APSNEWS

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Top Physics Newsmakers of 2012
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AMERICAN PHYSICAL SOCIETY
MOVING PHYSICS FORWARD
UPDATES TO THE APS STRATEGIC PLAN

Open Access Task Force Formed

APS has formed a new, top-level Task Force on Open Access, led by President Michael Turner, to better coordinate APS activities on this topic and to ensure its leadership role. The task force is charged with developing a compelling narrative and a clear set of "talking points" on open access that are consistent with APS policies and that will serve to articulate the APS position on this complicated issue The new task force will identify, create and coordinate opportunities to communicate APS recommendations to leaders in government agencies, science policy makers, other publishers, and the physics community.

Calls for greater public access to the peer reviewed research literature have grown dramatically in recent years. APS policies and practices on open access, including their history and context, were reviewed in a Back Page article in the November 2012 issue of *APS News*.

The task force is a top priority for the leadership of APS. Turner calls open access "an existential issue for APS because of its potential impact on the Society's mission to advance and diffuse the knowledge of physics as well as on the current financial model for the entire organization." The task force includes the four-member Presidential Line, the Society's three Operating Officers and APS Director of Public Affairs, Michael Lubell.

According to APS Treasurer/Publisher Joseph Serene "Council has resolved that APS supports the principles of open access to the maximum extent possible while maintaining the quality and impact of our journals and the long-term financial stability of the Society. Our challenge is to strike this balance in practice and to influence public policy to facilitate this goal."

TASK FORCE continued on page 5

Funding Uncertainty Plagues Science as Sequestration Cuts Still Threaten

By Michael Lucibella

The eleventh hour decision by Congress to postpone across-the-board cuts to spending (the so-called "fiscal cliff") has done little to settle uncertainty surrounding the future of federally supported scientific research. Experts expect the total amount of federal dollars devoted to research to decline in the coming year, but it is unclear by how much, making it difficult for scientists to plan for the future.

On January 1st the House and Senate agreed to maintain most tax rates at their current levels and delay the onset of imminent "sequestration" spending cuts until March. Had sequestration gone into effect, federal agencies would have seen an 8% cut to non-defense spending, and an 11% cut to defense spending. The major source of funding for fundamental science is the federal government, administered primarily by the National Science Foundation, the Department of Energy, NASA and the National Institutes of Health, as well as the Departments of Defense and Commerce.

How lawmakers will ultimately resolve the impasse is unclear. Republicans have been pushing for spending cuts to reduce the federal deficit, and it is likely that there will be some form of spending

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APS Sponsors the Conference for Undergraduate Women in Physics

By Halleh B. Balch

For the first time in its six-year history, the Conference for Undergraduate Women in Physics (CUWiP) has taken place with official APS sponsorship. On January 18-20, six universities across the country hosted the Conference under the aegis of the APS Committee on the Status of Women in Physics.

"Encouraging women to pursue physics is a top priority for us. CUWiP has been very successful over the years and we are delighted to be able to lend our organizational support and resources to the conference," says Kate Kirby, APS Executive Officer.

The Conference for Undergraduate Women in Physics was conceived by two graduate students at the University of Southern California in 2006 and is still organized and run by students at the host universities. Through invited talks by successful women in physics, panel discussions on graduate school and physics careers, and the opportunity for students to present their own re-

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Graphs are on different scales and show totals from January 2013

APS Membership Stands at 49,653; Students, Foreign Members Increase

The official APS membership count for 2012 has been tabulated, and stands at 49,653 total dues-paying members in the Society. The count is down about 402 people from last year, but still up more 1,390 over the year before.

"Although it's disappointing to not have another record this year, we're still showing growth over the long run," said Trish Lettieri, the director of APS Membership.

She said that one of the reasons for the slight decline may have been the popularity of last year's March Meeting in Boston. The meeting drew nearly 10,000 physicists, about 1,500 more than usual. It's likely that some fraction of the extra attendees joined only for the year.

"One of the bright spots in these numbers is that the number of paying student members is up over four hundred," Lettieri said. She commended the APS Education Department for reaching out to students. "APS has been working hard to offer great benefits to our student members and to keep them engaged."

In addition, the number of international members has shown consistent growth. The count this year showed almost 400 new international members, about a fifth of which came from China. Lettieri credited the efforts of the APS Office of International Affairs for the continued membership growth from overseas.

Beller, Marshak Lectures to Enhance March and April Meeting Programs

APS has announced the recipients of the 2013 Beller and Marshak lectureships, who will deliver their talks at this year's March and April meetings. The APS Committee on International Scientific Affairs selected the recipients from nominations submitted by various APS units.

Rupert Oulton from Imperial College London and Naoto Nagaosa of the University of Tokyo will present two of the Beller Lectures at the March Meeting in Baltimore while Linda Strubbe from the Canadian Institute for Theoretical Astrophysics will deliver the third at the April Meeting in Denver. Lilia Meza-Montes from the Universidad de Puebla in Mexico will give the Marshak lecture at the March Meeting.

The two endowments bring physicists from around the world to speak at the March and April Meetings. The Beller lectureship was endowed in 1994 by Esther Hoffman Beller and the Marshak lectureship was established by Ruth Marshak in 1996 in honor of her late husband, former APS president Robert Marshak. The recipients of both awards receive travel stipends to attend either the March or April meetings. Recipients have traveled to the United States from as far abroad as India, Israel and France.

During the focus session on Nanostructures and Metamaterials in March, Oulton will speak about his research into nano-lasers.

"The Beller lectureship came as a wonderful surprise to me and I am honored to have been selected. The APS meetings provide a great forum for communicating current results, learning about progress in a wide range of fields in Physics and of course meeting new friends, colleagues and collaborators," Oulton said. "The Beller lectureship is an excellent advertisement

LECTURES continued on page 7

APS Releases Colorful New Science App

SpectraSnapp, a new app released by the APS outreach department, is now available free of charge on Apple's iTunes store. It allows users to turn their iPhone or iPad into a spectroscopic device that can analyze common sources of light.

"SpectraSnapp is an app that APS developed that can break down any incoming light into its various wavelengths," said James Roche, a public outreach specialist at APS who helped develop the app. "You can turn your iPhone into a personal spectroscope."

The SpectraSnapp app comes with directions to build a simple spectrometer that fits over the phone's camera. All that is required is a tube made out of construction paper, with a thin diffraction grating at the end. The grating, available online for less than a dollar, breaks the light apart into its component wavelengths, which the camera sees as a series of colored lines.

Photo credit: Michael Lucibella

APS Public Outreach Specialist James Roche demonstrates SpectraSnapp in action. Using the simple spectrometer attached to his iPhone, he compares the spectrum from a fluorescent light (bottom) to the spectrum of neon from the library in the app, thus showing conclusively that the light in question is not produced by neon.

"You can determine through our app what the light source you're pointing the camera at is made out of," Roche said.

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Members in the Media

"In the robotics world this is very, very exciting because it's a blob that has no hard components in it… For us mere mortals, we would say, 'Well, gee, isn't that just a deflated soccer ball?' But it is a big deal because of the potential that it holds. ... You can imagine that it would have, for example, a payload that it could take with it and then disperse at the other end. Or it could pick up some liquid that's maybe dangerous and bring it to a decontamination area."

Heinrich Jaeger, *University of Chicago, on his research building flexible robots,* Chicago Tribune*, December 16, 2012.*

"I tell people, don't quit your day job, pay your rent, and for God sakes, do your laundry."

Michio Kaku*, CCNY, on what he says to people who thought the world would end on 12/21/12,* CNN.com *December 21, 2012.*

"For nearly a century, astronomers have studied a mysterious substance that appears to fill our universe and that we ignorantly refer to as dark matter. One of the reasons we believe this substance exists is that when we study galaxies, the stars in the galaxies move as if only ~10% of the mass in the galaxy is located in the stars. Indeed, the name 'dark matter' reflects our belief that this matter exists, but we can't see it."

Bhaskar Dutta and David Toback*, Texas A&M University,* The Houston Chronicle*, December 26, 2012.*

"We're not coming up with new color names or descriptions for things we've already established… A lot of the new words that we see are related to computers."

Alex Petersen*, IMT Lucca, on the usage of newly invented words,* FoxNews.com*, December 28, 2012.*

"In measuring a gas at room temperature, that means atoms, molecules are racing around, some at slow velocities, some at faster velocities. But there's more atoms at slow velocities than at fast velocities. As you heat the gas up, many more atoms go to fast velocities. At very, very high temperatures, like on the sun, there are more atoms–there are almost equal numbers of atoms at different speeds. Now if you give more energy to the gas into a system where there are more atoms that are moving at high velocities than at low velocities, this corresponds to a negative temperature, something that would not easily naturally occur."

Vladan Vuletic*, Massachusetts Institute of Technology, on how a temperature can be "negative,"* NPR*, January 4, 2013.*

"There is an all-star cast here… It didn't hurt that we had a major discovery; that played a central role in many of the discussions."

