APS NEWS
A PUBLICATION OF THE AMERICAN PHYSICAL SOCIETY
WWW.APS.ORG/PUBLICATIONS/APSNEWS/INDEX

March 2012 • Vol. 21, No. 3

New Editor for Phys Rev B
see page 5

Publications Oversight Committee Meets in Maryland

Photo by Michael Lucibella

As its name implies, the Publications Oversight Committee oversees the operations of all APS research journals. The committee met at APS headquarters on January 27, and took a moment out of its busy schedule, in which among other things it approved next year's pricing structure for APS journals, so that the members could pose for a quick picture. Seated are (l to r): APS Executive Officer Kate Kirby; committee Chair Berndt Mueller; APS Editor in Chief Gene Sprouse; and A. Ben Wagner (library consultant to the committee). Standing are (l to r): David Meyerhofer; APS Treasurer/Publisher Joe Serene; David Singh; Anthony Starace; Anthony Johnson; Cornelius Beausang; and Vladimir Goldman.

Bill to Kill Open Access Mandate Sparks Debate

By Michael Lucibella

A flurry of controversy, and conflicting legislation, has recently been swirling around the issue of whether scientific articles funded by federal research dollars should be made publicly available on the web.

According to existing policy at the National Institutes of Health, any journal article based on research funded by NIH grants must be posted to the open access PubMed database within a year of its publication. The Research Works Act (RWA), introduced in the House of Representatives by Darrell Issa (R-CA) and Carolyn Maloney (D-NY) would overturn that policy and prevent the federal government from requiring the posting of journal articles on a free public server. In response, Sen. John Cornyn (R-TX) and Rep. Mike Doyle (D-PA) reintroduced versions of the Federal Research Public Access Act, which would require that nearly all journal articles based on federally funded research be freely accessible online no later than six months after publication.

Few expect any of the bills to become law; however the RWA has become the focal point of a growing debate within the academic community over issues of free access to scientific results. It's set against a backdrop of growing dissatisfaction within segments of the scientific community over existing models of peer review and publication.

"A typical academic would, say, have to pay a journal for publishing, then the university has to pay again [to subscribe]…There's disgruntlement from the academic side," said Tom Statler, program director at NSF's division of astronomical sciences. "From the publisher's point of view, they're looking at an unstable business environment."

Publishers and industry groups are divided over the RWA. Those who have supported it have come under fire, which has included a high-profile boycott of one company. Publishers who oppose it have had to walk a fine line between supporting the mission of greater dissemination of science, while at the same time protecting their investments and intellectual property. There are no data available on how many articles are currently produced based on federal funding, nor are there any data that reveal the economic effect the policy has had on publishers.

"Our objection is not to voluntary contribution, it's against mandating the deposit…and I think it's an industry-wide concern," said Glen Campbell, head of the Dutch-based commercial publisher Elsevier's health sciences journals. "We have a lot of different journals and one size doesn't fit all of them."

BILL continued on page 6

Biggest March Meeting Yet Covers Lots of Ground

The APS March Meeting is early this year, and promises to bring a plethora of physics to Boston, Massachusetts. The meeting is taking place at the Boston Convention Center from February 27 through March 2nd, and is shaping up to be the biggest standalone March Meeting in APS history. Physicists from across the globe will present nearly 9,000 talks in almost 700 sessions on cutting edge research in condensed matter physics, computational physics, chemical and biological physics, new materials, polymers and fluids. In addition, a number of sessions devoted to social issues will explore the role of physics in industry, national security, human dynamics, sustainable energy and energy storage. More than 9,500 people are expected to attend including 900 invited speakers.

Here are a few of the meeting highlights:

Physics Sets its Sights on the Mesoscale

At a special session sponsored by the Kavli Foundation, some of the nation's top physicists weigh in on the next frontier of physics: the mesoscale, where physics, biology and chemistry all start to overlap. The fundamental question of whether physics can find emergent laws for proteins and other objects at this scale will be explored (session T19).

Spider Silk Takes Center Stage

Spider webs are made of an amazing material–natural silk that's flexible yet strong. It's long been a favorite of researchers, and is the subject of several sessions this year. A team from the University of Akron has been studying silk's characteristics at both the nano and macro level to explain where it gets its toughness and stickiness (session Y47.10). Another team, at Tufts University, has been controlling a spider-silk-inspired material's ability to self-assemble by varying its temperature and the length of its molecules

MEETING continued on page 7

APS Outreach Website Features Exclusive Videos from Space

By Brian Jacobsmeyer

Don Pettit, an astronaut aboard the International Space Station, is creating videos of microgravity physics experiments that will appear on the APS outreach website PhysicsCentral. Under the terms of a NASA/APS partnership named Science off the Sphere, APS has exclusive access to the videos when they're first posted online. The first few are already available to watch at www.physicscentral.com/sots.

Pettit's videos will feature a new experiment roughly every week, and the public will be able to get involved as well. At the end of each video, Pettit will pose a challenge question about the experiments, and a randomly chosen winner from the pool of correct responses will have his or her answer read by Pettit from the ISS.

While Pettit has done similar outreach efforts previously, NASA officials hope that partnering with APS will help broaden the videos' audience.

"It's about finding the right partner to disseminate the stuff Don is doing," said Cindy McArthur, Manager of NASA's Teaching From Space program. "We didn't have a partner before."

The videos sent down feature a number of novel experiments that are extremely difficult, if not impossible, to reproduce on

VIDEO continued on page 6

Panel Stresses Collaboration as Nanomaterial Use Surges

By Brian Jacobsmeyer

Large research gaps within the field of nanotechnology need to be filled to address growing concerns about safety, environmental and health issues, according to a new report from the National Academy of Sciences. But scientists remain divided over how to fill these gaps.

Increasingly, manufacturers have been taking advantage of engineered nanomaterials (ENMs) for a variety of products. Sunscreen made with ENMs, for instance, allows for better protection and coverage because the abundance of particles provides greater surface area. And newly developed artificial joints may benefit from sturdier nanodiamond coatings that reduce wear and tear.

In total, ENMs accounted for $225 billion in sales in 2009. Although experts within the physics community agree that more research needs to be done on these materials, most believe that increasing nanomaterial use should not be cause for immediate alarm.

"You have to keep your sanity about these things. People hear 'nano,' and they go hysterical," said Ivan Schuller, a physicist specializing in nanotechnology at the University of California San Diego who was not involved with the report. "But of course, studies have to be made to see if there are real dangers."

Risks posed by ENMs–and the amount of research on these risks –vary depending on the types of nanomaterials. While nanomaterials used in electronics have been around for awhile and are generally considered safe, scientists know less about the health implications of emerging applications in areas like cosmetics and medical drug delivery.

By building upon existing collaborative efforts within the government, members of the panel responsible for the report hope to better assess these potential risks. Since 2001, the National Nanotechnology Coordination Office (NNCO) has served as a centralized government program, and it now links together the nanotechnology work of 25 different agencies.

More interagency communication could help move research forward, said panel member Martin Fritts, a nanotechnology physicist at SAIC-Frederick, a National Cancer Institute contractor.

"The main obstacle is you have different areas that [agencies] are trying to attack," said Fritts. "Not everyone is going after the same thing."

Different agencies address different areas, ranging from broad environmental impacts to more specific health effects of prolonged exposure to nanomaterials.

PANEL continued on page 7

Members in the Media

"The impact of the cuts … will be to immediately terminate the Mars deal with the Europeans… It's a scientific tragedy and a national embarrassment."

***G. Scott Hubbard**, Stanford University, on budget cuts at NASA,* The Washington Post*, February 8, 2012.*

"I really see a basic conflict between science and religion… I try not to be preachy, but I think it would be wonderful for the cultural debate if people saw what an amazing universe we live in, even if the evidence says it is likely an accident."

***Lawrence Krauss**, Arizona State University,* USA Today*, February 6, 2012.*

"If we spread the costs among an international consortium with many member nations we can afford a better, healthier life, protect our planet from incoming asteroids and space debris, and outsmart our destiny to become extinct."

***Gene McCall**, Los Alamos National Laboratory, on the importance of funding space exploration,* MSNBC.com*, February 3, 2012.*

"You can look into the brain and see a true neuron in action."

***Stefan Hell**, Max Planck Institute of Biophysical Chemistry, on research that cut a window into the skull of a living mouse,* MSNBC.com*, February 2, 2012.*

"NBA players really are overly hesitant to shoot the ball in the early periods of the [24-second] shot clock…The later players took the shot, the worse the shot was. . . . If they see a pretty good early shot, they tend to assume 'Well, I bet I can get a better one.'"

***Brian Skinner**, University of Minnesota,* The Philadelphia Inquirer*, January 28, 2012.*

"He said, 'A lot of people all over the place are recommending you.' All I said was, 'Who are these former friends of mine?'"

***Steven Chu**, Department of Energy, recounting when the President asked him to be Energy Secretary,* The New Republic*, January 25, 2012.*

"Lawrence Berkeley was a lab that a lot of people said was really in search of a mission… And [Chu] transformed it."

