APS NEWS
Aug./Sept. 2004
Volume 13, No. 8
A Publication of The American Physical Society http://www.aps.org/apsnews

UN Declares 2005 the International Year of Physics

Next year will be not only the World Year of Physics, but the International Year of Physics as well, by declaration of the General Assembly of the United Nations on June 10.

By convention the UNGA is the only body entitled to name an International Year. 2005 had previously been declared the World Year of Physics by the International Union of Pure and Applied Physics (IUPAP) in 2002 and by the UN Educational, Scientific and Cultural Organization (UNESCO) in 2003. The action by the General Assembly is the final step in achieving international status for the WYP.

The resolution was co-sponsored by Lesotho, Monaco, France, the UK, Brazil, Portugal, St. Kits and Nevis and Croatia, and was passed by acclamation. The effort was spearheaded by the representatives of Lesotho and Monaco, both of whom are physicists. "It feels good that we have achieved what we had set out to do," said the permanent representative of Lesotho to the UN, Lebohang K. Moleko, after the resolution passed.

Efforts to obtain US co-sponsorship ran afoul of general State Department policy. Last summer, in a letter to Bruce Alberts, President of the National Academy of Sciences, Kim R. Holmes, Assistant Secretary of State for International Organization Affairs stated that "we have established a general practice of not encouraging the UNGA...to designate and celebrate the anniversary of historical events....We seek to have them focus their limited time and resources on the priority issues currently before them." The World Year of Physics celebrates the centennial of Einstein's "miraculous year" of 1905.

Martial Ducloy, past president of the European Physical Society and Chair of the International Steering Committee for the World Year of Physics, said "We are all very happy that finally the WYP draft resolution has been put on the UN agenda, and then approved by acclamation. It gives us a lot more confidence for all the events which have been planned worldwide."

Ducloy also addressed the issue of whether the logo of the World Year of Physics should be officially changed. He noted that the logo has been in use worldwide for two years now, and therefore should remain substantially the same. He suggested that a suitable inscription be added underneath the logo to reflect the UN's action. One possibility would be "endorsed by the UN as the International Year of Physics".

The text of the UN resolution follows:

The General Assembly of United Nations,

•Recognizing that physics provides a significant basis for the development of the understanding of nature,

See UNITED NATION *on page 7*

Latest Membership Survey Rates APS Activities

APS members feel that lobbying, informing the public, and improving education are what the Society should make its highest priorities, according to a survey of regular and junior members that was completed in June. (Junior members are those within 3 years of their PhD.)

The survey was sent out electronically in late March to approximately 5000 APS members, and after two additional reminders, a 61% response rate was achieved. The survey concentrated on membership issues; other surveys are planned for further specific areas of Society activity, such as meetings and publications. Respondents chose staying abreast of developments in the field (53%) as the highest ranking reason they continue as APS members.

Other highly-rated reasons included keeping in touch with the physics community (51%) and supporting the physics community (50%). Forty-four percent listed receiving *Physics Today* as a reason that they continue as members.

Junior members in particular appreciated the ability to submit abstracts at APS meetings (43%) and the reduced meeting registra-

See SURVEY *on page 6*

APS Hosts Chairs' Conference

Photo Credits: Bernard Khoury

On June 4-6, 84 physics department chairs from around the country gathered in College Park, MD to attend a biennial conference sponsored by the APS and the American Association of Physics Teachers (AAPT). The theme of this year's conference was "Physics in the Public Interest." The Friday evening session featured an address by Charles McQueary, Under Secretary for Science and Technology of the Department of Homeland Security. Among the speakers on Saturday were David Campbell of Boston University (top photo) shown addressing the conference on the National Task Force on Graduate Education, and Alan Dorsey of the University of Florida (bottom photo), shown participating in a panel on graduate education issues. Other speakers included Robert Dynes, President of the University of California, and, on Sunday, Peter Rooney of the House Science Committee and Michael Turner, Assistant Director for Mathematical and Physical Sciences of the National Science Foundation.

Physics Department Chairs Make Their Case on Capitol Hill

"All politics is local," former Speaker of the House Tip O'Neill once famously observed. After participating in an APS lobbying day on June 4, physicists Chris Gould and Mary Creason are not about to disagree.

Before they arrived in the nation's capital, Senator Elizabeth Dole (R-NC) had been asked on several occasions to sign a letter circulating in the Senate in support of the Department of Energy's Office of Science, which provides about 65% of all federal support for physics research. On each try, her office was receptive, but when the letter was finalized with 55 signatures on it, hers was not among them.

Enter Gould and Creason, of North Carolina State and Duke Universities, who were in Washington for the APS/AAPT Department Chairs Conference. They met with a member of Senator Dole's staff to explain the importance of a strong federal investment in science—to the nation as a whole, and especially to North Carolina. They described the key role that federally-funded physical science research plays in our economy, health care, and national security, and they also described its importance to scientists at their own universities and others around the state. Indeed, in fiscal year 2002, 240 North Carolina researchers used Office of Science facilities and many more received support in the form of over $12 million in grant funding.

The message got through. Within days, Dole's office had called a key appropriations subcommittee that controls the Office of Science budget and expressed the senator's support. It may seem like a small thing, but in a difficult year, when many federal programs are faced with the possibility of debilitating cuts, seemingly small communications among members of Congress can add up to significant sums when budgets are set.

Tales like this were common among lobbying day participants, who found that members of Congress put the concerns of their constituents above all else. Gould and Creason had a similar experience with Richard Burr (R-NC), a congressman who signed, at their request, a letter circulating in the House supporting the National Science Foundation, and with Brad Miller (D-NC) who signed a House letter supporting the Office of Science. "We found the staffers to be very knowledgeable and receptive

See PHYSICS CHAIRS *on page 7*

Highlights

The BackPage: Navigating Challenges in a Rapidly Changing World *By Myriam Sarachik.*

Executive Board Urges Review of Moon/Mars Mission Proposal

At its June meeting, the APS Executive Board passed a resolution expressing reservations about the Moon/Mars initiative announced earlier this year by President Bush.

Among the concerns was that "the rapid pace currently envisioned for this program may require a wide redistribution of the science and technology budgets that could significantly alter the broad scientific priorities carefully defined for NASA."

The Board urged that "an exhaustive external review of the plans should be carried out by the National Academy of Sciences and their likely budgetary impact estimated by the General Accounting Office."

This resolution expresses the opinion of the Board, but does not constitute a policy statement by the APS. Such a statement can only be issued by the APS Council, whose next meeting will be in November.

The text of the Executive Board resolution follows:

Reestablishing a human presence on the Moon and sending astronauts to Mars represents a major national challenge. However such a program could only achieve its full significance as part of a balanced program of scientific exploration of the universe and studies of the interaction between humankind and its environment. In recent years, NASA has captured the public's imagination through its spectacular scientific successes with the Hubble Space Telescope, the Mars rovers, and Explorer missions that have revolutionized our understanding of the universe.

The technical hurdles facing the Moon-Mars initiative are formidable, and the program's overall costs are still unknown. Further, the rapid pace currently envisioned for this program may require a wide redistribution of the science and technology budgets that could significantly alter the broad scientific priorities carefully defined for NASA and the other federal agencies. Launching such a massive program without broad consultation and a clear idea of its scope and budget may hurt rather than enhance, as intended, the scientific standing of the US and the training of its scientists and engineers.

Before the United States commits to President Bush's proposal, an exhaustive external review of the plans should be carried out by the National Academy of Sciences and their likely budgetary impact estimated by the General Accounting Office.

Members in the Media

"I don't think any time soon we're going to have jars of bacteria on our desk to surf the Web"
—James Collins, Boston University, on cellular computing, The Boston Globe, June 9, 2004

✶✶✶

"In a quantum computer it's straightforward enough to move quantum information around by simply moving the qubits, but you might want to do things very quickly, so you could use teleportation instead."
—David Wineland, NIST, on teleporting atoms, BBC News Online, June 16, 2004

✶✶✶

"This is a milestone. We are able to teleport in a deliberate way—that is, at the push of a button. This has been done before, but not in such a way that you can keep the information there at the end."
—Rainer Blatt, of the University of Innsbruck, on teleporting atoms, BBC News Online, June 16, 2004

✶✶✶

"Quantum teleportation is a fascinating aspect of science, but whether we'd be talking about it on the radio right now if there wasn't 'Star Trek' is not at all clear to me. To the extent that science fiction can be used to inspire people to learn about the real universe, I think it's very important. But it's also very important to know that there's a difference."
—Lawrence Krauss, Case Western Reserve University, NPR Talk of the Nation/Science Friday, June 18, 2004

✶✶✶

"I take this data and render it in various ways, experimenting. There is a point when I say, 'I'm stopping now in making pictures for my scientific article, and I am doing art.' "
—Eric Heller, Harvard University, on his science-inspired artwork, St. Petersburg Times (Florida), June 13, 2004

✶✶✶

"It's not a bit of a delay. This collection, which are known as the beyond Einstein Probes, are indefinitely delayed. Indefinite to me means it's not on the agenda at all."
— Burt Richter, SLAC, on NASA projects that have been put on hold to fund President Bush's plan to send humans to Mars, NPR Morning Edition, June 8, 2004