Howard Haber*, University of California Santa Cruz, on a recent symposium about the Higgs boson and supersymmetry,* San Jose Mercury News*, January 6, 2013.*

"Making the transition from graduate student to postdoc is a difficult step…They had a huge effect on my career; they set me up."

Patrick Fox*, Fermilab, on how UCSC helped with his career,* San Jose Mercury News*, January 6, 2013.*

"My research shows that based on the physics and physiology that we know muscle mass from steroid use is sufficient to turn a player with the home run productivity of a Hank Aaron into a player with the home run activity of Barry Bonds. So in that sense, no, I don't think the impact of PEDs is overstated."

Roger Tobin*, Tufts University,* Time Magazine*, January 10, 2013.*

"Do you lie awake at night wondering if you should be looking for something positive?"

Jay Pasachoff*, Williams College, asking physicists if they thought that repeated negative results in the hunt for dark matter and dark energy was discouraging,* The Los Angeles Times*, January 10, 2013.*

"It's not just one new particle and we're done… Hopefully there are new forces in the dark sector. … It could be a whole new branch of physics, and we just don't know until we look."

Douglas Finkbeiner*, Harvard-Smithsonian Center for Astrophysics, on the hunt for dark matter,*

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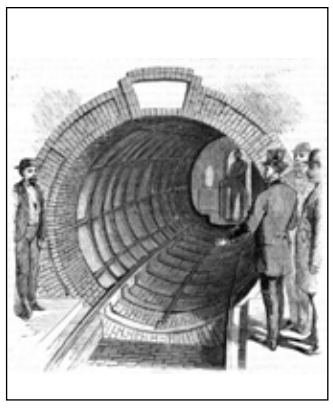
This Month in Physics History

February 26, 1870: First pneumatic powered subway line in New York City

Tunnels and pneumatic transportation systems are a staple of classic science fiction, starting with Jules Verne's *Paris in the 20th Century* (1863), in which the author envisions tube trains stretching across the ocean. In 1882, Albert Robida described not only tube trains, but pneumatic postal delivery systems in his novel, *The Twentieth Century*. Those authors based their fictional creations on real systems that were actually built, some of which still exist today.

In 1812, a man named George Medhurst speculated that it might be possible to blow carriages laden with passengers through a tunnel, but he never got around to building such a system. He lacked a pump with enough power to generate the requisite air pressure. By the mid-1850s, there were several rudimentary "atmospheric railways"–in Ireland, London, and Paris–and while the London Pneumatic Despatch system was intended to transport parcels, it was large enough to handle people. In fact, the Duke of Buckingham and several members of the company's board of directors were transported through the pneumatic system on October 10, 1865, to mark the opening of a new station. A prototype pneumatic railway was exhibited at the Crystal Palace in 1864, with plans to build a version connecting Waterloo and Charing Cross by running under the river Thames.

Alfred Ely Beach



Entrance pneumatic transit

Those early efforts inspired a man named Alfred Ely Beach back in the United States. Born in 1826 in Springfield, Massachusetts, Beach's father was a prominent publisher, and his son followed in his footsteps, eventually purchasing a fledgling magazine called *Scientific American*. But he was also an inventor and patent lawyer, patenting his design for a typewriter for the blind–an invention that garnered him a gold medal at the 1853 Crystal Palace Exposition–and founding his patent agency with his friend, Orson Desaix Munn.

From his office window in downtown Manhattan, Beach could see the congested traffic along Broadway in particular and pondered the possibility of a public transport system. He dismissed the idea of an elevated train on the grounds that it would be noisy and unsightly, focusing his attention on an underground option. He published an 1849 article in *Scientific American* suggesting a system employing horse-drawn cars to carry passengers instead of conventional steam engines, which would produce too much soot. Gasoline and electric motors were not yet widely available.

Then Beach discovered pneumatics: "A tube, a car, a revolving fan! Little more is required!" he enthusiastically exclaimed. The idea was to put people in carriages and propel them through underground tubes using air pressure generated by gigantic fans. He first built a prototype above-ground model, which debuted at the 1867 American Institute Fair. It was little more than large wooden tube (roughly six feet in diameter and 100 feet long) capable of holding a small vehicle with a ten-person capacity, with a gigantic fan on one end capable of funneling a blast of air to propel the car through the tunnel. When the fan was reversed, it would pull the car back to the origin point.

The demonstration was a huge success, and Beach proceeded to solve the problem of digging a tunnel underneath the buildings of lower Manhattan: he invented a hydraulic shield tunnel driller capable of moving left, right, up or down, while minimizing disturbances to the streets above. But he couldn't get permission from the city to construct a prototype underground system, given the political corruption in City Hall at the time. So Beach sneakily built the underground pneumatic subway anyway, pretending he was really building a pneumatic mail delivery system, and he did it right under the nose of City Hall, beneath a rented storefront across the street.

On February 26, 1870, Beach unveiled his masterpiece, and it was an immediate novelty attraction for the public, especially given the luxury of the station: it boasted a grand piano, chandeliers, and a fully operational fountain stocked with goldfish. There was a single car to fit within the tube, which spanned nine feet in diameter and ran from Warren Street to Murray Street at 10 MPH. A giant fan nicknamed "the Western tornado" supplied propulsion via a steam engine that drew in air through a valve and directed it into the tunnel. Upon reaching the Murray Street station, the car would trip a wire that rang a bell back at Warren Street. The engineer on duty then reversed the blower, sucking the car back to the station, "like soda through a straw."

The subway proved to be a popular attraction for the first year or so, and Beach fought for the next three years to get a construction permit to extend the line uptown all the way to Central Park, competing with a plan for an elevated viaduct that had the support of key politicians in the state legislature. Alas, while he ultimately succeeded–despite two vetoes by the governor–it proved an empty legislative victory: a stock market crash (the "Panic of 1873″) crushed his dream for good. He had to close his pneumatic subway for financial reasons.

Beach's failure didn't keep others from speculating on so-called "vactrains" (vacuum tube trains). The US government considered the possibility in the 1960s of running a vactrain–combining pneumatic tubes with maglev technology–between Philadelphia and New York City, but the project

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Washington Dispatch

A bimonthly update from the APS Office of Public Affairs

ISSUE: BUDGET

The Fiscal Cliffhanger–What has happened so far

Congress struck a last minute deal to avoid the fiscal cliff – a combination of increases in tax rates, expiration of tax credits, and massive cuts in government discretionary spending that were set to occur on Jan. 2, 2013. There was, however, no grand bargain on deficit reduction; instead, the lesser compromise focused almost solely on taxation. The Bush era tax rates were made permanent for 99.1 percent of all Americans and a number of tax credits, such as the one for wind energy development, were also extended.

The issues of entitlement reform, across-the-board budget cuts (sequester), and debt-ceiling limit were not addressed. Instead, the sequester was delayed by two months and moderately reduced. The across-the-board budget cuts to non-defense discretionary funding fell from 8.2 percent to 5.9 percent due to the agreement on taxation. The percentage cut on defense discretionary funding decreased from 9.4 percent to 7.3 percent.

The Fiscal Cliffhanger–Where are things heading

The deal on tax rates has, in effect, removed any new revenue from the table as House Republicans have publicly stated they will not accept any further tax increases. House Republicans will be looking to reduce the deficit through entitlement reform and reduced discretionary spending.

Senate Democrats, in preparation for the debate on the new fiscal cliff, have indicated that they will not consider any changes to entitlement programs. They are also highly unlikely to consider sparing the defense budget from the sequester if it places the burden squarely on non-defense discretionary funding, as a number of House Republicans have urged.

House and Senate Republicans have warned that they are loath to raise the debt ceiling without corresponding cuts to government spending. The White House has stated it will not negotiate raising the debt ceiling since it represents an obligation to pay bills previously incurred by Congress.

With the compromise on taxes, the path to reducing the deficit has narrowed significantly. The impasse between Republicans and Democrats over entitlement reform, spending cuts, and the debt-ceiling may very well lead to a scenario in which 1) the reduced sequester occurs in March 2013; 2) the Continuing Resolution (currently funding federal programs) is extended through the end of Fiscal Year 2013; and, 3) the debt ceiling is raised for one year. The White House and Congress would then be able to move on to Fiscal Year 2014.

Fiscal Year 2014 Presidential Budget Request

The White House has indicated that the president's budget request, typically delivered the first Monday in February, is likely to be delayed until March.

ISSUE:Key Scientific Posts in the Second Obama Administration

In Obama's second term many of the agency leadership positions are expected to remain unchanged. Likely to stay for at least another four years are: OSTP Director John Holdren; NIST Director Patrick Gallagher; NASA Administrator Charles Bolden; and NIH Director Francis Collins.

Secretary of Energy Steven Chu and Office of Science Director Bill Brinkman are expected to leave their posts.

NSF Director Subra Suresh is on a six-year cycle.

ISSUE: POPA

A study of the technical issues surrounding the extension of nuclear reactor licenses from 60 to 80 years is under way. The Study Committee has been selected, and a meeting will be held in Washington, D.C. in February.

A study for the Department of Homeland Security's Domestic Nuclear Detection Office (DNDO) regarding trends in nuclear and radiological detection, sponsored jointly by APS and the Institute of Electrical and Electronics Engineers (IEEE), is under review and will be released in 2013.

