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Vote in APS Society-wide Election
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APS Award Recipient Runs Boston Marathon; Finishes Shortly Before Tragedy Strikes

By Michael Lucibella

Feryal Ozel of the University of Arizona was the recipient of this year's Maria Goeppert Mayer Award, but she couldn't attend the APS April Meeting in person to receive her certificate. She was fulfilling a long-time dream of hers, to run in the Boston Marathon. She described how the day turned from one of determination and triumph to an unimaginable tragedy.

"It's the Holy Grail for any distance runner," Ozel said. "Something celebratory and historical… For that to be destroyed like this, I just couldn't wrap my head around it."

Started 116 years ago, the Boston Marathon is the oldest organized marathon in the nation. It's one of the most difficult, and, because of its legacy, the most popular. With so many people trying to register, Boston's is the only marathon in the country that requires runners to qualify for it with minimum times. Ozel first made the grade three years ago and promptly registered for the following year's race. However before she could run, she received an invitation to speak at a high profile international conference on the day of the marathon.

"It wasn't a colloquium, it basically had to be on the day of the Boston Marathon," Ozel said, "I said I better not turn this talk invitation down, so I didn't go [to the race]."

She was disappointed, so the next year she made sure to keep her schedule clear. However a rumor started circulating that the race requirements were about to get much more restrictive, and runners from across the country worried that their times wouldn't be fast enough for future races. Most years, registration stayed open for eight weeks, but this time it filled up in only seven hours and Ozel missed her chance.

"I said, 'OK, third time is the charm. I'm going to actually run it this year.'"

As race day neared, Ozel realized she was facing another conflict. She was set to receive the Maria Goeppert Mayer Award in Colorado on Sunday evening.

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APS Members Are Asked to Comment On Updated Education Statement

The initial draft of APS's updated statement on K-12 education has been posted on the APS website and members are invited to read the proposed statement and submit their thoughts and suggestions about it.

Every five years APS statements are reviewed and amended as necessary. The latest version of the K-12 Education Statement features many changes and updates to the previous statement, which was passed by Council in 2000. In particular, it highlights the need for qualified physical science teachers more explicitly than in previous versions.

"We are sort of in a key moment for education and science education in particular," said Paul Cottle, a physicist at Florida State University and Chair of the APS Committee on Education. He added that physics and the physical sciences are often the target of cuts as schools face budget constraints. "The most powerful thing we can do is to get the physics community to say teaching physics is important."

The statement calls on policy makers to provide every student with one year of high quality physics education. In addition, it calls for a national effort for colleges and universities to partner with colleges of education and local K-12 schools, teachers to have access to educational resources and training and to increase the

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Dark Matter Comes and Goes at April Meeting

By Michael Lucibella

Dark matter was in the air at this year's APS April Meeting, with researchers in many areas of the hunt saying that there were important developments. Some teams reported they were getting closer, while others saw once promising results fade away.

"It looks like the pot is boiling," said Leslie Rosenberg from the University of Washington. "A lot is happening in the dark matter sector."

At the meeting, researchers from the Cryogenic Dark Matter Search said they've seen three potential candidates for dark matter particles known as WIMPS. The experiment's eight silicon detectors recorded the readings at around 8.6 GeV during its 14-month run.

"The data are insufficient to claim discovery of WIMPs… neither are we claiming evidence for them, but further investigation is warranted," said Blas Cabrera, a physicist at Stanford University. "Analysis favors a WIMP signal with about a three sigma."

The silicon detectors are located deep underground in the Soudan mine in Minnesota. They're designed to detect the minute recoil that occurs whenever a WIMP strikes a silicon nucleus.

The results are surprising in a few ways, and Cabrera said that more analysis and data were needed before any conclusions

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Physicists Ready to Add Their BRAIN Power

By Michael Lucibella

Physicists are poised to play a major role in President Obama's proposal to better understand the human brain, which he announced on April 2. The president proposed allocating $100 million for the initiative, to be divided among the National Institutes of Health, the National Science Foundation and the Defense Advanced Research Projects Agency (DARPA). Though the specific goals and scope of the project are still being determined, they will likely include developing new techniques to map and study the brain.

Scientists involved with shaping the BRAIN Initiative, short for Brain Research through Advancing Innovative Neurotechnologies, emphasized the interdisciplinary nature of the research.

"Many of the advances if not most of the advances, come from the physical sciences," said Michael Roukes, of the Kavli Nanoscience Institute at Caltech. He added that physicists are adept at "thinking about complex highly correlated systems of networks."

Roukes was part of the Kavli team that first suggested to the administration's Office of Science and Technology Policy (OSTP) the idea for a project to map all of the neural connections in the human brain. Their original Brain Activity Map proposal, which the President highlighted in his State of the Union address in February, ultimately evolved into the White House's BRAIN Initiative.

"It is a very auspicious time for using advances that have accrued in the last couple of decades in nanoscience and nanotech, and assembling a new generation of tools that will enable a great leap forward in neuroscience," Roukes

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Meetings Impacted as Travel Cuts Take Effect

By Michael Lucibella

Scientific conferences have started to feel the effects of efforts by the US federal government to curtail spending on travel. Scientists have widely criticized the move to limit their ability to travel, and some conferences have been especially severely affected.

"I don't believe the administration understands what a science meeting really is," said Stephen Mackwell, an adjunct professor at Rice University and director of the Lunar and Planetary Institute. "It's not a boondoggle, it's the life blood of the scientific community."

Conferences have been hit with a double whammy over the last 12 months. In May of last year, the federal government adopted new travel restrictions for its employees following the General Services Administration scandal (see the report in the August/September 2012 *APS News*, available online). Following that, "sequestration" took effect on March 1 of this year, taking another slice out of scientists' travel budgets.

Different federal agencies have adopted different travel review policies. In the Department of Energy, if DOE scientists collectively request spending of more than $100,000 on travel to one meeting, the deputy secretary has to sign off on it. If they request more than $500,000, the secretary has to sign off. In the Department of Defense, travel needs to be authorized by the relevant branch's

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APS April Meeting Prize and Award Recipients

Photo by Ken Cole

On Sunday, April 14 at the April Meeting in Denver, APS President Michael Turner presented prizes and awards to 21 distinguished individuals. In the photo, front row (l to r): Geoffrey West, Stephon Alexander, Roberto Peccei, Helen Quinn, Sultana Nahar, Bernard Sadoulet, Michael Moe, and David Sanford. Middle row (l to r): George Fuller, APS President Michael Turner (standing slightly behind), John Galayda, Daniel Ratner, Irwin Shapiro, Randolf Pohl, Theodore Yoder, Gary Gladding, and Timothy Stelzer. Back row (l to r): Teppei Katori, Jinhui Chen, Jin Huang, Roger Stuewer, and Blas Cabrera.

Washington Dispatch

Updates from the APS Office of Public Affairs

ISSUE: BUDGET

Fiscal Year 2014 Presidential Budget Request

Though it was delayed multiple times, the president's budget request arrived in April. Overall the budget request was very friendly to science, with almost all accounts receiving increases as compared to either the FY12 appropriations or the FY13 sequestered appropriations (estimated). A chart detailing the FY14 presidential request has been posted online at www.aps.org/publications/apsnews

President's Budget Request: STEM Ed

The President's request, if approved, would realign STEM-Ed programs. Overall there are 78 programs that would be cancelled or consolidated within another department. The NASA E/PO programs are included in the list of 78, along 30+ other NASA STEM-Ed programs. There are another 48 programs that would be internally consolidated. For instance, the Transforming Undergraduate Education in STEM (TUES), Widening Implementation and Demonstration of Evidence-Based Reforms (WIDER), and the STEM Talent Expansion Program (STEP) programs at NSF would be consolidated into a new program titled Catalyzing Advances in Undergraduate STEM Education (CAUSE).

The Department of Education would have responsibility for many of the new STEM-Ed initiatives. The Smithsonian would take over new programs focused on informal education and outreach.

For more information, visit: http://www.whitehouse.gov/sites/default/files/microsites/ostp/2014_R&Dbudget_STEM.pdf

ISSUE: POPA

The proposed APS Statement on K-12 physics education was approved for member comment by POPA and the APS Executive Board. It is now posted on the APS website for review by membership, through June 30th, 2013. Visit http://www.aps.org/policy/statements/k12statement.cfm to read the statement and submit your comments. The statement will be drafted in final form with consideration of member input.