✶✶✶

"It's one of the few programs where universities can actually do a lot. Students get trained on them and these are the scientists and engineers who eventually will be needed by NASA for the large programs.
—Robert Lin, University of California Berkeley, on NASA's Explorer Program, which has been funding small- and mid-sized research spacecraft, and is being delayed by budget cuts, NPR Morning Edition, June 8, 2004

✶✶✶

"I hope they're wrong, but I can't prove it. And I bet my life work on their being wrong."
—Andrew Strominger, Harvard University, on skeptics who say there's nothing to string theory, Deseret Morning News (Salt Lake City), June 14, 2004

✶✶✶

"We make two steps forward, and one back."
—Curtis Meyer, Carnegie Mellon University, on building a detector for exotic mesons, Pittsburgh Post-Gazette, June 14, 2004

✶✶✶

"They open up a range of things you can't otherwise see because you're blinded on the surface."
—Ken Lande, University of Pennsylvania, on underground laboratories, Associated Press, June 25, 2004

✶✶✶

"The Navy wants to make non-magnetic submarine hulls. Right now, the steels the Navy uses for submarine hulls are ferro-magnetic. You don't want to be sitting in a mine field if you're sitting in a magnetic field to begin with."
—Joseph Poon, University of Virginia in Charlottesville, on amorphous steels, United Press International, June 25, 2004

✶✶✶

"For the past 10 years, [computer] companies have been scaring the government into thinking this era is coming to an end."
—Paul Thibado, University of Arkansas, on miniaturizing computer components, Arkansas Democrat-Gazette (Little Rock), June 28, 2004

✶✶✶

"The promise of this is to totally revolutionize the way that we do business technologically in almost all aspects of life,"
—Uzi Landman, Georgia Tech, on nanoscience, Arkansas Democrat-Gazette (Little Rock), June 28, 2004

✶✶✶

"We tend to invent the wheel for ourselves. We're just starting to realise that statisticians have a whole entourage of techniques that we can apply."
—Paul Padley, Rice University, on how physicists use statistical methods, New Scientist, June 26, 2004

This Month in Physics History

Making History

August 1932: Discovery of the Positron

Star Trek creator Gene Roddenberry incorporated a lot of actual science into what has become one of the most successful series franchises of all time. One of those is the matter/antimatter engines that power the Enterprise, enabling it to supposedly travel at speeds faster than the speed of light.

In 1928, British physicist Paul Dirac showed that Einstein's relativity implied that every particle in the universe has a corresponding antiparticle, each with the same mass as its twin, but with the opposite electrical charge.

The hunt was on to find experimental verification of this hypothesis; a Caltech postdoc named Carl D. Anderson would win the race.

Anderson was born in 1905 to Swiss parents in New York City. When he was 7, the family relocated to Los Angeles, and his parents divorced shortly thereafter. Anderson helped support the family at a very young age, but still managed to get a college education at Caltech. He originally intended to study electrical engineering but switched to physics after taking a particularly inspiring class in the subject. He ultimately went on to earn a PhD in physics engineering (now known as applied physics) from Caltech.

Anderson spent most of his career at Caltech. His early research was on X-rays, but then Victor Hess discovered cosmic rays in 1930. At the advice of his mentor, Robert A. Millikan, Anderson turned his attention to studying those high energy particles. Most scientists were doing this by using cloud chambers: a short cylinder with glass end plates containing a gas saturated with water vapor. If an ionizing particle passes through the chamber, it leaves a trail of water droplets, which can be photographed. By measuring the density of the droplets, scientists can deduce how much ionization is produced—indicating the kind of particle that passed through.

Anderson built his own, improved version of a cloud chamber, incorporating a piston so that he could get the pressure to drop very rapidly. He also used a mixture of water and alcohol

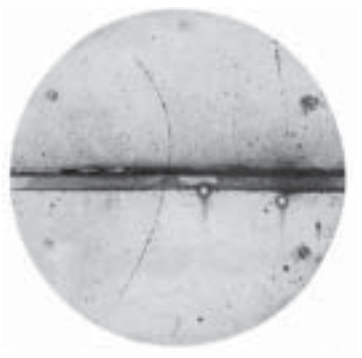

Photo Credit: Carl D. Anderson, Physical Review Vol.43, p.491 (1933)

Anderson's cloud chamber picture of cosmic radiation from 1932 showing for the first time the existence of the anti-electron. The particle enters from the bottom, strikes the lead plate in the middle and loses energy as can be seen from the greater curvature of the upper part of the track.

in the chamber. And he obtained much better photographs than his colleagues. He surrounded his chamber with a large electromagnet, which caused the paths of ionizing particles to bend into circular paths. By measuring the curvature of those tracks, he could calculate the particles' momentum and determine the sign of the charge.

The resulting photographs surprised Anderson by revealing that cosmic rays produced showers of both positively and negatively charged particlesand the positive charges could not be protons, as one might expect, because the track radius would specify a proton stopping distance much shorter than the length of the track.

Anderson and Millikan speculated that perhaps the positively charged particles were electrons traveling in the opposite direction.

To test the hypothesis, Anderson placed a lead plate in the chamber. When particles passed through the plate, they would emerge from the other side at a lower energy than when they started, so the direction of travel could be deduced.

In August 1932, Anderson recorded the historic photograph of a positively charged electron (now known as a positron) passing through the lead plate in the cloud chamber. It was definitely a positively charged particle, and it was traveling upwards.

Despite initial skepticism from the scientific community, Anderson's result was confirmed the following year, and scientists concluded that the positron was one of a pair of positive and negative electrons produced when a gamma ray converted into matter.

His discovery snagged Anderson a Nobel Prize in Physics in 1936, at the age of 31—the youngest person to be so honored.

Antiprotons—protons with a negative instead of the usual positive charge—were discovered by researchers at the University of California, Berkeley in 1955, and the antineutron was discovered the following year. It would take another 30 years before scientists created the first anti-atoms.

In 1995, CERN researchers used the Low Energy Antiproton Ring (LEAR) to slow down rather than accelerate antiprotons. By so doing, they managed to pair positrons and antiprotons together, producing nine hydrogen anti-atoms, each lasting a mere 40 nanoseconds.

Within three years, the CERN group was producing as many as 2000 anti-hydrogen atoms per hour.

That's still not enough to achieve practical antimatter propulsion. It would take tons of antiprotons to travel to interstellar destinations, yet the CERN facility only produces enough antiprotons in one year to light a 100 watt bulb for three seconds. And that's not considering the huge amounts of energy required to power the intense beams that produce the antiprotons.

Nonetheless, in 2000 NASA scientists announced early designs for an antimatter engine that might be capable of fueling a spaceship for a trip to Mars using only a millionth of a gram of antimatter.

The positron has found one useful application: positron emission tomography (PET). This medical imaging technique uses low energy annihilations of electrons and positrons to image the inner workings of the brain, injecting radioactive nuclei into a patient and observing the resulting pairs of gamma rays. The energy produced is insufficient to form even the lightest particle and antimatter and emerges instead as two gamma rays.

APS NEWS
Series II, Vol. 13, No. 08
August/September 2004

Coden: ANWSEN ISSN: 1058-8132

Editor ..... Alan Chodos
Associate Editor ..... Jennifer Ouellette
Special Publications Manager ..... Elizabeth Buchan-Higgins
Design and Production ..... Stephanie Jankowski
Forefronts Editor ..... Craig Davis
Proofreader ..... Edward Lee

APS News (ISSN: 1058-8132) is published 11X yearly, monthly, except the August/September issue, by the American Physical Society, One Physics Ellipse, College Park, MD 20740-3844, (301) 209-3200. It contains news of the Society and of its Divisions, Topical Groups, Sections and Forums; advance information on meetings of the Society; and reports to the Society by its committees and task forces, as well as opinions.

Letters to the editor are welcomed from the membership. Letters must be signed and should include an address and daytime telephone number. The APS reserves the right to select and to edit for length or clarity. All correspondence regarding *APS News* should be directed to: Editor, *APS News*, One Physics Ellipse, College Park, MD 20740-3844, E-mail: letters@aps.org.

Subscriptions: *APS News* is an on-membership publication delivered by Periodical Mail. Members residing abroad may receive airfreight delivery for a fee of $15. Nonmembers: Subscription rates are available at http://librarians.aps.org/institutional.html.

Subscription orders, renewals and address changes should be addressed as follows: For APS Members—Membership Department, American Physical Society, One Physics Ellipse, College Park, MD 20740-3844, membership@aps.org. For Nonmembers—Circulation and Fulfillment Division, American Institute of Physics, Suite 1NO1, 2 Huntington Quadrangle, Melville, NY 11747-4502. Allow at least 6 weeks advance notice. For address changes, please send both the old and new addresses, and, if possible, include a mailing label from a recent issue. Requests from subscribers for missing issues will be honored without charge only if received within 6 months of the issue's actual date of publication. Periodical Postage Paid at College Park, MD and at additional mailing offices. Postmaster: Send address changes to *APS News*, Membership Department, American Physical Society, One Physics Ellipse, College Park, MD 20740-3844.

