Physics and Astronomy
Communiqué
Autumn 2009

A "Royal" Welcome

Two new faculty members join the department

By Melody Galen

Gavin and Karen King made a couple brief visits to campus this summer — long enough to purchase a house — but they didn't actually move here until Gavin finished his postdoctoral work in October. The duo came from University of Colorado. Here's a bit of background to acquaint you with physics' newest faculty members.

Gavin and Karen King are the two newest members of the physics faculty.

Gavin King

Originally from New York City, Gavin earned his bachelor's degree in physics at Bates College in Maine, his master's from Dartmouth, and his doctorate from Harvard in 2004.

He'd been at JILA (a joint institute between the University of Colorado and the National Institute of Standards and Technology) for five years in a post-doctoral research position. The National Research Council funded his first two years there, and then he says he was lucky enough to get a Burroughs Wellcome Fund Career Award.

While at JILA, his team developed technology to stabilize an atomic force microscope (AFM). The problem that had been wrestled with was how does one get a molecule to sit still so that clear images can be produced? Gavin's team came up with techniques to stabilize the molecule and also the tip of the AFM.

"We now have the ability to take a very detailed image of a molecule by fixing the imaging mechanism (the tip of the AFM) relative to the molecule," he says. "We fixed those two in space, and we can control the sweep of the one over the other."

An exciting future application of this breakthrough is more than just good pictures of a molecule. "We could take the tip and hover it over a domain of the molecule of interest and ask what is that domain doing in time as a function of various parameters?" states Gavin.

For instance, imagine that molecule as a drug target. With the probe tip over the molecule's binding pocket for the drug, it may someday be possible to monitor the drug-binding event in real time at a single-molecule level, see its shape change or perhaps see the rate at which it fluctuates change as a result of the drug uptake.

"This is a potential experiment, a long-term goal. There are lower-lying fruit before we do this," Gavin admits.

Gavin has specialized recently in single molecule biophysics. He says that there is a long tradition of the tools of physics, such as the AFM, contributing in important ways to biological research, and he plans to carry on his experiments at the University of Missouri.

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From the Chair

By Peter Pfeifer

While 2008–09 will make the history books as a year of economic crisis and a great many challenges worldwide, the past 12 months have been a story of remarkable success for the Department of Physics and Astronomy. Continued record enrollment at MU fills our classrooms to capacity. We have more physics and astronomy majors than ever, and we have graduated more master's and doctoral students than we have in a long time. We have exceeded the $6 million mark in annual external grant funding. Generous gifts from our alumni provide support for scholarships and fellowships. Faculty and students have excelled in terms of achievements, awards, and honors. A selection of success stories is highlighted in this newsletter.

It is my great pleasure to welcome Gavin and Karen King as new faculty members to the department (see Page 1). Gavin has been all over the news for the ultrastable atomic force microscope he designed and built at JILA in Boulder ("Fidget-Free Microscopy," *Science,* March 2009; "Steady as She Goes," *Nature Photonics,* May 2009; and "Ultrastable AFM," *Nature Methods,* May 2009). Karen has designed, taught, and coordinated a unique array of engineering courses, including special programs for underrepresented students, at the University of Colorado, Boulder. We are thrilled to have Gavin and Karen bring their accomplishments to our biological physics and educational programs.

A snapshot of exciting developments in the area of astrophysics and in the area of organic optoelectronics and optical imaging is presented on pages 3 and 5 respectively. On Page 4, Meera Chandrasekhar introduces us to the big NSF grant, "A TIME for Freshman Physics in Missouri," which has been awarded to MU under her leadership. Only two weeks ago, we received news that an NIH/NIGMS proposal, "Hiring Plan for a Biological Physics Core Facility Position," with funds for a new faculty line in the department, has been selected for funding. The proposal was one of only 20 successful proposals nationwide, and the reviewers noted that "the department is comprised of 30% women, which is highly unusual (three times higher than the national average for physics departments) and reflects the commitment the institution has to promoting diversity within its faculty." These successes are a testimony of the extraordinary collaborative spirit in the department and across campus.

This is also a time to recognize and honor distinguished achievements of

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A "Royal" Welcome

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Karen King

Also from the East Coast, Karen earned bachelor's degrees in philosophy and physics at Bowdoin College in Maine. Her master's degree and doctorate are from Dartmouth in engineering sciences with an emphasis on computational mechanics and medical imaging

"I'm really passionate about teaching," she declares. "I have a lot of teachers in my family — professors and high school teachers."

Karen was one of the founding faculty members at a charter high school that was one of the Bill and Melinda Gates Initiative schools in Denver. "It was an exciting place to work," she remembers. "There were just eight of us on the teaching faculty in 2004, starting the school from scratch."

She began teaching ninth-grade physics, then 12th-grade advanced placement physics and engineering classes. Since the school was open-enrollment (populated by lottery), the range of abilities in each classroom was mixed. "It was a challenge to teach to that," Karen acknowledges. This past year, Karen has been teaching preparatory physics and engineering design at the University of Colorado, as well as coordinating a new program at CU for underprepared, underrepresented engineering students. These teaching experiences and her background in biomedical engineering have more than prepared her to teach introductory physics and biological engineering at MU.

