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Meet the New APS President
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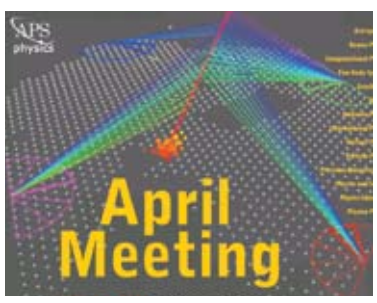
April Meeting Heads for Denver in May

The 2009 APS April Meeting will be held May 2-5 in Denver, Colorado. This year's April Meeting will center on the theme "New Eyes on the Universe: 400 Years of Telescopes."

Addressing this theme, Richard Ellis of Caltech will give a keynote address titled "The Quest for Giant Telescopes: Four Centuries of Challenge and Scientific Discovery."

The scientific program, which focuses on astrophysics, particle physics, nuclear physics, and related fields, will consist of three plenary sessions, approximately 75 invited sessions, more than 100 contributed sessions, and poster sessions. The meeting will be co-located with the Sherwood Fusion Theory Conference.

APS units represented at the meeting include the Divisions of Astrophysics, Nuclear Physics, Particles and Fields, Physics of Beams, Plasma Physics, and Computational Physics; the Forums on Education,



Physics and Society, International Affairs, History of Physics, and Graduate Student Affairs; and the Topical Groups on Few-Body Systems, Precision Measurement and Fundamental Constants, Gravitation, Plasma Astrophysics, and Hadronic Physics.

In addition to the regular program, there will be several special events, including a professional development workshop for women physicists, a high school teachers' day, a students' lunch with the experts, and the presentation of APS prizes and awards in a special ceremonial session. A special symposium on the APS energy efficiency report will be held May 2.

A town hall meeting on the DOE/NASA Joint Dark Energy Mission (JDEM) will be held on Saturday, May 2. A town hall meeting on the NRC's Astronomy & Astrophysics Decadal Survey will be held on Monday, May 4.

For further details of the program and registration information visit: http://www.aps.org/meetings/april/

The abstract submission deadline is January 9. The Early Bird registration deadline is February 27.

Physics Degrees Retain Value in Weak Economy

With the economy in a severe recession, states are cutting funds from public colleges and universities, and private universities have lost money from their endowments. Many colleges and universities have reported implementing or considering measures such as hiring freezes, salary freezes, furloughs, and other cuts to save money. In addition, many national labs are under funding pressures, and industries are under duress. Given this challenging job market, physicists may be faced with a difficult situation. But in the long run, people with degrees in physics tend to fare relatively well, and APS will do what it can to help.

"One of main roles of APS is to serve the community," said 2008 APS President Arthur Bienenstock. "We will be looking for ways to help physicists through any difficult times ahead and welcome suggestions on how we can be of service. I think over the long haul people who have analytic skills and a creative background will be much more in demand than most college graduates. Many career fields are open to those with training in physics."

"My basic view of the job market for physicists is that it is always very strong, but it is also well hidden," said Mark Sincell, Chair of the APS Committee on Careers and Professional Development. Many people with physics degrees will find work in areas not traditionally associated with physics. Recent graduates may need to be patient, and consider a wider range of options in their job search.

While data are not yet available on the rates of unemployment for physicists or other scientists for this year, the job market for PhD physicists has in fact been looking down for several years, according to Roman Czujko, Director of the Statistical Research Center of the American Institute of Physics.

One indicator, according to Czujko, is the fraction of new PhDs who take postdoctoral positions. This fraction has been increasing in recent years, reaching about 60% for the classes of 2005 and 2006. The proportion of new PhDs taking postdocs also increased sharply during the mid-1980s, preceding a major recession. While some postdocs indicate that they took the position to advance their career, many accepted a postdoc position because they could not obtain a suitable potentially permanent position.

However, physics PhDs typically have very low rates of unemployment, lower than for PhDs in other fields. In general, those with PhDs in any field have lower rates of unemployment than those with less education. Nonetheless, those who graduate during a bad economy do struggle. "In general we are expecting a lot of new degree

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Nominations are Key to Increasing Number of APS Women Fellows

By Nadia Ramlagan

In February of 1900, Jeannie Evans and Jessie I. Spofford were elected as APS Fellows–the earliest recorded names of female Fellows from APS archives. The Society itself had been founded less than a year before.

Since then, according to the APS Committee on the Status of Women in Physics, over 300 women have become APS Fellows. Although it is increasing, the number of women receiving Fellowship yearly remains relatively small. For example, in 1997 and 1998, there were 10 and 13 new women Fellows, respectively; in 2001 and 2002 there were 13 and 26, and in 2006 and 2007 there were 15 and 25. Of the two hundred and twenty five 2008 Fellows approved by the APS Council at its November meeting, 18 are women.

Only half of 1 percent of roughly 47,000 APS members can be elected to Fellowship yearly. As it currently stands, 94% of Fellows are male and 5% are female, with the remaining 1% providing no gender information, according to the APS membership database. Given that women constitute approximately 11% of total APS membership, there is a definite need and opportunity for improvement.

The Fellowship election process begins with a nomination by one's peers; there is no way to be elected if one is not nominated. Every individual nomination needs a sponsor and a co-sponsor, each of whom must be APS members. Nominations are evaluated by the Fellowship Committee of the relevant Division, Topical Group or Forum, and after review by the APS Fellowship Committee, those who have been recommended are elected by full APS Council.

"Women who are nominated to their unit have a very good chance of being selected for inclusion on the list of proposed new Fellows: the bottleneck is the nomination

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Physicist Chosen to be Secretary of Energy

Steven Chu, Director of Lawrence Berkeley National Laboratory, has been chosen by President-elect Barack Obama to be nominated the next US Secretary of Energy.

Chu, an APS Fellow, received the APS Arthur L. Schawlow Prize in Laser Science in 1994 and the APS Herbert P. Broida Prize in 1987. He received the Nobel Prize in 1997 for his work on laser cooling and trapping of atoms.

"Steve Chu's scientific accomplishments make him an outstanding selection for US Energy Secretary. As the Obama administration develops its energy policy, he will undoubtedly serve as an effective leader, striving to strengthen US energy security and tackle the devastating effects of global warming," said APS Past-President Arthur Bienenstock.

Chu has been a strong supporter of renewable energy and an advocate of controls on greenhouse gas emissions to combat global warming. As director of Berkeley Lab, he increased the lab's focus on researching clean energy technology, including advanced biofuels and solar energy technology. Chu has also been a leading organizer of the Joint BioEnergy Institute, one of three Bioenergy Research Centers funded by the U.S. Department of Energy, and the Energy Biosciences Institute, a $500 million pact among BP, the University of California, Berkeley, Berkeley Lab, and the University of Illinois.

Steve Chu

Chu received his PhD in 1976 from the University of California, Berkeley. He worked at Bell Labs from 1978 to 1987, then became a professor in the physics department at Stanford University. He served as chair of that department from 1990-1993 and 1999-2001. He became director of Berkeley Lab in 2004.

Seven Thousand and Counting

Photos by Ken Cole

A record number of 7,156 abstracts were submitted to this year's March Meeting. In December, a heroic band of about 130 physicists met at APS headquarters in College Park, MD to sort them all into appropriate sessions. In the top photo, Barry Wells of the University of Connecticut (center) makes a point to Karin Rabe of Rutgers (left) and Jaime Fernandez-Baca of Oak Ridge. In the bottom photo, March Program Committee Chair Allen Goldman of the University of Minnesota (left) consults with DCMP program representative David Pine of New York University (center) and Mark Stiles of NIST.

Members in the Media

"Every extrasolar planet detected so far has been a wobble on a graph. These are the first pictures of an entire system."

***Bruce Macintosh**, Lawrence Livermore National Laboratory, on new pictures of extrasolar planetary systems,* The New York Times, *November 13, 2008*

"It's not the way to do science in the long run."

***David Weitz**, Harvard University, on the decline in funding for space experiments following President Bush's Moon-Mars initiative,* Philadelphia Inquirer, *November 18, 2008*

"We're chasing the perfect dimple pattern."

***Kyle Squires**, Arizona State University, on how the dimples on a golf ball affect the distance it travels,* The Toronto Star, *November 25, 2008*

"We're here, so that means life can exist,"

***Sean Carroll**, Caltech,* Pasadena Star News, *December 8, 2008*

"We've shown that the sorting out of the different odorants before they even get to the receptors is also important."

***Brent Craven**, Penn State University, on his study showing that dogs' wet noses help their sense of smell,* The Daily Mail *(UK), November 27, 2008*

"You get a high pressure from that initial blast wave hitting any unprotected surface, and then you get focusing under the helmet as the blast wave penetrates the helmet."

***David Mott**, Naval Research Laboratory, on his simulation of helmets exposed to explosions,* San Antonio News, *November 26, 2008*

"It's not bad until a storm moves in. You put your hand out 'til you can't see it. Then you go out and start shoveling snow."

***John Wefel**, Louisiana State University, describing the weather at the McMurdo station in Antarctica,* The New York Times, *November 25, 2008*

"By 2015, there will be more optical links in one high-performance data center than in all telecommunications links worldwide."