APS Members Urged to Help Jailed Russian Researcher

The APS Committee on International Freedom of Scientists (CIFS) is calling on APS members to support its efforts to free Russian arms control researcher Igor Sutyagin. A physicist by training, Sutyagin is an investigator at the Institute of US and Canadian Studies of the Russian Academy of Sciences.

After being convicted on charges of treason and espionage, Sutyagin was sentenced to 15 years of hard labor by the Moscow City Court on April 7, 2004, following almost 5 years of FSB (Russian Security Service) investigation during which he was jailed.

The exceptionally harsh sentence has shocked Russian academic communities as well as international human rights groups. According to his lawyers and those groups, the trial process failed to meet international standards of fairness and due process, and seriously violated several Russian laws.

Photo Credit: Reuters

Igor Sutyagin listens to the Moscow City Court read his 15-year sentence to hard labor from the barred cage in which defendants sit during trial in Russia.

A panel of jurors sworn to hear the case in November 2003 was dismissed without explanation and replaced by a new one. The prosecutor did not even attempt to show that the information provided by Sutyagin to his foreign colleagues originated from classified sources.

Sutyagin has insisted that all information he ever had access to was obtained from open sources. The judge in effect instructed the jury to disregard this defense, creating a precedent wherein reporting unclassified scientific research is considered a crime.

On several occasions during the past 5 years, CIFS, along with AAAS, Amnesty International and Human Rights Watch, unsuccessfully appealed to President Putin to release Sutyagin from pretrial detention. Since his conviction, Sutyagin's situation has worsened dramatically. He is facing a very real possibility of spending a significant part of his life in a hard labor prison. Sutyagin's attorneys have filed an appeal for retrial with the Russian Supreme Court, quoting numerous procedural violations, but in the absence of international attention the Supreme Court is expected to rubberstamp the conviction.

In June 2004, Amnesty International declared Sutyagin a political prisoner. A number of other human rights groups have launched an effort in his support and against what is widely seen as a deliberate FSB campaign to prosecute scientists. CIFS is joining six other organizations in endorsing a letter of support for Dr. Sutyagin addressed to President Putin. The full text of the letter, a detailed explanation of the case, and a number of supporting articles from various Russian and international newspapers are on the website www.sutyagin.org.

Previous CIFS letters on behalf of Sutyagin can be found at http://www.aps.org/intaff/cifs/cases/index.cfm .

CIFS urges APS members to visit this site, to sign the letter and to publicize the Sutyagin case.

SPOTLIGHT on the Profession of Physics

Entrepreneurship Gains Ground in the Physics Curriculum

By Alaina G. Levine

What are the chances that the next millionaire entrepreneur will be a physicist? With more physics departments offering graduate curriculum in entrepreneurship and business, the chances are getting better and better.

"An understanding of basic business skills has become increasingly useful to many physicists, not the least of those who, not long ago, seldom ventured outside of academic research," says Daniel Stein, professor and Head of the University of Arizona (UA) Department of Physics. "Courses in entrepreneurship and new opportunities to develop skills in related areas can only help physicists who wish to contribute by creating products and companies that may benefit all of us."

With funding from the Alfred P. Sloan Foundation, the UA launched a Professional Science Master's Program (PSM) in Applied and Industrial Physics, Mathematical Sciences, and Applied Biosciences in 2000. While its curriculum always included business and project management courses, only recently did the physics department launch a new course, Topics in Entrepreneurship for Scientists , designed "to give students understanding of the elements of the entrepreneurship process in scientific ventures to prepare them for scientific careers in industry, and to pursue the development of new scientific ventures."

The significance of this course, says Stein, is that it is housed in the physics department, as opposed to having a home department in the business college. However, it is cross-listed in the UA's McGuire Entrepreneurship Program (as well as departments of biology and math), which not coincidently awarded the grant that ignited the course's development and teaching.

The class is just another step in the right direction, says Raymond E. Goldstein, UA professor of physics. "With more and more students going into industry, or expressing an interest in starting their own company, it is common sense to provide coursework that will help physicists succeed in these occupations."

Other Sloan-funded PSMs offer electives in entrepreneurship, although the classes are not housed in the physics department. The University of South Carolina's PSM in Modeling for Corporate Applications requires students to take a business elective, which can be in entrepreneurship. Participants are also encouraged to attend an annual workshop on science entrepreneurship.

Rice University's PSM in Nanoscale Physics also requires business classes, taught through the business college, and again gives students the option of delving more deeply into entrepreneurship through electives and exposure to regional entrepreneurial development and business investment communities via the Rice Alliance for Technology and Entrepreneurship. Georgetown University and the University of Arkansas also provide opportunities at the graduate level to learn and practice foundations of entrepreneurship and business.

One distinctive approach to graduate education combining the two disciplines is the award-winning Physics and Entrepreneurship Program (PEP) at Case Western Reserve University (CWRU). PEP is a two-year master's program that seeks to "empower physicists as entrepreneurs by providing training and real-world experience to students with a background in physics and a vision for new and growing

See CURRICULUM *on page 6*

Consider an Asymmetrical Pulsar....

Photo Credit: Liz Dart Caron

On June 22, APS participated in an event on Capitol Hill sponsored by the Coalition for National Science Funding (CNSF).

Here Jessica Clark, APS Public Outreach Coordinator, explains the Einstein@home project to David Goldston, Chief of Staff of the House Science Committee.

The Einstein@home distributed computing project, to be launched during the World Year of Physics in 2005, will enable owners of personal computers to donate CPU time to the search for gravitational waves, using data gathered by the Laser Interferometer Gravitational Wave Observatory (LIGO). LIGO, consisting of two observatories located in Livingston, Louisiana and Hanford, Washington, is funded by the National Science Foundation.

Workforce Issues Dominate Policy Briefing

By Ernie Tretkoff

Are enough American students going into science? Can we continue to attract talented foreign scientists to the US? Can American technology companies compete with high tech firms in other countries, where costs are lower?

These were a few of the questions addressed by panelists at a June 24 briefing in Washington, DC, on science and technology globalization, sponsored by the American Chemical Society and the Senate Science and Technology Caucus.

Indicators such as the number of scientific publications and patents, the number of students pursuing science, and support for research and development, suggest that other countries may be catching up to the US in basic science research and technological innovation. A *New York Times* headline declared in May, "US is losing its dominance in the sciences."

Some policymakers are beginning to pay more attention to the position of US science and technology in the global economy. In introductory remarks at the briefing, Senator Jeff Bingaman (D-NM) said, "I do think these issues are extremely important, and they haven't gotten the attention they deserve."

"Our standard of living depends to a great extent on our edge in science and technology," said Senator Lamar Alexander (R-TN). He recognized the need for funding for basic research, pointing out that federal investment in physical science research has remained essentially flat for a number of years.

Panelist Alan Rapoport, senior science resource analyst at the NSF, reviewed data from the National Science Board's report, *Science and Engineering Indicators 2004*.

Between 1988 and 2001, the US share of published articles declined from about 40% to about 30%. During that time period, US article output remained essentially flat, while worldwide article output grew by about 40%, driven by increased output in Western Europe, Japan, China, Singapore, Taiwan, and South Korea.

The US share of papers in *Physical Review* fell especially dramatically—from 61% in 1983 to 29% last year. The number of papers published by US researchers has remained flat even as investment in research and development has increased, said Rapoport. The NSF is examining reasons for this trend, he said. The share of US patents granted to foreign inventors has hovered between 44% and 48% since 1988.

Thomas Howell of Dewey Ballantine LLP, an expert on international trade matters, discussed the development of high-tech companies, especially in the semiconductor industry, in foreign countries.

Government policy in countries such as China encourages the building of technology parks modeled on those in Silicon Valley, said Howell. China offers generous tax incentives for high tech firms and their employees, enabling the country to attract some of the best workers from within China and from elsewhere, he said. "People see working for these companies as a way to get rich in a hurry." These tax structures give China an advantage over the US, he said.

Deborah Wince-Smith, president of the Council on Competitiveness, also said that the US faces many challenges in the global economy. The pace of innovation is quickening, technology has enabled businesses to operate anywhere, anytime, and other countries are replicating the US historical advantages, including the collaboration between universities and industry, she said.

Wince-Smith emphasized the importance of innovation in driving productivity, a high standard of living, and job creation, but she expressed several concerns for innovation in the US.

For instance, US companies face environmental regulations and high costs that hinder their competitiveness in the global economy, said Wince-Smith.

Tax structures also give US corporations a comparative disadvantage, and immigration policy keeps out some of the best workers, she said. "We send back many of the talented people we train," she said.

LETTERS

Readers Take Issue with Varmus's Praise of Secularism

Harold Varmus' article "Science, Government, and the Public Interest" (*APS News*, June 2004) makes several useful points, particularly in reference to globalizing science and disseminating scientific knowledge via the Internet. However, his antireligion rant is misguided, relying on a clear misreading of both American history and current events. For starters, the United States was founded in the main by people who considered themselves religious, regardless of what I or Varmus think. Secondly, no matter how little evidence there may have been that Iraq had WMDs (and I remind Varmus that the Clinton administration thought they were there too), it is patently absurd to suggest that Bush started some holy war against an "evil" country based on religious principles.

