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Top Ten Stories of 2010
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APS Member Count Tops 48,000

The official count of the APS membership has been tallied up, and the Society has reached a new record of 48,263 members. This passes last year's record of 47,947 members by a net of 316 people. It is also the first time that the number of members has broken 48,000 on the final official count.

The growth was spread throughout several different sections of the membership, including student members, international members and junior members.

"Overall as an organization we're doing a better job. We're offering better programs and also communicating better to the community," said Trish Lettieri, Director of Membership.

Students made up the biggest growing section with 345 new dues-paying students, and 113 participating in the free trial program. The society also enrolled 84 new junior members. The total number of regular members was down by 398 members, in part the result of current economic times and a generation of physicists reaching retirement.

International members saw their ranks grow as well. This year there are 10,349 international members, up 156 from last year. All together, international members make up nearly 22 percent of the total membership. Amy Flatten, APS's director of international affairs, credited

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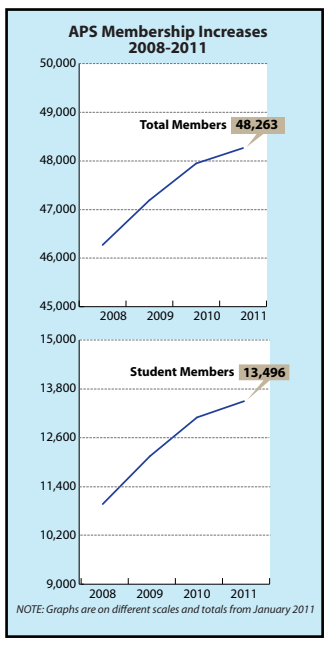

New *Physical Review* Journal Offers Online, Open Access Publishing

By Mary Catherine Adams

Authors who have wanted to publish their papers with open access in an APS journal will now have a new journal called *Physical Review X (PRX)* suited just for them. The new online, open access, primary research journal from APS will publish papers from all fields of physics, including those that in the past may not have fit comfortably into one of the other *Physical Review* journals.

"There are a lot of physicists, who are working outside some of the traditional *Physical Review* areas, that haven't had a good home for their high-quality research papers," David Singh, Chair of the APS Publications Oversight Committee, said, mentioning areas like interdisciplinary research and applications-oriented work.

"It's really nice that *Physical Review* now offers a home for those kinds of papers," Singh said.

Open access publishing appeals to authors for a variety of reasons, according to Daniel Kulp, Editorial Director of APS journals. "There are no barriers. Anyone can read it," he said. With open access, the dissemination of information is broader and information can enter the system more quickly. Both combine to give authors' work more visibility, he said.

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Kovar Reflects on State of High Energy Physics, and the Road Ahead

By Michael Lucibella

In December, Dennis Kovar retired as the Associate Director of Science for High Energy Physics in the Department of Energy, a position he assumed in October, 2007. He took the time to talk to *APS News*, reflecting on twenty years of work in the Department of Energy and the future of high energy physics.

Q: How would you describe your role in the Office of High Energy Physics in the Department of Energy?

A: The job of our office is to identify the scientific opportunities for the field, to put together a strategic plan, and then to try to implement that plan in a way that maintains a leadership role for the United States in particle physics and ensures that we are at the scientific frontiers. We have to have the research capabilities–both research facilities and a research community –to play that leadership role.

A very important part is identifying the scientific opportunities and priorities. We do that by getting guidance from the scientific

community. Our primary guidance comes from the HEPAP (High Energy Physics Advisory Panel). In areas of overlap in astrophysics and astronomy, there is the Astronomy and Astrophysics Advisory Committee (AAAC), also a federal advisory committee, of which DOE and NSF and NASA are sponsors. HEPAP is jointly chartered by DOE and NSF. DOE works very closely with NSF in order to generate a combined program that will make the US a leader in this field.

Q: What can you point to as your biggest accomplishment so far at the Office of High Energy Physics?

A: Before I came into this office, the strategic plan for the US in this field had been to implement a next generation lepton collider, the ILC (International Linear Collider), as rapidly as possible. About the time I came in, it became clear that the planned LHC program at CERN was slipping; it was important to see what was found at the LHC in order to establish what the parameters of this next generation lepton collider should be. Secondly, when the cost of ILC had been more carefully estimated, it turned out to be quite a bit more expensive.

With this delay, and the increased cost of the ILC, a new strategic plan for the US program was needed that was consistent with the changing circumstances and budget realities. And so shortly after I became the Director, the NSF and DOE charged HEPAP to put together a new ten-year plan and the P5 panel [Particle Physics Project Prioritization Panel] of HEPAP generated that report. The HEPAP (P5) report basically reminded everyone that particle physics has three scientific frontiers; the energy, intensity and cosmic fron-

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Funding Runs Out to Keep Tevatron Alive

Despite recent efforts to extend its life, the Tevatron at Fermilab in Batavia, Illinois will be decommissioned by the end of this fiscal year. In a letter to Melvyn Shochet, chair of the High Energy Physics Advisory Panel, William Brinkman, director of the Department of Energy's Office of Science, said that efforts to find funding to extend the life of the machine had been unsuccessful, and it would be shut down for good in September.

"Unfortunately, the current budgetary climate is very challenging and additional funding has not been identified. Therefore, based in part on the [Particle Physics Project Prioritization Panel] recommendation, operation of the Tevatron will end in FY2011," Brinkman wrote.

Fermilab director Pier Oddone said that people at the lab found the announcement "disappointing" but not unexpected.

"Shutting down the Tevatron is something we have understood for a long time as something that is going to happen," Oddone said. "In that sense this is not earthshaking."

Before the completion of the

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Comments Sought for APS Non-Proliferation Petition

The Nuclear Regulatory Commission (NRC) is considering a petition submitted by APS calling for a change in the NRC's regulations "regarding the domestic licensing of special nuclear material to include proliferation assessments as part of the licensing process."

Specifically, the rule change would require companies that apply to the NRC for an enrichment or reprocessing license to include an assessment of proliferation risks that their facility might pose. The assessment could help prevent the spread of nuclear technology to a nation seeking to develop nuclear weapons. Until now, there has been no requirement for a company to undergo a specific nonproliferation assessment; however, the NRC has argued that the "net effect" of all the rest of the licensing process should ensure the safety of nuclear secrets.

Francis Slakey, APS associate director of public affairs, said that NRC docketed the APS petition in late December asking for a specific nonproliferation assessment requirement. APS members interested in reading the petition and submitting a comment can either go to the regulations.gov webpage and search for the document "NRC-2010-0372-0003" or find a link on the APS homepage. The commission's open-comment period extends until March 8.

"APS is concerned about nuclear weapons proliferation and the development of covert enrichment facilities," Slakey said. "With its petition, APS wants to limit the possibility that other countries might acquire more advanced technologies."

In February of 2010, APS's Panel on Public Affairs released a report calling for proliferation risk assessments for companies applying for a permit to enrich nuclear materials. The report, *Technical Steps to Support Nuclear Downsizing*, highlighted the concern that new, easily concealed technologies

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Abstract Decisions

Photo by Mary Catherine Adams

In December, about 150 physicists gathered at APS headquarters to sort abstracts for the 2011 March Meeting in Dallas. In the photo, Birgitta Whaley (UC Berkeley, left), David Rueda (Wayne State University, center) and Weigun Peng (George Washington University, right) forge ahead, undaunted by the more than 7500 abstracts that needed to be placed in sessions on the big board.

Members in the Media

"We need to keep solar and renewables going, but not as an expense above everything else… The environmentalists know what we need to do, but they don't know enough about how we should do it to be prescriptive,"

Burton Richter, *SLAC,* Time.com*, December 16, 2010.*

"As our nation continues to recover from these challenging economic times, households and small businesses across the country are making sacrifices… In this spirit, we are asking our contractor employees, who are doing important research, operations, and environmental cleanup work, to join the federal workforce in playing a part,"

Steven Chu*, Department of Energy, announcing a two-year freeze on salary increases and bonuses,* The Washington Post*, December 20, 2010.*

"Trying to pack one too many presents in the trunk of my car after shopping, or 'creating' a parking spot for my car during the holiday season are certainly times I think of packing efficiency,"

Arshad Kudrolli*, Clark University,* FoxNews.com, *December 22, 2010.*

"The ideal icicle, the mathematically minimum icicle, is elegant and beautiful...But the reality has turned out to be much more complicated,"

Stephen Morris*, University of Toronto,* FoxNews.com*, December 25, 2010.*

"Scientists try to understand things…But chefs like Adria can create without understanding. They give us beautiful problems to solve. And they currently solve them not by understanding, but by making it work,"

David Weitz*, Harvard,* The Boston Globe*, December 29, 2010.*

"I considered myself very fortunate…I had a career I couldn't have imagined for a physicist: nuclear physics, biomedicine, toxicology,"

Jay Davis*, Lawrence Livermore National Lab, who is bringing a lawsuit against the Regents of the University of California over retirement benefits,* The New York Times, January 1, 2011.

