, 2012, "Black Holes, Waves of Gravity, and other Warped Ideas of Dr. Einstein."

"Testing General Relativity in the Strong-Field Dynamical Regime"

General relativity has been well-tested in the weak-field slow-motion regime of the solar system. In binary pulsar systems, some tests of strong-field aspects of the theory have been carried out. In the future, testing GR in the strong-field, highly dynamical regime will be an important theme in experimental relativity. We describe a number of possible tests that could be carried out, including tests using astrophysical phenomena around black holes, tests using gravitational waves, and tests of black hole no-hair theorems using high-precision observations of stars orbiting our galactic center black hole.

"Black Holes, Waves of Gravity, and other Warped Ideas of Dr. Einstein"

Einstein's theories of relativity have had a major impact on everything from popular culture to everyday life to basic science. Songs, plays, and movies proclaim Einstein as the symbol of genius, while users of GPS navigation devices unknowingly take account of Einstein's relativistic warpage of time. Two of the crazier ideas that come from Einstein's theories are Gravitational Waves and the Black Hole. Today, international teams of scientists have embarked on a quest to verify these ideas. Building and operating large-scale detectors on the ground, and designing space-based detectors for the future, they hope to detect and measure the waves, and to use those wave signals to reveal the hidden secrets of black holes.

## CHARLES HOHENBERG — *continued from page 1*

nearby supernovae not long before the solar system formed. He measured spallation-produced  $^{21}\text{Ne}$  from enhanced particle irradiation as the Sun passed through an energetic T-Tauri phase as it contracts onto the main sequence, the first direct evidence for an early T-Tauri Sun.

He has been funded continuously for his research here for 42 years — from research on lunar samples, to meteorite grains, to recent studies of material returned to Earth from the probes Genesis and Stardust.

NASA has frequently called on Charles to serve as a member of many planning teams and panels, including the Lunar & Planetary Sample Team and the Cosmochemistry Review Panel, both of which he chaired for a year, and the Mission Science Teams for both the Genesis and Stardust missions.

Throughout his time here, Charles has had a steady stream of excellent graduate students, some of whom are now in important leadership positions at other universities or government laboratories.

Charles has been a mainstay of this department's teaching of undergraduates in the basic course Physics 117-118. He probably has taught that course more often than anyone else in recent years.

Finally, we must acknowledge that Charles has been a generous benefactor of this department. His gift to the university has given us the endowed



↑ Retiree Charles Hohenberg (left) and Marty Israel (right)

Hohenberg Professor of Experimental Physics, a position currently held by our colleague Stuart Solin. Of course, that endowed position will benefit this department into the distant future, reminding generations of faculty and students of the important mark that Charles has left on Washington University.

We wish Charles well on his retirement, and we are glad to know that although he is officially retired, he intends to continue an active involvement in the research programs of the space sciences group.

# FACULTY NEWS

During 2011-2012, **Carl Bender** visited King's College London on sabbatical. He is supported in part by a fellowship from the UK Leverhulme Foundation.

During 2011, Bender published seven research papers in refereed journals, and so far he has published two papers in 2012. Ten more papers have been completed and submitted for publication, and there are many additional papers in various stages of preparation.

Bender presented invited plenary talks at 10 international meetings and gave many invited seminars and colloquia at universities. He presented 15 lectures at the Perimeter Institute in Waterloo, Ontario, Canada, where he has been a yearly invited lecturer, and he lectured at the University of Heidelberg in Germany, which he visits several times a year and where he holds a joint professorship position. Bender also gives a yearly invited mini-course course in theoretical physics in the MSc program at Imperial College in London.

There were several major conferences on PT quantum mechanics, a rapidly growing research area that Bender began in 1998. In 2011 there was a large meeting in Dresden and in 2012 a similar meeting in Paris. Bender also organized a select high-level meeting (30 invited speakers) on PT quantum mechanics in Heidelberg in 2011. There are now many research groups around the world in places such as Yale, Cal Tech, Florida, and at universities in Israel, China, and Germany, where experiments are being performed that validate the predictions of the theory. Dozens of experimental papers have been published in *Physical Review Letters*, *Science*, and *Nature Physics*. Bender has also performed a successful experiment himself at Kings College and a second experiment is in the planning stages. Currently, Bender is editing two different special issues on PT quantum mechanics, one for the *Journal of Physics A* and the other for *Philosophical Transactions A* (Royal Society).

**Christine Floss** was promoted to the rank of full research professor.

During 2011-2012, **Michael Friedlander** has continued with his volunteer work in the department including organization of the Saturday Science lectures that remain very popular. In April 2012, the Academy of Science–St. Louis recognized the importance and success of these lectures and honored Friedlander with one of its annual Outstanding Scientist Educator Awards.

The centenary of the discovery of cosmic rays is being celebrated in many ways during 2012. Friedlander was invited by *Nature* to write a commentary, which has appeared in its March 22 issue (Vol. 483, pp. 400-401). This essay provided a broad overview of the contributions of cosmic ray research to the establishment of the field of particle physics and the expansion of this research into many areas of modern astrophysics.

Friedlander has also been invited to deliver a lecture on the *Birth of Particle Physics* in the opening session of the *Centenary Symposium 2012: Discovery of Cosmic Rays*, to be held in Denver in June. Papers will be presented that describe the cosmic-ray discoveries that opened up several research areas and also survey their current status.

Friedlander continues to chair the university committee that selects the Compton and Ferguson Lecturers each year. The Ferguson bequest supports these two lectures for which distinguished scientists are invited to deliver major popular lectures, which are part of the Assembly Series. During 2011-2012, the lecturers were Richard Mueller (“Global Warming”) and Dudley Herschbach (“The IgNobel Prizes”).

