APS NEWS

A PUBLICATION OF THE AMERICAN PHYSICAL SOCIETY • WWW.APS.ORG/APSNEWS

October 2006
Volume 15, No. 9
www.aps.org/apsnews

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Why Are These Men Smiling?

Photo by Ken Cole

Tom McIlrath, left, has just stepped down after 10 years as APS Treasurer. He has the satisfied smile of one whose job has been well done and who leaves the APS in fine financial condition. Joe Serene, right, is the new APS Treasurer. He's smiling because, in the Treasurer's role of publisher of APS journals, he is looking forward to the challenge of maintaining APS's leadership position. An interview with Serene appears in this issue on page 7.

New Program Extends Open Access Offerings of APS Journals

The APS is expanding its Open Access (OA) offerings to articles published in *Physical Review A-E, Physical Review Letters,* and *Reviews of Modern Physics*. The new initiative is called FREE TO READ and can be applied to any article or group of articles published in APS journals dating all the way back to 1893.

Anyone (authors, readers, institutions, funding agencies, etc.) may, by paying a one-time fee, make articles published in APS journals available on the Society's various sites to all readers at no cost and without a subscription.

OA journals have proliferated over the last decade in an attempt to combat the sharp escalation in journal subscription prices. Among the movement's leaders is Harold Varmus, former NIH director and currently president and chief executive of the Memorial-Sloan Kettering Cancer Center, who helped found a nonprofit OA organization called the Public Library of Science (PLoS).

The emergence of OA journals has sparked heated debate over their potentially adverse economic impact on traditional scientific journals, such as *Science*, *Nature*, and the APS journals. Skeptics claim OA journals are not economically viable and could put an end to existing peer-reviewed journals, while proponents claim that OA improves the overall circulation and impact of scientific articles.

Among the controversial elements of the OA model is how one should define open access. A possible definition is any online journal that doesn't charge subscription fees. Because it charges a one-time fee, the APS FREE TO READ program is more of a hybrid OA model, according to APS Editor-in-Chief Martin Blume, who nonetheless insists it still falls under the evolving definition for OA. Thomas McIlrath, the retiring APS treasurer, concurs. "The operative word is 'access'," he says. "If there are no barriers to the reader accessing the material, then the material is open access."

The advent of electronic publishing brought about significant changes, and APS has adapted well. The same is true for OA. In fact, Blume maintains that the APS has been a leader in OA for years, with its early and continued support of arXiv.org and with its copyright agreement form. The agreement allows authors to make available their APS publications on their own or their institution's website.

APS introduced its first OA journal, *Physical Review Special Topics: Accelerators and Beams*, in 1998. Based on an institutional sponsorship model, this journal has steadily grown over the past 8 years and is now supported by an international group of accelerator laboratories. The Society introduced a second OA journal in 2005 called *Physical Review Special Topics: Physics Education Research*. This journal is financed by publication charges to the authors or the authors' institutions.

The introduction of FREE TO READ extends OA to the articles for all of the Society's journals. The FREE TO READ fees will initially be $975 for articles in *Physical Review A-E* and $1300 for *Physical Review Letters*. Articles in *Reviews of Modern Physics*, due to their large size and the limited number published annually, will be considered on a case-by-case basis. The higher price associated with PRL is due to its higher cost per published letter (because of its stringent acceptance rate).

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Cherry A. Murray Elected New APS Vice President

APS members have elected Cherry A. Murray, deputy director for science and technology at Lawrence Livermore National Laboratory, as the Society's next vice president. Murray will assume the office of vice president in January 2007. Arthur Bienenstock of Stanford University will become president-elect, and Leo Kadanoff, professor emeritus at the University of Chicago, will serve as APS president for 2007, succeeding 2006 APS President John Hopfield of Princeton University.

In other election results, Philip Phillips, a professor of physics at the University of Illinois at Urbana-Champaign, was selected as the new vice-chair of the APS Nominating Committee, which has the responsibility of selecting a slate of candidates each year to run for APS office. Robert Austin, a professor of physics at Princeton University, and Elizabeth J. Beise, a professor of physics at the University of Maryland, were elected as general councilors.

Murray is an experimental condensed matter physicist who has worked in surface and low temperature physics, light scattering and phase transitions in complex fluids. She received her PhD in physics in 1978 from MIT. She first joined Bell Labs in 1978 as a member of the technical staff. She held a number of management positions over the years, including department head for low temperature physics, department head for condensed matter physics, department head for semiconductor physics, and director of Bell Lab's Physical Research Lab.

Cherry A. Murray

Philip W. Phillips

In 2000, Murray became vice president for physical sciences and then senior vice president in 2001. *Discover Magazine* named her one of the "50 Most Important Women in Science" in 2002. She has served on the APS Executive Board and Council, and has been an active member of many APS task forces, divisions, and forums. In 1989, Murray won the APS Maria Goeppert-Mayer Award, and in 2005, the APS George E. Pake Prize.

In her candidate's statement,

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War Disrupts Mideast Physics Communities

With the cease-fire in place in Lebanon and Israel, physicists in those countries have begun returning to work and assessing the toll the war has taken on the physics community in the affected region.

When the attacks on Lebanon began on July 12, Bassem Sabra, an APS member at Notre Dame University–Louaize, had been in the Bekaa valley for a long weekend, planning to return to his home and work in Beirut. But the attacks intensified, and he was forced to stay in the Bekaa for the duration of the war.

His work was put on hold. Sabra and his astrophysicist colleagues had been working on a proposal to undertake site-testing at Lebanese mountains. "This key project that was to lay the foundations for observational astronomy in Lebanon is stalled now," he said. He and colleagues had been planning to do some measurements to assess the astronomical quality of some possible observing sites. "A site which we used to regularly visit was a 2000 m mountain pass. It was bombed several times in the recent weeks. Going to a high mountain at night and deploying a tube on a tripod would probably be a dangerous thing to do," Sabra said.

Laboratory equipment and textbooks were also delayed, he said. Sabra had hoped to attend the meeting of the International Astronomical Union in Prague in late August, but wasn't able to do so.

In late August Sabra returned to Beirut, finding his house badly damaged. "My Beirut apartment is damaged, basically uninhabitable. I will salvage what I can and find another place to live in as soon as possible, to continue business as usual. There are projects waiting, a summer session that must continue, and an academic year we have to save," he said.

While there was no physical damage to the university, "The impact on the physics community is huge in terms of lost work hours and various things, such as grants getting delayed," said Sabra.

Now that the war is over, Sabra worries that "probably money will be taken from research to aid in the rebuilding effort."

Roger Hajjar, a colleague of Sabra's at Notre Dame University –Louaize, shares that concern. Hajjar had been in France when the war broke out, and because the Beirut airport was closed, Hajjar had to delay his return to Lebanon.

He fears that funding for scientific research in Lebanon will suffer as more government spending will be devoted to reconstruction

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Sprouse to Succeed Blume As APS Editor-in-Chief

Gene D. Sprouse, professor of physics at Stony Brook University, will become APS editor-in-chief early next year. He succeeds Martin Blume, who will be retiring.

Blume has served as editor-in-chief since the beginning of 1997. Sprouse will take over the position on or about March 1, 2007.

Sprouse received his PhD at Stanford in 1968, and joined the faculty at Stony Brook in 1970. He rose through the ranks to become full professor in 1979, and served as department chair from 1990 to 1996. He served as director of the Nuclear Structure Laboratory at Stony Brook from 1984 to 1987, and again from 1996 to the present. His research interests include nuclear structure, neutral atom trapping, and laser spectroscopy of radioactive atoms. He is also interested in the development of radioactive beams. Sprouse was elected an APS Fellow in 1984.

The APS editor-in-chief, one of the Society's three operating officers, oversees the editorial staff and the journal production staff associated with all of APS's research journals: The *Physical Review*, *Physical Review Letters*, and *Reviews of Modern Physics.* APS journals are all available online, and APS produces print versions of most of these journals (two of the *Physical Review* journals are online only). In addition, the *Physical Review Online Archive* contains every article published back to the inception of the *Physical Review* in 1893.

Members in the Media

"Everyone knows about friction but we do not have a fundamental theorem of friction, and cannot predict friction between two surfaces."

***Robert Carpick**, University of Wisconsin-Madison, on friction at the nanoscale, Milwaukee Journal Sentinel, July 23, 2006*

"In the lab, blindfolded snakes can strike a running rat behind the ears to avoid its sharp teeth. It must be seeing more than just a warm blob."

***Leo van Hemmen**, Technical University of Munich in Germany, on his model showing how the snake brain processes information. New Scientist, July 28, 2006*

"What is close to our hearts is to understand the world, what it's made of, and how it behaves. We had a theory that this matter existed, and that's what we set out to prove."

***George Fai**, Kent State University, on the quark gluon matter, Akron Beacon Journal, July 27, 2006*

"As you expand the walls of the container, that gives the glass beads more space so they can settle a bit."

***Peter Schiffer**, Penn State University, on his finding that when you heat a container of glass beads, the beads settle, just as they would if the container were shaken, The New York Times, August 1, 2006*

"It is not that different from the Vietnam War, when people wondered whether to take money from the Defense Department for their research, even if their research had no conceivable military application."

***Sean Carroll**, University of Chicago, on a Templeton Foundation grant devoted to funding science with potential theological implications, Boston Globe, July 31, 2006*

"The question for the United States is this: Are we ready to relinquish leadership in this area of science? We risk falling behind not just in pure science, but in industry, medicine and communications, all of which have benefited from this research."