I question the implicit assumption that scientists should be the final arbiter of what research should or should not be conducted. Ethics cannot fundamentally be legislated by bodies such as the APS. If the objection is raised that the public is not qualified to judge such matters, my response is twofold: one, I agree with Varmus that we do a rather subpar job of educating the general public about science and we should work to improve that. Two, I question whether a PhD in any field of science qualifies one to deal with the ethical concerns of their research appropriately.

I also believe that on many questions—particularly those dealing with the definition and sanctity of human life—the view of the public is at least as important as the view of the scientific community. Varmus subtly recycles the typical party line that whatever science and technology can be done should be done, and we'll worry about ethics later. This is unacceptably arrogant, and it undermines his central thesis that the most prominent purpose of science is to create knowledge that advances public welfare. Sorry, but scientists do not and should not get to unilaterally decide the best interest of the public.

Matthew McMahon
Nashville, TN

✶✶✶

I found the inclusion of Harold Varmus's commentary on Science and Government totally out of place in the pages of *APS News*. This is a piece of political opinion barely disguised as views on science.

Statements such as "ill-timed tax cuts", and "the damage we are doing to our international reputation by our actions in Iraq and elsewhere" are political without disguise and unrelated to science. The consequences of the tax cuts, whether ill or well timed, remain to be seen, and the policies on Iraq are debatable.

I fail to see the connection between science and social policy on reproductive issues.

The criticism of the current Administration's focus on abstinence versus "realistic programs", based on contraceptives, is not very different from suggesting that it would be more effective to concentrate on occupant protection systems in motor vehicles, rather than enforcing DUI laws and promoting responsible alcohol drinking habits.

Varmus's criticism of the Administration emphasis on STD's control is not based on science, but on his underlying hostility to a policy that is viewed as based on the retrograde *Weltanschauung* of the Catholic religion and other conservative Christian denominations.

In the last few years, *APS News* has been gradually losing its focus from being the Society's newsletter to becoming one more forum where political views are aired, and the Back Page largely a free tribune for liberal views on social issues, hardly ever balanced by opposing views.

I would prefer that scientific societies devote themselves to promoting science, without falling into the fallacy of making science the religion of the 21st century. In the final analysis, science has some answers, but not all the answers.

Oscar Antonio Rondon Aramayo
Charlottesville, VA

Ed. Note: *Readers are invited to look at the collection of Back Pages archived at (http://www.aps.org/apsnews/backpage.cfm) to see if the author's contention that the Back Page is "a free tribune for liberal views" is even remotely close to the truth. Since the beginning of 2002, the only Back Page authors on the political side have been John Marburger (twice), Colin Powell, and Spencer Abraham, all members of the current administration.*

✶✶✶

Three articles in the June 2004 issue of *APS News* touch on the issue of whether one must be an atheist to be a scientist. Harold Varmus addresses the separation of religion and science by saying, "As recent immigration trends have made our country much more diverse culturally, ethnically, and spiritually, we have not become more securely secular." What does he mean by "securely secular?" Does he mean atheistic? Does he mean that one cannot believe in a higher power? A God? A Creator?

Similarly, in her letter, Mary Lu Larsen makes the illogical assumption that all Creationists believe in a young Earth. There are at least three theories of creation held by Christians who are also Creationists that agree with the scientific evidence for a creation beginning approximately 13.7 billion years ago. In another letter, William Pettus states in his letter that scientists should not abandon causality to defend atheism and that he is not "fearful of intelligent design." I agree for the following reasons.

Science can be based on either the premise that the physical world we experience with our senses is all there is, or on the premise that a spiritual world existed prior to the physical world, and that the physical world was created by God. One cannot identify this God using the scientific method; one can only say that intelligence was necessary. For most of the history of science, the second premise was assumed.

It was not until the 1700s and 1800s that people began to question the second premise. They did this because of their particular view of God and the existence of evil. Many people were deist and thought of God as a watchmaker: *God created the universe, stepped back, and let the universe run.* Darwin and others were concerned about natural evil. Why did plants and animals have unnecessary parts? Why didn't all seeds germinate? Why were there mutations? Darwin gave us natural selection to explain the survival of plants and animals. Others expanded on Darwin's idea and came to the conclusion that God wasn't just detached from his creation, God wasn't needed. They concluded that there was no God, and became atheists.

Varmus is concerned about public funding for science. Why should taxpayers want to fund efforts requiring the premise that there is no God? Polls show that approximately 90% of the citizens believe in a God of some sort and two-thirds believe in a Creator. If science will acknowledge that it can be based on either the premise that there is no God or the premise that there is a God, then the public will be more ready to support it. I concur with Pettus: "I am more alarmed about suppression of thought."

Franklin E. Niles
San Angelo, Texas

✶✶✶

As a Christian, I have some comments I would like to make about Mr. Varmus's thoughts expressed on The Back Page, June 2004.

Harold Varmus [*APS News*, June 2004] wants our government (1) to become more securely secular, and (2) to more adequately fund scientific research and supervise with more effective peer review.

In the 14th and 15th centuries, about the time of the Protestant Reformation in Europe, and the concurrent discovery of sparsely populated continents, a remarkable change occurred. Suddenly, things came alive. People enjoyed freedom and opportunity never possible before in history. Advances in manufacturers' production of goods, in communication and transportation, in science and knowledge concerning our environment, were truly remarkable. All this occurred while the cost of government was not a significant factor in the economy and the lives of the private citizen were relatively free from government control.

With regard to the first point, the founders of our country did an amazing thing. Religious as they were, they extended the gift of freedom to all, the Religious and the Atheist, and set up a government under which incompatible people could live together in peace. Government was not supposed to be secular; it was supposed to act as a referee and protect the freedom of all. Atheism is a religion, I insist, and secularism tends to establish Atheism and prevent the free exercise of religion. A few generations of secular public education has brought us to the "post Christian" era. Secularism is not a benign friend of all religions, but a mortal enemy; it is not a friend of a free society, but an enemy.

With regard to the second point, to give the funding and supervision of scientific research over to the government is a direct route to bring back the days of Galileo. It's a socialistic concept that does not take into account the perverse, evil nature of the human race. Socialism puts the lazy and incompetent in control and frustrates the initiative of the gifted and productive citizen. Let us keep the spark of freedom and opportunity alive in our society.

George A. Kuipers
Pittsford, NY

Harold Varmus Responds:

I appreciate these animated responses to the abbreviated version of my Carey Lecture. Two brief rejoinders. I certainly did not mean to imply that only atheists can be scientists! Science and religion are different spheres of activity, addressing different questions with different means. Second, I agree with the statement that our nation's founders were religious, and I make that very point in the full speech. (http://www.mskcc.org/mskcc/html/19743.cfm) But the founders were also careful to ensure that religious beliefs would be separated from the principles of governance, to endow their new country with protections against intolerance of thought, speech, and religious practice. This is the secularism that I am praising.

Appearance of Order is Perfectly Natural

The second law of thermodynamics should not be applied locally, as done by William G. Pettus ("Suppression of Thought is Alarming," Letters, *APS News*, June 2004), to infer "intelligent design" from the evolution of "increased order, regularity and life." Such free thinking would, for instance, lead one to argue for the existence of a guiding hand from the mere observation of the ordered patterns of wind on a weather map.

However, one must consider the total entropy of the Sun/Earth system in which heat passes from a high temperature to one much lower. The second law does not preclude the production of mechanical work in the process, nor a reduction in local order; it only places restrictions on the amounts. It does not assert that entropy has to increase at the maximum possible rate. The local appearance of order should be held in wondrous awe for what it is, a perfectly natural, mechanistic, albeit highly complex phenomenon.

Furthermore, I find it internally inconsistent that the existence of "intelligent direction" of the evolution of the complex universe is deemed acceptable by Pettus, whereas it is "incomprehensible that intelligent life has evolved spontaneously." This argument only works if it allows one to suppress the worrisome thought about how that directive intelligence must have spontaneously evolved.

Peter Mattocks
East Amherst, NY

Friendly Advice for Bob Park

As a physics student, I use the American Physical Society's web site frequently.

I have a brief comment regarding Bob Park's weekly newsletter, "What's New": A positive political campaign, promoting the benefits of physics, will be better received by the public than a negative political campaign of bringing down non-physics groups.

Almost all political campaigns, such as the presidential campaign, prefer positive rather than negative messages.

Ben Lee
Los Angeles, CA

"The Scream" May Reflect Munch Kin's Death

I quite enjoyed the Back Page article for May 2004, which argued that the blood red sunset of Munch's painting The Scream was produced by volcanic dust in the air from Krakatoa. My Time-Life book *The Mind*, which I read as a child, argued that Munch's profound reaction to the sunset was a memory of his mother's death by hemorrhage.

Assuming that the volcanic and the psychological explanations are both true, we get a prediction that his mother died before 1883.

Since his mother died when Munch was 5 years old in 1868, the prediction is confirmed, but unfortunately the date of his mother's death does not give a useful constraint on the date when Munch saw the sunset.

Theodore Lawry
Croydon, Surrey, UK

Photo Credit: Alexander Cronin

Eric Cornell delivers the DAMOP public lecture to a packed house in Tucson.