***Michael Lubell**, American Physical Society,* The New Republic*, January 25, 2012.*

"[T]hey're nothing to be afraid of."

***Marge Bardeen**, Fermilab, referring to cosmic rays,* The Chicago Tribune*, January 25, 2012.*

"With all the technology of our advanced civilization, solar storms can have significant effects on communication, power, things like that."

***Robert Lin**, University of California, Berkeley,* The Seattle Times*, January 24, 2012.*

"I really feel that working keeps me youthful… But even more than that, I feel if you're here, you should have some function in life. I think this idea that one owes something to society has grown on me."

***Edward Gerjuoy**, University of Pittsburgh, on keeping active at age 93,* USA Today*, January 23, 2012.*

New Forum on Outreach Off and Running

The brand new APS Forum on Outreach and Engaging the Public (FOEP) has conducted its first election, and now has a duly constituted Executive Committee, which plans to meet in conjunction with the March Meeting in Boston.

FOEP is the first new forum since the Forum on Graduate Student Affairs was formed in 2001. Organizers say that its aim is to involve members of APS who are interested in bringing the excitement of science to the public. Outreach and engagement can encompass a broad range of activities including, for example, working with the media, political engagement, hosting science cafes, or blogging.

"My hope for FOEP is that we can raise awareness within the APS membership in ways that are effective in engaging the public and help them find avenues to reach out and share their knowledge and experience and excite-

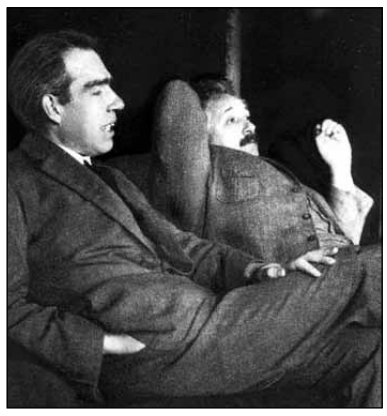
FORUM continued on page 3

This Month in Physics History

March 6, 1913: Bohr describes his model of atom to Rutherford

The classic diagram of the atom depicts a small nucleus and an electron circling around it in a fixed orbit, and has become a powerful symbol in the public imagination. It is featured in the logo of the United States Atomic Energy Commission, for example, and marks the change of scenes on the hit TV sitcom *The Big Bang Theory*. Less well known to the public is the man who developed it: Niels Bohr.

Born in Copenhagen in 1885, Bohr was the son of Christian Bohr, a professor of physiology at the University of Copenhagen, and Ellen Adler Bohr, who hailed from a prominent banking and political family in Denmark. Young Niels was encouraged to pursue his interest in science from a young age, and shared an enthusiasm for soccer with his older brother, Harald. (Harald was a member of the 1908 Danish Olympic team that won the silver medal in that year's competition, and went on to become a renowned mathematician.)



Niels Bohr and Albert Einstein in 1925.

Bohr initially chose to study philosophy and mathematics at the University of Copenhagen, but in 1905 he heard about a physics competition by the Royal Danish Academy of Sciences, and took on the challenge. Using his father's laboratory, he experimented with the properties of surface tension, producing an essay about his findings that won the top prize. Encouraged by this early success, he switched his focus to physics, earning his doctorate in 1911, writing his thesis on a theoretical explanation of the properties of metals.

While a postdoctoral student at Cambridge University, Bohr worked with the legendary J.J. Thomson, who years earlier had discovered the electron, and proposed the "plum pudding" model of an atom, in which the atom is composed of electrons (which Thomson called "corpuscles") surrounded by a soup of positive charge to balance the electrons' negative charges, like negatively-charged "plums" surrounded by positively-charged "pudding."

That model had since been superseded by the work of Ernest Rutherford, who discovered the existence of the atomic nucleus in 1911, effectively disproving Thomson's earlier model. In its stead, Rutherford proposed an atom with a small dense positively charged nucleus around which a negatively charged cloud of electrons orbited like planets around the sun.

Bohr met Rutherford the following year, and ended up spending four years in Rutherford's laboratory at Manchester University, working on a new model for atomic structure. Rutherford's model was a solid start, but classical physics dictated that, if it were true, the electrons would spiral inward and collapse into the nucleus, making all atoms inherently unstable.

So Bohr adapted the concept to make it more in keeping with the nascent quantum theory born from the revolutionary work of Max Planck at the turn of the century–specifically, the notion that energy could only increase in discrete units, called quanta. On March 6, 1913, Bohr sent a paper to his mentor, Rutherford, describing how his new model for atomic structure explained the hydrogen spectrum.

In Bohr's model, electrons moved around the atomic nucleus in circular orbits, but those orbits had set discrete energies, and electrons could gain or lose energy only by moving from one orbit to another, absorbing or emitting radiation as necessary. While it is still taught in introductory physics classes, the Bohr model is not quite correct. Most significantly, Bohr's model violates the uncertainly principle because it features electrons with known orbital periods and a definite radius–two attributes which cannot be directly determined simultaneously. It also makes poor predictions of the spectra to larger atoms. The Bohr atom is now recognized as a precursor of the description of atoms given by quantum mechanics, which was developed more than a decade after Bohr's work.

Nonetheless, this pioneering work earned Bohr the 1922 Nobel Prize in Physics, "for his services in the investigation of the structure of atoms and of the radiation emanating from them." He was 37 years old at the time, with many more significant contributions to physics before him. For instance, he devised a liquid drop model for the atomic nucleus, and identified the uranium isotope necessary for slow-neutron fission.

His name is also strongly associated with the Copenhagen interpretation of quantum mechanics, about which he had many good-natured arguments with Albert Einstein. And he developed the principle of complementarity to explain how two seemingly exclusive properties–such as light behaving as a particle and a wave, depending on what kind of measurement one made–could nonetheless be reconciled theoretically.

"The opposite of a correct statement is a false statement," he once observed, "But the opposite of a profound truth may well be another profound truth." When Bohr was awarded the Order of the Elephant by the Danish government, he designed his own coat of arms. The design included the yin/yang symbol and the motto, "Opposites are complementary."

Bohr's later life was marked by many personal and professional triumphs, but it was also marred by occasional tragedy. He famously quarreled with his brilliant young German protégé, Werner Heisenberg, after the latter revealed that Nazi Germany was working on an atomic bomb–a meeting that was immortalized, in fictional form, in Michael Frayn's award-winning play *Copenhagen*. When Hitler's army invaded Denmark, Bohr fled with his family to Sweden in a fishing boat. He and his son, Aage, wound up in the US working on the Manhattan Project, despite Bohr's lifelong qualms about nuclear weapons. He returned to the University of Copenhagen after World War II, and remained there for the rest of his life.

APSNEWS

Series II, Vol. 21, No. 3
March 2012

Coden: ANWSEN ISSN: 1058-8132

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

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

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

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

Subscription orders, renewals and address changes should be addressed as follows: For APS Members–Membership Department, American Physical Society, One Physics Ellipse, College Park, MD 20740-3844, membership@aps.org.

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

Washington Dispatch

A bimonthly update from the APS Office of Public Affairs

ISSUE: Budget and Authorization Environment

Fiscal Year 2013 Presidential Budget Request

The Obama Administration released its budget request for Fiscal Year 2013 (FY13) on Monday February 13th. Overall, the request reflects a Washington atmosphere of curtailed government spending, one in which budget increases are rare. Recognizing its impact on innovation and future economic growth, the White House made science one of the few beneficiaries of a general increase The major science agencies and their requests follow:

	FY11 Final	FY12 Final	FY13 Request	% Change	Actual Change
NSF (Total)	$6.8B	$7.03B	$7.37B	4.8%	+$340M
RRA	$5.56B	$5.72B	$5.98B	4.5%	+$260M
MREFC	$117M	$167M	$196M	17%	+$29M
EHR	$861M	$829M	$876M	5.7%	+47M
NIST Core	$578M	$622M	$708M	13.8%	+$86M
STRS	$507M	$567M	$648M	14%	+$81M
CRF	$70M	$55M	$60M	9.1%	+$5M
DOE Sci	$4.84B	$4.89B	$4.99B	2.0%	+$100M
ARPA-E	$180M	$275M	$350M	27%	+$75M
DOE EERE	$1.80B	$1.82B	$2.34B	28%	+$52M
NASA Science	$4.94B	$5.09B	$4.91B	-3.6%	-180M
JWST	$476M	$518M	$627M	21%	+109M
NIH	$30.69B	$30.64B	$31.0B	1.1%	+360M
DOD 6.1	$1.95B	$2.10B	$2.11B	0.2%	+$4.5M
DOD 6.2	$4.45B	$4.70B	$4.47B	-5.0%	-$230M

Congress will begin consideration of the Fiscal Year 2013 budget shortly, with a number of hearings already scheduled to examine the President's request. Even if Congress accepts the proposed spending for science, appropriations for the coming fiscal year will be subject to across-the-board sequestrations, scheduled to take effect on January 2nd 2013. The last edition of the Dispatch provided sequestration details: in brief, defense appropriations would suffer an 11% reduction, and every non-defense discretionary account would lose about 8%.