Karen's doctoral research looked at how the brain deforms and moves during neurosurgery. She explains that surgeons use a pre-surgery MRI as a virtual 3D road map of the patient's brain. The difficulty lies in the fact that the surgery itself causes the brain tissue to move, so it's no longer where the MRI shows it to be.

"It's like you're using a GPS system, but all the roads have moved." Her research tried to model how the brain will move based on equations of mechanics, specifically porous solids – things that are solid but have water moving through them.

The couple has a son, Marshall, 16 months, and they live close enough to campus to be able to bike back and forth. Gavin has an MU legacy of sorts — his grandmother grew up in Columbia and went to MU, and two of his great uncles were on faculty here, also. Lloyd B. Thomas, for whom the Thomas Lecture Series is named, was one of them. Hopefully, the King family will receive a royal welcome and feel right at home in Columbia.

MIZZOU ASTRONOMY

By Angela Speck

This is the International Year of Astronomy (IYA2009). It has been 400 years since Galileo pointed a telescope at the sky, 400 years since Kepler published his laws, and 40 years since we landed on the moon. In a year dedicated to astronomy, it seems appropriate to review Mizzou's contributions to astronomy. Over the past few years astronomy at MU has brought national recognition while also providing local and statewide support for astronomy outreach and education.

Professors Aigen Li and Angela Speck have successfully built large research groups whose studies are internationally recognized. Our research profile goes from strength to strength. At the American Astronomical Society in Pasadena in June we dominated the "Bridging Laboratory and Astrophysics" meeting-in-a-meeting with extremely well-received invited talks from both Li and Speck, and had 11 out of the 25 posters in the Cosmic Dust session, one of which won the Chambliss Medal (an award for outstanding student poster presentations, to Dan Caputo). Our strong presence at this and other recent conferences has put Mizzou Astronomy on the map.

Between Li and Speck, we have four postdoctoral research associates from all over the world, eight graduate students, and six undergraduate researchers. Research opportunities for undergraduates are now an essential part of undergraduate training in astronomy, and we have built a reputation for providing such experience. Since their arrival, Li and Speck have advised more than 20 undergraduates interested in astronomy; many are now graduate students in Minnesota, Colorado, Kentucky, Finland, and Australia, to name but a few places. We have also fielded many undergraduate students out to prestigious national research experience for undergraduate programs.

Our professors' national and international reputations have been further enhanced by recent research activities. Li was asked to write a "News & Views" article for *Nature* on how to make silicate crystals in space and to act as guest editor of the special issue on cosmic dust of the journal *Earth, Planets and Space*. Meanwhile Speck is now the chair of the National Optical Astronomy Observatory (NOAO) users committee.

In addition to our research and conference activities, Mizzou astronomy has also developed an excellent outreach program serving the local community, including numerous school and pre-school group tours of the Laws Observatory and a public talk series called Cosmic Conversations. As part of our IYA2009 efforts we have worked with Mizzou Recreation Services to provide "Dark Skies" events. Light pollution on campus is usually bad enough to prevent telescope viewing of all but the brightest objects (the moon, planets). By coordination with Recreation Services, we now have the lights switched off on Stankowski Field on the nights of Cosmic Conversations events. IYA2009 has also offered opportunities to spread outreach further afield, with public talks in St. Louis and Washington, Mo., and other events at Rockbridge High School. Furthermore, Speck is on the steering committee of the state-wide Curriculum Alignment Initiative (mandated by Missouri Senate Bill 389), which has provided our department with opportunities to shape physics and astronomy education within the state of Missouri.

Finally, the astronomy group has branched out into developing tools for teaching astronomy. In particular, a recently funded NSF CCLI grant aims to develop 3D virtual reality environments for teaching astronomy. Essentially we are designing video games to teach astronomy, and develop critical thinking skills in students.

From the Chair

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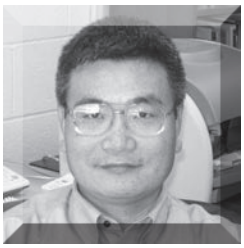
alumni of the department. On June 30, 2009, Bill Brinkman was sworn in as the director of the Office of Science of the U.S. Department of Energy, see Page 11. Congratulations, Bill! We are very proud to have you as an alumnus and member of the Physics Leaders Group.

On a sad note, we lost an eminent alumnus, James Fergason, BS '56, who passed away on December 9, 2008. He will be remembered as a founding member of the Physics Leaders group, for his generous gifts to the department, as the inventor and father of modern liquid displays, holder of hundreds of patents, inductee into the National Inventors Hall of Fame, awardee of an honorary doctorate from MU and recipient of numerous other honors, as you may read on Page 7.

Experimental Condensed Matter Physics: New Frontiers in Semiconductor Science



By Suchismita Guha and Ping Yu

The development of quantum mechanics in the early 1920s laid the foundation for condensed matter physics, a discipline explaining the structure and electronic properties of materials, such as metals, glasses, plastics, and semiconductors. The discovery of the transistor in 1947 by Shockley, Bardeen, and Brattain paved the way for the electronics industry, which heavily relies on semiconductor devices. The new wave of digital technology — computers, mobile phones, MP3 and CD players — would not have been possible had it not been for semiconductors. The best known semiconductor, widely used in the current electronic industry, is silicon. Semiconductors occur in many different chemical compositions with a large variety of crystal structures, including binary compounds such as gallium arsenide, and low dimensionality such as quantum wells and quantum dots. These materials belong to the category of "inorganic" semiconductors. Since the early 1990s a new class of semiconductors based on carbon — "organic" semiconductors — has received a lot of attention from the technology aspect, providing opportunities for plastic or flexible electronics. These semiconductors provide an alternate cheap technology for lighting, solar cells, and large-area displays compared to their inorganic counterpart.