***Yurii Vlasov**, IBM, predicting the growth of photonics,* Forbes, *December 8, 2008*

"It is not now cost-efficient, although the materials are cheap because it's plastic."

***Alan Aspuru-Guzik**, Harvard University, on plastic solar cells,* Reuters, *December 8, 2008*

"Let us all do our part to make sure that this never happens again, not just in India, but everywhere."

***Mohan Bhagat**, University of Maryland, at a vigil for the victims of the terrorist attacks in India,* The Prince Georges County (MD) Sentinel, *December 9, 2008*

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recipients to suffer,"said Czujko.

Sincell says he would still advise people who are interested in physics to get a degree in physics, rather than choose to study something more "practical." "The primary reason one should get a physics degree is because one is interested," he said. Sincell also points to the versatility of a physics degree. He notes that it is always challenging to find a job in a recession, but in the long run the prospects are good. The employment situation is difficult now for all fields, he said. "My experience has been that having a physics degree can work to your advantage because it is more general," he said. "I think it doesn't limit your possibilities. I think it does the opposite." In fact, *APS News* has been running a series of articles, called *Profiles in Versatility*, highlighting the diverse careers of people with physics degrees.

One area where there is clearly a demand now for physicists is high school teaching. Bienenstock says that he sees indications that many more high school physics teachers will be needed in the future.

For those looking for employment, APS holds career fairs regularly at the APS March meeting and some unit meetings, and there is an online job board at careers.aps.org. Unemployed APS members can qualify for a membership fee waiver by notifying the APS membership department.

In addition, APS has a careers website that includes advice about physics careers for middle school students, undergraduates, graduate students and postdocs (http://www.aps.org/careers/). The APS careers committee has been working to put more resources online and make those resources more visible to online searches. APS is also offering a travel grant to help physics departments that bring in speakers on career issues.

This Month in Physics History

January 1998: The accelerating expansion of the universe

In the mid-1990s, two competing teams began observing supernovas with the goal of pinning down the rate at which the expansion of the universe was slowing down. Much to everyone's surprise, they found just the opposite: the expansion was not slowing down, but speeding up, driven by a mysterious unseen force. In early 1998, the researchers announced these strange results that shook up the field of astrophysics.

In 1917, as he was developing his theory of general relativity, Einstein added an arbitrary constant term to his equations in order to keep the universe static and unchanging, as it was then believed to be. Without this term, an initially static configuration of matter in the universe would tend to be pulled together under gravity; the cosmological constant was needed to counteract that tendency and keep the universe from collapsing.

However, in 1929, Edwin Hubble looked at the redshifts of faraway galaxies and found that the rate at which an object is receding from us is proportional to that object's distance from us. The universe was actually expanding, not static at all. The cosmological constant looked unnecessary, and Einstein then abandoned it, calling it his greatest blunder.

After Hubble's discovery, for the next few decades most scientists believed that there was no cosmological constant. It was assumed that matter dominated the universe and would eventually cause the expansion to slow down. Depending on just how much matter there was in the universe, it might eventually collapse in a big crunch, or go on expanding forever, but more and more slowly.

Research concentrated on determining the history of the expansion of the universe by looking at extremely distant objects. Comparing the redshift of these objects with their distance gives a measure of how fast the universe is expanding.

But getting accurate distances to faraway objects is difficult. One way to do this is to find so-called standard candles, objects whose intrinsic brightness is known and thus can be compared with their apparent brightness to give a measure of their distance from us. Type Ia supernovas are just such objects. They occur when a white dwarf star that is part of a binary system attracts some extra mass from its companion star. When the white dwarf reaches a particular mass (about 1.4 times the mass of the sun), it explodes. These supernovas are extremely bright, visible billions of light years away. Since all type Ia supernovas explode when they reach the same mass, they make good standard candles. By the mid-1980s automated searches had begun to find these rare events.

In the late 1980s, a team called the Supernova Cosmology Project, led by Saul Perlmutter at Lawrence Berkeley National Laboratory, began their search for type Ia supernovas.

Starting in the mid-1990s, a second team, called the High-Z Supernova Search, led by Brian Schmidt of the Australian National University and Adam Riess of the Space Telescope Science Institute, worked on a competing effort.

The research teams used both ground-based telescopes and the Hubble Space Telescope in the race to find supernovas billions of light years away and use them to measure the (presumed) slowing of the expansion of the universe.

By late 1997, supernova data were piling up, and both groups were noticing that the distant supernovas were fainter than expected, indicating that the universe's expansion is actually speeding up, not slowing down.

In January 1998, at a press conference held during the Washington, DC meeting of the American Astronomical Society, the Supernova Cosmology Project team announced that they had analyzed 40 supernovas and found that the universe's expansion would continue forever, and that the data could be explained by a cosmological constant.

After that press conference, one reporter picked up on the incredible news that there were signs of accelerating expansion and a mysterious force pushing the universe apart ever faster, while most simply reported that there would be no big crunch.

In February, the High-Z team presented their supernova data at a conference, also showing that the expansion of the universe is accelerating. Now it was clear that some strange, unseen antigravity force was driving the universe apart. Both teams soon published papers in refereed journals. These findings were completely contrary to everyone's expectations, but with the two competing teams finding the same shocking result, they had to be taken seriously.

Later that year cosmologist Michael Turner coined the term "dark energy" to describe the mysterious force, in analogy with the invisible dark matter that makes up most of the matter in the universe.

Science magazine called the accelerating universe the "Breakthrough of the Year" in December 1998.

Now, more than ten years after the discovery, further results have confirmed that the expansion of the universe is accelerating, but the bizarre dark energy remains a mystery.

One candidate for dark energy is a cosmological constant, just as Einstein predicted (though with a different value). Quantum theory predicts that vacuum fluctuations, virtual particles that flit into and out of existence, provide energy to empty space. Unfortunately, the energy density associated with these vacuum fluctuations is, according to theoretical calculations, a whopping 120 orders of magnitude greater than the energy density cosmologists measure. Other suggestions for the dark energy have been made, and further studies are underway, but for the most part, scientists remain in the dark.

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Editor . . . . . **Alan Chodos**
Staff Writer . . . . . **Ernie Tretkoff**
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Science Writing Intern . . . . . **Nadia Ramlagan**

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Murray Stresses Long-Range Planning to Address Key Issues

Cherry Murray (Deputy Director for Science and Technology at Lawrence Livermore National Laboratory,) assumed the APS presidency on January 1, 2009. In the following interview with APS News*, she discusses her priorities for the Society during her presidential year.*

Q: What do you see as the most pressing issues facing the physics community right now?

A: Obviously there are some major issues at the forefront. First, let me start out with the challenges facing the nation and also the globe: national security, energy security, environmental security, and human health. And on top of that there's the global financial crisis and US economic security. All of the challenges facing the globe require the underpinning of an incredibly strong and vital science and engineering enterprise.

First, The Rising above the Gathering Storm Committee at the National Academies, on which I served, identified several areas of concern where I believe APS can play a role: the gathering storm that we see in this country is a lack of a future science and engineering workforce and plan for retaining our high tech economic sector that drives the rest of the economy. We have fallen down considerably. The US has become much too complacent. What APS can do is help to provide science teachers, and in particular physics teachers. The PhysTEC program is an excellent example of this. APS can also work to make sure that the US is getting the best and brightest into our higher education system, giving incentives for the foreign graduate students in the US to stay in the US, and increasing the number, the caliber and the diversity of our US citizen students, increasing our research funding to academia and national labs, and then providing incentives to industry for high-paying jobs in the US.

Second, it is really important that we have a strong science diplomacy effort. For example, Palestinian, Israeli and US scientists are working together on water issues in the desert. This is some of the best diplomacy that we can possibly do. I'm hoping that AAAS, which has a new science diplomacy center just established, APS, with its strong Forum on International Physics, the National Academies, and other societies can work together with the State Department, to promote this.

The third point has to do with the changing nature of the research enterprise in the 21st century. The global problems–and 21st century science–are multidisciplinary, and usually require teamwork. I believe that physics is a way of looking at the world and understanding how to solve problems. Physics thinking is very important in addressing these societal challenges and for advancement of science in general. I'm very supportive of the APS initiative to double the number of physics majors in the US. I expect that many of those majors will go on to different fields, including all of the branches of science and engineering, but also the law profession, social science, and government. I really do believe we need to have more science knowledge in government.

Q: What will be your focus during your presidential year?

A: We need a long-range plan for how the nation is going to address all of these challenges. Physics can play a huge role. I would like to see APS work with the National Academies and other professional societies to provide a unified picture. I am also the chair of the Division of Engineering and Physical Sciences at the National Research Council and I'm on the AAAS board. I think APS can be a leader at bringing the societies together.

For APS, I plan to focus, very much like APS past-president Helen Quinn did five years ago, on stepping back and looking at what we want to do in the future and how we are going to accomplish everything that we set as our goals. APS has a new opportunity and challenge, which is that the three top executives of the organization will all be relatively new, and I believe this is a time to look at an updated strategic plan for the Society.