It is unlikely that Congress will pass many or any of the twelve appropriations bills until after the November elections. And, depending on the outcome at the polls, lawmakers could decide to leave spending legislation for the new Congress or simply pass a yearlong continuing resolution, funding Federal agencies at Fiscal Year 2012 levels with sequestrations applied to them.

Be sure to follow the APS Washington Office's Blog, Physics Frontline (http://physicsfrontline.aps.org/), or Twitter feed (@APSPhysicsDC) for the latest news on the FY13 Budget.

ISSUE: POPA

The year 2012 promises to be a busy one for the Panel on Public Affairs. Work has begun to generate several study proposals whose topics include licensing nuclear reactors to 80+ years, the technical aspects of verifying tactical nuclear weapons reductions and science-backed federal standards.

A study for the Department of Homeland Security's Domestic Nuclear Detection Office (DNDO) regarding trends in nuclear and radiological detection is also being considered. If pursued, POPA plans to add expertise by collaborating with IEEE-USA on the study.

If you have suggestions for a POPA study, please send in your ideas electronically. http://www.aps.org/policy/reports/popa-reports/suggestions/index.cfm

ISSUE: Media Update

The New York Times published a letter-to-the-editor on January 23rd by APS officials Gene Sprouse and Joe Serene regarding the peer review process. The letter noted that the peer review process isn't free and that APS allows free access to its journals via public libraries.

Roll Call printed an op-ed titled, "Smart, Not Fat, Cats Fuel Economic Growth" on January 30th by Michael S. Lubell, APS Director of Public Affairs. The piece pointed out that research scientists fuel economic growth in the U.S., and that they require "patient capital" and "dependable policies" to be successful.

Dot Earth, a *New York Times* blog, published an op-ed February 2nd by Nobel Laureate Burton Richter, who responded to a previous piece published in *The Wall Street Journal* on the topic of climate change.

The Wall Street Journal published a letter-to-the-editor on February 6th by APS President Robert L. Byer who wrote that the APS Statement on Climate Change had been inaccurately characterized in a recent op-ed published in the newspaper.

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

Getting Ready for DAMOP XLIII

Photo by Michael Lucibella

On February 3, about 15 physicists gathered at APS headquarters in College Park to sort almost 1000 abstracts in preparation for the 43rd annual meeting of the APS Division of Atomic, Molecular and Optical Physics (DAMOP), which will take place June 4-8 in Anaheim, California. Shown hard at work in the photo are (l to r): Arati Dasgupta of the Naval Research Laboratory; David Schultz of the University of North Texas; and Tatjana Curcic of the Air Force Office of Science Research.

Chemistry Education Program Adopts APS Model

By Bushraa Khatib

Attendees of the eighth annual Physics Teacher Education Coalition (PhysTEC) conference held February 3-4 in Ontario, California learned that the project's successes have crossed disciplines and inspired the American Chemical Society to launch a parallel initiative, the Chemistry Teacher Education Coalition (CTEC).

"PhysTEC serves as an impressive model in launching CTEC. Future chemistry and physics teachers will benefit from this collaboration between chemistry and physics," said Mary Kirchhoff, Director of the ACS Education Division.

Similar to its physics counterpart, CTEC aims to actively engage chemistry departments in the preparation of future chemistry teachers and plans to incorporate features of PhysTEC, including regular conferences and a grant competition to create model teacher preparation programs.

The PhysTEC conference is the nation's largest event focusing on physics teacher preparation, and is a major component of the PhysTEC project. The PhysTEC project, a partnership between APS and the American Association of Physics Teachers (AAPT), strives to improve and promote the education of future physics teachers. It does so primarily by selecting colleges and universities that can effectively use substantial project support to develop their physics teacher preparation programs into national models and make significant increases in the number of teachers they graduate.

To date, the project has supported 20 such sites, and expects to fund 6 additional sites beginning in the fall of 2012. The number of teachers graduating each year from PhysTEC-funded institutions has greatly increased since the project began in 2001.

This year's PhysTEC conference was preceded by a day-long regional conference involving 80 representatives of two math and science teacher preparation efforts in California that had not previously met. The Math and Science Teacher Initiative (MSTI) of the California State University system and CalTeach at the University of California came together for the first time to discuss physics and chemistry teacher preparation efforts.

Collaboration between the two distinct groups with similar aims generated healthy discussion as leaders from both programs offered their insights on issues such as student recruitment and retention, course transformation, student-centered teaching, and how to consolidate the degree-granting process. Stephen and Phoebe Roeder from the physics department at San Diego State University found discussions on increasing enrollment and finding new sources for funding highly relevant to their university.

The PhysTEC conference officially started the next day with 120 science and math educators, program leaders, future physics teachers, PhysTEC site leaders and student representatives in attendance. Plenary speakers came from a wide range of disciplines to address the conference theme, New Paradigms for Physics Teacher Education. Philip DiStefano, Chancellor of the University of Colorado at Boulder, gave the opening plenary on engaging universities and professional societies in education and teacher preparation. Fred Goldberg, physics professor at San Diego State University, spoke on adapting physics and everyday thinking (PET) to large classes.

A panel discussion on cultural perspectives on teacher education moderated by Peter Muhoro, Minority Bridge Program Manager at APS, addressed underrepresentation of minorities in the population of U.S. physics teachers. The session featured faculty from minority-serving institutions and high school physics teachers from schools with significant minority populations. Panelists and participants candidly discussed cultural issues that rarely make it to the forefront of physics education.

Panelist Geraldine Cochran, a doctoral student at Florida International University, expressed her belief that minority students do not necessarily need to have role models that look like themselves in order to be inspired to pursue physics or teaching themselves. "This can be accomplished by good teaching, regardless of the student or teacher's personal background," Cochran said.

Vivian Incera, chair of the University of Texas at El Paso physics department, and Victor Gonzalez, AP physics teacher at Pioneer High School in southern California, cited examples of how sharing cultural backgrounds with their students gave them more insight into their students' experiences. "In the Latino culture, students have a hard time explaining physics as a career choice to their parents. I tell them to tell their parents that they're going into engineering instead," Gonzalez said.

A panel moderated by Howard Gobstein, Association of Public

CHEMISTRY continued on page 5

FORUM continued from page 2

ment about what they do," said Patricia Sievert, STEM outreach coordinator at Northern Illinois University and the Forum's newly elected vice-Chair.

Paul Chaikin of New York University was elected Chair, Ivan Schuller of the University of California, San Diego is the Chair-elect, and James Kakalios, University of Minnesota, will fill the past-Chair position. The Secretary-Treasurer E. Dan Dahlberg, who is also from the University of Minnesota, Charles Falco from the University of Arizona, Beth Parks from Colgate University, Laura Greene from the University of Illinois at Urbana-Champaign and Diandra Leslie-Pelecky at West Virginia University round out the Executive Committee.

"There's all kinds of ways we can interact with the public," Sievert said. "I think it's our responsibility to share that excitement."

The Forum is the result of a push from APS's Committee on Informing the Public to provide a way for members interested in outreach and engagement to network and share ideas. Signatures for its formation were collected over the latter half of 2010. In November the APS Council formally adopted a draft of its by-laws. The Forum accrued more than 800 members over the following year. Council approved the final draft of the Forum's bylaws in November, 2011, and elections were held early in 2012.

Letters

Readers interested in submitting a letter to APS News ***should email letters@aps.org.***

Textbooks Can Get It Wrong

In his January Back Page article, "Ten Mistakes for Physicists to Avoid", James Patterson urges physicists to go beyond secondary sources. I agree and would add another reason: all too often, textbook authors get it wrong.

Here are two common examples:

Textbooks often give the impression that the purpose of absolute temperature is to measure a system's amount of energy (per molecule, say). In his *Theory of Heat (*1872), Maxwell said it correctly (although, to us, archaically): "The temperature of a body is its thermal state considered with reference to its power of communicating heat to other bodies." In short, temperature measures hotness.

Textbooks often make a muddle of mass, matter, and inertia. In his three-page paper of 1905, Einstein said it clearly: if a body's energy changes by ΔE, then its inertia changes in the same sense by $\Delta E/c^2$ (in modern notation). In short, the connection is between energy and inertia.

Ralph Baierlein
Flagstaff, AZ

Thanks for an Excellent Back Page

I really enjoyed reading and got a great deal out of the January Back Page article "Ten Mistakes for Physicists to Avoid" by James Patterson. Every once in a while, you put an article back there that really knocks it out of the park. The other article which I found deeply important to academic life was the one on Violence and Knowledge. Honesty and clarity link these excellent pieces together.

Mark C. Hickey
Bedford, MA

Ed. Note: *The author refers to the Back Page "The Violence of Our Knowledge: On Higher Education and Peace Making" by Parker J. Palmer, which appeared in the July 2007* APS News *(available online at www.aps.org/publications/apsnews/200707/backpage.cfm).*

Fission Timeline Clarified

Part of the history column on Fermi in the December, 2011, issue of *APS News* needs clarification, at least with respect to timelines and names.