"How many things can we do in our lifetime that will excite a generation of scientists?"

Saul Perlmutter, *University of California, Berkeley, on the hunt for dark energy,* The New York Times*, January 3, 2011.*

"Dark energy and exoplanets are both fields of tremendous scientific importance and have caught the public's attention… In both cases, the U.S. is currently the leading contributor. To abdicate that investment and opportunity would seem a terrible shame, but it doesn't mean we have to see Europeans as enemies we have to vanquish,"

Roger Blandford*, Stanford University, on the delay of the first spacecraft to hunt for dark energy,* The New York Times*, January 3, 2011.*

"It may all be right, but I would personally like to be cautious about this,"

Thorsten Ritz*, University of California Irvine, commenting on recent research into possible links between quantum entanglement and internal "compasses" used by birds,* U.S. News and World Report*, January 10, 2011.*

"Unfortunately, the current budgetary climate is very challenging, and additional funding has not been identified. Therefore…operation of the Tevatron will end in FY2011, as originally scheduled,"

William F. Brinkman*, Department of Energy, quoted from a letter to the chairman of the High Energy Physics Advisory Panel,* CBSNews.com*, January 11, 2011.*

This Month in Physics History

February 12, 1935: Patent granted for Van de Graaff generator

Many a visitor to science museums has encountered a Van de Graaff generator. These contraptions are staples of hands-on demonstrations in labs and at science fairs, delighting audiences by producing "lightning", or making participants' hair stand on end when they touch the smooth spherical surface of the device's trademark hollow metal globe. But few people know much about the man who first invented them: Robert Jemison Van de Graaff.

Born in Tuscaloosa, Alabama, Van de Graaff earned B.S. and M.S. degrees in mechanical engineering from the University of Alabama. He worked at the Alabama Power Company for a year and studied at the Sorbonne, where he heard lectures by Marie Curie on radiation. He subsequently won a Rhodes Scholarship, earning a second B.S. in physics from Oxford University in 1926, completing his PhD in 1928.

While at Oxford, he became acquainted with Ernest Rutherford's work in nuclear physics, and Rutherford's idea that accelerating particles to very high speeds could disintegrate nuclei, enabling scientists to better study the nature of individual atoms.

Van de Graaff generator

Van de Graaff brought the notion of a particle accelerator back with him to the States in 1929, when he joined Princeton's Palmer Physics Laboratory. There, he constructed a working model of an "electrostatic accelerator" capable of generating 80,000 volts. That rudimentary prototype used a silk ribbon from the local five-and-dime store as a charge transport belt, running between two metal pulleys.

By November 1931, he had sufficiently improved his design to produce over 1 million volts, and demonstrated his device at the inaugural dinner of the American Institute of Physics. He presented a paper about his electrostatic accelerator at an APS meeting that same year.

He was not the only scientist working on such a project. In fact, the underlying concept dated back more than 250 years before Van de Graaff. Around 1663, Otto von Guericke constructed a primitive frictional electrical machine using a sulfur globe that could be rotated and rubbed by hand. (In *Opticks*, Isaac Newton suggested replacing the sulfur globe with a glass one.) By 1785, N. Rouland had invented an electrostatic generator that used a silk ribbon running continuously between two pulleys to produce static electricity. And in 1893, the von Busch generator appeared, a similar machine that used two pulleys and a belt with a charge collector comb in an insulated sphere.

Shortly after Van de Graaff's model demonstration, John D. Cockcroft and Ernest Walton, at the famed Cavendish Laboratory in England, built their own version of a particle accelerator in 1932, using voltage multiplier circuits to generate power. That machine was bulky and rather limited in how much voltage it could produce, however. Van de Graaff's design would ultimately prove to be both more compact, and capable of higher voltages, and hence, greater acceleration of particles.

In 1932, Van de Graaff joined MIT as a research associate, where he started building a large-scale version of his machine. Housed in an empty aircraft hangar on a local estate in South Dartmouth, MA, Van de Graaff's full-sized machine boasted two polished aluminum spheres mounted on insulating columns. Those columns in turn were placed on trucks in order to elevate the spheres 43 feet above ground.

He debuted his invention on November 28, 1933, which made headlines when it produced a staggering (for the time) 7 million volts. (The smaller Van de Graaff generators used for public demonstrations generate between 100,000 and 500,000 volts.) A patent for the Van de Graaff generator was awarded in February, 1935.

The device won the admiration of none other than Nikola Tesla, who wrote a *Scientific American* article on the new Van de Graaff generator in 1934, declaring, "I believe that when new types [of Van de Graaff generators] are developed and sufficiently improved a great future will be assured to them." Tesla was prescient, as always: the generators have since been used not just in atomic physics, but also for applications in medicine and industry.

Harvard Medical School was the first to use his machine clinically to produce X-rays for the treatment of cancerous tumors with radiation in 1937. A large Van de Graaff generator was installed in the Palais de la Decouverte during the 1937 Paris Universal Exhibition under the direction of Frederic Joliot, enclosed in a giant Faraday cage. Audiences thrilled to the meters-long sparks produced by the machine, and its debut was featured on the covers of several magazines. The intent was to use the machine as a source of radioelements, but the outbreak of World War II intervened, and it was eventually scrapped.

Van de Graaff spent the war as director of the High Voltage Radiographic Project, part of the Office of Scientific Research and Development, adapting his electrostatic generator for the U.S. Navy. Once the war ended, he returned to MIT and co-founded the High Voltage Engineering Corporation (HVEC) with John D. Trump. HVEC soon became a major supplier of electrostatic generators used for cancer therapy, radiography, and for the study of nuclear structure in scientific laboratories.

Tandem Van de Graaff accelerators first appeared in 1951, based on earlier work on the tandem principle by William Bennett in 1937. Also in the 1950s, Van de Graaff invented the insulating-core transformer for the production of high-voltage direct current–using magnetic flux instead of electrostatic charge–as well as many new methods for controlling particle beams. He stayed at MIT until 1960, when he resigned to work full-time at HVEC.

In 1966, he was awarded the APS Tom W. Bonner Prize for his "device that has immeasurably advanced nuclear physics." It was especially *apropos*, since Bonner himself had used a Van de Graaff generator in his fundamental work on nuclear structure. By the time Van de Graaff died in Boston on January 16, 1967, at the age of 65, there were more than 500 Van de Graaff particle accelerators in over 30 countries around the world.

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Editor . . . . . **Alan Chodos**
Staff Science Writer . . . . . **Michael Lucibella**
Art Director and Special Publications Manager. . . . . . **Kerry G. Johnson**
Design and Production. . . . . . **Nancy Bennett-Karasik**
Proofreader. . . . . . **Edward Lee**

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Washington Dispatch

A bimonthly update from the APS Office of Public Affairs

ISSUE: Budget and Authorization Environment

Appropriations Update

At the end of December, Congress passed a Continuing Resolution (CR) for Fiscal Year (FY) 2011 spending, and the President immediately signed it into law. The CR extended funding for federal programs through March 4th 2011 at FY 2010 levels with virtually no waivers. This action was necessary because the lame duck session of Congress could not reach agreement on a FY 2011 omnibus spending bill. A CR extending through the entire fiscal year is very likely, possibly containing rescissions of 5 percent or more.

As in 1995, there is a threat of a government shutdown, if the new Republican House members make substantial budget cuts a prerequisite for raising the "debt ceiling."

America COMPETES Reauthorization

In a last-minute act before wrapping up the 111th Congress, the Senate passed, by unanimous consent, the Reauthorization of the America COMPETES Act (S. 3605) on Friday December 17th. However, the Senate bill significantly scaled back authorizations contained in the version the House had passed in May. [*See the story on page 5 of this issue*.]

With the 111th session of Congress set to conclude, the House had little choice but to accept the Senate language. The House passed the bill by a vote of 228 (212D, 16R) to 130 (0D, 130R) (http://clerk.house.gov/evs/2010/roll659.xml). The President signed the bill into law on January 4th without any ceremony. But, in one of her last acts as House Speaker, Nancy Pelosi held a rare ceremonial enrollment of the bill following House adoption, underscoring her commitment to science. While passage of COMPETES is a symbolic victory for science, the real fight will take place during the appropriations process.

The year-long process to pass the Reauthorization of COMPETES portends difficulties for scientists for at least the next two years. The House of Representatives is now controlled by fiscal conservatives who campaigned on a pledge to cut Federal spending. And in the Senate, science proponents have slimmer margins than they did in the last two years.

In a forecast of the coming fiscal environment, recent Past APS President Curt Callan wrote to APS members in December indicating that science is no longer seen as a special case in the House and that the science community will have a far more difficult time keeping science on the COMPETES prescribed ten year doubling track. The text of his letter can be read here (http://www.aps.org/about/governance/letters/endyear2010.cfm).

