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Top Physics News of 2011
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APS Membership Soars Above 50,000 Benchmark

The official count of APS members for 2012 has been tabulated and the Society has reached a new record enrollment of 50,055 members. This surpassed last year's record of 48,263 by 1,792 new members, an increase of about 3.7 percent. This is also the first time the membership has passed the 50,000 milestone.

Membership increased in nearly all areas that APS tracked. Categories that showed the biggest growth are student and junior memberships. In addition, the number of regular members grew for the first time in a decade. The number of members from outside of the United States also continued to show steady growth.

"I'm really excited that all the membership categories are growing. It shows the organization is doing a great job reaching out to its members," said Trish Lettieri, APS's Director of Membership.

Student and junior membership both grew about 10 percent over last year, accelerating a trend that started in 2006. Lettieri credits this increase in part to a refocused emphasis on promoting APS benefits to physicists at all stages of their careers as well as to retention efforts by APS staff. The increase in regular members partially stems from that trend, as existing junior members stayed on and became full members.

"APS has done a better job promoting our career activities and we've added business cards as a benefit for junior members at

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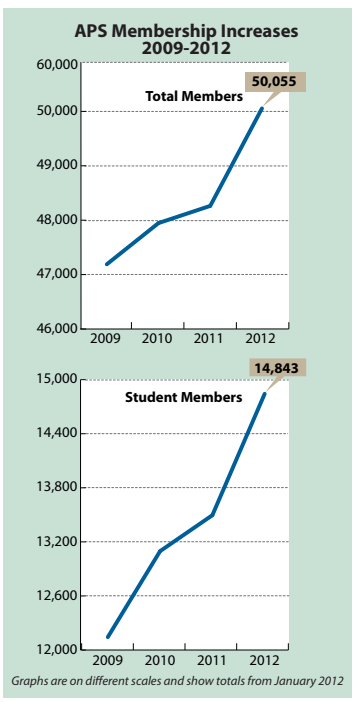

Graphs are on different scales and show totals from January 2012

Four Distinguished Scientists to Give Beller, Marshak Lectures

The recipients of the 2012 Beller and Marshak lectureships have been selected and will give their talks at this year's March and April meetings. The speakers were selected by the APS Committee on International Scientific Affairs (CISA), from nominations submitted by various APS units.

Terry Quinn from the Bureau International des Poids et Mesures in France and Roberta Sessoli from the University of Florence in Italy will be delivering the Beller lectures at the March Meeting in Boston, while Dong-Pil Min from Seoul National University in South Korea will deliver his Beller lecture at the April Meeting in Atlanta. Ömer Yavaş from Ankara University in Turkey will deliver the Marshak lecture at the March Meeting.

"The participation of invited speakers from abroad is an opportunity, in particular for students and young researchers, to hear about research carried out in other countries," said CISA member Maria Allegrini of the University of Pisa.

Each lectureship comes with up to $2,000 in funding to help the recipients travel to the March or April meeting. The meeting program and other printed meeting materials will highlight the

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Community Weighs Pros and Cons of Physics by Press Conference

By Michael Lucibella

Particle physics made headlines around the world in September with the announcement that researchers at the OPERA experiment recorded neutrinos traveling faster than the speed of light. Within the scientific community it sparked a heated debate not only about the veracity of the results, but also about when controversial scientific results should be released to the public. Voices from across the spectrum have spoken up, some supporting the research team's decision to release the information to the public, and others decrying it.

There has been sharp disagreement over whether or not the press coverage that followed left the public with an accurate picture of the situation. In an article penned for the *Los Angeles Times*, Lawrence Krauss of Arizona State University wrote that "the way [OPERA's result] was presented to the world is cause for concern. A dramatic claim from a distinguished laboratory that turns out to be false reinforces the notion that somehow science is not to be trusted, that one can dismiss theories one finds inconvenient."

Dario Autiero of the OPERA collaboration explains how they measured faster-than-light neutrinos.

In an interview, he expanded on his concerns over the announcement. He worried that internal scientific debates over technical matters would be misinterpreted by members of the public as scientists disagreeing over fundamental laws of nature.