Each fall, the Department of Anthropology offers a course on the Cahokia civilization, and Friedlander is invited to give a lecture on the “Woodhenge” that dates to around 1200 CE.

The Alumni News section of the Department of Physics’ annual newsletter continues to be very popular with our readers. Friedlander maintains contact with many physics alumni, providing the material for this news column. The department has over 900 living alumni, and Friedlander has corresponded with close to half of them.

**Patrick Gibbons**, in addition to teaching undergraduate physics students, participated in presentations about effective teaching of science to K-12 teachers. At Interface 2012 in February, a meeting for Missouri K-12 teachers, Pat, John F. (Jack) Wieggers, from WUSTL Institute for School Partnership, and Ann McMahon presented a workshop on force and motion. At the National Science Teachers Association annual meeting in Indianapolis in 2012, Pat, Jack, and Ann made one-hour presentations on astronomy, on forces and motion, and on engaging K-12 students in engineering design in their classrooms. In July, there was a three-day workshop in biology for middle- and high-

school teachers of physical science. With presenters from School Specialty Science, Pat and Jack present activities for learning solar-system astronomy.

In April 2012, Pat and recent physics PhD **Kasey Wagner** hosted in Compton and Crow a Saturday physics contest organized for high-school students. The Institute for School Partnership supported it, providing prize money. WUSTL physics PhD David Schuster and other members of St. Louis Area Physics Teachers organized and ran the contest. St. Louis Area Physics Teachers is the greater St. Louis local chapter of the American Association of Physics Teachers.

**Zohar Nussinov** was promoted to the rank of associate professor.

**Michael C. Ogilvie** spent three weeks in Beijing during summer 2011 at the Kavli Institute for Theoretical Physics China as part of a program on “Critical behavior of lattice models in atomic and molecular, condensed matter and particle physics.” While at the KITPC, he lectured on recent developments in the theory of quark confinement.

**Clifford Will** returned from his sabbatical in Paris, France, in the fall of 2011, and began preparations to move from WUSTL to the University of Florida, Gainesville, at the end of AY 2011-12, where he will take a position as Distinguished Professor of Physics. He will join the large gravitational physics group there, which includes experimentalists working on the optical systems for the Advanced Laser Interferometric Gravitational-Wave Observatories (LIGO) and theorists working on the implications of general relativity in astrophysics. He will formally become McDonnell Professor of Space Sciences Emeritus at WUSTL. The arrangement with UF allows him to continue to spend five months per year at the Institute of Astrophysics in Paris, where he has been a regular visiting *chercheur associé* for many years.

In July 2011, Will began a two-year term on the Space Studies Board, a committee of the National Academy of Sciences that advises the federal government and its agencies on all aspects of the use of space. Among other activities, the SSB sponsors decadal surveys in relevant areas, most recently, the decadal surveys of astronomy and astrophysics (ASTRO 2010), planetary science and heliophysics.

As chair-elect of the Division of Astrophysics of the APS, he was in charge of organizing the invited talks in astrophysics at the APS meeting held in Atlanta in April 2012. At that meeting he ascended to the role of chair of the DAP, wresting temporary control from the tyranny of the Chicago mob — his predecessors were Mike Turner and Rocky Kolb, and his successor will be Angela Olinto — proving that even St. Louisans can play Windy City-style politics. He began his fourth year as editor-in-chief of *Classical and Quantum Gravity*. In a feat of product placement, CQG made a cameo appearance in the CBS award-winning sitcom *The Big Bang Theory*. In season 5, episode 15, entitled “The Friendship Contraction,” just after the opening

credits, Leonard can be seen putting a copy of CQG into his backpack while in the Caltech cafeteria.

During the year, Will gave a number of public lectures on gravity around St. Louis, including a talk on measuring “big G” at the Saturday Science series; a lecture on the search for gravity waves at the Science Snippets course, and the annual Larry Jasper Lecture, both sponsored by the Lifelong Learning Program; a lecture on Einstein’s warped ideas for Science on Tap at the Schlafly Brewery (where the audience seemed strangely more enthusiastic than the average group); and finally the annual McDonnell Public Lecture.

In October 2011, **Ernst Zinner** spent two weeks as invited visitor at the University of Perugia, Italy. He presented two colloquium talks. He received a three-year NASA grant for the study of supernova dust grains in the laboratory. See [news.wustl.edu/news/Pages/23097.aspx](http://news.wustl.edu/news/Pages/23097.aspx).

He organized the Annual Workshop on Presolar Grains, which took place in the physics department on January 28-29, 2012. It was sponsored by the McDonnell Center for the Space Sciences and its director, Professor Ramanath Cowsik, presented the introduction. Forty-six participants from 14 institutions and five countries attended the workshop.

## STUDENT NEWS

### GRADUATE STUDENTS

The following students have received their PhD degrees. Their thesis titles, faculty advisors and current position (if known) are listed as well.