DAMOP Lecture Wows the Public

By Ernie Tretkoff

The main goal of World Year of Physics 2005 will be to bring the importance and excitement of physics to the public.

WYP organizers are urging members of the physics community to plan local events that will achieve this goal. A public lecture is an excellent example of such an event. Planning in advance and promoting the lecture can help ensure that it is well attended and enjoyable for the audience.

Illustrating the appeal of a public lecture, hundreds of people showed up at the DAMOP meeting in Tucson, Arizona on May 26, to hear Nobel laureate Eric Cornell speak about how things become weird as they get colder and colder. Cornell described how he achieved a Bose-Einstein condensate, and peppered his talk with amusing personal stories and anecdotes. Pierre Meystre, a physicist at the University of Arizona who helped organize the lecture, said, "Most importantly, Eric conveyed the idea of how exciting and how much fun research is."

Meystre began planning well in advance. "Trick number one was to line up a great speaker," said Meystre, who invited Cornell two years before the lecture. "We were lucky to have a superb speaker who can connect very well with everybody from kids to grown-ups ." Next, it helped to have someone in charge of organizing the lecture: University of Arizona physicist Alex Cronin.

To get ideas on how to advertise the lecture, they consulted with fellow professors and students, university science writers, and the department media consultants. They printed hundreds of color posters and sent them to local high school and community college science teachers and students.

They also placed the posters around the university campus, and used a posting service to distribute them around town. An email message announced the event to physics department faculty and students, and professors mentioned it to their classes.

To reach the public, they sent press releases to local newspapers, radio stations, and TV stations, and had the lecture included in several newspaper and online event listings. These announcements stressed that this entertaining lecture would be appealing to the general public. "We are not pros at this business, so we did everything we could think of and more or less afford," said Meystre. "The public lecture wound up being a tremendous success."

World Year of Physics events, including public lectures, should be registered on the WYP web site [www.physics2005.org] as soon as they are planned. They will be entered into a data base that can be searched by those interested in finding WYP events in their area.

NRC Releases "Physics of the Universe" Strategic Plan

Two years ago, the National Research Council (NRC) laid out 11 key scientific questions at the intersection of physics and astronomy in a report entitled "Connecting Quarks to the Cosmos" (*see* http://www.aps.org/apsnews/0602/060205.html).

Earlier this year, in response, an interagency working group of the National Science and Technology Council (NSTC) released a prioritized strategic plan for efforts across several government agencies to address those 11 questions.

Exploring the nature of dark energy receives high priority in the new report. Other areas considered ripe for "immediate investment" are the study of dark matter, neutrinos, proton decay, and the nature of gravity, while longer term objectives include research into the heavy elements, nuclear astrophysics, the birth of the universe, high density and high temperature physics and high energy cosmic ray physics.

The new report, entitled "The Physics of the Universe: A Strategic Plan for Federal Research at the Intersection of Physics and Astronomy," is available at http://www.ostp.gov/html/physicsoftheuniverse2.pdf. The main participating agencies are DOE, NSF and NASA, although NIST and the National Nuclear Security Administration (NNSA) also receive mention.

The NSTC Interagency Working Group on the Physics of the Universe assessed priorities based on the potential for scientific advancement, the timeliness or urgency of each question, the technical readiness of projects, and the need to fill gaps in the suite of projects to address each question. It did not address cost and budgeting issues, nor how these projects fit in with goals, projects and facilities in other areas of physics or astronomy.

A summary of the report's recommendations in priority order, divided into near term and longer term efforts, can be found in the sidebar.

— Audrey T. Leath, AIP

IMMEDIATE INVESTMENT

Dark Energy: Three projects to investigate Dark Energy are recommended: a still-to-be-defined NASA/DOE Joint Dark Energy Mission (JDEM); a study of "the weak lensing produced by Dark Matter" by a ground- based Large aperture Synoptic Survey Telescope (LSST); and observations of galaxy clusters by space-based X-ray and ground-based Cosmic Microwave Background (CMB) observations.

Dark Matter, Neutrinos, and Proton Decay: NSF and DOE should collaborate to "identify a core suite of physics experiments" for research into Dark Matter, neutrinos, and proton decay; and NSF, a scientific roadmap for an underground laboratory facility.

Gravity: Two efforts are recommended: enhanced numerical relativity research for more accurate simulation of gravitational wave sources; and "the timely upgrade of the Laser Interferometer Gravitational Wave Observatory (LIGO) and execution of the Laser Interferometer Space Antenna (LISA) mission."

FUTURE INVESTMENT

Origin of Heavy Elements: The report calls for DOE and NSF to develop roadmaps for the proposed Rare Isotope Accelerator (RIA), and for "the major components of a national nuclear astrophysics program."

Birth of the Universe: DOE, NSF and NASA should jointly develop "a roadmap for decisive measurements" of cosmic microwave background polarization.

High Density and High Temperature Physics: NSF, DOE, NASA, and NIST should generate a roadmap for major components of a "balanced, comprehensive" national high energy density physics program; DOE and NSF should develop a roadmap for upgrading the luminosity and maximizing the impact on high energy density physics of the Relativistic Heavy Ion Collider (RHIC); and at least one of NNSA's major compression facilities should include a high energy, high intensity laser capability.

High Energy Cosmic Ray Physics: DOE and NSF should work to "ensure that the Pierre Auger southern array [under construction in Argentina] is completed" and "consider plans for a possible northern array."

INSIDE THE BELTWAY:

Washington Analysis and Opinion

Physics in the Battleground

By Michael S. Lubell, APS Director of Public Affairs

Michael S. Lubell

If you're anything like me and noticed the words physics and battleground juxtaposed in the same headline, you'd probably picture laser guided weapons, night goggles, stealth fighters or myriad other military hardware that trace their space age technologies to the basic research laboratory. And ordinarily, you'd have gotten it right.

But this time the context is markedly different. The battleground will be strewn with bodies only in the figurative sense. It is the field of conflict where the 2004 presidential election will be won or lost.

Regrettably, most of us will only be spectators. Live in California, Massachusetts or New York? The Bush campaign has written you off. Live in Texas, Oklahoma or Alabama? The Kerry campaign has long forgotten you even exist.

But if you reside in the ten battleground states, where neither candidate is a clear favorite, you will be deluged with TV ads, push polls, billboards and door-to-door canvassers from now until Election Day. By November 2, you will be numb. Pulling the voting lever, punching the chad or tapping the video screen will be like arriving in paradise after four months in hell.

So which are the top battleground states? Florida (of course), Iowa, Missouri, New Hampshire, New Mexico, Ohio, Oregon, Pennsylvania, West Virginia and Wisconsin.

Remarkably, in all but one (West Virginia), the high-tech work force is larger than the 2000 presidential vote differential. In five of the ten—Florida, Iowa, Oregon, New Mexico and Wisconsin—the number of high-tech workers exceeds the 2000 margin by more than ten to one! If either campaign ignores these voters, it would be making a big mistake.

It's rare that the political newsletter *CQ Weekly* even mentions the word science outside the context of health. Yet, on July 3, *CQ Weekly* saw fit, not only to write about science, but to make it the cover story.

While the seven-page dissection of the issue put a spotlight on the importance of science, it did contain several disquieting thoughts, such as the one captured by the blurb on the front cover: "Basic Research is the key to finding the 'next big thing,' but few lawmakers see an immediate payoff for programs that offer knowledge for its own sake."

Amol Sharma and Stephen J. Norton, the authors of the piece, observed, "There is, indeed, bipartisan concern that the United States might lose its competitive edge at some point [due to lackluster funding of basic research] but broad disagreement about what to do."

And to underscore the difficulty Congress constantly faces in dealing with the science issue, they concluded with this quote from Sen. Robert F. Bennet (R-UT): "It's one of those problems you don't have to solve this year and you don't have to solve next year, but some year you're going to wake up and say, 'Hey, I can't reclaim that lost time.'"

Well, 2004 may prove to be the year of a political rude awakening for either party, if it ignores the importance of science.

The policy issue is simple: While the US dithers, China and India are offering high-tech companies a pool of low-cost, highly talented researchers, an impetus that ultimately could drain away our nation's most potent competitive advantage: leadership in discovery and innovation.

The political fallout is equally simple: facing the threat of further job losses, a disgruntled high tech work force could swing the 2004 presidential election in favor of George W. Bush or John F. Kerry, should either fail to address the science issue, especially in the battleground states.

Will scientists and engineers vote their pocketbook? It's hard to say, but I wouldn't want to be the campaign advisor who counsels against paying close attention to the hightech constituency in a year when a few votes in a few key states could well determine the occupant of the White House for the next four years.

Fred Stein Heads for the Hills

By Ernie Tretkoff

Photo Credit: Ken Cole

Fred and Claudia Stein.

Colorado is beckoning Fred Stein, APS Director of Education and Outreach, who will retire with his wife Claudia to their moun-tain retreat in September. In his five years at APS, Stein has overseen several education and outreach projects, most notably PhysTEC (*see article on page 7*).