"There are things that are ready for prime time and there are things that aren't," Krauss said. "We have to be very careful because the public doesn't know better."

Many scientists are highly skeptical of the OPERA results, and expect them to be explained away by some as yet unknown systematic error. At issue was whether the public at large understood the preliminary nature of the results, or if that was too much of a subtlety for news media looking for an easy headline.

"People are actually talking about sigmas and how things have to be checked and crosschecked," said Katie Yurkewicz, the Director of the Office of Communication at Fermilab. "It's nice to see some of that being covered in the media."

James Gillies, CERN's head of communication, said that he was generally happy with the way the press covered the story.

"I think that by and large the world got it right," Gillies said, "Our analysis of the coverage afterwards showed that as well."

Krauss however said that he felt that the news media hyped the story and focused on the controversial implication that faster than

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Companies Pioneer New Nuclear Designs

By Calla Cofield

Two relatively new nuclear companies, NuScale Power and TerraPower, are cooking up new reactor designs, and meeting new challenges along the way.

Modern light water reactors generate, on average, 1000 megawatts of energy. Medium reactors can dip down to 700 MW. Ideas for smaller reactors have always been around, but never made it past the drawing board, as they seemed reasonable only for small, isolated markets. But in the late 2000s, the cost of large nuclear power plants began to grow unwieldy. Even large buyers were forced to make drastic financial bets on new reactors. So around 2009, the market changed its mind about small reactors.

Paul Lorenzini is CEO of NuScale Power, which is aiming to have its first small modular reactor (SMR) up and running by 2020. Close on NuScale's heels is Babcock & Wilcox Modular Nuclear Energy LLC, with the mPower small reactor. Lorenzini says the two major factors in turning the market around were the need to build nuclear reactors without taking a major financial risk, and in turn demonstrating that small reactors could be built economically.

"And I am not bashful in saying that our entry into the market, followed by B&W," said Lorenzini, "were the two major events that triggered that shift."

NuScale formed in 2007, but it already had six years of R&D data to support its small reactor design. Lorenzini says the response to the design from all different branches

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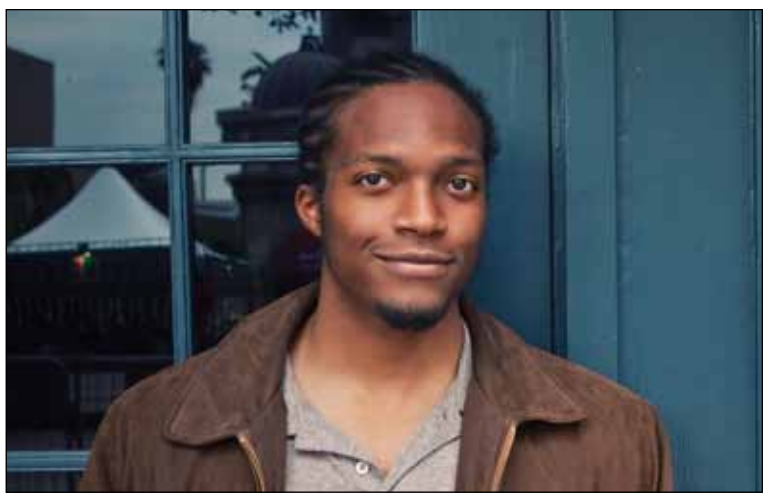
APS Honoree Brandon Turner Named Rhodes Scholar

By Bushraa Khatib

When Brandon Turner graduated from high school, his stepfather, Casey, used to jokingly call him a "renaissance man" because of his diverse interests within and outside of academia. He told Turner that the Rhodes scholarship was perfectly suited for such a person.

Now, poised to graduate from Wake Forest University in May with a bachelor's degree in biophysics and minors in chemistry and sociology, Turner is one of 32 Americans awarded the prestigious Rhodes scholarship for 2012.

Selected from a pool of 830 candidates, scholars anticipate beginning their studies at Oxford in October 2012. The award covers all expenses for two to four years of study. In a press release, American Secretary of the Rhodes Trust Elliot Gerson called the Rhodes Scholarships "arguably the most famous academic award available to American college graduates."



