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**Nominate some Golden Geese**
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# APS Bridge Program Selects New Sites

*By Bushraa Khatib*

The APS Bridge Program (APS-BP) recently announced that The Ohio State University (OSU) and the University of South Florida (USF) will receive funding to develop bridge programs to the physics doctoral degree. The goal of APS-BP is to increase the number of physics PhDs awarded to underrepresented minority students, including African Americans, Hispanic Americans and Native Americans.

Students selected as APS Bridge Fellows receive stipends to participate in programs at the bridge sites. APS-BP had initially planned on placing four students in its first year, but, because the bridge sites were able to secure their own funding as well, there are now seven Bridge Fellows, with the possibility that even a few more may be able to join.

OSU has established a one-or two-year transitional M.S. program beginning in summer 2013. The APS-BP Fellows will enter OSU's existing physics M.S. program, and eventually apply to a physics doctoral program there or at another institution. Students will spend the summer of their first year doing research and preparing extensively for the general and physics GRE. During the academic year, they will take graduate physics core courses and receive application coaching to prepare their applications for graduate school. The program also plans to implement a network of

**BRIDGE continued on page 6**

# APS Picks Pierre Meystre to Lead PRL Editorial Team

The new Lead Editor for *Physical Review Letters* is Pierre Meystre of the University of Arizona. He succeeds Jack Sandweiss of Yale, who held the position for 25 years.

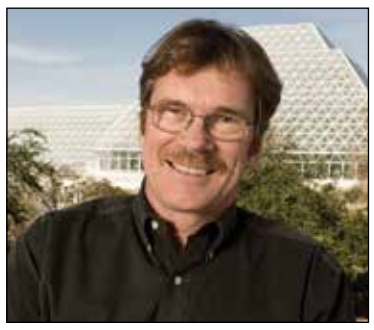
"*Physical Review Letters* is, in my opinion, the greatest physics journal. It is absolutely essential that this position be maintained and strengthened going forward in the face of a number of complex but interesting challenges," Meystre said.

Meystre will be in charge of the day-to-day operations of *PRL*, including handling author appeals as well as other major editorial decisions of the journal.

"We are fortunate that Dr. Meystre will be leading *PRL* into the future," APS's Editor in Chief Gene Sprouse said in a statement. "His prior involvement with *PRL* and his strong editorial experience is very compelling. We look forward to Dr. Meystre following Jack Sandweiss as an inspirational leader for the journal."

Meystre is an APS Fellow and has been a referee for *PRL* for years. He is an optical physicist who specializes in quantum optics, atomic physics and the statistical properties of radiation.

In addition he is the director of the Biosphere2 Institute which addresses the "Grand Challenges whose solutions require the combined expertise of a broad range of scientific fields and diverse interdisciplinary talents." He is also the director of the Arizona Center for STEM Teachers.



Pierre Meystre

Meystre received his PhD from the École Polytechnique Fédérale in Lausanne, Switzerland in 1974. He joined the University of Arizona as a professor of physics in 1986 and was head of the department from 2005 through 2007.

The search committee announced his selection in mid-June and his first day as Lead Editor was on the first of July.

# Science Community Slams Draft Legislation

*By Michael Lucibella*

Congress is stepping back and rethinking controversial legislation that many scientists saw as a change to how the National Science Foundation awards its grants. The leaked draft of the "High Quality Research Act" sparked controversy over fears that Congress was trying to interfere with the scientific process. The backlash within the scientific community has helped to delay action and, as *APS News* goes to press, the bill has yet to be introduced in the House. Congressional aides say, however, that they are continuing to work on it.

"Because of the uproar that this draft bill has caused within the scientific community…we are told that they are going 'back to the drawing board' to figure out what to do next," said Jodi Lieberman, APS Senior Government Relations Specialist. She added that it was unclear whether any version of the bill will be introduced at all in the foreseeable future.

The draft legislation, which originated in the House Science Committee, would have required the Director of the National Science Foundation to certify that every grant's research "is in the interests of the United States to advance the national health, prosperity or welfare, and to secure the national defense by promoting the progress of science," be ground-breaking, not duplicative

**COMMUNITY continued on page 7**

# Physicists in Outreach Face Tricky Career Choices

*By Calla Cofield*

The 2013 APS April Meeting was brimming with sessions on science communication and outreach. These talks addressed how physicists engage and communicate with the public by blogging, writing books, speaking at public events, teaching classes on unusual subjects like the physics of cooking and the like. Many of the presenters addressed a common question: When, during a physicist's career, is an ideal time to get involved in public outreach?

Diandra Leslie-Pelecky, a physicist at West Virginia University, outlined in her talk key issues that a physicist should consider before getting involved in outreach, including career timing, and what he or she is willing to sacrifice to make time for outreach. Early career physicists may have advantages such as more energy, more time, and fewer personal responsibilities.

But Leslie-Pelecky also warned that young physicists should consider how senior physicists with whom they work view outreach. She said that many physicists assume young people involved in outreach are "not serious" about their scientific work. Those opinions could harm young careers, especially if they come up on review boards or in recommendation letters.

To overcome this obstacle, Leslie-Pelecky says physicists should first find out how much their institution and their coworkers value outreach work.

Leslie-Pelecky is the author of the book *The Physics of NASCAR*, and her work has been featured in *The New York Times* and *Sports Illustrated*. Last year she began appearing the SiriusXM satellite radio show Sirius Speedway, where she addresses science questions about NASCAR, such as whether or not a misplaced oil tank cover can increase the speed of a car. An article she wrote about stock car science received over 40,000 unique views, about which she noted that "even if only five percent of those people actually read the article, that's more students

**OUTREACH continued on page 7**

# Chairs Conference Highlights New Technology and Techniques

The 2013 Physics Department Chairs Conference, jointly organized by APS and the American Association of Physics Teachers, took place at the American Center for Physics in College Park on May 30 and 31. Part of a series of conferences that have been organized biennially for the past three decades, the Chairs Conferences are now organized annually.

At this year's conference, attended by about 100 chairs from both large research universities and smaller colleges, speakers shared innovative ways to recruit, educate and assess physics majors at their colleges and universities. In the opening plenary session, professors from schools across the country described how they adapted new technology and techniques into their programs.

Attracting prospective students into their physics program had been a major problem for James Madison University. In the mid 1990s enrollment reached a decades-long low, which the administrators attributed to a perception of limited career options for physics majors.

"Physics is poorly viewed by prospective students and their parents," said Steven Whisnant, head of JMU's physics department.

To boost their enrollment in the physics programs, they started offering more specialized tracks for their physics majors. Over the next decade, the department instituted a wide variety of new "multi-track" degrees. These included a new physics and engineering program, an option for students to design their own track, and a multidisciplinary concentration, which incorporated minors from other fields including education or English.

"This gives us a way to combine physics with other possible career choices," Whisnant said. "Mostly it's replacing existing courses. It's how you sell it in the catalogue."

Since 1995, when the department first started reorganizing itself, the number of physics majors has quadrupled while the overall number of students at the university hasn't quite doubled.

Steven Pollock from the University of Colorado at Boulder

**CHAIRS continued on page 6**

Photo Credit: Ken Cole

The Chairs Conference Organizing Committee gathers outside APS headquarters to contemplate a job well done. They are (l to r): Willie Rockward (Morehouse College); Bob Hilborn (AAPT); Talat Rahman (University of Central Florida); Monica Plisch (APS); Chuhee Kwon (CSU Long Beach); Steve Whisnant (James Madison University); Rafael Muller (University of Puerto Rico at Humacao); and Ed Bertschinger (MIT).

## Senior Editor-*Physical Review Applied*

The American Physical Society is conducting an international search for the founding Senior Editor of the newly established journal *Physical Review Applied*. The Senior Editor will develop editorial standards and policies, direct the journal, and lead an editorial board and staff of editors. The scope of *Physical Review Applied* will comprise experimental and theoretical applications of all areas of physics, including condensed matter, materials, electronic structure and transport, lasers, optics and optoelectronics, magnetism, nanoscience, superconductivity, biophysics, fluids and devices, as well as applications to other sciences, engineering, and industry. This journal will maintain the same high editorial standards as the other *Physical Review* journals to select papers with significant, new results for publication.

The Senior Editor may maintain his/her present appointment and location while devoting at least 20% of his/her time to this position. The initial appointment is for a three-year term with renewal possible after review. Salary is negotiable and dependent on established time commitment. The desired starting date is 1 October 2013. The APS is an equal employment opportunity employer and encourages applications from or nominations of women and minorities. **Inquiries, nominations, and applications (cover letter plus CV) should be sent by 1 September 2013 to: Chair, PR Applied Search Committee, edsearch@aps.org**


# Members in the Media


"Nobody likes fire ants."

***Daniel Goldman**, Georgia Tech,* Los Angeles Times*, May 20, 2013.*

"The sound is like an elephant rumble…. It is way below what humans can hear but it travels long distances."

***John Trostel**, Georgia Tech, describing a tornado,* The Wall Street Journal*, May 21, 2013.*

"If crowdsourcing is one more way to almost weaken the regulatory environment, then that might actually have unintended consequences."

***David Kaiser**, MIT, on the idea of crowdsourcing science funding,* BBCNews.com*, May 22, 2013.*

"The difficulty is that you need a very lightweight nuclear reactor to get you enough power for it."

