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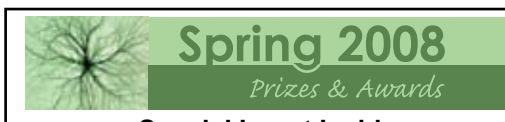


Special Insert Inside

March Meeting in New Orleans Spans Broad Range of Topics

The APS March Meeting, the largest physics meeting of the year, will take place March 10-14, 2008 in New Orleans, Louisiana. More than 7,000 scientists are expected to be on hand. The principal topic areas will be condensed matter physics, industrial applications, new materials, chemical and biological physics, fluids, polymers, and computation. A number of sessions will address education, physics history, and social issues.

SPM Turns 25. Scanning probe microscopy celebrates 25 years of cutting-edge imaging this year, and a special session at the March Meeting will focus on some of the latest innovations with this technique. Donald Eigler of IBM's Almaden Research Center will describe how he has extended the spectroscopic abilities of the STM to enable measurement of the g-value of single atoms, with the ultimate goal building nanometer-scale binary logic circuits. Scientists at the University of Hamburg have developed a new technique called Spin-Polarized STM that has led to the discovery of new types of magnetic order at the nanoscale. Sergei Sheiko of the University of North Carolina at Chapel Hill is using SPM to image flexible polymer molecules whose overall sizes are beyond the limits of optical resolution (Session G1)

Learning from Katrina. The city of New Orleans was devastated in 2005 by Hurricane Katrina, along with several other states along the Gulf Coast. Several speakers at the APS March Meeting will discuss various aspects of the underlying science of severe hurricanes and tornadoes, as well as any possible relation to climate change. Other speakers will focus on some of the lessons learned from that disaster, in terms of mitigation and better preparation. For instance, Robert Dean of the University of Florida will review wetlands loss and possible restoration options in southern Louisiana, while Murty Akundi of Xavier University and Jim McGuire of Tulane University will share the impact of the damage on their respective campuses, and suggest improvements to academic response to future disasters. (Sessions H6, V5)

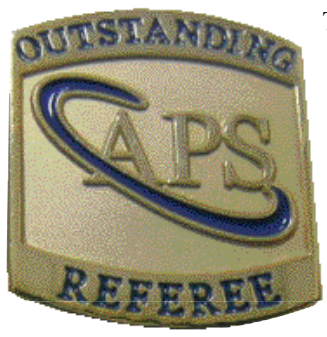
Physics in the Fast Lane. Materials physics plays a crucial role in the design and performance of both motorcycles and NASCAR vehicles. Charles Falco of the University of Arizona will discuss the inter-relationship of various technological, cultural and aesthetic factors over the last 100 years leading to high-performance motorcycles–including such new materials as carbon-fiber composites, maraging steels, and exotic alloys of magnesium, titanium and aluminum. Diandra Leslie-Pelecky of the University of Nebraska, author of the recently released book, *The Physics of NASCAR,* will talk about the important materials issues associated with auto racing, from safety equipment to building the cars themselves. Also featured in the session will be a talk on baseball, steroids and physics by Tufts University's Roger Tobin, and James Kakalios, a

MEETING continued on page 7

Outstanding Referees Gain Overdue Recognition

The APS editorial office has begun a new program to recognize excellent referees for their service to APS journals. Starting this year, a number of referees will be selected as "Outstanding Referees."

The peer review process depends on these anonymous volunteers, but their hard work has not until now been recognized.



"Peer review is really the pillar of the scholarly communication. We rely on these volunteers. Some of them have done outstanding work for us, and it really needs to be recognized," said APS Editor-in-Chief Gene Sprouse.

The APS Council approved the new recognition program in November, and the first Outstanding Referees have been selected.

Under the new program, each year APS journal editors will choose for recognition a number of referees based on the number, timeliness, and quality of their referee reports. Good referees "have to know the field; they have to be fair, reasonable and knowledgeable," said Sprouse.

Each year APS will recognize about 130 referees, or about one half of one percent of the referees in its database of active referees. To initiate the Outstanding Referees program, 534 referees have been chosen this year.

Referees will be recognized for their service to any of the APS journals, and they do not have to be APS members to be eligible for the award. This year's winners come from over 40 countries. The recognition will be a one-time award, and those selected are given the title "Outstanding Referee."

Referees often see their work as a duty to the physics community. APS is now recognizing those who accept that obligation.

"I am very pleased that it was felt that I have made a contribution, and

REFEREES continued on page 3

Conference Takes a Critical Look at Graduate Education

Photo by Ken Cole

Charles Holbrow of Colgate University leads a breakout session on "Does the Undergraduate Curriculum Prepare for Graduate School?"

Graduate physics education in US universities has not changed much in several decades. To address this issue, over 100 physics educators and researchers from physics departments across the country recently participated in a conference designed to reassess the graduate curriculum and share experiences and ideas about how to prepare today's physicists.

Discussions at the meeting covered a wide variety of topics in graduate education, including the graduate curriculum, preparation for non-academic careers, mentoring, TA training, ethics, comprehensive exam, departmental climate, and recruitment of underrepresented groups.

The conference, titled "Graduate Education in Physics: Which Way Forward," was held January 31-February 2, at the American Center for Physics in College Park, MD. It was sponsored jointly by APS and the American Association of Physics Teachers.

The conference was inspired in part by a 2005 report assembled by the APS and AAPT Task Force on Graduate Education. In a keynote address, Renee Diehl, a professor at Penn State University and a co-author of the report, summarized some of the Task Force's findings. "In physics we're teaching the same things we taught 50 years ago," she said. Other disciplines such as biology and chemistry have updated their graduate curricula, she pointed out.

Diehl pointed to a survey conducted by the AIP statistical research

CONFERENCE continued on page 6

Named Lecturers to Speak at March, April Meetings

Five named lecturers will enhance the program at the APS March and April Meetings. There will be three Beller Lecturers, two in March and one in April, as well as a Marshak Lecturer in March and a Primakoff Lecturer in April.

The Beller and Marshak Lectureships bring distinguished scientists from abroad to speak at APS meetings. The Primakoff lecture is named in honor of the late Henry Primakoff, who worked in the areas of theoretical nuclear, particle and astrophysics at the University of Pennsylvania, and the lecture is in a research area influenced by his work.

At the March Meeting, the Beller Lecturers will be Claudia Ambrosch-Draxl of Austria and Jay Fineberg of Israel, speaking on "Exploring exact exchange for collinear and non-collinear magnetism" and "Crack-like processes govern the onset of frictional motion" respectively.

Daniel DeFlorian of Argentina will deliver the Beller lecture at the April Meeting, on "Theoretical status and advances in understanding the role of polarized gluons." The Marshak lecture, in March, will be delivered by Dalia Šatkovskiene of Lithuania on "Women in Physics in the Baltic States Regions: Problems and Solutions."

The Primakoff Lecturer at the April Meeting will be Leslie Rosenberg of the University of Washington. He will speak on axions and their possible role as dark matter.

Both the Beller and Marshak lecturers are chosen by the APS Committee on International Scientific Affairs, from a pool of nominations submitted by various APS units. Choosing the Primakoff Lecturer is the responsibility of the Executive Committee of the APS Division of Particles and Fields.

More information about the Beller and Marshak lectures can be found on the International Affairs page of the APS website.

Mixed Picture Emerges from Science and Engineering Indicators

The National Science Board's recently released *Science and Engineering Indicators 2008* presents a mixed picture of the health of US research and development, with various statistics showing both areas of concern and areas where US science and technology is strong. The report, which contains hundreds of pages of data, was released in January.

A short companion report to the policy-neutral *Science and Engineering Indicators 2008* notes that some of the indicators show that the US is in danger of losing its dominance in science and engineering. The companion report, titled "Research and Development: Essential Foundation for U.S. Competitiveness in a Global Economy," says that "U.S. industry and the Federal Government are the primary pillars of financial support for the U.S. research and development (R&D) enterprise. The National Science Board observes with concern the indicators of stagnation, and even decline in some discipline areas, in support for U.S. R&D, and especially basic research, by these two essential patrons and participants."

The federal government is the second largest source of total research and development funding, but it is the primary source of fund-

INDICATORS continued on page 6

Members in the Media

"About 90 percent of physics is common sense. The hard part is knowing which 10 percent is not common sense."

***Michael Doncheski**, Penn State Mont Alto,* Waynesboro Record Herald*, January 28, 2008*

"This is a wake-up call that small bodies in the solar system don't necessarily come in two flavors. Instead, it's more of a continuum."

***Hope Ishii**, Lawrence Livermore National Laboratory, on the analysis from NASA's Stardust spacecraft of material from comet 81P/Wild 2, which suggests that some comets are very asteroid-like,* Los Angeles Times*, January 25, 2008*

"The support of physical science throughout the United States has been falling victim to the latest congressional action in which the American competitiveness has not been supported."

***Maury Tigner**, Cornell University, on cuts at Cornell University's Laboratory of Elementary-Particle Physics,* Ithaca Journal*, February 8, 2008*

"Finding these objects and discovering that they are a step in the evolution of our galaxy is akin to finding a key fossil in the path of human evolution."

***Eric Gawiser**, Rutgers University, on the discovery of some distant spiral galaxies,* Pittsburgh Post-Gazette*, January 12, 2008*

"Physics is really good at explaining problems that are linear, with clear borders, where all the forces are local. But so much of everyday life is governed by systems that are not linear, not bordered, and not in equilibrium. Right beneath our nose there can be a deep physics problem."

***Sidney Nagel**, University of Chicago,* Chicago Tribune*, January 29, 2008*

"I cannot tell it's not gold. It looks very pretty."