A tactical nuclear weapons workshop, sponsored by the State Department, in conjunction with the Center for Strategic & International Studies (CSIS), will be held in February.

A template for study proposals can be found online, along with a suggestion box for future POPA studies, by visiting:http://www.aps.org/policy/reports/popa-reports/suggestions/index.cfm.

ISSUE: MEDIA UPDATE

APS student members Kelly Reidy, John Mergo and Brian Tice recently authored op-eds on the devastating effects that would occur to science under sequestration.

The *Cleveland Plain Dealer* published Reidy's piece, "U.S. must avoid deep science cuts," on Dec. 20, 2012. The *Ithaca Journal* ran an op-ed co-authored by Mergo and Tice headlined, "Sequestration would harm future of science" on Dec. 28, 2012.

The students pointed out in their pieces that their careers and America's economic growth would be jeopardized under sequestration.

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INTERNATIONAL News

...from the APS Office of International Affairs

Teaching Intuition in Honduras

By Giulio C. Rottaro

When I was younger I had the privilege of going to a school with plenty of resources. If my biology teacher said that all living things are made of cells, she had a microscope and some slides and she could prove it. Only after being a teacher for a year have I come to understand how important those resources are in scientific education. I used to think that those little simple experiments and demos were just neat gimmicks that were complementary to my scientific education, but I am starting to believe that they WERE my scientific education.

Giulio Rottaro (far left) enjoys a light moment with his students in Honduras.

In 2010 I took a year off school to volunteer as a bilingual teacher in a small town in Honduras. I was assigned the position of resource teacher where I would pull underperforming students out of class for one-on-one or small group sessions. This position gave me a great viewpoint from which I could observe how all the subjects were being taught at all grade levels. The first and second graders learn about measuring and simple words like "hot", "cold", "solid", "liquid", "gas", etc. Third and fourth graders learn about the water cycle, the difference between natural and artificial, rocks, etc. The fifth and sixth graders learn about the scientific method and more complex ideas. And finally the middle schoolers learn biology, physical sciences and earth science, in that order.

I had no prior teaching experience so my understanding of education was only from the perspective of a student. I figured that science education could be divided into two elements: language and concepts. First you teach the student about the language of science and then you apply that language in teaching them concepts. But there is a third element that is the most important for both students who will go into sciences and students who will not: intuition.

For students from this predominantly agricultural nation it is easy to develop their Naturalist Intelligence, one of the nine types of intelligence accepted by educational theorists. It's not rare for the students to lend a hand on their parents' or grandparents' farms or for students to have fruit trees at home. Given their love of soccer there are also plenty of students with Bodily-Kinesthetic Intelligence. I took this as evidence that my students could indeed learn subjects to the point of intuition. So I tried to identify the aspects that allowed them to learn these skills and bring them to the classroom.

That's when I realized how important those little experiments and demos are. Not only are they fun for the students, they actually teach intuition through experience. Unfortunately, without beakers, hot plates, scales, multi-meters, etc. we had to get creative to come up with experiments. For a second-grade lesson on the water cycle, I dragged a skillet and a propane tank into the classroom, boiled some water on a pot and condensed it on a cool glass above the pot. The children all held their hands above the pot and felt the steam rise. They noticed the water level dropping and the condensed water building up on the glass. For a fifth grade lesson on the large intestine we used water and powdered drinks, and we reenacted peristalsis like a play out in the school's auditorium. I called that one "The Poopopera Lesson".

When it came time for the middle school science fair, the students' intuition shortcomings became very clear. Because of the lack of resources, especially when these students were in primary school and the school had just been founded, they were unable to intuit the answers to their science-fair problems and therefore got stuck in the hypothesis step of the scientific method. A lot of students traced back and tried to find a new question that was closer to their comfort zone. This was obviously not a valid problem-solving strategy. For example, a student wanted to create a man-powered electrical generator but he was unable to intuit how the magnets may interact with the coil or even with each other. (Nowadays our kindergarten and pre-k students play with magnets on a daily basis.)

Thanks to the hard work of the middle school science teacher and some of my help, the science fair was a huge success and most projects were quite impressive. However the obstacles that

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Pines Honored by AAPT

Photo by Matthew Payne

APS Fellow David Pines received the John David Jackson Award for Excellence in Graduate Education from the American Association of Physics Teachers (AAPT) at their recent meeting in New Orleans. In the photo, Pines (left) receives the award from AAPT Past-President David Sokoloff of the University of Oregon. Pines is emeritus professor at the University of Illinois at Urbana-Champaign, and the Founding Director of the Institute for Complex Adaptive Matter.

Letters

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

Criticism of Inquiry-based Learning Strikes Home

David Klahr in his Back Page "Inquiry Science rocks: Or does it?" in the December *APS News* clearly shows that the inquiry-based emperor, despite his legions of loyal followers, has no clothes. The most telling criticism in Klahr's essay is the lack of any clear "dose-response" correlation between positive results of particular educational materials and their degree of being inquiry-based. What a delightful irony that he faults much of physics education research for its lack of methodological rigor and clear definitions–properties which many physics education researchers presume to be hallmarks of their field, perhaps by virtue of their being physicists, unlike Klahr.

Bob Ehrlich
Fairfax, VA

G. N. Lewis Column Stirs Memories

I enjoyed the "This Month in Physics History" column in the December *APS News* on G. N. Lewis, which reminded me of a couple of anecdotes:

At the Centennial meeting of APS in 1999, H. Richard Crane (my academic grandfather) gave a talk about his days working with Lauritsen at Caltech in the 1930s on accelerated deuterons, made possible by a gift of D_2O by G. N. Lewis. Someone in the lab mentioned to a journalist about the connection of D_2O to nuclear physics, and the subsequent newspaper story was like something you'd see in the *National Enquirer* today. Lewis was furious and cut off their supply of D_2O, and Crane had to set up apparatus to make his own.

I visited Rob Varney and Leon Fisher (both of whom died recently) a few years ago in California. They had been grad students at Berkeley in the late 1930s to early 1940s and used to play bridge with G. N. Lewis. Varney and Fisher said that after Berkeley became recognized for nuclear physics, Lewis was determined to do nuclear work on his own. He gave a seminar in physics telling of being able to focus neutrons using a paraffin lens in his lab. They said that both Lawrence and Oppenheimer mercilessly ridiculed Lewis's results at the seminar, insisting that the neutrons he detected must have been bouncing off furniture and walls. Varney and Fisher added that when Lewis repeated the experiments out-of-doors he found no such focusing of neutrons, and that the humiliation seemed to have taken the steam out of him. They felt that he didn't do much after that, but of course by that time he was getting on in years [Lewis was born in 1875–ed.]. I've always wondered if this story is at all widely known.

Thomas M. Miller
Lexington, MA

Arms Policy Demands Broader Perspective

The debate on the Benefits and Risks of Laser Isotope Separation between Mark Raizen and Francis Slakey (January *APS News* Back Page) raises interesting points that, ultimately, are relevant to the development of any defense (but therefore also war-enabling) technology that some possess but do not wish others to have. Raizen and Slakey could have been talking about bows, arrows, guns and gunpowder that all have access to now. Or, they could have been talking about nuclear, biological and chemical weapons that all do not have today–but which are likely to become widespread, if we do not change our ways.

Unfortunately the debate does not address the root cause of many of our difficulties: We do not recognize that our conflicts can only really be resolved by negotiation rather than by slaughtering one another. No matter how hard we try to prevent "others" from acquiring the deadly weapons that we so dearly guard because we are "civilized" while they are not, these others will eventually also acquire them. The reason is simple. All technology is based on science and, if we have learned anything from the latter, it is that what can be done in one place at one time can be repeated in any other place at any other time. The laws of physics are invariant.

If we have nuclear technology today others will acquire it tomorrow. If we fly drones over other countries today they will have the capacity to do the same over ours –one day.

We may try to continuously stay a step ahead and hope that our defenses will be able to shield us while they attempt to catch up. But that is a dangerous game. A perfect shield against any weapon is an impossibility.

More physicists, engineers and other scientists ought to try and have a broader perspective and recognize the plight of people all around the world. In that way perhaps we could persuade our politicians to also look at the world without the blinders they seem to have on. Then they may not be as trigger-happy.

I cannot help but make one final comment, though. Admirably, Slakey exhibits that broad perspective and refers to the poverty of many in the world. I do take issue, however, with the "tribeswoman" appellation applied to that woman trekking miles to fetch water. One of the problems we have here in the "West" is that we often look at those whose cultures we may not understand well as being somewhat inferior.

Amin Dharamsi
Norfolk, VA

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cuts, but it is unclear what might be cut and by how much.

"Both parties agree that they don't want to see these [sequestration] cuts move forward," said Matt Hourihan, director of the R&D Budget and Policy Program at the American Association for the Advancement of Science. "It's hard to envision what that deal might look like and what the actual impacts on science funding will be."