***Geoffrey Landis**, Glenn Research Center, on using a nuclear reactor to power a rocket ship,* The Washington Post*, May 30, 2013.*

"We said, 'To heck with electromagnetic, we're going with electrostatic.' "

***Richard Post**, Lawrence Livermore National Laboratory, on his development of a new kind of battery using a flywheel,* The San Jose Mercury News*, June 3, 2013.*

"The subject has become very contentious."

***Mark Boslough**, Sandia National Laboratories, on a theory that a meteor created a minor ice age 13,000 years ago,* The Washington Post, *June 3, 2013.*

"In the first time cloak paper, they discussed hiding events of a few billionths of a second once in a while. Here, they are talking about being able to hide data 46% of the time. This really suggests that this has gone from a curiosity to something that could be used in optical communications and data processing."

***Greg Gbur**, University of North Carolina at Charlotte, on another researcher's paper on "time cloaks,"* BBCNews.com*, June 5, 2013.*

"The reason is simple: I believe I am the best candidate to continue the passionate advocacy for progressive values that Sen. Lautenberg exemplified."

***Rush Holt**, announcing his bid for a Senate seat from New Jersey,* The Washington Post*, June 6, 2013.*

"It was amazing to be able to see the complete aria…. For me, uncovering the composition of a genius' work that had been lost for centuries is as thrilling as trying to uncover one of the big secrets of nature."

***Uwe Bergmann**, SLAC, who used X-rays to see the lost sections of Luigi Cherubini's 18th century opera Medee,* The Daily Mail*, June 11, 2013.*

# This Month in Physics History

## July 21, 2004: Hawking concedes bet on black hole information loss

In 1684, Christopher Wren announced a wager of sorts: he promised a book worth 40 shillings to the first person able to demonstrate that Kepler's laws could be derived from the inverse-square law. Three years later, Isaac Newton's *Principia* was published, in which he addressed that challenge, but it proved too late to collect on the bet. Still, it is one of the earliest recorded scientific wagers–and modern-day physicists seem to be especially fond of making them.

For instance, Richard Feynman wagered in 1959 that it wasn't possible to build a motor smaller than 1/64th of an inch. He hoped this would provide incentive for an enterprising scientist to invent new fabrication techniques. Instead, a man named Bill McLellan managed to build such a motor using existing techniques and parts drawn from amateur radios. Feynman could have refused to pay on a technicality –he never really made a formal wager–but he paid McLellan the promised $1000 anyway, despite expressing disappointment that his ulterior goal hadn't been met.

John Preskill (right) declares victory at Stephen Hawking's expense

One of the most recognizable physicists today is Cambridge University's Stephen Hawking, author of the bestselling *A Brief History of Time*, among other books. In 1993, he made a cameo appearance in an episode of Star Trek: The Next Generation, in which Lieutenant Commander Data plays a game of poker with holographic representations of Hawking, Sir Isaac Newton, and Albert Einstein. Hawking "won" that fictional game, but in the real world, he has fared less well on the gambling front.

Hawking has made several high-profile scientific wagers over the years. In 1975, he bet Caltech physicist Kip Thorne that black holes–then still hypothetical objects–did not exist. The monetary stakes were fairly low: if Hawking won, he would receive a four-year subscription to *Private Eye* magazine; if Thorne proved right, and black holes did exist, he would receive a one-year subscription to *Penthouse*. As evidence for the existence of black holes piled up, Hawking was forced to concede the bet and supplied the promised subscription. But since so much of his own research postulated that black holes exist, scientifically he emerged a winner.

The second bet Hawking made, on September 24, 1991, was with Thorne and his fellow Caltech physicist John Preskill. It concerned whether naked singularities could exist outside a black hole, and hence be observed. Preskill and Thorne championed the possibility, while Hawking opposed it. Nearly six years later, Hawking conceded the bet, albeit on a technicality: He decided that it was possible for naked singularities to form under so-called "generic conditions."

Around the same time, the three men agreed to another bet, this one centered on the question of whether information behind the event horizon of a black hole is irretrievably lost, or whether it is possible to recover that information from the radiation emitted by the black hole as it evaporates. Or, as the formal wager phrased it: "When an initial pure quantum state undergoes gravitational collapse to form a black hole, the final state at the end of black hole evaporation will always be a pure quantum state."

This time, Hawking and Thorne championed the view that information is destroyed, arguing that the radiation from the black hole would be scrambled, so when it finally evaporated completely, any information about its contents would be lost. As Hawking put it, "Not only does God play dice, but he sometimes confuses us by throwing them where they can't be seen." Preskill bet that the information could be recovered in principle, and when physicists finally devise a theory of quantum gravity, we will understand the mechanism behind how this could occur.

Indeed, subsequent work by Gerard 't Hooft, Leonard Susskind, Juan Maldacena and several other string theorists suggested "that information is encoded in black hole spacetimes in a very subtle way," Preskill recalled. Specifically, they introduced the concept of a holographic universe, in which any three-dimensional (3D) region of our universe can be described by information encoded on its two-dimensional (2D) boundary.

Those arguments apparently helped sway Hawking's stance. On July 21, 2004, he gave a talk at a conference in Dublin, Ireland, in which he announced that he was conceding the bet. After concluding his talk, Hawking presented Preskill with the eighth edition of *Total Baseball: the Ultimate Baseball Encyclopedia*, "from which information can be retrieved at will."

Thorne, however, stubbornly refused to concede, and perhaps he was right to do so. In 2012, a new paradox emerged, postulating that if information is indeed conserved, then another beloved postulate must be sacrificed, pertaining to what happens to an observer who falls into a black hole. Specifically, instead of experiencing nothing unusual as the infalling observer passed the event horizon, s/he would burn up in a wall of fire. The black hole firewall paradox remains contentious and unresolved, but Preskill, for one, is willing to consider that perhaps he was wrong after all.

Most recently, Hawking lost a $100 bet with the University of Michigan's Gordon Kane that the Higgs boson would not be discovered at the Large Hadron Collider. CERN physicists announced evidence for a "Higgs-like particle" in July 2012. While Hawking acknowledged the importance of the discovery for physics, he admitted to BBC News, "It is a pity in a way because the great advances in physics have come from experiments that gave results we didn't expect."

**HAWKING continued on page 5**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# INSIDE THE Beltway

## The Summer of Our Discontent

*by Michael S. Lubell, APS Director of Public Affairs*

*"He's out," said Pooh sadly . . . and while he waited for Piglet not to answer, he jumped up and down to keep warm, and a hum came suddenly into his head, which seemed to him a Good Hum, such as is Hummed Hopefully to Others.*

*"The more it snows (Tiddely pom), The more it goes (Tiddely pom), The more it goes (Tiddely pom) On snowing. And nobody knows (Tiddely pom), How cold my toes (Tiddely pom), How cold my toes (Tiddely pom), Are growing."*

***-The House at Pooh Corner***

A.A. Milne wrote those words 85 years ago, and they are still apt, at least as far as the affairs of government are concerned. The calendar may read July, but there is a distinctly partisan chill in the Washington summer air, sadly with no end in sight.

As much as I had hoped several months ago that bipartisan cooperation on gun control and immigration might provide a path forward toward good faith bargaining between the Republican House and the Democratic White House, recent events have forced me to lower the odds substantially.

Benghazi missteps, Justice Department mischief and IRS misbehavior have created an Administration trifecta tripwire that Republicans could not possibly have imagined six months ago. Instead of a thaw in partisan dueling, both sides have unsheathed their swords and are doing battle anew.

Just weeks ago on CNN's "State of the Union," Darrell Issa (R-CA), chairman of the House Committee on Oversight and Government Reform, in discussing the IRS scandal with host Candy Crowley, called President Obama's press secretary Jay Carney a "paid liar."

David Plouffe, former senior White House adviser and Obama confidant, immediately snapped back with the tweet, "Strong words from Mr. Grand Theft Auto and suspected arsonist/insurance swindler. And loose ethically today."

Such dialog does not provide much hope for bipartisan hatchet burying. And without a cessation of hostilities, it's hard to see how Washington will fix the dysfunctional mess it created for science in the fiscal year 2013 budget.

To fiscal conservatives, across-the-board sequestration cuts, which the Continuing Resolution baked into the year-end pie, don't seem like a big deal. After all, they say, you can always root out five or six percent waste in any federal program. But, as with many generalizations, the facts often differ jarringly with the mythology.

Take the National Science Foundation (NSF), for example, which commits research support three years forward to guarantee continuity in grants it has agreed to fund, even though it only receives its appropriations annually. Such a policy leaves two-thirds of NSF grants fenced off in any fiscal year. So, absent any other machinations, a five percent reduction in the Foundation's budget would produce a 15 percent dip in support for new grants or renewals.

But for fiscal year 2013, the dip will be more like a dive. Here's why.

Congressional appropriators and NSF administrators have elected to hold a number of high-profile activities harmless, among them construction projects and initiatives. Those decisions place an overwhelming burden of the sequestration on the Foundation's "Core Program," which funds university individual investigators and accounts for slightly more than two-thirds of the NSF's research budget. The result: a projected 20 to 25 percent reduction in available funds for new proposals and renewal requests in many activity areas.