The article states "Reports of experimental evidence for nuclear fission began circulating early in 1939, in a manuscript by German chemists claiming they had detected barium after bombarding uranium with neutrons. Among those who heard the news was Lise Meitner, who realized, with her nephew, Otto Frisch, that this could be nuclear fission. The news quickly spread across the pond to American physicists, including Fermi."

The timeline for the quoted events actually starts in late 1938. The German chemists were Otto Hahn and Fritz Strassman with assistants Fräuleins Bohne and Müller. Hahn and Strassman could not make sense of their observations that apparently showed the splitting of the atom.

Therefore, on December 19, 1938, Hahn wrote to Meitner, an Austrian physicist who had worked with Hahn for some 30 years in Germany. She had escaped from Germany in July, 1938, to Sweden because of the Nazis and her Jewish background. In his letter Hahn wrote "Perhaps you can put forward some fantastic explanation." and asks her to keep the information he has sent her secret. In a second letter dated December 21 Hahn wrote "How wonderful and exciting it would have been if we could have worked on this together as we used to."

Meitner's nephew, Otto Frisch, usually joined his aunt for the Christmas holidays. 1938 was no exception and she showed him Hahn's December 19 letter. The two went on a forest hike in the snow all the while discussing Hahn's and Strassman's results. It was during this hike that they arrived at the explanation. Frisch introduced the word "fission" into the lexicon of physics.

Thus, Meitner did not learn of fission as a result of Hahn's and Strassman's manuscript as the *APS News* article implies, but rather she explained the observations (with her nephew) as a result of Hahn asking her if she could do so.

The news did not cross the Atlantic as a result of Hahn's and Strassman's manuscript but rather as a result of an oral communication from Frisch to Bohr, who was about to leave Copenhagen for the United States.

This history, and much more related to it, can be found in Hahn's and Frisch's autobiographies:

Otto Hahn: *My Life, The Autobiography of a Scientist.* Herder and Herder, New York, 1970. (Translation of the 1968 German original.)

Otto Frisch: *What little I remember.* Cambridge University Press, Cambridge, 1979.

Fred Peet
Brentwood Bay, British Columbia

Benefits of a combined-fields background

The Back Page article in the January 2012 issue, "Ten Mistakes for Physicists to Avoid" by James D. Patterson was very candid, and well thought out. The benefits of breadth in education and work experience deserve to be added.

Looking back, there is no doubt that the smartest thing I ever did was to obtain a combined-fields background. Got that one right. My undergraduate degree was in mechanical engineering, my PhD thesis was in particle physics. Diversification continued in my working life, sometimes by necessity and more often by choice. Consequently, I was able to make original contributions in five different subfields: particle physics, mechanics of solids and structures, fluid mechanics, applied physics, and acoustics of musical instruments. Often, my work on a research/development (R/D) project would involve more than one of these subfields at the same time.

James Patterson correctly points out that an academic career is no longer necessarily the path of many physics majors. Outside Academia, most R/D projects are interdisciplinary. But interdisciplinary research is coming to academia as well. A good example is the interdisciplinary approach to reconstructing European prehistory, making full use of linguistics, archaeology and genetics. Each of these disciplines by itself yields results that are only clues at best. But taken together, they produced solid evidence which overturned previous assumptions.

Another benefit of combined-fields capability is increased employment security. If one field or subfield were to tank, a sufficiently broad person could switch much more easily.

From this experience, a combination of breadth and depth is best, even if it takes longer time to graduate and requires harder work and study later on.

Andres Peekna
Waterford, WI

APS Awards Outreach Grants to Seven Creative Teams

APS has awarded grants to seven teams to engage in outreach programs across the country. The grants are part of efforts by APS to encourage its members to bring the fun and excitement of physics to the general public.

Each grant proposal could be for up to $10,000 and the contact person had to be an APS member. Other than that, the requirements for applying were left open to encourage creativity and originality.

"We wanted to give grants to a wide range of projects, so each project is different and going to reach a different audience," said Rebecca Thompson, Head of Public Outreach at APS. "We were looking for things that were new and innovative."

APS first offered outreach grants for the World Year of Physics in 2005. In 2010 it revived the program for LaserFest, the celebration of the 50th anniversary of the first working laser. Since then grants are being awarded annually as part of a three-year pilot program. This year the Society received more than 80 applications, which were evaluated by members of the APS Committee on Informing the Public.

Nancy Sandler, a professor at Ohio University, is working with the school's film students to create short claymation movies for children. She said that the films will focus on bringing the physics of nanotechnology to kids in kindergarten through third grade.

"We want to make a couple of short movies, five minutes or ten minutes at most, to capture the kids' imagination," Sandler said. "Claymation is very cool, it's different and it's a good way to tell stories."

She said also that she wanted to involve the school's film students instead of just physics students because of their skill at communicating with a broad audience.

"We targeted them because we want to reach people like them. We want them to tell the story of what we do and why we do it in their own words," Sandler said. "We want to educate them, so they can educate the rest."

Dan and Jan Jablonski are putting together performances that teach kids about space and the solar system.

"What we're planning to do is take the children's book, 'Halley Came to Jackson,' by [singer-songwriter] Mary Chapin Carpenter… and turn it into a penny theater for young children," said Jan Jablonksi, a preschool teacher and co-president of the Noyes Children's Library Foundation.

A penny theater is similar to a puppet show, but uses paper cutouts instead of puppets for the characters. The book, based on Carpenter's popular song, tells the story of a young child in her father's arms when Halley's Comet was in the sky above Jackson, Mississippi in 1910, and how the memory stays with her for the rest of her life.

Ariel Simons, a high school teacher in Los Angeles, is also looking to the skies for his project, but is planning to elicit some help.

GRANTS continued on page 5

Murnane Chairs Selection Committee for National Medal of Science; Nominations Due Soon

Margaret Murnane, a physics professor at the University of Colorado, Boulder, has been chosen by President Obama to chair the President's Committee on the National Medal of Science. Murnane is a Fellow of APS and a recent recipient of the APS Schawlow Prize, and is currently a member of the editorial board of *Physical Review X*, as well as a former APS Executive Board member. She has served on many nominating committees and was a committee member, and later chair, of the Committee on the Status of Women in Physics.

"It's very important to honor people who really have devoted their lives to science, and beyond just science," Murnane said of the award. "They're that caliber of person who has transformed science, has served the nation and has made a difference."

The National Medal of Science, first established in 1959, is awarded by the President to individual scientists and engineers who have made significant contributions to science over the course of their careers. Administered by the National Science Foundation, it's considered the highest national honor that can be given to a researcher. Murnane was first appointed to the committee that selects the recipients in 2010, and will now chair the committee. Past laureates include Mildred Dresselhaus, Charles Townes and Eugene Shoemaker.

"It's a different award from the Nobels because it counts both scientific excellence and service to the country," Murnane said.

Murnane's own research focuses on laser applications, specifically ultrafast laser pulses. In 2009, she and her team at JILA developed a tabletop x-ray laser produced by laser pulses. In addition she has also used laser pulses to study the motions of electrons, atoms, molecules and acoustic oscillations.

She said that her area of research has helped her on the committee because of its broad applications across science, including in chemistry, biology and engineering. In addition in 1994 she and her husband Henry Kapteyn started KMLabs which specializes in producing research-grade optics equipment, which she said has given her a lot of perspective on the economic importance and impact of research.

The committee has issued a call for nominations for the National Medal of Science, as well as the National Medal of Technology and Innovation. Administered by the United States Patent and Trademark Office, the National Medal of Technology and Innovation was established in 1985 as the highest national honor for technological innovation.

The committee for the National Medal of Science is looking for nominees whose work has significantly advanced science, and has had broad impacts on society, such as advancing the national health, prosperity, welfare or national security. The submission deadline for both awards is March 31, 2012. Submitters can nominate anyone except themselves and members of their immediate family. More details on the National Medal of Science can be found at www.nsf.gov/od/nms/medal.jsp while information on the National Medal of Technology and Innovation can be found at www.uspto.gov/about/nmti/guidelines.jsp.

Molenkamp Takes Charge of *Phys Rev B*

Laurens Molenkamp, Chair for Experimental Physics at the Universität Würzburg, has been named the new senior editor of *Physical Review B*. The current editor, Peter Adams, who also helped found the journal, stepped down on March 1 but remains on its editorial staff. Molenkamp, who resides in Germany, will be the third senior editor of an APS journal to be based internationally. *Physical Review B* is a leading international journal for condensed matter and materials physics, and is the largest section of *Physical Review*.

Molenkamp said that he was "much honored to become the senior Editor of one of the cornerstone journals of condensed matter physics and [is] looking forward to working with its experienced editorial staff."