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

Roll Call newspaper published an op-ed by Michael S. Lubell, APS director of public affairs, on May 3, 2013, titled "Don't let American Science Suffer From Federal Spending Cuts." You can read the full column at: http://bit.ly/10wXH3Q

The Hill newspaper's Congress blog published a piece by Stamatis Vokos, professor of physics at Seattle Pacific University, on April 25, 2013, titled "Highly trained physical science teachers needed to educate students for high-tech economy." You can read the full piece at: http://bit.ly/14SV9Ws

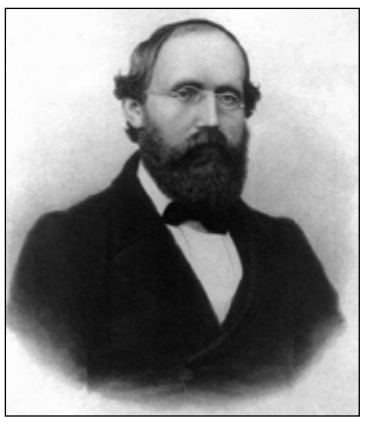
James Kakalios, a physics professor at the University of Minnesota and author of *The Physics of Superheroes*, also published an op-ed on the Congress blog titled "Scientific Research? We built that!" You can read the op-ed at: http://bit.ly/10ukOAy

This Month in Physics History

June 10, 1854: Riemann's classic lecture on curved space

Albert Einstein changed our view of the universe in 1915 when he published the general theory of relativity, in which he set forth the notion of a four-dimensional spacetime that warps and curves in response to mass or energy. The geometric foundation for his work was laid some 60 years earlier, with the work of a German mathematician named Georg Friedrich Bernhard Riemann.

Born in what is now the Federal Republic of Germany in 1826, Riemann was the second of six children of a Lutheran pastor, who taught his son until he turned ten. The young Riemann was shy and nervous, but gifted in mathematics–so much so that while attending high school in Hannover, his knowledge sometimes surpassed that of his teachers. In 1846, his father scraped together sufficient funds to send his son to the University of Göttingen, where Riemann initially intended to study theology so that he could help support his family. But then he attended lectures by Carl Friedrich Gauss and Moritz Stern, who inspired him to switch his studies. With his parents' blessing, Riemann transferred to the University of Berlin the following year, studying under some of the most prominent mathematicians of his time.



Georg Friedrich Bernhard Riemann

Two years later, in 1849, he returned to Göttingen to pursue his PhD with Gauss, completing his thesis in 1851 on the theory of complex variables, the basis for what we now call Riemann surfaces. Gauss described Riemann as having "a gloriously fertile originality" in his report on the thesis, and two years later, when Riemann was required to give a lecture to land a faculty position at Göttingen, Gauss assigned his star pupil the topic of the foundations of geometry–a seemingly mundane topic in the hands of a lesser mathematician.

Riemann did not disappoint his mentor, despite a phobia of public speaking. He used the opportunity to develop a highly original theory of higher dimensions, described in a lecture –"On the Hypotheses Which Lie at the Foundations of Geometry"–delivered on June 10, 1854, that included a workable definition of how one might measure the curvature of space. It wasn't published until two years after his death, in 1866, and is now considered one of the most important works in geometry.

The lecture consisted of two parts. First, the question of how we might define an n-dimensional space resulted in the definition of Riemann space, including the Riemann tensor. This laid the foundation for the field of Riemannian geometry. For the second part of the lecture, Riemann discussed the dimension of real space and what geometry one should use to describe it.

The lecture was a resounding success, despite the fact that Riemann's ideas were so advanced that only Gauss fully appreciated their profundity –Gauss had, after all, done important work early in his own career on the theory of surfaces in two dimensions, making it possible to precisely evaluate curvature mathematically. And in an 1824 letter to Ferdinand Schweikart, Gauss had speculated on the possible curvature of space, admitting, "I have from time to time in jest expressed the desire that Euclidean geometry would not be correct."

Gauss had demonstrated that a single number is required to describe the curvature near a point in two-dimensional space (the Gaussian curvature). Riemann extended that notion to spaces with any number of dimensions, demonstrating that one needs six numbers to describe the curvature of any point in three-dimensional space (the Riemannian metric), and 20 numbers for four-dimensional space. The Riemann curvature tensor is simply a collection of numbers at every point in space that describes its curvature.

Riemann went on to make valuable contributions to analysis, number theory, and complex manifold theory, among other areas. An attempt by his mentors to appoint Riemann a chair at Göttingen failed, although the university did appoint him as a professor in 1857, with a regular salary. That was the same year he published his work on abelian functions, picking up where his doctoral dissertation had left off and extending further his ideas on the topological properties of Riemann surfaces. He finally earned his chair in mathematics at Göttingen in 1859, and was elected to the Berlin Academy of Sciences in the bargain. In 1862, he married a friend of his sister's, and fathered a daughter.

But his personal and professional happiness was short-lived. Later that year, Riemann–who had never been very healthy–came down with a severe cold that developed into tuberculosis. He spent that winter in Sicily's warmer climate, but never fully recovered. He went back and forth between Göttingen and Italy for the next several years as his health deteriorated, and died on July 20, 1866, at age 39, while recuperating on the shores of Lake Maggiore. There is speculation that a housekeeper tidying up the clutter in his office after his death may have discarded several unpublished works.

Riemann's influence on math and physics remains undiminished. "Physicists were still far removed from such a way of thinking," Einstein later observed of Riemann's work. "Only the genius of Riemann, solitary and uncomprehended, had already won its way by the middle of the last century to a new conception of space, in which space was deprived of its rigidity, and in which its power to take part in physical events was recognized as possible." Mathematicians are still grappling with the repercussions of his ideas today.

In addition to Einstein, Riemann's seminal contributions to geometry likely inspired Lewis Car-

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Chip-scale Accelerators Verge on Breakthrough

By Calla Cofield

At a press conference at the 2013 APS March Meeting in Baltimore, Rodney Yoder of Goucher College predicted that within a year, he and his colleagues will accelerate a beam of electrons through a particle accelerator smaller than the eye of a needle. Yoder showed off samples of his team's design structure, called a micro accelerator platform, or MAP.

Yoder stated that these new devices could "democratize" accelerator science, and make their use widespread. Small particle accelerators could reduce the need for scientists to use large-scale, multi-million dollar accelerator facilities. Less powerful versions of the device could be used to inspect packages at border checkpoints.

Yoder and co-creator of the MAP structure, Gil Travish of UCLA, first confirmed sending electrons through the structure in results published in 2011. This isn't a great challenge in an accelerator if the electrons pass through a 2-inch wide copper pipe, but it is a major milestone when the "pipe" is only few microns wide. Their next step, acceleration, is achieved when laser light is injected into the structure, and electrons "surf" on the light waves to gain energy. Yoder says the MAP structure design has the potential to deliver energy gains of 1 GeV per meter, although for many potential applications the structures would most likely stay on the order of about ten centimeters.

The MAP collaboration is based at UCLA, but the structure is undergoing testing at SLAC National Accelerator Laboratory by the Dielectric Laser Acceleration (DLA) Group, which is led by Joel England.

England said in an interview that SLAC scientists have also sent electrons through two other microscale accelerator structures, and have discussed those results publicly. The group began tests injecting lasers into all three structures in December of 2011, but spent a year developing test beams that worked for the structure. This required ways of monitoring the very small laser and electron beams and being able to tweak them in various ways. In December of 2012 they began specialized tests of the structures with the ideal beams, and England confirmed Yoder's anticipation that within the year they will have results showing successful acceleration.

While these results are still preliminary, they represent major gains that as recently as 10 years ago, many people in the accelerator community doubted would ever materialize. Now these accelerator designs are in the running to become the first operational devices to change the paradigm of accelerator size.

"The fact that we've gotten particles through them," said England, "and are actually beginning to test them with lasers…definitely sets the stage for this type of technology as something with a lot of promise."

These "chip-scale" accelerators are officially called dielectric-based laser accelerators, or DLA's, in reference to the dielectric materials they are made from, and the use of lasers as an energy source. The MAP structure uses a titanium-sapphire laser which is tunable in the red and near-infrared wavelengths. They operate on the same basic idea as large accelerators: Bunches of particles gain energy by "surfing" on electromagnetic waves.

The particle bunches gain energy over distance, which partly accounts for the size of the world's most powerful accelerators, like the 2-mile-long linear accelerator at SLAC or the 27-km Large Hadron Collider. Accelerator size is also determined by the wavelength of light used to boost the particles. The particles pass through a central "pipe," and light waves are injected all along the length of the pipe, through cavities that run perpendicular to it. These cavities need to be roughly the wavelength of the light used. Most large accelerators use microwaves, meaning each cavity needs to be a few centimeters wide. To use optical light requires cavities on the scale of a few hundred nanometers to a few microns.

While designs for optical-light accelerators date back as far as the 1960's, two breakthroughs in the last 15 years have made them much more feasible. The cost of optical lasers continues to drop, including the cost of fiber lasers, which Travers says will work as

CHIP SCALE continued on page 5

To Activate, Press Here

Photo by Matthew Payne

On April 26, volunteers and staff from APS, the American Association of Physics Teachers (AAPT) and the Society of Physics Students (SPS) hosted over 2300 high-school students from the Washington DC area at Six Flags America in the nearby Maryland suburbs. This is an annual event that combines the fun of the amusement park with the opportunity to see how physics plays a role in things like roller coasters. In the photo, SPS volunteer Lori Laughrey from Dickinson College (right) instructs a student on how to operate the accelerometer that she will be wearing on the fearsome Superman: Ride of Steel. SPS is administered by the American Institute of Physics (AIP).