Be sure to check the APS Washington Office's Blog, Physics Frontline (http://physicsfrontline.aps.org/), for the latest news on the FY11 and FY12 Budgets.

ISSUE: POPA Reports

The Energy Critical Elements (ECEs) Study Group finished its report, which examines the scarcity of critical elements for new energy technologies. The Group will publicly release its findings at the annual meeting of the American Association for the Advancement of Science. The report includes policy recommendations on: the coordination of departmental efforts where ECEs are concerned; the gathering and analysis of information on ECEs; research, development and workforce issues; efficiency and recycling efforts; possible market interventions.

The Direct Air Capture Report will be reviewed and voted on at the February 2011 meeting of POPA.

Two draft statements, one on healing energy that was suggested by the APS Division of Biological Physics, and one on the misuse of quantum mechanics brought to the panel by the POPA Physics & the Public Subcommittee are being reconsidered by POPA after the APS Executive Board provided feedback. POPA will review both statements again at its February 2011 meeting.

The NRC docketed an APS petition to include proliferation assessments

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TOP TEN Physics Related Stories OF 2010

Top Ten Physics-Related News Stories of 2010

At the turn of the year, *APS News* staff looked back at the news about physics and physicists that made headlines in 2010. These top ten selections, arranged roughly chronologically, are not necessarily the stories that will prove the most significant or long-lasting, but they are a fair sample of what the media reported, and the public digested, over the previous twelve months.

Researchers at the Relativistic Heavy Ion Collider at Brookhaven National Lab in Upton, New York announced at the annual APS April Meeting (held in **February** in 2010) that they had confirmed the highest temperature ever recorded, about 4 trillion degrees Celsius. By colliding gold ions together at 370 MeV per nucleon, members of the PHENIX collaboration at the lab created a sample of the exotic state of matter known as quark-gluon plasma, the first to exist since a few microseconds after the Big Bang. Even more tantalizingly, during their work, the team reporter tiny localized "bubbles" of asymmetry in the charge separation of particles ejected from collisions, which could potentially hold clues to explain matter's ultimate triumph over antimatter in the primordial universe.

In **March** researchers at the University of California, Santa Barbara announced a remarkable crossover between the quantum and classical worlds. Andrew Cleland and John Martinis designed a small metal paddle made of a semi-conducting material, just visible to the naked eye. They cooled it down to its ground state, and then raised its energy by a single quantum, getting it to vibrate in both its ground state and its second lowest energy state at the same time. The achievement has been heralded as the first time the motions of a macroscopic object can only be described by the by the laws of quantum mechanics.

Physicists had a lot to do with helping to resolve the Gulf Oil spill last **April**. The Secretary of Energy, physicist Steven Chu, was a major figure on the team working to find a way to stem the gushing oil. Additionally, the Flow Rate Technical Group, composed largely of experts in fluid dynamics, was formed to estimate how much oil was spewing out of the damaged underwater pipe. The group used techniques like particle image velocimetry taken from videotape of the gushing pipe, pressure and flow readings and aerial photography to figure out the total amount. All together the group estimates that about 200 million gallons of oil spilled into the Gulf of Mexico, a figure that BP disputes.

In **July,** astronomers announced the discovery that a new star, R136a1 in the NGC 3603 star cluster, tipped the scales at 265 solar masses, the biggest star ever seen. Brighter than 10 million suns, R136a1 calls several existing models of star formation into question. Up to this point, it had been widely believed that stars couldn't form with a mass greater than about 150 solar masses. Astrophysicists are looking back at models for insights as to whether such a monster could form by itself, or if several stars had to merge early in their stellar lives.

In **September**, physicists at NIST announced that they were able to measure relativistic effects at a human scale using newly developed atomic clocks based on the vibrations of aluminum ions. The clocks are the most accurate ever devised, and represent the beginning of a new generation of atomic clocks, as they operate using laser light rather than the current standard of microwaves on cesium atoms. These new aluminum clocks were sensitive enough to detect the time dilation caused by different gravitational forces felt just 33 centimeters apart. Unsurprisingly, the amount by which the clocks varied was minuscule. The team estimates it to be no more than a difference of about 90 billionths of a second over a person's average lifetime of 79 years, but it's the first time that devices have been able to measure relativistic effects on a human scale.

Announced in **October,** this year's Nobel Prize for physics went to Andre Geim and Konstantin Novoselov, both at the University of Manchester in the United Kingdom, for their work isolating graphene. Graphene has quickly become one of the hottest and most studied subjects in condensed matter since Geim and Novoselov first published their paper in *Nature* in 2004. In it they described how they were able to first isolate the one-atom-thick lattice of carbon atoms by painstakingly using scotch tape to peel off thinner and thinner layers of graphite. Graphene promises to lead a revolution in how nearly everything is made because it is the strongest known material but still flexible and lightweight, transparent, as good a conductor of electricity as copper, and perhaps the best known conductor of heat.

In early **November** astronomers at the Harvard-Smithsonian Center for Astrophysics, using observations taken from the Fermi Gamma-ray Space Telescope, announced the surprising discovery of two gigantic bubbles or lobes of gamma-ray-emitting gas surrounding the Milky Way Galaxy. Each lobe is the size of a small galaxy, about 25,000 light-years across. The source of the bubbles is not clear. They might be the remnants from a period of star formation in the galaxy's distant past or they are the leftovers of a prehistoric eruption from the supermassive black hole that lurks at the galaxy's center. The two bubbles remained hidden until now in a veil of high-energy gamma ray fog, even though they take up more than half of the night sky.

In **November**, researchers at CERN announced they were able to capture atoms of antimatter in a magnetic trap. The ALPHA team, led by Jeffrey Hangst of the University of Aarhus in Denmark, were able to hold onto 38 anti-hydrogen atoms for one sixth of a second. Teams at the lab have been producing anti-hydrogen atoms since 2002 by combining antiprotons and positrons, but this is the first time that the antimatter atoms didn't combine with regular matter and annihilate within microseconds.

Iranian physicists have become the targets of repeated assassination attempts. In **November**,

TOP TEN continued on page 4

New PhDs Trending Away from Postdoc Positions

The proportion of recently graduated PhD students accepting a postdoctoral position has declined dramatically since 2004, according to a recently released study from the American Institute of Physics. The ratio has dropped from a high of 67% six years ago to 54% in the latest available data, from the PhD class of 2008.

The survey, which asked recently-graduated students and degree-granting institutions across the country about the where students ended up a year after receiving their PhD, found that students are more frequently opting to take jobs that could potentially lead to a permanent career position, up from about 25% in 2004, to 33% today. Graduates are still more likely to end up at a postdoctoral position, but its lead over a potentially permanent position has been shrinking.

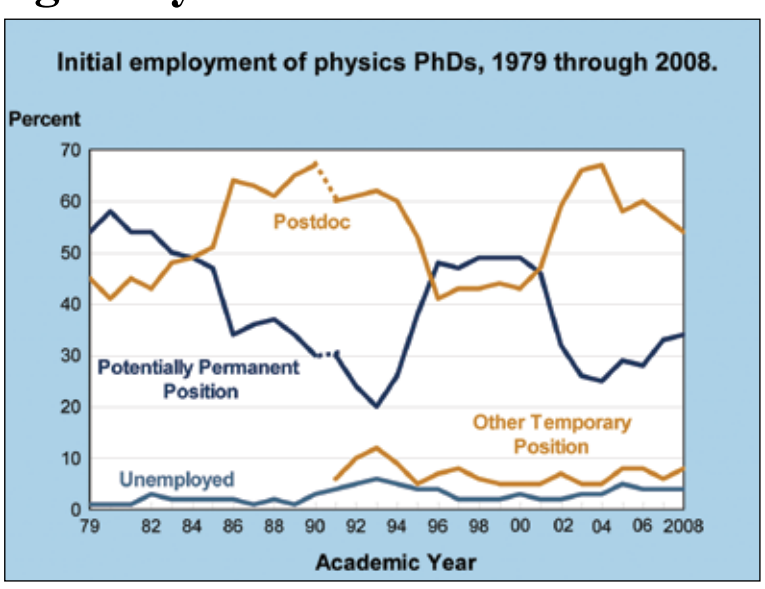

Image courtesy of AIP

Patrick Mulvey, one of the authors of the study, said that a potentially permanent position was a job without a set end date." If that person wanted to… they could stay in that job forever," Mulvey said.