Q: The APS has been trying to increase its efforts in educa-

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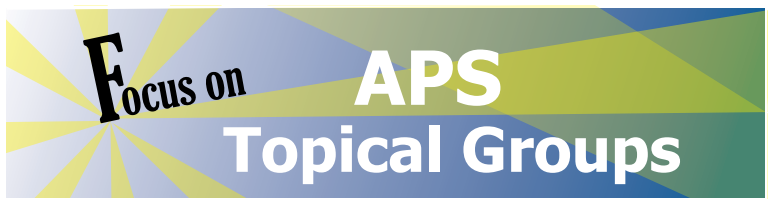

Focus on APS Topical Groups: Quantum Information

By Nadia Ramlagan

In just a few short years, the APS Topical Group on Quantum Information has burgeoned into an important focal point for researchers across a wide range of fields, while maintaining its dedication to continued discussion and vitality of research on the foundations of quantum theory.

The field has diversified itself so much that across the wide table of what the GQI represents is a variety of contributions from applied math, engineering, and computer science–fields which traditionally do not see APS as their primary home.

"What is clear is that the field is still booming and growing; I think one interesting aspect is that we are seeing more and more cross-collaboration with different disciplines; areas that used to be disjoined like quantum gravity or condensed matter or statistical physics aspects like quantum chaos and randomness are now sharing interesting ideas. It speaks to the cross-disciplinary nature of our field, "said Past Chair Lorenza Viola.

Yet the umbrella of the GQI will always provide a welcoming home for those pursuing speculations in the foundations of quantum theory, Chair-elect David DiVincenzo believes. "From the philosophical implications of quantum mechanics to what do we mean by wave function collapse? And, is there an alternative to the conventional theory and interpretation of quantum mechanics?" he said.

A major trend in current research is superconducting qubits; a whole symposium will be dedicated to the topic at the 2009 March Meeting. Superconducting qubits provide a new means of manipulating light one photon at a time by superconducting devices. "It is a very robust corner of the group right now, it probably constitutes a third of all research activity, as measured by contributed papers at the March Meeting," said DiVincenzo.

Superconducting devices are one of a number of possible technologies for storing and processing data in the physical realization of quantum computers. "This a big long-term goal that people would like to get to, and that is being attacked at all levels except the commercial, as no one has a large, working quantum computer yet", adds DiVincenzo. In addition, there is a bulk of research exploring the many different approaches to the sub-systems involved in the physical realization of quantum computers, areas that are well represented in the GQI.

Several smaller (in terms of number of researchers working within them) areas represent equally important future directions in fundamental research for the GQI community, including Quantum Shannon Theory. Denoting the application of the mathematical techniques of communication

QUANTUM continued on page 7

Civic Engagement Benefits Both Science and Society

The APS Council passed a statement supporting the civic engagement of scientists at its November meeting (see sidebar).

"Civic engagement is good for physics and itís good for the country," said Francis Slakey, APS Associate Director of Public Affairs.

APS has been working with other scientific societies to increase scientists participation in public service at the federal, state and local levels. In May, APS and other scientific societies sponsored a campaign education workshop (see APS News, June 2008). The workshop was organized by Scientists and Engineers for America, an organization that aims to promote a politically active scientific community. There were almost a hundred attendees, of whom at least half a dozen worked on a campaign this election season, according to Slakey.

Lesley Stone, Executive Director of Scientists and Engineers for America, identified several dozen people with science backgrounds who ran for Congress this fall. For instance, chemical engineer Marge Krupp ran for Congress in Wisconsin is 1st district against incumbent Paul Ryan. Though she didn't win the election, she said voters seemed to respect a scientific background. "People think that being a chemical engineer is so cool," she said. Krupp says she ran for Congress because of her strong opinions on several issues facing the country, including some, such as global warming, where a scientific perspective could be valuable. She pointed out that the general analytical skills and understanding good data from bad are useful for many issues. "We do need more scientists and engineers in office," she said. Among the current members of Congress, three have PhD's in physics.

In addition to being elected scientists can also serve in administrative positions in the executive branch. Robert Eisenstein, a member of the APS Panel on Public Affairs who worked for more than ten years in a leadership position in the mathematical and physical sciences division of the National Science Foundation, said that he had often found it a struggle to convince scientists to do that kind of public service. "I love the interaction between science and policy. I wish the community respected it more," he said. He noted that many scientists do engage in public service in various ways, but that the perception sometimes is that the work isn't interesting or that you can't have an effect. "It's not true that you can't have an effect. You can have a huge effect," he said. "The bottom line is there's a civic aspect to being a scientist. Yes, it takes time, and yes, it's hard, but it's important."

One of those who attended the May workshop and then got involved in a campaign was Maria Cranor, who worked for Barak Obama. Cranor, a physics graduate student in Utah who also has experience in business and management, had never participated in a campaign before. "I thought the conference was marvelous," she said. She made contacts with other scientists interested in public service and met other Obama supporters. "One of the reasons we got involved in the campaign was because of that conference," she said.

Cranor volunteered as an "Obama fellow" for six weeks in the summer, during which time she learned about community organizing, and then was hired as a field manager. Working in Colorado, she organized support for Obama, made cold-calls to potential supporters, and set up meetings. "It was a fabulous learning experience for me," she said.

While the campaign work mostly involves building relationships with people and didn't use her specific scientific expertise, she said good analytical skills are often useful. She also believes the campaign experience will enrich her teaching in the future. Cranor is interested in teaching science to nonscientists, as well as teaching undergraduate and graduate students more about policy issues related to science and getting them to think more about the uses to which science is put.

Text of APS Statement on Civic Engagement

At its November meeting, the APS Council has passed the following statement on civic engagement of scientists:

Many of the complex problems our society and its public officials face require an understanding of scientific and technical issues. Basic scientific knowledge is critical to making balanced policy decisions on pressing issues such as climate change, energy policy, medical procedures, the nation's technical infrastructure, and science education standards.

Increasing the representation of scientists and engineers in public office at the federal, state and local levels, and in positions of responsibility at government agencies, can help ensure that informed policy and science funding decisions are made. Scientists and engineers in public office–including school board members, mayors and legislators–have made significant contributions, not only on specific scientific issues but also by bringing their analytical and problem-solving abilities into the arena of public service. Additionally, many have found that civic engagement has contributed to their professional development through exposure to the broader implications of their work.

The American Physical Society recognizes that its members elected to public office or who hold key scientific and technical positions within government effectively serve both the physics community and the broader society. We strongly support the decision of members of the scientific and engineering communities to pursue such positions.

Letters

Goal Must Be Nuclear-Free World

In response to "Public Affairs Report Examines Nuclear Weapons Policy" (*APS News*, November 2008): The report appears to stress how to reinforce the US Nuclear Arsenal and how to induce other nations to reduce their Nuclear Arsenal. Such a biased approach can only lead to a catastrophe in the long run. One should start by stating that large Nuclear Arsenals are the foremost menace to the survival of humanity, and given that fact all nations should contemplate how to converge towards a world without Nuclear Weapons. That will necessarily involve the cooperation of all present and future Nuclear Powers.

Hopefully physicists should lead the way. I am optimistic that our next President may be sensitive to such issues.

Henry Blumenfeld
Gif sur Yvette, France

Ed. Note: *The APS/AAAS/CSIS report, Nuclear Weapons in 21st Century U.S. National Security, calls for deeper reductions in the US and Russian arsenals while maintaining the safety, security, and reliability–with no new capabilities–of any remaining weapons. (The full report is available on the APS website.) In support of President-elect Obama's vision of nuclear weapons elimination, the APS Panel on Public Affairs is now considering a study to evaluate and substantially improve verification technology.*

Fusion Power Plant Dubbed Ridiculous

Nadia Ramlagan's description of a 1 GW-day electrical D-T fusion power plant ["Bringing the Sun to Earth: Briefing Explains ITER Fusion Experiment," November *APS News*] sounds benign and reasonable as compared to a coal burner. Arithmetic reveals the perfect fusion power plant is ridiculous and pestilent. D-T fusion yields a 3.5 MeV He-4 nucleus and a 14.1 MeV neutron. Stated daily emission of 0.5 lbs of 14.1 Mev neutrons sums to 7.3×10^{13} calories or 73 kilotonnes nuclear, 80% of the power plant's fusion thermal output. Kinetic energy is recovered from neutral particles by inelastic collision (thermal neutrons continue to propagate) or nuclear reactions (lithium fission to tritium). The fusion reactor's inner wall is an exercise of academic elegance, not reality. One GW-day thermal is 2×10^{13} calories. Where does 70% of the power plant's thermal output go? 1.5 lbs of tritium/day, given 28.8 Ci/mmole specific activity, is 6.5 million gaseous curies/day. That is 2700 liters of gas at room temperature with a decay heat of 190,000 calories/hour (mean decay energy of 5.685 keV). The emperor is clothed in carbon nanotube fabric only visible to the worthy. Don't stand downwind.