***Nigel S. Lockyer**, University of Pennsylvania, on the need to maintain US leadership in particle physics, Newsday, July 30, 2006*

"The university values Fermilab as a part of our teaching and research, but even more important, we value its leadership for this nation's global role in scientific inquiry."

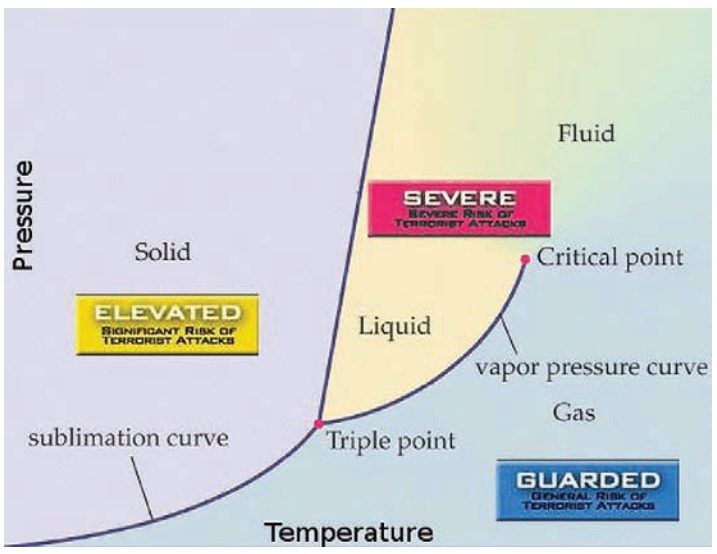
***Thomas Rosenbaum**, University of Chicago, on the university's bid to manage Fermilab, Chicago Tribune, August 23, 2006*

"What is also interesting in this case is how often, from his first infatuation as a high school boy, it was he who called a halt to the affair, often saying that it did no good to her or him."

***Gerald Holton**, Harvard University, on Einstein's love affairs, SEED magazine, August 2006*

All liquids banned from airlines!

For the first time, the Department of Homeland Security has deemed an entire state of matter to be a national security risk.



By Sean Carroll / www.cosmicvariance.com

This Month in Physics History

October, 1847: Maria Mitchell Discovers a Comet

Maria Mitchell, the first female professional astronomer in the United States, became instantly famous in October 1847, when she was the first to discover and chart the orbit of a new comet, which became known as "Miss Mitchell's Comet."

Maria Mitchell was born in 1818 in a large Quaker family on Nantucket. Her father was a schoolteacher, and later worked for a bank. The Mitchells encouraged education for all their children, even girls, which was unusual at the time.

Astronomy was Mr. Mitchell's favorite subject. The family owned a small telescope, and all the children assisted their father with his observations. Maria, a quiet child, worked hard at her studies, especially astronomy, and enjoyed helping her father. She also enjoyed reading, as there were always many books in the house.

NOAA Central Library

Maria Mitchell

As a young woman, Mitchell worked briefly as a schoolteacher, then as a librarian at the Nantucket Atheneum, while still continuing her astronomical observations. Her father encouraged her, and through him, Mitchell was fortunate to be able to meet some of the country's most prominent scientists, though generally as a young woman she was shy and avoided company.

At the time, some comets had been found, but the discovery of a new one was still considered a significant achievement. King Frederick VI of Denmark had offered a prize for the discovery of each new comet.

Every chance she got, even if the family had company, if the night was clear, Mitchell would go to the roof of the house to "sweep the heavens," using the family's 2-inch reflecting telescope.

On the evening of October 1, 1847, Mitchell slipped out of a party and went to the roof to begin her observations. She noticed a small blurry streak, invisible to the naked eye, but clear in the telescope, and she guessed at once that it might be a comet. Excited, she ran to tell her father. He wanted to announce the discovery right away, but she was more cautious. She recorded the object's position, and continued to observe it to be sure it was a comet. On October 3, Mitchell's father sent off a letter to Cambridge announcing the discovery.

It turned out others had seen the comet at about the same time. Father de Vico at Rome observed the same comet on October 3, and several other people observed the same object shortly after that. However, Mitchell's priority was recognized, and she received the medal from the King of Denmark.

This brought Mitchell immediate international fame, and further honors. In 1848, she was the first woman elected to membership in the American Academy of Arts and Sciences. She was also a fellow of the American Association for the Advancement of Science.

Mitchell was often bemused by all the attention she received as a scientist. She wrote in her diary after one scientific meeting, "It is really amusing to find one's self lionized in a city where one has visited quietly for years; to see the doors of fashionable mansions open wide to receive you, which never opened before. One does enjoy acting the part of greatness for a while! I was tired after three days of it, and glad to take the cars and run away."

Mitchell made many other astronomical observations during her career, including observations of sunspots, comets, nebulae, stars, solar eclipses, and the moons of Saturn and Jupiter.

She always appreciated the night sky not just for the science but for its beauty, and she recorded this thought in her journal: "Feb. 12, 1855.... I swept around for comets about an hour, and then I amused myself with noticing the varieties of color. I wonder that I have so long been insensible to this charm in the skies, the tints of the different stars are so delicate in their variety. ... What a pity that some of our manufacturers shouldn't be able to steal the secret of dyestuffs from the stars."

In 1865 Mitchell became a faculty member at Vassar College, making her the first female astronomy professor in the United States. She was also appointed director of Vassar College Observatory.

With her students, Mitchell emphasized the importance of observation, and was known for asking them, "did you learn that from a book or did you observe it yourself?" Exemplifying this philosophy, she went to great lengths to observe things herself. In 1878, she and several students traveled two thousand miles to Colorado to witness a total solar eclipse.

In addition to her scientific work, Mitchell was also active in opposing slavery and in advocating for women's rights. She believed that women's minds were too often wasted when they were forced to spend their time sewing rather than pursuing intellectual activities.

Maria Mitchell died on June 28, 1889. Although she is relatively unknown today, perhaps because her scientific accomplishments may not seem as impressive to us as they did to her contemporaries, she was well-known and respected in her day. As the first American woman astronomer and an advocate for women, she paved the way for others. The Maria Mitchell Observatory on Nantucket is named after her, as is the Mitchell crater on the moon.

APS NEWS

Series II, Vol. 15, No. 9
October 2006

Coden: ANWSEN ISSN: 1058-8132

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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.

Photo by Ken Cole

For almost 45 years, the old Woodrow Wilson Bridge carried the Capital Beltway across the Potomac River between Maryland and Alexandria, Virginia. In under a second, using the tools of physics, chemistry and civil engineering, a significant portion of the bridge in Alexandria disappeared with a series of flashes, a bang and a cloud of dust. The demolition occurred in the wee hours of August 29, while traffic on the new Woodrow Wilson Bridge (visible at right) was shut down to avoid potential mishap. Despite the late hour, a crowd of several thousand witnessed the blast; included among them was intrepid *APS News* photographer Ken Cole.

Viewpoint...

Sorry State of Science Politics in NASA

By Louis D. Friedman

The resignation in August of three noted leaders in space science from the NASA Advisory Council is a disaster. It is the third blow to science struck this year by NASA. First the US Administration presented a budget to Congress severely cutting back space science research and missions, including great exploration missions to Mars, Europa, and searching for terrestrial planets around other stars. Then, for no discernable reason, they announce that understanding the Earth is not a goal of NASA's anymore–despite the fact that understanding the Earth has been one of the principal products of space exploration. And now NASA Administrator Michael Griffin says he does not want the considered advice of scientists about space science and exploration – he wants it only about the decisions already made for the new exploration program focused entirely on the Moon and NASA's already decided architecture for it.

One forced resignation was of Wesley T. Huntress, Jr., Planetary Society President. Another was Eugene Levy, the provost of Rice University. Charles F. Kennel, Director of the Scripps Institution of Oceanography, then resigned from the Council for personal reasons. Huntress and Kennel are both former Associate Administrators of NASA, two of the very best who helped revitalize the Agency and set it on a direction of accomplishment in the 1990s.

Huntress and The Planetary Society (as well as I) are not just supporters of the Administration's Vision for Space Exploration, but we were also great and early supporters of Griffin personally. We lobbied for his appointment, and Griffin's leadership of a Planetary Society study two years ago was a sign of our alliance. But time, and Washington, change things. In my view, the Vision is now clouded and we are headed on a different path–a path without any science guidance and one that will lead to no human exploration of other worlds.

The problem is not simply about budget priorities – those arguments exist every year. It is not simply about the size of the NASA budget – space enthusiasts always want it larger. It is much deeper; it is about the heart and soul of exploration, which is the fundamental goal of NASA. NASA has separated science from exploration, bureaucratically and in their development of missions. They dismiss the great robotic missions: Voyager, Galileo, Cassini, Mars Exploration Rover, New Horizons (past) and Europa Orbiter, Mars Sample Return, Dawn, Terrestrial Planet Finder (future) as only science. Whereas the Vision for Space Exploration strongly supported these robotic missions and the search for extraterrestrial life, the new NASA exploration program cut out half the research connected with the latter subject and all those future missions I just mentioned.

Why would they do this? If the Administration can't supply the funds for the Vision for Space Exploration goals, wouldn't just delaying them make more sense than cannibalizing the part of NASA that is working and has provided such valuable and exciting results to the world, and which was supposed to guide humans into the solar system?

I think I am beginning to understand why. In a little publicized speech last March, the President's science advisor, John Marburger, declared, "we want to incorporate the Solar System in our [the US] economic sphere" and then went on to say "The fundamental goal of this vision is to advance US scientific, security, and economic interests through a robust space exploration program. It subordinates space exploration to the primary goals of scientific, security and economic interests." Whoa – what happened to exploration? What are the American economic and security interests in human exploration of the Moon and Mars? What happened to "we came in peace for all mankind?"