The study looked also at in what sectors PhDs were likely to seek a postdoctoral position versus a potentially permanent position. Students with degrees in Atmospheric and Space, Applied Physics and Surface Physics were more likely to take a potentially permanent position, while students with degrees in Astronomy and Astrophysics, Biological Physics and Nuclear Physics were more likely to seek postdoctoral positions

Non-United States citizens were more likely to accept a postdoctoral position than United States citizens. About 61% of foreign citizens took a postdoctoral position, while 49% of US citizens took such positions. At the same time United States citizens were more likely to take a potentially permanent position than a foreign citizen. About 39% of US citizens

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Letters

Civil Rights for Minorities not a "Wedge Issue"

While I applaud Michael Lubell's call for a renewed federal commitment to science R&D (Inside the Beltway column "The Task Ahead", November 2010), I take strong exception to his characterization of immigration reform and gays in the military as "wedge issues" that are less urgent than funding for science.

As a past chair of the APS Committee on International Freedom of Scientists and as an openly gay theoretical physicist in a 14 year interracial marriage, I believe that the advancement of civil rights for all minorities is no less vital to the long-term health of our society in general–and science in particular –than the vagaries of year-to-year federal funding decisions.

Ironically, the same issue in which Lubell's column appeared also included an article detailing the continuing under-representation of African Americans and Latinos in physics ("Physics Lags in Minority Representation"). Perhaps the continuing pathetic state of minority representation in physics is closely tied to the insensitivity of some of our spokespersons to the importance of promoting human rights for minorities of all types.

I believe that the scientific endeavor in general, and that of physics in particular, can only be strengthened by ensuring that the climate of the scientific community embraces, supports, and promotes the contributions from a diversity of individuals. The creation of such a climate requires that the leaders of our community be attuned to the needs and challenges faced by minorities who seek to pursue a scientific career.

Michael Ramsey-Musolf
Madison, WI

JOURNAL continued from page 1

About six years ago, APS started the Free to Read program which gives authors the chance to have their published work made freely available on the Internet. Since then, APS has seen an increasing interest in open access publishing from authors.

"We felt the time was right to offer this new journal, especially because we know we can do it right," Kulp said.

Jorge Pullin, Editor of *PRX*, praised APS's position on open access, which he sees as essential in the evolution of publishing. "In the future, there could be incentives to publish in open access [journals] coming from funding agencies and research institutions themselves."

Pullin is Chair of the Horace C. Hearne, Jr., Institute for Theoretical Physics and professor in both the Louisiana State University Center for Computation & Technology and the Department of Physics and Astronomy. He has served on the editorial board of several journals including *Living Reviews in Relativity* and *New Journal of Physics*.

Articles in *PRX* will be published under the Creative Commons Attribution 3.0 License which gives copyright to the authors and allows reuse provided that proper credit is given. "Our decision to offer this license continues APS's proud history of being progressive, but responsible, regarding the rights governing the articles it publishes," Gene D. Sprouse, APS Editor in Chief, said in a January 19 APS press release.

An article-processing charge of $1500 will cover the expenses of peer review, composition, hosting, and archiving. Joseph W. Serene, APS Treasurer/Publisher, said in the press release that "APS strives to be among the most cost-effective publishers in physics and is committed to a sustainable model that makes *PRX* affordable for authors and their funding agencies, nationally and internationally."

The first Call for Papers will be issued in March and the first *PRX* article will be published this fall. More information about the new journal can be found at prx.aps.org and information about receiving e-mail updates can be found at publish.aps.org/alerts.

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took a potentially permanent position while only 27% of foreign citizens did. Part of the reason for this difference is because of visa limitations as 6% of foreign citizens said that the reason they took a temporary postdoctoral position was because of visa restrictions.

Altogether, about 20% of foreign citizens left the United States after earning their doctorate while only about 8% of US citizens left. The employment information covered by the report focused exclusively on the people who stayed in the United States after graduating.

Over a third of students taking a postdoctoral position said that they did so because it was an important step to getting a desired future position. Another quarter said that they wanted to get research experience in their fields.

The study found that about 7% of students also took some other type of temporary position, with an end date, that was not a postdoctoral position. The overwhelming reason graduates gave for taking such a temporary position was that they were unable to land a permanent position.

The survey showed also that unemployment among recently graduated PhDs has been consistently very low, around 4%, for as long as the survey has been taken. Mulvey did say that unemployment among PhDs is not a good indicator of the economy as it is more likely that a student graduating with a doctorate will be working part time or somehow underemployed rather than unemployed.

The study, titled "Physics Doctorates One Year Later," was released in November.

Lerch Responds to Back Page Letters

Ed. Note: *In January, we printed 2 responses to Irving Lerch's October Back Page "Invisible Nukes." The Back Page and the letters, by John Richter and Igor Kleyn, are available online. Richter stated that the US has no tactical nuclear weapons, and Kleyn advocated vigorous nuclear deterrence. A response by Lerch follows:*

John Richter's assertion is probably based on misconceptions and confusions. The Presidential Nuclear Initiatives promulgated by President George H. W. Bush in the wake of his September 1991 meeting with Soviet President Mikhail Gorbachev proposed to withdraw to the United States all ground-launched short-range weapons deployed overseas and destroy them along with existing US stockpiles of the same weapons (1); and cease deployment of tactical nuclear weapons on surface ships, attack submarines, and land-based naval aircraft during "normal circumstances." Implicitly, the United States reserved the right to redeploy these arms in a crisis.

In return, Gorbachev promised to withdraw the Soviet tactical arsenal from East-Central Europe to the Soviet Union (but he did not commit to decommissioning them). In the end, a small US arsenal remained committed to NATO forces because the NATO Council insisted that such weapons were needed to counter the Russian tactical arsenal which remained very large and ready for deployment. To this day, between 150-200 weapons, manned by US units, remain on European soil.

Well before the collapse of the Soviet Union, in the 1980s, US military planners were aware that the forward deployed nuclear armaments of the 1960s were unsustainable and vulnerable and therefore a whole new class of armaments were developed. These were largely to be warheads mounted on submarines (Tomahawk cruise missiles) and air-launched gravity bombs. Thus, instead of deploying these weapons at the Division and Corps level, they were held safely in the rear for release by theater commanders upon approval by the President. They are, nonetheless, tactical nuclear weapons.(2)

I'm sure it would come as a shock to NATO commanders to learn that there are no tactical weapons extant. It would also come as a shock to Administration negotiators who are responsible for discussing the status of these non-existent weapons in the next round of talks.

In any event, I am not as concerned with these weapons as I am with the integrity of the Russian, Chinese, Pakistani, Indian, Israeli, North Korean and perhaps Iranian arsenals and the very real possibility that terrorist organizations might get their hands on them. But I must agree that the carriers in the gulf did not carry nuclear warheads; a force of accompanying submarines were assigned that role.

Igor Kleyn accuses me of disliking nuclear deterrence as a concept. Although I never mentioned deterrence, I did express my worry that many arsenals in the most unstable regions were vulnerable to security breaches.

We know the vulnerabilities of the Pakistani arsenal. My own experiences during the Vietnam era made crystal clear that it was insanity to position small nuclear weapons with forward deployed combat units where they would be vulnerable to capture or destruction. Thus removing the artillery shells and replacing them with missiles and bombs and moving them to the rear sounded both safer and saner. But we then set the stage for others to emulate us and thereby create a class of weapons whose very existence creates an unimaginable hazard to international stability.

My point was to do everything possible to prevent "government [that] hides in schools and sends women out to blow themselves up" from acquiring nuclear weapons. I welcome all comments, pro or con. Let's keep the discussion rolling. But most important, let's promote education and understanding of policies that shape our world.

Irving A. Lerch

(1)http://www.armscontrol.org/factsheets/pniglance
(2)http://www.armscontrol.org/subject/134/date

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coordinated attacks killed Majid Shahriari and critically wounded Fereydoon Abbasi. This followed an attack in January when quantum physicist Masoud Alimohammadi was killed when a motorbike rigged with explosives detonated outside his home. It is unclear if the January attacks and the November attacks are connected. It is widely believed that Alimohammadi was a political moderate, while the Iranian regime was quick to blame foreign enemies of the state for the November attacks. It has been alleged that the two physicists targeted in November's attacks were involved with Iran's nuclear program.