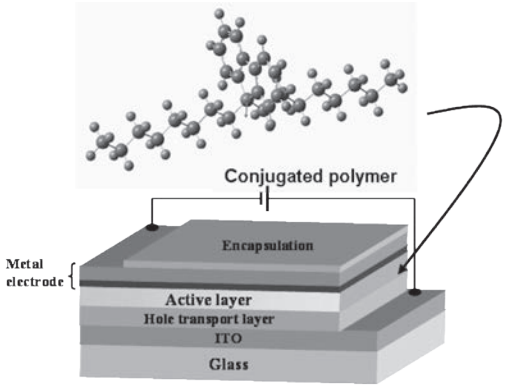
Suchi Guha and Ping Yu, who joined the physics department in fall 2003 as part of optical physics, have unique research programs in the area of semiconductor physics. Guha's research in the area of organic semiconductors is to develop and understand the science of organic optoelectronic devices with a major emphasis on light-weight, flexible, and efficient organic field-effect transistors and organic solar cells. Yu's research in the area of holographic optical-coherence imaging techniques based on inorganic semiconductor devices shows unique potentials of semiconductor science in the area of biomedical imaging. In addition to biomedical imaging, Yu's research includes nonlinear optics of new materials, semiconductor quantum dots, and optoacoustic imaging.

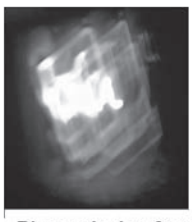
Organic Optoelectronics Research at MU

Imagine that you could roll up your computer monitor or television screen, and carry it as your ball-point pen, or even better, a flexible plastic card, the size of your credit card, serves as your computer and/or a solar power source. Performance improvements coupled with the ability to process organic semiconductors (conjugated molecules and polymers) at low temperatures over large areas on flexible substrates provide unique technologies and generate new applications in "plastic electronics." Plastic electronics have already become a reality and may soon become synonymous with the future semiconductor industry. The organic optoelectronics research laboratory headed by Guha is involved with fabrication and characterization of light-emitting displays, field-effect transistors, and solar cells using organic polymers and molecules. Guha's organic semiconductor research is funded by the National Science Foundation. Since joining MU she and her group members have published more than 35 peer-reviewed journal papers in this area.

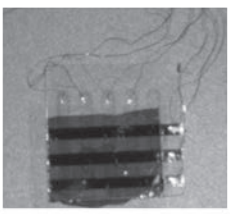
Guha and her research group have made great strides in deciphering structure-property relationships in blue-emitting polymers at the nanoscale level using light scattering techniques, and their application in light-emitting diodes. Blue electroluminescent materials are of particular interest for organic displays since blue light can be easily converted into red and green by fluorescent dyes. Using conjugated polymeric semiconductors based on aromatic hydrocarbon, Guha's research has shown that the luminescence properties heavily depend upon the structure of the side chain of such polymers. Such studies are an important step toward developing a universal picture of structure-property relationship in conducting polymers that mainly derive from chain morphology at short-length scales.

Another area that Guha's group is currently working in is organic photovoltaics. Typical light-emitting or photovoltaic structures involve sandwiching the polymer layer within a transparent electrode, indium tin oxide (ITO), and a metal cathode. The development of high-efficiency organic solar cells based on bulk heterojunctions is rapidly increasing as a viable alternative to inorganic solar cells. The most efficient organic solar cells use a phase-separated composite blend of





Blue emission from organic LEDs



A research-grade polymer solar cell with 4% efficiency.

two materials with electron-donating and electron-accepting properties. Unlike inorganic solar cells, organic solar cells are excitonic in nature and the efficiency depends upon their disassociation power of the excitons formed upon absorbing sunlight. Recently Guha's group showed that the photovoltaic efficiency may be increased by a factor of 10 by utilizing triplet excitons in addition to the usual singlet excitons. Details of this work are found in Applied Physics Letters 94, 063307 (2009).

Biomedical Optical Imaging Research at MU

Yu's main research directions are to develop novel optical-imaging techniques for biomedical imaging applications. In vivo imaging of targeted fluorescence molecular probes, or molecular imaging, is an emerging field in biomedical imaging. During the past 40 years, three-dimensional biomedical imaging technologies such as CT and MRI have been extensively used in human health and diseases. However, the human body is a complex and interactive biological system. A fundamental scientific barrier in previous biomedical imaging technologies is their limited ability to study physiological processes in vivo at the cellular and molecular levels. New molecular imaging technologies can overcome this barrier. Although technologies such as PET and SPECT have been used in molecular imaging, they are either very expensive or limited in sensitivity and speed for many physiological processes.