***Chunlei Guo**, University of Rochester, on his method of using ultrashort laser pulses to make other metals look like gold,* The New York Times*, January 31, 2008*

"There's going to be a lot of white knuckles, frankly, as building does not go forward aggressively on any kind of plant, and demand keeps going up."

***Ernest Moniz**, MIT, on possible electricity shortages in coming years,* The New York Times*, February 5, 2008*

"I believe in free speech, and I certainly respect the right of Code Pink to protest. But I'm also concerned we treat all sides fairly, and I think the Marine recruiters are just doing their job. They're not evil people."

***Gordon Wozniak**, retired nuclear scientist and Berkeley city council member, on the city council's decision to allow an anti-war group called Code Pink to protest in a parking spot in front of a marine recruiting station,* The New York Times*, February 1, 2008*

"It's exciting to be able to take this inanimate object and then apply a technical set of measurements and then hear a human voice from 100 years ago."

***Carl Haber**, Lawrence Berkeley National Laboratory, on a method of preserving old audio recordings,* The Press Democrat*, February 9, 2008*

"What you do in school that's called a lab experiment is not really an experiment, because you already know the answer. When you listen to a driver and his crew chief trying to figure out how to give the car more grip in Turn 2, that's the scientific method in action. They're asking questions about load transfer and downforce, and they don't know the answers until they've done the experiment."

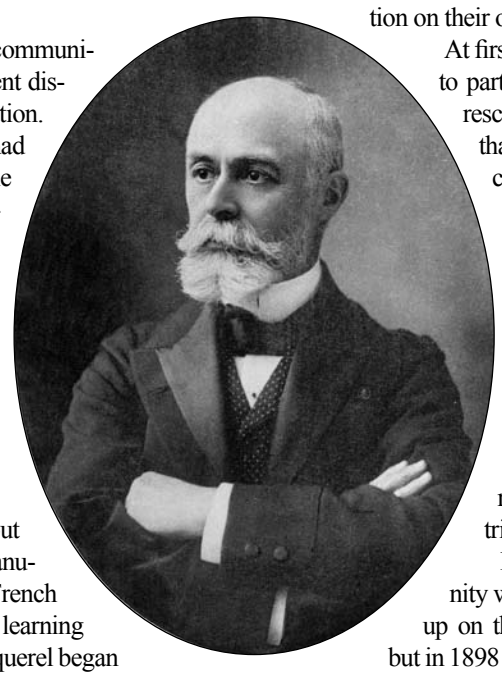
***Diandra Leslie-Pelecky**, University of Nebraska, on the physics of Nascar,* The New York Times*, February 12, 2008*

This Month in Physics History

March 1, 1896: Henri Becquerel discovers radioactivity

In one of the most well-known accidental discoveries in the history of physics, on an overcast day in March 1896, French physicist Henri Becquerel opened a drawer and discovered spontaneous radioactivity.

Henri Becquerel was well positioned to make the exciting discovery, which came just a few months after the discovery of x-rays. Becquerel was born in Paris in1852 into a line of distinguished physicists. Following in his father's and grandfather's footsteps, he held the chair of applied physics at the National Museum of Natural History in Paris. In 1883 Becquerel began studying fluorescence and phosphorescence, a subject his father Edmond Becquerel had been an expert in. Like his father, Henri was especially interested in uranium and its compounds. He was also skilled in photography.



In early 1896 the scientific community was fascinated with the recent discovery of a new type of radiation. Wilhelm Conrad Roentgen had found that the Crookes tubes he had been using to study cathode rays emitted a new kind of invisible ray that was capable of penetrating through black paper. The newly discovered x-rays also penetrated the body's soft tissue, and the medical community immediately recognized their usefulness for imaging.

Becquerel first heard about Roentgen's discovery in January 1896 at a meeting of the French Academy of Sciences. After learning about Roentgen's finding, Becquerel began looking for a connection between the phosphorescence he had already been investigating and the newly discovered x-rays. Becquerel thought that the phosphorescent uranium salts he had been studying might absorb sunlight and reemit it as x-rays.

To test this idea (which turned out to be wrong), Becquerel wrapped photographic plates in black paper so that sunlight could not reach them. He then placed the crystals of uranium salt on top of the wrapped plates, and put the whole setup outside in the sun. When he developed the plates, he saw an outline of the crystals. He also placed objects such as coins or cut out metal shapes between the crystals and the photographic plate, and found that he could produce outlines of those shapes on the photographic plates.

Becquerel took this as evidence that his idea was correct, that the phosphorescent uranium salts absorbed sunlight and emitted a penetrating radiation similar to x-rays. He reported this result at the French Academy of Science meeting on February 24, 1896.

Seeking further confirmation of what he had found, he planned to continue his experiments. But the weather in Paris did not cooperate; it became overcast for the next several days in late February. Thinking he couldn't do any research without bright sunlight, Becquerel put his uranium crystals and photographic plates away in a drawer.

On March 1, he opened the drawer and developed the plates, expecting to see only a very weak image. Instead, the image was amazingly clear.

The next day, March 2, Becquerel reported at the Academy of Sciences that the uranium salts emitted radiation without any stimulation from sunlight.

Many people have wondered why Becquerel developed the plates at all on that cloudy March 1, since he didn't expect to see anything. Possibly he was motivated by simple scientific curiosity. Perhaps he was under pressure to have something to report at the next day's meeting. Or maybe he was simply impatient.

Whatever his reason for developing the plates, Becquerel realized he had observed something significant. He did further tests to confirm that sunlight was indeed unnecessary, that the uranium salts emitted the radiation on their own.

At first he thought the effect was due to particularly long-lasting phosphorescence, but he soon discovered that non-phosphorescent uranium compounds exhibited the same effect. In May he announced that the element uranium was indeed what was emitting the radiation.

Becquerel initially believed his rays were similar to x-rays, but his further experiments showed that unlike x-rays, which are neutral, his rays could be deflected by electric or magnetic fields.

Many in the scientific community were still absorbed in following up on the recent discovery of x-rays, but in 1898 Marie and Pierre Curie in Paris began to study the strange uranium rays. They figured out how to measure the intensity of the radioactivity, and soon found other radioactive elements: polonium, thorium and radium. Marie Curie coined the term "radioactivity" to describe the new phenomenon. Soon Ernest Rutherford separated the new rays into alpha, beta and gamma radiation, and in 1902 Rutherford and Frederick Soddy explained radioactivity as a spontaneous transmutation of elements. Becquerel and the Curies shared the 1903 Nobel Prize for their work on radioactivity.

The story of Becquerel's discovery is a well known example of an accidental discovery. Somewhat less well known is the fact that forty years earlier, someone else had made the same accidental discovery. Abel Niepce de Saint Victor, a photographer, was experimenting with various chemicals, including uranium compounds. Like Becquerel would later do, he exposed them to sunlight and placed them, along with pieces of photographic paper, in a dark drawer. Upon opening the drawer, he found that some of the chemicals, including uranium, exposed the photographic paper. Niepce thought he had found some new sort of invisible radiation, and reported his findings to the French Academy of Science. No one investigated the effect any further until decades later when Becquerel repeated essentially the same experiment on that gray day in March 1896.

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Washington Dispatch

A bi-monthly update from the APS Office of Public Affairs

ISSUE: Science Research Budgets

Caught in a political dispute between Congress and the White House, the federal Fiscal Year 2008 budgets dealt an unexpected and damaging blow to science accounts. The budgets for NSF, NIST, and the DOE Office of Science ended up significantly lower than the levels approved by Congress earlier in the year and authorized in the America COMPETES Act. The US commitment to the international fusion project ITER was zeroed, placing at risk US credibility as an international science partner. High energy physics projects were also halted resulting in hundreds of lay-offs and furloughs. National science facilities will have to trim back their operations and several hundred more layoffs are expected at campuses and universities across the country because of the funding short falls for these three agencies.

The APS Washington Office is working hard to reverse some of the damage by advocating for funding at these three agencies in an FY08 emergency supplemental bill. Already, 4500 APS members have responded to the call by writing to Congress using the APS website. The Washington Office urges those of you that haven't written to do so at our Write Congress site, which you can reach from the "Click here to write" link under "Latest News. . ." on page http://www.aps.org/policy/index.cfm.

President Bush proceeded with his American Competitiveness Initiative (ACI) for Fiscal Year 2009 despite the funding shortfalls for these programs for FY08. As a result, the requested increases for the ACI agencies are very large: NSF, 13%; DOE Science 19%; and NIST Core, 5.5%. The DOD basic research (6.1) receives a 4% boost over the total FY08 appropriations, but the increase rises to 16% compared to the non-earmarked portion of the FY08 budget. Defense Secretary Robert Gates, one of the authors of the National Academies report, "Rising Above the Gathering Storm," has made basic research a DOD priority.

To track the progress of the appropriations bills, visit http://www.aaas.org/spp/rd/approp08.htm or go to http://www.aps.org/policy/issues/research-funding/index.cfm.

ISSUE: Nuclear Forensics

The APS Panel on Public Affairs, in cooperation with the AAAS Center for Science Technology and Security Policy, has issued an unclassified report that reviews the US nuclear forensics program. The report provides a summary of the techniques and capabilities and identifies five areas for improvement. The report can be downloaded from the APS website: http://www.aps.org/policy/reports/popa-reports/index.cfm.

ISSUE: Campaign Education Project

The American Physical Society, in cooperation with 10 science and engineering organizations, is hosting a "Campaign School" on May 10th to be held in Washington DC. The purpose of the event is to educate members of the participating organizations on running for local elected office. If you are interested in participating, please contact Francis Slakey in the APS Washington office at slakey@aps.org.