Brandon Turner

"When I heard the announcement, I was lost for words," Turner said. "My stepdad is over the moon about it."

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Members in the Media

"Well, there's thousands of people involved in the program, hundreds of professional scientists at his level… killing one of them is not going to have a big impact on the program… There's a lot of Iranians who can step up to the plate in order to help improve or fulfill Iranian needs for its equipment. Now, a lot of those efforts are being stopped. And we don't know how good this guy was. You know, he was a brilliant, in a sense, smuggler. His loss may be significant. If he was average, he can easily be replaced."

***David Albright**, Institute for Science & International Security, on the recent assassination of an Iranian physicist,* PBS's Newshour*, January 12, 2012.*

"Magnetic materials are extremely useful and strategically important to many major economies, but there aren't that many of them… To make a brand new material is very intriguing and scientifically very important."

***Shan X. Wang**, Stanford University, on a new 12-atom nanomaterial used to store digital information,* The New York Times*, January 12, 2012.*

"If you do this with two atoms, then they behave more like a quantum mechanical object," Dr. Heinrich said. "This is why science is interested in this work more than the technology."

***Andreas Heinrich**, IBM, on a new 12-atom nanomaterial used to store digital information,* The New York Times*, January 12, 2012.*

"El Gordo is at a distance that corresponds to a distance of about seven billion light years–we're looking at it at a time that the Universe was only half as old as it is now, when structure was forming at a different rate… By looking at and understanding the properties of El Gordo, we're able to understand the time evolution of the structure formation of the Universe."

***Jack Hughes**, Rutgers University, on discovering the largest galaxy cluster ever seen, dubbed El Gordo,* BBC News*, January 10, 2012.*

"Because it would be electrically powered by ASRGs (Advanced Stirling Radioisotope Generators), we could theoretically go forever on that power…The nominal mission is a year, but we don't really have an upper limit. We could maintain flight indefinitely."

***Jason Barnes**, University of Idaho, on his idea to send a flying drone to Saturn's moon Titan,* MSNBC.com*, January, 10, 2012.*

"My goal is not to destroy religion, though in fact that would be an interesting side effect… It's not any more my goal than it was Charles Darwin's goal with his book [*On the Origin of Species*]. My goal is to use the hook of this fascinating question, which everyone asks, to motivate people to learn about the real universe."

***Lawrence Krauss**, Arizona State University, discussing his new book which poses the question "Why is there something rather than nothing?,"* MSNBC.com*, January 9, 2012.*

"It is significant because it opens up a whole new realm to ideas involving invisibility."

***Martin McCall**, Imperial College London, on Cornell research into a "time cloak,"* The Associated Press*, January 9, 2012.*

"I think it's a big step forward… It's another example of the beauty of 'transformational optics,' which is behind all these ideas."

***Vladimir M. Shalaev,** Purdue, on Cornell research into a "time cloak,"* The Washington Post*, January 4, 2012.*

"I play around with Mathematica a lot… We were eating pasta, and I was wondering how easy these shapes would be recreated."

***Sander Huisman**, University of Twente, on generating mathematical equations for pasta shapes,* The New York Times*, January 9, 2012.*

"In recent years, people have found emergent behaviors that look very much like properties that seem fundamental. For example, the motion of electrons in a single layer of carbon atoms looks in many ways like special relativity. So, before the world ends, I'd like to know, deep down, is Nature reductionist or emergent?"

***Doug Natelson**, Rice University, upon being asked what one thing would he want to know if the world were about to end,* The Houston Chronicle*, January 7, 2012.*

"First, you have to understand the size and scope of this problem. The debris field from this Japanese

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This Month in Physics History

February 6, 1957: MIT introduces the first cryotron

It is difficult to imagine today, but computers used to be built with bulky vacuum tubes and often filled entire rooms. One of the lesser-known devices invented to help scale them down to size was the cryotron, invented by an MIT graduate student named Dudley Allen Buck. The cryotron was the first practical application of superconductivity, the ability of certain metals to conduct electrical current with no resistance at very low temperatures.