Yu is developing two biomedical optical-imaging techniques. The first technique is coherence-domain imaging for high-speed and high-resolution tissue imaging. This technique can be used to monitor interactions between targeted fluorescence peptide conjugates and cancer cells at a tissue level. It can be used in the drug development process for obtaining longitudinal in vivo information from animal models and thereby significantly improve pharmaceutical research practices. The second technique is fluorescence mediated tomographic imaging using an image-intensified CCD camera. This work is expected to lead to the development of a new biomedical optical-imaging technique which will greatly improve the specificity and accuracy of anatomical and functional information for early cancer detection and therapy-based pharmaceutical development.

Fluorescence and MRI images of in vivo site-specific probes of T-47D human breast cancer xenografts

The dynamic holography technique uses devices called photorefractive semiconducting quantum wells. The photorefractive effect is based on electro-optics properties of quantum-confined excitons in multiple quantum wells structures. By using the photorefractive multiple quantum devices the coherence domain imaging system can overcome the sensitivity and speed limitations of conventional coherence-domain imaging used in biomedical applications. The developed image modalities will be used for site-specific drug delivery to cancerous tissues and will be helpful for monitoring the effects of therapy.

Physics Leaders: (front) Don Packwood, Linda Godwin, Jim Seeser; (back) Phil Chumbley, Carl Anderson, Paul Leath, Robert Cunningham, Chuck Crowder, and John Shumway.

MU's Physics First Wins $5 Million NSF Grant

By Meera Chandrasekhar

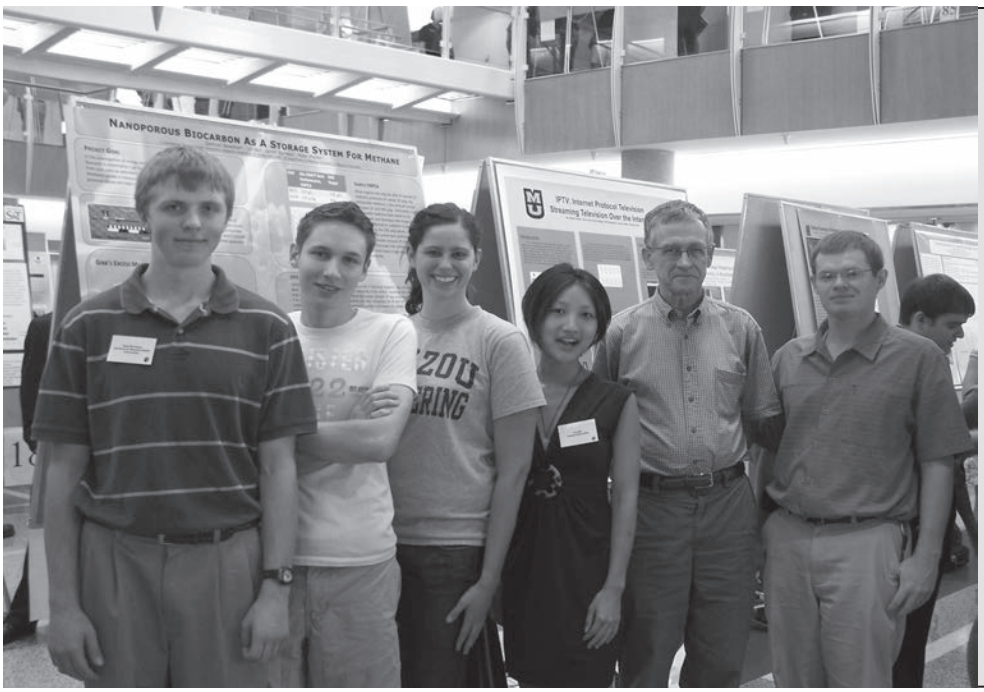
A team of faculty from MU in partnership with Columbia Public Schools has received a $5 million five-year grant from the National Science Foundation's Math-Science Institute Partnerships Program. The project is led by Meera Chandrasekhar (principal investigator). Several faculty from physics are involved: Dorina Kosztin and Debi Hanuscin as co-principal investigators and Paul Miceli and Angela Speck as senior personnel, with Sarah Hill as project director. Eight school districts are part of the partnership, and more are being recruited. A total of 80 Missouri ninth-grade science teachers will be recruited.

A previous $3 million, three-year grant from the Missouri Department of Elementary and Secondary Education, which ended in 2008, was used to train 72 Missouri ninth-grade teachers to teach a yearlong ninth-grade physics course and to create a professional development curriculum now in use in 25 Missouri school districts. This new grant, called Academy for Teachers using Inquiry and Modeling Experiences for Freshman Physics in Missouri (A TIME for Freshman Physics in Missouri), focuses on building physics content, pedagogy and leadership in ninth-grade teachers, so that they can become intellectual leaders as they learn to teach a yearlong freshman physics course. NSF's intent in this grant program is to empower teachers to become trainers for other teachers, as well as to effect institutional change. Both university faculty and teacher–leaders will develop an expanded range of pedagogical and leadership skills that they share with others, as they serve as resources and catalysts for reform in science education at the secondary and post-secondary institutional levels.