**Jerrad Martin**, “Optimization Studies for the Cobra Neutrinoless Double-Beta Decay Experiment and Results from a Prototype,” April 20, 2012 (Professor Krawczynski), SADAR 3D (Research and Applications Scientist)

**Simin Mahmoodifar**, “Probing the Phases of Cold Ultra-Dense Matter Using Neutron Physics,” April 20, 2012 (Professor Alford), University of Maryland – Department of Physics (postdoc)

**David Morton**, “The Automation of Electrophysiological Experiments and Data Analysis,” April 24, 2012 (Professor Wessel), The Genome Institute, Washington University Medical School (Programmer/Analyst)

**Adam James Hajari**, “Studies of Lung Micromechanics via Hyperpolarized  $^3\text{He}$  Diffusion NMR,” April 25, 2012 (Professor Woods)

**Dihui Lai**, “Information Processing in a Midbrain Visual Pathway,” April 27, 2012 (Professor Wessel), University of Maryland (postdoc)

**Wei Wang**, “Micro-Imaging of the Mouse Lung Via NMR,” April 27, 2012 (Professor Woods), Harvard Medical School (postdoc)

**Kelly A. Lave**, “The Interstellar Transport of Galactic Cosmic Rays,” May 3, 2012 (Professor Israel)

**Benjamin L. Johnson**, “Ultrasonic Characterization of Shear Thickening Suspensions,” May 4, 2012 (Professor Miller) Towers Watson, Clayton, Missouri (Actuarial Analyst)

**Hiromichi Nishimura**, “Phase Structure of Gauge Theories on  $R^3 \times S^1$ ,” May 4, 2012 (Professor Ogilvie), Bielefeld University, Bielefeld, Germany (postdoc)

**Saurish Chakrabarty**, “Microstructure of Systems with Competition,” May 15, 2012 (Professor Zohar Nussinov), Indian Institute of Science, Bangalore, India (postdoc)

**John Flavin**, “Effective 1D Language for Fractional Quantum Hall States,” May 30, 2012 (Professor Seidel), SADAR 3D (Research and Applications Scientist)

**Dandan Hu**, “The Statistical Mechanics of the Community Detection Problem, Theory and Application,” June 18, 2012 (Professor Nussinov), Halliburton (Sr. Petro Application Engineer)

**Michael Desantis**, “Image Deconvolution Techniques for Single Molecule Studies,” June 18, 2012 (Professor Wang), University of Michigan (postdoc)

**Patrick G. Johnson**, “Pattern Formation in Certain Classical and Quantum Systems,” July 9, 2012 (Professor Nussinov), William Jewell College, Liberty, Missouri (visiting assistant professor)

**Steven McArthur**, “Investigation of Energy-Dependent Morphology in Pulsar Wind Nebulae,” August 20, 2012 (Professor Buckley), University of Chicago (postdoc)

**Xiaoqi Wang**, “The qBOLD MR Model: Uncertainty in Parameter Estimation, Inclusion of Multiple Compartments and Correction of Macroscopic-Field-Inhomogeneity Effects,” September 10, 2012 (Professor Conradi), Phillips, (MR Clinical Applications Development Scientist)

**Sarah Thibadeau**, “Time-Dependent Studies of High-Energy Radiation from Blazars,” September 19, 2012 (Professor Krawczynski)

**Lingzhi Hu**, “New MRI Techniques for Nanoparticle Based Functional and Molecular Imaging,” November 1, 2012 (Dr. Wickline), Phillips, Research Scientist

### 2012 Seniors

Seventeen seniors graduated in May 2012:

**Daniel Cole**

**Alexander Drake**

**Daniel Dutcher**

**Austin Ekaireb**

**Jacob Friedlein**

**Clark Ice**

**Michael Ingber**

**Ross Ladau**

**Alison Onken**

**Nicholas Orlofsky**

**Jeremy Rose**

**Gryte Satas**

**Mark Sholte**

**Anthony Sommer**

**Srun Sosothikul**

**Katherine Thomas**

**Matthew Williams**

### New Graduate Students

For the 2011-12 academic year, the department admitted 20 new graduate students:

**Michael Abercrombie**  
**Timothy Amen**  
**Rashied Armini**  
**Avery Archer**  
**Adam Archibald**  
**Li Chen**  
**Samuel Emery**  
**Qingzhen Guo**  
**Tyler Harmon**  
**M. Hoseini Faradonabeh**  
**Seyyed Hadi Hosseini**  
**Yahya Karimipannah**  
**Leandro Medina de Oliveira**  
**Kamal Pangeni**  
**Christopher Pueblo**  
**Robert Thomen**  
**Nathan Todd**  
**Xinxin Wang**  
**Amila Weerasinghe**  
**Nathan (Caleb)Wright**

## STUDENT AWARDS

### Departmental Awards to Students: May 2012

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: **Shane F. Carr** and **Chun N. Li**.

#### Senior Prize

Awarded to the outstanding senior physics majors:

**Alexander G. Anderson**, **Jacob Friedlein**, and **Nicholas Orlofsky**.

### Undergraduate Research Fellowships in Physics

Awarded to undergraduate students who proposed outstanding summer research projects:

**Walter Buhro**, **Dan Corin**, **Aaron Foote**, **Erin Gauger**, **David Goldfinger**, **Zack Markow**, **Jordan Raisher**, **Samuel Rudy**, **Hannah Sieber**, **Jacob Strang**, **Ken Tharp**, **Adam Trebach**, **Harison Wiesman**, and **Sam Witte**.



↑ Mark Alford (left) and Mohammad Hossein Mahzoon (right)

### Graduate Students

Graduate student **Mohammad Hossein Mahzoon** was recognized for his exemplary teaching skills with the 2011–2012 **Franklin B. Shull Prize**. This departmental award, in memory of Franklin Shull, longtime member of our faculty, recognizes exceptional teaching by graduate students in the physics department. Hossein served as a teaching assistant for the graduate course Classical Electrodynamics. His outstanding work in this course included delivering a lecture to the class while Professor Krawczynski was absent for a day.

### Student Research News

News about graduate students of WUGRAV (gravitational physics group) during the 2011-12 academic year:

**Laleh Sadeghian** published a paper in CQG: "Testing the black hole no-hair theorem at the galactic center: Perturbing effects of stars in the surrounding cluster," Laleh Sadeghian, Clifford Will, *Class. Quantum Grav.* 28, 225029 (2011).