Marburger has gone further. In testimony to Congress he asserted, "The greatest value of the Moon lies neither in science nor in exploration, but in its material ... The production of oxygen in particular, the major component (by mass) of chemical rocket fuel, is potentially an important Lunar industry." This is ludicrous–we could probably not devise a more expensive way to make rocket fuel than by producing it on the Moon – especially with oxygen which we do not know how to extract, or at what cost.

Paraphrasing John Kennedy, Marburger asserts "We go to the Moon and do these other things, for its oxygen."

I am beginning to think that the new interpretation of the Vision, and the new direction of NASA, is more ideological than visionary, more about extending our economic interests than anything to do with the public good and public interest in space exploration. This is why I feel we are fighting for the heart and soul of NASA (and space exploration around the world).

Maybe I am an alarmist; Griffin maintains that only the budget constraints have forced science cuts, and that he has to make them in order to get the new rockets built that will replace the shuttle (a goal we support). But then why

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APS Members Now Have Easy Access to Network of Experts

APS has recently created a strategic agreement with Fortnight Solutions, a company that matches engineering problems with leads for their solutions using its network of experts. The agreement allows the Society's members to use the Fortnight's services at a discount and join its network of experts free of charge.

Fortnight Solutions is a network of science and engineering experts that helps technology companies locate solutions, products, and services. Technology companies that have a manufacturing or development problem can hire Fortnight, which refers the problem to its network of experts. Clients may be looking for specific expertise, a product, process, or service.

Experts with a suggested solution submit a brief description of their proposal. Fortnight then presents the most promising of those leads to the client, who can then select the most suitable ones to pursue.

Fortnight's fee structure is incremental and tailored to the scope of the problem and individual client's needs. Due to the cooperative agreement between APS and Fortnight, APS members, and companies that have an APS member as an employee, can now receive a discount of $750 on each of their first two uses of Fortnight's services of at least $5,000.

"I'm very excited about this agreement because I think it will be a great benefit to industrial members, especially those in small companies," says Judy Franz, APS Executive Officer. Companies often don't have the resources or time to develop a solution in house, and the Fortnight network can help them quickly find a solution.

APS members can now join the Fortnight expert network for free (normally a $25 fee applies). Experts are paid about $250 for each lead they send in that Fortnight submits to the client, and have the opportunity to earn more if the client decides to pursue the lead further. Submitting a lead often takes only a few minutes.

Fortnight limits the number of emails sent to experts, so they will not be overwhelmed with requests. The company operates with strict confidentiality and internet security protocols. Experts and clients are kept anonymous; an expert's contact information would only be provided to the client with explicit, specific permission.

More information about Fortnight Solutions can be found at its website, at www.fortnight-solutions.com

APS Selects Engel, Saltman as 2006-2007 Congressional Fellows

Don Engel and Alex Saltman have been selected as the two 2006-2007 APS Congressional Fellows. They will both spend a year on Capitol Hill providing advice to Members of Congress and learning about the legislative process.

These fellowships aim to provide a public service by making available individuals with scientific knowledge and skills to Members of Congress, few of whom have a technical background. In turn, the program enables scientists to broaden their experience through direct involvement with the legislative and political processes.

Congressional Fellow Don Engel, a biophysicist from the University of Pennsylvania, has been interested in science policy for a long time. He initially heard about the Congressional Science Fellowship nearly ten years ago as an undergraduate at the University of Maryland. "I wanted to learn science because I thought it was important to society," he says. "I've been planning to apply for this for ten years."

Congressional Fellow Alexander Saltman is a string theorist from Stanford University. Saltman grew up in Austin, Texas, received his undergraduate degree from Harvard University, and recently earned his PhD from Stanford.

Though he has little previous policy experience, Saltman has been interested in applying for this fellowship for some time, and is excited about exploring this option. "It's very invigorating doing something new," he said. His particular policy interests lie in arms control and energy policy, which has become especially important in the past few years.

Engel attended the University of Maryland, and then transferred to Brown University, where he received a BSc in physics and math and an MSc in computer science. He recently completed his PhD in physics at the University of Pennsylvania.

His research in computational protein design has drawn on techniques from artificial intelligence. He examined large databases of protein features, and used statistical analysis to find potentially useful patterns. Engel says that he has been especially pleased to find that, working with a research group from the UPenn medical school's biophysics group, he was able to work closely with experimenters who were able to produce in a lab some of what he had found computationally. The research has applications to drug design and nanotechnology.

Engel's political experience so far includes work on political campaigns, including that of the current mayor of Providence, Rhode Island. Engel has also held publicly elected offices in Philadelphia, serving as representative of the 20th Division on the 27th Ward Committee, and as the Secretary of the 27th Ward Committee. These ward committee positions, which each serve only a small number of people and require only a minor time commitment, tended to go vacant, so Engel also led an effort to increase awareness of these local offices and get people elected to them. He also built a voter education tool that used GoogleMaps to show voters where to vote, where district boundaries lie, and who represents them.

Engel's particular policy interests include environment and energy, health policy, and technology and

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Letters

American Nuclear Weapons, and Vigilance, Promote Peace and Security

This physicist, and volunteer in WWII, disagrees totally with the letter by J. Eckerman in the August/September *APS News*, which claims that our use of two atomic bombs on Japan to end the war quickly, "brought about the feasibility of the predicted Apocalypse." As Andrei Sakharov emphasized, the Soviet Union would have pursued nuclear and thermonuclear weapons regardless of our actions or inaction.

President Roosevelt authorized the Manhattan Project and President Truman, remembering the surprise attack on Pearl Harbor in peacetime, wisely chose not to sacrifice many millions of Japanese lives, along with the total destruction of Japan, by massive conventional air bombardment, and not to sacrifice a couple hundred thousand American men and women in the Allied invasion of Japan planned to begin November 1, 1945. The perhaps up to 150,000 Japanese lives lost in Hiroshima and Nagasaki are far less than what would have occurred without our use of nuclear weapons. Even when the two atomic blasts convinced the Emperor to order surrender, Japanese Army officers tried to prevent his surrender message from being broadcast. Fortunately some loyal aides managed to have his message broadcast.

The presence of our formidable nuclear weapons prevented the Soviet seizure of Berlin and all of Western Europe. Thanks to President Reagan's rearmament and vision, the Soviet Communist Empire no longer exists. Partly due to President Bush, for five years after 9/11, terrorists have not yet scored a similar surprise attack on American soil. Our major worldwide intelligence effort, along with allies, deserves credit for that.

Iranians should contemplate that if their fanatic leaders obtain nuclear weapons and use them for surprise attack as they proclaim and threaten, many millions of peaceful Iranians will lose their lives and their futures from the inevitable retaliation. It is in their own interest to overthrow their religious tyrants, and construct an Iranian government worthy of their great past which includes the reign of the emperor Cyrus, famous for his friendship toward the Jewish people.

The arguments by Jorge Hirsch, while much less strident, are also not correct. The fallacy is the persistent illusion that sweet reason with no nuclear weapons will persuade ruthless fanatics (like Hitler, Tojo, Stalin, and Bin Laden types who seek to destroy "the infidels") to cease efforts at the destruction of peaceful, democratic nations.

Howard D. Greyber
San Jose, CA

Why Quibble About Multiple Universes?

In response to Ronald Hodges's letter [*APS News*, July 2006] about insight into the religious community, perhaps we could use some insight into science as well.

For the religious Christian community, it is written "Thou shalt not tempt the Lord thy God" (Matthew 4: 5 - 7). I believe this means that this religion is not really testable. Isn't it strange that a unified Theory of Everything may be based on some string theory, which is not directly testable either? Where is your distinction between philosophical and methodological naturalism now?

As far as Intelligent Design is concerned, evolution is a natural process, meaning it follows from the laws of physics as they actually operate, not necessarily as we conceive them. In physics we call this the anthropic principle, where the natural process involves multiple universes with random laws of physics and physical constants and the only ones which seem to count for anything are the ones evolving intelligent life (note that we are solely responsible for the term intelligent). Maybe it's the hard way, but this is certainly one approach to getting the job done. Why quibble about the details, if you can't come up with any evidence of other universes? This is where the Intelligent Design question belongs, not in biology classes which are only attempting to teach a natural process based on carbon chemistry and the laws of physics as we know them.

Len Loker
Indianapolis, IN

Unnatural Causes Don't Exist

Lawrence Krauss' excellent Back Page article, "When Worldviews Collide: Science and Religion Face Off Again" [*APS News*, April 2006] has elicited some interesting responses in the June issue. Walter Schimmerling was quite right in his complaint that Krauss implies that the face-off involves religion in general. Only a small subset of religious thought, the fundamentalist believers in a personal God, active in human affairs, and their politically motivated hangers-on, is represented in the challenge to the theory of evolution, and we should be careful to maintain the distinction.

Kennell Touryan, on the other hand, finds there is a valid controversy about the theory of evolution because the nature of the origin of life is so much in doubt. The theory of evolution is about the origin of species, given the existence of life, and says nothing at all about the origin of life. Controversy about the origin of life does not equate with controversy about the theory of evolution.

I quite disagree with John Fletcher, who objects to Krauss equating methodological naturalism with the scientific method, stating that the latter does not limit the kinds of causes that can be invoked when arriving at a theory. The very essence of the scientific method is the checking of theory against experiment. Science must a priori assume that there are no unnatural causes at work in the natural world, for otherwise experiment could not be trusted to provide any test of the validity of the theory. This assumption, of course, is arbitrary, but without it we would have some other system of thought, not science. The battle with ID must be based on whose system of thought works to provide the most successful predictive power, but ID must be taught as something other than science. George Kuipers makes a related statement that if the existence of God is not a scientifically testable proposition then evolution and ID are on an equal footing as far as science is concerned. I think this reflects again an incomplete understanding of the nature of science.