He is one of the recipients of the 2012 Oliver E. Buckley Condensed Matter Physics Prize, and is a Fellow of the APS. He was also named an APS Outstanding Referee in 2009. He has previously had editorial experience working with *Semiconductor Science and Technology*, as a divisional associate editor for *Physical Review Letters* and as editor for *EPJ Applied Physics*. Molenkamp's own research interests focus on quantum transport in nanostructures, semiconductor spintronics, and optical spectroscopy of semiconductors.

Laurens Molenkamp

"We were favored with an outstanding group of candidates," said Susan Coppersmith of the University of Wisconsin-Madison, who chaired the search for the new editor. "Dr. Molenkamp impressed the committee with his scientific eminence, editorial experience, and management ability."

APS Editor in Chief Gene Sprouse said he was excited that Molenkamp is taking the reins at *Phys Rev B*. "We were prepared for the possibility of an international editor," Sprouse said. "We know that distance is no longer an impediment to effective editorial management, even of our largest journal. It's an honor that a scientist of Dr. Molenkamp's stature will be leading *PRB*."

GRANTS continued from page 4

His proposal will turn the cameras of thousands of cell phones across the country into a massive distributed cosmic ray detector.

"The idea is that we're using the camera chips in cell phones as the detector plate for cosmic rays coming in from air showers," Simons said. "Each phone acts as a single pixel in a big array."

He and Justin Vandenbroucke from Stanford are programming an app for Android and iPhones that will record the time and GPS coordinates of any cosmic ray signature that the phone's camera picks up. Any ray that hits the light-sensitive chip will show up as a bright spot in the frame.

"The big thing is we're just trying to get data in general that we could use to study cosmic rays," Simons said. "It is outreach because it makes it really approachable. It's like 'here's an experiment and you can help us out with part of it'… It helps show the public what people are actually doing in science."

Other projects that will receive funding include a website for scientists to share their research, greeting cards that describe the physics of everyday objects, a series of physics-themed short films and a physics camp for high-school girls.

CHEMISTRY continued from page 3

and Land-grant Universities, discussed how to engage university administrative leaders and education faculty in efforts to enhance the training of future physics teachers. Panel members included Al Bennett (Dean, School of Biological Sciences, University of California-Irvine), Jane Conoley (Dean, Gevirtz Graduate School of Education, University of California-Santa Barbara), and Michael Gottfredson (Executive Vice-President and Provost, University of California-Irvine).

This year's PhysTEC conference was held just prior to the AAPT winter meeting, taking place at the nearby Ontario Convention Center.

James Selway, Teacher-in-Residence at Towson University, very much enjoyed his experience at the conference. "I've had some great conversations and picked up a number of good ideas," he said.

Monica Plisch, Associate Director of Education and Diversity, was pleased with the discussion generated by the series of workshops and panels. "Many participants mentioned that this was their best experience at a PhysTEC conference yet," she was happy to note.

The 2013 PhysTEC conference will be held March 16-17 in Baltimore, Maryland, prior to the APS March Meeting.

INTERNATIONAL News

…from the APS Office of International Affairs

Brazil a Great Place to do Physics …and Other Things

By Carlos J. Arguello

In May of 2011, I applied for the Brazil-US exchange program sponsored by the APS. A possible trip to Brazil had been discussed before, given the long-standing collaboration between one of my PhD advisors at Columbia University, Professor Yasutomo Uemura, and the group of Profesor Elisa Baggio Saitovitch at CBPF (Centro Brasileiro de Pesquisas Físicas) in Rio de Janeiro. While at first my trip to Brazil was only a possibility discussed over dinner in New York in February, by April when Professor Uemura gave me information about the APS exchange program, I realized I had an opportunity not only to visit a place known worldwide for its vitality and natural beauty, but also to work in Mössbauer Spectroscopy, a technique in which I hadn't had any direct experience before that would complement my own research experience at Columbia. Given that Rio was one of Richard Feynman's favorite places, I was sure the experience would be very interesting, and I quickly became excited about it.

So, I traveled from New York City to Rio de Janeiro at the beginning of June. I planned to stay in Rio for a couple of days to settle in, and then travel to Foz do Iguazu to attend to the "Encontro de Fisica 2011" for a week. This nationwide conference would gather Brazilian physicists from several fields, as well as some international visitors like myself. After the conference, I would return to Rio for the remainder of my trip.

It's too easy (and probably too much of a cliché) to talk about how beautiful the landscape of Rio is. I had heard a lot about it, of course, and I was not disappointed. Rio has a unique energy coming from its people and natural beauty that permeates every aspect of daily life. That was the first thing I noticed after stepping out of the airport. From the window of my assigned space at CBPF I could see one of the emblems of the city, the Sugarloaf Mountain, a constant reminder of how wonderful the opportunity to be in Rio was for me.

After a brief stay in Rio, I headed to Foz do Iguazu in the south of the country at the triple border of Brazil, Argentina and Paraguay. The first thing that came to my mind when I traveled there was, of course, the Iguazu Falls. They are absolutely breathtaking, for lack of a better expression ("Poor Niagara!" in the words of Eleanor Roosevelt). But what surprised me the most during that week was finding myself immersed in the middle of a growing and vibrant physics community; a reflection of what I think is an overall abundance of economic resources in Brazil nowadays.

The broad scope of this conference gave me the opportunity to learn about current research being done throughout Brazil in different fields, ranging from applied physics to Quark Gluon Plasma. Unconventional superconductors are my main research focus, so I paid special attention to the condensed matter oral sessions (experimental and theoretical).

Of particular interest to me were the poster sessions held at the conference, due to their more informal nature, and the fact that the presenters were usually graduate students like myself. During these sessions and in my conversations with the expositors, I inquired as much as I could not only about physics, but also about their experience as graduate students or postdocs at their home institutions. While in general I had no problems regarding the language in the oral sessions, when talking with the poster expositors, more often than not I had to rely on Portuguese to communicate, which made it difficult (and interesting) at times. Thankfully, my fluency in Spanish proved to be very useful because the two languages are very similar. However, speaking Spanish/Portuguese is not mandatory in Brazil. As a matter of fact, professors and graduate students alike spoke English fluently, so I didn't have any communication problems in my day-to-day work at the laboratory in Rio.

Photo courtesy of Carlos J. Arguello

Carlos Arguello on Copacabana Beach

Much of the research presented at the conference was theoretical or computational in nature. Based on my own observation, the ratio between theoretical-computational and experimental work was about 1.5 to 1. This could be advantageous for young experimental researchers, if, as I expect, new positions for experimental fields gradually increase to overcome this gap. The conversations I had with different postdoctoral research associates opened my eyes to completely new career possibilities at Brazilian universities and research institutions that I hadn't contemplated during my studies in the US.

I went back to Rio for the remainder of my trip to work with part of the Mössbauer group led by Professor Elisa Baggio-Saitovitch at CBPF. Mössbauer spectroscopy offers complementary information to Muon Spin Relaxation (muSR), which I'm studying under Prof. Uemura's direction at Columbia. The focus of our experiments was to study the interaction between antiferromagnetic order and superconductivity in underdoped $BaFe_2$-x(Ni,Co)xAs_2.

Being an active part of the research group for those two weeks allowed me to become acquainted with a completely different working environment. I was very impressed not only with the good quality of the equipment found at CBPF, but also with the resourcefulness of the students and laboratory staff. I was lucky to have my coworkers show me some of Rio's nightlife… and boy, Brazilians sure can dance!

All in all, my personal observations on the openness of the research community, scientific culture and quality of life have led me to consider Brazil as a very interesting place to continue my career in the near future (after finishing my graduate studies). We hope to continue our collaboration with the group at CBPF; we have already had some Brazilian students travel with us to perform muSR experiments, and several joint papers have been published (one has been submitted recently to review our work in the summer).

I think that the increasing availability of material resources, paired with the traditional attractiveness of the country, will generate a constant influx of researchers from different parts of the world. I had an amazing time, and I hope that more graduate students and researchers take notice of this wonderful opportunity through the APS exchange program. Muito obrigado Brasil!

Carlos J. Arguello is a PhD candidate in the Department of Physics, Columbia University. APS and the Sociedade Braileira de Física (SBF) co-sponsor the exchange of physics graduate students and professors between the United States and Brazil. The APS is ACCEPTING APPLICATIONS until MARCH 31. More information is available at: www.aps.org/programs/international/honors/

VIDEO continued from page 1

Earth. For instance, the first video sent to APS features water droplets orbiting around a charged knitting needle. Because the needle has a charge, it exerts an attractive electric force on the oppositely charged water droplets, causing them to revolve around the needle.