International News

...from the APS Office of International Affairs

Attitudes towards teaching evolution in Turkey

by Zehra Sayers and Zuhal Özcan

The theory of evolution occupies a central place in modern biology, but a very different place in the public sphere. It is vilified by politically and religiously conservative organizations, and is widely misinterpreted by the public. Here we describe some subtle (or not-so-subtle!) changes that have been shaping evolution instruction in Turkish secondary school education.

In Turkey, where the structure and content of primary and secondary education is developed and regulated by the National Education Ministry (NEM), coverage of evolution in curricula is influenced strongly by national political trends.[1] In early years of the Turkish Republic (up to about 1945), evolution was introduced in history textbooks as a well established scientific truth in the context of history of humanity. Later, as populist religious rhetoric in the political scene became stronger, evolution was relegated to science and biology curricula and at the same time instruction became unsystematic and superficial; textbooks' treatment of evolution became ambiguous and less assertive. After the 1980 military coup, NEM's stand against teaching evolution culminated in the inclusion in biology textbooks of creationism as an alternative theory for origin of life on earth. Since 2001, evolution's textbook presence has further diminished.[1,2] Currently, only those students who choose a science-oriented track have any exposure to evolution, and this is in the second term of the 12th (final) year, when they spend most of their time not at the school but preparing elsewhere for the central university entrance exam. It is interesting to note that religion instruction, introduced in the 1980s and expanded in the later years, is now compulsory for all students between 5th and 12th grades.

In the 1983 edition of a standard high school textbook, evolution merits its own chapter. In the 2011 edition, by contrast, evolution is part of a chapter called "The beginning of life and evolution" in which creationism is also discussed. Another interesting difference between the two books relates to the meaning of "scientific theory"; the recent version treats the concept as an open-ended, indefinite opinion rather than a fact, reducing it to an unclear hypothesis. It is not only high school education that is affected. There are no universities in Turkey offering undergraduate or graduate degrees in evolutionary biology or in related fields, and even courses in the area are hard to come by.

A recent study of 75 students training to be biology teachers illustrates evolution's problems in Turkey: 44% considered the idea to be speculative and 68% thought that it was not based on scientific evidence. When probed deeper it became clear that those who had inadequate or inconsistent conceptions about the nature of science were likely to reject evolution.[3] Another survey, of 1098 freshman and senior undergraduate students enrolled in biology, biology education and elementary science education programs in 11 public universities in Turkey, yielded similar results. 20.7%

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Twelve hours later and 1900 miles away, the starting gun would sound at the Boston Marathon.

"I'm extremely grateful for the award, but I can't do this for the third time when I really want to run this marathon," Ozel said. "I came very close to saying 'I can't not get my award this April.'"

Ozel was already spending the year in the Boston area as a Radcliffe Institute fellow. She also had family and friends living nearby.

"It's not the same if you fly out by yourself and there's nobody on the course to meet you," Ozel said. "My friends and family are here right now and they all wanted to come out and see it so I'm not going to blow this opportunity."

The morning of the race started out like any other. The sky was clear and the temperature was in the low 50s.

"It was a good race," Ozel said. "The weather was perfect. So many spectators on the course."

Fellow runners had warned her that some of the "cheer tunnels" could be almost deafening. The streets were filled with onlookers, sometimes five people deep.

"It has a lot of energy, it has a lot of history," Ozel said. "It's a tough course because of the hills, but I really felt great running it."

Ozel finished in three hours and 28 minutes, forty minutes before the attacks. She walked around the finish area for a short while to meet up with friends and family and to collect her finisher's medal and belongings. Together, she and seven companions walked up the street to the Prudential Center, a large shopping complex a block from the finish line. Just as they were entering the front doors, two pressure cookers rigged with explosives detonated within sight of the finish line.

"I did hear the explosion but in that first split second… I don't think any of us quite put it in place that this was a bomb going off," she said. "Very quickly the panic started. Then it occurred to us what had happened."

Everything stopped. Police ordered everyone to shelter inside the center. The cell phone system in the area crashed. Ozel and her family were supposed to meet another group of friends, but they were on the other side of the attack and had been evacuated in the opposite direction. News about the grave injuries that people suffered near the blast started to spread by word of mouth.

After two tense hours of waiting, the police came through and announced that the whole center was being cleared out. People started leaving from the far side of the building, into a city that was shut down. Trains and buses had stopped running, and traffic was being diverted away from downtown. Even though she had already run 26.2 miles, Ozel, her friends and her family had to walk nearly three more miles across the Harvard Bridge into Cambridge to find a cab and finally make it home.

"Once I realized we are ok and we're going to have to basically do that walk…to get home, I think that's when tears started to come down," she said. "The shock of it really started sinking in at that point."

Over the next few days, while the city of Boston searched for the attackers and tried to make sense of what had happened, runners across the country began organizing meets in support of Boston. Almost immediately, Ozel started receiving messages from her old training groups in Tucson, San Francisco and Chicago where people were organizing runs to show support. She said the running community is one that refuses to be intimidated.

"I wasn't planning to run Boston next year," Ozel said. "I really wanted to do it once, to be part of it, but I didn't ever think that I was going to be one of these return Boston marathoners. And now I'm pretty sure that I'm going to come back and run it next year."

Letters

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

In Which Physicists Lose Their Shirt

On the Back Page of the March *APS News*, James Owen Weatherall in a delightful article informs us about the influence physicists have had on economic theory. I did not know that towering economists like Jan Tinbergen, Irving Fischer and Paul Samuelson were trained as physicists. Lest our kind should burst from overconfidence in our abilities to master other fields, Weatherall notes that Isaac Newton lost his shirt in The South Sea Bubble, after which Newton delivered his famous remark about his inability to calculate " the madness of men."

Perhaps as another sobering-up for physicists tempted to get rich quickly it could also be mentioned that the brilliant theorist Irving Fischer fared no better than Newton. Back in 1929 Fischer assured the public that the great downturn on the New York stock market that fall was only a "shaking out of the lunatic fringe", and that the prices of stocks would soon rebound. Among his reasons for optimism was that the market had not yet reflected the beneficent effect of prohibition on workers' productivity. As described by John Kenneth Galbraith in *The Great Crash, 1929*, Irving Fischer put his money where his mouth was, and lost considerably.

Tor Laankan
Sparbu, Norway

Newton Beats Hooke–Again

The column "This Month in Physics History" in the April *APS News* credited Robert Hooke with making the first reflecting telescope, but I thought it was Newton, and I queried Mordechai (Moti) Feingold of Caltech, a Newton expert. He replied that it was indeed Newton, citing the Wikipedia article on "Gregorian telescope" as accurate. Gregory had his plans for a reflecting telescope before Newton, but Newton built his own before Hooke made a telescope from Gregory's 10-year-old plans.

Jay M. Pasachoff
Williamstown, MA

Teach Physics for Physics' Sake

Regarding Meg Urry's Back Page in the May issue of *APS News*, entitled "Raising the Bar in Physics Graduate Education":

We teach physics as subject matter and not as a means to indoctrinate students to believe "that they can solve the problems of the world." Did Erwin Schrödinger develop wave mechanics to solve the problems of the world? Were his teachers educating Schrödinger to solve the problems of the world? Was Schrödinger envisioning, when he wrote, "What is life?" that in 1953 Francis Crick and James D. Watson would discover the structure of DNA? Was Michael Faraday concerned about the welfare of the world when he set out to discover the law of electromagnetic induction? I challenge any science fiction writer to conceive of a world without Faraday's law of induction.

Richard Feynman's scientific curiosity knew no bounds, which led to great achievements in physics. Feynman was also interested in flowers, music, strip clubs, etc., but it was the former rather than the latter that his advisor John Archibald Wheeler must have stimulated by the knowledge and vision that Wheeler taught him.

The teaching of physics must be directed purely at its subject matter. It is physicists, as human beings, who determine what sort of persons they become and how they interact with the rest of the world.

Moorad Alexanian
Wilmington, NC

Letter Could Discourage Women Physics Students

Regarding the letter by Jeffery Winkler in the April *APS News*: In mathematics, computer science, and other hard sciences, the ratio of men to women is much closer to 50-50, showing that women are not only interested in challenging fields, but also excel in them. I don't know if the letter was published for shock value or as a reminder of how far we need to come as a community, but either way it's entirely inappropriate for the year 2013. One can imagine a young undergraduate perusing *APS News* in her physics library, only to come across his letter– would she be interested in joining a community that gives merit to this way of thinking by publishing it in their newsletter?

Mark Limes
Salt Lake City, UT

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said.

Other researchers said that physicists were the key to developing the next generation of measurement and diagnostic tools.

"This is mostly physicists. Physicists are a principal driver in the effort to understand brain activity," said Tim Harris, the Director of the Applied Physics and Instrumentation Group at the Janelia Farm Research Campus of the Howard Hughes Medical Institute. "This is a tool-making problem, this is not a biology project. We do not have the tools to measure brain activity properly. So the question is how do we make the tools."

Representatives from DARPA declined to comment directly, but a statement posted on the DARPA website on April 2 said, "DARPA plans to explore two key areas to elicit further understanding of the brain. New tools are needed to measure and analyze electrical signals and the biomolecular dynamics underpinning brain function. Researchers will also explore, abstract and model the vast spectrum of brain functions by examining its incredible complexity."