The truly amazing success of science in creating coherent pictures of how the world works, and the way we can confidently use these pictures to guide great and complex enterprises, has convinced me that naturalism goes beyond the methodological to the philosophical. It seems to me to be true, to a high degree of confidence, that there are no unnatural causes in the natural world, saving perhaps only what got the whole thing started in the first place.

Alan D. Franklin
Newville, PA

Drell Hews to Mies's Line

I was disappointed to learn (*APS News,* Back Page, August 2006) that the same dangerous nuclear stance propounded by Admiral Mies (Back Page, June 2006) is being advocated (albeit less bluntly) by such an eminent physicist as Sidney Drell.

Making an ironclad commitment to unconditionally renounce the use of nuclear weapons against non-nuclear countries would have benefits to the US that far outweigh the losses. It would remove the possibility that a reckless President could single-handedly make a legal decision that would change the future of humanity in a disastrous way. We would gain moral authority, other nuclear countries would follow suit, the non-proliferation framework would be enormously strengthened, and we would create a real incentive for nuclear states with small arsenals to disarm.

It is high time that American physicists, who carry a heavy responsibility for the existence and only use so far of nuclear weapons, address this issue, and I would hope forcefully advocate such a stance for our country.

Jorge Hirsch
San Diego, CA

Great Talk, Wrong Speaker

Just a quick correction to "Meeting Briefs" in the July *APS News* : Terry Oswalt of the Florida Institute of Technology gave the stellar archaeology talk, not David Bixler. Oswalt's talk was, as you say, "among the highlights" of the meeting. He covered a great deal of science in a manner that was highly accessible to high school physics teachers, many of whom were there for the joint meeting with Texas AAPT. It was one of the best talks for such an audience that I've ever heard.

David Hough
San Antonio, TX

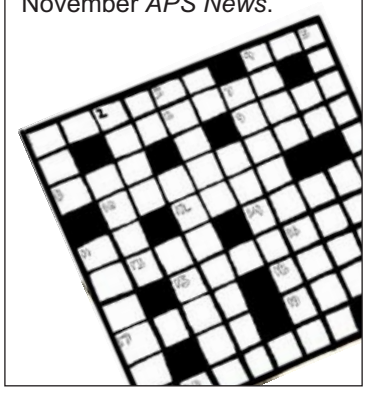
Wrong Century

There is a typo in Jean Barrette's letter [*APS News, July 2006*], in the sentence, "...communicated by J.J. Thomson to the *Philosophical Magazine* ...". You have the date 1998. I'm sure it was meant to be 1898.

Frank R. Tangherlini
San Diego, CA

Crossword Puzzle Contest Results Next Month

In the March issue we announced a contest for the best physics crossword puzzle. The deadline for submission was September 1. Our panel of experts is now evaluating the submissions, and the results will appear in the November *APS News*.



Science, Religion, and Pershing Square

– *Adlai Stevenson*, accepting the Democratic presidential nomination in 1952, characterized the 20th century as "that portal to the golden age."

– *Ray Kurzweil* in his 2005 book, *The Singularity is Near*, says that within twenty years, technology will have developed to the point that, among other things, people can live as long as they want to.

– *Charles Dickens* in the introduction to *A Tale of Two Cities*, set during the French revolution, said, "It was the best of times; it was the worst of times."

– *Enrico Fermi* is said to have remarked, in response to a question about extraterrestrial life: "Where is everybody?"

– Fictional *Charles Addams*-type cartoon factory gate-keeper walking onto the laboratory floor swinging his bunch of keys: "Closing time, gentlemen."

Science deals with reason; religion deals with faith. The people who wrote the Bible were the original high energy physicists (the book of Genesis was the first theory of everything). And considering the primitive nature of their observational tools and theoretical background, they didn't do such a bad job. The problems arose because their descendants refused to allow for the results of advancing knowledge, like the Hubble telescope, the standard model, and Saran wrap.

The tension between science and religion arises out of the fundamental inability of people to come to grips with the finiteness and vicissitudes of existence and the infinities of time and space. Because of this insoluble problem, they are driven to faith. Or, as Hippocrates and succeeding philosophers put it, more or less, "Art is long; life is short, so come to the tavern and have a snort."

But times they are a-changin! Nanotechnology promises immortality. The Golden Age is coming, and it won't require the Second Coming. What could faith healers during the age of miracles do that a bottle of Viagra can't accomplish this afternoon? It's the best of times.

Not so fast. Nuclear proliferation is rampant. Religious extremism is on the march. Seventy-two virgins are waiting for the faithful. The earth is heating up, Bush couldn't care less, and GM killed the electric car. It's the worst of times.

I'm beginning to think that those wackos who used to march around Pershing Square carrying signs proclaiming that "The End is Coming" were right all along. Only it's not going to be the result of divine intervention–we are going to do it to ourselves, and maybe it's an inevitable consequence of the second law, because sooner or later some nut is going to be in a position to press the button. Evolution may contain a built-in self-destruct mechanism. In plain language, when they get too smart, they blow themselves up. This could be why no extraterrestrial civilizations have been discovered.

And the really weird part about it is that those who precipitate the destruction will probably say that it was divine intervention that did it.

Closing time, gentlemen?

Robert A. Levy
El Paso, TX

Trouble with Eratosthenes

I always wondered how Eratosthenes knew the distance from Alexandria to Syene, because I doubted accurate maps were available in those days. So I was delighted when your "This Month in History" piece on Eratosthenes *[APS News*, June 2006] explained how he learned the distance. Sort of.

Please finish the story. How did the accurate pacers know the direction to pace? If Syene were due south of Alexandria, they could pace at night directly from or to the North Star, depending on their direction. But Syene, or at least Aswan, is about three degrees off due south. And surely they couldn't have known that. The road between the cities, even over that unobstructed desert, surely was not straight. But somehow they managed.

So, please. How?

Paul Dickson
Aiken, SC

Ed. Note: Perhaps the following letter will answer your question. Then again, perhaps not.

* * *

I am most perplexed as to why you continue to advance the fallacious doctrine that it was Eratosthenes who had first determined the circumference of the Earth. The fact that none of his writing has survived poses no problem to those who propagate this falsehood. It never does for those whose agenda is to promote the fallacious doctrine. In fact it was the Greek philosopher and geometrician Sphericles (an enemy of the Pythagoreans) who first determined the circumference of the Earth, his method stolen by Eratosthenes, aided by the Proto-Pythagoreans.

Sphericles resided in Alexandria, a recent addition to the Egyptian landscape. He knew that a well near present-day Aswan was directly illuminated by the overhead sun on but one day of the year. Best of all the well was approximately at the latitude of Alexandria (actually off by about 3°) on the Tropic of Cancer. He sent his brother Hemisphicles, a professional walker (actually his half brother) to Aswan to measure the distance from the well (then called the Sacred Well of Dreams) to Alexandria. The rest is history, unfortunately distorted history.

I do hope that you will set the record straight, thought I do not really think it will in any way change the attitude of the propagators of this falsehood.

Moishe Garfinkle
Philadelphia, PA

Washington Dispatch

A bimonthly update from the APS Office of Public Affairs

ISSUE: Science Research Budgets

Since floor approval of the Department of Energy (DOE) Office of Science appropriations bill in June, the full House has acted on funding bills for NSF ($6.02B; +7.8% over FY06), NIST core programs ($0.47B; +18%); DOD basic research ($1.56B; +6.1%), DOD applied research ($5.25B; +1.5%), and NASA Science ($5.41B; +3%). The Senate Appropriations Committee has also passed the bills funding DOE Office of Science ($4.24B), NSF ($5.99B), NIST core programs ($.47B), DOD basic research ($1.48B), DOD applied research ($4.81B), and NASA Science ($5.40B), but the full Senate has yet to vote. It is widely anticipated that many of these funding bills will not see final action until after the November elections.

The proposed funding levels for DOE Office of Science, NSF, and NIST core programs are generally consistent with the President's American Competitiveness Initiative (ACI) request.

For details of the FY07 budget process, go to http://www.aaas.org/spp/rd/fy07.htm

ISSUE: Interim Nuclear Waste Storage Study

The APS Panel on Public Affairs Nuclear Energy Study Group met on August 8th and 9th to examine technical and programmatic issues associated with the centralized interim storage of spent nuclear fuel. The study group received briefings by representatives of the Nuclear Regulatory Commission (NRC), DOE, and the nuclear industry, as well as Congressional staff and independent experts. The study group report is expected to be available by mid-November. The members of the study group are Roger Hagengruber (Co-Chair), John Ahearne (Co-Chair), Robert J. Budnitz, Margaret Chu, Kevin Crowley, Richard Meserve, Ernest J. Moniz, Burton Richter, Frank Von Hippel, and Francis Slakey.

ISSUE: POPA Electricity Storage Study

The APS Panel on Public Affairs Electricity Storage Study Group held a workshop on August 14th and 15th to examine the technical issues associated with electricity storage. Technology experts provided briefings on the current status of the technologies used for electricity storage. In addition, representatives from industry, DOE, and the utilities sector briefed the study group on the implementation and current status of electricity storage programs. A report from the study group is anticipated by February of next year.