The project will offer a summer and academic-year programs. The Summer Academy series, held at the Physics Building, is an intensive residential experience that builds in content-level each year over three years. The academies focus on physics content integrated with pedagogy and leadership training, team-taught by MU faculty and experienced peer teachers. Academies will be four weeks long in years one and two, and two weeks in year three. Participants earn graduate credit and receive a stipend, room, board, travel support and a kit of materials.

Additionally, selected teachers of mathematics from the same schools will participate in a concurrent week-long summer academy, and school administrators attend a three-day academy, in order to provide additional support for teachers and students as they engage in freshman physics.

To help participating teachers implement this challenging course in the ninth-grade classroom, extensive academic-year support includes professional learning communities for small-group teamwork, follow-up sessions, support from trained coaches or mentors, online peer collaboration, online access to content experts and a materials-kit lending program. Physics-related talks from MU's Saturday Science and Cosmic Conversations lecture series will be used for academic-year discussions among teachers. M.A. Henry Consulting, LLC, will evaluate this project. The project Web site, **www.physicsfirstmo.org** will feature information and updates.



Summer Interns

Sam Bowman, Patrick O'Keeffe, Lauren Aston, Lin Bai, Chair Peter Pfeifer, and Jacob Burress. The students were 2009 summer interns in Pfiefer's lab.

In Memoriam

James L. Fergason, January 12, 1934–December 9, 2008

MU's Department of Physics and Astronomy is privileged and proud to have had Jim Fergason as one if its stars, as an inspiring role model, and as a most distinguished and generous friend of the department.

Jim is widely recognized as one of the leading independent inventors of the past 50 years and as the father of the modern liquid crystal industry. His technical insights, leadership, creativity, optimism, and hard work led him on a life-long path of major technology contributions. He grew up in Carrollton, Mo. After obtaining a bachelor's degree in physics from the University of Missouri in 1956, he began his work on the practical uses of liquid crystals at the Westinghouse Research Laboratories in Pennsylvania, earning his first patent U.S. Patent 3,114,834, in 1963. In 1966, he joined the Liquid Crystal Institute at Kent State University as its associate director. There, in 1969, he made his seminal discovery of low-power, field-operated liquid-crystal display, know as the twisted nematic cell. The twisted nematic mode enabled the development of a practical flat-panel display for a wide range of applications and is considered one of the most important technological achievements of the 20th century. In 1968, Jim formed his own company, XILIXCO, to manufacture liquid crystal displays. His first customers were the Bulova Watch Company and Gruen Watch Company, which used the technology to market the first LCD watches. Later, he founded and was president of both the International Liquid Crystal Company and Optical Shields. In 2001, he founded Fergason Patent Properties, LLC. He held over 150 U.S. patents and over 500 foreign patents in the field of liquid crystal displays and related devices, including key U.S. patent number 3,731,986 for "Display Devices Utilizing Liquid Crystal Light Modulation" (1973). He was inducted into the National Inventors Hall of Fame (1998), was awarded an honorary doctorate from MU in 2001, and he received the distinguished Lemelson-MIT Prize in 2006 and the Jun-Ichi Nishizawa Medal from the IEEE in 2008.

Dora and Jim Fergason.

Lester Skaggs, November 21, 1911–April 3, 2009

by William Kennedy

The MU physics department and the medical physics community recently lost a pioneer in the person of Lester Skaggs. After earning a bachelor's degree in chemistry, '33, and a master's degree in physics, '34, here, he went on to finish his doctorate at the University of Chicago in 1939. He was born Nov. 21, 1911, in Trenton, Mo., and died April 3, 2009, of renal failure, at the age of 97.

He is probably most remembered in scientific circles for the first use of high-energy electron beams (from betatron accelerators) in the treatment of human cancer. This was achieved by his landmark development of a vacuum tube called the "peeler," which allowed tangential extraction of the long-awaited free electron beam from the betatron. He developed many of the principles needed to predict high-energy electron dose and dose distribution in tissue.

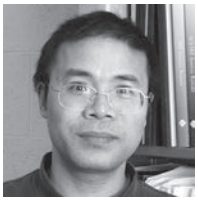
Prior to these achievements and after a two-year post-doctoral fellowship and work on an anti-aircraft radio fuse, Skaggs helped develop the detonation device for the first atomic bombs as a physicist with the Manhattan Project. After World War II he joined the University of Chicago where he was put in charge of developing radiation therapy facilities at the Argonne Cancer Research Hospital, the first medical facility to use radiation to treat cancer when it opened in 1953. He and others worked to develop cobalt-60 treatment devices and built a linear accelerator, called the Lineac, for medical applications in 1959. In the 1970s Skaggs went on to develop a method to produce neutron beams for radiation therapy, starting a continuing evolution of novel uses of neutrons for radiation treatments, such as boron neutron capture therapy.

He was a member of APS, AAAS, and the Royal Society of Medicine.

Faculty, Student, and Alumni Kudos

Graduate student **Jacob Burress** won an MU Graduate School's 2009 Donald K. Anderson Graduate Research Assistant Award.

Graduate student **Dan Caputo** won the Chambliss Medal at the American Astronomical Society meeting in Pasadena in June. This is an award for the outstanding grad student poster.



Shi-Jie Chen was awarded two single-investigator NSF grants: one for $0.7 million, 2009–12; and a $1.1M single-investigator NIH grant for 2010–14.