Well before the BRAIN initiative was announced, physicists in increasing numbers have been working with neuroscientists to improve the way doctors and neurologists can probe how the brain works.

"Physicists have for the last 10 or 15 years realized there are lots of interesting measurement problems in biology and come over," Harris said. "It's a much messier problem, the brain is just way goo-ier than a proton beam."

Administration officials are currently meeting with researchers to decide on a more concrete set of goals for the initiative.

Because the money will be split among three different research agencies, it is unclear how, or even whether, they will coordinate with each other. In addition, researchers say that while the $100 million is appreciated, it's a relatively small amount that is not likely to be fundamentally game-changing.

"[It's] a modest amount of funding being added to an ongoing research problem,"

Harris said. "It's not like they're going to change the trajectory of what's been going on for the last five to eight years. The feds are late to this party."

Members in the Media

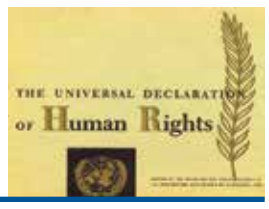
"It's a rather formidable game… Sometimes, having a photographic image snap into place with the surrounding terrain is a matter of walking 10 feet in a certain direction."

Dan Gillespie*, on hunting for the original sites movies were filmed in California's Alabama Hills,* The Los Angeles Times*, April 30, 2013.*

"In the unlikely event that antimatter falls upward, we'd have to fundamentally revise our view of physics and rethink how the universe works."

Joel Fajans*, Lawrence Berkeley National Laboratory in California,* CBSNews.com*, May 1, 2013.*

APS Committee on International Freedom of Scientists



CIFS Briefs: Highlighting the Connection Between Human Rights and Science for the Physics Community

Since its creation in 1980, the APS Committee on International Freedom of Scientists (CIFS) has advocated for and defended the rights of scientists around the globe. In this column, CIFS describes some of the issues that the Committee is monitoring as well as the Society's other human rights activities.

Sentences Upheld for Two Russian Scientists

In February, the Russian Supreme Court upheld the sentences of scientists Yevgeny Afanasyev and Svyatoslav Bobyshev, who were convicted in June 2012 of passing secret information to the Chinese concerning Russia's intercontinental ballistic missile. The professors from St. Petersburg Baltic State Technological University were detained in March 2010 and accused of divulging state secrets during lectures given at a Chinese university. The allegations supposedly stem from an agreement between their university and Harbin Engineering University in China. Bobyshev and Afanasyev have argued that their lectures did not contain any state secrets. During the period between their detention in 2010 and trial in 2012, they were held for many months without any formal charges, something that CIFS protested to Russian authorities.

Omid Kokabee Writes Letter from Prison

APS member Omid Kokabee has written a letter from Evin prison in Iran indicating that he is being persecuted for refusing to work on Iranian security and military projects. In the letter to his friend and former roommate at Sharif University, Kokabee writes that he has repeatedly been asked to work on such projects since 2005, but has always refused as he wishes to pursue a life path of his own choosing. His letter mentions that the day before his arrest in January 2011, he had been chased, and forced to attend a meeting at the Atomic Energy Organization of Iran. This pressure to work on security and military projects has continued during his imprisonment. In fact, Kokabee wrote that he has been offered his freedom should he cooperate.

Students and scientists at the University of Texas at Austin who are supporting CIFS member Herb Berk's efforts to help Kokabee released a short documentary to mark the two-year anniversary of Kokabee's detention. APS members can view the video at: http://freedomforomid.com/

In March, CIFS wrote to the 47 members of the UN Human Rights Council requesting that they bring up Kokabee's plight with officials from Iran. CIFS asked that they encourage Iran to comply with its international human rights obligations with respect to Kokabee's treatment.

Kokabee was arrested in Iran in January 2011 while trying to travel to the United States to continue his graduate studies in optics at the University of Texas at Austin. He was convicted and sentenced in May 2012 to ten years in prison for "cooperation with a hostile government," i.e., the United States. His conviction was upheld on appeal in August 2012, and Kokabee subsequently had 91 days added to his sentence for earning illegal money for teaching fellow inmates physics as well as Spanish, English and French.

AAAS Science and Human Rights Coalition

On January 31 and February 1, the Science and Human Rights Coalition met at the headquarters of the American Association for the Advancement of Science (AAAS) in Washington, DC. This meeting focused on the intersections among children's rights, science and technology. Participants learned about the rights of children as set out in international declarations and treaties as well as issues on which science and technology could impact important children's rights concerns.

While at the meeting, APS representatives Juan Gallardo and Michele Irwin attended a meeting of the Coalition's Working Group on the Welfare of Scientists. The Working Group aims to help the scientific community better respond to cases of alleged human rights violations by increasing the number of scientific societies advocating for the rights of scientists, coordinating their efforts, and providing access to tools and resources necessary to effectively respond to human rights abuses.

The next Coalition meeting on July 11-12 will focus on Article 15 of the United Nation's International Covenant on Economic, Social and Cultural Rights (ICESCR), i.e., that all people have the right to "enjoy the benefits of scientific progress and its applications." The meeting will include sessions on international scientific cooperation, open access, and the connection between government funding for science and the right to enjoy the benefits of scientific progress.

CIFS encourages APS members to attend the Science and Human Rights Coalition meeting in July to learn about the connections between science and human rights and see how they and their

CIFS continued on page 6

Education Corner

APS educational programs and publications

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. To find *Wavefront* go to: http://www.aps.org/programs/education/wavefront.cfm

Graduate Education Conference Notes and Presentations Available
As reported in the March *APS News* (www.aps.org/publications/apsnews/201303/secondgradconf.cfm), at the end of January, APS & AAPT held their second two-day conference on Graduate Education, which featured sessions on preparing students for non-academic careers; educating successful graduates; promoting diversity; developing university, lab, and industrial partnerships for graduate education; and thoughts on the future of graduate education. The conference notes and presentations are now available online: http://www.aps.org/programs/education/graduate/conf2013/presentations.cfm

Nominate Women and Minorities for Fellowship, Prizes, and Awards
Several Prizes and Awards deadlines are quickly approaching and the Committee on Minorities in Physics (COM) and the Committee on the Status of Women in Physics (CSWP) strongly encourage nominators and award committees to consider a diverse pool of nominees. For those needing help identifying qualified women and minorities for prizes and/or awards, please contact Deanna Ratnikova (ratnikova@aps.org) or Arlene Modeste Knowles (Knowles@aps.org), the committee administrators for CSWP and COM respectively.

APS Commends President Obama's Plan for Regional Centers to Train STEM Teachers
President Obama's Fiscal Year 2014 budget included regional centers within the STEM Innovation Network to develop highly trained STEM (science, technology, engineering and mathematics) teachers who will prepare students to meet the demands of an increasingly technical workforce. Called the STEM Master Teacher Corps, the president's plan is consistent with recommendations in a four-year study recently completed by the Task Force on Teacher Education in Physics (T-TEP).

The T-TEP Report stresses the importance of providing specialized professional preparation to teachers in the physical sciences. Just 47 percent of physics and 46 percent of chemistry classes are taught by teachers with a degree in the subject. By comparison, 73 percent of biology teachers have a degree in biology. The Report was researched by APS, the American Association of Physics Teachers, and the American Institute of Physics. Read the T-TEP report here: http://www.ptec.org/webdocs/TaskForce.cfm

New Jonathan Reichert and Barbara Wolff-Reichert Award for Excellence in Advanced Laboratory Instruction: Deadline is July 1
A new APS Award has been endowed by Jonathan Reichert and Barbara Wolff-Reichert to recognize and honor outstanding achievement in teaching, sustaining (for at least four years), and enhancing an advanced undergraduate laboratory course or courses. The course(s) should provide a selection of experiments in a range of the various interest areas of physics, for example atomic physics, electronics and optics. The award consists of $5,000 plus travel expenses (up to $2,000) to attend an APS meeting at which the award is presented, and a certificate citing the achievement of the honoree. The honoree will be invited to present a lecture at that meeting. The award will be offered annually. Full details of the award are here: http://www.aps.org/programs/honors/awards/lab.cfm

Register for the APS Bridge Program Summer Meeting, June 27-29, 2013 in College Park, MD
The meeting will bring together experts to discuss efforts to increase the number of underrepresented minorities who receive PhDs in physics. Faculty, administrators, researchers and students are welcome to attend. Registration fees are $100 for Bridge Member Institutions and $175 for non-member institutions. http://www.apsbridgeprogram.org/conferences/summer13/index.cfm
Become a member: http://apps3.aps.org/phystec/apsbridge.cfm

The PER User's Guide: A Web Resource for Physics Educators
The Physics Education Research (PER) User's Guide is a growing web resource designed to translate, summarize, and organize the results of PER in an accessible and useful way for busy educators. Peruse the PER User's guide at: http://perusersguide.org/