Al Schwartz
Irvine, CA

Imagining the Future of Scientific Software

Michael Nielsen (The Back Page, *APS News*, November 2008) writes "We should ... create an open scientific culture where as much information as possible is moved ... onto the network ... [including] data, scientific opinion, questions, ideas, folk knowledge, workflows, and everything else." He does not explicitly mention software, but it raises the question: What would ideal scientific software look like? I propose the following criteria: (1) free; (2) collaboratively built, (3) extensible; (4) self-contained; (5) modular; and (6) intellectually traceable. Of these conditions (1), (2) and (3) are, by now, banal. About (4), much existing freeware requires other freeware which requires other freeware. It isn't necessarily backward compatible. I recently failed to port a code; along the way I found myself making a "software museum" of versions of GNU packages current at the time the code was frozen. About (5), it should be possible to use pieces of the whole without using the whole package. My personal example here is I found myself spending a month rewriting a code because I couldn't disentangle a bit of it from a larger package; in particular, the initializations were diffused throughout over 250,000 lines of code in a common class statement. About (6), it should be possible to reconstruct the equations from comments in the code including references to journal articles.

My nightmare vision (and I need precious little imagination) is that a day comes in which we don't understand the codes we have, and we can't fund their redevelopment because the problems have already been solved.

Zachary Levine
Rockville, MD

Correction

In the article entitled "Bringing a Sun to Earth: Briefing Explains ITER Fusion Experiment," in the November *APS News*, it should have been stated that the host for ITER is the European Union, not France. As such, it is the EU (not France) that has committed to provide roughly 45% of the ITER resources.

In addition, the sponsors of the briefing were ASME and IEEE-USA (the US unit of IEEE). Also, on the current reference schedule, the first plasma is expected to begin in July 2018, not 2016.

APS Report Short-changes Plug-in Hybrid Technology

My letter-to-the editor, "Plug-ins are a Panacea" (*APS News*, August-September 2008), pointed out that despite extensive propaganda to the contrary, batteries were not an obstacle to plug-in hybrid cars. Now, having read the APS Report, *Energy Future: Think Efficiency*, I have come to the disturbing conclusion that the Report itself constitutes part of the propaganda campaign against the plug-in hybrid: "Given the technical difficulties, plug-in hybrids will not replace the standard American family car in the near term."

The referenced technical difficulties relate to the battery, which the Report says is not ready for prime time, based primarily on a private communication that the battery would add nearly $20,000 to the price of the vehicle from the expected cost of a new lithium ion battery going into the Chevy Volt by General Motors (GM), plus a projected five-to-ten-year learning curve to work out the glitches.

This despite the fact that both GM, with its EV-1, and Toyota, with its RAV4-EV, produced all-electric vehicles, whose nickel metal-hydride (NiMH) batteries could power them for 120 miles on a single charge. The GM EV-1's were later all shredded, but many of the Toyota EV's are still on the road with their original batteries. Nothing in the Report indicates any reason why a battery suitable for an all-electric vehicle would not work in a plug-in hybrid, which only requires a 40-mile trip on a charge.

However, the NiMH batteries used in these vehicles, the Panasonic EV-95, are no longer in production. GM bought the patents for them in 1994, sued Panasonic, and recovered $30 million, after which the line of EV-95 batteries was shut down. In 2000, GM sold their control of EV batteries to Texaco, which became part of Chevron, and that's where it stands now.

Thus it appears that the problem with batteries is legal and political, not technical.

The panel which prepared the Report knew or should have known about these matters and addressed them. Had they done so, they would have been compelled to arrive at substantially different conclusions and recommendations regarding plug-in hybrids, which are indeed a panacea, as the Report implicitly acknowledges.

These are serious issues. The Big Three automakers are seeking large amounts of money from the government. When they sit down with President-elect Obama, they will be armed with the Report, with the imprimatur of the American Physical Society, to show that plug-in hybrids are not ready for the market. Thus the APS will have been used by the Big Three and Big Oil to assist in another giant ripoff of the taxpayer, the consumer, the planet, and yes, national security.

Robert Levy
El Paso, TX

Burton Richter Responds

Ed. Note: *We asked Burton Richter, who chaired the APS study group that produced the energy efficiency report, to comment on the above letter. Here is his reply.*

Robert Levy seems to think the APS energy efficiency report was too negative about the state of the batteries required for plug-in hybrid vehicles (PHEVs). On the contrary, the report was, I thought, clear that we regarded PHEVs as one of the most important developments in the automotive industry to reduce both gasoline consumption and emissions. We did say that if all the light vehicles were plug-ins with a 40 mile electric range, gasoline consumption would decrease by 60%

What the report meant to say about the batteries for the Chevy Volt is that they are the first generation of a new Li-Ion battery and as such are not likely to be good enough for the FULL span of all the light vehicles on the road. When they first appear they will be expensive and will need the kind of real life testing that comes from having a fleet of Chevy Volts running. General Motors has not announced prices yet, but as reported in the auto press, the cost of a Volt is likely to be around $40,000. I expect that within 5 to 10 years battery manufacturers will have worked their way down the learning curve and they will be suitable for all the light vehicle fleet. Perhaps we were not clear enough.

My wife had the all electric GM EV-1. When they first appeared they could only go about 60 miles with their first generation of batteries. When we got ours, they were using Ni metal hydride batteries and could go 120 miles on a charge. Its lease cost was about the same as a Mercedes sedan. Over the 3 years we had the EV-1, it was recalled for software and firmware fixes six times and for hardware fixes twice. I don't expect miracles from the Volt, but I do expect plug-ins to take over as the technology matures.

LHC is an Avatar of International Science Collaboration

Advancing science, pushing technology, and bringing together scientists from countries around the globe are among the benefits of the Large Hadron Collider, according to Lyn Evans, project leader for the LHC. He outlined the status of the LHC and the importance of large international collaborations at an event on Capitol Hill in November sponsored by APS, the American Association for the Advancement of Science, and the British Embassy.

CERN, the European Center for Nuclear Research, was established in 1954, nine years after the end of World War II. Geneva was selected as the site for the laboratory, said Evans, because "Geneva was neutral, and it was cheap. It is still neutral."

As an international laboratory, one of CERN's goals has been to bring scientists together across national boundaries and train students in an international environment. "An essential feature of CERN is collaboration," said Evans. CERN has 2415 staff, 730 Fellows and Associates, and 9133 users from all over the world. The United States is an observer state; 1278 of CERN's users come from the US.

In his talk, Evans described the areas where the LHC could make important discoveries. "The first real mystery is what is the origin of mass," Evans said. "It may seem a strange question to ask," he said, since mass seems intuitive to most people. Theory predicts the existence of a Higgs boson, which gives mass to other particles. The LHC has been designed to cover the mass range where the Higgs is predicted to be. "If the Higgs exists, the LHC will find it," Evans said.

Other questions the LHC could potentially answer include the origin of the matter/antimatter asymmetry and the nature of dark matter and dark energy. It may also pick up evidence of supersymmetry or extra dimensions, Evans said. While the Higgs has been promoted as the main discovery the LHC is expected to make, Evans emphasized that the LHC could find many things we haven't even considered yet. "I think the Higgs is oversold," he told *APS News*. "The LHC is a discovery machine."

In response to a question about the timescale for discoveries, Evans pointed out that experimental results will not come out immediately once the machine turns on again. The LHC will be running for many years, and it might take several years before significant results come in. The next steps for the field of particle physics will depend on what the LHC finds, Evans said.

The LHC is 17 miles in circumference, and will accelerate protons to 7 trillion electron volts. Accelerators have grown exponentially in size and energy over the years, Evans pointed out. The first circular accelerator, built at Berkeley in 1930, was only five inches in diameter and accelerated ions to 80,000 electron volts.

The improvements over the years have been achieved not by bigger and bigger budgets, but by pushing technology, Evans said. Since the 1980s, superconductivity has been the key to increasing the energy accelerators can reach. The LHC uses 7000 km of superconducting Nb-Ti cable and 23 km of superconducting magnets. An equivalent accelerator without superconducting technology would have to be much larger and consume much more power, Evans said.

With the uncertainty in the US budget cycle, one never knows from year to year what will happen, but the LHC has been lucky so far (unlike, for instance, ITER), Evans said. "The best we can hope for is stability in budget."

The LHC was shut down shortly after its initial opening in September 2008 due to an electrical failure that caused a helium leak, which damaged some of the magnets. The failure was caused by one bad connection among 10,000 electrical connections. "We did the best we could with quality control," Evans told *APS News*. "It's a good thing that it happened now," rather than later, he said. Evans added that work had been done on figuring out how to spot such defects in the future to prevent further problems.

It has been estimated that it will cost $21 million to repair the problem. The LHC is not expected to restart until summer 2009. "When you get a problem, it's a long time to make a repair," said Evans.

Once the LHC does restart, there will soon be a massive amount of data to be processed after the LHC gets running again.

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Token of Appreciation

Photo by Ken Cole

Following a tradition that began 2 years ago, at the November Council meeting APS Executive Officer Judy Franz (right) presented past-President Leo Kadanoff with a bound volume containing the minutes of all the meetings that he chaired during his Presidential year in 2007. In addition to his many other duties, Kadanoff chaired 5 Executive Board meetings and 2 meetings of the APS Council.