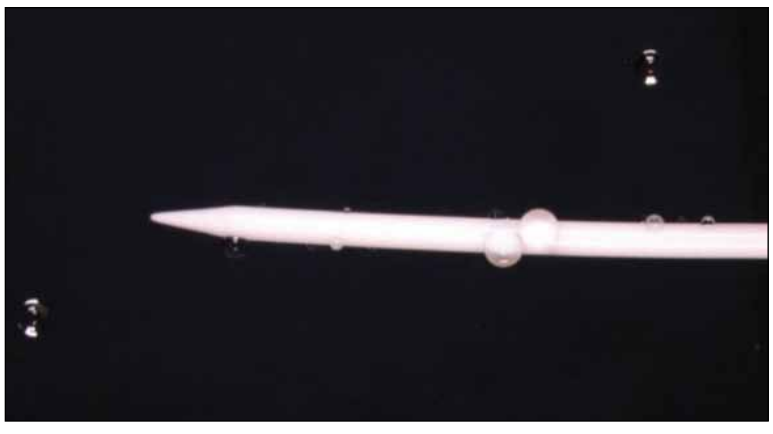
In another experiment, Pettit will demonstrate peculiar surface tension properties of water in a circular ring. When he shoots droplets of water from a syringe toward the water-filled ring, the droplets bounce off as if they were made of rubber. For each video, Pettit will guide the viewers through the physics involved.

"So far, the videos have dealt with how surface tension forces and static charge forces dominate in microgravity," said APS Outreach Specialist James Roche, who is in charge of editing the raw footage.

During his first trip to the ISS, Pettit hosted a series of Saturday morning science sessions that explored some of the difficulties of living in a weightless environment. For instance, one of his videos showed how the crew invented a special cup that resembles the shape of an airplane wing. With this cup, the astronauts could sip their coffee instead of sucking it out of a bag—certainly a more refined way to drink. Pettit will revisit this topic in one of the new videos.

"[Pettit] can explain very complex scientific principles in a way that people can understand them," said McArthur. "That's a talent."

Pettit can work on his videos only when he is off duty; most of the time he's been upgrading and maintaining the space station. Pettit was stationed on the ISS for six months in 2002 and 2003, and he participated in a 15-day mission to provide new equipment for the station in 2008. For his third stint, Pettit recently rode on a Russian Soyuz spacecraft to the ISS and arrived on December 23, 2011.



Charged water droplets orbit a teflon knitting needle in microgravity.

Due to Pettit's other responsibilities, it remains unclear how many videos he will be able to produce. Nonetheless, Pettit has a history of dedicating much of his limited off-duty time aboard the ISS to educating the public about basic physics.

As the videos are uploaded to the APS website, NASA plans to notify its 1.7 million twitter followers, ensuring that plenty of physics enthusiasts can participate in the project. Officials at both NASA and APS have become increasingly excited about the partnership while the first videos have been put online.

"Starting a collaboration with NASA is fantastic," said APS Head of Public Outreach Rebecca Thompson. "It can even lead to doing this with other astronauts in the future."

And McArthur believes that the partnership presents an opportunity to merge similar outreach efforts: "When I saw the materials and the way APS is presenting physics, it seemed to me that it was aligned with how Don has taught physics. It's a really good match."

BILL continued from page 1

Elsevier is facing a boycott from academics in part over its support of the bill. According to the website "The Cost of Knowledge," which is organizing the boycott, more than 5,000 scientists, including 440 physicists, have agreed to not publish, review or edit articles for Elsevier. Scientists who review articles for journals do so voluntarily and without compensation.

"Researchers are going to not give free labor," said Tyler Neylon, who started the website and is co-founder of the internet startup Zillabyte. "The boycott is saying I won't do all that free work."

The American Association of Publishers (AAP), an industry group whose membership includes many of the top academic publishers, is backing the bill. In a statement on their website, the organization "applauded" the act, saying that it will strengthen the peer-review system.

"While the federal government may fund research or some portion of it, it does not fund the scholarly, technological or financial investments made for value-added journal articles produced by private-sector publishers. The federal government should not be permitted to give away these private-sector products without the prior consent of the publishers," their statement reads.

In an interview, Allan Adler, the vice president for legal and government affairs at the AAP, said that they were not fundamentally opposed to the concept of wider access to scientific research but did not support government mandating the publication of journal articles resulting from it.

"We agree that the government should be doing everything possible to provide efficient and quick access to federally funded research… [Taxpayers] really deserve to know," Adler said. "What is a matter of dispute is…how to go about doing it."

Several members of the AAP have publically distanced themselves from the organization's stance on the legislation. Nature Publishing Group, AAAS which publishes *Science*, and MIT Press among others have all released statements opposing the RWA.

The American Institute of Physics issued an official statement that reads, "It is AIP's position that the proposed legislation is counterproductive to current efforts and not needed at this time. The measured, imaginative discussions between publishers and federal agencies that have been spurred by the existing COMPETES law offer the most productive route to success in broadening public access."

The statement refers to a provision of the America COMPETES Reauthorization Act of 2010. It established a committee under the administration's National Science and Technology Council (NSTC) to evaluate options to increase public access to federally funded research results and has been working with research agencies, academics, publishers, libraries and others to develop a future policy.

Until the provision was included, some version of the Federal Research Public Access Act had been introduced in Congress almost every year since 2006. The original intent of having the NSTC evaluate open access options was to avoid battles in Congress over the issue.

"The reappearance of dueling legislation is probably not needed," said Fred Dylla, Executive Director of the AIP. "That's why I felt this law was ill-timed and unproductive."

Publishers who have come out opposed to the RWA have been careful as to the position they take on the issue, as they depend on revenues from the sale of journals and articles to recoup the costs of editing and publishing.

"The federal government pays for research, taxpayers should see the result of the research," Dylla said. "Did the government pay for the expression of that research as a journal article? The answer is 'No.'"

Dylla estimates it can cost them between $1,000 and $4,000 per article to publish. These include costs for printing, copyediting, servers and management of the peer review process. This last cost has been particularly controversial, as much of the peer review process is done voluntarily by researchers in the field.

"The management of the peer review process for our 10 large journals requires 50 full-time professional editors with a PhD in physics, and they must be compensated," wrote APS Editor in Chief Gene Sprouse and Treasurer-Publisher Joseph Serene in a letter to *The New York Times*. "Although we do not support the Research Works Act, we know that the costs of the peer review process are not negligible and must be supported either by subscriptions or article charges."

The RWA came at a time when tensions have been running high over issues of intellectual property and open access, the free exchange of information and the costs of producing that information. Traditional publishing business models have begun to show cracks in the age of the internet. Established media industries ranging from music labels to newspaper and academic publishers have all been wrestling with the declining revenues. Many have also faced consumer backlash over efforts to protect their established business models. Elsevier has received the brunt of the backlash in the academic publishing world.

"[The RWA] might be one of the things that got most people riled up in the beginning," Neylon said. "I think that there's a lot of disgust over SOPA and PIPA," referring to Elsevier's support of the proposed anti-piracy legislation which sparked high-profile online protests in January. The website also criticized rising journal costs, the company's high profit margin and the practice of bundling the sale of journals.

Neylon added that he felt discontent towards commercial publishers was "pretty widespread," and Elsevier was the focus of the boycott because there was already a strong distrust of them among segments of the academic community. "More people are willing to boycott one publisher instead of all of them."

Campbell said that there was a lot of misinformation about the company on the web, and that most of the company's business practices were in line with standard industry practices.

"I would think that it's because we're a very large publisher and very visible. It could have been other publishers as easily as it could be us," Campbell said. "You're always going to be challenged in times of turmoil."

The company has been experimenting with some open access models. It offers eight open access journals and lets authors buy open access right in 1,100 of its 2,000 journals.

"I think the future is going to be a more exciting but challenging one," Campbell said. "I think that we're going to continue to experiment and launch new titles with new business models."

Researchers and the public have been clamoring for greater openness of scientific results for more than a decade, especially as the internet has made access to information easier. Traditional models of academic publishing were not designed to handle the increased demand for low-cost access, and many different ideas for new publishing models have been proposed.

"Different research communities have different degrees of need for this kind of open access," Statler said. "I can't imagine anyone thinks a 'one size fits all' would work."

He added that in general the federal government is looking for ways to support a transition to business models that can adopt more open access policies.

"The overall idea is to…go towards a model where the cost of publication is borne at the publication stage rather than the subscription stage," Statler said.

Journal publishers have started to cautiously dabble with open access. APS now publishes three journals that are completely open access. In addition, it has made all of its journal articles freely available through on-site access at public and high-school libraries.

"APS is proceeding with caution because as we said before not all fields of physics have embraced open access as fervently," said Jorge Pullin, editor of APS's open access journal *Physical Review X*. He added that he personally felt that more publications and organizations were likely to migrate to open access as time goes on. "It seems to me that in the age of Google and the internet, openness is the future."

APS and AIP have both introduced a "rental" model in 2010 where researchers can read an article online for as little as $0.99. The articles can't be saved or printed and can only be accessed for a limited time after being purchased.

Adler proposed a different approach, one where progress reports already required by federal grants could be published in PubMed and other open access websites, while journal articles remain the intellectual property of publishers.

"Part of our consternation about all this is what do those agencies do with these progress reports?" Adler said. "We don't understand why the government doesn't make those reports accessible to the public."

Pullin said that he was skeptical that a progress report could replace a journal article for researchers.

"I don't think that's sufficient because the reports that one submits to funding agencies are not as detailed as the papers," Pullin said.