Regrettably, young scientists, who are just entering the competition for research funding, will be hit hardest. Unless lawmakers put an end to the gridlock that has caused the current mess, our nation could foreclose on an entire generation of scientists.

Which brings me back to the issue of bipartisanship, without which there will be little hope for science or anything else. Unfortunately, for now, it appears more likely that the summer months will reflect more of an ideological freeze than a much-needed thaw in across-the-aisle relations. Even the House Science, Space and Technology Committee, historically a paradigm for bipartisan comity, has recently fallen prey to nasty partisan sniping.

In an ill-conceived and poorly executed hunt for social and behavioral science grants that might not pass muster in some congressional quarters, House Science Committee Chairman Lamar Smith (R-TX) sent a politically tinged letter on April 25 to NSF Acting Director Cora Marrett requesting copies of the peer review reports for five proposals the Foundation had funded. Smith wrote, "Based on my review…I have concerns regarding some grants…and how closely they adhere to NSF's 'intellectual merit' guideline."

It took less than 24 hours for Eddie Bernice Johnson (D-TX), the committee's ranking Democrat, to respond. In a sharply worded message to Smith, Johnson wrote, "… your letter marks the beginning of an investigative effort, the implications of which are profound. This is the first step on a path that would destroy the merit-based review process at NSF and intrudes political pressure into what is widely viewed as the most effective and creative process for awarding re-

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# Physics Olympians Participate in Training Bootcamp

*By Halleh Balch*

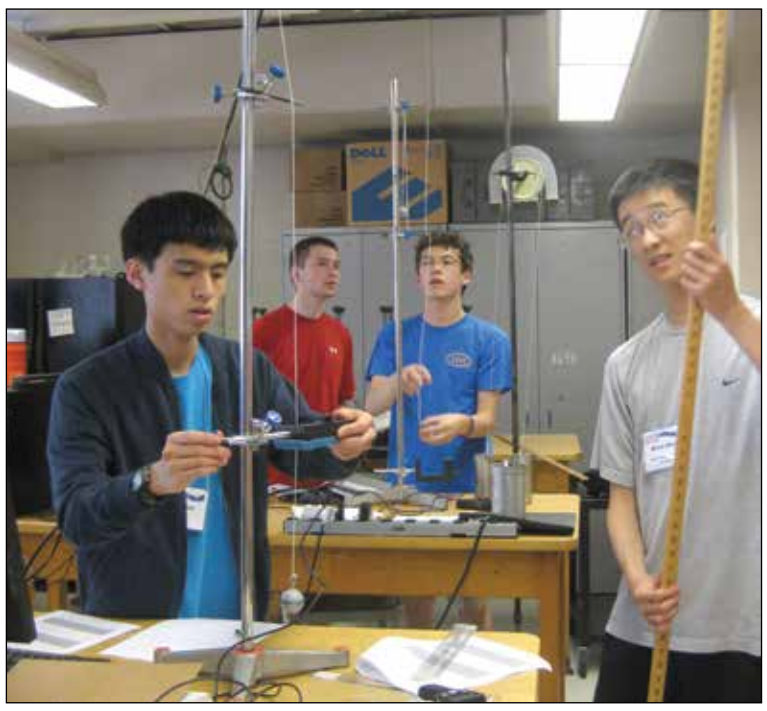

Photo credit: Halleh Balch

In the foreground, Jeffrey Cai of Ridge High School in Basking Ridge NJ and Kevin Zhou of High Technology High School in Marlboro NJ take some measurements, while in the background, Owen Gray of Thomas Jefferson High School in McLean VA and Jonathan Tidor of Lexington High School in Lexington MA get ready to do the same.

Nervous laughter filled the concrete hallway as twenty students poured excitedly out of a classroom at the University of Maryland in College Park. They had ten days to prepare–and compete–as physics Olympians.

The twenty high-school students, members of the US Physics Team, arrived in late May for intense training at the physics bootcamp. With faculty and former physics Olympians from the University of Maryland and across the country, the students spent mornings and afternoons working on theoretical calculations and performing detailed experiments as they strove to become one of the five members of the traveling team who will represent the United States at the 44th International Physics Olympiad this July in Copenhagen, Denmark.

Notwithstanding the underlying competition, the students found time to experience new friendships and to share their love for physics and mathematics.

"Have fun this week and enjoy the process," urged Drew Baden, Chair of the University of Maryland Physics Department. "If you win, then you win and it's over; taking part in and enjoying the process is what really makes a difference."

The exclusive group at the bootcamp was honed down from 4,435 students who participated in the preliminary multiple choice F=ma exam, followed by a semi-final exam for the top few hundred. Most of the finalists had previously participated in international or national math or science competitions.

"It's really different from my school at home," said Zach Markos, a senior from Los Angeles CA, "I have one or two friends who are like these students, interested in math and physics. Everyone here is."

"The level of the students has gone up every year," said Paul Stanley, the team's academic director and professor of physics at Beloit College in Wisconsin. The students are so good, he noted, that he and the other coaches spend a lot of time developing new questions to keep the students properly challenged.

For Stanley, much of the value of the Physics Olympiad is in the training camp itself. Over the past decade, the focus of the international competition has shifted away from cookbook questions and migrated back towards questions of an older format–which don't guide students through the steps to the solution. "Most of these students know a wealth of equations with which to solve problems," he explained, "but I would hope that at the end of camp they would not only be better problem solvers, understanding the importance of symmetries and approximations, but that they would be able to think like physicists–like the best physicists."

The United States has competed among 90 nations in the Physics Olympiad since 1986, earning 46 gold medals, 33 silver medals, 29 bronze medals, and 11 honorable mentions. Since its inception, the American Association of Physics teachers (AAPT) and the University of Maryland have trained the US team, sponsored by APS and the American Institute of Physics (AIP), along with more than a dozen other organizations.

This year's Fabulous Five were chosen for their performance over the course of the bootcamp. Representing the US in Denmark will be: Jeffrey Cai, Ridge High School, Basking Ridge, NJ; Calvin Huang, Gunn High School, Palo Alto, CA; Jeffrey Yan, Palo Alto High School, Palo Alto, CA; Samuel Zbarsky, Montgomery Blair High School, Silver Spring, MD; and Kevin Zhou, High Technology High School, Lincroft, NJ. Their ten days overseas will include an acclimation period in Italy, before moving north to Denmark for the competition July 7-15.

# APS Topical Group is New Home For Physics Education Research

APS's brand new Topical Group on Physics Education Research (GPER) was recently approved by Council and is now recruiting new members. So far, 160 people have joined the group, which needs a minimum of 200 to hold elections for its Executive Committee.

Eric Brewe, an assistant professor of science education at Florida International University, has been one of the main organizers of the new group.

"The topical group is the organization that is going to represent the interests of physics education researchers," Brewe said, adding that until now the overlap between working physicists and education researchers has been limited because they tend to go to different meetings.

"Physics education research is a field of physics so we ought to be represented in the physics professional society," Brewe said. "It's really important to interact with people at the national meeting level."

The main purpose of the new group is to bring in researchers whose primary focus is physics education research, as opposed to traditional physics. There is already a similar group in the American Association of Physics Teachers, and Brewe has worked with them to set up the topical group within APS. In addition, he has been working with APS's Forum on Education.

"One of the things is to understand how different GPER is from the Forum on Education," Brewe said. "While the two have a strong overlap, they're not identical."

The primary charge of the Forum on Education is to get physicists more involved with education at all levels, even though their primary research is elsewhere. The topical group however is primarily aimed at education researchers who specialize in physics, many of whom also have a background in physics.

"[It's like] the difference between astronomers and the people who look at stars," Brewe said. "I might go to a public talk about astronomy, but I wouldn't necessarily go to a research talk on astronomy."

Brewe, along with the other founders, started organizing the new group a year and a half ago. They wrote their first article about the formation of the group in the Summer 2012 *Forum on Education* newsletter. At about the same time, they also polled the membership about potential support for the new group.

Not long afterwards they started collecting signatures to petition the APS Council. Council approved the formation of the group at its meeting in April of this year.

The organizers expect to reach 200 members by the end of summer and are aiming to hold elections in November if all goes well. Looking ahead, Brewe said that the group will be working with the Forum on Education for the April 2014 meeting, and will likely start organizing its own sessions at the 2015 meeting.

# Letters

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

## Academia Ignores a Major Issue for Women

As the wife of a physics grad student, I hear about the need for attracting more women into the field of physics. I have a specific observation to make regarding one major issue for women in graduate school, especially those in long programs (as physics often is). That factor is family-building, and it seems to be largely ignored.

It is a truth substantiated in studies (for example "The Shriver Report: A Report by Maria Shriver and the Center for American Progress") that whereas a male graduate student (or postdoc, or even beyond) can manage to start a family simultaneously with facilitating his career, females find it far more difficult, virtually having to choose one or the other.

The Shriver Report says: "Forty-six percent of female respondents began their graduate studies working toward a faculty position in a research university, but babies changed that, resulting in only 11 percent of new mothers saying they now want to continue on that path. And once again, fatherhood for men similarly situated in graduate studies appears to have less impact. Fifty-nine percent began their doctoral programs planning to pursue a research-intensive academic career and 45 percent still plan to do so."