Oak Ridge Boys

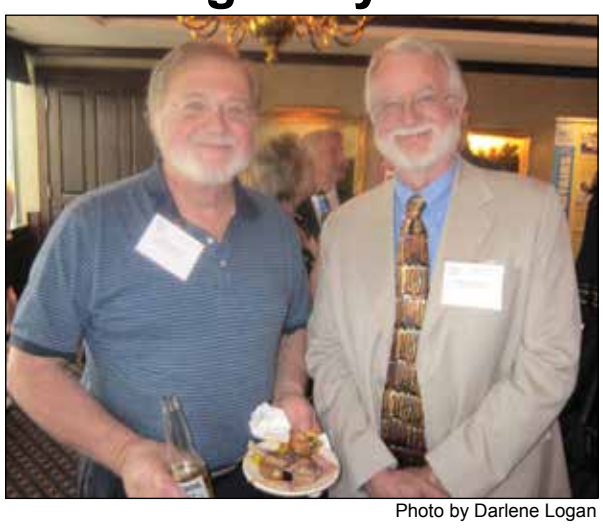


Photo by Darlene Logan

On May 2, APS hosted a Fellows' reception in Knoxville, Tennessee, which, besides being the home of the University of Tennessee, is also near the Oak Ridge National Laboratory in Oak Ridge, and not far from the Dolly Parton theme park in Pigeon Forge. Two of these three institutions are well-supplied with APS Fellows, and more than 40 of them attended the reception, which, in addition to good food, good drink and good company, featured brief remarks by APS President Michael Turner, Executive Officer Kate Kirby, and Director of Public Affairs Michael Lubell. In the photo, Fellows Tony Gabriel of Oak Ridge (left) and Soren Sorensen of the University of Tennessee enjoy the event.

Supernova Data Hide in Ancient Bacterial Remains

By Michael Lucibella

At this year's April Meeting, researchers reported seeing hints of an ancient supernova embedded in the remains of 2.2-million-year-old bacteria. Scientists in Germany extracted a radioactive element that only forms in a supernova from magnetic crystals that now-fossilized bacteria once used to orient themselves. This is the first time that researchers have been able to pull the rare isotope from the ancient magnetic crystals, an achievement that could turn into a useful tool for astro-archeologists.

The team found radioactive iron-60 in the fossilized bacteria under the deep ocean's surface. Iron-60 is a rare and unstable element that naturally forms only in the fiery crucible of a supernova. With a half-life of about 2.7 million years, just about all traces of the isotope on Earth should have long decayed away. The fact that there is any at all indicates that the bacteria likely consumed the metal when Earth passed through a supernova's debris cloud about 2.2 million years ago.

"That we're here talking about it indicates that the supernova wasn't too close," said Shawn Bishop of the Technische Universität München, a member of the team that identified the iron.

The radioactive particles settled on the surface of the planet, and were subsequently absorbed by species of "magnetotactic" bacteria. They consume iron, concentrate it and forge microscopic chains of tiny magnetite crystals, which they use to keep themselves directionally oriented. If there is iron-60 in the environment, the bacteria absorb it along with other more common iron isotopes.

After the bacteria die, their crystals can be preserved in the mud at the bottom of the ocean. Over time layers of the dead bacteria pile on top of each other and solidify, leaving behind a fossil record with their magnetite crystals.

"If there's iron-60 in these crystalized fossils from the time of the supernova, the fossils are still there and the iron-60 should still be in them," Bishop said.

To test for the exotic iron, the team dissolved the fossilized bacteria in a chemical bath, and then bombarded the samples with a cesium ion beam from the tandem accelerator at the Maier-Leibnitz-Laboratory in Munich. The cesium bonds with the iron, and is carried along to a particle counter.

"We're literally counting individual atoms of iron-60 that come out of the sample material," Bishop said.

He said that it takes about 40 grams of sediment to get a single usable 3-milligram sample of iron. Within that iron sample, the concentration of iron-60 is minuscule, only about one in one quadrillion, hence the need to count individual atoms.

Though the data are promising, Bishop emphasized that the team was presenting raw data, and was not yet definitively claiming a discovery.

"The data are preliminary, they have not been published, and the work has not gone through any peer review. It is hot off the press, so to speak," Bishop said. "Some fraction of the data was taken in January, and another fraction… was done just ten days ago."

The sample that Bishop's team has focused on so far came from four kilometers below the surface of the ocean, a few hundred miles off the coast of Ecuador. They are now looking at a much bigger core sample, and hope to improve the confidence level of their results.

Their findings fit with other indications of a possible ancient supernova at about the same time. According to astronomical evidence, there was likely a supernova in the Scorpius–Centaurus star cluster about 2.2 to 2.4 billion years ago. This fits with a previous set of iron-60 tests from 2004, in which researchers found a similar unusual concentration of the radioactive element in a naturally iron-rich layer of sediment in the Pacific Ocean.

Bishop said he was excited about the possibility of being able to extract the iron from bacteria fossils because iron-rich sediments are rare.

"The bacteria fossils are everywhere in the oceans," Bishop said. "With this new avenue, especially if the second sediment core confirms what we see here, there's a chance now to do some sampling in the Pacific and the Atlantic Oceans, looking to see if in fact the deposition of this material on the planet was uniform, or if it was concentrated in one area."

He added that with some refinement of their technique, and using more samples, they may be able to glean some information about where supernovas were located.

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roll, a.k.a. Oxford math professor Charles Dodgson, when he wrote *Alice in Wonderland* and *Through the Looking Glass*. Dodgson was a traditional Euclidean at heart; he liked his spaces flat. In many respects, the absurdity of the imaginary world he created for Alice mirrored the intellectual upheaval of late 19th century mathematics, in which scholars grappled with a topsy-turvy looking glass world filled with curved space and imaginary numbers.

CHIP-SCALE continued from page 3

an energy source for the DLA's. At the same time microscale fabrication techniques, driven mostly by the semiconductor industry, have also improved.

DLA designs differ mostly in their architectures. Yoder and Travish's design is called a "slab" structure, because it consists of two flat slabs of dielectric material. Sandwiched between the slabs is a section of vacuum where the particles pass through. The pair began serious work on the design in 2006, having both worked with James Rosenzweig at UCLA, though at different times.

The particle bunch duration from a DLA structure is only a few attoseconds, which opens up the possibility of imaging very fast processes, because the bunch duration functions like a shutter speed. The bunches may contain as few as 100 to 1000 electrons each, resulting in a low charge per bunch and a weak signal to a detector, so they may be grouped together into picosecond-long "macrobunches," that provide significantly more charge and signal. The beam may then produce over a million of those macrobunches (over a billion individual bunches) per second. Yoder and England both estimated that in five years, they would have a test accelerator. This would mean the ability to line up multiple structures in series, and accelerate a beam through them, to observe a higher energy gain.

There is still a significant amount of work to be done before a prototype accelerator could be used for experimentation. Neither of the research groups have an electron beam small enough to fit exclusively through the beam "pipe" of any of these microscale structures. For their tests they have used a beam that is larger than the structure's beam tunnel, and had to confirm that portions of the beam did pass through it. In addition, development of a full prototype will require detectors for these devices and diagnostic tools to study the beams they produce.

"I don't know if one research group is capable of doing that on its own," said England. "So we have collaborators that are experts on [semiconductor] fabrication techniques…and experts on lasers, experts on materials science. We're trying to fold new people into the field to help tackle some of these challenges."

Still Time to Vote in APS Society-wide Election

Homer A. Neal | Stewart Smith | Beverly K. Berger | Patricia McBride | Dolores Bozovic | Nadya Mason | Kiyoshi Ueda | Mu Wang

The APS Society-wide election is now in full swing, running until the end of June. Every APS member should have received an email notice with instructions on how to vote online. Below are capsule biographies of the candidates for the various positions. The person elected as vice-President will join the APS Presidential Line, serving next year as vice-President, then as President-elect, President, and past-President over a four-year cycle.

More complete information about the election, including expanded candidate biographies and statements, can be found online at http://www.aps.org/about/governance/election/index.cfm

Vice-President

Homer A. Neal is the Interim President Emeritus and Vice President for Research Emeritus at the University of Michigan. From 1987 to 1993 he was Chair of the University of Michigan Physics Department. He served as Vice President for Academic Affairs and Provost at Stony Brook (1981-86) and Dean for Research and Graduate Development at Indiana University (1976-81).

Neal was the principal originator of both the D0 and ATLAS groups at the University of Michigan. Neal has served as Regent of the Smithsonian Institution. His service on numerous advisory committees and directorships include: Oak Ridge National Laboratory, MIT Visiting Committee on Sponsored Research, Board of the Center for Strategic and International Studies, Argonne National Laboratory, Lawrence Berkeley Laboratory and Fermilab. He is currently the PI for the Michigan-CERN REU Program allowing US students to spend a summer of research at CERN.

He is a member of the Board of the Ford Motor Company and currently chairs its Committee on Sustainability. He is a Director of the Lounsbery Foundation and is currently a member of the Council for the Smithsonian Museum of African American History on the Mall, and has served as a member of the NRC Board on Physics and Astronomy. He served as a member of the APS Panel on Public Affairs.