The looming cuts stem from a political fight over the national deficit and the federal debt ceiling in 2011. Concerns about the growing national debt prompted the passage of the Budget Control Act of 2011, which empowered a Congressionally appointed "Super Committee" to come up with a deficit reduction plan, or else face serious across-the-board budget cuts to every part of the federal government. The Super Committee failed to reach an accord, setting the US on a course toward sequestration.

Few observers expect the deep sequestration cuts will come to pass, but any solution would require accord between the two parties. Congress can overturn their own law, but getting the two parties to agree to any kind of compromise budget has been intractable thus far.

Michael Lubell, APS Director of Public Affairs, worries that this deep partisan split will continue or possibly even worsen. Recent redistricting might have made the House more polarized than before the election. Every ten years voting districts are redrawn following the census, and lawmakers often try to influence how they're drawn, by grouping together their constituencies.

"If anything the House probably tilts a little further to the right than it did before," Lubell said. "If you're a Republican and you're sitting in one of those districts, you're not afraid of being attacked by someone to the left of you, you're afraid of being attacked from the right."

Conservative Republicans have led the charge to reduce federal spending overall, and Lubell says that with a more conservative House, "It's going to be even dicier to achieve anything on reductions."

The agreement reached to delay cuts until March did contain a few provisions beneficial to scientific research. It extended the federal R & D Tax Credit, which has been in place since 1981, and included tax credits towards development of wind power as well.

If sequestration sets in, all programs and line items across the board are supposed to be reduced, though it is also possible that lawmakers will seek to safeguard some favorite programs. In the more likely scenario where Congress and the White House come to some kind of agreement over smaller cuts, it's possible that science funding might fare better than average.

"In recent years, there are a few areas that have done pretty well," Hourihan said, highlighting the DOE's Office of Science and the NSF. "My guess is there probably is an interest in preserving DOE science funding ahead of other areas."

The Obama administration has defended research funding, mostly sparing science from cuts that have befallen other programs. Lubell said he is hopeful that funding for science will continue to escape the axe.

"Science is a good story to tell," Lubell said. "It really does have a great deal to do with economic development."

Experts worry that should significant cuts materialize, the Department of Energy's Offices of Fusion Science and especially Nuclear Physics (NP) could be in the most trouble. The latter has already been facing a funding crunch.

In 2007, the Nuclear Science Advisory Committee put together a long-range plan under the assumption that budgets would continue to increase as they had for the DOE's Office of Science in the previous years. Instead, the agency's budget remained flat while Jefferson Lab's Continuous Electron Beam Accelerator Facility received an upgrade and while Michigan State University began using federal dollars to move towards construction of its Facility for Rare Isotope Beams. Combined with the continued operation of Brookhaven's Relativistic Heavy Ion Collider, these programs have put NP in a bind.

"Not everything is going to fit," said Robert Tribble, a physicst at Texas A&M University who is heading a commission to make budget recommendations to the Department of Energy.

"The charge was to provide a strategy to implement the 2007 long-range plan recommendations under two budget scenarios," Tribble explained. The first scenario allowed for a slight increase in the budget, while the second assumed that the budget remains "flat flat," meaning that it's the same dollar amount as the previous year, which, because of inflation, somewhat reduces its buying power. "It's pretty clear that it is not possible to keep everything going under flat flat," Tribble said.

The committee is not contemplating scenarios involving either modest budget cuts or the more drastic cuts that would happen under sequestration. "The notion of increases in the next two years, on which the planning for DOE facilities was based, is unrealistic. Those increases are not going to materialize," Lubell said.

The committee expects to submit its recommendations by the end of January, after *APS News* goes to press, and could not discuss any specific recommendations until then.

Because of the uncertainty over future budgets, long range planning has been difficult for the projects that will likely be most affected. News reports have indicated that RHIC might be facing significant cuts, or might even be shut down. However nothing is official, and RHIC's recent upgrades have boosted its science output significantly.

"The budget situation is so unresolved at the moment, it's not clear it makes the most sense to come up with contingency plans now," said Berndt Mueller, Brookhaven's new Associate Laboratory Director for Nuclear and Particle Physics. "We would have to see how it is distributed across the various subprograms in the Office of Science."

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Different light sources produce different spectral signatures, depending on their chemical composition. The spectrometer lets users see that white light given off by different types of bulbs is a combination of different emission lines. A fluorescent bulb will have a different series of lines than a sodium light, while an incandescent bulb emits a continuous spectrum. The app comes with a spectral library of twenty of the most common light sources, which the team anticipates expanding as the app becomes widely used.

"We hope in the future to provide access to a library of user generated spectra samples you can cross-reference on the internet," Roche said. "We developed this to make a fun app," Roche added. He said that on the surface it's a tool for people to find out what different lights are made out of, but it's also a springboard for members of the public to learn a bit more about the wavelengths of light and the quantum nature of atoms.

Initially, the SpectraSnapp app is available only for Apple devices, but the team is exploring options to develop a version that works with Google's Android operating system.

This is the first app put out by the APS Outreach Department. It's aimed at anyone in the general public with an interest in physics and science. In 2010 the outreach department produced a kit, not an app, called SpectraSound, that can transmit sound from an iPod or similar device to a speaker using a laser beam. SpectraSound is for sale through the APS online store at store.aps.org (under "toys").

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was deemed prohibitively expensive, and was scrapped. An engineer with Lockheed named L.K. Edwards proposed a Bay Area Gravity-Vacuum Transit system for California in 1967, designed to run in tandem with San Francisco's BART system, then under construction. It, too, was never built. Nor was the underground Very High Speed Transportation system, conceived by Robert M. Salter of RAND in the 1970s to run along what we now call the Northeast Corridor.

Beach caught pneumonia and died on January 1, 1896, and didn't live to see the debut of New York City's first underground train (the IRT) in 1904. His subway was forgotten until 1912, when a construction crew digging a tunnel for a new line running under Broadway knocked through a wall and found the old Warren Street station. The passenger car was still on its track. The City Hall station on what is now the BMT line boasts a plaque in Beach's honor.

Education Corner

A column on educational programs and publications

Task Force on Teacher Education in Physics
The full report of the Task Force on Teacher Education in Physics is now available. A printed copy of the report will be sent to all physics departments and schools of education, and a PDF version will be made freely available on the PhysTEC website. See www.PTEC.org/taskforce for more information and a copy of the report synopsis.

Change the Equation publishes 2012 Vital Signs
The nonprofit initiative Change the Equation (CTEq) published its 2012 Vital Signs, which offers a state-by-state measure of the health of K-12 STEM education. Among other statistics, these reports break down the availability of jobs for STEM versus non-STEM majors, and also provide data on the percentage of students in schools that do not offer challenging physics as well as other math and science courses, by race/ethnicity. See http://vitalsigns.changetheequation.org/ for more information.

Sign up for the Wavefront Newsletter
Educators, stay informed! APS *Wavefront* is a free electronic newsletter for physics educators. Sign up to stay informed about APS programs, upcoming meetings, recent APS actions, and activities within the physics community. See http://www.aps.org/programs/education/wavefront.cfm

Career Workshop with Peter Fiske at APS March Meeting
In this workshop with celebrated author and science career coach Peter Fiske, students will learn about job search strategies, interview writing and networking skills, and effective career planning for scientists. This extremely popular event is FREE and open to all meeting attendees–however, space is limited! Please RSVP to Crystal Bailey (bailey@aps.org) to reserve your seat. For more information, please visit:http://www.aps.org/careers/guidance/webinars/fiske.cfm

Career and Networking Events at the APS March Meeting
The APS is offering a number of career and professional development related events at the APS March Meeting in Baltimore. In addition to the Sunday evening career workshop with Peter Fiske, there will also be a Tuesday lunchtime session focusing on Industrial Careers. Topics will include the nature of a successful physics career in industrial contexts, how to effectively build your network for industrial physics jobs, how to successfully apply and interview for these jobs, and how to take your innovations from academic research and build new opportunities–such as starting your own company. The APS is also hosting its annual Job Expo at the March Meeting on March 19–21. We are expecting a large number of recruiters from industry, national labs, and academia this year, and Job Seekers will be able to apply and interview for jobs directly on-site. For more information on the Job Expo, contact Crystal Bailey (bailey@aps.org).

Please continue to check the APS March Meeting webpage for more information on Career Events as it becomes available in the coming weeks.

Special Undergraduate Events at APS March and April Meetings
APS and SPS are once again teaming up to offer events specifically for Undergraduates at the APS March and April Meetings. In addition to the SPS Undergraduate Research Presentation sessions, we are also having a Student Welcome Reception and Career Panel (where students can learn more about exciting career paths and interact with a panel of working physicists), a Graduate School Fair (where students can meet one-on-one with recruiters from Graduate Programs to learn more about research opportunities), and a special Awards reception where the top presenters will be recognized and receive fun prizes.

A limited number of travel awards will also be available for undergraduate students who are presenting at the meetings! For more information, please visit our APS Future of Physics Days pages: http://www.aps.org/programs/education/undergrad/students/futurephysics/

2013 PhysTEC Conference
The 2013 PhysTEC conference will be held March 16-17, 2013 in Baltimore, MD, immediately preceding the APS March Meeting. For info on the 2013 PhysTEC conference, visit www.ptec.org/conferences/2013/

TASK FORCE continued from page 1

APS Executive Officer Kate Kirby adds that "We're looking at strategies for allowing greater public access, while preserving the contributions that publishers make to the scientific enterprise."