In our small, local Christian fellowship, most of the single women members pursuing graduate degrees express the struggle with loneliness, depression, and anxiety over missing out on serious romantic involvement, marriage and children. There is a fear that their chances of ever realizing this aspect of life are diminished by their pursuit of higher degrees and the time it takes from important and limited family-building years.

A 28-year-old single woman, having just defended her doctoral thesis in physics, has roughly seven years to unite with Mr. Right, obtain a stable job, start and nearly conclude building her family. That isn't much time!! Now, add a two-year postdoc (though many are longer) to the wait time, while our female scientist of great potential seeks a stable research position in a competitive market. This narrows her window down to about five years.

The likelihood is, when she *finds* that position, the demand for high performance early in the game will lessen her ability to start a family even more. According to the Shriver Report:

"But, as with graduate students, childbirth often derails the scientific ambition of postdoctoral students. Forty-one percent of women graduate student scientists who have babies in the University of California system while working in a postdoctoral position decide not to pursue an academic research career…. Unfortunately, students and postdocs are also sometimes openly discouraged from having children by their mentors, who explain that, as mothers, they will not be considered 'serious scientists.' "

Maybe this is indeed why, or partly why, a childless woman has approximately equal chances with a similarly educated man of snagging a tenure-track position, while a woman with children has 37% lower chances (Survival Analysis of the Survey of Doctorate Recipients, op. cit. Shriver Report).

Media coverage has been fairly prolific on women in high-power positions of the business world requiring and finally receiving in some places of work the innovative accommodations necessary for their family-life, but academic institutions have regressed in this area. Twenty years ago my mother was able to take me on campus as a child, and even to class, and complete two degrees in statistics while being a wife and mother simultaneously, but today most universities abound with hostile policies toward children. Policies against children in the classroom for any reason are almost universal.

There are no family-friendly areas of campus; no changing tables in bathrooms; no space to nurse; no place where it feels "okay" for little ones to cry, play, or babble. No other mother of young children and wife to a grad student of my acquaintance feels particularly comfortable on campus either. I can't answer to women who are grad students with small children, because I rarely if ever meet any. Within the ranks of the department that I have seen, one finds not one female physics student with a child.

I would personally *love* to go to graduate school (albeit not in physics). I always intended to. And I look forward to the day when a family woman can also realize her academic potential. But not at the expense of my children; greater elasticity of the institution is required, in order to accommodate the basic reality of my womanhood as motherhood. Claiming to desire "diversity" through the presence of women, and yet requiring women to fit the mold of a traditional male student and ignoring other tangible, practical aspects of life distinct to womanhood, eliminates the desired diversity. It might make the numbers look nicer–it doesn't contribute to the actual flourishing of women in the field.

***Keri Haruza,***
*Rochester, NY*

### CORRECTION

In the May *APS News*, in the caption to a picture on page 6 about the PhysTEC Conference, we misidentified one of the subjects. The person standing on the left, next to Ashwani Kumar, is Jesse Southwick, not Aaron Osowiecki. Both Southwick and Osowiecki attended the conference, and both are teachers at Boston Latin School.

## Letter Misses the Point Regarding Laser Isotope Separation

The letter in the April *APS News* by Frank Chen concerning isotope separation gives rather interesting information about activities at UCLA and Livermore's LLNL. It misses the point that Michael Goldsworthy's SILEX method for isotope separation by lasers (see Google: SILEX, Silex Systems) is being commercialized by General Electric-Hitachi Global Laser Enrichment (GLE) to produce fuel for carbon–free nuclear power plants in the market. Despite the necessary confidentiality of this technology, the inventors and original developers–Australian-listed company Silex Systems Ltd–said that the efficiency of the SILEX process is far higher than centrifugation, meaning that the capital costs for an equivalent capacity enrichment plant are expected to be about half that for a centrifuge plant. The company has also said that a SILEX plant will still be a very large industrial complex–a point Francis Slakey seems to consistently overlook (*APS News* Back Page, January 2013). In view of the enormous future potential of energy from nuclear power as fundamentally the only carbon-free base load electricity alternative to coal, the commercialization of this technology should be regarded as a key component of an essential industry for modern society. The related proliferation issue, consistently raised by critics of nuclear power and enrichment technology in particular, has also been discussed by Silex and GLE. Without doubt, the technical and logistical barriers to developing a laser based enrichment technology such as SILEX are infinitely higher than those for centrifuge technology. History has proven this *fact* over and over again. Billions of dollars have been spent by various governments and organizations around the world trying to develop laser enrichment technology without success–the only exception being the brilliant SILEX innovation from Australia. On the other hand, several countries have already successfully developed centrifuge technology (Iran, North Korea, Pakistan and others). Clearly, the SILEX technology represents a significant shift away from proliferation-sensitive technology.

The debate by Frank Chen also reveals the further role played by John Dawson leading to recent developments in the field of laser driven fusion energy. A potential solution may be closer than generally believed, using direct drive laser implosion volume ignition (*Laser and Particle Beams*, DOI:10.1017/S0263034613000219). This goes back to basic physics questions of electron beam interaction with laser beams as derived from the Kapitza-Dirac effect [*Appl. Phys. Letters* 102, 141119 (2013)]. It is pleasing to see the success of Alfred Wong recognized. His related early result on the measuring of cavitons generation by laser-induced ponderomotion following on from the Livermore result was pioneering (see Figures 2a and 2b of the review - *Proc. of SPIE* Vol. 8780 24; DOI:10.1117/12.2017534).

***Heinrich Hora***
*Sydney, Australia*

***Ed. Note:*** *Perhaps it should be mentioned that, in addition to his success in research, according to the May 9* Los Angeles Times*, retired UCLA professor Alfred Wong "has agreed to plead guilty to federal fraud charges and pay almost $1.7 million for turning in false invoices related to nanotechnology research he was performing for the Department of Defense."*

## Definition Given for Proper Affirmative Action

I heartily concur with Meg Urry's description of equity (Back Page, May 2013 *APS News*), as "when women of slightly-less-than-world-changing ability succeed as easily as men of similar ability." This was true in the narrow window within which I received my PhD (l968), but probably not by the time she received hers, nor, perhaps, ever since.

She and I might, however, part company over my definition of the only appropriate form of affirmative action, encouragement, etc: Be sure the barriers look as high to white, upper class males as they do to everybody else.

***Virginia Trimble***
*Irvine, CA*

## Sold-out Crowd Examines Distance Learning in Physics

*By Deanna Ratnikova*

An increasing number of US colleges and universities are turning to online course offerings and other versions of distance education for a portion of their courses. Physics departments are not exempt from the push for distance education and are putting substantial time and resources into online homework systems, video-recorded lectures and Massive Open Online Courses (MOOCs). Over 100 participants gathered at APS headquarters in College Park on June 1-2 to learn about the opportunities and implications of distance education and online learning for the physics community.

Over the course of the workshop, which lasted a day and a half, speakers primarily focused on online resources designed to enhance the classroom experience, and they presented what physics education research has to offer to optimize the effectiveness of distance education efforts. Some speakers, however, directly addressed the contentious topic of distance education and MOOCs.

Jack Wilson, President Emeritus of the University of Massachusetts Lowell and former CEO of UMass Online, kicked off the conference with the keynote "Radical Change in Higher Education–will physics lead, follow, or get out of the way?" He noted that traditional press coverage of MOOCs ranges from skepticism (how to deal with cheating; are these courses effective?) to hype (distance education will change the world and transform education).

Wilson reported on a Sloan Foundation/Association of Public and Land-grant Universities survey finding that nearly three-quarters of university presidents believe online learning is critical to their institution's long-term strategy. This is consistent with the results of an informal survey conducted at the workshop, which showed that physics departments are primarily encouraged by entities outside the department (deans, provosts, presidents, and other high-level administrators) to offer more online courses. In response to this pressure, 87% of the responding workshop participants noted that they anticipate their department will increase its use of distance education modes in the next three years; the other 13% anticipate their use of distance education modes will remain the same in the short-term.

Renee Michelle Goertzen, APS Education Programs Manager, remarked, "Conference participants expressed the need for increased attention and research into the best practices in distance education and online learning, and they were particularly enthusiastic in sessions on topics such as MOOCs and assessment in online learning."

Ryan Baker of Columbia University addressed concerns over assessment and discussed how it is not necessarily measuring whether the knowledge is learned but whether it is robustly learned (i.e., will it stay retained for a longer period?) and whether it can be transferred to other situations or used to learn new skills. Baker presented research on models that can predict whether students will learn robustly early in their learning process.

Gerd Kortemeyer and Wolfgang Bauer, both of Michigan State University, reported on their experience running completely online and blended large-enrollment physics courses for more than 10 years at Michigan State. Kortemeyer presented his work using the free open-source platform LON-CAPA as a learning delivery system—a tool that David Pritchard of MIT has also used for his online classes. Prichard now, however, bases his online classes on EdX, a non-profit organization created by Harvard and MIT that offers MOOCs and interactive online classes in a variety of subjects. According to Pritchard, those who satisfactorily complete the required portion of his course are awarded a certificate from EdX, and for teachers in the US, the course awards Professional Development Points (free for teachers in Massachusetts) or, for

**LEARNING continue on page 7**

# Diversity Corner

**41 Minority Scholarships awarded for 2013-2014**
The APS Committee on Minorities in physics recently selected 27 new students and 14 renewal students for the 2013-2014 APS Scholarship for Minority Undergraduate Physics Majors. This merit-based scholarship provides each recipient with a monetary award of $2K - $3K, and pairs the students with a mentor at their institution as well as a mentor from the Committee on Minorities. The committee also selected 17 students for Honorable Mention. These students are being recognized for their accomplishments and are deemed by the committee to have great potential in the field of physics.