Stewart Smith is a particle physicist whose major research interest is the BaBar experiment at SLAC. As Spokesperson (2000-02) and Technical Coordinator (1999) he had central roles in BaBar's 2001 discovery of CP-violating asymmetries in B meson processes. For these achievements he shared the APS Panofsky Prize in 2011. Previously, Smith carried out experiments at the Deutsches Elektronen-Synchrotron (DESY), Fermilab, and at the Brookhaven AGS.

Smith received BA and MSc degrees from the University of British Columbia and his PhD degree from Princeton University in 1966. After postdoctoral work at DESY, he joined the Princeton faculty in 1967, chairing the Physics department from 1990 to 1998, and spending 2000 to 2002 as Visiting Professor at Stanford University. In 2006, Smith was appointed Princeton's first Dean for Research, bringing under his umbrella several previously separate administrative departments. Several major campus research centers report to him, as does the Princeton Plasma Physics Laboratory (PPPL). This summer Smith will take on a new university position as Vice President for PPPL.

Smith chaired the APS Division of Particles and Fields in 1991 and later served on the Physics Planning Committee. He has worked on numerous advisory committees over the years for the DOE and for National Laboratories in the US, Canada, and at CERN.

Chair-Elect, Nominating Committee

Beverly K. Berger retired from the US National Science Foundation where she was Program Director for Gravitational Physics from late 2001 through 2011. Previously, she had spent 24 years as a faculty member at Oakland University (Michigan). Her research field is theoretical gravitational physics with recent emphasis on singularities and other properties of cosmological spacetimes.

In 1995, she founded and was the first Chair of the APS Topical Group in Gravitation (GGR). She was elected again to the Executive Committee as vice-Chair in 2012. She was a member of the APS Council and chaired the Committee on the Status of Women in Physics, the Publication Oversight Committee, and the selection committees for the Aneesur Rahman Prize for Computational Physics and the Dannie Heineman Prize for Mathematical Physics.

She is currently the secretary of the International Society on General Relativity and Gravitation, a member of the Editorial Board of *Reports on Progress in Physics*, a member of the International Scientific Advisory Board (Fachbeirat) for the Max Planck Institute for Gravitational Physics in Potsdam, a member of the External Advisory Board for the College of Sciences of Rochester Institute of Technology, and a member and ombudsperson of the LIGO Scientific Collaboration.

Patricia McBride is a Senior Scientist and Director of the CMS Center at Fermilab and a collaborator on the CMS experiment at CERN.

She has been a member of the scientific staff at Fermilab for nearly 20 years. She was a member of the scientific staff at the SSC Laboratory in Texas before joining Fermilab. In 1995, she was awarded an NSF Visiting Professorship for Women to spend a year teaching at Princeton University.

Her main research interests are in the areas of experimental particle physics, scientific computing and instrumentation. She was the Deputy Head of the Fermilab Computing Division and served as the deputy computing coordinator for the CMS experiment at CERN during the commissioning and startup phase of the experiment.

She was elected Chair of the APS Division of Particles and Fields (DPF) and serves as a member of the APS Physics Policy Committee.

She served as the Chair of the Commission on Particles and Fields (C11) of the International Union of Pure and Applied Physics (IUPAP) and was a Vice-President of the IUPAP Executive Council. She is currently the Chair of the US Liaison Committee for IUPAP.

She has served as a member of various committees and advisory groups.

General Councilor

Dolores Bozovic received her PhD in Physics in 2001 from Harvard University, on electron transport in carbon nanotubes. She switched fields for her postdoctoral training, joining the Sensory Neuroscience Laboratory at Rockefeller University on a HHMI fellowship. From 2005 to the present, she was Assistant and then Associate Professor at the Department of Physics and Astronomy and the California NanoSystems Institute, at University of California Los Angeles.

The Bozovic lab focuses on problems at the interface between physics and auditory neuroscience. Her laboratory is interdisciplinary in nature, with experimental and theoretical tools from different fields integrated to address the open questions. As a teacher, she has focused on incorporating instrument-building with biophysical measurements, and has received teaching awards. She has been a mentor for a number of undergraduate research programs for underrepresented minorities, as well as a research mentor for Marlborough School, a mid- and high-school for young women.

Nadya Mason is an associate professor of physics at the University of Illinois at Urbana-Champaign, and a principal investigator at the Frederick Seitz Materials Research Laboratory.

Her research focuses on the electronic properties of low-dimensional materials and the unique behavior they exhibit due to confinement, strong electron interactions, and material structure. Mason is an advocate for diversity in physics; she has actively engaged and mentored women and underrepresented minority graduate, undergraduate, and high-school students. She chairs the Physics Diversity Committee at Illinois (2011–) and is a current member of the APS Committee on Minorities (2013–2016). She also served as co-organizer of the condensed matter sessions of the National Conference of Black and Hispanic Physicists (2007–2011).

Mason participated in the College of Engineering Ad-Hoc Leadership Committee (2012), co-organized an Aspen Winter Conference (2012), and chaired the Facilities Committee at the Frederick Seitz Materials Research Laboratory (2011–).

International Councilor

Kiyoshi Ueda is a professor at Tohoku University. He was also a visiting scientist at University of Maryland (1985-87), an invited senior scientist at Daresbury Laboratory in the UK (1992-1993), and an invited professor of Université Paris Sud in France (1998). He has also occasionally played the role of an opponent for the PhD thesis in some universities abroad, such as Uppsala University in Sweden and Turku University in Finland.

His research centers on photoionization and photofragmentation of atoms, molecules, and clusters by synchrotron radiation, femtosecond lasers, and short-wavelength free-electron lasers (FELs).

In the last decade, he has organized a series of international conferences and workshops and also served as an international advisory board member and/or a program committee member for many international conferences. He served also on a program/proposal review panel for FEL facilities and as an advisory and/or review board for relevant facilities. He also serves on the editorial board for *J. Phys. B: At. Mol. Opt. Phys.*

Mu Wang is the Cheung-Kong professor in condensed matter physics and the Director of the National Laboratory of Solid State Microstructures at Nanjing University (NJU), China.

As an experimental physicist, Mu's research interests focus on the fundamentals of interfacial growth and the optical properties of microstructured materials.

Mu has been the member of the Standing Committee, the Council of Chinese Physical Society since 2004, and a member of the Commission on Structure and Dynamics of Condensed Matter (C10) of the International Union of Pure and Applied Physics (IUPAP) since 2011. He is an APS Fellow, and also a Fellow of the UK Institute of Physics.

As the Director of the Laboratory, he endeavors actively to promote exchanges and cooperation between different countries with diverse cultural backgrounds, exemplified by the exchange program he helped establish between Johns Hopkins University and NJU and the "dual-degree" program between NJU and Louisiana State University.

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research can contribute to the Coalition's efforts.

APS Andrei Sakharov Prize

APS is currently accepting nominations for the APS Andrei Sakharov Prize. The Prize is named in recognition of the courageous and effective work of Andrei Sakharov on behalf of human rights, to the detriment of his own scientific career and despite the loss of his own personal freedom. The Prize is awarded to "recognize outstanding leadership and/or achievements of scientists in upholding human rights." The next prize will be issued in 2014 and nominations are due July 1, 2013.

COMMENTS continued from page 1

participation of underrepresented groups.

"Physical science is a core discipline that underlies almost everything else that students do," said Susan Seestrom of Los Alamos National Laboratory and member of APS's Panel on Public Affairs.

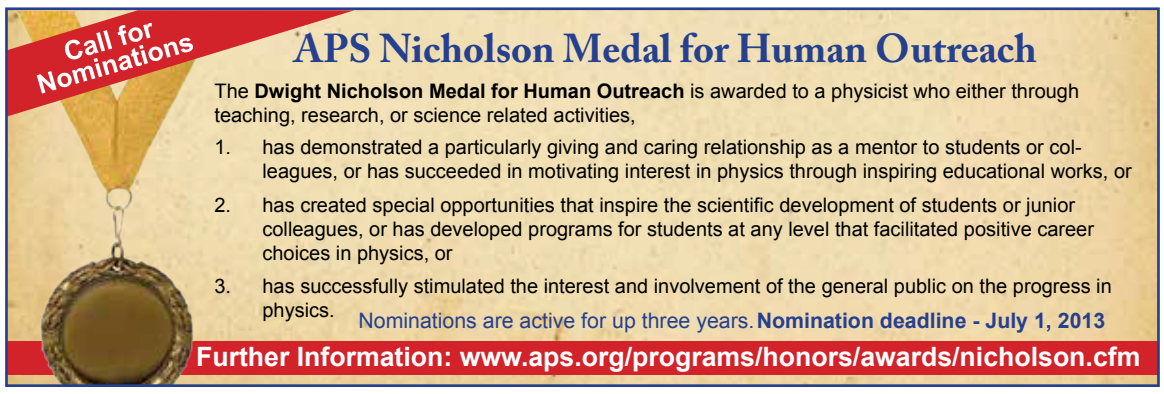
The statement was first drafted by the subcommittee on K-12 education of the APS Committee on Education, then approved by the full committee and the Panel on Public Affairs.