ISSUE: Reliable Replacement Warhead (RRW)

The Nuclear Weapons Complex Assessment Committee (NWCAC), in which the APS is informally participating, had its second meeting at Lawrence Livermore National Laboratory. The NWCAC received both classified and unclassified briefings on the technical issues associated with the proposed Reliable Replacement Warhead (RRW). A report is anticipated to be completed by early next year.

For more information, log on to the APS Office of Public Affairs web site:
http://www.aps.org/public_affairs

INTERNATIONAL News

...from the APS Office of International Affairs

Physics in Lebanon: An Overview, and Ways to Help

By Bassem Sabra

When representatives from the APS emailed me in the first days of the war on Lebanon, they inquired about my safety, the effect of the war on the Lebanese physics community, and how the APS could be of help. I replied with a short letter, which appeared in the August/September issue, written hastily while fighter jets screamed overhead. In that letter I addressed the first couple of issues and intentionally left out the last. Circumstances at that time did not grant me the luxury of thinking clearly about how the APS can help Lebanese physicists. Having now pondered the issue further, I would like to use my contacts with *APS News* and the APS International Office to help build a long-term relation between the Lebanese physics community and the APS.

I should stress that I am not a spokesperson for Lebanese physicists. There are no physics organizations in Lebanon. I am simply a Lebanese astrophysicist living and working in his country. I can, however, host you on a "tour" of Lebanon's physics arena.

The physics community in Lebanon is about 500 strong. There are about 100 professors and 400 students. Most students go on to teaching careers in Lebanese schools, as well as schools in the Arab Gulf states, where the salaries are more lucrative. Students who opt for a PhD go mostly to France and the US. Their research covers the full spectrum in physics. A remarkable absence is that of physicists in Lebanese industry, probably due to the lack of R&D.

Four universities grant undergraduate physics degrees: Lebanese University (LU), American University of Beirut (AUB), Universite Saint-Joseph (USJ), and Notre Dame University-Louaize (NDU). Only the LU and the AUB grant master's degrees. The AUB and NDU follow the American education system. Their students use the same physics textbooks used in US universities. The LU, which is the only public university in Lebanon, hosts most of the faculty and students, and it maintains strong ties with French universities in terms of education and research.

The fields of expertise of the faculty are atomic physics, condensed matter physics, string theory, optics, astrophysics, elementary particles, etc. Theoretical/computational studies are more common since experimental projects require more funding. However, the government has been encouraging research projects that have direct applications. The Lebanese Council for Scientific Research (LCNRS), the main government-run funding agency for basic sciences, governs joint grant programs with its French counterpart. Research output is generally low. A high teaching load, lack of incentives, and lack of adequate support all conspire negatively. Fortunately, some physicists, both old and young, are determined to carry out research and have been succeeding in publishing in international refereed journals. Many of the faculty, especially those who were educated in the US maintain strong research ties with their US colleagues.

Support for research is meager. The LCNRS has an annual budget of only $3.5 million US, roughly $1 US per Lebanese citizen. This is extremely low, even by developing world (to use the politically correct term) standards. Recently the LCNRS has taken some initiatives to encourage research, giving preference to fields that have direct applications. Certain areas in physics benefit from this, namely condensed matter physics and materials science. Despite the modest support for basic research, the outlook in the last couple of years has been improving. For example, the LCNRS was willing this year to

LEBANON continued on page 7

WAR DISRUPTS continued from page 1

efforts. Scientific research had not been a high priority in government budgets in recent years, said Hajjar, and the current situation may only make that worse. Hajjar now fears that science in Lebanon is in "deep deep trouble."

In the past, Hajjar's lab had received a lot of support from his university. "We had the plan to equip our lab with an optics table and a plan to slowly start a lab for the development of small astronomical instruments," he said. "It is not clear today how easy it will be to proceed with the plan," since the university now needs funds for other priorities.

He also worries about enrollment at his university, as students who used to commute to campus on a daily basis from remote areas may now be unable to reach the university due to damaged roads and transportation infrastructure.

Ghanem Oweis, an APS member in the mechanical engineering department of the American University of Beirut, was able to flee to Jordan, of which he is a citizen, at the start of the war.

Oweis, who had been in Lebanon for the first time, said, "I was busy building up my lab for experimental fluid dynamics. Momentum was building up and my research was taking off. But suddenly everything changed on July 12th when the hostilities started."

At first Oweis thought he would stay in Lebanon. But "the situation was getting worse by the hour, and it became clearer that it would be safer for me to leave the country. I was also worrying about food, water, and electricity in the days to come if the war went on," he said.

He decided to evacuate to Jordan, and contacted the Jordanian embassy, which had chartered buses. "The buses were 4 hours late, and these were the most tense 4 hours of the whole experience because of the sonic booms, and the sounds of exploding bombs presumably in the southern district of Beirut. The thing that touched me most during the wait was the sight of the frightened children who would cry with each loud bang," he said.

The 200 mile trip to Amman took more than 10 hours, said Oweis. They had to drive on side roads through farm and residential areas because the main highway had been cut off by the bombing.

At the American University of Beirut, the summer session was suspended during the war, Oweis reports, and research has been delayed. In addition, "the lives of students, faculty, and their families had been disrupted. Some have left the country and left family, friends, and belongings behind without a hint on when they might be back. Some have probably left for good."

The mechanical engineering department in which Oweis works had been working on getting the ABET accreditation for the undergraduate program and opening a PhD program, he said. "I think the recent events will have an adverse impact on these efforts for quite some time to come, and we may have to take extra measures to counter the negative effects, such as multiply our recruiting efforts to stay near target."

Oweis's own work has also been disrupted. "Like many others, I've lost the precious summertime which I've been sparing to get my research going," said Oweis.

As of late August, Oweis was still in Amman, but planned to return to Beirut for the start of the fall semester.

Mounib El Eid, also of the American University, spent the war in Beirut. "Although the situation in Beirut where I remained was really hard during that time, I have developed a deeper sense for life and its beautiful peaceful side," he said. "It was great to see how peaceful and human most of the Lebanese are. They were overwhelmed with helpful ideas."

At AUB, Eid and his colleagues had recently worked hard to re-install a PhD program in theoretical physics, in high energy physics, astrophysics and soft matter physics. "There is a real need to develop and enforce the program of graduate study," he said. But he now worries that the new program will have difficulty attracting students and faculty because of fears that Lebanon is unsafe and unstable. "We need to hire new faculty members and attract graduate students to be able to conduct serious research," he said.

Like the other Lebanese physicists, El Eid is concerned that funds for scientific research will have to be used for rebuilding infrastructure instead. "Huge effort is needed to rebuild the damaged infrastructure with a cost estimated more than $3 billion," he said. "The problem is not only rebuilding the infrastructure, but Lebanon has lost a lot of its credibility as a peaceful country. It has returned to a state of instability with not yet known future. A settled situation is crucial for developing scientific activities."

In Haifa, the Technion closed for a week during the rocket attacks, but soon returned to normal operations.

During the war, residents of northern Israel, including Haifa, were advised to avoid being in the open or on roads during rocket attacks, and were advised to stay as much as possible in bomb shelters or in "protected areas"–inside rooms with no external walls and not directly under a roof. Many buildings at the Technion have such "protected areas," said Arnon Dar, a physicist at the Technion, but some students had been taking exams in unprotected classrooms.

"So, when rockets hit a railroad depot in Haifa at 9:10 a.m. on July 16, killing eight Israeli workers in explosions which were heard well all over town and on campus, and another rocket exploded soon after on a main road within sight of the northern side of the campus, the Technion authorities decided to evacuate the students living in the unsheltered student dormitories of the Technion and to send home those who have not been called for active military duty," said Dar. Many Haifa residents also chose to leave town.

Spring semester exams at the Technion had been underway at the start of the war. The university delayed those exams until fall. The summer session at the Technion was cancelled. Many technical and academic staff did show up every day, while others had left Haifa with their families.

Those who stayed tried to continue their normal summer activity as much as possible. "Like everyone who has lived in Israel for a while, I tried to continue as much as possible with my daily activities and commitments, while trying to do my best to minimize unnecessary risks," said David Gershoni, a physicist at the Technion.

Dar said, "Even the customary daily tea and lunch breaks at the h-bar club of our physics department were continued, though many were interrupted by air raid sirens."

The air raid sirens went off about a dozen times per day during the war, said Dar. "As soon as they were heard, we stopped everything and walked to the nearest 'protected area' where in a couple of seconds we could hear clear and loud the sound of the explosions from anywhere in town and in the Haifa bay area," said Dar.

Some of the rockets fell near the Technion, but not in it. Some laboratory work was affected, Dar reports, because supplies and equipment deliveries were disrupted by the hostilities. Lab work that requires constant attention could not be attended to, as people frequently had to rush to bomb shelters at a moment's notice. Some experiments switched to a night shift for this reason, said Dar.

By late August, most of the population of northern Israel had returned home. Technion students, some returning from active military duty, began to arrive on campus, and the Technion community has begun preparing for the fall semester.

PHYSICS AND TECHNOLOGY FOREFRONTS

Catching an Electron Wave with Emerging Plasmon Applications

By Jennifer Ouellette

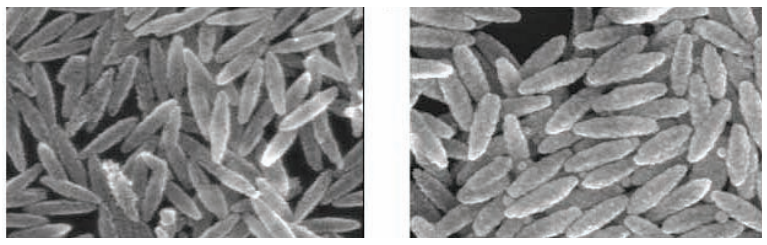
When light strikes a metallic surface, it generates electron waves, called plasmons. This remarkable effect was discovered in 1897 by Robert W. Wood, a physics professor at Johns Hopkins University. Wood was also the first person to unwittingly record the energy lost as heat by plasmons skimming along the surface of metals in 1902.