Rob Duncan, vice chancellor for research, appeared April 19 on CBS' 60 Minutes on possible breakthroughs in low-energy nuclear reactions.

Deborah Hanuscin is the principal investigator on a QUEST: Quality Elementary Science Teaching grant from the Department of Higher Education, Improving Teacher Quality Grants Program. This project was awarded in January 2008 and is ongoing until June 2011 with a total value of $355,350. She has received a 2009 MU Division of Student Affairs Excellence in Education Award and a 2008 Provost's Outstanding Junior Faculty Teaching Award.

Fred Hawthorne was awarded the American Chemical Society (ACS) highest honor, the Priestley Medal; he was also appointed a fellow of the ACS. Hawthorne also received (?) a Senate of the State of Missouri Resolution of Appreciation for Scientific Achievements, April 14, 2009, (Senate Resolution 795 Offered by Senator Kurt Schaefer). He delivered the Hans B. Jonassen Lecture at Tulane University in 2008.

In 2009 the University of Missouri Board of Curators appointed **Kattesh Katti** a curators professor of physics. An honorary doctorate was conferred on him in January by his alma mater, Karnatak University in Dharwad, India. Katti is a fellow of the Royal Society of Chemists and senior research scientist at the University of Missouri Research Reactor. He also serves as the editor of *Synthesis and Reactivity in Inorganic, Metal-Organic, and Nanometal Compounds*. Katti, who was recently recognized by *rt Image* magazine as one of the 25 most influential people in radiology, and his research team have formed Greennano Company, a company that is in the beginning stages of producing environmentally friendly gold nanoparticles. The company will focus on the development, commercialization, and worldwide supply of gold nanoparticles for medical and technological applications. Katti believes that because of this new process to produce the nanoparticles, researchers are developing other ways to use them.

Sergei Kopeikin and his colleagues measured the bending of light caused by the sun's gravity to within one part in 30,000. Bending of starlight by gravity was predicted by Albert Einstein in 1916. Einstein's theory holds that gamma should equal exactly 1.0. Even a value that differs by one part in a million from 1.0 would have major ramifications for the goal of uniting gravity theory and quantum theory. To make extremely precise measurements, the team of scientists turned to the VLBA http://www.nrao.edu/index.php/about/facilities/vlba, a continent-wide system of radio telescopes ranging from Hawaii to the Virgin Islands. The VLBA offers the power to make the most accurate position measurements in the sky. The observations were made as the sun passed nearly in front of four distant quasars in October 2005. It took almost four years to process the data as the turbulent solar corona causes strong radio interference making the extraction of signal from noise extremely difficult. The result was a measured value of gamma of 0.9998 +/- 0.0003, in excellent agreement with Einstein's prediction of 1.0. Kopeikin worked with Ed Fomalont and John Benson of the NRAO and Gabor Lanyi of NASA's JPL. They reported their findings in the July 10 issue of the Astrophysical Journal.

Jagat Lamsal, a graduate student being advised by Bill Yelon and Wouter Montfrooij, might well be the most prolific student the department has seen in a long time. He already has 17 refereed publications to his name, with three more in submission. Lamsal hopes to graduate this academic year.

While continuing his research on the interstellar medium and circumstellar matter around evolved stars and dust in planet-forming disks, **Aigen Li** now also is interested in active galactic nuclei (AGNs), gamma-ray bursts (GRBs) and the high-redshifted early universe. Promoted to associate professor, Li and his postdoctoral students, Melanie Koehler and Moping Li, developed a porous dust model to successfully explain the "anomalous" infrared spectral features of AGNs arising from silicate dust observed by the Spitzer Space Telescope. Now he is collaborating with H.A. Smith of Harvard to model a large number of AGNs observed by Smith's group. With his graduate student Shunlin Liang, Li developed a "Drude" model to reveal the true extinction of GRB host galaxies. Together with nano science and planetary science experts from top institutions like Harvard, Cornell, and the Max-Planck Institutes, Li is one of the 10 team members of the International Space Science Institute (ISSI) nano dust in the solar system working group.

Alumnus **Ben Rockwell,** PhD '91, at Armstrong Laboratory, Brooks Air Force

Base, San Antonio, was elected Air Force Research Laboratory Fellow.

Sashi Satpathy has been elected a fellow of the London-based Institute of Physics. This senior class of membership in the institute is reserved for individuals with a very high level of achievement in physics and an outstanding contribution to the profession. The APS Pairie Section has selected Satpathy and graduate student Tianyu Liu as candidates for member at large and student representative.

Angela Speck is the principal investigator on an NSF CCLI award, "Virtual Learning Environment for Scientific Thinking in Astronomy (VLE-STAR)." This project seeks to develop learning materials for laboratory experiences in an undergraduate astronomy course that utilizes advances both in technologies available and in our understanding of the social nature of learning. These learning materials will serve as "proof of concept" units demonstrating the power of combining 3D virtual learning environments (VLEs) with social interaction to augment science learning so that it is more engaging, active, visual, and effective. She also received supplementary funds from NSF to run a research experience for undergrads program this past summer. She had five students who all presented their work at the Summer Research Forum, and all of them will present their work at the AAS meeting in Washington, D.C., in January. Speck was recently awarded a 2009–10 Big 12 Faculty Fellowship to develop new collaborations with astronomers at the University of Oklahoma and the University of Texas at Austin. She hopes also to cultivate links to other Big 12 schools, facilitating student recruitment and student placement. She also received the 2008 Provost's Outstanding Junior Faculty Research and Creative Activity Award.