ISSUE: Washington Office Media Update

In an effort to reverse the damage done to science following the FY '08 budget, articles appeared in the following publications: *The New York Times*, Reuters, MSNBC.com, *Chicago Tribune*, *San Francisco Chronicle*, *Tech Daily*, *Newsweek* and Newsweek On-Air (online broadcast). In addition, the February edition of *Capitol Hill Quarterly* led with a story about the APS initiative to push Congress for emergency funding for ITER, high-energy physics and X-ray and neutron sources. Regarding the FY '09 budget, a piece appeared in *The New York Times* touting the big boost for basic research funding in the president's spending plan.

Log on to the APS Public Affairs website (http://www.aps.org/public_affairs) for more information.

AAPT Medal Goes to Judy Franz

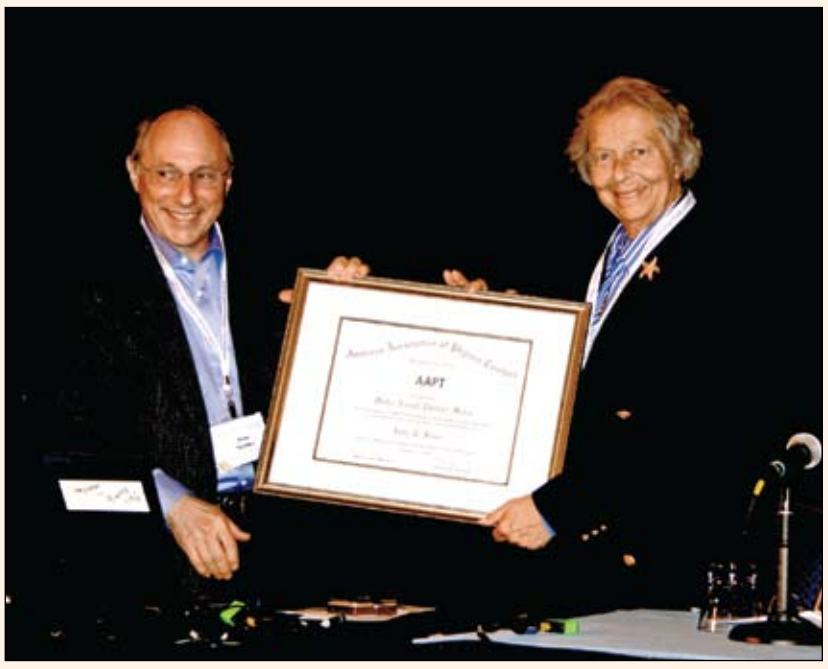


Photo by Matt Payne

At its winter meeting in Baltimore, the American Association of Physics Teachers (AAPT) presented its Melba Newell Phillips Medal to APS Executive Officer Judy Franz. Here Ken Heller, Chair of the AAPT Awards Committee, hands Franz the certificate emblematic of the award. The Melba Newell Phillips Medal is presented to an AAPT leader whose creative leadership and dedicated service have resulted in exceptional contributions to AAPT.

With Increasing Acuity, Einstein@Home Scours the Heavens for Gravity Waves

By Richard Harth

An APS-inspired distributed computing program, Einstein@Home, is currently enhancing the search for gravitational radiation with over 70 teraflops of computational power, well outpacing other available computing resources.

Einstein@Home was begun during the World Year of Physics in 2005, when, in commemoration of the 100th anniversary of Einstein's *annus mirabilis*, the APS instigated a number of outreach efforts, drawing on the public's fascination with all things Einstein, including his revolutionary ideas about gravity.

James Riordon, head of media relations for APS, first presented the concept of Einstein@Home to Peter Saulson of Syracuse University, who was then the spokesperson for the Laser Interferometer Gravitational Wave Observatory (LIGO). Following years of strenuous construction, calibration, obsessive tweaking and design innovation, LIGO's three massive interferometers, (located in Hanford, Washington and Livingston, Louisiana), are now taking data in search of gravitational waves.

As Saulson explains: "Einstein@Home came into being because of the happy confluence of a need and a desire." The need on the part of the LIGO team was for vast computing power, particularly to aid the search for continuous wave sources not yet detected in radio, x-ray or other emission. The desire was to encourage direct public involvement in challenging frontiers of science.

Einstein@Home gathered momentum when Bruce Allen of the University of Wisconsin-Milwaukee took charge of the project, assembling a multinational team to approach the formidable challenges of code-writing and hardware assembly.

A celestial screensaver on which constellations, known pulsars and supernova remnants appear, activates when a member's computer is idle. The relative positions of the earthbound Hanford and Livingston observatories and the Geo600 detector (in Hanover, Germany) can be seen, as well as cross-hairs marking the area of sky being searched.

Einstein@Home analyzes data from successive LIGO scientific runs, comparing the interferometers' data with anticipated gravitational waveforms from a neutron star at each sky location. The results are forwarded to LIGO's servers and another chunk of data is then downloaded by the screensaver for analysis.

Public enthusiasm for the project has been strong, with some 75,000 current users in 206 countries, donating their idle computer time for the search.

LIGO's exquisitely sensitive search for gravitational waves is conducted by looking for changes in the path lengths of laser light traveling down the 2 or 4 km interferometer arms. Differences in strain amounting to less than one thousandth the diameter of a proton can be measured as a passing gravitational wave alternately squeezes and stretches the weave of space-time.

LIGO's pursuit of gravity waves has focused on four primary sources: inspiraling binary systems (of either black holes or neutron stars), stochastic background emissions (from primordial events, including the Big Bang), various "burst" sources, (including gamma ray bursts), and continuous wave sources, specifically, rapidly spinning neutron stars known as pulsars. It is these pulsars—city-sized objects with staggering densities (equal to hundreds of millions of tons per cubic inch), which Einstein@Home is designed to stalk.

Unlike binary coalescences, stochastic noise or burst signals, pulsars are *continuous* sources which emit gravity waves at twice the star's rotational frequency. The amplitude of gravitational emission depends critically on the star's degree of asymmetry, making highly spherical pulsars too faint for detection.

REFEREES continued from page 1

that I have been distinguished for a task which I assumed as an obligation to the physics community," wrote one new Outstanding Referee.

Many referees work very hard to do a good job, and some are overburdened with requests to referee papers. One new Outstanding Referee wrote, "I am thrilled at the honor. But perhaps you can lighten the load a bit this year..."

The Outstanding Referees will receive a certificate and a lapel pin. They will be honored at the APS March and April meeting Prize and Awards sessions. Their names will also be listed online and in the journals, though referees can choose not to be listed.

Immigration Case Comes to Happy Conclusion

Branislav Djordjevic, a Serbian physicist and software engineer who spent months in jail in the US in 2003 after an inadvertent immigration violation, has finally had his case resolved. In February 2004 *APS News* reported that he had recently been released from prison, but still feared deportation. Now, his case has finally had a happy outcome. Deportation proceedings have been dropped, and Djordjevic and his family have received permanent residency status.

In 1991, Djordjevic came to the US as a graduate student in physics at the Michigan State University. He only intended to stay half a year, but when war broke out in Yugoslavia, he decided it would be unsafe to return, so he applied for asylum status. After completing his PhD in 1996, Djordjevic took a job as a software engineer with a small company, and then accepted a position as a software specialist with Verizon. Djordjevic and his wife, whom he had met in Yugoslavia, and their two children, both American citizens, moved to Falls Church, Virginia.

In 2002 he was granted an approval notice for an H1-B visa, but his attorneys at the time didn't follow through on the procedure for him to receive the visa. His lawyer also failed to notify him when his petition for asylum was denied, causing him to miss the deadline to appeal or leave the country.

It came as a surprise when he was arrested for an immigration violation in July 2003. He was sent to jail, deemed a flight risk, and held without bail. During the nightmarish 146 days he spent in jail, he suffered many indignities and was depressed by the lengthy legal proceedings, and was especially distressed that he was unable to be with his children.

The physics community tried to support him as much as possible during that ordeal. Djordjevic's former PhD advisor at Michigan State, Michael Thorpe, alerted APS to his case. Professor Ronald Cappelletti and other friends and supporters set up a website and collected contributions to Djordjevic's defense fund. APS President Myriam Sarachik wrote a letter to Secretary of Homeland Security Tom Ridge asking him to support Djordjevic's release, and the APS Committee on the International Freedom of Scientists wrote letters to the Bureau of Immigration and Customs Enforcement. Irving Lerch, then APS Director of International Affairs, sent letters to various officials and attended a hearing in the Virginia Eastern District Court. Edward Gerjuoy, chair of CIFS, was also active in trying to help Djordjevic.

Although APS did not get any useful response to those letters, Djordjevic says he was extremely grateful for support from APS and the physics community. "It meant much more than I can describe. I did not feel alone," he said.

Djordjevic was finally released on bond in December 2003. His immigration status was still uncertain as legal proceedings dragged on.

Several months after being released from jail, Djordjevic was able to return to work at Verizon. In August 2006 he became a consultant for Geico, doing computer programming.

In November 2006, the government agreed to terminate the case against him. There was no new evidence at that time, said Djordjevic. "I'm not sure what was the cause of the government's change of mind." His case simply seemed to dissolve into nothing, he said.

Djordjevic was then able to apply for a green card through the regular immigration system. The application process went smoothly, and in December 2007, he and his wife were approved for green cards.

Djordjevic believes that the support he had from APS and others, including Congressman Tom Davis (R-VA), may have ultimately influenced both the government's decision to drop the case, and the approval of his green card. "All this help came together," Djordjevic said. "I believe the APS help made a huge impact on them in the long run," he said. "This is also an APS victory."