Stein has been dedicated to education since he spent time in the Peace Corps teaching PSSC physics to high school teachers in Colombia. After the Peace Corps, Stein received his PhD in chemical physics from Indiana University. He then held a position at a small liberal arts college in Colorado for 17 years before heading to Philadelphia to lead a non-profit organization that helped train science and math teachers. Then Colorado State University hired Stein to start an outreach center, and he worked there for eight years before taking the position as APS Director of Education and Outreach in 1999.

Stein said he has always cared about good teaching, for a variety of reasons. "I felt teaching was a calling," he said. "At the student level, I wanted to teach better than my teachers taught me." Later, as a parent, he wanted to do something to improve the science education his children were getting.

As a professor, Stein found that even with very good lectures, the students still weren't learning. He realized that students needed to be more actively engaged, and since then he has been devoted to hands-on, active, student-centered teaching and learning.

That's the kind of teaching Stein has tried to promote through the PhysTEC program he conceived and developed while at APS. Stein wrote the original proposal for the program, obtained a $5.76 million grant from the National Science Foundation, directed the project, attended leadership meetings and annual conferences, and participated in every site visit to each of the participating institutions."My job responsibilities grew unexpectedly larger with PhysTEC," he said.

Though PhysTEC has been his major project, Stein also oversaw other APS education and outreach projects. He received support from the APS, the American Association of Physics Teachers (AAPT) and the APS Forum on Education (FEd) for the Physics on the Road Conference and follow-up activities, he helped plan the NSF grant for ComPADRE: Communities for Physics and Astronomy Digital Resources in Education, and he participated in fundraising for APS education projects.

Stein has also served as the APS officer liaison for the committees on education, minorities, the status of women in physics, and careers and professional development, as well as the FEd, where he helped create an APS award in physics education. He also presented numerous papers at AAPT and APS meetings, and at universities and potential PhysTEC sites.

In November of 2002 Stein received his colleagues' recognition by being selected as an APS Fellow.

After Stein retires, he plans to move to Colorado and spend more time with his grandchildren. But he intends to stay involved with education by continuing to work with PhysTEC as a consultant as needed. Stein also wants to become active in the local schools, and possibly run for the school board. "I'm not retiring in the sense of hanging up my shoes and sitting on the porch swing," he said.

APS Selects 26 as 2004-2005 Undergraduate Minority Scholars

The APS has awarded Scholarships for Minority Undergraduates to 26 students who are majoring or planning to major in physics. Since its inception in 1980, the program has helped more than 300 minority students pursue physics degrees. Eighteen new scholars and eight renewal scholars were selected. Each new scholarship consists of $2000. This may be renewed once, at a level of $3000.

Minority scholar Peter Blair spent part of his childhood in Jamaica before his parents relocated to the US. He comes by his interest in science naturally: both his parents are chemists. Now a sophomore at Duke University, Blair has experienced firsthand the challenges facing a minority student at a predominantly white school, and he has made it his mission to become a professor of physics so that future generations of aspiring black physicists will have a role model.

To that end, he is a physics mentor in the tutoring program at Duke, and is active in the Duke Students of the Caribbean Association. He is also a research assistant on a Duke study to evaluate the effectiveness of NSF and DOE initiatives aimed at enhancing minority participation in physics.

His fluency in French came in handy when he spent last summer in Paris, studying the French avant-garde movement. This fall he will become president-elect of Duke's Society for Physics Students chapter. His dream is "to be an excellent physicist with a heart for giving back to the community."

A senior at W.T. Woodson High School in Fairfax Virginia, Minority scholar Christopher Hain attributes his interest in physics to a natural curiosity and thirst for unsolved problems. "Physics is constantly opening up new and unexplored areas that require fresh minds and new points of view," he says. He is one of the top students in his physics class, frequently earning perfect scores on exams, and last year performed an independent study experiment to determine the effect of molecular weight on the index of refraction.

In addition to his studies, Hain is a varsity athlete on the cross-country team, and sings baritone in the choral department. He also volunteers as a youth soccer coach and spends one week each summer with an organization called HOMES, which demolishes old houses and builds new ones for impoverished families. He sees physics in everything as he goes about his daily life, and says he wants to major in physics "to give my imagination direction and put it to practical and beneficial use." Hain will attend Stanford University in the fall.

Minority scholar Lauren Oldja is a senior at Lakewood High School in St. Petersburg, Florida, and will be attending MIT this fall.

Inspired in part by Richard Feynman, who emphasized the joy of physics, Oldja says she is most intrigued by physics because "It blends the practicality of observable research with the purity of mathematical theory."

Among her many science-related activities, Oldja is on the robotics team and won an award for lightest vehicle in the Physics I Mousetrap Car competition. She is also involved in multimedia with Lakewood's Center for Advanced Technology. In addition to her studies, she participates in the Drama Club and Spanish Honor Society. In her spare time, she volunteers at local museums and at the Center Against Spouse Abuse, and participates in the Bay Area Renaissance Festival. She has also spent time designing and maintaining the Website and creating 2D graphics for FOX Thirteen Magazine, a Saturday morning TV show on teen issues.

The APS scholarship program operates under the auspices of the APS Committee on Minorities in Physics, and is supported by funds allocated from the APS Campaign for Physics. Scholarships are awarded to African American, Hispanic American, and Native American students who are high school seniors or college freshmen or sophomores.

The selection committee especially encourages applications from students enrolled in institutions with historically African American, Hispanic or Native American enrollment. After being selected, each scholar is matched with an accomplished physicist to act as a mentor.

For applications for the 2004-2005 competition, contact Arlene Modeste Knowles at knowles@aps.org. *Information can be found at http://www.aps.org/educ/com/index.cfm.*

New Minority Scholarships

Samuel Alemayehu
Peter Blair
Cesar Caro
Micaela Casas
Brian Chavarria
Bree Guerra
Christopher Hain
Gilbert R. Lee IV
Michael Maindi
Matthew McDonell
William Miller
Curtis Morales
Jeremy Morales
Lauren Oldja
James Silva
Sharon Torres
Ilse van Meerbeek
Yonas Yemane

Renewal Scholarships

Barry Barrios
Laura Burton
Ayodele Osasona
Alejandro Rodriguez
Joshua Smart
Michael Tambe
Pedro Urquedez
Soun Ja Walters

CURRICULUM *from page 3*

For more information:

Case Western Reserve University Physics and Entrepreneurship Program: http://pep.cwru.edu/

The University of Arizona PSM in Applied and Industrial Physics: http://psm.arizona.edu

The University of South Carolina PSM in Modeling for Corporate Applications: http://www.cosm.sc.edu/professional/

Rice University PSM in Nanoscale Physics: http://www.profms.rice.edu

ventures," said Cyrus Taylor, Program Director and Armington Professor of Physics.

The program integrates graduate-level physics coursework (specifically focusing on innovation in physics) with classes in entrepreneurship, and includes a seminar series and a physics master's thesis involving an entrepreneurial-based project. The thesis typically arises from an internship at a start-up, or from a student-designed research project that can be the foundation for launching a new venture.

Now in its fourth year, PEP has graduated 14 students, who have gone on to start their own companies, work for new ventures, or even Fortune 500 companies, in roles that range from technical to business-focused.

"Physicists can do anything," said Taylor, "but starting a new company is an enormously painful process. We want to produce graduates who are experts in the various subtasks of the entrepreneurial environment so they have the skills to transform their advancements in physics into viable, successful ventures."

One PEP alumnus started a company the first year he was in the program. The firm, Neomed Technologies, developed a nuclear medicine technique for screening coronary artery disease, and it has just secured funding for the last round of clinical trials before FDA approval. Another alumnus has a position with a Fortune 500 corporation in which he "bridges the gap between the science and business sides of the company," said Taylor.

According to faculty in the UA Karl Eller Center, the home of the McGuire Entrepreneurship Program, future physicists can greatly benefit from entrepreneurship education because at its very heart, scientific entrepreneurship is about bringing together a technical vision, a business sense, and an entrepreneurial spirit. These elements can only serve to help students advance in both technical and business-based careers, and give them more insight into the scientific process itself.

Tony Nottke, a student in the UA PSM in Applied and Industrial Physics and founder of a company based in photonics and spectroscopy, concurs: "I took the entrepreneurship class because I wanted to learn skills that would help my business grow and help me be a better physicist. Entrepreneurship education has helped me to better translate my technical prowess into business success and has given me a greater appreciation for doing research outside academia. Our entire society is based on technology, and it is essential for technically-trained professionals to have business skills so they can better contribute to society's issues. A physicist with a good education and research work, and experience in entrepreneurship can do anything. The world is your oyster."

Alaina G. Levine directs the Professional Master's Program in the UA College of Science and is the founder of Quantum Success Solutions. She can be reached at Alaina@u.arizona.edu.

SURVEY *from page 1*

tion fees (47%), although these benefits were rated only at 28% and 22% by all the respondents.

Survey respondents had the opportunity to provide comments as well as answer questions.

Although lobbying activities were ranked as a high priority by 76%, the survey collected a wide range of individual views, from "I put high priority in APS using its clout to educate the public and Congress, and to actually lobby" to "APS is strongly mistaken if it tries to become a lobbying organization. Its strength is that it can promote the education of the public in general, which is where the power resides for the future of physics."