**Sign up to receive the COM/CSWP *Gazette* newsletter**
The COM/CSWP *Gazette* newsletter features updates on CSWP and COM activities and programs, book reviews, statistical reports, and articles on programs designed to increase the participation of women and minorities in science. The *Gazette* is distributed free of charge. To add your name to the *Gazette* mailing list, e-mail women@aps.org and include your postal mailing address.

**Planning a colloquium for women or minorities? Check out these APS speakers lists**
APS offers online databases of both women and minority physicists who are willing to give talks on a variety of subjects. The lists include names, contact information, and talk titles.

- For women speakers, see http://www.aps.org/programs/women/speakers/
- For minority speakers, see http://www.aps.org/programs/minorities/speakers/

And don't forget that travel grants are available for institutions inviting women speakers. Find more information about the grants here:
http://www.aps.org/programs/women/speakers/travel-grants.cfm

**Women in Physics (WIPHYS) Email Group**
The Committee on the Status of Women in Physics (CSWP) invites you to join WIPHYS, its electronic mailing list. WIPHYS is sent weekly and includes funding, job, and professional development opportunities for women. WIPHYS was "officially" started in January 1993, and now has over 900 subscribers. Join here: http://www.aps.org/programs/women/email-lists/wiphys.cfm

**Network with other physicists on LinkedIn**
Join the LinkedIn groups for Minorities in Physics (http://go.aps.org/minoritiesinphysics) and Women in Physics (http://go.aps.org/womeninphysics) and start networking today!

## APS Honors Vera Rubin and Kent Ford at Carnegie Institution

Photos by Michael Lucibella

On May 17, APS President Michael Turner presented a plaque to the Department of Terrestrial Magnetism (DTM) of the Carnegie Institution for Science, as part of the APS Historic Sites Initiative. Located in Northwest DC, the DTM is the site of work in the 1970s by Vera Rubin and Kent Ford on the rotation curves of galaxies, which provided early evidence for the existence of dark matter. At left, Michael Turner congratulates Vera Rubin, while on the right, Kent Ford shows where a key component, the image tube spectrograph, was located in a photo of the two of them inspecting the telescope at Kitt Peak where the data were taken.

## Golden Goose Award Issues Ongoing Call for Nominations

The organizers of the year-old Golden Goose Award are poised to announce the second round of winners and are looking for nominations for future honorees.

"The Golden Goose Award honors scientists whose federally funded work could initially have been perceived as wasteful or obscure but turned out to have significant positive benefit to society," said Barry Toiv, the Vice-President for Public Affairs at the Association of American Universities, and one of the award's organizers.

Last year the awards recognized the achievements of seven scientists, including Charles Townes of the University of California, Berkeley, whose invention of the maser in 1954 paved the way for the ubiquitous laser.

"At the time he discovered the maser…his own department chair, who was himself a Nobelist, tried to get him to stop working on it. He thought it was a waste of time," Toiv said. "[Today there are] very few elements of modern technology that don't involve some use of the laser."

The idea for the awards originated with Congressman Jim Cooper of Tennessee, who had wanted to highlight the benefits of federally funded research for years. They are a response to the "Golden Fleece Awards," presented as a dubious distinction by Wisconsin Senator William Proxmire in the 1970s and '80s, to government programs that he deemed wasteful of taxpayers' money.

Toiv said that it is especially important now to highlight the benefits of federal support of sci-

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# Profiles In Versatility

## A Stint in Italy's Parliament Teaches Many Lessons

*by Alaina G. Levine*

As Cardinals began to gather in Vatican City to elect a new Pope earlier this year, another type of conclave was occurring only a few kilometers away. In the Italian Parliament in the heart of Rome, Giovanni Bachelet was saying arrivederci to his colleagues. For the past five years, the physicist has served his nation as an elected member, and as a deputy in the Italian Democratic Party. When his term ended on 24 February 2013, he stepped down to return to a life of academic research.

His decision not to pursue a second term in Parliament was not "because I feel unhappy," he explains. "But this is not my profession." Rather, his profession, he notes with pride, is physics. An APS member since 1980, when he was a young postdoc at AT&T Bell Labs in Murray Hill, New Jersey, he has served as a professor of physics at Sapienza University of Rome for the last twenty years.

An expert in the theory of electronic states, Bachelet has been involved in some form of the political process for many years, actively participating in campaigns and referendums. "I am interested in the democratic development of my community," he says. Much of this desire to affect change stems from his parents. His father, a prominent judge, professor of law and religious leader, was later elected to the Rome city council and then to the leadership of the Consiglio Superiore della Magistratura (Supreme Council of Magistrates), which is similar to

Giovanni Bachelet

the Supreme Court in the US. His mother, a teacher, "participated with enthusiasm" in her school board elections, he recalls. As a youngster, Bachelet realized "it's not just about your own career, but about contributing to society too." He was additionally influenced by the examples of John F. Kennedy, Martin Luther King, and Pope John XXIII with his reform of the Catholic Church in the 1960s, and together with an extended Boy Scout experience, took to heart to always "be prepared, and take action, if needed, in both volunteer political activism and elected government positions," he says.

In 2008, the (then burgeoning) Democratic Party asked him to run for office and be part of their list of candidates for the national Parliament. Bachelet obliged, "even if the election was far from certain," he recalls. He hoped to "support Italy's progress toward a tighter European integration and thus toward European standards in education and research, civil and social rights, fight against corruption, and promote media freedom." In a few words, more than becoming a member of the Parliament, his goal was to help his country resume Democratic Party President Romano Prodi's center-left program, or at least free it from Berlusconi's nightmare. The opposite, however, occurred: Berlusconi won the elections and became Prime Minister, but Bachelet was elected and served most of the time in the parliamentary opposition, except for the very last year, when an emergency bipartisan government was formed after economic problems and Berlusconi's personal shenanigans led to his party's loss of power.

One of his proudest accomplishments as a member of Parlia-

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**HAWKING continued from page 2**

So when it comes to scientific wagers, Hawking's track record isn't stellar. As Preskill quipped during an April 2013 tribute, "It's sad to say that although Stephen Hawking is without doubt a great scientist, he's a bad gambler."

**Further Reading**

Almheiri, Ahmed; Marolf, Donald; Polchinski, Joseph; and Sully, James. (2012) "Black Holes: Complementarity or Firewalls?" arxiv.org

Hawking, Stephen. (1976) "Breakdown of predictability in gravitational collapse," *Physical Review D* 14: 2460-2473.

Hawking, Stephen. (2005) "Information loss in black holes," *Physical Review D* 72(8): 4.

**DISCONTENT continued from page 3**

search funds in the world."

According to several members of the House committee, the rupture between the chairman and the ranking member has sown seeds of partisan mistrust that will be difficult to repair anytime soon.

And if the winds of partisanship don't soon abate, the current session of Congress could well be the least productive in history. And the coming months will become the summer of our discontent.

# Water Dating Technique Finds Many Potential Applications

*By Calla Cofield*

A technique for determining the age of water using three atmospheric radioisotopes is coming into its own. The Atom Trap Trace Analysis method, or ATTA, was first developed by researchers at Argonne National Laboratory in 1999, but it is only in the past 18 months that it has become a practical way for geologists and hydrologists to determine the age of water samples from the field. In the last 12 months the Argonne team has analyzed samples from seven continents, and can determine when those samples became isolated from the atmosphere. Now the team has begun a project with the International Atomic Energy Agency's water resources program to determine the age of water samples from many of the world's major underground aquifers.

Zheng-Tian Lu, a senior physicist at Argonne and a part-time professor at the University of Chicago, leads the team that developed ATTA more than a decade ago. Lu spoke about the recent ATTA developments at the 2013 APS April Meeting in Denver, Colorado.

The ATTA method uses lasers to trap and isolate three radioisotopes, krypton-81, krypton-85, and argon-39, that are dissolved in water samples. All three isotopes occur naturally in Earth's atmosphere and can be used to measure the time since a sample became isolated from the atmosphere. The different isotopes each have a unique half-life and can date samples of different ages. Argon-39 has a half-life of 269 years, and is ideal for dating samples between 100 and 1000 years. This fills a gap between the ideal dating ranges of carbon-14 (half-life 5730 years) and hydrogen 3 (tritium, half-life 12 years).

Hydrologists interested in tapping underground water sources can use the technique to determine how frequently those sources refill or drain to keep them from being exhausted. Finding out how isolated one is from other sources matters especially if, for example, the water table is located beneath a nuclear waste storage facility. Glaciers are largely organized into sequential layers of ice, but sometimes the oldest layers are pushed up and out to the sides, disrupting the chronology. Glacial layers provide information about the history of our planet, and ATTA helps chart that history more precisely.