**Saeed Mirshekari** published a paper in PRD: "Constraining Lorentz-violating, Modified Dispersion Relations with Gravitational Waves," Saeed Mirshekari, Nicolas Yunes, Clifford Will, *Phys. Rev. D* 85, 024041 (2011).

**Dimitris Manolidis**, **Laleh Sadeghian**, and **Saeed Mirshekari** attended the 21st Annual Midwest Relativity Meeting, University of Illinois (October 4-5, 2011). Mirshekari and Sadeghian delivered talks about their recent publications.

**Dimitris Manolidis**, **Laleh Sadeghian**, and **Saeed Mirshekari** attended APS April Meeting, Atlanta, GA (March 30- April 3, 2012). Mirshekari and Sadeghian delivered talks about their current research projects.

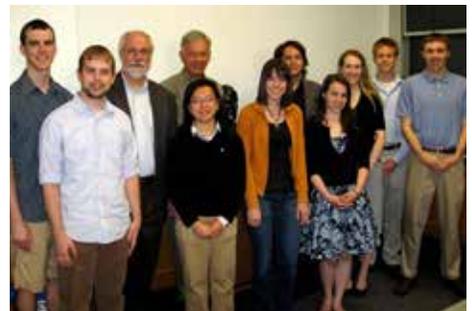
**Laleh Sadeghian** received a travel award to attend the NSF-sponsored APS Professional Skills Development Workshop in March 30, 2012, in Atlanta, Georgia. (\$650).

**Saeed Mirshekari** received a Division of Astrophysics (DAP) travel award to attend and present his paper to the 2012 April APS meeting in Atlanta. (\$300).

**Laleh Sadeghian** and **Saeed Mirshekari** received Topical Group on Gravitation (GGR) travel awards (\$300 each) to attend and present their papers to the 2012 April APS meeting in Atlanta.

### Sigma Pi Sigma

Eight students were elected to Sigma Pi Sigma, the national physics honor society. The 2012-13 newly elected members are: **Alex Anderson**, **Jacob Friedlein**, **Nicholas Orlofsky**, **Monatrice Lam**, **Daniel Dutcher**, **Daniel Cole**, **Marieke Jaeger**, and **Allison Onken**.



↑ Sigma Pi Sigma

# IN MEMORIAM

## Mark Bolsterli (AB 51, GR 55)

by John W. Clark, Professor of Physics, and Michael Friedlander, Professor Emeritus

Many of our older readers will remember Mark Bolsterli, who died at age 81, in Sante Fe, on May 19, 2012, from complications from Parkinson's Disease.

Mark was born in 1930 in New Haven, Connecticut. The family moved to St. Louis, where his mother was a highly regarded piano teacher. He attended Webster Groves High School and then came to WUSTL where he received his AB degree in 1951. He proceeded with graduate studies as a student of Gene Feenberg and received his PhD in 1955, with a thesis on "A Perturbation Procedure for Bound States of Nuclei."

During 1955-56, Mark held a Fulbright Scholarship at the University of Birmingham in England, followed by a year back at WUSTL as a postdoctoral research associate.

From WUSTL, Mark moved to the University of Minnesota, where he was member of the faculty during 1957-68, and then moved to the Theoretical Physics Division of the Los Alamos Scientific Laboratory where he remained until retirement in 1991.

He was awarded a fellowship to the Niels Bohr Institute in Copenhagen in 1961 and was a Guggenheim Fellow at Oxford University in 1964. Mark spent 1992 at the National Science Foundation in Washington, D.C.

Over his long career, Mark made numerous highly original and wide-ranging contributions to theoretical physics. An early highlight, symptomatic of his insight and skill, was his 1959 collaboration with Gerald Brown in a tour-de-force solution of the problem of the Giant Dipole State in nuclear physics. This achievement electrified the nuclear theory community and foretold the remarkable advances in nuclear many-body theory that were to come in the next decades. Much of Bolsterli's research at Los Alamos was classified. In the public domain, he continued to make seminal contributions to hadronic physics, but his interests were broad, and he published in all four sections of the *Physical Review* (A, B, C, D).

Mark spoke six languages, read ancient Greek, traveled widely, was devoted to classical music,

excelled in skiing, squash and biking, and sought adventure wherever he could find it. He lived such a full and active life that his many friends regarded him as a renaissance man. He enriched the lives of all who knew him.

## Chris Hohenemser (GR 63)

by Michael Friedlander, Professor Emeritus

Chris died in Eugene, Oregon, in November 2011, from complications associated with multiple sclerosis. He was 74.



↑ Chris Hohenemser

He was born in Berlin, Germany, in 1937, shortly before the start of WW II. The war years in Germany were very difficult. The family survived but suffered hardships and was able to emigrate soon after the war, when

Kurt, Chris' father, obtained a position with McDonnell Aircraft in St. Louis, as a recognized expert in aerodynamics. After a few years, Kurt accepted a faculty position in the WUSTL School of Engineering in the Department of Applied Mathematics. Kurt died in 2001 at age 95.

Chris went to the Webster Groves High School, then to Swarthmore College, before returning to St. Louis and starting his graduate studies in our department. His graduate dissertation was on the Mossbauer Effect in beta Tin for  $1.3 < T < 370 \text{ o} \rightarrow \text{K}$ ; his faculty advisors were John Fowler, Alec Pond, J. B. Reynolds, and Frank Shull.