See Djordjevic's letter of thanks to the science community on page 4.

Letters

Articles Make Reader Blink and Sigh

There are two articles I wish to comment on. The first, "Council calls for Reduced Greenhouse Gas Emissions," made me sigh. I do not propose to argue the details of this topic, which is rapidly acquiring the flavor of a fervent religion. I simply wish to state for the record that the quoted text does not cast scientists in a very scientific light. Conflating Global Warming (which has occurred in times when no humans existed) with Anthrogenic Global Warming (the existence of which is in fact still under debate) is the sort of sloppy thinking and writing I have become wearily accustomed to in the general media but is entirely out of place in a statement from the APS Council.

Second, the introduction to "The Back Page" also made me blink. It is curious that the editors feel the need to warn their fragile readers of the "exclusive use of the male pronoun," yet are strangely silent with regard to the highly emotional and simplistic anti-military statements. This might lead one to suspect the editors believe these statements are so self-evident, even now, that they do not require any further explication or historical context. Why not apply the same historically-enhanced hindsight and assure readers that the liberation of Dachau by an army "designed to kill other people" was not anticipated in 1899? I wonder if the survivors also feel the money spent on the military that saved them should have been used elsewhere?

Sabrina Chase
Bothell, WA

Ed. Note: *The sentence that made the author blink ("...readers may find the exclusive use of the male pronoun by Rowland grating") was inserted as a surreptitious reference to Rowland's best-known scientific achievement. Further interpretation is unwarranted.*

Population Growth Trumps Emissions Reduction

As reported in the January *APS News*, it is encouraging that the APS Council has expressed its concern for the problems arising from greenhouse gas emissions: "We must reduce emissions of greenhouse gas beginning now." The following observation seems pertinent. The world population is growing about 1.2% per year. It would be an incredible achievement if we could achieve worldwide a reduction of per capita emissions of 1.2% per year. Together these would leave us with no change in the annual emissions. It will take more than this incredible achievement to realize a real reduction. We need to recognize that population growth is the more serious problem which, with enlightened leadership from Washington, can and must be addressed in the US and worldwide.

Albert A. Bartlett
Boulder, CO

Don't Apologize for Physics

Once I was asked to teach a special subject certification course for high school teachers. Of course I became aware that I would be in front of people trained to look at classroom techniques. So I brought along toys and demos that might help them or which they might themselves use. I asked if they wanted me to use them or just present the material clearly with all logical elements in order, letting the subject speak for itself. They chose the second option. Even considering that they had adult minds, we might find that if we don't apologize for physics and present its concepts and applications to everything in the universe in its own naturally esthetic forms, there is a greater chance students won't come away thinking that physics is a thing to be hidden.

Jane Owen
New Smyrna Beach, FL

New Policy Makes APS Membership Easier in Developing Countries

By Calla Cofield

Physicists in developing or hard-currency-poor countries who cannot afford regular APS membership fees can now qualify for four years of dues-free membership through the APS Matching Membership Program.

To ensure that this opportunity is utilized by those who need it, APS is encouraging its current members to spread the word about the program to their colleagues in qualifying nations.

The Matching Membership Program previously offered two categories of reduced-cost membership. However, surveys found that many participating physicists still struggled to pay this amount. Now, the "fund" category will offer four years of free membership, and the "sponsor" category will continue to offer half-price membership for six years to those physicists who have an individual or institution who will sponsor them and provide payment.

As of 2008, there are only 25 physicists taking advantage of the Matching Membership Program, which has not been actively promoted for many years. The Matching Membership Program began in 1983 as a way to make membership accessible to physicists in developing countries. By 1995, the program had 450 participants, many of whom were living in the former Soviet Union.

APS Director of International Affairs Amy Flatten hopes that participation numbers will rise with the installment of the new program, but she emphasizes that physicists need to be made aware of the opportunity. For more information visit www.aps.org/membership/matching.cfm.

Djordjevic Grateful for Support from the Science Community

Editor's Note: *An article about Branislav Djordjevic's immigration story appears on page* 3.

I wish to personally thank everybody in the American Physical Society and in the New York Academy of Sciences, for their powerful and overwhelming support I enjoyed during my almost 5 months jail detention by the immigration authorities. I consider myself very fortunate to have had such a tremendous support from the physics community. Although it seemed at the time that all APS efforts were in vain, I am confident that, in the long run, this effort changed the government's mind on my case, and ultimately resulted in the happy outcome of our ordeal–our approved permanent resident status. For me, locked up and isolated in my prison cell, the APS support meant great hope and encouragement. For my wife, left alone to take care of our two children and her elderly disabled uncle, the APS support was a huge boost to endure that Kafkaesque nightmare until its end. I cannot name everybody in APS who helped me, but I would like to mention just a few names: I wish to thank my former Ph.D. advisor Professor Michael F. Thorpe for alerting APS to my case; to my friend and former colleague Prof. Normand Mousseau for starting this chain reaction of support; to Prof. Irving Lerch for his support and touching letter he sent me upon my release from jail; to Prof. Edward Gerjuoy for his untiring support and encouragement; to Professor Ronald Cappelletti for creating and maintaining the web site to support my case; to Professor Joel Lebowitz for his support and regular reporting on my case during his Statistical Physics conferences; to Professor Joseph Birman for his help and support; to Prof. Martin Blume for his generous help, to Prof. David Drabold, Prof. Milan Mijic, Prof. Draza Markovic, and Dr. Petar Simic for their help and support, and to everybody else whose name I missed to mention here.

I am very proud to belong (by education if not by my current line of work) to the physics community which is so much concerned for the rights of scientists and for justice to be served. I hope that the positive resolution of my immigration case, which came as a result of the APS efforts, will further encourage the APS to continue helping other similar cases that may occur, thus making a tremendous difference in this world of mistakes and errors.

With gratitude,

Branislav R. Djordjevic

zero gravity

The Lighter Side of Science

SCI-COPS to the Rescue!

By Jeff Lindsay

We have police to enforce traffic laws, drug laws, gun and alcohol laws. **But who enforces the laws of nature?** Who's there to protect you from thermodynamic impossibilities? Who works night and day to keep our streets free of perpetual motion machines, anti-gravity gangs, and time-traveling thugs? Who puts their neck on the line to ensure that every action has an equal and opposite reaction? I'll tell you who: it's **SCI-COPS**, a crack team of scientists turned law enforcers.

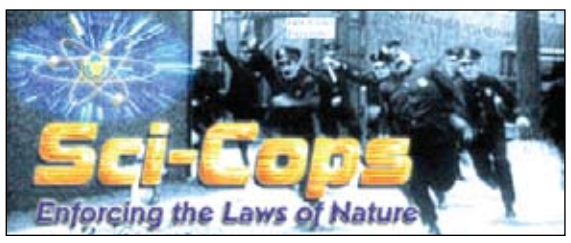
One Sci-Cop agent, known in the force as "Agent Zeta" for his unorthodox use of zeta-potential measurements, has posthumorously left us his memoirs. An excerpt follows, from "The Strange Case of Madame Zelda and the Spurious Data Point."

Tuesday, May 15, 1979. I'm a colloids guy, specializing in interfacial chemistry. Aqueous double layer interactions with cationic polymers used to be my bread and butter, but my bread kept landing butter side down. As a Sci-Cop, my specialty isn't exactly in high demand. We don't face many crimes in interfacial chemistry, so I've branched out into gravitational physics, chromodynamics, a little nonlinear optics, and herbal medicine. Can't stagnate in Sci-Cops, or you're out on the street, writing proposals again just to survive. I've been there, and I'm not going back.

Anyway, I was zipping through a few issues of the *Journal of Quantum Gravity* when a 207 was called in. That's telekinesis–the unlawful use of mental power to move objects. It's a felony. Minimum five years.

I went with my partner, Chuck "The Spectre" Manning. The call was for a third-floor apartment on National. A little sign on the door said it all: "Madame Zelda: Let the Power of The Mind Work Miracles in Your Live." (Sic.) Yeah, she spelled "life" wrong. Criminals of her ilk don't care about grammar. Orthography means nothing to them, entropy means nothing, conservation of mass and energy mean nothing. All they want is a buck–forget the rest of the universe.

The Spectre kicked the door open, then I rushed in with my lab book and camera. Document, document, document–the only way to make sure a case holds up to peer review. Madame Zelda was an old Russian lady. There were two customers, both men, staring at a big pile of nails under a glass cover. Madame Zelda had her eyes shut, looking like she had a bad migraine. The nails under the glass were moving. First one way, then the other, as if possessed by supernatural power. I took three successive photos to capture the motion while the Spectre was scribbling at top speed in his lab book. We flashed our badges.



The men–they were dupes. Maybe we'd do a little 'technical lecture' for them later on in the back alley, teach them a few things about equal and opposite reactions, maybe instruct them on Fourier's law of heat transfer with the help of a few hot cigarettes. But the Madame was the kind of woman that could bring the whole galactic house of cards down if she got out of control. I asked what she was doing, and she answered: "I am demonstrating ze power of ze mind."

In a flash, I had the cuffs out. Nothing better than a fast confession.

And then the Spectre spotted it. An electric cord running into a leg on the table. Her table had been prepared with an electric motor that moved a pair of magnets just below the surface.

We'd seen this once before. The criminals claimed that they didn't really use telekinesis, but used hidden moving magnets to move the metal objects. So the mysterious motion would be due to forces fully in compliance with the laws of nature, and the criminals had to be released after nothing more than a 'technical lecture' on the stupidity of appearing to violate physical law. Madame Zelda was a pro. She'd prepared an ironclad alibi in case she were caught.