Scientists began experimenting with materials at low temperatures, and the impact on electrical properties, in the 19th century, achieving both liquid and solid states of gases. In 1911, a Dutch physicist named Heike Kamerlingh Onnes successfully used liquid helium to cool solid mercury down to 4.19 K, at which point, he noted, the material's electrical resistivity abruptly disappeared. This was the first observation of superconductivity.

Dudley Allen Buck

By the mid-1950s, in the wake of the invention of the transistor, researchers were looking for ways to integrate thousands of transistors on a single circuit, thereby creating computers that would be thousands of times faster and much smaller than the old vacuum tube technology previously in use. One of the challenges was heat: packing all those components so close together led to increased electrical resistance. Superconductors were eyed as promising candidates because they could conduct with no resistance. And one of those researchers eying such materials was Dudley Allen Buck.

Born in San Francisco in 1927, Buck grew up in Santa Barbara and developed a passion for amateur radio, earning a commercial radio operator license at just 16. He worked part-time at a local radio station before heading off to the University of Washington to study electrical engineering, radio, and radar theory. After graduating in 1948, he served two years in the US Navy, working on classified cryptography research in Washington DC, in a building that housed 121 "bombe" computers used to break Japanese and German ciphers during World War II. He was even sent on a top-secret mission to Berlin that remains classified to this day.

After his return from Berlin, Buck began his graduate studies at the Massachusetts Institute of Technology. His first assignment, working with Ken Olsen, was to develop ferrite materials for a magnetic core memory in a prototype computer called the Whirlwind. This became the basis of his master's thesis, demonstrating that ferroelectric materials could be used for digital data storage and switching–the earliest demonstration of ferroelectric memory (FeRAM). He also showed that these materials made excellent voltage controlled switches. He earned his MS in 1952.

Buck's other work included a new method of nondestructive sensing of magnetic materials. One challenge with magnetic core memory was that as one read the data, the memory would be erased and had to be re-written back into magnetic storage– a time-consuming process. Buck's nondestructive method eliminated that extra step, since the data could be read without erasing the memory. He also invented content addressable memory, a means of storing and retrieving data with no need to know the precise location of that data, which also reduced processing time.

On top of all this other research, Buck was intrigued by the possibility of making computer circuits that didn't require vacuum tubes or a transistor, which had only recently been invented. He realized he could make a logic circuit using just wire, diodes and magnetic cores, like those used in early cryptographic communication systems. Furthermore, if he could exploit the ability of magnetic fields to disrupt superconductivity–usually seen as a drawback–it would be possible to make a switch for use on integrated computer chips.

Buck sketched out his concept for a cryotron in his research notebook in December 1953, and began building practical devices within two years, using two superconducting wires made out of niobium and tantalum, respectively, each with a different critical temperature. He wrapped the higher T_c niobium wire around the lower-T_c tantalum wire , and made sure they were electrically isolated from each other.

Then Buck immersed the device in liquid helium, making them superconducting. The tantalum wire could conduct large amounts of electrical current in its superconducting state. But when current passed through the niobium coil, it produced a magnetic field to switch off the superconductivity of the tantalum wire. The tantalum served as a "gate," while the coiled niobium served as a "control."

The breakthrough generated a great deal of excitement for the prospect of miniaturization of computer components, despite the need for liquid helium to maintain the superconducting state. *Life Magazine* featured a full-page photograph of Buck and his cryotron in one hand, and the outdated vacuum tube in the other, in 1957, and the Institute of Radio Engineers gave him their award for engineers under the age of 30 that same year.