The ATTA apparatus is a tabletop device, about two meters long, which can be operated by a single person. Liquid or ice samples are vaporized, funnelled into a beam, and then sent through a vacuum chamber and into a magneto-optical trap. A laser tuned to a transition frequency of one of the isotopes excites the atoms, causing them to fluoresce. A CCD camera measures the fluorescence, which can be used to count the number of individual atoms in the trap.

Lu and his team published the first results using the ATTA method in the journal *Science* in 1999. At the time, the device could only capture only about one in ten million krypton-85 atoms. Coupled with the rarity of the isotopes, the method required roughly a kiloton of water to gather enough atoms to determine the age of the sample.

The newest version of the instrument, the ATTA-3, is now ten thousand times more efficient. The team requires only about 100 kilograms of water to determine the age of the sample, which is more reasonable for scientists to collect from the field. Lu adds that the team hopes to continue to improve the efficiency.

There are two other methods for dating krypton 85 and argon 39, and Lu says at the moment ATTA's contribution is a useful alternative, but with its current efficiency, it certainly doesn't replace these. However, ATTA appears to be the most feasible way to date krypton 81. Its half-life is 229,000 years, so dating methods that rely on observing particle decays take far too long. Dating krypton 81 is possible with Accelerator Mass Spectrometry (AMS), the technique most commonly used to date samples using carbon-14, but this required many tons of water and was largely abandoned.

"As ATTA-3 became operational," said Lu, "krypton 81 dating, an idea that had been discussed for more than 40 years, finally became available to the earth science community at large."

**BRIDGE continued from page 1**

mentors for each Bridge Fellow, including academic, research and peer mentors, and emphasizes student networking and study groups to ensure success.

"There is great enthusiasm for the OSU Physics Bridge Program at a variety of levels across the university," said Bridge site leader Jon Pelz. The OSU Center for Emergent Materials was a major driver in establishing the program by securing and providing funding and administrative support for the program. The program also received significant support from its physics faculty, the Dean of the Division of Mathematical and Natural Sciences, and current graduate students.

The University of South Florida in Tampa will admit Bridge Fellows into a hybrid post-baccalaureate/transitional master's program. Students can elect to complete their master's degree and continue on to complete their physics PhD at USF or another institution.

Casey Miller, Bridge Program Site Leader at USF, said, "Tackling diversity is beyond the scope of any single program, so we are quite excited to be participating at this moment in the history of the APS. One of our principal goals is to diligently document our path forward to enable rapid, low risk replication of existing programs."

APS-BP secured a $3 million multi-year grant from the National Science Foundation in fall 2012 that allowed programmatic activities to take off.

Bridge Program Manager Brian Beckford joined APS in April, after receiving his PhD in nuclear physics at Tohoku University in Sendai, Japan, and his M.S. and B.S. degrees in physics from Florida International University. He is excited by the program's potential to increase diversity in physics on a national scale. "The program presents a tremendous opportunity for collaboration between new APS bridge sites, existing bridge programs, and other colleges and universities committed to program goals," Beckford said. "Over the span of the project, we can make a significant improvement in the number of underrepresented minorities receiving PhDs in physics."

The program hosted its annual Bridge Program summer meeting at the end of June. The meeting included representatives from newly selected APS Bridge sites, existing bridge programs, students, and faculty from colleges and universities committed to improving diversity in physics graduate education.

The program anticipates issuing another request for proposals for new Bridge Sites in fall 2013. The student application will reopen in the fall as well, and it is anticipated that the summer meeting for the program will become an annual conference as the program expands.

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described how his upper level students have successfully adopted a common technique often used in more basic courses. Over the last few years "clickers" have become very popular in large classes to get students to answer questions and immediately see how the whole class responded.

Pollock brought the clickers into several of his advanced junior and senior year classes. After taking surveys at the beginning and end of the school year, he found that clickers helped students in the advanced classes retain what they learned.

"We're seeing evidence at Colorado that is consistent with the research that active engagement is working," Pollock said.

New technologies are also being adopted for assessing what students have learned. Andy Rundquist from Hamline University pioneered a new evaluation technique that videotapes students explaining their work.

After a student solves a problem, he or she makes a video describing each step of the process. Rundquist then goes back and records his own video explaining any errors the student made.

"I don't spend one minute longer grading now than I did before," Rundquist said. He added that instead of grading papers "I'm just watching videos."

Other plenary sessions at the conference dealt with trends in graduate education, including a description of the new APS Bridge Program, and with issues of "Department Climate." The latter included an overview of the site visits conducted by the APS Committee on the Status of Women in Physics and given by Committee Chair Susan Blessing, and a discussion of "Ethics and the Welfare of the Physics Profession" by APS Executive Officer Kate Kirby.

**GOOSE continued from page 5**

ence.

"There is a growing trend in Congress to single out specific grants for special scrutiny," Toiv said. "We're very concerned at the possibility that Congress would want to substitute its political judgments for the scientific judgments made by scientists and those who administer the grants process."

Scientists can nominate researchers for the prize at the award's website, www.goldengooseaward.org.

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ment was helping to block a bill which would have negatively affected high school teachers. "The government wanted to increase their working time by 30%, without increasing their salaries," he explains. "Teachers in Italy are paid less than average European teachers. With a few colleagues I was able, on the basis of sound data, to convince first my party, and then the entire committee which dealt with this bill, that schools and teachers had suffered from previous budget cuts more than any other part of the public administration, and a further thwack was simply not acceptable." As a result, the government withdrew the bill.

While it is an honor to serve his country as an elected official, it is not an easy job, he notes. It is physically demanding, particularly for someone who is not a "career politician." He jokingly compares his time in Parliament to his experience as a professor: As an academic, he considers department meetings and other service requirements as "a tax I have to pay in order to do the two things I like, which are research and teaching," he says. "In this respect, a term in Parliament is as exciting as being locked in a department meeting for five years in a row." But while he laments that 50% of his time was spent in assemblies with other politicians, "the most extraordinary thing is what you gain in the other half," when he would convene one-on-one with constituents.

On weekends, Bachelet would travel all over Italy "meeting with people who want to know what is going on in Rome and how their particular problem is being treated," he says. "People really appreciate talking to members of Parliament. The most enjoyable thing is that people get excited if given a chance to participate in government, especially those who are far away geographically, or feel far away from the process."

His physics background aided him, in his ability to "understand and elaborate numbers rapidly by heart," he says. "Lawyers are not as familiar with statistics." Bachelet's linear and logical approach to problem solving also contributed to his success, and he affirms that by studying physics, he gained an aptitude for presenting results to many different types of audiences, and responding to difficult questions on the spot. "I know what I'm an expert in and to be assertive, and I know what I don't know and to say that I need to do further research to give an answer," he says. "That's an important difference with 'professional' politicians: in my country many of them tend to elude questions they don't know how to answer. I realized that all of our voters, and not just [political] activists, prefer to be treated as adults."

Although he is looking forward to rebooting his research program, he is not leaving politics completely. Until the next internal selection of the Democratic Party leadership, he will remain President of the National Forum on Educational Policies within the Party, a position he has held since 2009.

As he prepares to leave his post, he reflects on what this foray onto a national stage has taught him. "It confirmed three ideas which my father and mother taught me as a boy," he says. "First, it's easy to talk politics at lunch or coffee break, but it's difficult to take an entire nation a tiny step forward, or, sometimes, prevent a step back: this requires technical skills, energy, patience, and *savoir faire*. Second, bad politics is usually the result of an immature society, and thus, for the progress of democracy, education is by no means less important than direct political engagement. This is why, after five years of civil service, I am going back to my usual profession of university professor."

And the third lesson which Bachelet has learned from his tenure in Parliament is that "each generation must pay a price to maintain freedom and welfare for the next generation." He points out that his father, who was also a consultant to the Vatican and considered a personal acquaintance of the Pope, paid the ultimate price for his advocacy: in 1980, he was assassinated by the Red Brigades, a terrorist organization credited with murdering many other Italian politicians in the 1970s and 80s. "My sacrifice of five years of physics in favor of five years in the Parliament was much less than my father's sacrifice of his life at the age of 54."

*Alaina G. Levine is a science writer and President of Quantum Success Solutions, a science career and professional development consulting enterprise. She can be contacted through www.alainalevine.com.*

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than I teach in a year."

James Kakalios, a condensed matter physicist at the University of Minnesota, got involved in science outreach when he started teaching a freshman seminar class titled "Everything I Know About Science I Learned from Reading Comic Books." The class drew physics lessons from the pages of superhero comic books—such as why Lois Lane would still die from a fall off a skyscraper even when Superman catches her in his arms, inches above the pavement. Kakalios' work caught the attention of major media outlets, and he eventually wrote the book *The Physics of Superheroes*. He has since written a second book, this one about quantum mechanics, and served as a science adviser for the most recent Spiderman movie.

At the April Meeting, Kakalios chaired a session hosted by the newly-organized APS Forum on Outreach and Engaging the Public, FOEP, for which he is now the Past Chair. In a press conference preceding the session, he echoed Leslie-Pelecky's concerns for young physicists.