The England-based "Faculty of 1000," an online subscription service that tracks and rates the importance of biology and medical articles for researchers and clinicians, has announced that it will be starting its own free, open access journal. Its model is unique. Partially inspired by the popular ArXiv website used by mathematicians and physicists, F1000 Research will freely and immediately publish any scientific paper it receives after an initial "sanity check." The model incorporates the peer review process after the article is published, and all commentary will be open and visible.

"If we can show that this model works, I think others will gradually follow suit. I think it's the direction that publishing is going," said Rebecca Lawrence, who is heading the new journal. "I think it will change the landscape. Whether it will completely change subscription journals, I don't think that will happen any time in the near future."

ANNOUNCEMENTS

INDIA-U.S. Travel Grants

Physicists and physics graduate students in India and the United States can apply for travel grants to pursue opportunities in the other country.

The **APS-IUSSTF Professorship Awards in Physics** funds physicists in India or the United States wishing to visit overseas to teach short courses or provide a physics lecture series delivered at a U.S. or Indian university. Awards are up to U.S. $4,000.

Through the **APS-IUSSTF Physics Student Visitation Program**, U.S. and Indian graduate students may apply for travel funds of U.S. $3,000 to pursue opportunities in physics. The travel funds could be used to attend a short-course or summer institute, to work temporarily in a laboratory, or for another opportunity that the student and the host professor believe is worthy of support. The Physics Student Visitation Program aims to mostly support graduate student travel to India by U.S. citizens, while enabling some students of Indian citizenship to travel to the United States.

Further details about both programs, including proposal guidelines, are provided at: www.aps.org/programs/international/us-india-travel.cfm

This program is sponsored by the Indo-U.S. Science and Technology Forum (IUSSTF) and administered by the American Physical Society (APS).

APS physics

Deadline: Friday, 30 March 2012

IUSSTF

Brazil-U.S. Exchange Program

The American Physical Society is now accepting applications from U.S. applicants for the Brazil-U.S. Exchange Program.

Through the **Brazil-U.S. Physics Student Visitation Program**, graduate students can apply for travel funds to pursue a breadth of opportunities in physics, such as: 1) attending a short-course or summer institute; 2) visiting with a professor in his/her field of study; 3) working temporarily in a lab; or 4) any other opportunity that the student and professor feel is worthy of travel support. Grants are for up to USD $3,000.

The **Brazil-U.S. Professorship/Lectureship Program** funds physicists in Brazil and the United States wishing to visit overseas to teach a short course or deliver a lecture series in the other country. Grants are for up to USD $4,000.

The application deadline for U.S. applicants traveling to Brazil is 30 March 2012. Applications from U.S. applicants should be submitted to Michele Irwin, APS Office of International Affairs, Irwin@aps.org. Additional information about the program, including application guidelines, is provided at: www.aps.org/programs/international/

Information for applicants from Brazil can be found on the SBF website at: www.sbfisica.org.br/v1/

APS physics

This program is sponsored by the Sociedade Brasileira de Fisica (SBF) and the APS.

SBF SOCIEDADE BRASILEIRA DE FÍSICA

MEETING continued from page 1

(session H52.09). At Florida State University, engineers have investigated spider silk's electrical properties, and its potential uses in electronics (session W49.12).

Potential Dangers from Soviet-Era Nuclear Reactors

Demetra Papadopoulou of Neumann University takes a long hard look at VVER nuclear reactors, an old Soviet design still in use in some parts of Eastern Europe. If a major accident, on the level of Fukushima or Chernobyl, were to happen at one of these plants, the result could be calamitous, resulting in potential environmental devastation or possible destabilization of weak democratic governments. What's more concerning is that many of these reactors likely have serious deficiencies in their fire suppression systems, reactor confinement and emergency cooling systems (session L37.06).

Electronics Made out of Paper

There's nothing like the feel of a good book, and now researchers think they can replicate that for e-readers. Andrew Steckl and his team at the University of Cincinnati have come up with a way to use actual paper to make an interactive and flexible screen for e-reader displays. Using a process called electrowetting, which moves oil-based inks across a surface using changes in voltage, and hydrophobic paper as a substrate, the team is working to create the first generation of bendable computer screens and ultimately entire computers (session B42.13).

Omni-Directionally Strong Diamonds

Researchers from Stanford University and the Carnegie Institution of Washington have created a new form of ultra-strong carbon. Dubbed amorphous diamond, it is made by subjecting carbon to pressures that are 400,000 times normal atmospheric pressure, thus forming a material with a disorganized molecular structure that is as strong as diamond in all directions, and that can't be cleaved like natural diamonds. Unfortunately, the material lacks the luster of a true diamond, so it is not suitable as a gemstone (session V25.06).

On the Origin of Words

It's a competitive world out there for new words. Either they catch on and become part of the vernacular, or get forgotten and are consigned to the dustbin of history. Hoping to better understand the evolution of language, researchers at Boston University scoured Google's massive Ngram database, which searches for the frequency of word use in millions of books stretching back to 1800. They found that words compete for usage, and will become widely accepted if continually used for about 40 years, about the time it takes to be incorporated into a dictionary (session J54.11).

The Physics of Ponytails

Ponytails come in many different lengths and styles and now a team of researchers from the United Kingdom can predict their shapes based on measurements of individual hairs. The team developed an equation to predict the shape of a ponytail that factors an individual hair's elasticity, response to gravity and intrinsic fluffiness. They used high-resolution stereoscopic images of commercial hair samples to come up with the equation. The researchers say that next up is the physics of ponytails in motion (session H52.03).

Nanostethoscope for Insects

Researchers at Clarkson University have found a way to listen to a ladybug's heartbeat. They poked a hole in a thin metallic membrane for the tip of an atomic force microscope to peek through. This let them hold the tip of the AFM up to the exoskeleton of a variety of insects beneath it and listen to the subtle and high pitched hum coming from the tiny creature's heart. Researcher Igor Sokolov will also discuss how this technique might one day be used to diagnose the health of a human organ (session H1.07).

PANEL continued from page 1

Consequently, agencies can have a difficult time providing financial support for collaborative efforts that also align with their mandated research programs. With more authority and funding, the NNCO could more easily pursue areas that are useful and common to all agencies, said Fritts.

But the NNCO has a somewhat conflicting mandate itself. NNCO's mission charges it with promoting nanotechnology advances while simultaneously acting as a buffer against potential risks.

"In one sense you're looking to slow down research, and in the other you're trying to expand it," Fritts said.

Other obstacles to ENM research advances extend beyond government policy and pervade the wider scientific community, according to the report. In particular, cultural problems that dictate how science should be presented constitute a barrier to studying ENMs thoroughly, said Fritts.

"What would really help is something to counteract how scientists interact," said Fritts. "There are not enough good databases, not enough raw data."

In an effort to facilitate data sharing, the National Science Foundation has funded the increasingly popular Nanohub.org website. Nanohub provides a place for researchers and students to share data, simulations and other resources related to nanotechnology.

Nanohub originated in 2001 as a part of the National Nanotechnology Initiative set forth by the Clinton administration. Since then, the website has developed a dedicated user base, and the site served 200,000 users over the past year.

Krishna Madhavan, an engineering education professor at Purdue University in West Lafayette, Indiana, has been working on the Nanohub website for years. Madhavan hopes to make running simulations easier for scientists by providing computational solutions all in one place.

"[Researchers] shouldn't have to build their own web infrastructure or computational infrastructure," Madhavan said. "Nanohub will find the proper resource and push the code out to run where it needs to run."

As part of its mission, Nanohub aims to maintain research data and simulations that aren't published in journals due to space restrictions. For example, a graduate student may have years worth of code left over at the time of graduation, but that code may never leave his lab. Nanohub administrators hope that publishing that work can benefit the nanotechnology community long after a student's graduation.

Despite growing support for open databases like Nanohub, not all physicists are convinced that these repositories are helpful. In fact, these databases can flood researchers with too much information, according to Schuller.

In addition to acting as a database, websites like Nanohub have been promoted as a way for fellow researchers to connect. With similar approaches in the future, the government panel hopes to develop more professional relationships among researchers, leading to more fruitful research.

But Schuller contends that collaboration needs to be more organic.

"Spending a large amount of money and hoping this will revolutionize the way people interact, I think it's been overdone," he said. "Collaborations in science have to naturally evolve."

Nonetheless, Schuller thinks that reports like this one have succeeded in the past by guiding future research areas: "They distill what's important. I find these reports useful, and you don't have to agree with everything [in the report]."

The panel will revisit the issue of nanomaterials' health and safety impacts in about 18 months.

In the meantime, Madhavan believes that the public should rest assured that scientists are probing potential risks related to nanomaterials.

"In general, the people doing this kind of work are very serious people," he said. "They're very careful."