The smaller he could make the cryotron systems, the greater the processing speeds that could be attained, so Buck's research in the late 1950s focused on ways to shrink the components further. With his colleague, Kenneth Shoulders, he started making thin-film cryotron integrated circuits (using lead and tin thin films) in the laboratory, incorporating insulating oxide layers. He also improved the mechanical strength of the system through the development of electron beam lithography techniques that reduced the need for chemicals when

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

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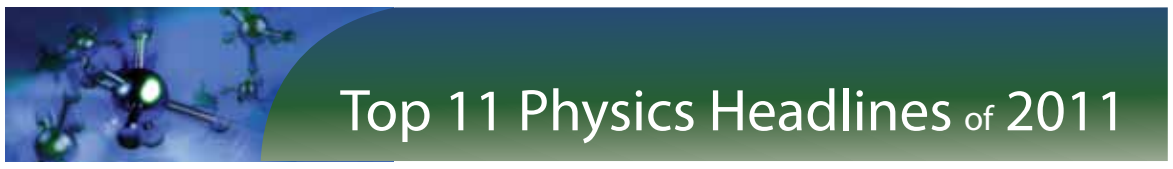

APS News Picks 2011's Top 11 Physics Headlines

At the turn of the year, *APS News* staff looked back at the news about physics and physicists that made headlines in 2011. These top eleven selections for 2011 are not necessarily the stories that will prove the most significant or long-lasting, but they are a fair sample of what the media reported, and the public digested, over the previous twelve months.

Closing in on Habitable Planets

Astronomers using the Kepler telescope are homing in on discovering a true Earth-like, potentially habitable planet outside our solar system. In January, news broke that it had discovered its first rocky planet, one just 1.4 times the size of Earth, but twenty times closer to its star than Mercury is to the Sun. In February, the team said that out of Kepler's more than 2,300 planet candidates, it found 54 signals that indicated a planets orbiting their parent stars in the zone where liquid water can exist. The first habitable zone planet was confirmed in December with the announcement of a planet 2.4 times the radius of Earth orbiting a star 600 light-years away. Just a few days later, NASA revealed its discovery of the smallest rocky planets yet, the smallest being 87 percent the size of Earth, orbiting a star 1,000 light years away.

The Japanese Tsunami and Fukushima

The magnitude 9.0 Japanese earthquake and subsequent tsunami and nuclear meltdown were terrible tragedies of an almost incomprehensible scale. The coinciding disasters prompted a mass of news coverage that intimately tied together science and public safety. As the catastrophe at the Fukushima Daiichi power plant continued to unfold over weeks, then months, news about the dangers of radiation exposure, containment and cleanup grabbed headlines around the world. Even months later, as scientists continued to sift through data from the disaster, new insights into what happened have been gleaned. In December, researchers from NASA and Ohio State University announced that the resulting

Helicopter view of Sendai, Japan after 2011 tsunami which shows damage in the Tōhoku region with black smoke coming from the Nippon Oil Sendai oil refinery

tsunami was so devastating in part because two tsunami waves merged offshore to form a single massive ocean surge.

Quantum Computing

Researchers working towards building a workable quantum computer hit a major milestone in 2011. In March, a team at University of California Santa Barbara announced that it had built a chip that holds four qubits capable of doing basic calculations. In September, the same team announced that it had improved upon the design and built a chip that incorporates Von Neumann architecture similar to that found in home computers. The design utilizes a tiny central processing unit hooked up to rudimentary memory that holds programming instructions and data. The chips are about as elementary as computing can get, and there remains a lot of work ahead, but it is a major early step on the road from quantum qubits to viable processors.

Higgs Boson

The hunt for the Higgs boson captured headlines throughout the year. Every few months scientists seemed closer than ever to pinning down proof of the elusive particle, only to have it dodge discovery again and again. The first wave of news came in the beginning of April when the CDF collaboration at the Tevatron at Fermilab made headlines with the announcement of an unusual "bump" in their data that could indicate a new particle. Ultimately the bump turned out to be a statistical fluke that disappeared with more data. Hot on its the heels came a leaked memo seemingly indicating that an announcement was imminent from the ATLAS detector at the LHC that the boson was spotted with a mass around 115 GeV. An official denial from CERN put that rumor to rest. The airwaves went quiet for a few months, until mid-December when an announcement through a public seminar revealed that physicists at ATLAS and CMS both saw enhancements in their data at around 125 GeV, but not nearly at the levels of significance needed to be declared a discovery. Thus, the search continues.