"I think young scientists have a great deal of enthusiasm for [outreach] and…they are able to communicate in a very natural way to their peers," he said. "On the other hand, they're also trying to establish their own careers. And right now efforts in science outreach are more tolerated and accepted than actively rewarded. And I think it's probably important for them to focus on first establishing themselves."

Kakalios said that as a tenured professor he felt he had "flexibility and protection," when he began his outreach work. He advised other physicists to perhaps treat outreach as a "hobby" or "diversion," while always placing research and professional responsibilities first. Kakalios also said that the physics community's aversion to outreach does not serve its current needs.

"At the same time that institutions are saying 'Where's the next Carl Sagan?' and 'Why doesn't the public support more of what we're doing?' they're…not giving support to those people who are engaged in it," he said.

Kakalios says his own turn into science outreach was a surprise, and he confessed that he was once one to scoff at the pursuit: "Back when Carl Sagan was doing Cosmos I said, 'Oh, this is trivialization!' And so for my sins I now get to be the person that people say that about."

Sidney Perkowitz is a professor of physics emeritus at Emory University. In his 45-year physics career Perkowitz contributed to over 100 scientific publications; but he also authored five books, two plays, a performance dance piece, a handful of YouTube videos, and dozens of articles about or inspired by physics, all meant for non-scientist audiences. Recently he was a co-editor and contributor to the anthology *Hollywood Chemistry*, about science in entertainment.

Perkowitz spoke about the reasons why physicists should engage in public outreach: to inspire future scientists and to return society's support of science. He echoed the warning that many physicists do not look kindly on outreach, despite the community's need for it, but he also pointed out that a career should match the individual. In his case, that meant a combination of science and art.

"For each of us it comes down to a personal decision," said Perkowitz, "about varied career paths and satisfactions, with inevitable tradeoffs."

Some physicists ultimately choose outreach as a career. Ben Ames, a physics graduate student studying quantum optics at the University of Innsbruck, Austria, spoke at the April Meeting about a project he participated in called "The Flame Challenge." Ames won the 2012 contest to create a video that explains the science of fire in a way that is understandable and engaging to 11-year-olds. He spent two weeks working only on his animated video, complete with original songs.

In his talk, Ames told the story of how he initially wanted to be a filmmaker, then decided to shoot for a more lucrative career as a patent lawyer, which landed him in the physics department and ignited his passion for the subject. While Ames expressed nothing but love and excitement for physics research, he is now working on an animated, science-themed television project with an executive producer of the children's show Yo Gabba Gabba. After he completes his PhD, Ames says he will have to consider in which direction he wants to take his career.

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and to solve problems that are "of the utmost importance to society at large."

An aide from the House Science Committee said that the leaked bill was essentially a rough draft whose intent was to establish a way for the NSF to publicly explain its grant decisions. Currently the NSF does not have to explain, online or elsewhere, the reason why a research project was approved for funding. The aide said that the Committee is talking with the NSF to find a way to provide information on their website. If the NSF and House Science Committee do not come to an agreement, legislation similar to the High Quality Research Act might be introduced in the future.

"We are not interfering with the peer review process," the aide said. "When you make those awards, justify that, in a public way."

However science advocates feared the additional requirements would give Congress the ability to politicize science by allowing it to veto grants its members didn't approve of. When the NSF was first chartered in 1950, it was set up with an independent board to review grants so as to eliminate political influence from funding decisions.

The leak came at a time of heightened sensitivity about Congress micromanaging scientific research. In March, Congress voted to eliminate most funding for research in political science from the NSF budget. Just two weeks before the leak, Science Committee Chair Lamar Smith (R-Texas) held a hearing on the NSF science budget, at which he criticized a number of individual grants with seemingly frivolous sounding titles, including one about how photos portray animals in *National Geographic Magazine*. Smith followed up the hearing by sending a letter asking Cora Marrett, the Acting Director of NSF, to turn over the normally confidential technical reviews of five grants that Smith had "concerns" about.

The congressional aide said that the draft of the High Quality Research Act was in part a response to the Acting Director's unwillingness to turn over the information requested.

"There were several questions that were raised about why the NSF is funding certain research grants," the aide said, pointing to the National Geographic study. "Why is this study worth a quarter of a million dollars from the American taxpayer?"

The combined actions prompted a strong response from the scientific community worried about political interference in the NSF grant process. The bill ignited a firestorm in online forums. Three former NSF directors and three former chairs of the National Science Board signed a letter sent to the House Science Committee criticizing the draft bill. Eighteen former assistant directors of the NSF signed a separate letter of protest. Both letters said that the proposed requirements would effectively require researchers to accurately predict the outcomes of research.

"The history of science and technology has shown that truly basic research often yields breakthroughs–including new technologies, markets and jobs–but that it is impossible to predict which projects (and which fields) will do that," said the letter signed by the former NSF directors.

The outcry over the bill touched on a larger debate about the role of the federal government in science.

"Many of us feel that the role of the federal government is to fund the basic research that no one else is going to fund," said Neal Lane, a former Director of NSF. "Industry is not funding basic research for reasons that everyone pretty much understands."

Lane added that industry is much more apt to fund research that can be easily turned into a commercial application.

"Maybe it's a lot to ask and maybe it's counterintuitive, [but] the way science works is not the way business as usual works. You have to trust, you have to look long term and you have to accept that something might not pay off for 20 years," said Robert Eisenstein, a former Assistant Director for Mathematical and Physical Sciences at the NSF.

In addition to fears about politicization of science, researchers said that it might cause researchers to be reluctant to pursue grants for riskier science, a trend that some claim has already begun.

"Peer review has already moved in the direction of being pretty conservative," Lane said. "People making proposals have been shying away from being too speculative, being too bold, out of fear of being shot down in the review process."

ANNOUNCEMENT

Reviews of Modern Physics

Leaking chaotic systems

*Eduardo G. Altmann, Jefferson S.E. Portela and Tamás Tél*

When a hole or a leak is introduced in an otherwise closed chaotic system, persistent dynamics is converted into transient chaos. Theories based on the persistent dynamics of closed systems are often applied to leaking systems, but they fail to describe realistic configurations which typically have finite-size leaks. A transient chaos based theory is developed and shown to be applicable to problems in planetary science, hydrodynamical flow and environmental sciences, room acoustics, and magnetic confinement in plasmas up to quantum and wave chaotic systems with leaks.

▶ http://link.aps.org/doi/10.1103/RevModPhys.85.869

http://rmp.aps.org

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a fee, Continuing Education Units through the American Association of Physics Teachers.

Michigan State's Bauer discussed how MOOCs can be monetized—which may account for the push from higher administrators for their implementation. He explained that MOOC materials can be used in a flipped classroom along with a teaching assistant for student interactions, thus potentially removing the need for faculty, and that institutions may soon start to charge some tuition to those students who successfully complete a MOOC and wish to receive college credit.

The first day of the workshop finished with a keynote address from Candace Thille of Carnegie Mellon University's Open Learning Initiative (OLI), a grant-funded group offering online courses to all. OLI was built upon the idea of integrating cognitive tutoring into online courses that can stand on their own and provide instruction. Their model is based on cognitive science telling us how students need help to think more metacognitively, and it provides feedback when the students need it. OLI provides students with simulations, time-independent access to the course, and connections to students around the world, but more importantly, it allows education researchers to collect data on how people are learning and using the system.

On the final day of the workshop, Pritchard and Kortemeyer delved deeper into the challenges of distance education. Pritchard remarked that academic cheating can be broken down into several groups—general cheating, exam cheating, plagiarism, and unauthorized collaboration—and according to literature on the subject, only unauthorized collaboration is significantly growing. An MIT study, which defined cheating as putting in the answer into the online system faster than it would take to read the problem and input the answer, showed that students who cheated more did worse on the exams and that they pass future classes less often. This leads to a division of opinions by instructors—one extreme contends that it is not appropriate to intervene, as they should only maintain standards and allow the students to decide what to do, while the other extreme believes in trying to reduce copying because the wrong message is conveyed if instructors ignore the cheating.

Kortemeyer noted that there should be a distinction between cheating on homework, which leads to learning failure and demoralization, and cheating on exams, which should lead to course failure. Based on an analysis of student discussions, Kortemeyer found that multiple choice problems produce the most solution-oriented discussions and that the best discussions occur with problems of medium-range difficulty. He also shared his results from conducting weekly exams rather than just a midterm and final: there was less use of unsanctioned websites and more use of the sanctioned site, more student satisfaction, more regular e-text use, and better final exam scores.

Andy Rundquist of Hamline University brought to light a major challenge for mass adoption of authentic assessment methods—scalability. At the Department Chairs Conference held just prior to the Distance Education Workshop, Rundquist presented his standards-based grading with voice approach and noted that it could be a possible solution to cheating. He recognized, however, that it could not scale easily past a 40-person class, so the question remains how instructors can best address cheating in large introductory college courses that are based online or use online homework.

APS Director of Education & Diversity Ted Hodapp remarked that "APS staff and the Committee on Education are considering ways to connect faculty wrestling with the issues of distance education, and to provide resources for understanding this changing landscape."