Haskell Taub has been invited to conduct neutron scattering experiments on single bilayer lipid membranes supported on a solid substrate at the Center for Neutron Research at the National Institute of Standards and Technology (NIST). He has received a total of 16 days of beam time for his research, which has been funded continuously by NSF for the last 30 years. In addition to his research activities in neutron scattering, Taub was invited to present a talk titled "Neutron Scattering for the Science and Engineering of the 21st Century," to the meeting of the Oak Ridge National Laboratory (ORNL) Neutron Sciences Core Universities in Washington, D.C., in February. He is the principal investigator on an invited proposal to the Integrative Graduate Education and Research Traineeship (IGERT) Program of the NSF in partnership with Indiana University, Fisk University, North Carolina State University, ORNL, and NIST, as well as neutron scattering centers in China, the United Kingdom, and Italy. He also visited the Catholic University of Chile in Santiago for two weeks in May to serve on the doctoral thesis committees of three students.

Carsten Ullrich was recognized as an outstanding referee by the American Physical Society in 2009.

Samuel Werner, professor emeritus, was elected fellow of the American Association for the Advancement of Science.

Carlos Wexler gave the inaugural public lecture "A Brief History of Alternative Energies: from Firewood to Hydrogen" for the XXXIII International Workshop in Condensed Matter Theories (CMT33), in Quito, Ecuador, in August. During CMT33 he also gave an invited talk on "Hydrogen Storage in Boron-Doped Nanoporous Carbon".

One of the publications by the ALL-CRAFT group (Pfeifer, Wexler), "Hydrogen Storage in Engineered Carbon Nanospaces," *Nanotechnology* 20, 204026 (2009), was deemed by referees and editors as being "of particular interest and importance" and after only one month of publication was one of the 10% most downloaded articles in the IOP (Institute of Physics, UK). This publication was featured by PhysOrg.com ("Engineering Carbon for Impressive Hydrogen Storage," http://www.physorg.com/news162195986.html).

Ping Yu, promoted to associate professor, gave talks, "Holographic Coherent Domain Imaging" and "Molecular Probe for Small-Animal Imaging," at the 2009 Photonics West Meeting in San Jose.

Xiaoqin Zou was awarded a $0.5M single-investigator NIH grant for 2009–11 and won a 2009 MU Division of Student Affairs Excellence in Education Award.

The 20 Best Papers Published in 2008–09

Arif, M., K. Yang, L. Li, P. Yu, S. Gangopadhyay, M. Förster, U. Scherf, and **S. Guha**
2009 "Harvesting triplet excitons for application in polymer solar cells," *Applied Physics Letters* 94; *Virtual Journal of Nanoscale Science & Technology* 9.

S. Guha
2008 "Raman spectroscopic studies of polyfluorenes", *The Open Journal of Physical Chemistry* 2. (*invited review*)

Abell, S. K., M. P. Rogers, **D. L. Hanuscin,** M. H. Lee, and M. J. Gagnon
2009 Preparing the Next Generation of Science Teacher Educators: A Model for Developing PCK for Teaching Science Teachers. *Journal of Science Teacher Education* 20(9):77–93.

Abell, S. K., K. Appleton and **D. L. Hanuscin**
n.d. *Designing the Elementary Science Methods Course.* London: Taylor & Francis (in press).

Brockman, J. D., D. W. Nigg, **M. F. Hawthorne** and C. McKibben
2009 "Spectral Performance of a Composite Single-crystal Filtered Thermal Neutron Beam for BNCT Research at the University of Missouri." *Applied Radiation and Isotopes* 67:222–225.

Kennedy, R. D., C. B. Knobler and **M. F. Hawthorne**
n.d. "Toward Unidirectional Rotary Motion in Nickelacarboranes: Characterization of Diastereomeric Nickel Bis (Dicarbollide) Complexes Derived from the [Nido-7-CH3-7,8-C2B9H11]– Anion." *Inorganic Chemistry* (in press).

Shukla, R., S. K. Nune, N. Chanda, K. Katti, S. Mekapothula, R. R. Kulkarni, W. V. Welshons, R. Kannan, **K. V. Katti**
2008 Soybeans as a Phytochemical Reservoir for the Production and Stabilization of Biocompatible Gold Nanoparticles. *Science, Editors' Choice* 322(5899):167.

Nune S. K., N. Chanda, R. Shukla, K. Katti, R. R. Kulkarni, S. Thilakavathi, G. Sieckman, R. Kannan, **K. V. Katti**
2009 Green Nanotechnology from Tea: Phytochemicals in Tea as Building Blocks for Production of Biocompatible Gold Nanoparticles. *Journal of Materials Chemistry* 19:2912–2920

Li, A., S. L. Liang, D. A. Kann, D. M. Wei, S. Klose, and Y. J. Wang
2008 On Dust Extinction of Gamma-ray Burst Host Galaxies. *Astrophysical Journal,* 685:1046–1051.