Heaviest Antimatter

Researchers at the Relativistic Heavy Ion Collider at Brookhaven National Laboratory announced in April that they had synthesized the heaviest antimatter ever produced, a handful of antihelium-4 nuclei. They produced the anti-alpha particles by smashing gold atoms together nearly a billion times, producing the signature of antihelium a total of eighteen times. The scientists at the STAR collaboration, responsible for the creation of the antihelium, say that this will likely stand as the record for the heaviest antimatter for the foreseeable future, as the production of heavier, stable nuclei are far rarer and beyond the capacity of any current accelerator technology.

Living Laser

Scientists at the Harvard Medical School and Massachusetts Gen-

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2011 in Review: Policy and Budget Highlights from *FYI*

The following are reprinted from FYI, *t*he American Institute of Physics Bulletin of Science Policy News*, http://aip.org/fyi/.*

January

President Barack Obama signs into law a reauthorization of the America COMPETES Act. OSTP Director John Holdren issues a memorandum on scientific integrity. NASA warns of inadequate funding and unattainable schedule for Space Launch System and Crew Vehicle.

February

A NASA safety panel expresses concern about the human spaceflight and exploration program. House Republicans put forth a budget plan that includes significant cuts in funding for the DOE Office of Science and the National Institute of Standards and Technology. The President's FY 2012 budget request keeps funding for NSF, the DOE Office of Science, and NIST research programs on a doubling track. Corporations, associations, and universities warn of "devastating impact" of funding cuts to S&T programs in House-passed budget bill.

March

Appropriations hearings begin, with Members expressing support for S&T agencies and doubt about Administration's intentions for NASA.

April

Republican and Democratic appropriators fiercely criticize Administration's decision to cancel the development of the Yucca Mountain nuclear waste repository. Congress completes work on FY 2011 appropriations legislation, about six months after the new fiscal year started. House passes a FY 2012 budget plan that would cut science funding to the 2008 level. Key Senate Democratic appropriator warns NASA officials that appropriators will not support projects with cost overruns.

May

House and Senate authorizers express skepticism about Administration's human spaceflight plans. House appropriators express strong support for federal science funding, but severely criticize Administration's interpretation of a directive prohibiting interactions by OSTP and NASA with China. Federal Reserve Board Chairman Ben Bernanke highlights the government's role in promoting research and development in a keynote address. Sixty-one representatives sign a letter to House appropriators expressing their "strong support for robust and sustained funding" for the DOE Office of Science. A National Academy of Science committee declares "Climate change is occurring, is very likely caused by human activities, and poses significant risks for a broad range of human and natural systems."

June

House appropriators start approval of FY 2012 funding bills. "U.S. Department of Energy Strategic Plan" identifies as one of its four goals "Maintain a vibrant U.S. effort in science and engineering as a cornerstone of our economic prosperity with clear leadership in strategic areas." FDA and EPA announce plans to review nanotechnology applications. National Science Board requests comments on draft NSF merit review criteria.

July

House appropriators terminate FY 2012 funding for James Webb Space Telescope. Government Accountability Office faults Department of Energy about the helium-3 stockpile shortage. House re-

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light travel undermines the theory of special relativity.

"For me, if a story leads the public to follow-up, and the stories that can be written follow-up on sound science, it's a good thing. If instead it leads the public to totally misinterpret the science, than that's a bad thing," Krauss said. "What is the message the public is going to get?"

Still others have taken a more carefully nuanced view.

"Like anything else there was press that was responsible, carefully noting the caveats, and there was press that was not as responsible," said Robert Garisto, editor of *Physical Review Letters*.

What role these news reports have on the general public's overall perception of science is at the core of many of these debates. A big concern is whether members of the general public see a news item about a scientific discovery seemingly overturning long-established theories, and start to lose faith in the authority of scientific results.

"People get the impression that science is just a series of fads," Krauss said.

On the flip side is the opinion that the public is interested in the process of science, and has a right to know how it works. Announcements like OPERA's have been seen as a way for people to learn about what happens within large scientific collaborations.

"I don't see why we can't tell the public when we're making progress but not there yet," said Sean Carroll of Caltech. "More information is more honest. The public can get a better idea of how science actually works."