Already task force members have met with representatives from the National Science Foundation and the Department of Energy, and future meetings are being scheduled.

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In a related item, Michael Lubell, director of public affairs for APS, was quoted in a *Nature* story on Jan. 2, 2013, titled, "U.S. fiscal deal leaves science vulnerable."

Lubell noted science may end up in better shape under the new fiscal deal due to reductions in proposed funding cuts.

Ozel, Alexander Convey the Excitement of Physics

By Michael Lucibella

Each year APS presents two special awards; one, the Maria Goeppert Mayer Award for outstanding achievement by a woman physicist in the early years of her career, and the other, the Edward A. Bouchet Award, to recognize a distinguished minority physicist who has made significant contributions to physics research.

The recipient of this year's Maria Goeppert Mayer Award is Feryal Ozel, an associate professor of astronomy and physics at the University of Arizona. In addition to a certificate honoring her achievement, she will receive $2,500 plus $4,000 in travel allowances to be used towards speaking at up to four US universities and at an APS meeting.

Ozel's research delves into the extreme astrophysics of black holes and neutron stars. She said that it's the idea of solving the mysteries of the universe that draws her in.

"Astronomy is an observational science… we typically work with clues we're offered, so like detectives we try to put together the whole picture from the clues we can obtain," Ozel said. "I love the fact that we can address basic physics questions by looking at these particular types of objects.

"By measuring the macroscopic properties of neutron stars, what their masses are, what their radii are, we want to be able to get a handle on what makes up their interior. Neutron stars and black holes are my specialty."

Originally from Istanbul, Ozel found herself drawn to the idea of traveling abroad for college. Her high school teachers were instrumental in guiding her towards options in the United States.

She found the flexibility she was looking for at Columbia University in New York. She tried a couple of different areas of science before settling on a double major in physics and applied mathematics.

"It was a very enriching experience," Ozel said. "At that time I thought of going into particle physics, but it has been the golden era of astronomy with a lot of new data coming in from satellites and Earth-based telescopes… I could still do basic physics and address the questions that interest me, but the amount of data that has been coming in in astronomy has been very exciting."

After graduating from Columbia she received her master's degree at the Niels Bohr institute in Copenhagen and her PhD at Harvard University. She then received a NASA Hubble fellowship at Princeton's Institute for Advanced Study.

"That was awesome," Ozel said. "I loved the environment at the Institute for Advanced Study… "I thought it was a great place to be a postdoc."

From there she joined the faculty of the University of Arizona in 2005. Currently she is on sabbatical at the Radcliffe Institute for Advanced Study at Harvard. She said it's given her a chance to work on a new range of projects.

Astronomers have been keeping tabs on a cloud of gas and dust that should pass in front of the supermassive black hole at center of our galaxy sometime in the middle of 2013. Ozel has been working on what astronomers should look for when it does. In addition she has been helping develop the next generation of satellites that will peer into the hearts of neutron stars.

Feryal Ozel

Stephon Alexander

NASA's Neutron Star Interior Composition Explorer, or NICER, is in development to look for the X-ray emissions coming from a neutron star's magnetic field. If selected by NASA, it should launch in the summer of 2016. A similar mission, the Large Observatory for X-ray Timing, or LOFT, is in development by the European Space Agency and slated to launch in 2022. Ozel is doing theoretical work on what these telescopes should look for.

"I am very excited about these missions," Ozel said. "There's also data coming in at other wavelengths."

When not unraveling the mysteries of the neutron stars and black holes, Ozel is an avid triathlete. She recently ran a half Iron Man in Phoenix, Arizona where she placed third in her age group, and a sprint triathlon in Tucson where she placed first. She's planning to run the Boston Marathon in the spring.

Though she is always involved with new and exciting projects, family is just as important to Ozel. She and her husband, who's also an astrophysicist, have made a big effort to be as involved as possible in their six and eight year old daughters' school and activities.

"It's not always easy," Ozel said. "Anyone will tell you it's a juggling act, and I completely agree with that."

For this year's Bouchet Award recipient, Stephon Alexander, jazz and theoretical physics go together like peanut butter and jelly.

"I've gained a lot of inspiration from the art and practice of music," said Alexander, who is a jazz musician himself. "The idea is that you have sharply tuned tools… [and] you can use these tools to make new creations."

Whether these tools are quantum gravity or his saxophone, Alexander likes to use them to explore new ideas and concepts. To him a big part of the process is learning from mistakes, whether they are arrangements that just don't work out, or calculations that ultimately don't add up.

"It's exactly those mistakes that tell you how close or far you are from the correct answer," Alexander said. He added that he uses intuition and free association to explore new ideas, "but at the end of the day if you're on to something, you can use tools to get the answer."

Alexander is an associate professor of Physics and Astronomy at Dartmouth. He will receive $3,500, plus travel to an APS Meeting to receive the award and deliver a presentation on his work, as well as funds to cover travel to at least three academic institutions to talk about his research.

How matter won out over antimatter, and what that has to do with quantum gravity is the central question behind much of Alexander's work.

"I use cosmology as a window to probe fundamental physics such as theories of quantum gravity and theories beyond the standard model," he said.

The path that brought him to theoretical cosmology was anything but straightforward and was full of unexpected turns and career changes.

Alexander was born in Trinidad, and moved with his family to the Bronx when he was eight. He went through the public schools in New York and counted himself lucky to have had the science and math teachers he did. He remembers many of his high school teachers as having advanced degrees so they could talk about everything from the fundamentals of physics, to what was cutting edge.

"I think growing up in a very diverse background in the Bronx really made a difference because in my field, it's so international," Alexander said.

After he finished high school, he went to Haverford College in Pennsylvania. Starting out he was unsure of what path to take.

"I had really no ambitions to become a physicist," Alexander said. "I knew I liked physics, and I knew it came a little bit easier than some of the humanities. But I didn't really think I was going to be a physicist."

Then during his freshman year, he met physics professor Lyle Roelofs, who became a role model for Alexander.

"He worked me very hard. He had very high expectations but at the same time he made it known to me that physics was available to me if I wanted to pursue it."

At around the same time, Alexander was introduced to Jim Gates at a National Society of Black Physicists meeting. Gates made a major impression on Alexander. He realized that people of any ethnicity could be theoretical physicists.

Alexander delved into studying physics, and was involved with re-

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Top Physics Newsmakers of 2012

Each February *APS News* looks back to see what physics news stories grabbed the most headlines in the previous year. The list is a compilation of not necessarily the most "important" advancements of the year, but the stories that captured the attention and interest of the world. In roughly chronological order, the Top Physics Newsmakers of 2012 are:

Exoplanets

2012 was a big year for the discovery of planets outside of our solar system, and many scientists believe that the discovery of a potentially habitable planet like Earth is not far away. **January** brought the announcement of the discovery of a system of planets around the star Kepler-42 with planets similar in size to Venus and Mars, the smallest discovered yet. In **February,** astronomers announced the discovery of Gliese 667Cc only 22 light years away, the first planet discovered inside of a star's habitable zone. The discovery of Alpha Centauri Bb, a planet orbiting the star closest to Earth, was announced in **October**, hinting that planets might be very common around stars. In **December** the five-planet system around Tau Ceti was discovered, which included two planets far enough away from their parent star that liquid water could exist on their surface.

Majorana Fermions

In **February**, physicists from Delft University found evidence of Majorana fermions, particles that are their own anti-particles, in the behavior of electrons in a semiconducting nanowire. The team did not observe the particles directly, but they were able to infer hints of their existence by detecting minute electrical currents that matched predictions. Scientists are excited because such particles could form the basis for a future quantum computer. Fermions that are their own antiparticles were first predicted by Ettore Majorana in 1937, just months before his mysterious disappearance at sea.

Daya Bay

The international Daya Bay Reactor Neutrino Experiment, announced in **March** the successful measurement of the neutrino mixing angle θ_{13}. Six detectors measured the neutrinos emitted by China's Daya Bay nuclear reactors, looking for differences in the number of electron antineutrinos detected. Neutrinos oscillate between different flavors, and θ_{13}, the parameter that governs the rate at which electron neutrinos morph into other flavors, was the last to be measured. The collaboration found the angle was relatively large, making it easier for physicists to investigate the origin of matter-antimatter asymmetry in the universe.

Pioneer

The "Pioneer anomaly" has vexed physicists since it was first noticed in the early 1980s. The two Pioneer probes, numbers 10 and 11, have been inexplicably slowing down more than expected on their way towards interstellar space. Numerous explanations have been put forward, ranging from leaking gas to a fundamental reworking of general relativity, but in **April**, an analysis by Slava Turyshev published in *Physical Review Letters* finally determined once and for all that pressure from uneven thermal radiation has been the culprit for all of these years.