NAS Launches New Program to Connect Scientists and Entertainment Professionals

When the worlds of science and Hollywood collide, the results often highlight the differences between the two realms instead of celebrating their similarities. The National Academy of Sciences is trying to change that with a new initiative: The Science and Entertainment Exchange. The goal is to connect the entertainment industry with scientists and engineers to work on everything from movies, television, and even video games.

"This is the Academy's first formal effort to reach out to Hollywood," said Ralph Cicerone, president of the National Academy of Sciences, at the November 19th symposium held at the Creative Artist's Agency in Los Angeles to officially launch the Exchange. "We are very hopeful that it's going to give the general public better access to science through entertainment, whether factual or fun."

Cicerone will chair the Exchange's advisory board. The Exchange is endorsed by the Directors Guild of America, the Producers Guild of America, the Writers Guild of America, and Women in Film. Director Jerry Zucker, producer Janet Zucker and Abraxis Bioscience CEO Patrick Soon-Shiong will serve as vice chairs of the advisory board. "We would love to use the power of Hollywood storytellers to educate," Jerry Zucker said. "There is a fear of science, and that is what we would like to dispel. I want people to embrace science, to be excited about science."

At the symposium, film directors and screenwriters were inspired and entertained while listening to some of the top scientists in the country talk about their research. "It's like introducing your two best

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Scene from a Symposium

Neil deGrasse Tyson is an astrophysicist, and director of New York City's Hayden Planetarium, so he knows his night sky. He was very irritated by a scene in the blockbuster movie *Titanic*, in which Rose (Kate Winslet) floats on a wooden plank after the ship sinks, staring up at the night sky.

Director James Cameron went to extraordinary lengths to recreate the actual ship down to the tiniest historical detail, including the china patterns. And yet, said Tyson, "Here we knew the day, the month, the year, the time of day, the latitude and the longitude. There should have been only one sky [Rose] was looking up at in that scene–and it was the wrong sky!" He was so peeved at this slight to good science that he dashed off a letter to Cameron. Predictably, he received no reply.

Then Providence intervened. Tyson ran into James Cameron in person, and proceeded to repeat his complaint. Cameron listened patiently and then sarcastically observed, "I see what you mean. That movie only grossed [umpteen million] dollars. Imagine how much more money it would have made if we'd just had the right sky!"

Tyson, to his credit, was suitably mollified: "I had no response to that." Cameron had pointed out a glaring difference in their priorities: scientists care about technical accuracy. Filmmakers might care up to a point, but ultimately, they want to tell a compelling story that will resonate with millions –and beef up their bottom lines.

Here's the twist. A few months later, Tyson received a call from a production assistant in Cameron's office. They were putting together the director's cut DVD and including a few extras. The assistant said, "I understand you have a sky for us...."

Viewpoint...

We are Science

By Chad Orzel

If you listen to people talking about new ways of doing things, you'll frequently hear references to Science or Academia as if they were vast but monolithic entities existing in their own right.

Statements like "The culture of Science does not reward open access..." or "Modern Academia does not reward high-risk research..." are quite common. They also are often paired with a call for external relief, usually through some government mandate: "We need funding agencies to make this a condition of grant funding."

I always find these statements faintly annoying, because they're based entirely on a flawed premise. There is no "Science." There is no "Academia." These things do not exist as coherent entities, any more than "The Market" does.

What we think of as "Science" is the result of the individual actions of millions of scientists.

What we think of as "Academia" is the result of the individual actions of millions of people working in higher education: faculty, deans, academic staff.

There are two main implications of these facts, the first being that if you really want to change scientific or academic culture, you need to change the minds of the people making up those cultures. You need to convince them that the things you want them to do are worth doing, and in their best interests to do.

This is a hard project, and it's the reason why so many people are prone to calling for external mandates to change things. Getting the NSF or the NIH to order people to adopt your preferred behavior seems like an easier task than convincing the people directly. You only need to convince a few agency heads to change, and then, presto, everyone else will go along.

It's a nice idea, but it's nothing but a comforting illusion. The funding agencies won't implement your policies for you, and even if they do, it won't do any good. When the NIH requested that researchers deposit their data in the PubMed database, they got 4% compliance. Making it a requirement boosted that to 56%, 30% directly by authors with a further 26% from journals after publication–but nowhere near 100%.

Or consider the public outreach requirement of NSF grants. Researchers submitting grants to the NSF are required to include an explanation of what they will do to disseminate their results to a broader audience. I've reviewed a good number of NSF proposals over the last few years. Typical responses on the public outreach section are of the form "We train a lot of graduate students in our lab, and some of them will go on to become educators," which is a complete cop-out.

The fact is, any attempt by the NIH or any other agency to mandate these sorts of practices is nothing but a bluff that huge numbers of researchers will be happy to call. After all, are they really going to start denying funding based on a failure to meet public outreach requirements? Hardly–especially when the bulk of the review work is done by other researchers in the field. If people in the field are not convinced that outreach or open access are things they ought to be doing, they're not going to give it any weight in reviewing proposals, and those rules will be every bit as effective as speed limits on major highways, which not even the police bother to heed.

There is no way around the fact that changing scientific or academic culture requires changing the minds of the scientists and academics who make up those cultures. As lovely as it would be to wave a policy wand and have everything magically change overnight, it's not going to happen.

The second important implication is this: If you want to change scientific or academic culture, you don't have to wait for anybody else. There is no "Science," there is no "Academia"–there are only scientists and academics. If you work in those fields, you can start changing them any time you want.

People will say "Hiring committees don't look for the right things," or "Tenure committees don't reward risky research." Yet hiring committees and tenure committees are made up of academics. If you are an academic, you can be on those committees–in fact, it's kind of hard to avoid.

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Pasadena Presentation of Positron Plaque

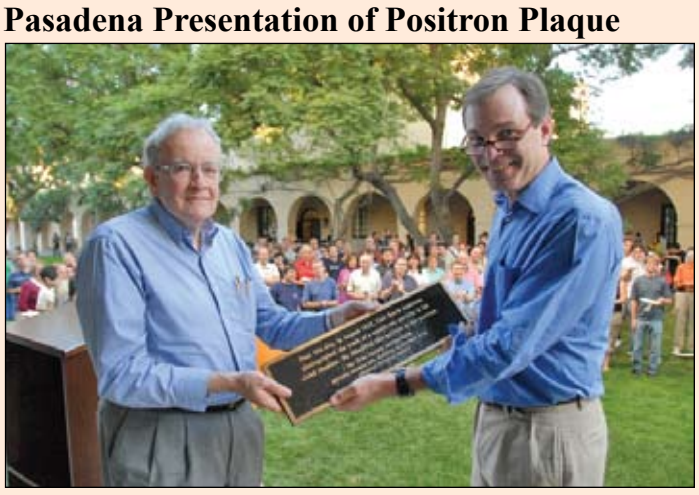

Photo by Bob Paz

In August 1932, Carl David Anderson of Caltech discovered the positron, for which he shared the 1936 Nobel Prize in physics. On a beautiful California afternoon in October 2008, APS presented a plaque designating Caltech as a physics historic site in commemoration of Anderson's achievement. In the picture, John Rigden (left), Chair of the APS Historic Sites Committee, presents the plaque to Andrew Lange (right), the Marvin L. Goldberger Professor of Physics and chair of Caltech's Division of Physics, Mathematics and Astronomy.

INSIDE THE BELTWAY
WASHINGTON ANALYSIS AND OPINION

Change is Coming in More Ways than One

by Michael S. Lubell, APS Director of Public Affairs

"Brother, Can You Spare a Dime?" Yip Harburg and Jay Gorney collaborated on the lyrics and music of the song that became a number one hit in 1932. And judging by the soaring number of layoffs around the country and the tin cups you see around Washington these days, it could make it to the top of the charts again. All we need is a modern-day Rudy Vallee to belt it out.

I don't think Eminem could pull it off, but then again, my judgment is far from perfect. A year ago, if you had asked me whether I could imagine GM, AIG, or Citigroup on the public dole, I'd have said you were delusional. But Washington has been shoveling billions of dollars out the door so fast the last few months, propping up banks, insurance companies and automakers, that you need pretty sharp eyes to spot something the size of a dime.

When President-elect Barack Obama promised to bring change to Washington, I don't thing he had in mind sacks of coins, but the economic woes he is inheriting from the Bush Administration will require trainloads of them. The totals are staggering.

Beyond the regular federal budget, here's what we've committed in taxpayer money so far. On February 13, 2008, President Bush signed a $152 billion stimulus bill that sent tax rebate checks to most Americans. Less than five months later, on June 30, he signed a $162 billion supplemental spending bill. And on October 3, only a few hours after a badly divided Congress had finally agreed to bail out Wall Street, he put his signature on the Emergency Economic Stabilization Act of 2008 that is funding the $700 billion Troubled Asset Relief Program, also known as TARP.

If you add to the current commitments the $82.5 billion the Treasury Department gave AIG (separate from the $40 billion the TARP has handed over) and the $200 billion Treasury doled out to Fannie Mae and Freddie Mac to keep them afloat, you are talking some pretty big bucks–$1.3 trillion to be more precise. And, if all the additional stimulus plans the Obama Administration has been formulating become a reality, you're in $2 trillion territory.