These kinds of debates are likely to intensify in the future as the public continues to get a more unfiltered view of the internal workings of science. The internet has changed the paradigm of how and when news is released and through what channels. Information about big discoveries, especially at large collaborations, is nearly impossible to keep out of public view for long. In many fields of physics, including particle physics, it is now standard practice for the preprint of an upcoming paper to be posted to the online website arXiv.org, where it is freely accessible by anyone, including the press.

"The world, the blogosphere, the press was talking about this before CERN put out any press release," Gillies said.

In addition, huge research teams like OPERA or the ATLAS and CMS collaborations are made up of scientists from hundreds of institutions. Coordinating what information is released and when can be difficult.

"These collaborations have thousands of people, all of whom have access to the internet and can tell people about findings," Yurkewicz said.

Leaks are not uncommon, and can quickly spiral out of control. In April, an internal memo from the ATLAS collaboration about a supposed detection of the Higgs boson was posted to Peter Woit's blog "Not Even Wrong." Over just a few days, rumors circulated around the world until CERN put out an official statement saying that the memo was not a definitive statement of any official results.

Preprints, leaks and rumors like these have shaped how public information officers deal with potential news coming out of labs and experiments in the age of the internet. Press officers say they have to try to be the first to release information in order to have their voices heard and stay ahead of the rumors.

"I think it's more confusing for the public that results are being made public anyway, being disseminated by people who are not part of the collaboration," Yurkewicz said.

Such was the case with the OPERA results. They were presented not at a true press conference per se, but an open seminar showing results which garnered much press attention. In conjunction with the seminar, CERN put out its own press release, which featured caveats about the results including, "independent measurements are needed before the effect can either be refuted or firmly established. This is why the OPERA collaboration has decided to open the result to broader scrutiny."

Even before the press release and seminar, information about the findings started appearing on the internet and in the popular press. Postings by the scientists on the internet and interviews given to the news media prompted CERN to put together a press release about the findings. Gillies said that in the days before December's seminar that presented "tantalizing hints" of the Higgs boson, news of the findings likewise started to trickle out.

"In these two cases we've been trying to tone down what has been said about them already," Gillies said. "We're not driving this conversation, we're joining it."

SCHOLAR continued from page 1

This isn't Turner's first time receiving recognition for academic success. He received the 2010-2011 APS Scholarship for Minority Undergraduate Physics Majors, which provides funding and mentoring to underrepresented minorities pursuing degrees in physics. Past scholars have gone on to earn PhDs in physics, work as university faculty members, research scientists, and high school physics teachers. Turner also attends Wake Forest on a full, merit-based Reynolds scholarship.

Turner hadn't always planned on majoring in physics. When he was younger, he thought that he would become a biologist. Everything changed when he took and fell in love with AP Physics as a senior in high school. He liked that physics combined mathematical rigor with the ability to explain the world–something that he appreciated and enjoyed about other sciences.

"I was really excited to find out, in college, that there is actually a great variety of ways to combine my interest in biology and physics," he said. Jacquelyn Fetrow's lab at Wake Forest presented an ideal combination of his two interests, and Turner has worked on various computational biophysics and bioinformatics projects there since his freshman year.

Fetrow was very happy to hear that Turner was named a Rhodes scholar. She calls Turner a smart, hardworking student who very much deserves the honor. "His contributions to my research and to the lab group rival those of graduate students," Fetrow said.

Fetrow's research group aims to identify or strengthen the connection between the structure of a protein's active site and its function. "The more success we have with this will allow us to take any protein, analyze its structure, and make claims about its function," Turner said. Since numerous medications deal with binding to the active site, Turner's work could potentially have applications in reverse-engineering drugs or determining their ideal protein components.

His classes and lab work in college helped Turner develop a physicists' approach to problem-solving that he finds applicable to other areas. "You can work out a lot beforehand if you picture a problem in your head and extrapolate from that," he said.

Though Turner was aware of the Rhodes Scholarship since graduating high school, he dismissed the idea while in college, believing he wasn't competitive enough. Tom Phillips, Director of the Wake Forest Scholars Program, approached Turner during his junior year and encouraged him to apply.