The statement will remain open for comment until the end of June. The recent APS climate change statement's review process was the very first to ask the membership to comment on its language. The K-12 statement is the first of the statements to require membership comments as part of its usual five-year review.

"It will be interesting to see what the comments look like," Cottle said. "We'll do revision work based on the comments we receive."

The statement can be read at http://www.aps.org/policy/statements/k12statement.cfm

ANNOUNCEMENTS



Reviews of Modern Physics

The spin structure of the nucleon

Christine A. Aidala, Steven D. Bass, Delia Hasch, and Gerhard K. Mallot

Throughout much of the twentieth century, the nucleon spin has been–just as the spin of the electron–viewed as an intrinsic property. There are, however, very complex interactions that lead to the spin of 1/2 of the nucleon. Extensive experiments have established that most of the proton's spin cannot be attributed to the sum of the spins of its three quarks and that contributions from the orbital motion of quarks and/or gluons play an important role. This review is devoted to the proton spin puzzle. The current experimental and theoretical developments are reviewed, and open questions and challenges for future investigations are discussed.

▶ **http://link.aps.org/doi/10.1103/RevModPhys.85.655**

http://rmp.aps.org

ATTITUDES continued from page 3

rejected and 27.8% accepted the theory of evolution, with 51.4% being undecided, presumably because of their lack of exposure to these ideas.[2]

There is plenty more to ensure that the picture is truly bleak: the circulation of glossy anti-evolution books in the country and abroad (e.g., Atlas of Creation[4]), the organization of anti-evolutionary symposia (under the auspices of the Turkish Higher Educational Council),[5] and the banning of student-organized discussion panels on evolution in some universities.[6] Finally, on a personal note, during 2009-2010 we participated in "Power of Thinking: Teacher Training Support Program for a Youth that Questions and Queries", a collaboration between the NGO "Education Reform Initiative" and NEM.[7] We prepared material on evolution and genetics. The NEM group asked us to remove this section because evolution was not proven and it conflicted with genetics. When we refused this request, produced counter arguments, and met with the officials, it became clear that none of the members of the NEM group accepted the theory of evolution. These people, all science graduates, are responsible for the content of secondary school text books. Only after agreeing to take out a figure alluding to human evolution, were we able to retain the section in the teaching material. We conclude that official anti-evolutionary influences dominate the Turkish secondary education system.

The only positive aspect of this anti-evolutionary atmosphere in Turkey is the development of efforts to counter its influence. Some academics, including, just to name a few, A. Kence and A. Birand of Middle East Technical University, N. Dalfes and A. Erzan of Istanbul Technical University and E. D. Ozsoy of Hacettepe University, are vociferous proponents of evolution at the undergraduate and graduate levels. Among voluntary organizations that promote evolution are the award-winning "Evrimcaliskanlari" (Hard-workers for evolution), who are translating the University of California, Berkeley's "Understanding Evolution" website into Turkish[8] and also organize conferences/workshops.[9] "Universite Konseyleri Dernegi" (Association of University Councils) have been organizing evolution-themed symposia since 2006.[10] However, even with these voluntary efforts, it is difficult to refrain from pessimism about Turkey's scientific future: Turkey is raising a generation of biologists/scientists whose grasp of scientific thinking is flawed and whose ability to participate in modern biology is correspondingly compromised.

Acknowledgements

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Chief of Staff.

The travel restrictions have had different effects on different meetings. Astronomy-related conferences have been particularly hard hit. The Eighth International Conference on Mars, scheduled for July at Caltech, was postponed for a year. For this year's Lunar and Planetary Science Conference, only a hundred of the usual 170 civil servants were authorized to attend, resulting in the cancelation of several events featuring high-ranking officials from NASA headquarters.

"They decided not to come so their slots could be filled by the scientists who needed to come to the meeting," said Mackwell, who organized the conference. "This is a community that is powered by conversations and discussions… So much of what goes on at these science meetings is not what goes on during the sessions."

This year's meeting of the APS Topical Group on Shock Compression of Condensed Matter, scheduled for early July in Seattle, looks like it will be affected because of the large number of national laboratory scientists who usually attend. David Moore, a researcher at Los Alamos and organizer of the meeting, said that the Department of Energy authorized only just over half of scientists who submitted requests.

"Even if the DOE agrees with the latest submittal…the impact of cutting from 227 to 155 isn't devastating for the conference, but it does hurt," Moore said. "At the moment, my information is that none of the 30 DOD attendees who wanted to come to the meeting will get to go."

Moore added that the Shock meeting will still likely reach the minimum number needed to break even because it is being held in conjunction with the annual meeting of the International Association for the Advancement of High Pressure Science and Technology, which takes place in the United States only once every 20 years. However, as many as one third to one half of the session chairs may have to be reassigned.

Organizers of this year's APS March Meeting in Baltimore and April Meeting in Denver said they didn't see any obvious drop in attendance resulting from these restrictions. The March Meeting was down about 600 people from last year, but the most likely explanation is that the 2012 meeting in Boston was unusually well attended.

Last fall's Division of Nuclear Physics meeting in Newport Beach, California was one of the first held after the imposition of the new travel restrictions, and before the onset of sequestration.

"We didn't get approval for lab scientists to travel to that meeting until two weeks before the meeting," said Robert McKeown, a researcher at Jefferson Lab and organizer of the conference. "I think the system at DOE is working much better now."

He added that he didn't think there would be a big change in this year's attendance rates for his meeting. Speaking more broadly, he said that who is going to the meetings can be as important as how many.

"The largest effect that I worry about is on young people whose careers are dependent on showing their work at conferences and networking and meeting people," McKeown said. "Certainly the people at the beginning of their careers will be the most affected."

McKeown said also that approval delays meant that scientists would miss out cheaper airfare and early registration, ultimately costing the departments more money.

"There has been some study of that and people have established that there are extra costs with the new procedures in place," McKeown said.

In an interview published in the May issue of *APS News*, the outgoing Director of the Department of Energy's Office of Science, William Brinkman, said he didn't think the restrictions were saving the department money.

"I think we're spending more on the bureaucracy than the savings we might accumulate from restricting conference attendance," Brinkman said.

According to the Office of Management and Budget, the federal agencies have saved about $2 billion in total over the last two fiscal years.

The Department of Energy declined to comment.

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could be definitively drawn. If the results hold up, the relatively light particle would be consistent with the COGENT dark matter experiment, also in the Soudan mine, but at odds with results from the Xenon-10 and Xenon-100 dark matter experiments located in Italy. It is also unclear why such light particles would not have been seen in particle accelerators already.

"You can construct models where you would not have seen such particles in accelerators," Cabrera said, "But clearly the mass is such that you can access it with accelerators, so you have to ask that question and analyze it in detail."

The team is also taking data with another experiment in the Soudan mine using nine kilograms of germanium, and is developing a larger, 200-kilogram detector for the SNOLAB facility in Canada.

WIMPS aren't the only exotic particle that physicists think might explain the missing mass of the universe. Axions have been the focus of much theoretical work since the 1970s, and researchers are preparing an experiment that might be able to confirm the existence of axions.

According to the theory, the particles are ubiquitous throughout the universe, but are very light and weakly interacting. There are as many as 10 quadrillion axions per cubic centimeter on Earth, but they are very difficult to detect with a mass only in the micro-electron volt range.

"We really don't have a lot of clues about what makes up the dark matter," Rosenberg said. "An axion could be a perfectly good solution to the dark matter problem. The WIMP could make up the dark matter completely, and it would be a wonderful solution to the dark matter problem. Or you could have a mix."

Researchers at the University of Washington are building the Axion Dark Matter Experiment (ADMX) to hunt for them. The experiment employs a strong magnetic field around a resonant microwave cavity to convert the occasional passing axion into a faint radio signal. A sensitive receiver powered by quantum electronics then picks up that radio signal.

"With our radio receiver, you could go to any planet in the solar system and get four bars on your cellphone without any trouble whatsoever," Rosenberg said.

ADMX is currently in its commissioning phase, and will begin to collect data this summer. The first results are expected sometime next summer.

"In a short number of years, we'll actually have a very sharp answer, a definitive answer, to the question of 'Is the axion… the dark matter in our galaxy?'" Rosenberg said. "We'll either find it and be really happy, or we won't and we'll be out of business but we'll still be really happy."

At the same time, hopes faded for a different, formerly promising dark matter clue seen late last year. In late October there was a buzz in the astrophysics community about an apparent spike in gamma rays seen by the Fermi Gamma Ray Space Telescope's large area telescope. However, the team running the satellite said at the conference that, after reprocessing, the spike has all but disappeared.

Researchers independent of the Fermi collaboration pored over the original raw data release and saw a four-sigma spike in gamma rays with energies of about 130 GeV emanating from the galactic center. The thought at the time was they might be signals from annihilating WIMPS of the same mass.

"There is evidence for some type of spectral feature here, but the effect is not large enough to claim any kind of interpretation beyond statistical fluctuations at this point," said Alex Drlica-Wagner of Stanford University, adding that with reprocessing the feature's significance dropped off to less than two sigma.