It took 40 years for Italian physicist Ugo Fano to provide an explanation: metals are not perfect conductors. A conducting surface can guide light as a 2D surface wave plasmons are also known as two-dimensional light–and those waves absorb energy. Hence, Wood's anomalous observations of energy loss in the light reflected from metallic surfaces. Their unusual properties make surface plasmons extremely promising for a wide range of applications, including plasmon microscopes and "superlenses," plasmon-based nanoparticle biosensors, and electronic circuits capable of operating at optical frequencies.

Cutting-Edge Microscopes. Plasmons can enable scientists to see fine details that were previously undetectable. For instance, a team of scientists at the University of Maryland led by Igor Smolyaninov, along with colleagues at Queen's University in Belfast, Ireland, are developing a two-dimensional plasmon microscope, ideal for imaging living cells, that could operate much like a point-and-shoot camera and reveal much more detail that currently available with existing imaging techniques. They were able to image tiny objects with spatial resolutions of 60 nm, further reduced to 30 nm with a bit of mathematical tweaking. The UMD team believes they can improve the resolution even further, down to around 10 nm.

A sample is placed on a metal-coated glass surface and covered with a drop of glycerin. Laser light shines through the glass and produces surface plasmons in the metal. The glycerin acts like a parabolic dish that can collect plasmons sprayed out from the sample at its focal point. It then forms them into something like a "plasmon beam" that goes back down towards the metal surface. Part of that beam bounces back up and can be seen with a regular light microscope. The performance is close to what an electron microscope might achieve, but involves no vacuum, high voltage or elaborate specimen preparation.

Other planned improvements include replacing the micromanipulators currently used to adjust the glycerin droplet's shape by hand with solid mirrors etched on the glass using lithography – an important step towards building a practical device. This would enable scientists to buy these special glass slides to use with any microscope: any lab could achieve electron microscopy resolution for the cost of a regular microscope. Nor would there be a need for special sample preparation. Movies might even be possible, since the image is taken all at once, rather than one pixel at a time. State-of-the-art lithography cannot yet produce sufficiently smooth mirrors to match that of the glycerin drop's surface, but the UMD researchers are hopeful that the technology will continue to improve rapidly to make it possible in the near future.



"Nanorice" shown in the images above, can be used to map the surfaces of biological cells.

Super-Lensing. Other researchers are exploiting plasmons to create "super lenses," relying on tiny nanoparticles to amplify and focus the light shining on a given sample. Scientists at the University of Texas, for example, have built a "super lens" and used it in a device to take pictures just below the surface of thin material substrates. According to Gennady Shvets, by combining his "super lens" with near-field scanning optical microscopy, he was able to achieve microscope resolutions as good as 1/20th of a wavelength in the mid-infrared range of light.

This in turn enabled him to observe "giant transmission," in which light falls on a surface covered with holes much smaller than the wavelength of the light. Even though the total area of the holes comprised a mere 6% of the total surface area, 30% of the light nonetheless came through, thanks to the presence of plasmons. It is very difficult to image objects smaller than half the wavelength of the light being used for the imaging, but Svets and his colleagues were able to achieve much higher resolution because there was less diffraction.

Meanwhile, at Rice University, researchers have created rice-shaped particles of gold and iron oxide, called "nanorice"–so named because when magnified the structures resemble tiny grains of rice that they hope to attach to the probe tips of scanning microscopes to map out the surfaces of biological cells. According to group leader Naomi Halas, nanorice is similar to an earlier structure she invented in 1998 called nanoshells. Both are made of a non-conducting core covered by a metallic shell. Changing the shape of a metal at the nanoscale enables researchers to modify the properties of the plasmon waves produced. Spheres and rods are the most optically useful shapes, and nanorice combines the best properties of both.

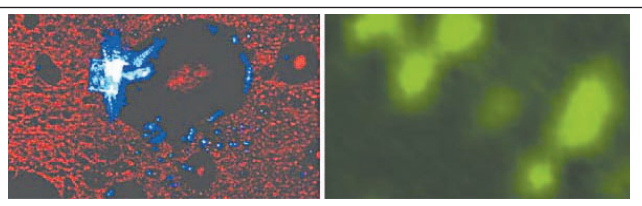
Nanoshells and nanorice can also serve as "super-lenses," amplifying light waves and focusing them to spots far smaller than a wavelength light. In fact, Halas reports that nanoshells are about 10,000 times more effective at surface-enhanced Raman spectroscopy (SERS) than traditional methods. Raman scattering is routinely used by medical researchers, drug designers, and chemists to determine the precise chemical makeup of materials. So single grains of nanorice could provide the needed field intensities to characterize biomolecules like proteins and DNA that adsorb on a particle. They could also be used not just to identify, but eradicate cancer cells in rats.

Integrated "Plasmonics." To date, it's proven difficult to combine photonic components –such as fiber optic cables – with electronic components like wires and transistors because of their mismatched capabilities and size scales. Photonic components can carry a lot of data –witness the explosion in broadband data transmission rates–but are bulkier than electronic components, which in turn can carry less data. Ideally scientists would like to be able to combine the best features of both onto a single chip in an emerging new discipline known as plasmonics.

Plasmons might be the key to achieving true integration on a single chip, since they operate at optical frequencies – typically 100,000 times greater than the frequency of even the most cutting-edge microprocessors – and the higher the frequency of the wave, the more information you can transport over it. Yet they take up much less space because their wavelengths are much smaller than the light used to create them. In such devices, light would be converted into plasmons, which propagate along a metallic surface with a wavelength smaller than the original light. The plasmons could then be processed with their own 2D optical components–mirrors, waveguides, or lenses–and then later converted back into light, or into electrical signals.

Nader Engheta of the University of Pennsylvania believes that nanoparticles–including those capable of supporting plasmon excitations–could be configured to act as nanometer-scale capacitors, resistors and inductors: the basis elements of an electrical circuit. But in this case, the circuit would operate not at radio or microwave frequencies, but at optical frequencies. This would enable the further miniaturization (down to about 30-50 nm) of optical components and the direct processing of optical signals with nano-antennas, nano-circuit filters, nano-waveguides, and nano-resonators. It could even lead to possible applications in nano-computing, nano-data storage, molecular signaling and molecular-optical interfacing.

Physicists in Denmark and France led by Sergey Bozhevolnyi of the University of Aalborg have developed a waveguide that could allow light at fiber-optic wavelengths to be "squeezed" to below the diffraction limit, allowing it to pass though small regions such as channels on a chip without being significantly lost.



A "plasmon microscope" formed with a glycerin drop (left) creates an image of a 30 μm x 30 μm array of "nanoholes" (blue square), in which the triplets of the 100 nm diameter holes can be resolved (right).

Bozhevolnyi's team used a new class of surface plasmons called channel plasmon-polaritons – electromagnetic waves that originate at the interface of a metal and an insulating dielectric such as air. These plasmons can guide and manipulate light along the bottom of V-shaped grooves in a gold film without significant propagation losses. This is because the surface plasmons remain tightly bound to the interface and thus concentrate the light into a volume that is less than one wavelength across.

Channel plasmon-polaritons can be used to transmit light signals for wavelengths of around 1.5 microns – just right for telecommunications applications. Furthermore, the propagation length of a plasmon at a planar gold-air interface is around 1 mm, which is long enough to optically connect two devices on a chip.

Cloak and Dagger. In 2005, scientists at the University of Pennsylvania announced that they could potentially use plasmon coatings as a cloaking device to render objects invisible by creating a kind of "shell" around the object. Plasmon waves limit light scattering off an object because they resonate at the same frequency as the light striking them, so they cancel each other out. This makes the object in question very difficult to detect.

The roots of their research date back to 1998, when researchers led by Thomas Ebbesen of the Louis Pasteur University in Strasbourg, France shone light on a sheet of gold foil that contained millions of tiny holes. The holes were smaller than the wavelength of the light, and Ebbesen expected no light to get through. Instead, more light came out the other side than what hit the holes. Follow-up research found that plasmons were snagging light and stuffing it through the holes. When the energy and momentum of the photons match the energy and momentum of the plasmons, the photons are absorbed and radiated again on the other side.

Practically speaking, the technology, if developed, might be used in antiglare materials or to improve microscopic imaging. A more futuristic goal is that an entire aircraft might be made transparent to radio waves or some other long-wavelength detector.

But cloaking ability would depend on an object's size, so that only with very small things–items that are already microscopic or nearly so–could the visible light be rendered null. A human could be made impossible to detect in longer-wavelength radiation such as microwaves, but not in visible light.

Anything not perfectly ball-shaped presents additional problems. The researchers' calculations suggest "homogeneous spherical objects" in the nanoscale range could be rendered optically invisible.

More than 100 years after their serendipitous discovery, an increasing number of researchers are catching an electron wave. As a result surface plasmons are emerging as a critical element in many next-generation technological applications because of the remarkable properties. Further research and development is needed before such applications become truly enabled, but the future of plasmons appears as bright as a shiny metallic mirror.

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internet policy, including issues such as network neutrality, and electronic voting. These issues all involve a lot of technical detail, and Engel believes his broad science background will be especially useful this year.