After completing his studies, Chris accepted a position at Brandeis University. He remained there until joining the faculty in Clark University in 1970 and retired in 2002, moving to Eugene.

Chris' interests were wide-ranging. In addition to publishing more than 80 physics papers, including an analysis of fallout from the disaster at the Chernobyl reactor. He also wrote on subjects that had particular appeal: nuclear weapons, electric power production using nuclear reactors and environmental topics. At Brandeis, he led the effort to establish the Transitional Year Program, for

talented disadvantaged high school students. In 1971, he was a founder of the Clark's Program on Environmental Science and Policy. He was a fellow of the American Physical Society and the Society for Risk Analysis.

His strong anti-war opinions found expression in several ways. At Swarthmore, he was a leader of the Student Peace Union. On returning to St. Louis, Chris was an active member of the Committee for Nuclear Information, where the focus was on the effects of radioactive fallout from nuclear weapons explosions, both military and civil projects.

Chris is survived by his wife, Anne, daughters Lisa and Julie, and four grandchildren.

## Susan Niebur (GR 01)

by Michael Friedlander, Professor Emeritus

We were especially saddened to learn of the death of Susan Mahan Niebur, in February 2012, at the very early age of 38. Before coming to WUSTL, Susan received her BS from Georgia Tech in 1995 and graduated with her PhD 2001, as a member of the Cosmic Ray group which was examining the charge spectrum of the heavy cosmic ray nuclei.

While she was a student, Susan founded the American Physical Society's Forum on Graduate Student Affairs and served as its first chair; founded and led the first peer mentoring group; co-created



↑ Susan Niebur

and administered the first National Doctoral Program Survey; and served as president, vice president, regional coordinator, and first alumni affairs coordinator for the National Association of Graduate-Professional Students.

From WUSTL, Susan went to NASA Headquarters, as a presidential management intern in the Office of Space Science and became the Discovery Program scientist in 2003. During her five-year service at NASA Headquarters, she co-founded the first-ever Early Career Fellowships and Workshops for Planetary Scientists, held at annual meetings of the American Astronomical Society's Division

for Planetary Science and the Lunar and Planetary Science Conference.

In 2006, Susan retired from NASA and founded Niebur Consulting, an independent, woman-owned business dedicated to helping scientists succeed. Susan was the CEO and lead consultant.

In the five years after she was diagnosed with inflammatory breast cancer, Susan devoted much of her considerable energy to alerting women, their families, and doctors to the need for constant awareness, and she had many words of comfort and advice on her blog *Toddler Planet*.

Among her numerous honors is the Public Service Award from the NASA Planetary Science Division in November 2011, for her “exemplary leadership abilities [that] have helped many women in the field, both planetary and astrophysics.” And, in June 2012, American Astronomical Society Division for Planetary Sciences has announced that it is giving Susan the Masursky Award “to recognize and honor individuals who have rendered outstanding service to planetary science and exploration through engineering, managerial, programmatic, or public service activities.”

Susan is survived by her husband, Curt, and two young sons.

### **Harvey Rowland (LA 68)**

*by Michael Friedlander, Professor Emeritus*

Harvey was born in 1946 and was a member of our 1968 class. After leaving WUSTL, Harvey worked for NASA on computers. In 1974, he decided to get a PhD in plasma physics at the University of Maryland in College Park where his faculty supervisor was Dennis Papadopoulos, and his doctoral project was on simulations of beam plasma instabilities

Following his graduation in 1979, he joined the Papadopoulos lab as a research associate in the Space and Plasma group. Here he worked in two programs: the Solar Terrestrial Theory Program (SSTP), a new NASA program, and the other program, funded by NSF that focused on non-linear beam plasma interactions including collapse and Langmuir soliton effects. Harvey carried the second program single-handedly.

Harvey remained in this group till the mid '80s, when he moved to the Beam Physics Branch of the Plasma Physics Division at the Naval Research Laboratory. He retired from this position in 2004. During his NRL years, Harvey worked in the area of High Altitude Lighting (Blue jets, Sprites, etc.), plasma discharges and ionospheric modifications, especially artificial generation of ELF/VLF waves.

Papadopoulos remembers Harvey as “valuable as extremely pleasant colleague, always available to talk to the students. I will always remember our late-night discussions at the various AGU conferences where we always closed the bar, after we exhausted scientific as well political problems.”

Harvey died in April 2011. He is survived by his wife, Nancy R. Rowland.

### **Ronald Sundfors (1932–2012)**

*by Michael Friedlander, Professor Emeritus, and James Miller, Professor of Physics*

Our department was saddened to learn of the death of our colleague Ronald K. Sundfors, Emeritus Professor of Physics, in February 2012.

Ron was born in Santa Monica, California, in 1932. He received his BS and MS degrees from Stanford, and his PhD in experimental physics at Cornell in 1963. Ron joined the department as a research associate in 1963, attaining the rank of professor of physics in 1976.

For the next 34 years, Ron played a significant role in our department's teaching and research. After spending many years teaching the department's first-year physics course, Ron devoted unbounded energy as the professor manning the advanced laboratory course, Physical Measurements Lab, which is required of all physics majors. His tireless efforts in that setting had a significant impact on the undergraduate experience for many generations of students.

Ron's research focused on the use of highly quantitative experimental measurements of the coupling between nuclear spins and phonons. Along with Dan Bolef and throughout his entire career, Ron was a major contributor to that field. A very thorough and highly regarded summary of that work appears in their book

*Nuclear Acoustic Resonance* (D. I. Bolef and Ronald K. Sundfors, Academic Press, 1993). Excerpts from the description of that comprehensive manuscript provide a good summary of the depth and breadth of Ron's contributions: “The authors stress fundamentals in both theory and experimental techniques. Topics include dynamic nuclear electric quadrupole interactions; dynamic Alpher-Rubin dipolar interaction; line broadening and relaxation effects; bonding in insulators, semiconductors, and metals and the strain-electric field gradient tensors; experimental techniques; acoustic saturation NMR and double resonance; magnetic materials; and SQUID detection of nuclear acoustic resonance.”