But we already had her confession. All the evidence we needed was on tape, in lab books, and on film. What about the data from the gimmicked table? We looked at each other and nodded. This data point was an outlier. (We'd both been brushing up on statistics.) No need to record it or consider it in our subsequent analyses. Drop that outlier and everything fits into one, solid, cogent whole that would pass peer review anywhere. Our publication of this case was not going to be ruined by a single spurious data point.

I took the table out to the dumpster. Madame Zelda may be a pro–but she was going to do hard time.

Some people have trouble with our tactics. Let me tell you, we're dealing with the laws of nature here. Stuff that holds together the universe and Earth as we know it. You let people tamper with the laws of nature, and you might as well just kiss this whole cosmos good-bye. We're doing the best we can–and usually, our best is pretty good. You want to know why your streets are free from perpetual motion machines and anti-gravity gangs? Because we do what it takes to stop crime.

Jeff Lindsay is a US patent agent, has a PhD in chemical engineering from Brigham Young University, a background in both academia and corporate R&D with 95 US patents, and is currently Director of Solution Development at Innovation Edge (innovationedge.com. Read the further adventures of the Sci-Cops at http://www.jefflindsay.com/Sci-Cop.shtml. Reprinted with permission.

The Gavel Travels

Photo by Ken Cole

At the February meeting of the APS Executive Board, past-President Leo Kadanoff of Chicago (right) handed the gavel, symbolic of APS leadership, to President Arthur Bienenstock of Stanford.

INTERNATIONAL News

...from the APS Office of International Affairs

Growing Opportunities for International Collaboration in Physics in South Africa

Nithaya Chetty, Simon Connell, and Harm Moraal

This is the second article in a two-part series focusing on the expanding physics scene in South Africa. The first article, which appeared in the January APS News*, focused on shaping the future of physics in South Africa.*

South African physics is currently experiencing a renaissance in strategy and funding that opens up many exciting new opportunities,with an almost limitless scope for international collaborations. To fully reap the benefits of these opportunities, more must be done to mentor young physicists, and here the international community can play a more active role.

Even during the grim years of Apartheid, South African physics maintained high levels of international standards and research linkages. This was partly due to the sterling efforts of particular individuals and also our continued affiliation to the International Union for Pure and Applied Physics (IUPAP) of which South Africa was a founding member in 1923. Since the political transition, the opportunities have grown exponentially. The Department of Science and Technology (DST) has set up several support instruments to assist South African institutions and individual scientists to develop international collaborations. Some of these are administered by the National Research Foundation (NRF). For example, the number of binational science agreements has grown to 24. These agreements are with countries covering all levels of scientific development, and spread over all five continents. The major EU Framework support instrument is managed by the Council for Scientific and Industrial Research (CSIR), and the DST manages the co-funding instruments directly. A regional office for Africa of the International Council of Science (ICSU) was established in Pretoria in 2005.

The international scientific community is proactively inclined to strengthen South Africa's scientific base and to welcome and nurture new linkages with institutions, groups, and individuals. There is a growing perception of the importance of science as an instrument for development and for furthering the aims of democracy. Norway and Sweden have historically had a strong commitment to scientific development on the African continent, and this legacy continues today. The Royal Society of the UK has been actively engaged in building up research capacity at many universities in South Africa. France, Germany and the USA are investing substantially in developing a stronger scientific base in South Africa, sometimes related to specific research thrusts. More recently, South Africa has signed agreements with India, Brazil, China, Japan and Russia, and we are now beginning to extend the research relationships into the former Eastern Bloc. Several South African universities have research relationships and student exchange programs with prominent universities and laboratories around the world.

The South African Large Telescope (SALT) is by far our greatest international success story, involving collaborative agreements with several international partners. This project has significantly changed our mode of interaction to one of equal standing and mutual benefit with our international partners. Here South Africa has a distinctive geographical advantage. This gives a clue as to how we see ourselves today: South Africa must pursue its research agenda so that it can enter the global knowledge arena on equal terms having secured local legitimacy. This is the essence of the Africanisation debate, and in this science has no small role to play. Three programs in observational astronomy have carried this notion still further.

The National Institute of Theoretical Physics (NITheP) has a strong developmental agenda, based on the integrated participation of high quality international theoretical physicists. Another component seeks to support young African theorists from outside South Africa–who are often working in dreadful isolation–to routinely travel to South Africa to participate in NITheP activities. Similarly, The African Institute for Mathematical Sciences (AIMS) brings quality graduate students from across the entire African continent to Muizenberg near Cape Town where students are exposed to high quality international and local lecturers. Already a number of AIMS graduates have either returned to their home countries where they are contributing to the development of an intellectual culture, or they have sought further studies at the masters or PhD levels in South Africa.

A national (or even African) synchrotron light source is in the pre-proposal phase, and strong involvement and interest shown by international experts will help drive this national flagship project to fruition. This is also true for the Photonics Initiative of South Africa (PISA), which is still in the exploratory phase. A relationship has been forged between CERN, iThemba Labs, and a selection of South African universities, which creates opportunities for our scientists to have access to facilities, equipment and both academic and technical expertise.

We encourage our international

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Focus on APS Topical Groups

Topical Group in Gravitation

By Calla Cofield

The APS Topical Group in Gravitation reached 1,000 members at the end of 2007, making it the largest topical group in APS. But general relativity alone can't take the credit. As the group's Chair Dieter Brill, of the University of Maryland, explains, "The community of gravitational physicists is widely varied and very diverse, ranging from astrophysicists to mathematicians, from experimentalists to quantum gravity theoreticians, and from cosmologists to data analysts. It is united not by a shared toolbox of techniques or by a common point of view, but rather by a passion to understand the workings of gravity."

The group's chair-elect David Garfinkle hopes the group is on its way to becoming an APS Division. It will take a few hundred more members for the group to achieve that goal, but over 30% of the group's members are graduate students, suggesting that the group will continue to grow in the near future.

The field of gravitation is experiencing a particularly large growth spurt as scientists begin to analyze data from the Laser Interferometer Gravitational-Wave Observatory (LIGO). LIGO is searching for gravitational waves, originally predicted by Einstein. Gravitational waves are thought to arise mainly from violent events, such as two colliding black holes or supernova explosions. Until recently, the existing technology, both experimental and theoretical, was insufficient to allow the detection of gravitational waves, and even LIGO is unlikely to detect them. Advanced LIGO, an upgrade that will make the current LIGO detectors 10 times more sensitive, is set for completion in 2008, and is expected to detect gravitational wave signals.

"We are all waiting for the first confirmed detection of a gravitational wave signal. This will confirm once again…that purely by thinking about things (if you are an Einstein) you can bridge the gap over enormous distances in space, interaction strength, conceptual pictures …if, that is, these waves are discovered. If not it's an even greater challenge, to find out why the Good Lord does not fully use this beautiful possibility (as Einstein might have said)," says Brill. If Advanced LIGO can't find signs of gravitational waves, it will seriously call into question the understanding of how astrophysical bodies behave, but will not immediately rule out the existence of gravitational waves.

About 30 scientists work full-time for the NSF-funded LIGO Laboratory, a joint effort of MIT and Caltech, which built the LIGO detectors in Oregon and Louisiana. Over 580 scientists, engineers, and other contributors from 11 countries and 42 institutions belong to the LIGO Scientific Collaboration. Members of the Collaboration have worked to analyze LIGO's data and interpret the results, to develop improved detector technologies for future upgrades and to contribute to building and installing the detectors.

Beyond LIGO, current questions facing gravitational physicists include how to unite gravitation with quantum theory, as is being pursued, for example, by string theory. Brill adds, "Another exciting challenge to [gravitation] theory is the new cosmological observations that give us ever better data about the early universe, about dark matter and dark energy, extra dimensions, and even more exotic constituents. This is a far cry from the old days, where the few cosmological parameters we had were only inaccurately known. Today we can build quite exact models of the universe."

The gravitation group has a semiannual newsletter that Brill recommends to anyone interested in learning more about the field of gravitation. The newsletter began in 1995, and features original articles written by active gravitational physicists. The articles aim to be accessible to all physicists, not just specialists.

Many GGR members participate in four annual regional general relativity meetings (Pacific Coast, Gulf Coast, East Coast, and Midwest). The GGR sponsors a $200 prize at each of them for the best student presentation. Hosted by different universities each year, these meetings are free and open to all, and information on them is sent through the GGR mailing list.

The APS April Meeting also serves as an important venue for GGR. Both Brill and Garfinkle were excited about last April's meeting when Francis Everitt of Stanford announced the results of the Gravity Probe B experiment, which, after decades of planning, successfully launched a package of four gyroscopes into orbit around Earth. The results were in accordance with Einstein's theory, and were also an advance in precision instrumentation. Other GGR sessions are organized for the April Meeting, such as last year's History of Relativity. The GGR supplies travel grants for graduate students and postdocs to attend the April Meeting, which is an important tool for bringing together its community of physicists. The GGR also presents certificates to its new Fellows at the meeting, and organizes the prize session for the biennial Einstein Prize, awarded by APS for out-

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Decision Time

Photo by Calla Cofield

On January 18, about 30 dedicated physicists gathered at APS headquarters to sort the more than 1100 abstracts submitted to the April Meeting. Shown here hard at work are Allena Opper of George Washington University, Abhay Deshpande of Stony Brook University, Ben Gibson of Los Alamos, Rick Casten of Yale, and Jim Thomas of Lawrence Berkeley Lab. The APS April Meeting takes place in Saint Louis, April 12-15.