Astronomers have observed a strange anomaly in the velocity and trajectories of Pioneer 10 and 11, launched in 1972 and 1973 respectively. They're slowing down, and each year the crafts experienced an unexplained decelleration of about 8.74×10^{-10} m/s^2 per year, an eye-catching rate because it's close to the product of the Hubble constant multiplied by the speed of light. Numerous theories have been put forward to explain the anomaly, ranging from observational errors to a fundamental reassessment of the nature of gravity. However in late **December**, word leaked out that Slava Turyshev, a researcher at NASA's Jet Propulsion Laboratory and Viktor Toth, a software developer from Canada, are getting ready to publish a report that should conclusively solve the Pioneer problem. They're being guarded on the precise results, but they've painstakingly constructed a complete 3D model of every surface of the spacecrafts along with heat recoil force data for all of the surface materials. It's expected that when they finally release their data, this recoil force should make up almost all, if not all, of the discrepancy.

zero gravity

Black Hole Leaves Science Fishing for Explanation

By Leonard Weisberg

Undoubtedly, the greatest discovery of this century was a new type of black hole that attracts only leaves.[1] As discussed, it exists in several places including pools and in the exterior inverted corners of houses and buildings, but fish ponds were not mentioned. I happen to own a fairly large fishpond, and have been able to make certain discoveries that will greatly add to the knowledge of this new phenomenon:

- The black hole is located 1.4 m below the surface of my fishpond, while the event horizon is located 4.7 m above the black hole. *Very sadly, this means that any leaf within 3.3 m (about 11 feet) above the fish pond is directly pulled onto the surface of the pond.*
- The surface of the pond acts as a new secondary barrier (a new type of flat (!!) event horizon). A leaf that goes below this new surface type of event horizon passes through the black hole and enters an alternate universe as suggested by string theory; *it is never seen again!*
- The strength of attraction of the black hole is at least one order of magnitude higher in the fall months and during this period, two orders of magnitude in high wind conditions.
- Strangely, after about 1/3 of the surface is covered with leaves, the strength of attraction of the black hole greatly diminishes. Then, as leaves are removed from the surface, the strength of gravitational attraction builds up again, so within 24 hours, 1/3 of the pond surface is again covered with leaves.

I am sure that proponents of string theory will find this additional data most important since it provides specific facts that allow the theory to be tested, and I am humbled by being able to help this very important field.

[1]Ock, C. and Ull, B, (2010), *J. Grav. Shrinking*, Vol. 207, p. 13,476

Dutch, Spanish Physicists to Give March Meeting Beller Lectures

The APS Committee on International Scientific Affairs announced that this year's recipients of the Beller Lectureships are Francisco Guinea at the Instituto de Ciencia de Materiales de Madrid, and Rienk van Grondelle at Vrije University in the Netherlands. The two recipients will receive an endowment to travel to the 2011 March Meeting in Dallas to deliver lectures on their research. Van Grondelle was nominated for the lectureship by the Division of Biological Physics for his research in photosynthetic energy transfer and charge separation and Guinea was nominated by the Division of Materials Physics for his work on graphene models.

"These two people were selected, because they had the 'strongest' nominations–good CVs, good supporting letters, interesting topics. It was a hard choice, since we do get a number of good candidates," said University of Waterloo professor Vengu Lakshminarayanan, chair of the selection committee.

Lakshminarayanan added that the lectureships allow APS meeting attendees to hear about new research from people who otherwise may not attend the meetings for financial reasons.

"It is a great honor. Previous recipients of the award are outstanding scientists. The APS March Meeting is an excellent place to present your work," said Guinea. "I hope it will enhance the visibility of the research I am doing in my home country, Spain, and elsewhere."

The Beller lectureships were established in 1994 using a bequest by Esther Hoffman Beller "for the purpose of bringing distinguished physicists from abroad as invited speakers at APS meetings." Each year, up to three physicists receive $2,000 in travel assistance to come to their field's annual meeting. So far there have been 22 recipients who have traveled to the US from as far as India, Israel and France.

"I find it a great honor, the first Dutch person to be selected. It also shows that the research into photosynthesis has a major physics aspect. It furthermore shows that our current knowledge of the photosynthetic process could be of great importance to develop 'biosolar cells; i.e. solar cells based on the principle of photosynthesis," said van Grondelle.

Van Grondelle will talk in session H7 on Tuesday, March 22, at 9:48 am. Guinea will speak in session P37 on Wednesday, March 23 at 8:00 am.

COMPETES Act Signed Into Law

In late December, as part of the lame-duck session of Congress, the House of Representatives passed the Senate's version of the America COMPETES Act, sending it to the President's desk. It was the second time the House had approved a version of the legislation aimed at strengthening the country's leadership in scientific research.

The bill is wide-ranging, touching on furthering research and development as well as science and math education. It authorizes funding for the National Science Foundation, the National Institute of Standards and Technology and research programs in the Department of Energy's Office of Science. It also directs the Department of Commerce to create an Office of Innovation and Entrepreneurship to help commercialize new technologies. The bill sets up numerous other federal research and education programs in agencies including the Office of Science and Technology Policy, the National Academies and the Department of Energy.

The COMPETES Act had a difficult time working its way through the 111th Congress. When it first came to a vote in the House in May, Rep. Ralph Hall (R-Texas) added a so-called "poison pill" amendment to stop the bill. In a surprising parliamentary move, Bart Gordon reintroduced the bill under suspended House rules to avoid any amendments, but fell short of the two-thirds majority needed to pass it. The bill was then introduced for a third time in the House, and passed 262-150.

After making it through the House, Senate Republicans balked at the reauthorization bill's initial $85 billion price tag over five years. The Senate passed a version that authorized $45 billion over three years, including $7.4 billion funding for new initiatives. The House voted 228-130 in December, largely along party lines, to adopt the Senate's version, which was signed into law by the president in early January. Ultimately 16 House Republicans ended up voting for the final bill, including the retiring Vern Ehlers (R-MI), a former nuclear physicist and an APS Fellow.

"Science funding is the engine of a knowledge-based economy. If we remove it, our economy will crash and burn," said Bart Gordon (D-Tenn.), ranking democrat on the House Science and Technology Committee. "If we are to reverse the trend of the last twenty years, during which our country's technological edge in the world has diminished, we must make the investments necessary today. More than half of our economic growth since World War II can be attributed to development and adoption of new technologies. These investments are the path toward sustainable economic recovery and growth and the path toward prosperity for the next 50 years."

Members of the Republican leadership emphasized that they do not oppose scientific research and development in principle, but rather they objected to the cost of the bill and the process the Democrats used to pass it in the lame duck session.

"As much as I want to support COMPETES and see NSF, NIST and the DOE Office of Science reauthorized, I simply cannot sup-

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INTERNATIONAL News

...from the APS Office of International Affairs

Dutch students tour scientific America Amsterdam to New Amsterdam and beyond

By Maartje A.B., Edo van Veen, and Maaike Zwart

There was an almost infinite number of little lights that shone through the airplane window as we reached the other end of the Atlantic. We, being a group of nineteen Dutch (astro)physics undergraduates of the Radboud University Nijmegen, were ready to start our two-week study tour in the United States.

Photo courtesy of Edo van Veen

During their visit to MIT, the students pose with Professor Jagadeesh Moodera (center).

There is a long tradition of study tours. Other students of our student association, Marie Curie, have been to countries like Japan, South Africa and Russia. Last fall it was our turn to discover New York, Boston and Chicago, with their prestigious universities and high-facility labs.

It instantly struck us that there are some major differences with our own little country. The cities, the buildings, the cars, the streets, the sodas and even the squirrels were bigger than we are used to. In the Netherlands, we almost never see squirrels, as they are just too timid. In America they ate out of our hands. What we noticed most about the food was that it is all much sweeter, especially the bread and the sodas. A small disappointment was the fact that one has to be 21 to drink in the US. We were not even allowed to enter a bar for a coke. A pleasant surprise was the presence of a Chinatown in all the cities we visited. In the Netherlands, this is not usual. Also, the spoken American language is–like –totally different from the English we learned in high school and it is–like–exactly like in the Hollywood movies.

The universities in the US have very much in common with ours: the way that they are organized, the labs, the humor of the professors, it was all quite familiar to us. However, there are a few differences that are worth mentioning. The campus of a Dutch university is quite small; one easily walks from one side to the other in less than fifteen minutes. In the US, one needs to take the bus. The buildings are built much further apart than in the Netherlands, creating a lot of space for sports fields and nice parks. Another interesting difference is found in the cafeteria. In Holland, you can have a sandwich, some salad or soup for lunch. On our trip, we saw a completely new concept: several cafeterias were host to fast-food branches. Fries and burgers for lunch on campus! Furthermore, we noticed that all institutes and universities are very internationally oriented, which we liked a lot. Our own university is also improving in this field, but it is not yet as far as its American counterparts.

New York City

Our tour started in New York. The first thing we did was pay a visit to Lady Liberty, because you cannot say you have seen New York without having seen her. After all, we are tourists. We took far too many pictures, and sailed on to Ellis Island. It was quite impressive to see that a lot of ancestors of American families have fairly recently (by European standards) entered the US through this island. For the remaining part of our spare time in New York we walked around in small groups, visiting famous buildings such as the Empire State Building. It was an amazing feeling to stand on the extremely busy Times Square, watching the typical yellow cabs passing by. We were astonished by the appearance of a three-storied M&M store: something like that can only exist in the USA. We also went to Central Park for a quiet walk. Well, that is what it was supposed to be. Apparently, going to Central Park without jogging equipment is a bad idea if one does not want to be knocked off one's feet.

During our stay in New York, we visited Princeton, Rutgers, Stony Brook and the astrophysics department hosted at the National Museum of Natural History. All of these visits were wonderful, but since we cannot discuss them all, we would like to share some of our experiences at Princeton and Stony Brook in more detail.