Don Holcomb, Emeritus Professor of Physics at Cornell University, offered these memories of his time with Ron: “I was Ron's PhD thesis supervisor at Cornell University, many years ago. We had a great time working in the basement of an aged physics building. The journal paper based on his PhD thesis made a significant contribution to our knowledge of the electronic properties of heavily doped silicon crystals. The paper is still cited occasionally in the physics research literature, 50 years later. I'm deeply sorry to learn of his passing.”

In addition, Ron served in the U.S. Naval Reserve while a student at Stanford, on active duty aboard *U.S.S. Helena* 1955-1958 and in the Naval Reserve, 1958-1966.

Ron is survived by his wife, Marjorie, and their daughters — Karen Sundfors in St. Louis; Margaret Scholl of Richardson, Texas; and Emily Hawkins of Haines, Oregon; and seven grandchildren.

## PHOTO DISPLAYS IMPRESSIVE DEPARTMENT HISTORY

by Michael Friedlander

For many years, it has been our custom to assemble for a photograph to be taken of the entire department — staff, students and faculty. Most of these photographs are taken at the foot of the steps in front of Brookings Hall. In earlier years, when the department was much smaller, the photo site was usually at an entrance to Crow Hall, built in 1934.

Our oldest photo was taken at Eads Hall, then the home of the Department of Physics and dates from 1923. **In the center is the imposing figure of Arthur Compton**, head of the department. The others are identified (on the back of the oldest print) — but who are they?

**On the right of Compton is George Eric Macdonnell (G.E.M.) Jauncey**, who had completed his PhD at the University of Leeds, U.K., in 1913.

In the early years of the 20th century, most (and especially small) physics departments had little or no active research. WUSTL was an exception. Compton's X-ray research is, of course, widely known and was responsible for his departure to the University of Chicago in 1923.

**Jauncey** was probably best known for his wide-ranging undergraduate text, *Modern Physics*, that was published in 1932 and survived into a revised edition in 1948 that I had as my own senior text in that year. Looking through it again today, I am impressed by its breadth and — to the extent that I can judge — by its accuracy.

Jauncey's work with Compton is not nearly as well known. It was recently the subject of a major review by John Jenkin in *Physics in Perspective in 2002: G. E. M. Jauncey and the Compton Effect*.

As Jenkin writes: "In late 1922 Arthur Holly Compton (1892-1962) discovered that an X-ray quantum of radiation undergoes a discrete change in wavelength when it experiences a



↑ Members of the Department of Physics, June 1923

billiard-ball collision with a single atomic electron, a phenomenon that became known as the Compton effect and for which he shared the Nobel Prize in Physics for 1927. But for more than five years before he made his discovery, Compton had analyzed X-ray scattering in terms of classical electrodynamics. I suggest that his colleague at Washington University in St. Louis, G.E.M. Jauncey (1888-1947), helped materially to persuade him to embrace the quantum interpretation of his X-ray scattering experiments."

**On the left of Compton is Charles F. Hagenow**, known primarily for his teaching. He wrote a well-regarded paper: "Some Aspects of the Cultural Value of Physics Teaching" that appeared in *School Science and Mathematics* in 1922.

The subject of his PhD dissertation at the University of Chicago in 1919 was "Thermionic

and photo-electric phenomena at the lowest attainable pressure," published that year in the *Physical Review*.

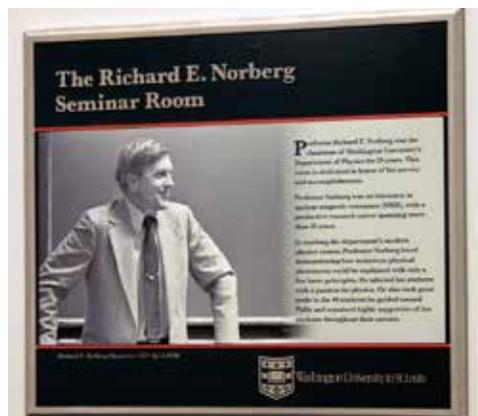
**Second from the left is Carl Eckart**, a teaching fellow. After completing his BS and MS degrees in engineering, Eckart continued his studies at Princeton where he obtained his PhD in 1925 and went on to a distinguished career. He held a National Research Council Fellowship at Caltech during 1925-27 and then joined the University of Chicago as an assistant professor. He was initially a member of Enrico Fermi's group during WWII but resigned in 1941 because of his strong anti-bomb views.

In 1946, he moved to the University of California—San Diego, where he was vice chancellor for Academic Affairs from 1965 until his retirement in 1967. Eckert was elected to membership in the National Academy of Sciences in 1952.

## THE RICHARD E. NORBERG SEMINAR ROOM



↑ The Richard E. Norberg Seminar Room, Compton 241



↑ Plaque within Norberg seminar room

# ALUMNI NEWS

It is always good to read your letters and emails. Please continue to send us your news. We continue to find that there are some errors and gaps in our master list of alumni addresses. This is where you can help us: obviously, if you read this, then you have received the newsletter. But ask your alumni friends, and let us know of any whom we appear to have missed. Send us their email and mailing addresses and we'll be happy to add them to our list. Michael Friedlander ([mwf@wuphys.wustl.edu](mailto:mwf@wuphys.wustl.edu)) or Pat Gibbons ([pcg@wuphys.wustl.edu](mailto:pcg@wuphys.wustl.edu)).