Over 300 Universities Endorse Joint Statement on Education

By Calla Cofield

Over 300 physics departments have endorsed the physics societies' Joint Statement on the Education of Future Physics Teachers. This new milestone represents nearly half of the physics departments in the U.S. The statement encourages physical science and engineering departments to "take an active role in improving the pre-service training of K-12 physics and science teachers." APS has been seeking endorsements directly from physics department heads since 2003.

"Good science and mathematics education will help create a scientifically literate public, capable of making informed decisions on public policy involving scientific matters. A strong K-12 physics education is also the first step in producing the next generation of researchers, innovators, and technical workers," says the Joint Statement.

In 1999, the American Institute of Physics (AIP), the American Association of Physics Teachers (AAPT), and APS jointly created the statement to address the national need for improved K-12 physics education and the responsibility of undergraduate physics departments to train future teachers. Many physics departments are not currently involved in future teacher education.

"It's not a new problem; it's something people keep rediscovering," says APS Executive Officer Judy Franz, referring to the lack of attention given to teacher education programs within physics departments. "Since we issued the statement there's been a dramatic increase in universities' awareness of this issue," she says. The endorsement of the statement requires no formal commitment by the departments, but is an acknowledgement that they do have a responsibility for future physics teachers. Franz says, "Now the next step is to sustain and act on that responsibility. This is important."

To address the need for improved physics teacher preparation, AIP, APS, and AAPT initiated the Physics Teacher Education Coalition (PhysTEC) project in 2001. "The PhysTEC project has been successful at helping institutions develop sustainable programs in teacher education while recognizing the significant faculty workload in research and teaching." said APS Director of Education and Diversity, Ted Hodapp. "With the dramatic shortages of qualified physics teachers, the community must act collectively to take responsibility in this important area." Information on PhysTEC can be found at www.phystec.org.

The full statement and list of departments that have endorsed the statement can be found online at http://www.aps.org/programs/education/future-teachers.cfm

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standing work in gravitation. The 2007 prize went to Ronald Drever of Caltech and Rainer Weiss of MIT for their fundamental contributions to LIGO.

As part of its public outreach effort, GGR collaborated with the Forum on the History of Physics to establish the Las Cumbres Speakers Program. Schools and groups can apply to have specially selected speakers come and give talks on Einstein's life and science, as well as talks on current developments in gravitation. The program was established in 2005, in conjunction with The World Year in Physics, celebrating the centennial of Einstein's "miracle year." Einstein's legacy is a large part of public fascination with physics, and Brill says that's important for the GGR to consider. He adds, "Society certainly has not been indifferent to relativity and cosmology. They are among the topics in which people show the greatest, purely curiosity-driven interest. The recent centenary of Einstein's Annus Mirabilis has renewed worldwide interest in relativity and physics generally, an interest that deserves to be further explored in educating people, particularly young people, in the sciences."

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ing for basic research (industry primarily funds development). While federal spending on R&D continues to increase overall, spending on academic R&D, mostly basic research, has been declining for three years in a row. This is the first time this has happened since 1982, the report points out.

In recent years industry in the US has shifted its focus away from basic research. The number of articles published in peer-reviewed journals by industry authors declined by 30% from 1995 to 2005. In physics, publications by industry authors dropped dramatically, from nearly 1000 in 1988 to 300 in 2005. The US also declined in its share of "highly influential" physics papers, dropping from first to second rank in physics from 1992 to 2003, the NSB study found.

The report also pointed to some positive trends. For instance, the US leads the world in its share of global R&D expenditures. Total R&D spending in the US in 2006 was $293 billion (in 2000 constant dollars), more than any other nation. High tech manufacturing revenue in the US is also strong, and total R&D spending is continuing to increase.

The US continues to lead the world in "triadic" patent filings (filings in the world's three largest markets–the US, the EU, and Japan), with nearly 20,000 applications in 2003. The share of US patent applications from US-based inventors has decreased slightly, to 53% in 2005 from 55% in 1996, mostly due to an increase in Asian patents.

In addition, public attitudes towards science are generally positive, the study found. There is broad support for federal funding of basic research; 87% of those surveyed believe the government should fund basic research, and 41%, the highest ever, think that the government spends too little on basic research. The science and engineering workforce in the US has been growing, as has the number of science and engineering degrees awarded by US colleges and universities, the study found.

The National Science Board offered the following recommendations:

1. The Federal Government should take action to enhance the level of funding for, and the transformational nature of, basic research.

2. Industry, government, the academic sector, and professional organizations should take action to encourage greater intellectual interchange between industry and academia. Industry researchers should also be encouraged to participate as authors and reviewers for articles in open, peer-reviewed publications.

3. New data are critically needed to track the implications for the U.S. economy of the globalization of manufacturing and services in high technology industries, and this need should be addressed expeditiously by relevant Federal agencies.

The full report can be found at: http://www.nsf.gov/statistics/seind08/

CONFERENCE continued from page 1

center in 2004 that found that most physics departments still require students to take the same traditional core courses, including Classical Electrodynamics, Quantum Mechanics, Classical Mechanics, and Statistical Mechanics. These courses haven't changed much in 50 years. Conference participants discussed whether these traditional core courses should be maintained.

The average time to degree has been slowly increasing over the past several decades. In part to reduce the time to degree, some departments have tried various changes, including reducing the number of required courses, giving the comprehensive exam earlier, tracking students' progress closely, and involving students in research earlier. "The student who is in a research group has a home," said Thomas Greytak of MIT. "They couple into the excitement from the very beginning."

Preparing students for careers in industry and other nonacademic careers was another topic of discussion at the conference. Bijoy Chatterjee of National Semiconductor said physics graduates are valuable to industry because "physics is at the heart of everything." Industry needs people who can solve problems, work well in a team, and figure out how things work, he said.

Shirley Chiang, a professor at UC Davis who previously worked at IBM, suggested that departments should pay attention to the need to train students for industry, but shouldn't radically change the graduate physics program. "We don't want to water down the PhD," she said. "It's got to be original research; otherwise it's not a PhD."

In surveys, students say they want more advice about nonacademic careers, but faculty often don't know enough about such careers to advise their students, and many professors consider industrial jobs to be second rate. One suggestion, which the University of Texas at Austin has successfully instituted, is a weekly seminar that brings physicists in nontraditional careers to talk to the students.

A few conference attendees felt that physics departments do not need to change their programs to train students for industrial careers, pointing to the low unemployment rate of physics PhDs no matter what sector they go into. "It seems to me we're doing a pretty good job without doing anything," one conference attendee said. Others at the conference pointed out that a PhD is unnecessary for many industrial jobs. Professional masters degree programs, which are offered by a small but growing number of institutions, may be a good alternative for some students.

Many departments said their biggest challenge was recruiting talented students, especially minorities and women. One suggestion that came out of the discussions was to set up a single centralized application processing system, similar to the system through which students apply to medical schools. Students could then submit one common application rather than submitting separate applications to multiple institutions. Such a system might help smaller institutions increase their applicant pools, some conference participants suggested.

Other topics of discussion at the conference included climate and diversity, communication skills, interdisciplinary courses, TA training, and ethics awareness.

Conference participants said they found it valuable to exchange ideas. The conference "provided a unique forum for directors of graduate studies to discuss the graduate experience in physics with their counterparts from other institutions," said conference organizer Janet Tate of Oregon State University. "I don't think this opportunity has arisen before."

"The very fact that so many people came to the conference is evidence that departments want to continue to improve the graduate experience," said Tate.

Many of the presentations are available on the conference website. A list of best practices is being compiled. You can visit the conference website at http://www.aps.org/programs/education/conference.cfm.

SOUTH AFRICA continued from page 5

visitors to also focus on relationships with historically Black African universities to help develop capacity by breaking their isolation. Here, one may start with lecture series on basic graduate-level topics, including tutorials and computer exercises, and leaving behind the capacity to sustain the courses. Co-supervision of graduate students is a very practical next step to collaborate, and to help maintain the international standing of the local researcher. Thereafter, it is considered of vital importance that the students and young faculty travel abroad to gain international experience to form their own linkages. Several programs provide for long-term visits, but short-term working visits, which link local and international partners, are very affordable and effective. A new feature is the growing recognition of the importance of intra-African interaction and of exposing our international visitors to a wider trans-African audience.

To affirm the summary of the previous article, the challenge is to build on our new, now solid, foundation for South African physics, laid by the strongest financial support from the government in many decades. Efforts must be intensified to recruit, educate and retain physicists in South Africa, building on our achievements, and growing the collaborative networks locally and internationally. We need to accelerate our human resource development to take up the increasing number of opportunities, and we encourage our international physics colleagues to continue to partner us in our efforts.