Traffic Ticket

In **April** Dmitri Krioukov argued his way out of a traffic ticket using physics. In a paper published on the ArXiv, Krioukov claimed that a confluence of coincidences, including his sudden deceleration and acceleration, an optical illusion making objects farther away seem to be moving faster, and an obstructing car made it appear that he drove through a stop sign, when in fact he had stopped. The judge seemed to agree and rescinded the traffic offense.

Elements

In **May**, the two most recently discovered elements were given names after the physics labs that discovered them. Number 114 is flerovium (Fl) after the Flerov Laboratory of Nuclear Reactions in Dubna, Russia, and number 116 is livermorium (Lv) after the Lawrence Livermore National Laboratory in Livermore, California. In September researchers at the RIKEN laboratory in Japan claimed to have successfully generated atoms of element 113. If confirmed, it would be the first new element to be discovered in East Asia, though researchers in the US and Russia have also claimed to have synthesized the element in the past.

Supercomputer

The title of the "World's Fastest Computer" returned to the United States this **June** when Lawrence Livermore National Laboratory's Sequoia machine topped out at 16.2 petaflops. Then in November, Oak Ridge National Laboratory one-upped them with its Titan supercomputer, which hit 17.59 petaflops. US computers now hold the top two slots for the first time since 2009, beating out Japan's K computer. Sequoia is used by the military to simulate nuclear detonations while Titan is an open machine leasable by the public.

Teleportation

Teams on opposite sides of the globe have been duking it out to hold the title of the farthest distance two quantum particles can be kept in an entangled state. In **May** a team in China shattered the existing record by teleporting a photon 97 kilometers, nearly 100 times the existing record. In **September** a team from Austria working in the Canary Islands was able to teleport a pair of photons 147 kilometers, between two islands, hoping to pave the way to teleport a pair between an orbiting satellite and the planet's surface sometime in the future.

Higgs

On the 4th of **July**, CERN announced that it had found what appeared to be the long sought-after Higgs boson. The laboratory was guarded in its original announcement, saying only that they had found a boson with Higgs-like properties. The accomplishment caps decades of work and billions of dollars building the Large Hadron Collider. The discovery confirms the existence of a "Higgs field" that gives matter its mass, first proposed almost 50 years ago.

New Physics Prize

Russian billionaire Yuri Milner is giving the Nobel Prizes a run for their money with his announcement in **July** of the new Fundamental Physics Prize. Each of the nine inaugural winners, primarily theoretical physicists in cosmology, mathematics and string theory, received $3 million. Milner personally chose the first round, but past recipients will in part choose future winners of the new annual award. In **December**, Milner made two special awards, one to Stephen Hawking, and another to be shared amongst top scientists at CERN for discovering the Higgs Boson.

Maser

Researchers in England announced in **August** that they were able to build the first solid-state maser that works at room temperature. The very first masers were built in 1954 but were weak and required extremely low temperatures to operate. Soon thereafter, the first solid-state masers were built, which offered more power, but still required near zero temperatures to operate. The team from Imperial College in London developed a completely new technique to create a collimated beam of microwaves using p-terphenyl as a gain medium rather than traditional crystalline ruby.

Sea Ice

In **September**, the National Snow and Ice Data Center announced that 2012 broke the record set in 2007 for the lowest amount of sea ice ever. Ice only covered 1.32 million square miles of the arctic, 18 percent below the 2007 record, and 49 percent below the 1979 through 2000 average. Climatologists pointed to this as more evidence that climate change is a major concern and that rising global temperatures are having an impact on the environment.

Retractions

Physicists had to make two major retractions this year. In **February** CERN announced that the controversial claim a year before, that neutrinos appeared to travel faster than the speed of light, was likely the result of a loose cable. Two months later, the lead scientist of the team that made the announcement stepped down. In **October,** Moses Chan officially retracted his 2004 announcement of the discovery of supersolids. In an experiment designed to eliminate a source of error first identified in 2007, Chan was unable to recreate the effects observed in his first experiments, and subsequently published his new results in *Physical Review Letters*.

Water

Throughout the year, the news has been dominated by headlines about water being found in unexpected places throughout the solar system. In **June** an article in *Science* said that the Cassini spacecraft found evidence of a liquid ocean of water deep under the icy shell of Saturn's moon Titan. In **September**, scientists announced that NASA's Curiosity rover found beds of rounded pebbles, evidence that water likely once flowed in deep streams across the surface of Mars. Also in **September**, scientists announced that they unexpectedly found water on the asteroid Vesta. Rounding out a year of soggy discoveries in November, NASA's Messenger spacecraft found evidence of frozen water underneath the surface of the closest planet to the sun, Mercury.

–list compiled by Michael Lucibella

HONDURAS continued from page 3

were encountered highlighted another aspect of the importance of experienced-based science learning. A lot of the students had difficulties learning the difference between anecdotal evidence and empirical research, not only because they are kids who have been taught to believe everything their elders say, but also due to the fact that they live in a small third-world town where the main source of information is hearsay. By performing their own experiments in the classroom, the students familiarize themselves with how the scientific method works and they also learn how to question it. While presenting their results, two fifth graders who were assigned to determine whether candles float or not, realized that they should determine if lighting the candles would make a difference. Students also learnt the importance of repetition and replicability. Next time they hear from a family member that the humans have been infecting the chickens in the farm, they can challenge that assertion and ask for evidence.

Now that we have enough momentum to write our own customized science curriculum going into the new school year, we can carry these lessons forward and hopefully address the issues. Some Caltech undergrads have generously donated some lightly used lab equipment, and we can start adding more awesome experiments. To all you APS readers out there, if you know of any noteworthy and resourceful experiments that could inspire curiosity among my students, I am all ears. And yes, we already built a Rubens' tube.

Giulio C. Rottaro graduated from Caltech with a BS in Physics this past June. During the 2010/2011 academic year he volunteered with Bilingual Education for Central America (BECA: www.becaschools.org) as a resource teacher for San Jeronimo Bilingual School. He is now in his first year at Yale School of Medicine.

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search through talks and a poster session, the Conference aims to give young women the resources, motivation, and confidence to pursue graduate work in physics and in careers related to physics.

The focus of APS sponsorship will be to provide an institutional home for the conference, which has grown from twenty-nine attendees in 2006 to almost five hundred in 2011. This year, the conference organizers expect almost one thousand students.

"Adding APS sponsorship has been very transformative," says Daniela Bortoletto, a professor of physics at Purdue University and the present chair of the CUWiP faculty committee. "We needed a framework that would enable us to organize more effectively."

Organization is a particularly challenging task for CUWiP because each satellite conference is organized by the local undergraduate students, sometimes with the help of graduate students, postdocs and faculty.

With APS sponsorship, CUWiP will formalize a national organizing committee to maintain continuity in future years. The national committee will be composed of undergraduates who have led past conferences, those who hope to organize future conferences, as well as a current member of the Committee on the Status of Women in Physics, and a representative from the APS Education and Diversity department.

"Among the goals of the national organizing committee", says APS Director of Education and Diversity Ted Hodapp, "is to think about how you bring the organization forward, and learn from past conferences."

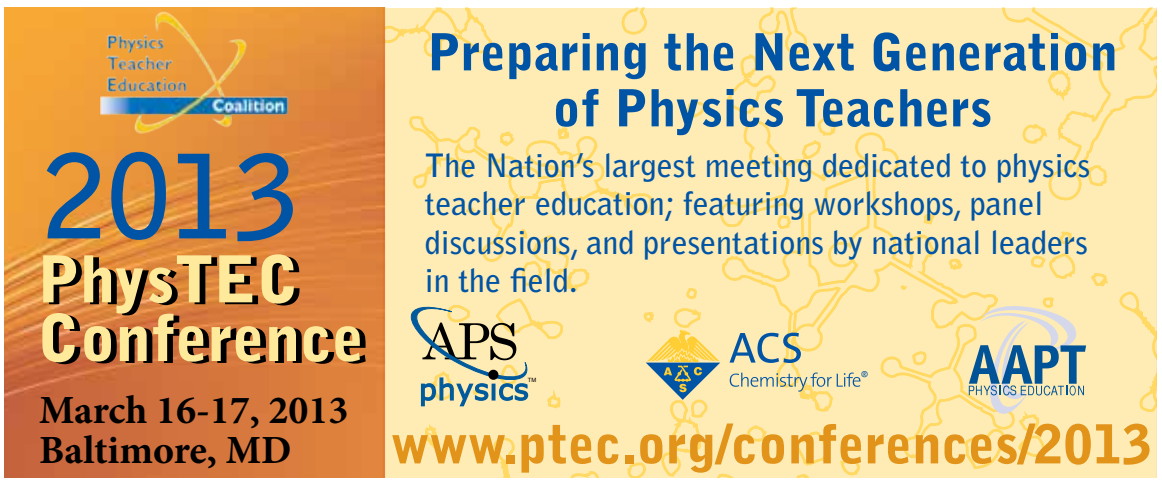
Apart from the new CUWiP wiki that both organizes meeting notes and outlines how to organize a conference, APS sponsorship enables CUWiP to apply for multi-year funding grants from federal and private organizations. Until now, organizers had to apply for new government and university grants every year. "The ability to apply for multi-year grants will be very important to the future of the conferences," says Bortoletto.