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# The Back Page

## No Evidence LEED Building Certification is saving Primary Energy

*by John H. Scofield*

John Scofield testifies before a Congressional subcommittee in May 2012

Buildings are responsible for 39% of our nation's energy consumption and associated green house gas (GHG) emission and they use 72% of the nation's electricity [1]. It has long been established that cost-effective improvements in energy efficiency has great potential to reduce primary energy consumption and GHG emission associated with buildings. The American Physical Society first took up this topic in 1974 [2]. A more recent APS study confirmed the potential remains [1]. Despite forty years of building technology research and public policy efforts to promote energy efficiency the energy efficiency potential for buildings remains largely untapped.

The Environmental Protection Agency (EPA) began promoting building energy efficiency in 1993 as part of its ENERGY STAR (ES) program, introducing its ES building score in 1999 [www.energystar.gov]. This score is based on measured energy consumption and is supposed to represent a building's energy efficiency percentile ranking with respect to similar buildings in the U.S. commercial building stock. A score of 75, required for ES Certification, implies that the building uses less primary energy than 75% of similar buildings under similar operating conditions nationally.

In 2000 the US Green Building Council (USGBC) introduced its Leadership in Energy and Environmental Design (LEED) green building rating system [www.usgbc.org]. Unlike ES, LEED certification was not based on measured energy performance but rather on "points achieved" through a checklist of items included in the building design and/or design process–all intended to make the building "green" or more energy efficient. Four levels of certification are awarded depending on the total number of LEED points achieved–Certified, Silver, Gold, and Platinum.

LEED's contribution was to marry the substance of energy efficiency with the popular appeal of green design. It was a brilliant marketing strategy and, since its introduction, LEED certification has far surpassed ES certification in popularity. Today nearly every large organization owns one or more LEED-certified buildings, and many institutions–particularly governmental–have mandated that all their future buildings must be LEED certified at the silver level or higher.

But do LEED-certified buildings actually save primary energy and reduce GHG emission? LEED certification has clearly captured the public's fancy–not unlike organic farming or herbal medicines. But also like these fields there is a woeful lack of scientific data supporting LEED's efficacy. And what little measured building energy consumption data there are have been gathered through a "self-selected" process that is clearly biased towards the "better-performing" buildings. In these data, proponents find evidence that LEED-certification is saving energy [3]. But careful analysis of even these biased data show that LEED-certified buildings, with regard to primary (or source) energy consumption and GHG emission, perform like other buildings–no better and no worse [4].

First consider the amount and quality of energy consumption data published for LEED-certified buildings.

The vast majority of energy savings claims are not based on measured building energy performance but rather on design team projections. LEED points for energy savings are based on these design projections–providing incentive for the design team to produce optimistic energy projections and to construct an inefficient "baseline" model to which these are compared. Studies show there to be little correlation between design energy projections and subsequent measured energy performance (see [3] and references therein). These design projections demonstrate intent not accomplishment.

There are, however, a dozen or so published studies containing measured energy consumption data for LEED-certified buildings. These collectively provide energy data for, at most, 229 buildings–roughly 3% of the 8,309 LEED buildings certified before 2012. Only four of these studies appear in peer-reviewed venues (two of these written by me–the rest are reports written by or paid for by the USGBC or organizations closely aligned with it. Buildings included in these studies are unlikely to be representative of the larger population. Building owners control access to their energy data. Nature–galaxies, rocks, atoms–doesn't care what humans learn from their experiments. Buildings do–or rather, their owners and design teams do–they have a vested interest in controlling energy data for the building for which they have already enjoyed extensive green publicity. Owners are unlikely to voluntarily disclose embarrassing energy consumption data. In a many cases requisite meters are not even installed–rendering the question moot.

The largest and most-widely publicized of these studies, conducted by the New Buildings Institute (NBI) in 2008 for the USGBC, concluded that "...average LEED energy use [is] 25-30% better than the national average" [3]. But the APS Energy Efficiency Study Committee concluded that the LEED buildings in the NBI study used more energy per square foot than the average for all existing commercial buildings [1]. NBI's conclusion–similar to those published by other studies, is obtained by 1) a mathematical error in calculating the *gross energy intensity* for the LEED buildings, and 2) focusing on site energy–energy used at the buildings, while ignoring off-site energy losses associated with electric generation and distribution.

First consider the mathematical error. A building's energy use intensity (EUI) is the ratio of its annual energy use to its gross square footage (gsf) or total floor area (surrogate for building volume). EUI is convenient for comparing the energy use of two similar buildings differing only in size. The Energy Information Agency (EIA) similarly defines the *gross energy intensity* of a set of N buildings to be their total energy divided by their total gsf–mathematically equivalent to the gsf-weighted mean EUI of the N buildings. The EIA's Commercial Building Energy Consumption Survey uses this metric to characterize the energy use of subsets of the national commercial building stock [5]. In the NBI study–indeed, in most LEED building studies–energy used by LEED sets of buildings are characterized by summing their individual EUI and dividing N. This unweighted or "building-weighted" EUI is unrelated to the total energy used by the buildings. When this error is corrected we find the LEED buildings in the NBI study use 10-15% less energy on site as compared with other buildings [4].

But energy used on site–called site energy–is only part of the story. Site energy fails to account for the off-site losses incurred in producing the energy and delivering it to the building–particularly important for electric energy that, on average, is generated and distributed with 31% efficiency [1]. The EPA defines source energy to account for both on- and off-site energy consumption associated with a building; building ES scores are based on source energy consumption. When you compare the source energy consumed by the LEED buildings in the NBI data set with that of comparable non-LEED buildings you find no difference–within the margin of error [4].

How do we understand these results? First, LEED-certified buildings, similar to other new or renovated buildings, are showing a modest reduction in energy used on site. But these buildings are relying more on electric energy–and the off-site losses in the electric power sector are offsetting any savings in site energy.

The other issue is that larger buildings tend to have higher EUI than smaller buildings. This may seem counter-intuitive since energy use in simple buildings (like houses) is dominated by surface losses/gains (windows, insulation, etc.). But energy use in large commercial buildings is driven by internal loads–equipment, people, and lighting. Large office buildings are typically air-conditioned year-round. This is seen nationally as well as in LEED-certified buildings. Roughly 5% of the nation's commercial buildings account for half of the gsf of the building stock–and an even larger fraction of primary energy consumption.

In recognition of the need for actual performance data the USGBC has required all buildings certified under its 2009 version of LEED to measure and report annual energy consumption data to the USGBC for five years following certification. And, for its Existing Buildings program–which targets renovated buildings–the USGBC has adopted the ES building rating system as its method for determining energy efficiency points–for the first time rewarding measured energy performance.

But these changes have not yielded convincing scientific data that demonstrate energy savings for LEED. More than 2,400 buildings have been certified under LEED 2009–with 711 of these certified before 2012. Yet the USGBC has released no scientific report analyzing the energy data they have collected. Instead they "cherry-pick" the data to create clever marketing sound bites that have no scientific value. A USGBC press release last November claimed their data reveals that 195 LEED certified buildings received ES scores averaging 89–demonstrating a 43% energy savings [6]. So what–presumably a million (of the 5 million) buildings in the commercial building stock have an "average" ES score of 89. Scientists should not be impressed. Moreover, while the source energy savings of a single building may be inferred from its ES score, it is mathematically impossible to determine the energy savings for a collection of buildings from their average ES score (unless they all are identical in size and function)–hence the claim of 43% energy savings is unjustified.

These days the USGBC points to the high ES scores of its Existing Buildings program as evidence of energy savings for this program. But the "value added" by LEED-certification is not established by comparing the certified building's ES score to 50–the presumed mean for all US buildings–it is found by comparing its ES score to those of similar, newly-renovated buildings that did not use the LEED process. Any newly-renovated commercial building (LEED certified or otherwise) ought to see reduced energy consumption owing to cost-effective efficiency upgrades in lighting and heating, ventilation, and air-conditioning equipment. Moreover, many of the buildings certified under the LEED Existing Buildings program have previously been certified by ES with scores significantly higher than 50.

The lack of energy consumption data for LEED and other commercial buildings is soon to change. Six of our nation's largest cities have passed ordinances requiring all commercial buildings to annually submit their energy consumption data into the ES system for subsequent municipal use. New York City is the first such city, and last fall it made public 2011 energy consumption data for some 4,000 buildings of 50,000 sf or larger–and this list included nearly 1,000 office buildings of which 21 were identified as LEED certified. These data clearly show there to be no statistically significant difference between the source energy consumed by or GHG emitted by LEED certified buildings as compared with other large NYC office buildings. It should be noted that LEED office buildings certified at the Gold level and higher did outperform other office buildings.

At present there simply is no justification for governments mandating LEED building certification–using public dollars to subsidize a private enterprise with no scientific data to demonstrate efficacy in lowering primary energy consumption or GHG emission. The problem is that LEED does not require public disclosure of energy consumption data and it does not have a mandatory energy performance requirement. LEED certification clearly delivers green publicity but there is no evidence for primary energy savings, except possibly at the highest levels of certification (Gold and Platinum). The USGBC could implement changes that would result in substantive savings–but this might negatively affect "sales of their product." We need to stop awarding buildings green publicity at the front end of a project and, instead, save the accolades for demonstrated reduction in GHG emission and primary energy use.

*John Scofield is a professor of physics at Oberlin College. He has served on the APS Panel on Public Affairs and provided congressional testimony on the topic of green buildings.*

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