In Princeton, Professor Annabella Selloni showed us around on the campus. We saw huge microscopes at the Imaging and Analysis Center, and we were even allowed to play with an expensive electron microscope. Furthermore, we had to wear funny clean suits in the Micro/Nano Fabrication Laboratory. In the afternoon, we learned about fusion and plasma in the Princeton Plasma Physics Laboratory.

Our visit to Stony Brook was organized by Distinguished Professor Peter van Nieuwenhuizen. We were given as many as eight talks by some of the finest speakers of the physics department. For instance, Prof. Chang Kee Jung explained all about neutrinos: what they are, where they come from, how we could detect them and in what way they might be the key to solving some of the mysteries surrounding fundamental physics today. He managed to make us all very enthusiastic for neutrino-research, so this was an excellent preparation for our visit to Fermilab later that week. Another talk was given by Prof. Martin Rocek. He gave us an introduction to string theory, which was a very welcome subject, as it is not a hot topic in Nijmegen.

Boston

We arrived in Boston late at night. Nevertheless, the train to our hostel was packed. It turned out that we were staying in the local party-district and there was no reason not to use this happy coincidence to see if college parties are as awesome as they seem in the movies. They are.

The city itself is beautiful. On our day off, we walked the so-called "freedom trail", read things about some party that involved angry people and tea, explored the parks and had dinner in Chinatown.

At MIT we visited the Francis Bitter Magnet Laboratory, where Professor Jagadeesh Moodera showed us the research he and his group are doing. It was a very exiting visit: next to various interesting talks, we were allowed to try to make our own graphene using the scotch tape method, and we watched helium turn into a superfluid. The enthusiasm came from both sides, resulting in not only a wonderful day, but also a lot of group pictures to remember it.

Studying physics in Nijmegen means participating in both physics and astrophysics courses in the first year. This wide range of interest was reflected in our program during the trip. So at Harvard, the focus was on astrophysics. At the Harvard-Smithsonian Center for Astrophysics (CfA) Dr. Jonathan McDowell showed us among other things the control room of the Chandra X-ray satellite and told us about the work done in the CfA and of Chandra in particular. Another person telling about her work for the CfA was graduate student Sarah Ballard. She enthusiastically explained to us what methods are used to detect exoplanets and surprised us with the fact that Gliese 581g has a very active twitter account.

Chicago

Chicago turned out to be as windy as its nickname claims it to be. We visited the impressive Skydeck, looked at a deformed reflection of the skyline in the big shiny blob [i.e., Anish Kapoor's sculpture "Cloud Gate" in Millennium Park (Ed.)] and saw the first signs of Halloween. Also, some people in our

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tiers. Progress at all three scientific frontiers is needed in order to answer the major questions identified by the field. The guidance we got from the community was that the US should try to have a balanced program at these three frontiers and that there was a real opportunity for the United States to establish a world-class program at the Intensity Frontier, building on the existing accelerator infrastructure at Fermilab. A world-class intensity frontier program would provide the US with an important role in the global HEP program that complements research capabilities elsewhere. This guidance has been used to develop a new US strategic plan and in the last couple of years we have started to implement this plan. The establishment of the new strategic plan and the progress made in implementing this plan is what I would say is the accomplishment I'm most proud of.

Q: In a nutshell, what do you think the US labs can still offer now that the LHC is up and running?

A: The US laboratories can play important roles in US efforts at all three scientific frontiers. What the US can offer is a world-class Intensity Frontier program.

It has taken the world community more than a decade of investment and hard work to implement the LHC program at CERN. That infrastructure is now there and I think most of the community expects that for the next decade or more CERN and the LHC will be the center for energy frontier studies. The US laboratories and the US community are active and important participants in that program. As the LHC program evolves the US laboratories and universities will participate in extracting the science and in accelerator and detector upgrades as they come along. The laboratories have the core competencies and the technologies to be able to implement these upgrades, and they will partner very well with the universities in doing this.

But as pointed out in the HEPAP (P5) Report, the evolution of Fermilab's program to develop capabilities for rare decays and neutrino studies offers the opportunity for establishing a world-class US intensity frontier program. If we implement those capabilities, I think this will be the place where people around the world come and participate in these programs. Other US laboratories will play an important role in implementing this program.

At the cosmic frontier we partner with the NSF and NASA in both the ground-based and the space-based observatories. Our laboratories have capabilities for developing this next generation of detectors that I think will allow us to play an important role with these other agencies.

Q: How is high-energy physics research important to the average person?

When I sit down on a plane and start talking to the person next to me about what I do and particle physics, I invariably find that there's this intellectual curiosity about exactly how things work, what the fundamental particles and forces of nature are. There are these just fascinating questions that I think catch the imagination of everyone. I mean there's a form of matter, dark matter, that is twenty-five percent of the energy balance of the universe and we have no idea what it is. There is an acceleration of the universe that is either a new force that we do not know about, or it is in fact telling us something about the properties of gravity over large distances. Fascinating questions! At the LHC there is a chance to produce and perhaps understand what this dark matter particle is. There is the possibility that we are going to see a whole new range of particles, super-symmetry, new dimensions; all of this is very fascinating.

It's fascinating for young scientists, and the opportunity to be able to participate in such studies attracts the best minds among young people. It recruits a whole range of young people into the field and the problems that we take on are very complex. Everything that we build is generally the next generation. It is pushing the frontiers in terms of instrumentation, in terms of accelerator capability, and that of course brings in and challenges engineers and designers and particle physicists. So this attracts a whole generation of scientists and technical people, of which some fraction remain in the field but the other fraction of these people go out into the private sector or parts of the government. The technologies that we develop are transferred to the private sector and they contribute to US competitiveness.

If we read *The Gathering Storm*, and other analyses, the way the United States is going to be able to compete is by continuing to drive innovation. Particle physics is a field that, in trying to understand and answer fundamental questions, develops the next generation of technology, the next generation of scientists–that get motivated and are always at the cutting edge of technology–and the new ideas that are going to contribute to the country. So I think it's the intellectual curiosity as well as this underpinning of people and technologies that are important to the country.

Q: What do you see as the outlook for the future of high-energy physics in this country and what challenges does it face?

A: I think that the challenges we face are that most of the tools that we need to answer the next questions are now quite big and they're quite expensive and they're quite complex. The challenge is to provide enough resources for exploring these next generation technologies so that the cost of the tools and the accelerators are going to decrease. That's one of the challenges.

The other challenge has to do with the context we're living with right now. The world is in the midst of struggling with financial issues. There is emphasis on dealing with the energy problem, climate change, and national competitiveness. In that context, within the Office of Science, there are programs that are focused on trying to deliver, in a rather short time, solutions to some of these problems. I think that rightly so, resources should be provided to try to solve these problems.

The challenge, I would like to say, is to educate the policy makers that a field like high energy physics in the long term is going to be driving innovation, and in the process, develop important scientific and technical core competencies for the country, and that adequate resources should be provided to this field in order to sustain it and allow it to contribute in the long term, as the country deals with some of the more immediate problems.

Q: The prevailing wisdom seems to be that funding for science programs will be tighter in the future. Do you think that's going to be the case? What do you think the future of federal funding for science programs will be?

A: I think the country as a whole, the taxpayers, the administration and Congress really believe it is time to deal with some issues facing the country. These are very complex issues so federal funding for science is going to have to compete with the other priorities that the government faces. High-energy physics and all of basic research is going to have to make a case in the context of more applied research. There's a case to be made for a balanced program, and that's going to be the challenge.

Q: What do you think is the future of US participation in programs like the LHC, ITER, the ILC and other international science collaborations?

A: I think we are going to continue our participation in the LHC. As I mentioned, globally other countries have interests, at some point down the road, in developing the next generation of accelerator facilities for particle physics. There's going to be cooperation in trying to leverage the funds globally in order to spend the most wisely in terms of R&D that will position the countries interested in doing this in the future. ITER I have no comments on, it's just outside of my expertise, but clearly the US has joined this and is a partner in this endeavor.

Q: Why is it you are stepping down as Associate Director?

A: Twenty years. I've been with DOE for twenty years now and I just thought it was time to go do something else.

Q: What is next for you?

A: I have no plans at this moment.

Q: What advice would you have for your successor at the office?

A: The advice I would give would be to make sure that you engage the scientific community in identifying the scientific opportunities and priorities. You need to ask the community to do this exercise in the context of what may be reality. In my experience, with both NSAC in nuclear physics and with HEPAP in high energy physics, that the scientific community will step up and really seriously address this and give good advice. You need to then take that advice. Your focus has got to be on what science you can deliver to the country. If in fact you identify those priorities right, and you deliver, than I think the program will be successful.

Q: How does working in an administrative position compare to being a research scientist? What are some of the challenges you've encountered?