"APS sees it in its mission to back these ideas," says Hodapp. "We put our name behind it; we put our resources behind it."

Bortoletto agrees. When she helped host the conference at Purdue in 2011, APS provided information on physics graduate and career resources. "Even having the information around made the students more aware of what APS can do for them. APS really does offer a lot of information for students; through the conferences, there is a more direct contact between students and the APS."

This year's conferences were held at the California Institute of Technology, Colorado School of Mines, Cornell University, University of Central Florida, University of Illinois at Urbana-Champaign, and the University of Texas at Austin. A report on these meetings will appear in next month's *APS News*.

ANNOUNCEMENTS



Reviews of Modern Physics

Nuclear spin physics in quantum dots: An optical investigation
Bernhard Urbaszek, Xavier Marie, Thierry Amand, Olivier Krebs, Paul Voisin, Patrick Malentinsky, Alexander Högele, and Atac Imamoglu

Individual electrons and holes confined to a semiconductor quantum dot can be manipulated in optics and transport schemes that aim for control on a single spin and single photon level. The coherence properties of these single carrier states are governed by the interaction with the mesoscopic nuclear spin ensemble of the lattice nuclei that form the dot. This article reviews the highly nonlinear electron spin-nuclear spin interaction in quantum dot optics experiments that explore ways of controlling this coupled spin system.

http://link.aps.org/doi/10.1103/RevModPhys.85.79

http://rmp.aps.org

Now accepting applications
India - U.S. 2013 Travel Grants

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

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

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

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

Application deadline: Sunday, March 31, 2013

Further details including proposal guidelines: www.aps.org/programs/international/us-india-travel.cfm

APS physics
IUSSTF Indo-US Science and Technology Forum

APS Bridge Program Summer Meeting

June 27-29, 2013
American Center for Physics
College Park, MD

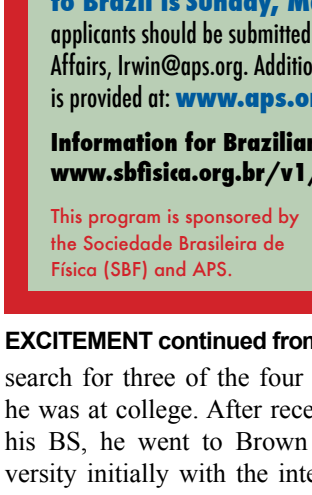
The APS Bridge Program Summer meeting will bring together experts to discuss efforts to increase the number of underrepresented minorities who receive PhDs in physics. Workshops, panel discussions, and presentations will address topics such as:

- mentoring
- bridge program logistics
- cultivating faculty/administrative support
- building a sense of community for students

Conference designed for faculty, administrators, and students from prospective and existing bridge program sites, as well as interested graduate programs.

www.APSBridgeProgram.org

APS BRIDGE PROGRAM



2013 BRAZIL-U.S. Exchange Program
Accepting Applications

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

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

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

The application deadline for U.S. applicants traveling to Brazil is Sunday, March 31, 2013. Applications from U.S. applicants should be submitted to Michele Irwin, APS Office of International Affairs, Irwin@aps.org. Additional information, including application guidelines, is provided at: **www.aps.org/programs/international/**

Information for Brazilian applicants is available from SBF: www.sbfisica.org.br/v1/

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

APS physics
SBF SOCIEDADE BRASILEIRA DE FÍSICA

LECTURES continued from page 1

for my research field of nanoscopic lasers, which is relatively new, and I hope it helps highlight my talk against the backdrop of this important physics meeting."

Also at the March Meeting, Nagaosa will speak at a symposium titled "Stabilization and Dynamics of Magnetic Skyrmions" which is sponsored jointly by the Division of Condensed Matter Physics and the Topical Group on Magnetism.

"This is a great honor, and I am very much encouraged by this award, which will stimulate the further studies on the related topics. Especially, I am now excited about the dynamics of the topological spin textures in magnets, which will be even more exciting in the near future." Ngaosa said.

Montes will deliver her talk, "Women in Physics: Increasing in number, and what else?" at a session organized by the Forum on International Physics titled "Recent Advances in Condensed Matter in Latin America."

"It will give support to the work that I and some other physicists in Latin America are doing to develop science in our region. It will also give visibility to female physicists, help to attract attention of our male colleagues to gender issues, and even in the long term to convince administrators in universities, agencies and government to develop specific public policies such as funding of programs which motivate young girls to study physics and the setting of better conditions for female scientists," Montes said. "In my personal case, it is a turning point since it allows me to stop for a while and reflect on what we have done and what still remains to be done. I hope also this will be a starting point for joint work in the region."

Strubbe's talk at the April Meeting will focus on the "expected signatures of tidal disruptions" of black holes.

"I study how stars get ripped apart by massive black holes in the centers of galaxies," Strubbe said. "It's a really exciting time to study black holes eating stars–for the first time, we're starting to be able to discover and observationally follow up this type of event in real time. My research is specifically on predicting and understanding the light emitted in these events, important for helping us find black holes eating stars and interpreting newly discovered events. I have quite a bit of experience teaching and giving talks, so I think I'll be able to do a good job explaining and reviewing the physics of this phenomenon to a broad audience."

EXCITEMENT continued from page 5

search for three of the four years he was at college. After receiving his BS, he went to Brown University initially with the intent to study experimental quantum optics.

Once he arrived though, his focus changed and he started researching neuroscience with Nobel Laureate Leon Cooper. Alexander got his first real taste of cosmology when he decided to write his dissertation on neural networks applied to large-scale structures in the universe.

He traveled to Imperial College in London for his postdoc, where he studied how cosmic inflation could arise from string theory. During the summers, he worked on string theory at Columbia University with Brian Greene.

After his stay in London, Alexander traveled to SLAC to continue pursuing the connection between the origin of matter in the universe and inflation after the Big Bang. It was there that he started thinking about handedness in nature. Only one force, the weak force, has a preferred handedness. Alexander postulated, however, that gravity might be a sort of sister force to the weak force and might also have a preferred handedness in certain quantum regimes.

"It's going to be a new unified theory between gravity and the weak interaction," Alexander said.

After SLAC, Alexander held faculty positions at Penn State and his alma mater Haverford, before accepting the Ernest Everett Just 1907 Professor of Natural Sciences chair at Dartmouth.

When not unraveling the mysteries of quantum gravity, Alexander has been also been delving into the mysteries of music. He's been working with mathematicians at Berkeley looking for organizing principles that might apply to music harmonic structure.

"Why and how music works in terms of principles of physics?" is the central question he's been looking at. "It's also a good teaching tool. It's a good way to get students interested in physics."

He's also been working on his own jazz album with a producer in New York.

He said that he was honored to receive the award. "It came as a shock, I wasn't expecting this kind of recognition from my colleagues," Alexander said. "The past winners are all people I've looked up to."

He added that he plans on using the award to talk about his research at other institutions, and to get more young people involved with science.

"It's important for me to pass on the torch and to mentor other minorities in physics and in particular to identify and have some PhD students of my own from those backgrounds."

MEMBERS continued from page 2

The Los Angeles Times*, January 10, 2013.*

"We have demonstrated that you can make a clock from a single massive particle."

***Justin Brown**, University of California , Berkeley, on his team's atomic clock based on a single atom,* MSNBC.com*, January 11, 2013.*

"They could put up something that would look like a credible missile but ... it's not really much of a threat… They have no idea whether it's going to blow up on the launch pad or dump one of their precious nuclear weapons into the Pacific Ocean."

***David Wright**, Union of Concerned Scientists, on the missile threat from North Korea,* The Los Angeles Times*, January 13, 2013.*

The Back Page

Admissions Criteria and Diversity in Graduate School

By Casey W. Miller

The development of the APS Bridge Program (APS-BP) [http://www.aps.org/programs/minorities/bridge/] provides our community with a great opportunity to help physics shed the notoriety of being the least diverse of the sciences. We can all play a role in this effort, whether or not our individual programs are or will become affiliated with the APS-BP. In this article, I hope to raise awareness of some relatively simple but impactful means to enhance racial and gender diversity. What follows is hardly comprehensive, but hopefully suggests pragmatic next steps that can be widely and rapidly implemented.

There are about 180 physics programs listed in the AIP Graduate Programs book. The General GRE is required by 96%; a quarter of these have an explicitly stated minimum Quantitative GRE (QGRE) score for admission, with the median stated cut-off being 700 (64th–70th percentile, depending on year). As educators, we naturally expect exams to be meaningful. Most people *believe* this is the case for the GRE exams, and may thus prefer high scores. But analysis of the data often finds no significant correlation between long-term success and GRE scores (the stated predictive power is limited to first-year grades). In my time on the Graduate Council of the University of South Florida, I have seen few programs that have taken the time to correlate "success" with admissions materials. Of these, none, including my program, have concluded the GRE predicts success in research, which no one argues is the aim of the PhD. Our analysis finds that the QGRE correlates with only one metric, the graduate GPA (but it is such a weak correlation the scientist in me rebels when fitting it to a line). That said, we find undergraduate GPA to be a better predictor of graduate GPA. We also find that undergraduate GPA is correlated with all three sections of the General GRE.