The Back Page

Beyond the Endless Frontier: A 20th Century Model faces 21st Century Realities

By Dimitri Kusnezov and Wendell Jones

Dimitri Kusnezov

Wendell Jones

Vannevar Bush's legacy, S*cience–The Endless Frontier,* has been recognized as the cornerstone of post-World War II US science and science policy. It is viewed as the justification for principal investigator (PI) driven academic research, a model that has worked well to shape the frontiers of science and engineering at research universities. This model has been a spectacular success in fostering innovation and progress in the basic sciences, pushing the frontiers of knowledge and leading to breakthroughs that affected and improved all our lives. At the same time in the ensuing decades, unclassified research has nourished and helped keep the nation's classified research vibrant. Vannevar Bush was concerned with the issues of governance of science and sought to not only reformulate it but also put in place a structure that would make the US the leader in scientific innovation. It is interesting to note that many of the issues that sixty years ago vexed Bush apply today: the looming fears of losing innovation, competitiveness, and leadership. We propose that these issues indicate the need for a governance approach to the national security science and technology (S&T) capability base that sustains the potency of the PI-driven approach but adds a dimension that stimulates the shared benefits of planning and investments made across multiple government agencies.

Cold War Legacy

Throughout the Cold War, federal agencies and congressional committees supported the research areas of direct interest to their agency or committee. Today, basic science and technology is supported through the National Science Foundation, the Department of Energy, National Institutes of Health and so forth. This multiplicity of funding sources allows for a vigorous competition of ideas and fosters innovation. The breadth of the resulting S&T activities has created a vibrant research marketplace of funders and principal investigators (PIs) that serves a multitude of applied needs as well. At the same time, a significant infrastructure has developed for national security S&T, manifested visibly through national laboratories. An analogous marketplace has emerged for the nation's classified needs. Broadly speaking, each Federal agency oversees its own S&T capabilities, and each supports the unique skills that have historically met their needs.

During the Cold War, the perceived existential threat provided a priority and focus for investment that cultivated sets of unique skills and capabilities that are not found elsewhere. The nature of that problem promoted the creation of vertically integrated programs. Everything from the basic sciences to needed technologies and engineering to prototype development to full manufacturing were planned and executed under single programs in single agencies. Stovepipes were typically disjoint, and each problem could be bounded and budgets within agencies could balance both strategic and tactical investments in order to deliver against the mission. Adequate funding across national security missions allowed agencies to assume that capabilities each utilized which resided in another agency would be fully funded and cared-for by the other agency. This stovepipe approach worked well and provided straightforward planning and oversight to avoid confusion over lines of authority and priorities. In time, a certain amount of implicit inter-reliance developed among agencies and their unique sets of capabilities that emerged. Such an approach in the post-Cold War era no longer produces a sustainable S&T base for the nation. Further, the problems the nation faces have increasing scientific complexity and are not solvable in the model of the post-World War II 20th century science envisioned by Bush in *Science-The Endless Frontier*, and exemplified with principal investigator driven research.

We suggest that, in ways distinct from the open scientific environment, the national security marketplace is endowed with properties of a 'commons'. Said another way, federal agencies with national security missions have become dependent on S&T resources (unique skills and facilities) owned across multiple agencies. This, in turn, suggests that the manner in which planning for S&T is done in these agencies requires revision. Post-Cold War geopolitics and economic realities require a reanalysis of how we organize to address the 21st century national security challenges. Developments in economic theory, game theory, and common pool resource management provide a framework in which whole new governance models can be explored.

One of the challenges we face today, different from the Cold War, is a proliferation of disparate S&T challenges whose resolution is required for the development of US policy. Each of these challenges is a mission priority for one of the federal agencies while the S&T resources engaged are spread across agencies. How are priorities for funding set? How can important new capabilities be funded? How can existing capabilities be recapitalized? These are challenging governance questions in their own right whose solutions do not lie within the PI driven model or with autonomous S&T stovepipes. The current austerity faced by all R&D programs presents both opportunity and threat for the US R&D base.

Prisoner's Dilemma and Game Theory

Game Theory provides a convenient approach to quantify and analyze this complex S&T environment. While originally developed as a quantitative basis for economics, it has grown to be a tool for broad application to many different social settings as well.

The optimal solutions include shared investments that strategically maximize the utility and value of the nation's S&T. A poor solution is one that is self-protective and cannot address the inherently strategic aspects of long-term federal needs beyond the stovepipes.

Within Game Theory, the Prisoner's Dilemma is a simple yet illuminating model that applies in part to the problem at hand. It is a construct that illustrates the surprising paradoxes that can be found in even simple situations. In the elementary case, two players are provided options and chose the one that provides the lower risk to them. The players are driven to a collective solution that is an overall inferior economic solution. Our current environment shares the characteristics of an n-body Prisoner's Dilemma. We are faced with analogous choices in the long-term planning of national security S&T capabilities, and the choices available can lead to non-optimal economic solutions at the national scale. The challenges are much exacerbated in times of austerity. A key attribute of this framework is that players motivated by good intentions, but lacking in deep-rooted trust, can be led to poor overall solutions.

Garret Hardin's article "The Tragedy of the Commons" has become a classic statement of the problem of shared resources. In the model, a community utilizes a Commons and locally optimized behavior inexorably drives the Commons to ruin. Hardin concluded that shared resources could only be protected through coercion and force. The conclusion that only this outcome derives from utilization of such common pool resources has held as a "general truth" since Hardin's paper. However, this does not mean that there is no exit from this inevitability.

Other Possible Strategies

Nobel Prize winning economist Elinor Ostrom has documented a number of human-natural systems where common pool resources have been sustained through governance that is neither top-down coercion nor pure market-driven outcomes based on individual decision. She has recognized that there are examples of common pool resources that include both natural and human-constructed equities. When the concept of common pool resources is applied to the S&T base of the nation, this work suggests that there are governance models beyond the simple dichotomy of centralized government ('stovepipe' in our analogy) versus private property (principal investigator-driven S&T). Much of Ostrom's work on governance of shared resources is based on the analysis of natural ecosystems such as forests, fisheries, watersheds and such.

What has emerged is clear evidence in real systems that a different class of resources exists–so called 'common pool resources'–and we are not all doomed to the tragedy of the commons. Novel governance, with a shared fate, can be developed that can save and grow the commons for maximal societal benefit. What are the critical criteria for the success of these polycentric governance models? First, trust must be built from extensive face-to-face discussions among the parties. Next, sufficient numbers of cooperators are needed; if there are too few, the system fails in time. And third, feedback mechanisms with transparency regarding outcomes are necessary to sustain participation of cooperators.

The National Security Commons

While there are commonalities of the national security S&T base in this country with the definition of common pool resources, there are also significant differences. Nevertheless, one can create a consistent model for such resources that can avoid the dilemma. But an essential step is the recognition of the existence of such commons.

We are in a time of prolonged austerity in which the pressure on S&T budgets will remain severe. Each agency involved in national security will likely be driven to employ the usual two strategies: to cut internal funding for all work not identified as absolutely critical to the near-term demands of their missions, and to leverage the assets of other agencies to the maximum extent at the lowest possible cost. This reality vividly shows the nature of this challenge as having attributes of both a Prisoner's Dilemma and a common pool resource tragedy. Most of the existing discussion of these challenges falls into one of the two alternatives recognized by Hardin: allow the free market of federal budgets to determine the S&T base, or re-organize the ownership of the national laboratories to fit current missions (re-align the stovepipes). Neither outcome is suited to the class of 21st century complex, multidisciplinary S&T problems.

So what are the options?

The issues here have been recognized among select federal agencies with national security S&T missions, and there is currently an effort among these mission agencies that own S&T capabilities to self-organize to address these issues. The Departments of Energy, Defense, Homeland Security and the Office of the Director for National Intelligence have signed up to avoid this potential "tragedy of the commons". A four-party governance charter has been signed at the Cabinet level, quite novel in its intentions, and it establishes a means to examine strategic alignment of S&T capabilities across agencies in order to circumvent failure in critical national security areas. If done properly, and supported across Congressional committees, it can potentially avoid strategic failure of this ecosystem to responsively deliver against national priorities.

We either face hard choices in down selecting from the large number of problems we will choose to tackle, or we need to develop a more flexible and strategic approach to planning across agency and committee boundaries. Solutions do not lie with PIs, since the problem is inherently structural. It is not for the lack of commitment to accomplishing national missions. Rather, it is the paradox of the Prisoner's Dilemma that drives rational players into the overall non-optimal situation. The reward structure, planning and approach is still a relic of the 20th century model, where vertical integration built around the desired problem was a feasible option if funding was not limited, and duplication of capabilities could be supported at any level. In such an environment, this would work fine. But as we head into austere times, a more flexible way for federal programs to plan jointly strategically is increasingly critical. The overall infrastructure that is needed is neither trivial nor readily reproduced. Long term planning of capabilities is an essential top-down overlay that cannot be done simply using Vannevar Bush's approach.

Dimitri Kusnezov is Chief Scientist & Director of the Office of Science and Policy at the National Nuclear Security Administration /Department of Energy in Washington, DC and a laboratory associate in physics at Yale University. Wendell Jones is a retired Senior Scientist of Sandia National Laboratories and an advisor to the Chief Scientist of NNSA/DOE.

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