Saltman points out that taking a year to do this sort of fellowship is unusual in physics, where one is expected to stay on the straight academic path. "It seems, in string theory especially, that doing this kind of fellowship is not particularly encouraged," Saltman said. He hopes that by doing this fellowship, and by letting other people know about it, he will be able to encourage others to begin to see policy work as an important and valuable thing for physicists to do.

After an orientation session in September sponsored by the AAAS and an interviewing process, the Congressional Fellows will each find a placement for the year in either the office of a Congressman or on the staff of a committee.

For more information about the APS Congressional Fellowship program, see http://www.aps.org/public_affair/fellow/index.cfm.

Treasurer Looks to Keep Journals Healthy in Challenging Environment

On September 30, Joseph Serene officially took over the position of APS Treasurer, succeeding Thomas McIlrath, (see photo on page 1) who has retired. Serene comes to APS from Georgetown University, where he was a professor of physics. He has also served as chair of the physics department and as dean of the Graduate School of Arts and Sciences at Georgetown.

Serene says that one way or another, throughout his career, his research has been related to strongly correlated fermions. He was a graduate student at Cornell when superfluid helium 3 was discovered. Later he became interested in superfluid neutron star matter, and then worked on other strongly correlated electronic systems, including heavy electron metals and high T_c superconductors. He has also worked on computational approaches to strongly correlated electron systems.

In addition to physics, Serene has an avocational interest in music: he sings, plays the cello (though not nearly as well as his two sons, he says) and plays the French horn, though not as much as he used to, because it is a very difficult instrument to play, especially if one is out of practice. The French horn, unlike most brass instruments, is played high on its overtone series, so the notes are very close together, and it's easy to miss a note.

For the past year Serene has also served as the Interim Director of Music and Dance at Georgetown. Though it's an unusual post for a physicist, with his administrative and musical experience, Serene says he was in a good position to direct the program for a year, especially because he felt strongly that it was important for the university to have a good program in music and dance.

As Treasurer, Serene is responsible for the Society's budget and for oversight of the Society's investments. That can sound like a rather dry job, but in fact, he says, budget hearings can be quite interesting because he gets to find out about what people are doing and why. "It's really what the money's doing that's important," he says.

In addition to his role as Treasurer, Serene is also the Publisher of APS journals, responsible for setting subscription prices, trying to predict subscriptions and control costs, and overseeing marketing activities. The Publisher role is very important, he says, because as a fraction of the Society's budget and staff time, publishing the journals is the Society's principal activity.

It is also a challenging job, says Serene, because journal publishing is in a state of flux right now. Costs of publishing the journals have fallen over the past ten years, especially as the journals continue to move towards more electronic and less paper publishing. Among the costs associated with publishing the journals are the editorial costs, the composition costs, and the cost of printing and mailing the paper journal, explained Serene. APS costs associated with production of the journals are falling, and Serene believes that at some point in the future, though not right away, it may be possible to entirely eliminate the paper journals.

A more immediate change is the new open access policy, which will allow anyone to pay a fee to make any article free to read (see related article on page 1). It's not clear yet how many papers will be made open-access under the new policy, or what the effect on subscriptions will be, and Serene is closely watching how this new policy works out. "We don't know yet what the response will be to this new open access policy," he said. "We have to do this in a way that doesn't put us out of business."

Serene points out that a lot of the content of APS journals is already freely accessible, as many physicists post their work on the eprint ArXiv before publication in an APS journal, and they are also free to post the journal articles on their own websites. There is still value in the journal, however, and we have to make sure we keep that, he says.

Making some articles available more widely might benefit groups that don't normally read APS journals.

In fact, the Society might want to consider more outreach in general, says Serene. As one of three operating officers, Serene is partly responsible for directing the Society as a whole. "There has to be a concern that we in the physics community have been too focused solely on the interests of professional physicists. We should be looking a little more outward," he says.

For instance, he noted that many Americans don't know much about science. Average Americans don't realize how science affects their lives; they are unaware of the basic physics underlying most modern technology. It's clear there is a fundamental misunderstanding of science in this country, says Serene. "It seems to me those of us in the research and academic communities haven't done a good enough job of connecting science to people's lives."

In addition to changes in open access policy, another issue Serene is watching is the rapid growth of physics in China and India, which, among other effects, has resulted in a sharp increase in submissions to APS journals from those countries. "Things are changing quickly and we have to have our heads up and be prepared," says Serene.

Overall Serene thinks the Society is in excellent shape right now. "I don't come in with an agenda of things I want to change. The agenda I have is to maintain what's been so expertly constructed."

There is concern about the future, but the important thing is to keep the community of physicists talking. We have to keep having a discussion about how to meet these challenges, says Serene. "One of the attractive things about this job is that there are a lot of challenges facing the Society, but there's also this extensive community engaged in a wonderful discussion about what we should be doing."

ACCESS continued from page 1

The reality with any publishing model, of course, is that there are always costs incurred, and therefore, "Someone will inevitably have to pay for creating the final product," says McIlrath, whether it is a federal grant, advertising revenues, the authors themselves (via the time-honored tradition of page charges), or a laboratory or university sponsoring a journal. PLoS requires authors to pay fees ranging from $500 to $1500.

The Royal Society in the United Kingdom–one of the most outspoken critics of OA–recently implemented its own hybrid OA model on a trial basis. Under the new scheme, authors can choose to pay 300 pounds per page to make their paper freely available immediately, or stick with the Royal Society's current model, in which they pay nothing and wait 12 months for the paper to become freely available.

The FREE TO READ fees will not be replacing subscriptions, but have been set well below the current amount per article needed to recover costs in the absence of subscriptions. The fees will therefore be adjusted as necessary to maintain APS's ability to sustain this initiative. Additional revenues will primarily be used to lower the current subscription rates of the smallest institutions.

"We are not naïve and do not ignore the need to be financially strong in order to do our job," says McIlrath. "However, we are confident that we can bring new ideas to the process, and that through these innovations we will continue to be in a position where institutions will financially support our efforts."

The FREE TO READ initiative represents a path by which APS could gradually transition to full Open Access. If the community (especially institutions and funding agencies) shows continued support for this initiative, a sustainable level may be reached in which the APS can recover its costs, offset its risks, and eliminate subscriptions for some or all of its journals.

For additional information, please go to the FAQ at http://publish.aps.org/FREETOREAD_FAQ.html.

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Murray said "I prefer to think of physics as an inclusive rather than an exclusive field. I believe that it is important for APS to promote a broad definition of physics."

She credits her work experience at Bell Labs with fostering an appreciation for "the importance of linking interdisciplinary science and engineering to create impact for society." She pledged to promote increased federal funding for all science, mathematics and engineering teaching and research. "In order for the US to compete effectively, we must work hard to stay in the technology lead in a few key areas," she said.

Murray also called for the APS to promote the US as a site for a future major physics facility, such as the proposed International Linear Collider. "US science and technology is greatly enhanced by being part of the global science and engineering enterprise," she said.

A theoretical condensed matter physicist, Phillips studies quantum phase transitions and strongly correlated electrons. Phillips is a past recipient of the APS Edward A. Bouchet Award. He was an APS general councilor and a member of the Executive Board. He also served on the APS Committee on Committees. Phillips received his PhD from the University of Washington in 1982. He joined the faculty at MIT before coming to the University of Illinois in 1993.

An important and perhaps overlooked role of APS committees is to provide a training ground for the Society's future leaders," Phillips said in his candidate's statement. "I believe that it is important to involve not only established stars in committee work, but to provide opportunities for professional growth and development for the next generation of our nation's science leaders."

Austin received his PhD in physics from the University of Illinois Champaign-Urbana in 1976. He did a postdoc at the Max Planck Institute for Biophysical Chemistry from 1976-1979 and has been at Princeton University since 1979. He has chaired the APS Division of Biological Physics. He received the 2005 APS Edgar Lilienfeld Prize. He has a wide-ranging set of interests in the field of biological physics. Recently he worked on high resolution multimode imaging of biological objects using new nanocrystal materials.

In his candidate's statement, Austin emphasized the importance of reaching out to other scientific fields. "I also believe that it is absolutely critical in the 21st century that physics not look back complacently at its enormous successes but instead reach out to other disciplines, in particular biology, that are exploding in their growth, for their successes surely have had their foundations laid by physicists and they will need the continued close connection with physicists and our approaches to problem solving to thrive," he said.

Beise received her PhD in physics from the MIT in 1988. She worked as a Research Fellow in the Kellogg Laboratory at Caltech prior to coming to the University of Maryland as an assistant professor in 1992. Since then, her research has focused on the use of electron scattering to study aspects of nucleon structure and light nuclear systems. In 1998 she received the APS Maria Goeppert-Mayer award. Beise has served on the APS Division of Nuclear Physics executive, program, and nominating committees, and on the APS Committee on the Status of Women in Physics.

In her candidate's statement, Beise identified several areas of longstanding concern for the APS, including improving visa access for international scientists, communicating with Congress and with the public about the science opportunities ahead, and working towards balancing the demographics of the physics community. "The physics community has an important and necessary role in providing scientific leadership for the nation." she said.

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support two astronomy projects, a first in its history.

The war and its aftermath have profound effects on physics, and science in general. Much of the infrastructure in the country lies in ruins. Many schools have been destroyed. The research budget for the LCNRS will probably be cut. Universities will not fare better. Enrollment will probably be low because of economic hardships in the aftermath of the war. Lab equipment, textbooks for the upcoming academic year, and supplies will be late in arriving given the current air and sea siege. Operating under these conditions will be very frustrating.