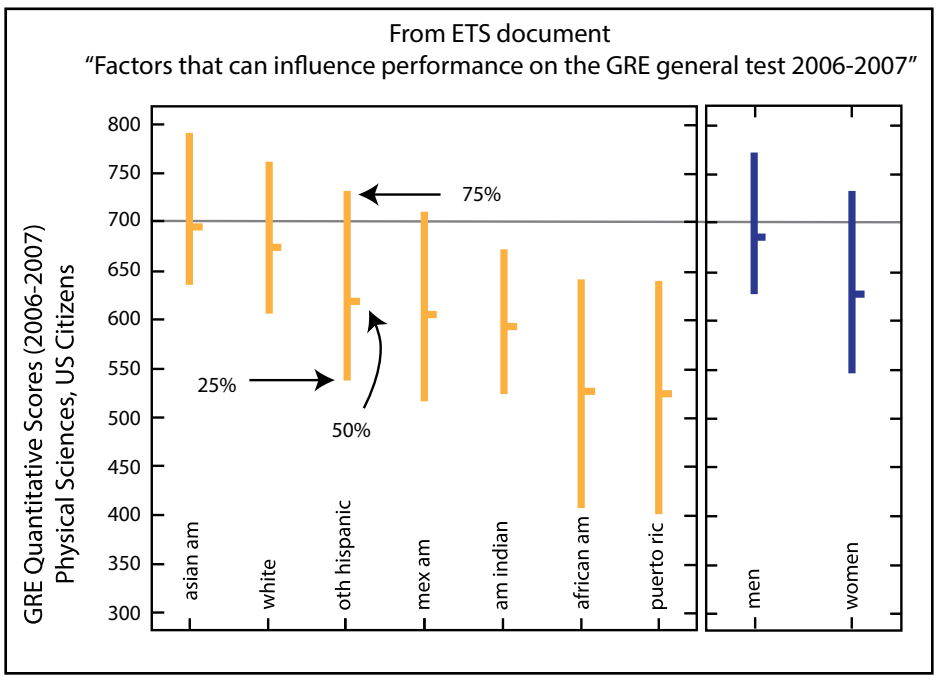
So why use the GRE at all? One certain answer: national rankings. Consider *US News*, whose rankings of graduate programs are widely influential among both prospective graduate students and administrators. In the *US News* formula, the weight given to the mean GRE score is 12% (6% each to Verbal and Quantitative). The acceptance rate weighting of 6% is added to give "student selectivity" a total weight of 18%. This exceeds student/faculty ratio (4.5%), percent of faculty with awards (2.5%), and doctoral degrees granted (5%), and is far too close in my opinion to tangible productivity measures such as research expenditures (15% each for dollars per program and dollars per faculty member). This weighting can lead administrators to the simple conclusion that their rankings will go up if they only admit students with perfect GRE scores.

Justifying using the GRE becomes significantly more complicated, however, when the test results are dissected by race and gender. The figure plots QGRE scores by race/ethnicity and gender for US citizens whose intended graduate major was "physical sciences". The top and bottom of the lines are the 75th and 25th percentiles of the score distributions, respectively; the tick is the mean. This pattern is qualitatively unchanged when controlling for undergraduate GPA. Note the implications for diversity of using 700 as a minimum acceptable score: nearly three quarters of Hispanics would be rejected, and significantly more than this for American Indians, African Americans, and Puerto Ricans; similarly, women are filtered out at a higher rate than men. Mixing cut-off scores with these racial and gender disparities sets the foundation of a glass ceiling erected by the lopsided treatment of minorities and women before they even set foot in grad school.

The Asian>White>Hispanic>Black pattern permeates standardized testing: it is the same for the SAT, and is reflected in the recent race-based levels set by Florida and Virginia for grade schoolers' performance on state-wide standardized tests [http://www.npr.org/2012/11/12/163703499/firestorm-erupts-over-virginia-s-education-goals]. The GRE pattern, however, must be more complex in origin than a property tax distribution problem–these are students who have done so well in college that they consider themselves serious enough candidates for graduate studies to spend hundreds of dollars on the tests and score reporting. As for gender, there is not a single section of the GRE general test in which women outscore men, regardless of how the data are diced. Isn't the ubiquity of these patterns odd?

Casey W. Miller

The results of Fig. 1 are not new, but are not trumpeted loudly or often enough to be well known among physicists.



When a skeptical colleague asserts, "something is wrong with those data!" I point out that they come from ETS, the company that administers the GRE (nevertheless, even though I accept their validity, I wholeheartedly support the assertion that something is wrong). Others have noted the impact of the GRE on diversity in physics, hopefully not limited to: "How Not to Pick a Physicist?" Glanz, *Science* 274, 710 (1996); "Fighting the Gender Gap: Standardized Tests Are Poor Indicators of Ability in Physics," *APS News* 5, #7 (1996); "Views from an Affirmative Activist," Georgi, from *Status: A Report on Women in Astronomy* (2000); "Where are the Female Physicists? Ehrlich, from *CSWP Gazette* 26, 3 (2007). Perhaps of interest to administrators, "Legal Implications of Gender Bias in Standardized Testing," *Berkeley Women's Law Journal* 7, 13 (1992).

Do we physicists appreciate how significantly admissions practices can impact diversity? It should be clear that using "minimum acceptable" scores to filter applicants will have adverse unintended consequences. Applicants send many items, and we all aim to take the whole package into consideration. However, I grow curious when programs report average GRE scores that are nearly perfect, particularly given that the published standard measurement error is on the order of 60 points (i.e., 740/80th percentile is insignificantly different from a perfect 800). For the record: the *Guide to the Use of Scores* published by ETS states, "A cut-off score (i.e., a minimum score) should never be used as the only criterion for denial of admission or awarding of a fellowship." The latter sentiment refers, likely, to *Sharif v. New York State Education Department*, in which a federal court found that the sole use of SAT scores for awarding scholarships violated Title IX because of the exam's gender gap. While one hopes cut-off scores are not being intentionally employed for admissions, it is awfully easy to sort a spreadsheet by GRE score and start from the top of the list, giving this metric undue weight. How different is sorting from a cut-off? Can this approach actually provide equal opportunity for admission?

While I'm sure no one fully understands the origins of the data in the figure, there are well documented points faculty should note. With other factors equal (e.g., GPA), women score lower on high-pressure timed tests than men. As a result, for example, it is recommended in *Graduate Education in Physics: Which Way Forward?* [http://www.aps.org/programs/education/graduate/conf2008/index.cfm] that time constraints on qualifying exams be eliminated. Minority students often graduate with relatively limited advanced physics coursework. This cannot explain the QGRE results, but is worth noting for programs that use the Physics GRE (for which no equivalent to the figure is publicly available, to my knowledge). Language must play a role to some extent (probablemente yo no haría un buen examen si estuviera escrito en perfecto español). Finally, there is a strategy for taking the tests that can be learned (would businesses like The Princeton Review exist otherwise?) Are any of these points relevant for predicting success in your graduate program?

It is my hope that the biases noted here, along with the emerging body of evidence questioning the utility of the GRE, will nucleate a transformation in admissions practices. To be clear: this is not to suggest that we admit less qualified students for the sake of diversity, but rather a call for us to acknowledge that the historical importance given to GRE scores exceeds its predictive capabilities, and has societal implications that we may not have anticipated. One approach we are pursuing to address this issue involves developing a coarse-grained admissions rubric that ranks applicants based on a variety of factors we have determined to be useful in predicting research success: GPA, recommendations, personal statement, and undergraduate institution (liberal arts students are very successful in our program…please apply!). While we still have more to learn, instituting meaningful admissions practices can help lift physics out of the diversity basement.

In closing, Physics has the opportunity to move forward on the major issue that is diversity in physics. If many parties participate, even with small steps, progress can be accelerated. While none of these will be sufficient to completely address diversity, I would like to propose several challenges to the community:

- To PIs: get involved–helping to reform your graduate program is a long-term investment, but your gains will start immediately, e.g., by enabling meaningful broader impacts statements.
- To programs: determine (and share!) admissions factors that actually predict research success (the aim of the PhD) and develop corresponding admissions practices; reduce the unintentional weight GRE scores presently receive.
- To administrators: encourage and reward appropriate admissions practices (practices, not policies).
- To program ranking entities: abandon using the GRE in program evaluations–this puts downward pressure on diversity.
- To professional societies (AAAS, APS, NSBP, NSHP, SACNAS, AWIS, etc.): develop statements regarding the GRE exams and their usage by graduate programs–your guidance is crucial.
- Finally, to the next generation: your voices are more powerful than you think, and are needed more frequently than every four years.

Casey W. Miller is Associate Professor of Physics and Associate Director of Physics Graduate Programs at the University of South Florida. He is a recipient of the AFOSR Young Investigator and NSF CAREER Awards.

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