Nithaya Chetty is at the School of Physics, University of KwaZulu-Natal, and is the current South African Institute of Physics (SAIP) president; Simon Connell is at the School of Physics, University of the Witwatersrand, and SAIP president-elect; Harm Moraal is at the School of Physics, North-West University, and a recent SAIP past-president. Direct correspondence to: Nithaya Chetty, e-mail: chettyn@ukzn.ac.za

MARCH MEETING continued from page 1

physics professor at the University of Minnesota and author of *The Physics of Superheroes*. (Session D3)

Optical Lattices for Quantum Computing. Quantum computing just got one stop closer with an advance in optical lattice technology. David Weiss (Penn State) will describe a 3D optical lattice partially filled with individual atoms at 250 sites. Ultimately, Weiss and his colleagues hope to use the atoms as qubits in a quantum computer. Unlike previous 3D lattices, the spacing between the atoms in the new system is large enough that the atoms can be individually manipulated with lasers and microwaves without disturbing neighboring atoms. The atoms' individual addressability and the fact that the atoms have multiple neighbors to quantum mechanically interact with make the system a promising route to quantum computing. (B6.4)

Gold, Tin and Lead Buckyballs. Carbon buckyballs (fullerenes) are tiny spherical clusters of carbon atoms. The structures were first identified in 1985. But it was only two years ago that Lai-Sheng Wang (Washington State University and Pacific Northwest National Laboratory) and colleagues found that gold atoms could form similar spherical arrangements. Last year, Wang and his research group expanded the list of buckyball-forming elements by showing that tin and lead atoms could form into tiny spherical clusters, which they have respectively designated stannaspherene and plumbaspherene. Fullerenes are important in part because their properties can be adjusted by trapping other atoms at the center of the atomic cages. But some important elements interact strongly with gold and can't be trapped inside golden fullerenes, which limits the structure's potential for chemical applications. Tin fullerenes, on the other hand, can accommodate a number of important transition metal atoms and may end up being the most chemically versatile form of fullerenes discovered so far. (B21.5)

Artificial Neurons. The biophysics of neurons helps us understand how the brain works and suggests that artificial neurons may someday help in repairing or replacing damaged nerves. Donald Edwards (Georgia State University) will open session Y36, which is dedicated to various aspects of artificial neurons, with a look at a new software package called AnimatLab that allows researchers to construct models of neural circuits and test their ability to mimic the movements of living creatures. Specific examples of AnimatLab studies will be presented by David Cofer (Georgia State University) in a talk about the mechanics of locust jumping (Y36.2) and Alexander Klishko (Georgia Tech), who has studied the extremely high accelerations cats' paws achieve when shaking in response to an irritating stimulus (A38.7). In talk Y36.7, Ranu Jung (Arizona State University) presents recent work on interfacing artificial neurons with damaged nerves in attempts to create neuroprosthetics. Other talks in the session describe a robot designed to mimic the locomotion of sea lampreys (Nikolai Rulkov, University of California, San Diego, Y36.3) and new ways to analyze neuronal activity (Y36.4, Y36.5, Y36.8, and Y36.11).

The Econophysics of Epidemics. Understanding human mobility patterns can help improve urban planning and traffic forecasting, as well as help prevent the spread of diseases. Scientists at Notre Dame University and Northeastern University have tracked the individual mobility pattern of cell phone users and time-resolved the data, and have come up with a new model for a universal mobility pattern. In the same session, researchers from the College of William and Mary will present their findings on the dynamics of epidemic spread, focusing on multi-strain diseases (such as dengue fever and Ebola) with a high risk of secondary infection by a different strain. Also, scientists from the Max-Planck Institute for Dynamics and Self-Organization in Goettingen, Germany, have modeled the dynamics of panic reactions: how infectious wave front dynamics are affected as people disperse more widely to avoid infection. (Papers D39.3, D39.4, D39.5)

Circuit QED. Quantum electrodynamics (QED) is the most precise theory in all of physics, allowing tests of theory with experimental findings to levels of a part in a trillion or better. One sub-category of research is cavity-QED, in which the arena is a tiny cavity where basic interactions between atoms and photons, or photons alone, can be studied with great care. Recently a group of physicists at Yale in the group of Rob Schoelkopf accomplished two important feats that might help in the important endeavor to produce and process quantum bits (qubits) for future computers that handle quantum information. First, they produced a reliable source of single microwave photons; producing such photons by the million is easy, but not so easy if you want to make them singly on command. Second, they were able to transfer quantum information from one qubit to another along a wire; to be more precise the wire guided the photon (a virtual photon) from one place on a chip to another, the wire acting as a sort of common bus for moving information. The qubits (in effect bits consisting of a superpositions of both 0s and a 1s) reside in the form of the presence (or absence) of a single photon in a tiny cavity. Now, Johannes Majer (recently moved from Yale to the Vienna University of Technology) will report on progress of coupling superconducting qubits via a quantum bus. (Paper D5.3)

Toward Gigabar Pressures. Several sessions and a town meeting of practitioners will address the subject of producing ultrahigh pressures in laboratories or in simulating the effects of high pressure on various materials. Generally megabar (10^6 atm) pressures can be produced in the lab using either static pressure produced in a tiny anvil cell employing the facets of diamonds (up to about 5 megabar) or dynamic pressure produced in the form of shock waves. Laser driven shocks currently produce pressures in the tens of megabar (1 tera-pascal) range, but within a few years gigabar pressures will be accessible with lasers at the National Ignition Facility (NIF) in the US and the Laser MegaJoule (LMJ) facility in France. Raymond Jeanloz of UC Berkeley will report on studies of liquid diamond (diamonds melted by laser light), which is metallic in nature. Jeanloz makes the point that the megabar pressures at work squeezing a material are equivalent to electron-volt-levels changes in the strengths of chemical bonding among neighboring atoms. In effect, he says, the periodic table properties of atoms are fundamentally altered by megabar pressures. All of this is magnified at gigabar pressures (equivalent to keV changes in bonding), where core-electrons, normally very reticent inside their atoms, become participants in the chemistry. (Paper T16.2)

Nanoparticles Kill Tumors In Rats. The ability to deliver drugs specifically to one part of the brain or some other specific tissue in the body is highly desirable in diseases like cancer, where the drugs may have widespread toxicity to healthy cells throughout the body. One nanotechnology-based approach to solving this problem was designed about 10 years ago by Raoul Kopelman (University of Michigan). Kopelman found a way of making tiny polyacrylamide particles about 60 nanometers in diameter that can be imbedded with drugs or other compounds and safely delivered to the bloodstream. Moreover, antibodies or other "targeting" molecules can be attached to the outside of the particles so that they can ferry this payload though the body and dock at the tissues where the drugs are needed. In his talk, Kopelman describes one experiment where he and his colleagues decorated these particles with peptides that helped guide them into the nuclei of cancer cells in the brain, There, MRI contrast agents loaded in these nanoparticles helped image the tumor cells, and when illuminated by a laser, photodynamic chemicals inside the nanoparticles released highly-reactive singlet oxygen into the cancer cells, killing them. One 5-minute blast with simple red laser cured a few rats of glioblastoma, one particularly nasty form of brain cancer. (X15.2)

Micro-Ocean. An important part of the biosphere is the population of micro-organisms, which stand at the lowest level of the food chain but which dominate all others in terms of mass. At his MIT lab, Roman Stocker looks at such micro societies in ecological landscapes created on micro-fluidic chips. To marine bacteria, the ocean is a desert, a place where nutrients are scarce. Stocker will report on surprising signs that bacteria are much more efficient than was previously thought in their search for patches of nutrients. This might be an important step in studying how carbon and carbon dioxide are taken up in the ocean. (Paper P6.4)

Record-Setting Subwavelengh Image Transmission. As a rule, images manipulated with lenses and mirrors cannot reveal details smaller than half the wavelength of light used to transmit them. Recently, many research groups have tried to break the resolution limit with new optical devices. Pavel Belov (Queen Mary University of London) and colleagues appear to have captured the subresolution flag with a system that can produce images with resolutions fifteen times smaller than the wavelength of the light used to create them, and transmit the images over distances 3.5 times the light's wavelength. The record was set with an array of parallel metallic rods that can be manufactured to work for wavelengths ranging from microwaves to mid-infrared light. Belov will report on the performance of the novel subwavelength system and discuss the potential for image magnification, data storage and other applications. (V28.5)

Switch Alternatives for Microelectronics. Miniaturization is the primary focus of most efforts to advance the state of the art in microelectronics. An added benefit of shrinking devices is that energy efficiency tends to improve dramatically as well, with one notable exception–even at tiny dimensions transistors are power-hungry components. Session S2 focuses on the increasing importance of finding alternatives to transistors in microelectronics. Eli Yablonovitch (University of California, Berkeley) will start the session off by considering a number of low voltage alternatives to transistors. Among the other speakers in the invited session, Joerg Appenzeller (Purdue) will consider solid state carbon nanotube devices, and Marc Baldo (MIT) will describe a prototype nanoscopic mechanical switch (also built of carbon nanotubes) that has the potential to eliminate losses characteristic of transistors, operate at low voltages, and run at much higher temperatures than typical of many silicon-based devices. (Session S2)

Solar Cells: The Next Generation. More silicon goes into the making of solar cells than into the making of microchips. Although accounting for only a tiny portion of overall electricity generation so far, solar cells are moving up quickly. For the past five years the amount of solar-generated electricity has increased by about 40% per year. Mass production of solar panels will help immensely in the overall long-term goal of bringing the cost of solar electricity down closer to that of coal-fired electricity. In the meantime, the things physicists can do are to explore new ways to make the cells more efficient and cheaper to produce. Session L2 is devoted to this effort. For example, one paper will consider the use of silicon nanocrystallites rather than more cumbersome (and expensive) single-crystal configurations used in present cells. Making cells from dye-sensitized paint components (titanium dioxide particles) is another route to cost reduction; the cells are somewhat less efficient than Si cells but are really cheap. Another paper looks at the use of quantum dots for utilizing solar radiation at certain infrared wavelengths that would otherwise be lost to the conversion process. One speaker will report on the use of high-efficiency (and more expensive) tandem solar cells and the use of concentrators to focus sunlight and reduce the cost. The issue of high efficiency is especially crucial for portable solar-powered devices that are being developed by the military for use by soldiers in the battlefield. (Session L2)

ANNOUNCEMENTS

M. Hildred Blewett Scholarship for Women Physicists

This scholarship has been established to enable women to return to physics research careers after having had to interrupt those careers for family reasons. The scholarship consists of an award of up to $45,000. The applicant must currently be a legal resident of the US or Canada. She must be currently in Canada or the US and must have an affiliation with a research-active educational institution or national lab. She must have completed work toward a PhD.