The Back Page

APS: Moving Forward in a Rapidly Changing World

by Robert L. Byer, Past President, APS

Last year, 2012, saw a global celebration in July with the discovery of the Higgs. In October we celebrated the Nobel Prize for research in quantum physics. We are now seeing a continued increase in the number of students enrolling in physics in high school and in colleges. It is a great time to be a physicist!

The American Physical Society was founded in 1899 when 36 physicists gathered at Columbia University for that purpose. They proclaimed the mission of the new society to be "to advance and diffuse the knowledge of physics." In one way or another, APS has been doing that task ever since.

As the premier membership society for 50,000 physicists, the APS is in very good stead in its core areas of publishing, meetings, membership growth and finances. We have exceptional programs in outreach, education, international affairs, and government relations and advocacy. However, in moving forward we should continue to strengthen our organization and to respond to new opportunities.

In 2011 we initiated a strategic planning process to help define goals and objectives for the APS over the next five years. The elements of the plan were developed jointly with APS staff and members of the APS Executive Board, and communicated to the APS membership in May 2012. The Strategic Plan is available on the APS website.

The **Strategic Plan for 2013 to 2017** provides a roadmap for ensuring that APS will continue to be:

- A highly valued membership organization for physicists in the US and around the world
- A global resource for physics information
- A strong and visible advocate for the discipline of physics and key communicator about physics to the community and general public
- A recognized leader in designing educational programs to serve the next generation of physicists as well as a more science-literate citizenry

I call the Strategic Plan the three-plus-one plan, with three outward-facing goals and the fourth goal looking inward to increase organizational excellence.

- **Goal One** is to better serve APS members with improved communications, a more diverse and inclusive APS membership and enhanced international engagement.
- **Goal Two** is to better serve the physics community by disseminating physics more effectively, serving as the principal voice for physics to policy makers, and leading the development of outstanding programs in education and diversity.
- **Goal Three** is to better serve society through becoming an authoritative source for physics information, increasing the public's appreciation of the value of physics, and providing innovative programs to enhance STEM education.
- **Goal Four**, the plus-one goal, is to increase organizational excellence and become "One-APS"–a unified organization that shares a common vision and purpose.

Implementation of the Strategic Plan will be guided by recommendations of various Task Forces of APS members. A Development Task Force, led by President-Elect Mac Beasley, was created early in the process because fund-raising is essential to fulfilling many of the Strategic Plan goals. We also established an Early Career Task Force to advise APS on how best to support and engage this important and rapidly growing segment of our membership. A significant challenge for APS publishing is to maintain our excellence while meeting the goal of public access to research supported by federal funds. A Task Force on Open Access is working to communicate with policy makers on these issues.

In the process of being formed is a Task Force on the April Meeting with the goal of ensuring that our meetings are must-attend events. Of course we can make progress in some areas without a formal task force. For example, we reorganized the unit convocation, now called the APS Leadership Convocation, and used the event to enhance communication between unit leadership and APS governance. This article is based on the President's Report presented at the Leadership Convocation held at APS Headquarters in February 2013 in conjunction with a day on Capitol Hill.

Other important areas, which we will be examining in the future, include increasing our international engagement by better serving our international members, and looking at new ways to serve our community of industrial physicists.

APS is in good financial health with revenue and expenses nearly balanced at $46.9M. Most of our revenue stems from publications. Our publications are growing, and submissions keep increasing, necessitating a larger editorial operation. We are adding 18,000 sq. ft. of new space and refurbishing old space at the Editorial Offices on Long Island. Further, we initiated a high impact factor, open access, online journal *Physical Review X*. We have a very strong reviewer base and strong support for our journals from our members. In particular, more than two thirds of our authors are from outside of North America. More than half of our reviewers are overseas. We are completing the transition to an all-electronic set of journals with less than 15% of our journals delivered as printed copy. APS members have been extremely well served by APS journals for one hundred years. I urge you to support your journals through volunteer service and through papers submitted for publication.

APS Scientific meetings are critical to the communication of physics. The March 2012 meeting held in Boston had nearly 10,000 attendees. The scientific program included more than 100 invited sessions and 550 contributed sessions of which approximately 7000 papers were presented. The April 2012 Meeting held in Atlanta celebrated 100 years of Cosmic Ray Physics and had three special plenary sessions that complimented 75 invited and 100 contributed sessions. In addition, our Divisions held their annual meetings in Plasma Physics, Fluid Dynamics, Particles and Fields, Nuclear Physics, AMO Physics and Laser Science.

Starting with the 2011 April Meeting in Anaheim, APS began posting invited talks online. The idea originated in the Committee on International Affairs and was supported by then-APS-president Barry Barish. The experiment has been a resounding success. A survey following the 2011 April Meeting found that 97% of the respondents would find online talks useful and 95% believed that online APS presentations would enhance research or professional development of students and postdoctoral scholars.

Through the efforts of our Executive Officer, Kate Kirby, the Kavli Foundation has agreed to support special Kavli Symposia at our meetings. At the past two March meetings we have held Special Kavli Symposia on "Emergent Physics at the Mesoscale" (2012) and "Forefront Physics for Real World Problems" (2013). At the April meetings we have held Kavli Symposia on "100 years of Cosmic Ray Physics" (2012) and "Frontiers of Physics, from the Lab to the Cosmos" (2013).

The APS Prizes and Awards, about fifty in number, recognize outstanding achievements in research, education and public service. In addition, APS Fellows achieve the honor of being recognized by peers as having achieved distinction in physics. APS has now increased the visibility of the prizes and awards with a number of new features at the special sessions at the March and April meetings, and is taking additional steps to enhance the public recognition of these prizes and awards.

Communications is critical to the APS because of its global reach. We have continued to hold a series of Fellows meetings around the country during the past year and later this year we are headed to London to meet with and discuss APS issues with APS Fellows in the UK. In 2012 the Fellows meetings were held in Atlanta, Chapel Hill, Chicago and Northern California. The latter meeting involved fellows from UC Berkeley, Stanford, SLAC and LLNL. The meeting was hosted by LLNL and included a tour of the NIF Laser facility.

The APS has a longstanding program to recognize Historical Sites in Physics. Recent sites recognized were at Brookhaven, Dartmouth, University of Minnesota, Aspen Center for Physics, JILA, SLAC and the Carnegie Institution in Washington. It is a particularly pleasant responsibility of the President to attend these events and to recognize the impact each site has had on the history of physics.

The APS membership is representative of the international community. An element of the Strategic Plan is to increase the international engagement of the APS and to better serve international members. Last year witnessed trips by the APS President to Korea to celebrate the 60th anniversary of the Korean Physical Society, and in the late summer to Beijing to celebrate the 80th anniversary of the Chinese Physical Society (CPS), an event held at Tsinghua University. In September, the APS leadership visited China, Hong Kong and Taiwan to explore joint activities to engage with the international community. The CPS and the APS held their first joint scientific session at the CPS Annual Meeting held in Guangzhou, China. This trip was very successful with extended discussions with APS members held at six universities.

APS has a tradition of supporting public policy discussions where physics and science matter. APS works through its Office of Public Affairs in Washington to accomplish two tasks: to inform the public debate through the Panel on Public Affairs (POPA) and to advocate on issues that affect the physics community through the Physics Policy Committee (PPC). APS develops reports through POPA that often lead to legislation. Recent examples, available on the APS website, include *Technical Steps to Support Nuclear Downsizing* (2010), *Integrating Renewable Electricity on the Grid* (2010), and *Energy Critical Elements: Securing Materials for Critical Technologies* (2011). APS members also participate in Congressional Visits Day to inform representatives about issues critical to science and the health of the nation.

APS is active in its broader roles in physics education and in public outreach. The need for high school science teachers, especially those in physics and chemistry, is now well documented. The APS-led program PhysTEC has the goal to increase the number of highly qualified high school physics teachers. The PhysTEC program, supported by the NSF, has been particularly successful in establishing sites for training more physics teachers. This effort is particularly important in view of the growing number of high school students taking physics courses, a trend that is now also apparent at universities where Physics Department Chairs are scrambling to find additional space and resources to accommodate increasing enrollment in physics courses.

Our broader outreach to the public takes many forms. Two are gaining significant attention. We now have a physics heroine "Spectra" in a Comic Book. Spectra is a "laser superhero" who uses her powers to educate middle-school girls and boys about the wonders of physics. The second, "Science off the Sphere", is a series of videos in which astronaut Dr. Don Pettit does physics demos in microgravity on the International Space Station. Access to these programs is available at the PhysicsCentral website that saw almost three million page views in 2012, nearly double those of the year before.

It has been my privilege to serve the APS as a member of the Presidential Line and as President in 2012. Face-to-face meetings with APS unit leaders, committee chairs, fellows and members have confirmed that the core strength of the APS lies in its members and volunteer leaders. With your support, the APS is moving forward.

Robert L. Byer is the William R. Kenan, Jr. Professor of Applied Physics at Stanford, and Co-Director of the Stanford Photonics Research Center. He served as APS President in 2012.

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