A: The thing I tell someone who comes in and interviews for a job is that when I was a research scientist I was an expert in a certain area. I was a mile deep and I thought I was broad, but really I was an inch wide. When you come here and become a program manager, you will find that what you really need to do is be a mile wide, and then you try to be as deep as you can. I think your perspective changes. When I was a research scientist I was very focused on answering certain questions. When you become a program manager in an office such as this, you begin to look strategically for what is important for the US program to accomplish. Your perspective changes enormously. Both are enormously challenging and satisfying careers, but they're really quite different. To be a program manager you do need to really be on top of the science. You're in a position to really understand the physics opportunities and their significance, because every proposal gets reviewed by perhaps five experts and you sit through many reviews. You utilize that advice, but if you're here for a few years, you need to direct the program in a way that delivers something for the country.

Q: Any final thoughts?

A: I spent twenty years as a research scientist doing research and I immensely enjoyed that. I came here as a detailee for one year and I saw this as a challenge. In looking back at it, I've very much enjoyed it, it's been very satisfying and I think I've accomplished a few things. And so, I'm very happy that I had a chance to do this.

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group went to the Art Institute of Chicago. The best parts were the French impressionism and modern European sections.

One of the most fascinating things we visited during our trip to the Fermilab were the MINOS (Main Injector Neutrino Oscillation Search) Areas. These are part of the NuMI Facility, a beam facility which creates a beam of muon neutrino particles. We went down a hundred meters with an elevator to see the detector. Aria Soha showed us the several experiments that are going on now. We also saw MINERvA (another experiment using the neutrino beam) and set-ups of some dark matter experiments.

Our last stop was Argonne. Dave Hooper, wearing a huge number of security name tags, gave our group a tour around the entire terrain, which is quite large. Firstly, we saw ATLAS and the numerous projects it hosts. Prof. Michel van Veenendaal told us about the Advanced Photon Source. We even got to go up to his office where we had a fantastic view over the synchrotron. In the afternoon we went to see a laser lab and a new type of particle accelerator. The day ended with a nice story about the herd of white deer living on the terrain.

All in all it was a very interesting and educational tour. We experienced the American culture, which was pretty awesome. We have been to some great institutes and universities where we saw famous experiments and learned a lot. We saw various possibilities to work and study abroad in the field of physics and it was a nice experience to see the theories we learn in practice. When given the chance, we would certainly do it again!

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as part of the licensing process. It is open for public comment (http://www.regulations.gov/#!submitComment;D=NRC-2010-0372-0003) until March 8th.

If you have suggestions for a POPA study, please send in your ideas electronically. http://www.aps.org/policy/reports/popa-reports/suggestions/index.cfm. If you would like to nominate an APS member for a seat on the Panel of Public Affairs in 2012, please visit http://www.aps.org/about/governance/election/nomination.cfm to submit your nomination.

ISSUE: Media Update

New Scientist quoted APS Director of Public Affairs Michael S. Lubell in a Jan. 4th article, "Battle looms over U.S. Science Funding." In the news story, Lubell stated that "there's going to be a big fight" over boosting funding for science.

In a Dec. 27th blog post published by ScienceInsider, Lubell was quoted in the piece, "Why Didn't Obama Mention Landmark Science Legislation?" He stated that President Obama "should have mentioned" the passage of the reauthorization of the America COMPETES Act.

Global Security Newswire published an article on Jan. 12 titled, "U.S. Nuclear Body Weighs Proliferation Appraisals for Facility Licensing," which quoted APS Associate Director of Public Affairs Francis Slakey. He pointed out that an APS petition to the NRC requests a rule change to elevate the non-proliferation assessment of small, more efficient nuclear fuel technologies. The NRC docketed the petition, which is available for public comment until March 8.

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

ANNOUNCEMENTS

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port this version. This measure continues to be far too expensive, particularly in light of the new and duplicative programs it creates. Further, we have not had the opportunity to give proper oversight to the programs we put in motion in the first COMPETES before authorizing new, additional programs. And, unfortunately, this bill still goes way beyond the goals and direction of the original America COMPETES, taking us from good, solid fundamental research and much too far into the world of commercialization, which many of us on this side of the aisle do not believe is the proper role of the federal government," said Ralph Hall (R-Texas), incoming chair of the House Science and Technology Committee in the 112th Congress.

Despite opposition to the bill in Congress, business groups, education organizations and science societies lined up to support the bill. Organizations that promote science, technology, engineering and mathematics education were strong supporters of its passage.

"The significance is that funding is being provided for teacher training and for us that is a really big thing," said Beth Cunningham, Executive Officer of the American Association of Physics Teachers. "Overall, I think the bill is good for us, it's good for the US and it's good for AAPT."

Before its passage, APS joined over 750 different organizations in publicly endorsing the bill. These included the US Chamber of Commerce, the American Association for the Advancement of Science and the American Council on Education.

"The reason the COMPETES Act passed in my judgment, the reason it passed in the Senate in particular, was that the science community got behind it. There were a lot of people, a lot of members of APS, who weighed in on the thing, most recently at the plasma physics meeting. And people should understand that they do have influence, because without the work the individual scientists did on this issue, it probably would not have not have passed in the Senate, and never would have made its way back to the House," said Michael Lubell, director of Public Affairs at APS.

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Large Hadron Collider at CERN, the Tevatron was the most powerful particle collider in the world, so named because it could accelerate protons to energies up to one trillion electron volts, or 1 TeV. The Tevatron has been at the forefront of high energy research since it was completed in 1983. It was instrumental in the discovery of the top quark in 1995.

When the LHC came online in 2008, plans were in place to decommission the Tevatron in 2011. After the full startup of the LHC was delayed because of its accident, scientists at Fermilab pushed to extend the life of the Tevatron to try to beat CERN to the Higgs boson. An expert panel in October recommended that the life of the Tevatron should be extended for three years in hopes of first discovering the Higgs boson. Oddone said that the life of the accelerator would be extended only if additional funding could be secured, otherwise the shutdown would continue as planned. He added that there were no plans for any further cuts or shutdowns.

"Probably the sign is just the opposite. Running the Tevatron on top of the other programs would have been very taxing," Oddone said.

All together, about 600 physicists were involved in the Tevatron's research collaboration. Most are expected to move to other projects around the world, including to CERN. There are about 100 employees of Fermilab directly connected with the operation and maintenance of the Tevatron. Their fate is unclear as Congress has not yet approved a federal budget for 2011, making it difficult for the lab to plan ahead.

As for the fate of the massive detectors and nearly four miles of tunnels that make up the Tevatron itself, Oddone said that it will likely be cleaned up and opened for tours to the general public.

"It has not been easy to take people in to show them," Oddone said. "This could be set up in a very nice way, with a couple of stops to give people a sense about how a machine like that works and how the detectors work."

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could make it easier for a country to hide its clandestine nuclear weapons program. One such example is the recently developed technique known as SILEX, which uses lasers to enrich uranium. To prevent sensitive technology from spreading to unfriendly regimes, the report recommended that NRC "elevate the priority of non-proliferation in the licensing process." An effective way to achieve this, according to Slakey, is to require a proliferation assessment.

This is the second petition submitted to the NRC. The first, submitted last summer, was initially rejected. In a public meeting last September with APS staff, NRC staff identified additional information that was needed in order for the petition to be considered. The revised petition was submitted last November. The POPA report on Nuclear Downsizing is available on the APS website at www.aps.org/policy/reports/popa-reports/index.cfm .

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the increase to more efforts to reach out to physicists internationally.

"The Society is working to expand its international engagement and to better serve its international members," Flatten said. "We have already expanded the number of APS International Councillors in our governing body, the APS Council, and have established a network of contacts worldwide, the International Friends Network that will help us strengthen the Society's communication and offerings to our members outside of the United States."

These membership counts are held every year to assess the health of the Society. The membership numbers are important also in enhancing the Society's grass roots lobbying efforts when advocating for improvements in science policy and increased research funding.

The Back Page

Rising Above the Gathering Storm, Revisited

By Members of the 2005 "Rising Above the Gathering Storm" Committee

Ed. Note: *The 2005 report "Rising Above the Gathering Storm", issued by the National Academies, was enormously influential in stimulating debate and action with respect to the science and technology enterprise in the US. In 2010, many of the original committee members collaborated on a second report (of which what follows is an excerpt) designed to update the global context and events.*

During the five years since the *Gathering Storm* study was published, a new research university was established with a "day-one" endowment of $10 billion, equal to what it took MIT 142 years to accumulate. Next year over 200,000 students will study abroad, a large fraction in the fields of science, engineering, and technology. A new "innovation city" is being constructed, patterned after Silicon Valley, that will house 40,000 people. A multi-year initiative is underway to make the country a global nanotechnology hub, including constructing 14 new "world-class" universities. A new facility was opened to collect, store and analyze biological samples and serve as an international hub for biomedical research. A high-level commission with the objective of creating jobs at home has developed a long-term strategy for science and technology patterned after the National Academies study.