**John Roeder (AS 62)** visited WUSTL in May



↑ Mark Alford (left) and John Roeder (right)

2012 to celebrate the 50th anniversary of his graduation. WUSTL is a gracious host for these veteran alumni. Reunion events started with the medallion ceremony and reception during the Thursday evening. Each of the Class of 1962 received a special WUSTL medallion. On Friday, there was the reunion breakfast and then Commencement in the Brookings Quadrangle; fortunately the weather cooperated. The special-reunion alumni marched in the Commencement parade. There was then the post-commencement lunch. In the afternoon, there was an architectural tour of St. Louis before the 5 p.m. Dean's Reception and the 6:30 p.m. Class Party at the Chase Park Plaza.

However, the Department of Physics has its own recognition ceremony in the afternoon, so John's departmental loyalty won out. At this ceremony, the graduating seniors are called and departmental awards are presented. As John told us after he had returned to New York: interacting in the department "was a very important part of the enjoyment of my 50th reunion at WUSTL. Getting suited up for the medallion ceremony and Commencement made me feel as if I were graduating all over again, and this time I was really savoring it."

**Andy Chraplyvy (AS 72)** Andy sent us his good wishes at New Year's, adding (which we like to hear) that "...as always, the arrival of the WU department of physics newsletter is a highlight, and I read it cover to cover...one of the other points of great interest to me appeared in Professor Kelton's letter from the chairperson that made special mention of two long-term members of the staff, Julia Hamilton and Tony Biondo. I remember that you and Professor Klarmann let me earn a bit of money on the side around 1971-72 (about the time that the newsletter says that Julia started there) by working in the cosmic ray group helping to measure particle tracks....Looking forward to the next newsletter."

**Bob Joseph (GR 72)** writes that they "go to Europe every summer, and the last three years we have done cruises...last summer we did a cruise up the Danube, from Budapest through Hungary and Austria to Passau in Germany...we spend most of our time in London and had especially good visits this summer with my son, Jamie, and lots of old friends." Bob also still sings with the Honolulu Symphony Chorus, which recently performed the Haydn Creation.

**Janice Karty (EN 78)** Seven distinguished alumni and a former dean of the School of Engineering & Applied Science at Washington University in St. Louis were honored at a dinner in April 2012 at the Coronado Ballroom. Our physics alumna, Janice Karty, was among the honorees.

After earning a BSs in engineering in 1978, Janice

went on to earn master's and doctoral degrees from Rice University in 1981 and 1983, respectively. In 1985, she joined McDonnell Douglas Astronautics Company (now Boeing) as a research scientist.

She currently serves as a technical fellow within Boeing Defense, Space and Security. Since 2010, she has worked on electromagnetic environmental effects (known as E3) for products such as the F/A-18E/F Super Hornet, the F-15 and the T-45 Training System.

During her 27-year career at Boeing, she has established a record of sustained technical

excellence. She was elected to be a Boeing associate technical fellow in 2001 and named a technical fellow five years later.

Janice is a frequent guest lecturer at WUSTL as well as a local science fair judge. She often visits area high schools to speak about careers in engineering and the sciences.

**Larry Altman (LA 73)**, a very proud father, called to tell us that his son Michael had obtained his MD and PhD from the University of Chicago and would in June 2012 take a position in the Siteman Cancer Center in the WUSTL School of Medicine.

**Otto F. Sankey (GR 79)** has retired as Regents Professor of Physics at Arizona State University. **Dave Drabold (GR 89)** was one of the organizers of a Festschrift on the occasion of Otto's 60th birthday and writes that "Otto has been a prime contributor to solid-state physics, biophysics and the methodology of simulation of materials..." Otto was a student of Peter Fedders, then a postdoctoral research associate at the University of Illinois at Urbana-Champaign with John Dow in the theory of defects in semiconductors. He joined ASU as an assistant professor of physics in 1983.

Dave noted that "Otto's research achievements are remarkably diverse, beginning with work on the theory of atomic hopping, then moving into the theory of defects in semiconductors." In 1986, Otto and Roland Allen published a paper in *Physical Review B* that was prescient in its insistence that interatomic forces should be derived from the electronic structure, not from ad hoc empirical potentials.

Otto and his students next created FIREBALL, a local orbital, *ab initio* density functional code to compute the electronic structure and dynamically simulate molecular, surface and bulk systems.

According to ISI, Otto's work has been cited nearly 10,000 times. Harbingers of a new interest for Otto became apparent in the '90s with work on theoretical biophysics. He carried out one of the first *ab initio* calculations on DNA and has since contributed to an array of problems in the area. Among the Festschrift papers is a review of FIREBALL and its evolution: J.P. Lewis et al. *Phys. Stat. Sol. B* 248 1989 (2011). Otto has been highly recognized member of the scientific community and was a beloved teacher and adviser. He had many entertaining stories of his student years in Compton Hall.

Among marks of Otto's recognition for his



↑ Janice Karty

scientific contributions have been his election as a fellow of the American Physical Society and his designation as Regents' Professor for 2008 and 2009. The title regents' professor is the highest faculty honor awarded at Arizona State University. "It is conferred on ASU faculty who have made pioneering contributions in their areas of expertise, who have achieved a sustained level of distinction and who enjoy national and international recognition for these accomplishments." Otto also has served as associate chair of his department. Otto retired from ASU but remains as active as ever with new interests.