American physicists can help in many ways: 1) Just visiting Lebanon to give colloquium/public lectures would be a vote of confidence and show of solidarity with the devastated nation. 2) Another way would be to open the opportunity for undergraduates to visit US universities in the summer to do research. I am thinking here of some kind of a joint REU program between Lebanon and the US. 3) Many experimental physicists in Lebanon may have interesting ideas about projects, but they do not have the necessary equipment to carry out their research. Hosting a Lebanese researcher at a US university lab to carry out her/his experiment would be an idea. 4) US physics labs may donate oldish or no longer used equipment to physics labs in Lebanon. 5) Researchers in the US may "out-source" some aspects of their projects to Lebanese researchers. These are just a few ideas of how to increase collaborations between the physics communities in the US and Lebanon.

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The Back Page

Meeting Our Long-Term Energy Needs Through Federal R&D

by Senator Pete V. Domenici

The funds we spend on research and development (R&D) for new energy technologies are some of the most important dollars in the federal budget. But we have a problem–federal funding for energy R&D has been declining for years, and it is not being made up by increased private sector R&D expenditures. There is a vital need for a bipartisan effort to increase federal R&D funding for energy technology, to leverage those funds with increased private sector investment and to work with the Executive Branch to bring new energy technologies quickly to the market place. In the last year, we have taken important steps to implement this vision.

Over the 25-year period from 1978 to 2004, federal appropriations for energy R&D fell from $6.4 billion to $2.75 billion in constant year-2000 dollars, a reduction of nearly 60 percent. Even worse, federal and private sector expenditures combined are less than one percent of total energy sales. Private sector investment in energy R&D fell from about $4 billion in 1990 to about $2 billion today. Of our nation's high-technology industries, energy is the least intensive in terms of R&D. Consider, for comparison, that private sector R&D investments equal about 12 percent in the pharmaceuticals industry, and about 15 percent of sales in the airline industry. It is past time to reverse that trend.

> "There is a vital need for a bipartisan effort to increase federal R&D funding for energy technology..."

Last August, Congress enacted the first comprehensive energy legislation in 12 years – the Energy Policy Act of 2005. Already we are seeing results. But the challenges we face are long-term–they will require continued hard work for years to come. To this end, the Act strengthens our commitment to investing in energy-related R&D. In all, it calls for $24.2 billion in funding over the next three years for research programs in energy technology and energy-related science.

The Energy Policy Act also provides a framework for a balanced set of programs in energy research, development, demonstration, and commercial application. Previously, the Secretary of Energy had no guidance in choosing research topics and program components for energy R&D. The Act addresses this problem, establishing clear guidelines for research programs in energy efficiency, renewable energy, fossil energy, and nuclear energy technologies.

With the Energy Policy Act, the Department will be better able to manage our R&D investments. The Act creates a new Under Secretary for Science to serve as the primary science and technology advisor to the Secretary of Energy. The new Under Secretary is responsible for monitoring civilian research and development programs, and advising the Secretary in managing national laboratories supporting basic research.

The Under Secretary for Science will also ensure that the Department remains focused on our long-term energy goals. In particular, we need to build bridges between basic science and applied energy functions. This is vital for crossover applications–so that areas in applied energy where we need scientific breakthroughs are addressed. An example is the workshop held in 2003 that produced the report on Basic Research Needs for the Hydrogen Economy. The new Under Secretary for Science should help ensure that more of this kind of bridging work is undertaken by the Department and that the Department gives it high priority.

While our nation must increase domestic energy production, we must also increase our production of *new energy technologies*. And these technologies must move from laboratory to market, or we will be no closer to realizing a stronger energy economy. Crossing this "Valley of Death" is not easy. Even technologies with obvious commercial potential often confound attempts to find successful markets.

Federal funding for energy R&D is critical, but we also need policies that encourage greater private sector investment.

The Energy Policy Act strengthens Department of Energy efforts to partner with private companies interested in lab-developed technologies. The Act establishes a technology transfer coordinator to advise the Secretary on technology transfer and commercialization. It also creates a technology commercialization fund with a budget of about $25 million annually. That federal funding will be seed money to leverage private sector investments through partnerships with local businesses. Helping laboratories "spin-off" technologies to the private sector will lead to new businesses, job creation, and a more innovative economy.

The Energy Policy Act also gives the Department of Energy new authority to hold prize competitions in "grand challenge" areas of energy technology. The Department can use this authority to accelerate progress in challenging areas — such as hydrogen and fuel cell vehicles and carbon capture and storage. This prize authority is modeled after that used successfully by the Defense Advanced Research Programs Agency (DARPA). DARPA spurred private sector investment in robotics technologies, for example, through a well-publicized race through the Mohave Desert. The X-Prize stands as another example of successful use of prize authority. This $10 million privately-funded award produced the first successful space flight ever achieved without public support. These prizes encourage multiple teams to undertake novel approaches, and they generate significant private sector investment due to their inherent prestige.

We need to encourage high-technology industries, including energy sector industries, to increase their R&D investments. Legislation that I introduced with my Senate colleagues Jeff Bingaman (D-NM) and Lamar Alexander (R-TN) will do just that. The Protecting America's Competitive Edge through Finance (PACE-Finance) Act will modernize and make permanent the R&D tax credit. After two decades of extending the tax credit for just a year or two in advance, it is time to give industry the certainty it needs. This certainty will lead to greater spending on R&D, leading to more innovation, and to a stronger, more competitive economy.

In his State of the Union address earlier this year, the President announced his Advanced Energy Initiative (AEI). The President's Advanced Energy Initiative builds on the Energy Policy Act by identifying key technologies where we will focus our efforts.

The purpose of the AEI is to reduce our national dependence on foreign sources of energy, including the natural gas we use to heat our homes and the crude oil we rely upon to fuel our cars. To support this initiative, the President has requested an overall 22 percent increase in fiscal year 2007 funding for the development of key technologies.

Under the President's Initiative, we will invest in technologies for zero-emission coal-fired power plants. These plants will capture and store pollutants and carbon dioxide rather than releasing them into the atmosphere. We will continue our support for revolutionary new solar and wind technologies, to make them more cost-competitive. Through the Global Nuclear Energy Partnership, we will develop a nuclear fuel cycle that enhances energy security, while addressing proliferation concerns.

The AEI emphasizes the importance of advanced transportation technologies. To accelerate consumer adoption of hybrid-electric vehicles, the administration has committed to increase the energy storage and the lifetimes of batteries for these vehicles. To achieve greater use of homegrown renewable fuels, the initiative will develop advanced technologies to make competitively priced ethanol from cellulosic biomass, such as agricultural and forestry residues, trees, and grasses. Moreover, President Bush three years ago gave Americans the vision of a hydrogen future free from a reliance on foreign oil. The Energy Policy Act moves us toward that future with an authorization of over $3 billion in research on hydrogen and hydrogen fuel cells.

> "Greater public and private investment in energy R&D will make our energy sector cleaner, more secure, and more resilient."

Our nation has a bright energy future. Greater public and private investment in energy R&D will produce a suite of new technologies that will make our energy sector cleaner, more secure, and more resilient. We laid the groundwork in the Energy Policy Act, and by following through on the President's vision of the Advanced Energy Initiative we will meet the energy challenges that lie ahead.

Senator Pete V. Domenici (R, NM) chairs the Senate Energy & Natural Resources Committee and the Senate Appropriations Energy & Water subcommittee.

About the Senator

- Republican, Senior Senator from New Mexico; serving in his 6th term.
- Chair of the Senate Energy & Natural Resources Committee, which has jurisdiction over the Department of Energy (DOE) and all the national labs. As well, he is chair of the Senate Appropriations Energy & Water subcommittee, which has jurisdiction over the budget of DOE.
- A strong proponent of greater energy independence, he is actively engaged in setting a 21st Century American energy policy that encourages maximizing all domestic energy resources.
- As a Science and Technology Caucus member, the Senator is a strong proponent of science and scientific research, consistently assisting in attainment of funding for efforts that will provide significant benefits to the lives of Americans.
- Recipient of the 2003 AAS-AMS-APS Public Service Award, the 2000 Henry DeWolf Smyth Statesman Award from the American Nuclear Society, and the 1999 Science-Engineering-Technology Leadership Award.

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all the anti-science rhetoric? Why these new policy pronouncements? And why, as asked above, cannibalize the science research and exploration missions that brought NASA such past glory?

Louis D. Friedman is co-founder and Executive Director of The Planetary Society, which is conducting a "Save Our Science" campaign to restore budget cuts made to the NASA space science program. For more information visit: http://www.planetary.org/programs/projects/sos/

This article is reprinted from The Planetary Society Weblog

Professional Skills Development for Women Physicists

***Do you want** to improve your negotiation skills? **Do you have** great ideas that you want to communicate to your colleagues?*

If so, the **Committee on the Status of Women in Physics** invites you to attend one of the workshops entitled "Professional Skills Development for Women in Physics." These workshops will:

- Coach women in key skills that are needed to enhance their careers.
- Provide training in persuasive communication, negotiation, and leadership presented by experienced professionals, with an aim towards increasing the influence of female scientists within their own institutions.
- Provide a special opportunity for networking among participants.

Workshops at the 2007 March and April APS Meetings will be aimed at women in industry and government labs, and will take place on Sunday, March 4, 2007 (Denver). We hope to receive funding for a second workshop on April 13 (Jacksonville, FL) in association with the April APS Meeting. Deadline to apply for the March workshop is December 4.

Workshops will be limited in size for optimal benefits. Participants are eligible to receive a stipend to help cover the cost of travel and up to two nights lodging. These workshops are funded by the National Science Foundation.

Details at **http://www.aps.org/educ/cswp/index.cfm**