APS Director of Membership Trish Lettieri noted that a 1996 membership survey had found that the APS was not communicating effectively with its members. After much attention was paid to this issue, a 2001 survey showed that the situation had improved considerably. Lettieri said that the current survey confirms the trend that members generally know about, and approve of, the activities that the APS is conducting.

APS-led Teacher Prep Program Is Seeing Results

By Ernie Tretkoff

The Physics Teacher Education Coalition (PhysTEC), about to begin its fourth year, continues to work to improve teacher education, and is seeing some success. Led by the APS, the American Association of Physics Teachers (AAPT), and the American Institute of Physics (AIP), PhysTEC aims to produce more and better-prepared science teachers who are committed to inquiry-based, hands-on teaching and learning.

Research has shown that students learn better when they are engaged in active learning, said Fred Stein, APS Director of Education and Outreach. Very few students can learn well by listening to a lecture, and many introductory labs are "cookbook" exercises in following directions. Instead, said Stein, students should be engaged in making discoveries themselves. There has been a movement towards more active learning, but it's hard for many teachers to change how they teach. "We teach the way we were taught," said Stein.

To improve science teaching, PhysTEC aims to reach undergraduates who plan to become K-12 science teachers, and expose them to hands-on, inquiry-based instruction. At the participating institutions, physics departments work with education departments to improve preservice teaching by implementing the following six components of the PhysTEC program.

1. An active collaboration among the physics department, the education department, and local schools;

2. A Teacher-in-Residence (TIR) program that provides for a local K-12 teacher to assist faculty in course revisions and teaching;

3. The redesign of physics courses, including the use of more interactive techniques;

4. The redesign of elementary and secondary science methods courses to emphasize inquiry-based teaching;

5. The establishment of a mentoring program for novice science teachers;

6. Participation of physics faculty in improving and expanding school experiences for perservice students.

Though it's too early to have much data, Stein said that some successes can already be seen. An external evaluation will assess the effectiveness of PhysTEC in improving graduates' understanding of physics and skills in inquiry-based instruction.

In addition to successfully implementing the core program components, some of the participating institutions have gone beyond the basic expectations. For instance, some PhysTEC schools have worked with chemistry departments and helped them adopt some of the PhysTEC components. Other institutions have collaborated with local community colleges. Some schools hired new faculty members in physics and education to help meet the needs of PhysTEC. One school instituted a special effort to recruit minority students to careers in teaching.

To introduce the new TIRs to the project, PhysTEC held a TIR Orientation and Mentoring Workshop in Sacramento on July 30-31. The Orientation was planned and presented by present and past TIRs. The Mentoring Workshop was presented by Mike Wolter, the TIR at Ball State University in 2003-2004. Wolter was a PhysTEC mentor this past year and in addition enrolled in the State of Indiana mentoring program.

The six initial participating universities were: Ball State University, Oregon State University, University of Arkansas, University of Arizona, Western Michigan University, and Xavier University of Louisiana.

In the past year, PhysTEC was able to use funds raised by the APS itself to support three more institutions: Cal Poly at San Luis Obispo, which completed its first year in the program; Towson University in Baltimore, and the University of Colorado at Boulder, both of which will begin their first year this fall.

PhysTEC is now almost halfway through its NSF funding, with three more years to go. The APS capital campaign will provide additional funding. Stein hopes PhysTEC will expand to a total of 12 schools of various sizes, and that these 12 schools will serve as models for other institutions to implement some aspects of the PhysTEC program.

This fall, PhysTEC will lose its founder and director, Fred Stein, who will retire in September. But Stein said he's ready to hand the program off to his successor. "I feel like I'm leaving it in good shape," he said.

UNITED NATIONS *from page 1*

•Noting that physics and its applications are the basis of many of today's technological advances,

•Convinced that education in physics provides men and women with the tools to build the scientific infrastructure essential for development,

•Being aware that the year 2005 is the centenary of seminal scientific discoveries by Albert Einstein which are the basis of modern physics,

•1. Welcomes the proclamation of 2005 as the International Year of Physics by the United Nations Educational, Scientific and Cultural Organization;

•2. Invites the United Nations Educational, Scientific and Cultural Organization to organize activities celebrating 2005 as the International Year of Physics, collaborating with physics societies and groups throughout the world, including in the developing countries;

•3. Declares the year 2005 the International Year of Physics.

PHYSICS CHAIRS *from page 1*

—across party lines—to our message of concerns about scientific workforce development, and higher education access," said Gould.

Three Texas physicists who came to the lobbying day got through to two congressmen from their state who had been similarly unresponsive. Ed Fry (Texas A&M—College Station), Dan Suson (Texas A&M—Kingsville), and Scott Yost (Baylor University) met with Congressmen John Carter (R-TX) and Ruben Hinojosa (D-TX) and convinced them to sign the NSF letter; Hinojosa signed the Office of Science letter, too. "The ability to interact with congressional delegations was enlightening," Suson said of his experience. "It gave me insight not only into how a congressional office works, but also how information that goes into making policy is gathered, prioritized, and linked with the needs of other constituents."

Alan Dorsey of the University of Florida, along with David Van Winkle of Florida State, met with a legislative aide to Cliff Stearns (R-FL), a congressman whose district was recently redrawn and who now represents the University of Florida.

In 2002, Stearns voted against an authorization bill that backed large budget increases for the NSF. But when Dorsey described the impact of NSF support on researchers at his university, the aide was visibly impressed. Dorsey hopes that in time, Stearns will come around. "It's a good idea to cultivate relations with our representatives and educate the staffers—who are very young—about science policy and funding issues," he said.

Maria Dworzecka (George Mason University) and Claudia Rankins (Hampton University) convinced Senator George Allen (R-VA), an ally of the science community in the past who did not sign the Office of Science letter this year, to send his own letter of support to the Senate Appropriations Committee.

They also induced Congressman Tom Davis (R-VA), an influential committee chairman, to sign the House letters supporting NSF and the Office of Science. And Harold Hastings (Hofstra University) and Mike Mauel (Columbia University) convinced Congresswoman Carolyn McCarthy (D-NY) to sign the House Office of Science letter.

While these immediate successes help demonstrate the importance of constituent contact with Congress, the main purpose of the APS lobbying day was for participants to build long-term relationships with their legislators' offices so that they can go back to them in the future at important junctures in the legislative process. The 25 participants, constituting nearly 30% of the department chairs conference attendees, represented university and college physics departments in 17 states and met with a total of 76 congressional offices.

The APS Office of Public Affairs organized the event and provided a briefing for participants on how to communicate with congressional offices and make the case for science. Participants were given background information and press clippings about the importance of federal research funding to leave with congressional staff, as well as suggested "asks" to make in each of the 76 offices, which var- ied depending on the legislator's record of support in the past.

ANNOUNCEMENTS

2004 APS Election Closes
September 1

Full information about this year's election, including the list of candidates and their biographies, can be found online at http://www.aps.org/exec/election2004

Information about the candidates appeared in the July issue of APS News. **The election closes on September 1.**

Librarians Honor APS Journals

Photo Credit: photo taken with Bob Kelly's camera

At the meeting of the Special Libraries Association in Nashville on June 8, APS Journals received the SLA Physics, Astronomy and Mathematics Division Award. The citation mentioned the APS's long-standing awareness of the importance of the "historical" literature in physics, and its commitment to archiving that literature in scanned, reference-linked and searchable backfiles made available to its subscribers at reasonable cost. Note was also taken of the Society's trailblazing role in archiving of electronic versions of its publications. Shown here receiving the Award are (l to r): Donna Magnani, Sharon Lensky, and Bob Kelly (APS Journal Information Systems), Martin Blume (APS Editor-in-Chief), Barbara Hicks (APS Associate Publisher), Louise Bogan (Journal Information Services), and Anita Wiley (APS Publisher's office).

zero gravity — The Lighter Side of Science

When Physicists Cook, Watch Out!

By Gin Bell

Since our retirement in 1994, my husband, Dick, has taken an interest in helping me run our home, especially the kitchen. He found that an awful lot of haphazard, hit-or-miss methods were being used in the preparation of our daily meals.

Even the shopping seemed to need an overhaul, since I was not making maximum use of coupons and buy-one-get-one-free offers.

Our new stove has an elaborate timing mechanism, which I quit using when I noticed that the stove turned off when the time was up. I'll decide when to turn it off, thanks very much! Dick tends to time it precisely, look at his watch and say, "It's done!" I tend to look in the oven and say, "Not done yet!"

I, myself, have an MA in chemistry, but have been a schoolteacher most of my working life. I have also been cooking by the trial and error method for 55 years without any real disasters worth mentioning.

Dick has had a long career as a physicist specializing in material science. His approach is get out the cookbook, set the timer, measure everything, I'm sure you know the type.

Our first joint venture was to make cranberry sauce. We happen to have two archaic food grinders, one inherited from each Grandma. We picked the better one, keeping the other in case of a systems failure and a need for an equipment backup.

The cranberries were pulverized according to directions, then a quartered orange was added. The next ingredient was two cups of sugar. Juice was spraying everywhere, so I grabbed the sugar bowl and emptied it into the grinder.