Applications are due June 2, 2008. Announcement of the award is expected to be made by August 1, 2008.

Details and on-line application can be found at http://www.aps.org/programs/women/scholarships/blewett/index.cfm

Contact: Sue Otwell in the APS office at blewett@aps.org

Correction

APS News failed to credit the source of the image of Henry A. Rowland that appeared on the Back Page of the January issue. The image was a reproduction of a painting in the collection of the Addison Gallery of American Art at Phillips Academy in Andover, Massachusetts, with the following catalog entry:

Thomas Eakins (1844–1916) *Professor Henry A. Rowland*, 1897
oil on canvas, 80 1/4 in. x 54 in. (203.84 cm x 137.16 cm)
1931.5, gift of Stephen C. Clark, Esq.

Now Appearing in RMP: Recently Posted Reviews and Colloquia
You will find the following in the online edition of
Reviews of Modern Physics at
http://rmp.aps.org

Orbital-dependent density functionals: Theory and applications

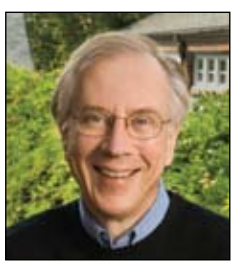
Stephan Kümmel and Leeor Kronik

Density-functional theory is widely used for electronic structure calculations. It is based on a very simple, density-based variational principle discovered by Kohn and Hohenberg. However, many physical effects are hard to describe using the density, yet are easily described using orbitals. This article describes how orbital-dependent functionals are incorporated into density-functional theory and how they resolve formal and practical difficulties of the theory.

The Back Page

Physics Tomorrow

by Thomas R. Cech, Steven Chu and Neal Lane



Thomas R. Cech

Steven Chu

Neal Lane

Federal funding for physics is flat, if not falling. The 2008 budget passed in December provides a 1.1% increase for the NSF's research budget, not the much-anticipated first step towards doubling, which had been recommended by the National Academies' "Gathering Storm" report and had received strong support from the President and both parties in Congress. And DOE's Office of Science had its requested budget increase cut by two-thirds, with high-energy physics and fusion sciences especially hard hit (1). NIH funding of biomedical research has been flat for five years in a row, following doubling of its budget.

In times of constrained budgets, it's especially important to think about the directions in which federal research dollars are focused. That's the impetus for a new American Academy of Arts and Sciences (AAA&S) study on Mechanisms of Federal Funding of Research. The Committee is not suggesting that research budgets are adequate, but the focus of our study is on how those funds are allocated.

Our committee has recognized that this is a very broad topic indeed, so we're focusing our attention on two of the issues that are of widespread current concern: launching the research programs of early career scientists, and making sure the nation continues to support high risk, high reward research that has the potential to be transformative.

The interest in providing sufficient funding for young faculty to start their research programs has a simple explanation: those beginning their independent research careers today will make the discoveries of tomorrow and will teach the physics students of tomorrow. Put another way, it makes no sense for the society to educate young physicists through their undergraduate, graduate and postdoctoral years, offer faculty positions to the best of the best through intense world-wide competitions, and then not give them the wherewithal to initiate their programs. Grad students and postdocs are privy to their research advisor's thoughts; low morale among junior faculty leads to disenchantment of younger colleagues still in training.

". . . it makes no sense for the society to educate young physicists. . . .and then not give them the wherewithal to initiate their programs."

What are the numbers? At NSF, the funding rate for new investigators was 22% in FY 2000, and it had dropped to 15% in FY 2006 (2). Although the proportion of all awards that were given to new PIs compared to prior PIs has not changed in the past decade (2)–that is, the suffering has been spread evenly–missing is an analysis of how much funding new investigators require to maintain our nation's research leadership, let alone capitalize on emerging opportunities such as nanotechnology and interdisciplinary efforts with biologists. Furthermore, "new investigators are submitting many more proposals per PI [by almost a factor of two] than are experienced investigators" (2), a dubious use of their time and energy.

What needs to be done? Although our Committee is still finishing its final report, some draft recommendations are already crystallizing. The federal funding agencies need to analyze the number of awards needed to sustain a robust US science and engineering enterprise into the future. And the agencies need to implement or sustain a sufficient level of one-time, non-renewable grants programs dedicated to the support of early career faculty (such as the NSF CAREER awards) and to institute career-stage-appropriate expectations for their mainstream grant funding, with merit review processes tailored for beginning independent researchers. Universities need to contribute as well, by actively mentoring young faculty and also by reviewing their criteria for tenure and promotion to ensure that faculty who participate in teams receive appropriate credit for their contributions to collaborative research projects.

Just as securing tomorrow's talent is imperative for American scientific competitiveness, so too is supporting high-risk, high-reward research. When funding becomes tight, there's a natural tendency for reviewers and program officers to give highest priority to those projects that are most likely to produce "useful" results. Much research that might be described as incremental is important and worthy of funding. But our nation's research portfolio needs to be balanced with some projects that set out to transform our understanding of the world or develop radically new technology, while accepting the risk that they might fail completely.

At the same time, many paradigm-shifting discoveries arise from serendipitous observations rather than a direct approach, so research grant mechanisms should empower rather than inhibit discovery. Long proposals containing a large amount of experimental detail side-track reviewers into dissecting the proposed techniques for potential shortcomings; but if one picks creative researchers, they need to be trusted to overcome such challenges as they arise. How many research projects ever proceed precisely as anticipated, anyway? Proposals should be idea-based, focusing on goals and strategies, and should articulate the potential impact of the work, not be encumbered with excessive methodology. In many cases, more emphasis should be placed on the track record of the investigator or, in the case of early career scientists, on the creativity they showed during their training period.

In addition, transformative research can be stimulated by seed money dedicated to projects that are truly high risk, high reward. Such grants could be non-renewable, but should be of sufficient size and duration to permit proof-of-concept. Some would lead to successful funding in the regular grant system.

A major portion of our report will address the question of how federal funding at universities can improve the development of young scientists and support the genesis of transformative science. However, attention must also be paid to the National Laboratories, which have historically played a vital role in the training of early career scientists. As an example, many Nobel Laureates in Physics and Chemistry received a significant part of their early career training while working at one of DOE's Office of Science National Labs–30 at Lawrence Berkeley Lab alone. While individual genius is still nurtured in the setting of a national lab, teams of scientists can be quickly formed to tackle problems that would be difficult to solve with the resources of an individual principal investigator in a university. When tenure is not an issue, intimate mentoring within these collaborations becomes a natural part of the development of a young scientist. With the demise of the great industrial labs such as Bell Laboratories, the national labs remain one of the few pathways outside of the tenure track system of universities that can train the next generation of stellar scientists.

Our committee's final report will be available later this year. Our hope is that it will stimulate a deeper discussion of our nation's research and education enterprise and, in particular, the intertwined government and university policies and procedures that affect the success of early career scientists and the opportunity to engage in high risk, high reward research. For, as much as we may enjoy reading *ww*, we need to lay the groundwork for physics tomorrow as well.

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Steven Chu is Director of Lawrence Berkeley National Laboratory, Professor of Physics, Molecular and Cell Biology, University of California, Berkeley, and a recipient of the 1997 Nobel Prize in Physics. He is a member of the AAA&S committee and the National Academies "Gathering Storm" committee.

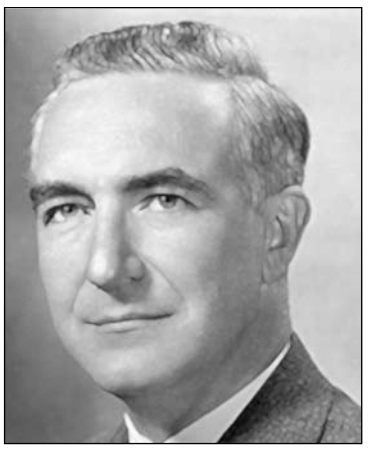
Neal Lane is the Malcolm Gillis University Professor and Senior Fellow of the James A Baker III Institute for Pubic Policy at Rice University and a professor in the Department of Physics and Astronomy. He is a member of the AAA&S Council and Executive Committee.

(1) J. Mervis (2008). *Science* 319, 18-19.

(2) K. L. Olsen and J. Turnow (2007). Impact of Proposal and Award Management Mechanisms. Final Report to the National Science Board. http://www.nsf.gov/od/ipamm/ipamm.jsp

APS Valley Prize Rewards Tomorrow's Physicists

As noted in the Back Page article above, funding for young scientists at the outset of their careers can be crucially important. This year, the APS calls for nominations for the fourth presentation of the George E. Valley, Jr. Prize, which is aimed specifically to help with this problem.



George E. Valley, Jr.

The Valley Prize is given every other year to an outstanding young physicist who has received his or her PhD no more than five years ago. To be eligible for this year's competition, nominees must have received their PhD no earlier than April 1, 2003. The Prize carries the largest stipend of any APS Prize–$20,000–with the intention of providing a potentially significant contribution to the recipient's research effort.

The nomination deadline is July 1, 2008. More information about the nature of the Prize, and the nomination and selection process, can be found on the Valley Prize web page at http://www.aps.org/programs/honors/prizes/valley.cfm .

The Prize was established by APS Council in 2000, and was endowed by a bequest from the estate of George E. Valley, Jr., who was Project Supervisor and a senior staff member of the Radiation Laboratory at MIT from 1941 to 1945. He was on the faculty at MIT from 1946 to 1974, was one of the founders of MIT Lincoln Laboratory, and was Chief Scientist of the Air Force in 1957-58. His areas of research included: Artificial Radioactivity, Mass Spectroscopy, Cosmic Rays, design of Radar Systems and invention of the SAGE Air Defense System.