With a projected deficit of more than $0.5 trillion in the regular FY 2009 budget–excluding the Social Security trust fund surplus –the total deficit spending is approaching 20 percent of the gross domestic product. Even if you are a Keynesian, that's a number that should keep you up at night.

It's pretty amazing how fast Washington has recalibrated itself when it comes to money. Just a year ago, the Bush White House and the Democratic Congress were beating each other up over a *major* disagreement on total expenditures for fiscal year 2008. Eventually, the Democratic leadership caved in and lowered spending to meet the President's bottom line, sacrificing science and other domestic programs in the process. The size of the disagreement that had tied the federal government up in rhetorical knots for nearly six months was a paltry $22 billion.

When President-elect Obama moves into the Oval Office later this month, he will be inheriting the worst economic mess the United States–and perhaps the world–has seen since the Great Depression. How he deals with it in the first 100 or 200 days of his presidency could ultimately determine his legacy.

Based on information from Hill sources and public statements from some of Obama's economic advisors, my best guess is that Congress will first convert the fiscal year 2009 Continuing Resolution into an omnibus appropriations bill and send it to the White House for signature as soon as the new President is sworn in. The bill is likely to have smaller increases for science than the versions

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process itself, something which is ultimately the responsibility of individual members," says APS President-elect Curtis Callan, who chaired the 2008 Fellowship Committee.

The fraction of female nominations relative to their representation in the membership is significantly less than that of men. Data from 2001-2008 indicates that once nominated, women have a somewhat better chance of being elected than men do; it is the process of being nominated that presents an impasse, a pattern noticed by the current APS Fellowship Committee.

Some units are notably consistent in female nominations, particularly the Division of Particles and Fields, which has recommended several women every year since 2001. Other units are less impressive, and some haven't had even a single female nomination during the same time period. Since unit membership varies greatly among divisions, topical groups, and forums, some unit Fellowship Committees have a broader range of nomination choices while others can be severely limited.

An important factor is how long ago women members received their PhD. Rachel Ivie, Assistant Director at the Statistical Research Center of the American Institute of Physics, notes that a reason for low representation among women physicists may be the available pool. This situation can be seen with women faculty, according to a 2005 report by Ivie and Kim Nies Ray. The report shows that in 2002, women represented 5% of full professors at US universities. While quite small, this percentage is commensurate with the average 4% percent of PhDs received by women between the years of 1967-1980. One would expect that the pool of faculty members who are eligible for APS Fellowship is composed of the upper echelon of older, accomplished physicists who have been PhDs for many years.

A similar trend may apply to Fellowship nominations. Because APS Fellows tend to be elected at least a decade after receiving their PhDs, low nomination numbers may be the result of fewer women in the pool to nominate. A selective breakdown of female membership by age, based on information in the APS membership database (which is not entirely complete), shows that roughly 1,600 women lie in the pool eligible for Fellowship (assumed to be non-student, age 36 and up), compared with about 21,000 males eligible for Fellowship. A more comprehensive analysis of female membership is needed before any solid conclusions can be reached.

In recent years several prestigious APS prizes and awards have been awarded to women. In 2008,the Oliver E. Buckley Condensed Matter prize was awarded to Mildred Dresselhaus, the George E. Pake Prize was awarded to Julia Philips, and the David Adler Lectureship went to Karin Rabe. In 2009, the Joseph A. Burton Forum award will be given to Patricia Lewis.

Raising awareness and assiduously encouraging women nominations are ways to perhaps mitigate the bottleneck. Diversity among unit Fellowship Committee members should also be supported. "We need to communicate the message that the APS Fellowship Committee urges the membership to be more energetic in nominating women to their unit fellowship committees. Of course, this kind of 'jawboning' has to be done on a regular basis in order to have a real effect, so we need to remember to revisit this issue every year," said Callan.

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friends that have never met before," says Jerry Zucker, a director for the movies *Airplane!* and *Ghost*. "Scientists and Hollywood are really two sides of the same coin."

The Exchange's launch was hosted by Seth MacFarlane, creator and producer of the animated series *Family Guy*. He encouraged attendees to get enthused about science. "I grew up watching *Star Trek* and I remember we used to be so excited about NASA and what they were doing, but you don't hear about it much anymore and people don't seem to be as interested. We need to get people excited about science again."

MacFarlane said an initiative to better support the role of science in pop culture is needed in an era in which "comic book spiritualism" in film and TV has replaced the more science-rooted storytelling found in older sci-fi and fantasy properties. "Instead, we now have *The Ghost Whisperer,*" he said. "I don't know why I chose to crap on that show specifically, but the point is that the realism is gone and the believability is gone."

The event featured six short plenary talks in six different subject areas, followed by six breakout "salons" where attendees could interact with the scientists more informally. Steve Chu, a physicist and director at Lawrence Berkley National Lab and the 1997 Nobel Prize winner in physics, talked about climate change and the effects of global warming in our lifetime. Rare and infectious diseases were described by Bonnie Bassler, a molecular biologist at Princeton University who has spent her career studying bioluminescent bacteria and how they communicate with each other.

(from left, back row) Kimberly Peirce, director of "Boys Don't Cry"; production designer Alex McDowell; former covert CIA officer Valerie Plame Wilson; producer Janet Zucker (in front of Plame) and Jerry Zucker (far right); and National Academy of Sciences president Ralph Cicerone.

Astrophysicist Neil deGrasse Tyson, director of the Hayden Planetarium at the American Museum of Natural History, talked about our place in the universe, while the future of personalized medicine and genomics was discussed by J. Craig Venter, a biologist who led the private effort to sequence the human genome.

Artificial intelligence and cutting-edge robotics was explored by Rodney Brooks, a roboticist and chief technical officer of Heartland Robotics, while some of the mysteries of the brain were revealed by neurologist V.S. Ramachandran, director of the Center for Brain and Cognition at the University of California, San Diego.

"We were just trying to include scientific topics that we thought were relevant (to entertainment pros)," said Jerry Zucker about the choice of subjects for the salons. "We just didn't have time for the one on studio accounting practices."

While the science underlying some of the talks was complicated, the sessions avoided the feel of classroom lectures because the intimate settings allowed the film industry professionals to ask questions and talk informally with the scientists.

Jerry Zucker summed the event up by using Humphrey Bogart's famous line from *Casablanca*: "This is the beginning of a beautiful friendship."

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The Grid computing network will make traveling to CERN unnecessary for many of the scientists who will analyze LHC data. "People do not need to come to CERN. They can be analyzing data in their home institutes," Evans said.

While organizing the huge international collaborations working on the LHC could potentially be "a big sociological problem," these groups have been well organized, have operated with mutual respect, and have had no major problems, Evans said. "CERN's mission in 1954 was to bring nations together, and it is still doing it."

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tion and outreach. How do you view those efforts? What suggestions do you have for guiding those efforts?

A: I think the focus on PhysTEC is exactly right. Expanding that program, which APS Director of Education Ted Hodapp has a proposal to NSF to do, is very important. Also, doubling the number of physics majors is critically important. A number of physics departments have already doubled the majors in physics and have exceptionally vital undergraduate programs. They are providing a real, exciting view of what you can do as a physicist. And as they're doing this, far more women are coming into the field. Another thing we need to work on is getting more underrepresented minorities into the mainstream, We also must continue our outreach efforts.

Q: How do you view the Society's role in terms of public policy?

A: I think it's critically important. APS in general has done a very good job. The APS Panel on Public Affairs and its Physics Policy Committee have done exceptional jobs and should continue to be at the forefront of writing reports and counseling government. For example, the energy efficiency report that was released a few months ago has gotten quite a bit of very good press and congressional attention. The APS-AAAS nuclear weapons workshops last year brought the community together to focus on the fact that the US needs to have a new outlook on nuclear weapons and nonproliferation in the 21st century. These things have been quite influential and we need to continue doing them.

Q: How well is the society serving its members? Are there any areas where you think APS programs could be enhanced?

A: I think for the academic members the Society is doing quite well. We should address, as part of the strategic planning, how to provide peer review at the lowest cost. We need to look at how APS journals could migrate to something like Open Access. APS already provides the journals free to the third world. APS must remain at the forefront of disseminating physics to everyone, including the use of more technology to include more international folks at our meetings. We have to do it with a business model that is consistent with doing all the other things that APS does and should do.

For those working in industry or government labs, which is about 2/3 of physicists, APS has not done as well. I think by being more inclusive, we can be better equipped to help those who get degrees in physics and go off into another field. What would be wonderful is if those people still considered themselves as physicists. Part of what we do to be more inclusive could include partnering more with the American Institute of Physics and other societies.

The other cohort that is absolutely critical is students. We need to be more inclusive of students in our meetings and focus on career development. Executive Officer Judy Franz was very successful in increasing the number of student members, and we have graduate student-run meetings and undergrads coming to meetings. I think we need to do more of that.

Q: How can we ensure APS has funds for all of these critically important programs in this difficult economic time?