Dick rolled his eyes, sighed, and started stirring and tasting the mixture. "It's pretty sour," he said. I next grabbed the sugar cannister standing nearby, and poured it all in. More stirring and tasting.

"Really good!", he exclaimed. "You know what I like about cooking with a chemist?" he asked. "It's the precision!"

What really works best, we've found, is to take turns cooking.

The Back Page

Navigating Challenges in a Rapidly Changing World

By Myriam Sarachik

We live in interesting and challenging times. Although this statement has been made by many throughout history, it seems truer than ever right now. There are many changes occurring that affect our present and our future in physics, and in science more generally. The American Physical Society is facing an interesting set of challenges that require the Society to continue to be nimble, fleet-footed, and proactive. In the space below, I will single out a few areas that require our attention and focus.

PUBLICATIONS

There have been tremendous changes during the past several years in the area of publications. Under the strong leadership of our Editor-in-Chief Marty Blume and treasurer, Tom McIlrath, APS has done a remarkable job of integrating new technology, online publication, cross-linking and archiving through PROLA.

APS leads the physics community in providing electronic information services, and currently occupies a truly dominant position among physics journals throughout the world.

So we're ahead. But this is an area where things are moving extremely fast. There are a number of very important challenges that need to be recognized and addressed if we're to stay ahead.

The most immediate problem flows from our enormous success. The number of manuscripts submitted to the APS journals, with more than half arriving from outside the US, has increased substantially over the years; APS has handled the influx through streamlining its operations (becoming leaner and meaner) and by hiring more editors. However, recent data indicate that the pace of article submissions is increasing sharply.

The editors of the APS journals work very hard, and have little time to maneuver. "Problem" papers occupy much of their attention, leaving little time for more straightforward papers. With the sharp increase in submissions, the workload may become unmanageable. How do we respond to this challenge? Do we continue to hire more and more editors? Do we alter our policies to accommodate the increased demand? If so, how?

Another major question concerns the future role of journals. The preprint archive introduced by Paul Ginsparg in 1991 has changed the publishing landscape in very major ways.

In some fields, notably High Energy Physics and Condensed Matter Physics, the eprint archive has become a major forum for dissemination of results. The communication is "instant" and there are no referees. Other fields of physics are sure to follow.

The recent Loken II report suggests that the distribution of information will be handled in the future entirely through preprint servers, and the value added by APS will be in the form of refereeing, collections of significant reprints, reviews and similar activities.

Is this likely to happen? If so, what will be the role of APS journals? Should we consider novel methods of distributing information that are tailored to individual readers' interests? Should APS take a closer look at how refereeing is done in various subfields with an eye to maximizing the effectiveness, reliability, and "customer" satisfaction of peer review? Should we expand our activities in the area of review articles and critical commentary?

Another challenge is posed by the movement, spearheaded by Harold Varmus and others, toward open access publication as exemplified by the Public Library of Science initiative. In this funding scheme, authors pay a fee for each article submitted and the term "open access" refers to free access by anyone who wants to read the article after publication.

It should be noted, however, that APS now provides open access—it provides it to authors. The real issue is "who pays" for publications. And surely, someone must pay. We need to carefully examine different funding schemes, and we must be ready to move quickly and decisively as the landscape changes. Publishing is a very major activity for the Society. It is a critical issue that may well determine the future form of APS and its activities.

VISAS

This is a very serious problem that is impeding our ability to enroll graduate students at our universities; new data are now available that show that 2004 applications are sharply down from a year ago. The difficulty of obtaining visas in a timely way is wreaking havoc with international collaborations and with our ability to participate in international science.

IUPAP has recently approved a resolution to withhold sponsorship of international conferences held in the US if the situation on visas does not improve. We all know that physics is an international activity, and its "globalization" has been on-going for many years. Even those of us who have collaborated over the years with individual scientists abroad are finding that many of our friends are no longer willing to come for their usual collaborative visits.

Obtaining visas has become expensive, time-consuming and often very demeaning. Through its Office of International Affairs, the Washington office and in concert with other societies such as NAS, ACS, FASEB, and AAAS, APS is working very hard to improve the situation.

Helen Quinn, the APS President for 2004, has taken an active role in this very tough problem. There appears to be an increasing and broader awareness of the damage

that this is doing, but it will take some time to fix. We can only hope that the problem regarding visas will be ameliorated quickly enough to avoid serious and irreversible damage to American science.

FUNDING

The prospect for adequate funding for science in the next few years is discouraging. As you know, this derives from the fact that discretionary spending, which is always a small portion of the total budget, is expected to decrease sharply due to the war in Iraq, and due to tax cuts proposed by the current Administration and passed by Congress during the past several years.

We will have to work very hard through lobbying, communications and outreach activities to explain to the public and its representatives that supporting science is in the interest of the nation's economic health and viability, our standard of living, our security, and our strong position in the world.

We will need intensive and effective lobbying efforts to stem or reverse the decline in funding for the sciences. We need to join together with each other, with industry, and with other scientific societies to make the strongest possible case.

Under the direction of Michael Lubell, the APS Washington office has been remarkably effective in making our voice heard. Resulting from efforts of the Washington office, there has been a substantial increase in the number of APS members who act on behalf of science through letter-writing campaigns and visits to Capitol Hill. It is important that many more of us join in these efforts so that we are seen as a political constituency that makes a difference.

OTHER PROGRAMS

APS is engaged in a number of other activities. These include programs to provide new tools and methods for the teachers who teach our high school students, networking with industry, and various activities to insure the health of our profession, such as increasing the participation of women and of minorities.

CSWP (the Committee on the Status of Women in Physics) was established in 1972, ostensibly on a temporary basis. It has continued to exist as one of the strongest and most active APS committees. Although there is clearly much work left to be done, there is little doubt that conditions for women in physics are substantially better than they were when I entered the field many years ago.

I believe that APS must substantially increase efforts to increase the participation of our minority populations. At the time I entered the field, physicists were almost all white and male. With the passing years, more women earned Bachelor's degrees and PhD's, and it has been very gratifying to find more women at our conferences reporting on their work, and becoming increasingly visible in high-level positions. We must continue to improve the climate for women in physics and continue to attract them to do physics.

It is important that APS now devote serious attention to diversifying further by encouraging African Americans, Hispanics, and all others to join our ranks.

Given the rapidly changing demography in the US, and our need to attract more students to study physics, this is in our own interest as well as theirs.

The American Physical Society must accept this challenge and devote serious attention to it. This will require that we explore ways to accomplish the goal which may entail new programs and new directions. This is a major, very important challenge for APS in the coming years.

And now, for some personal comments. I would be truly remiss if I neglected to tell you what a privilege it was to serve as President of the American Physical Society during the past year, and to lead and participate in the entire range of activities of the Society. It was particularly satisfying to be given the opportunity to represent APS on the international scene. Following an extended trip to Taiwan and Hong Kong early in the year, I opened a conference in Physics Education in Havana in July, gave the closing address at the celebration of the 100th anniversary of the Spanish Royal Physics Society in Madrid during the same week, traveled to Dresden, Trieste, and represented APS at the Canadian-American-Mexican conference organized by graduate students from all three countries in the fall. These occasions provided opportunities to promote human rights and freedom of expression for scientists, and to urge that science and our contacts with physicists throughout the world be used to transcend national boundaries and to serve as bridges in a world that is in great turmoil.

Given my checkered past as a WW II refugee who traveled widely during my early years, my knowledge of languages (such as Spanish and French, in which I have an early teenage vocabulary but a near-flawless accent) was particularly useful in my role as ambassador for American science and the American Physical Society.

And by no means least of all, my presence as a woman President of APS had an effect that surprised even me in its intensity—it truly galvanized the women in physics in every country I traveled in.

The women asked to meet with me, arranged special sessions, took me to lunch and/or dinner. They were proud of me, and thereby, took pride in themselves. My successor and current President is Helen Quinn. The two of us, back-to-back woman Presidents of APS, represent a singularity in the history of our Society. To summarize, APS is an exceptionally effective organization that engages in a broad range of activities in the service of the physics community.

I believe that its strength derives from the fact that, unlike some other sister societies, it is run at every level by physicists. It relies on volunteers who commit a great deal of energy and time. It is guided by an excellent staff headed by physicists—Judy Franz, Marty Blume and Tom McIlrath, and it is led by a Presidential line and a Council of physicists elected by the membership.

APS has served the community well. We're heading for choppy waters, and we face a set of interesting challenges in the future. We need to examine how we publish our journals, and what role our journals will have in the future. We must do what we can regarding current visa requirements that are stifling American science. We must do our utmost to convince the public and our government that funding science is an urgent priority to insure the nation's future. It is essential that we increase the participation of minorities in physics and the sciences. We must reverse the decline in the number of students who choose physics. This is particularly crucial in light of the decrease in the number of students coming to us from abroad.

Working together, we can make progress in all these areas. There are interesting times ahead!

Myriam P. Sarachik, Distinguished City University professor of Physics at City College of New York, was President of APS in 2003. This article is adapted from her retiring presidential address at the APS April Meeting.

APS News welcomes and encourages letters and submissions from its members responding to these and other issues. Responses may be sent to: letters@aps.org.