These actions were taken by Saudi Arabia, China, Russia, India, Luxembourg, and the United Kingdom, respectively.

Meanwhile, in the United States, six million more youths dropped out of high school to join a cadre of similarly situated youths–over half of whom under 25 years of age are currently without jobs. During the abovementioned interval, another $2 trillion was spent on K-12 public education while K-12 students remained mired near the bottom of the developed-world class. Labor costs in the United States continue to eclipse those in developing nations, although in some cases by narrowing margins. Over 8.4 million jobs were lost in America . . . and the dollar dropped 9 percent against the Euro. The United States' share of global high-tech exports dropped from 21 percent to 14 percent while China's share grew from 7 percent to 20 percent. China continued to graduate more English-trained engineers than the United States.

Three new factors have evidenced themselves during the half-decade that has elapsed since the *Gathering Storm* report was prepared that are particularly significant.

(1) Decreased Financial Wherewithal to Address the Competitiveness Challenge. While the *Gathering Storm* report warned of an impending financial crisis, it was not addressing the type of crisis that subsequently occurred. It is not the long-term crisis of which the *Gathering Storm* committee sought to warn and avert: a far more serious and much more enduring financial reversal attributable to fundamental flaws in the nation's process of generating quality jobs for which its citizens can be competitive. This failure includes such practices as tolerating a K-12 educational system that functions poorly in many areas, prolonged underinvestment in basic research, and discouraging talented individuals from other parts of the world, particularly, in science and technology, from remaining in America after having successfully completed their education here.

During the years since the *Gathering Storm* report was produced there has been another change in the character of job creation in America that presumably cannot sustain itself over the longer term. In particular, during this period the private sector eliminated 4,755,000 jobs while government (at all levels) added 676,000 jobs. The difficulty of reversing this trend is exacerbated by yet another development wherein, according to the Bureau of Labor Statistics, federal jobs now pay wages and benefits that on average exceed those in the private sector by 55 percent for similar occupations.

(2) Progress . . . Abroad. While all nations have suffered from the recent financial meltdown, not all have suffered equally. China's GDP grew at an average annual rate of 11 percent between 2005 and 2008; India's by 8.6 percent; Brazil's by 4.5 percent. In contrast, the United States growth rate has averaged 2 percent, albeit from a much larger base but with a much higher standard of living to support.

The above circumstance permitted China to increase its R&D investment as a fraction of GDP at an annual rate of 5.7 percent between 2001 and 2007, while the United States investment declined at an annual rate of 0.5 percent. Similarly, the number of first university degrees received in the natural sciences and engineering in China increased at a rate of 42 percent per year, whereas the production of such degrees in the United States has increased just 3 percent per year–with part of the increase attributable to growth in the number of non-citizen students receiving degrees.

During the most recent decade China increased its number of higher education institutions from 1,022 to 2,263. Tsinghua University, Peking University and Shanghai Jiao Tong University in China and the Indian Institutes of Technology are now considered to be among the world's foremost academic institutions. Perhaps the most innovative of the newly created institutions is KAUST, in Saudi Arabia. KAUST has no departments, no tenure, no undergraduates, no tuition, and a broadly international faculty and student body, heavily focused on research . . . and a very large endowment. It is led by an individual born in Singapore and educated in the United States.

The Information Technology and Innovation Foundation recently analyzed 16 innovation competitiveness indicators and found that the United States now ranks 40th out of the 40 countries and regions considered in "making progress on innovation and competitiveness."

(3) The United States Higher Education Outlook. America is still blessed with a disproportionate share of the world's finest universities–particularly research universities. Today, however, two forces are at work that could modify that circumstance. The first of these is that a number of other nations are placing extraordinary priority on higher education, particularly in science and engineering. The second is that as a result of the recent financial reversal, many United States universities are in greater jeopardy than at any time in nearly a century. As tax revenues have declined, state support of public higher education has been curtailed–in some cases severely. Simultaneously, the endowments of public and private institutions in the United States declined during the recession, suffering an average loss of 18.7 percent during 2008 and 2009.

The trend towards lesser government funding for public universities in most fields is not new . . . only the magnitude of the decline is new. The innovation that is so critical to our economic vitality is in jeopardy when our universities are in jeopardy. In 1975 private firms accounted for more than 70 percent of the "R&D 100" (R&D magazine's annual list of the 100 most significant, newly introduced research and development advances in multiple disciplines), but by 2006, more than 70 percent of the top 100 innovations came from "public or mixed" sources, including academia and federally-supported startups.

Given this demanding environment, a number of other countries are seizing the opportunity to attract United States-educated faculty "superstars" from United States universities where they are now employed. Attracting such individuals to other nations is made easier by political and economic developments in the past two decades that have enabled many more countries to offer reasonable lifestyles along with extraordinary research facilities (e.g., CERN in Switzerland, Biopolis in Singapore, the nuclear-fusion research facilities in China, and the high-energy particle research program in Japan). Further, in the case of engineering, over 35 percent of the faculty of United States institutions was born abroad, considerably easing the disruption of returning home.

United States universities, for the first time since World War II, are thus faced with a serious–and increasing–competition for talent from abroad. Perhaps the most disconcerting assessment comes from a United States Conference of State Legislatures report: *Transforming Higher Education*, which concludes that "The American higher education system (overall) is no longer the best in the world. Other countries outrank and outperform us."

It is instructive to ask which of the following two job candidates one would hire:

Candidate "A," ranks in the lower quartile of the high school class, expects to be paid a wage of $17 per hour (the lifetime average wage of a United States high school graduate) with an additional one-third of that amount in benefits. Candidate "B" speaks two languages fluently, ranks near the top of the class and is eager to work for $1.50 per hour.

This scenario, although oversimplified, is nonetheless a reasonable representation of the challenge faced by the average United States high school graduate seeking a job in the global job market–setting aside altogether the one-quarter of United States youths who have not received a high school diploma by the time their class graduates.

The *Gathering Storm* report concluded that, "Market forces are already at work moving jobs to countries with less costly, often better-educated and highly motivated workforces, and more friendly tax policies." From a shareholder's perspective, a solution to America's competitiveness shortfall has already been found–but it is at the expense of those seeking employment here at home. This represents a major dislocation of interests and loyalties that has as yet not been widely addressed or in many cases even recognized.

From America's perspective, events that have occurred over the past five years have both positively and negatively impacted the nation's competitiveness stature. On the positive side, there is a much greater awareness of the peril implicit in continuing in the direction the nation has been drifting for several decades. This is a non-trivial development, given that the basic nature of the competitiveness challenge does not lend itself to any sudden "wake-up call"–such as was provided by Pearl Harbor, Sputnik or 9/11. Also on the positive side of the ledger are past actions that have been taken by the federal government, particularly as part of the American Recovery and Reinvestment Act of 2009.

Gathering Storm assessments with findings that echo those from the study conducted by the National Academies–and in some cases the states have followed their findings with concrete actions. Unfortunately, a number of adverse developments with regard to the nation's competitiveness have also occurred. Prominent among these has been the economic collapse triggered by the proliferation of sub-prime mortgages. Although not rooted in the same fundamental practices as the economic reversal described in the *Gathering Storm* report, the fallout from this relapse has further weakened America's ability to respond to the long-term challenges it faces–including those addressed in the *Gathering Storm* report.

Further, for the first time in many decades the nation's higher education system is being seriously challenged. This is a consequence of the decline in operating funds attributable to reduced endowments and declining tax revenues. Finally, although no nation has escaped the recent financial crisis unscathed, some have fared better than others and have focused additional sums on competitiveness. For example, last year China sustained an annual real GDP growth rate of 9.1 percent while India and Vietnam achieved 7.4 and 5.3 percent, respectively. The United States real growth rate was a minus 2.6 percent. The abovementioned three foreign countries of course have smaller GDP's than the United States (India, for example, by a factor of four in purchasing power terms). But they also have a lower standard of living to maintain–and new funding sources are being generated, the fruits of which can be relatively quickly allocated as the nation's leadership deems appropriate.

In balance, it would appear that overall the United States long-term competitiveness outlook (read jobs) has further deteriorated since the publication of the *Gathering Storm* report five years ago.

Today, for the first time in history, America's younger generation is less well-educated than its parents. For the first time in the nation's history, the health of the younger generation has the potential to be inferior to that of its parents. And only a minority of American adults believes that the standard of living of their children will be higher than what they themselves have enjoyed. To reverse this foreboding outlook will require a sustained commitment by both individual citizens and by the nation's government…at all levels.

The *Gathering Storm* is looking ominously like a Category 5…and, as the nation has so vividly observed, rebuilding from such an event is far more difficult than preparing in advance to withstand it.

Copies of the report *Rising Above the Gathering Storm, Revisited* are available from the National Academies Press, www.nap.edu/catalog.php?record_id=12999 .

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