A: That is a good question! This is one of the reasons I would like to do this strategic planning exercise, which looks at what do we expect to do with our business model. We've been quite successful in the 21st Century Campaign for Physics, which funds a number of these educational and outreach programs. I believe we're going to have to continue to campaign to provide funding, but this is going to be really tough given the financial situation.

Q: How did you become interested in physics?

A: I come from a family of artists. I became interested in science for two reasons. First of all I had a spectacular chemistry teacher in high school. He got me excited about science. I have noticed that it is usually the case when you ask scientists what got them into science, it's a teacher of some sort, which is why we really need to focus on getting the best quality science teachers in our schools.

The second reason I decided to choose physics was that my brother, who is nine years older than me and went to MIT, made a comment to me, "there's no way you would ever succeed in physics at MIT." I applied to MIT, I got in, and I went and majored in physics. It was partly because I really liked science, but also the challenge he set. I was really excited by the fact that you could do research right away at MIT, and that was so rewarding I stayed in the field.

Q: What have been your career highlights?

A: I spent about nine years actively engaged as a bench research scientist at Bell Labs and I absolutely loved it. Then I was convinced to go into management, and I had a career in management and research there for another 16 years, which was very challenging, but also very rewarding. The third part of my career, I'll call public service, because I'm now working at a national lab and doing a great deal of work with APS, with the National Academies, and on various committees. Through this whole career I've gotten to understand the research enterprise as a whole, and that's also very rewarding. Whatever I'm doing, I would like to have an impact. And I believe I have had an impact in all three areas.

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Colloquium: The physics of Maxwell's demon and information

Koji Maruyama, Franco Nori and Vlatko Vedral

By encapsulating the essence of both thermodynamics and information Maxwell's demon provides valuable insights into very basic constraints on possible physical devices, both classical and quantum. This Colloquium explains various forms of the demon and presents numerous applications.

ANNOUNCEMENTS

APS CONGRESSIONAL SCIENCE FELLOWSHIP 2009-2010

THE AMERICAN PHYSICAL SOCIETY is currently accepting applications for the Congressional Science Fellowship Program. Fellows serve one year on the staff of a senator, a representative, or of a congressional committee. They are afforded an opportunity to learn the legislative process and explore science policy issues from the lawmakers' perspective. In turn, Fellows have the opportunity to lend scientific and technical expertise to public policy issues.

QUALIFICATIONS include a PhD or equivalent in physics or a closely related field, a strong interest in science and technology policy and, ideally, some experience in applying scientific knowledge toward the solution of societal problems. Fellows are required to be US citizens and members of the APS.

TERM OF APPOINTMENT is one year, beginning in September of 2009 with participation in a two-week orientation sponsored by AAAS. Fellows have considerable choice in congressional assignments.

A STIPEND is offered in addition to allowances for relocation, in-service travel, and health insurance premiums.

APPLICATION should consist of a letter of intent of no more than two pages, a two-page resume with one additional page for publications, and three letters of reference. **Please see the APS website** (http://www.aps.org/policy/fellowships/congressional.cfm) for detailed information on materials required for applying and other information on the program.

ALL APPLICATION MATERIALS MUST BE SUBMITTED ONLINE BY JANUARY 15, 2009.

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theory to problems in quantum mechanics, Quantum Shannon Theory has overlapped with areas that are more recognizable to theoretical physics, resulting in new perspectives and approaches to the theory of many-body quantum systems.

"For example, it's recognized that mathematical characterizations of quantum entanglement are very effective in building new theories for quantum many-body systems and also new approaches to the simulation of quantum many-body systems," said DiVincenzo. A symposium at the 2009 March Meeting will highlight recent Quantum Shannon Theory developments.

"GQI is a very young group, but nevertheless I'm very pleased with our presence at the March Meeting and the breadth of activities that we've been able to ensure," said Viola. At the 2007 March Meeting in Denver, GQI held a total of 13 sessions that the group has either sponsored or co-sponsored, while last year in New Orleans the number of sessions increased to 20, on top of several heavily attended tutorials. While the program for the upcoming 2009 meeting in Pittsburgh is still in the works, the group will continue to have a significant number of invited sessions. Thus far, at least 4 sessions have been confirmed, 2 are pure GQI sessions and 2 are co-sponsored with Division of Condensed Matter Physics.

"I think these things should be taken as a strong indication of the scientific solidity and visibility of the group within the broad physics community. We are also putting a lot of emphasis on educating young students and researchers to attract them to the area," said Viola.

The group awards "Best Student Paper" $500 prizes at the March Meeting, open to both undergraduate and graduate students. In the future, the GQI has ambitious plans to create more major prizes for recognizing outstanding achievements in theory and experiments in quantum information processing among both young and established researchers.

GQI emerged out of a petition by Anton Zeilinger of the University of Vienna and Daniel Greenberger of the City College of New York (CUNY). The letter, presented to APS in 2002, expressed concern over a lack of unified dissemination of new knowledge in the wake of ballooning interest in the field from physicists of all subdisciplines. However, the first bylaws weren't established until three years later, in 2005.

"We started off having roughly 600 members and now we are at almost 900. And of course now the growth is continuing at a slower pace as eventually things will have to stabilize a bit; but I think these numbers are very impressive because we are talking about just a few years of existence," said Viola.

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passed by last year's Appropriations Committees but never voted on by either chamber.

Congress will likely follow the lead of the Obama Administration on stimulus and recovery spending, and the dollar figure will be large–somewhere between $500 and $700 billion. Part of it will be targeted to put people back to work within 120 days and part of it will establish a foundation for a longer term recovery, extending out to at least two years. Look to early February for congressional action.

Finally, in late March or early April the Obama Administration will present its fiscal year 2010 budget request to Congress. And that budget will be fairly austere.

I am not a prophet like Tiresias, but as I see it, the stimulus and recovery legislation offers the best near-term hope for sustaining science funding.

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If you think that your institution should be hiring or promoting different sorts of people, get on the relevant committee and make the case for the change you'd like to see. Don't sit around and wait for the NSF to do it for you.

People will say "Grant agencies don't fund the right kind of research," or "The good journals are full of terrible papers." But grant reviewers and journal referees are drawn from scientists in the relevant fields. And they're not exactly beating people back with sticks. If you want to review grants or referee papers, it's not hard to get the opportunity.

If you think that grant agencies and journals should be funding or publishing different things, become a reviewer or a referee and make the case for the change you'd like to see. Demand re-writes to the papers, mark down the grants with half-assed outreach sections. You might not win right away, but you might change a few minds on the grant review panels and editorial boards. That's the first step toward real progress.

People will say "The Ivy League schools set the agenda for all of academia; nothing will change unless Harvard changes." But if your school is not Harvard, it's not likely to become Harvard. And you'll certainly never catch them just by copying them.

Contrary to what they'll tell you, the Ivies do not have a monopoly on good ideas. They may have more money than your school does, but that doesn't mean that everything they touch turns to gold.

Don't wait for Harvard to change–get out there, and make the case for the change you'd like to see in your own institution. If it's as good an idea as you think, your institution can blaze a trail for everyone else, or at least make up some ground by attracting good people who like what you're doing. You may find other people copying you.

Together, we are Science, and we are Academia. What we do is not imposed on us by an unchangeable culture of Science; rather, the things we do determine the culture of Science. We have the power to change those cultures by changing our behavior, and making the case for others to do the same. If we want change, we have to do it ourselves, which is a hard job. But here's the thing: we can do it ourselves, because in the end, we are the thing that needs to change.

Chad Orzel is a professor of physics at Union College in Schenectady, New York. The above originally appeared on his blog, Uncertain Principles.

The Back Page

The Nuclear and Science Policy Paradigm of Pakistan and Regional Stability

By Wasif Syed

The US has just gone through a transformative time in its history–it has just elected its first African-American President, Barack Obama. For many this feat, in and of itself, is indicative of the fact that the US has come a long way since the start of the civil rights movement over 50 years ago. For others, it represents the shift in changing attitudes in America. Overall, one cannot but feel that something is changing. During the gruesome two years of campaigning that each candidate engaged in, several issues–both on the domestic and foreign front–were brought to light. On the foreign policy front, one country that was mentioned repeatedly in various contexts was Pakistan and its role in the international sphere was scrutinized at length. It is therefore conducive to better understand Pakistan and its policies from various perspectives. This article will discuss the nuclear and science policy of Pakistan and its role in regional stability.

Pakistan's nuclear tests in 1998 shortly after India's tests served as a stern reminder that the pursuit of weapons of mass destruction was far from over. The architect behind Pakistan's nuclear program was Abdul Qadeer Khan, who is considered a hero among the Pakistani population in spite of the fact that he allegedly sold nuclear secrets to other nations considered to be hostile to the US. His reputation in Pakistan was undiminished and many considered him to be a scapegoat of the government as part of a larger conspiracy. Nevertheless, whatever the reality may have been, his abilities as a scientist are not in doubt.