**Sister Martha Ryder (GR 83)** is living in the Mother Home of the Sisters of Charity BVM, at Mount Carmel in Dubuque, Iowa. She was planning for general viewing of the transit of Venus in June 2012 and writes that she "ordered 45 Sun Viewers from a California optical company and suggested that the Sisters send these as Christmas presents to nieces and nephews — inexpensive and educational... I'd like *some* Sisters, at least, to make dots, showing times of observation, on the NASA circle that shows the path of Venus across the sun as seen from the center of the earth. Then I want them to calculate — with some help — the A.U. The sister showing most interest so far has her BA in Latin and Greek. The transit will begin late in the afternoon here in Dubuque, and we have tall trees in the West, about a city block from where I'm thinking of watching the Transit."

**Natalie Mahowald (BS Physics 88, AB German 88)** is an associate professor and director of Undergraduate Studies in Science of Earth Systems in the Department of Earth and Atmospheric Sciences at Cornell University. After leaving WUSTL, Natalie obtained her MS in Resource Policy Analysis at the University of Michigan in 1993 and her PhD in Meteorology at M.I.T. in 1996. Natalie came to Cornell in 2007 from the National Center for Atmospheric Research in Boulder, Colorado. She is currently working on natural feedbacks in the climate system and how they modulate future projections of climate. She works with global datasets as well as climate models for this work.

Natalie has been recognized for her research, through her 2011 election as a Fellow of the American Meteorological Society and by being chosen as recipient of the Henry G. Houghton Award from American Meteorological Society in 2006.

She is married to another member of the Cornell faculty, and they have two boys, 6 and 8 years old.

**David Drabold (GR 89)** is distinguished professor in the Department of Physics and Astronomy at Ohio University, where his research is in theoretical physics of disordered materials. He tells us how his choice of physics was influenced by two WUSTL physics alumni: "Charlie Wilson (GR 25) was department head at the University of Akron when I was an undergraduate. One day, a brochure on the Wash U graduate program appeared in my mailbox, with a note from Charlie. For this reason, I applied to Wash U and decided to go there. It was one of the best choices I ever made. Charlie was a wonderful man with a bright and generous outlook on life. I kept in touch with him in subsequent years.

"Otto Sankey (GR 79) was another tremendously positive influence on me. In practical terms, my first post doc was under his direction and under his wing. I moved into computational electronic structure work. The timing was perfect — the area was burgeoning at the time, and I was lucky to be a participant in these early days of density functional codes and their application. Otto, too, is a close friend, and it was a real pleasure to assemble many of his friends and colleagues, and to honor him with the meeting and Festschrift."

Dave is a fellow of the American Physical Society and also a fellow of the Institute of Physics in Britain. Understandably, he confesses to being "an incorrigible Anglophile" and has spent two sabbaticals in Cambridge!

**Eric Majzoub (EN 93, GR 00)** Eric left a staff position Sandia National Laboratories in 2007 to return to the St. Louis area as an assistant professor of physics and astronomy at University of Missouri-St. Louis. His research has continued in the area of metal-hydrides for (hydrogen) energy storage. With colleagues at UCLA, Eric developed a highly successful global optimization code for crystal structure prediction using state-of-the-art Monte Carlo techniques and a simplified empirical Hamiltonian. The resulting prototype electrostatic ground state (PEGS) method has been highly successful in the discovery of several new metal hydride compounds and has been extended to study the phase diagrams of ionic nanoparticle systems. Eric continues to work on metal hydrides (with funding through the DOE) in collaboration with two WUSTL faculty, Mark Conradi (physics) and Sophia Hayes (chemistry).

Eric was recently promoted to associate professor in the physics department, as well as being named associate director of the Center for Nanoscience (CNS) at UMSL. The CNS includes faculty members from physics, chemistry, and biology and is broadly focused on nanoscience

with biomedical and materials science applications. It interacts closely with St. Louis technology companies. Eric's most recent externally funded research is in the area of electrochemical energy storage and encompasses metal-hydride and Li-ion batteries, as well as nanostructured materials for ultra- and super-capacitors.

**Becky Troussel (GR 02)** and **Kirk Wallace (GR 01)** moved to Glenville, New York. Becky writes to tell us that she and Kirk have found a house and are enjoying this, even as they "open boxes and are reunited with a part of our lives that we haven't seen in many months."

Kirk has been at General Electric for more than two years and continues to enjoy his position there and the challenges and opportunities that it affords. Becky has been doing some free-lance work developing physics curricula, though she tells us that she does miss working with students. She is exploring teaching opportunities.

**Aaron Mertz (LA 06)** is a graduate student at Yale, where he has been selected to receive the 2012 D. Allan Bromley Graduate Fellowship in Physics. The fellowship is awarded annually to graduate students in physics who have advanced to candidacy in the PhD program, particularly those "who exhibit a broader interest than just physics, including, but not limited to, science and public policy, engineering, and applied science."

Aaron's PhD research is at the intersection of physics and biology and concerns emergent mechanical properties in multicellular systems. Earlier, as an undergraduate, he had been involved in a number of initiatives to promote science research and education to diverse groups of students and the public. He received a Rhodes Scholarship to pursue a master's degree in the history of science, medicine, and technology at the University of Oxford, where he wrote his thesis on the public understanding of science in the 20th century.

**Hiromichi Nishimura (GR 12)**, recent physics PhD, attended the Strong and Electroweak Matter Conference at Swansea University in July 2012, where he presented his work on the conflict between confinement and the Higgs mechanism. In fall 2012, he took a postdoctoral position at the University of Bielefeld in Germany.

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## DEPARTMENT OF PHYSICS NEWSLETTER / 2013



↑ Members of the Department, spring 2012

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