Liang, S. L., and **A. Li**
2009 Probing Cosmic Dust of the Early Universe Through High-redshift Gamma-ray Bursts. *Astrophysical Journal Letters,* 690:L56–L60.

Li, A.
2009 Cosmic Crystals Caught in the Act. *Nature* 459:173–176.

J. Burress, M. Kraus, M. Beckner, R. Cepel, G. Suppes, **C. Wexler,** and **P. Pfeifer**
2009 Hydrogen Storage in Engineered Carbon Nanospaces. Nanotechnology 20, 204026.

L. Firlej, B. Kuchta, **C. Wexler,** and **P. Pfeifer**
2009 Boron-Substituted Graphene: Energy Landscape for Hydrogen Adsorption. Adsorption 15, 312.

B. Kuchta, L. Firlej, **P. Pfeifer,** and **C. Wexler**
2009 Numerical Estimation of Hydrogen Storage Limits in Carbon Based Nanospaces. Carbon 47, DOI: 10.1016/j.carbon.2009.09.009.

Nanda, B. R. K., and **S. Satpathy**
2008 Spin-polarized Two-Dimensional Electron Gas at Oxide Interfaces. *Physical Review Letters* 101, 127201.

Larson, P., and **S. Satpathy**
2009 Supercell Studies of the Fermi Surface Changes in the Electron-doped Superconductor LaFeAsO1-xFx,. *Physical Review B* 79:054502.

Diama, A., B. Matthies, K. W. Herwig, F. Y. Hansen, L. Criswell, H. Mo, M. Bai, and **H. Taub**
2009 Structure and Phase Transitions of Monolayers of Intermediate-length n-alkanes on Graphite Studied by Neutron Diffraction and Molecular Dynamics Simulation. *Journal of Chemical Physics* 131, 084707:1–10.

del Campo, V., E. Cisternas, **H. Taub,** I. Vergara, T. Corrales, P. Soza, U. G. Volkmann, M. Bai, S.-K. Wang, F. Y. Hansen, H. Mo, and S. N. Ehrlich
n.d. Structure and Growth of Vapor-deposited n-Dotriacontane Films Studied by X-Ray Reflectivity. *Langmuir,* DOI: 10.1021/la901808t.

V. Turkowski, A. Leonardo, and **C. A. Ullrich**
2009 Time-dependent Density-functional Approach for Exciton Binding Energies. *Physical Review B* 79, 233201

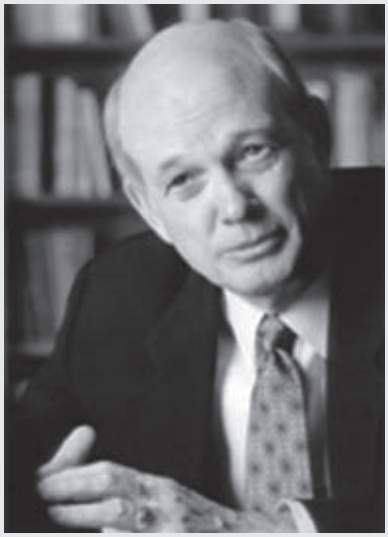
F. V. Kyrychenko and **C. A. Ullrich**
2009 Transport and Optical conductivity in dilute magnetic semiconductors. Journal of Physics: Condensed Matter 21, 084202

Dr. Brinkman Goes to Washington

By Laura Lindsey

William Brinkman, BS '60, PhD '65, was confirmed as director of the Office of Science at the Department of Energy (DOE) this past June. Brinkman was nominated in April for the position by President Obama.

"I believe that, with the current people in this administration, there is a real chance for change happening," Brinkman said after his nomination.



Courtesy of American Institute of Physics.

In his address to the Senate Committee on Energy and Natural Resources on June 2, Brinkman said he will bring decades of experience in managing scientific research in government, academia, and the private sector. He worked for 35 years at Bell Labs; under his leadership, research there earned two Nobel Prizes. In addition to his experience at Bell Labs, Brinkman served as vice president of research at Sandia National Laboratories and most recently was a senior research physicist in the physics department at Princeton University.

Brinkman's goals for his new role overseeing DOE's $4.8-billion basic science portfolio are to improve management and the relationship between headquarters and the laboratories. He is committed to scientific research and development, and he says the science education of our youth must be improved.

"We find a world in which science and technology is being pursued by many nations while the U.S. interest has seemed, at times, to have waned," says Brinkman. "I believe that President Obama is determined to change this situation and place a new emphasis on a strong scientific and technical enterprise."

Brinkman is a member of the American Physical Society, the National Academy of Sciences, and the American Academy of Arts and Sciences. He was the recipient of the 1994 George E. Pake Prize by the American Physical Society.

As a student at Mizzou, Brinkman was a tackle for the 1959 football team, a member of Kappa Alpha, a social fraternity; Phi Beta Kappa, an academic honor society; and a member of the Mystical Seven, a secret honor society founded in 1903. The Mystical Seven selects their members based on the students having shown leadership and service to the community and the university.

Associate Professor Ping Yu is aligning an image intensifier for fluorescence mediated tomography. The project will develop a methodology for early detection of breast cancer.

Communiqué is published annually by the Department of Physics and Astronomy at the University of Missouri.

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