I recently spoke with Terry Wallace, Principal Associate Director for Science, Technology and Engineering at Los Alamos National Laboratory, who closely monitored the Pakistani nuclear testing program while he was a professor at the University of Arizona. He said that "A.Q. Khan developed a very sophisticated program that no one expected." Wallace went on to comment that "Pakistan took a very different path than the US or Russia." Pakistan's nuclear program was a remarkable achievement, primarily because it was a completely indigenous program. The primary purpose of Pakistan's nuclear tests was simply as a deterrent in response to India's tests. It is imperative to understand that Pakistan acquired nuclear weapons not for a greater ambition of being part of a bloc of superpowers that possess nuclear weapons but in light of ensuring its own national security after India had decided to take the initiative to conduct nuclear tests and declare itself a nuclear power.

In spite of the rhetoric questioning the safety of Pakistan's nuclear arsenal during the recent US presidential campaign, Wallace expressed the view that "officially the US believes that Pakistan's nuclear arsenal is safe." The threat to Pakistan's nuclear arsenal has been exaggerated. What has not been exaggerated is the expectation that India will conduct more testing in the near future which is not ideal from the US standpoint. If India does opt to take this path, inevitably, Pakistan will follow suit.

On the science policy front, Pakistan has much work to do. In the Fall of 2006, President Musharraf was invited to speak at Cornell University and arrived with 55 members of his cabinet. He delivered an emphatic speech touching upon a range of issues pertinent to an elite academic audience. One of the issues he mentioned that was very close to his heart was the issue of Western-educated individuals of Pakistani-origin returning to Pakistan to help rebuild the country in the science and technology sectors. This notion of "investment in human capital" was a cornerstone of Pakistan's vision to rebuild its scientific infrastructure.

It was under President Musharraf's directive that the Government of Pakistan Planning Commission compiled a very lofty and ambitious "Vision 2030" report that outlined a series of measures that would need to be implemented to attain its aspirations for scientific and technologic innovation. The underlying vision outlined in the report was "a developed, industrialized, just and prosperous Pakistan through rapid and sustainable development in a resource-constrained economy by deploying knowledge inputs." Although President Musharraf did take the initiative to open up several new universities in Pakistan during his tenure, the overall implementation of the plan undoubtedly did lag. Now, with a new government in place, under the directive of President Zardari, the question is whether he will continue President Musharraf's policies. President Zardari has not yet taken the time to consider science policy in any serious way especially at a time when a crisis is looming, so it is too early to say what direction he plans on taking the country.

In 2007, the US-Pakistan Joint Committee on Science and Technology held its first meeting at the National Science Foundation in Arlington, VA. This committee was created under the framework of the Agreement on Science and Technology Cooperation signed by the US and Pakistan in 2003. This agreement was an element of the Pakistan-US Strategic Partnership affirmed by President Musharraf and President Bush in 2006. The committee's purpose is to enhance cooperation in areas of science and technology, higher education and engineering, and to strengthen the capacity of education, research, and innovation between United States and Pakistani institutions of higher education and research establishments. The Joint Committee is also mandated to enable innovative, entrepreneurial partnerships between the two countries' respective science and technology business communities. The high-level meeting in 2007 was a key development on the scientific front for Pakistan. The next meeting is planned for 2009 but it depends on whether President Zardari honors the agreement and decides to continue in this direction.

One of the first tangible manifestations of the NSF-Pakistan science efforts was the development of a new high speed network connection which was inaugurated in October 2008. This new network connection will enable Pakistani scientists to work with their international colleagues and peers on research projects that require fast data transfer and facilitate transmission of this information across the globe. According to Arden Bement, Director of the National Science Foundation, "This represents a major milestone in the development of physical network connectivity between Pakistan and the global scientific community." In a recent communication that I had with Jeff Nesbit, the director of the Office of Legislative and Public Affairs at the NSF, "The high speed connection linking Pakistan to the global research community is an excellent example of both the US and EC commitment to Pakistan's science community. It's a good model for future cooperation and collaboration on other science and research efforts."

Although such agreements are conducive to both parties, there are many hindrances to Pakistan's development as a scientific and technology powerhouse–two of the fundamental predicaments are poverty and corruption. The disparity between the rich and poor is enormous and getting larger day-by-day. It is a feudal society with the majority of the population living in rural areas, and furthermore illiteracy is very high in the country. Pakistan requires a complete overhaul of the educational system, and this reform has to be initiated from the grassroots level to be able to develop its infrastructure. Granted any imposition of change has to be gradual, so the proposition herein is one for a long-term solution. Another problem is that corruption exists throughout all levels of society and government. Embezzlement of funds is a practice that administrations have engaged in to various degrees. Pakistan, like many countries is not a meritocratic society–nepotism is rampant. Although such practices also exist in the US, the degree of the malady is considerably less.

Ultimately, a reform of the educational paradigm is required at the local level across the country. This requires a significant degree of fiscal investment by the government. Adoption of Western school systems is one way to proceed. To add diversity to the schooling options available in Pakistan, more international schools should be built. Although private schools with British and American curricula are present in Pakistan, these are, for the most part, only accessible to the upper echelons of society. One success story though, is the Turkish schools that recently have started to open up across Pakistan. They have been able to assimilate students from poor socio-economic backgrounds and provide them with a first-rate education. More such models are needed.

Additional investments are needed to develop scientific laboratories and institutions of higher learning that can train students to develop Pakistan's science and technology sectors. School administrators also need to be closely monitored as the same corruption that is prevalent at the governmental level is quite often found among university-level administrators.

The state of scientific affairs was not always this appalling in the Islamic World. There was indeed a time during the Islamic Empire, from the 9th to 13th century, when the center of learning was located in Baghdad. It was called the "House of Wisdom" (Bait Al-Hikma in Arabic). This was a place and time of extreme scientific and technological innovation. Jewish, Christian and Muslim scholars were all present in a central location working collaboratively on some of the most advanced problems of their time under the umbrella of an Islamic government. This spirit of innovation led to pioneering discoveries from fundamental tools in mathematics such as algebra, to optics in physics, and to medicine. Philosophical works by Aristotle, Plato and Socrates were also embraced by the Islamic Empire at a time when these were considered blasphemous by Christendom. In fact these very works were translated from Greek to Arabic in the House of Wisdom and then later found themselves in the Western corner of Europe in Al-Andalus (Islamic Spain–the Iberian Peninsula was ruled by Muslims for almost 800 years). They then provided the fundamental outgrowth for the Italian Renaissance. The ambiance that was omnipresent during the House of Wisdom years has been long been lost and on some level, Pakistan and the rest of the Islamic World needs to implement this very paradigm to recreate the same spirit of innovation that will allow it to progress on multiple fronts including in science and technology.

At present, it would be fair to say that contemplating implementing the paradigm of the House of Wisdom is not a discourse conducive for Pakistan to engage in, as there are more pressing matters at hand–such as the massive economic crisis. This past summer, in a conversation that I had with Musharraf's Chief of Staff, it was already clear that the country's situation was not rosy and symptoms of what it is to come were surfacing. With inflation sky-high, consumer spending at an all-time low, unemployment rampant, and with the recent devastating earthquake that hit southwestern Pakistan, the country's economy is desperately weak. According to a recent article in the *Economist*, on Oct 17th the central bank's liquid asset reserve was just over $4 billion, enough only to cover about 4-5 weeks of imports. Pakistan was forced to go to the IMF to seek funds, and it is widely anticipated that the IMF will bail out Pakistan. Furthermore, in a recent trip to Saudi Arabia, Zardari met with King Abdullah who agreed to bail out Pakistan with a substantial oil supply on deferred payment and cash assistance, according to media reports. Ultimately what matters is the manifestation of these bailouts for the average person on the street in Pakistan. Until he or she is able to reap the benefits of this monetarily, the country will keep regressing further.

It is important to understand the regional significance of Pakistan. The country borders three different cultures and is strategically situated. The US government always seeks strategic allies and therefore Pakistan is strategically important for the US. Pakistan plays an important role in regional stability, especially with the current ongoing war in neighboring Afghanistan. It is inevitable the US will have to intervene in Pakistan at some point to maintain regional stability. However, the US needs to exert more pressure on Pakistan to reform. Only after the basic mechanisms of reforms are initiated, and closely monitored by the US, will the effects trickle down and directly impact science and nuclear policy. However, the first priority is the economic prosperity of Pakistan, especially with many in the country suffering direly–only once this is meticulously addressed can the country prosper on any serious level. Furthermore, now coupled with the recent events in Mumbai, Pakistan has more than it bargained for on its plate. The "blame game" between India and Pakistan is standard modus operandi and with elevated tensions, this predicament needs to be addressed.

There is an intricate connection between what Pakistan needs and what the US needs. Both have been yearning for change–though we have yet to see that materialize in Pakistan for the good. Although we have elected our first African-American President, only time will tell what change it will bring to this country and how different it will be from the last 8 years. As President-Elect Obama said in his address in Grant Park in Chicago on the monumental evening of November 4th, 2008, "change has come to America." History will determine what that change is and if the manifestations of such a change are to directly impact countries like Pakistan in our lifetimes.

Wasif Syed is a PhD candidate in applied physics at Cornell University. He was Chairman of the Musharraf Welcome Committee from 2005-2006 and in 2006 he brought and coordinated the visit of Pakistani President Musharraf to Cornell along with his cabinet members.

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