Turner will head to DC in September for a farewell party of sorts, where this year's scholars will leave for Oxford together. He looks forward to exploring a range of possibilities for his next two years abroad. He plans to try a Masters in evidence-based social intervention for a year, and if that doesn't suit his tastes, to continue on with a one-year global health science program. Classes and summer research won't leave Turner with too much free time to return to the US. Instead, his family anticipates seizing the opportunity to visit him–and Europe–in the near future.

Beyond the Rhodes Scholarship, Turner sees medical school on the horizon, perhaps with a residency in radiation oncology since the specialty can be physics-oriented. He dreams of a way to tie his myriad interests–biophysics, sociology, and social intervention, among others–into a cohesive set of activities.

Turner said that reading about the accomplishments of other Rhodes scholars blows him away, and that it's an honor to be included in the group of current and past scholars. "I look at this as a great opportunity. It doesn't say much about me yet. It says a lot about what I can do," he said. "I'm looking forward to this opportunity to challenge myself and grow in the process."

Letters

APS encourages interested readers to submit letters to APS News ***by emailing letters@aps.org.***

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our meetings," Lettieri said. "It's starting to pay off in growth of both junior membership and the regular members."

The number of international members showed healthy growth as well. All together 10,989 members live abroad, up 640 from last year or about 6 percent. In total, international members make up about 22 percent of APS membership. Amy Flatten, APS Director of International Affairs, credited the increase to more efforts to reach out to physicists internationally.

"We've been trying to expand our international engagement, and through our International Friends network, we've provided activity grants to encourage APS activities in the local communities of our APS members," Flatten said. She noted that the Society has also recently added more international members to its Council and has been developing more programs and other ways to serve international members.

Other demographics of the membership held constant or showed very slight growth. Senior members also posted an increase of just less than 1 percent, while lifetime members all posted increases of 1.6 percent over last year.

These membership counts are held every year to assess the health of the Society. The membership numbers are important also in enhancing the Society's grass-roots lobbying efforts when advocating for improvements in science policy and increased research funding.

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tragedy is the size of the state of California."

Michio Kaku*, City College of New York, on debris that washed up on the west coast of the United States, purportedly left over from the Japanese tsunami,* CNN.com*, December 29, 2011.*

"Not only is the physics of ice crystals particularly rich, but experiments are pretty cheap and easy. As you can imagine, ice doesn't have a lot of safety issues. For almost anything else you can think of growing, experiments are confounded by safety issues. Just about any chemical has hazards, so you have to spend a lot of money and time worrying about that. I just love the ability to be able to pour your experiment down the drain or just evaporate it into the air without any thought of safety."

Kenneth Libbrecht*, Caltech, on his work researching snowflakes,* The Los Angeles Times*, December 23, 2011.*

DESIGN continued from page 1

of the industry was overwhelmingly positive. The cost of small reactors alleviated the growing cost of large reactors, while also offering scalability, that is, the option to add more modules to one facility if the energy demands grew.

The NuScale design is based on light water reactor designs, but the NuScale reactor units are only 45 megawatts. The reactor is scalable, and a single facility can host between one and twelve units. The reactor is cooled by natural circulation, so there are no pumps or pipes, which can potentially fail. The entire plant, including the containment, sits in a pool of water, so that no systems need to be running to remove heat. Lorenzini describes the technology as revolutionary, but also emphasizes its simplicity.

Work on the NuScale design began in 2000, and emerged out of a collaborative project led by Idaho National Environment & Engineering Laboratory (INEEL) with support from Oregon State University (OSU), and funded by the U.S. Department of Energy. The project ended in 2003, but OSU continued to support R&D on the reactor design. By the time the company was officially formed in 2007, the organization had six years of strong R&D data to support the design.

It is possible that NuScale could have sold the design to a larger nuclear company, but each meeting with a potential buyer also revealed NuScale's design to a potential competitor. Eventually, the decision was made to start an independent company.

"We believed right from the beginning that you couldn't sustain yourself in this business without establishing both market credibility and a financial balance sheet," said Lorenzini. "The buyers of these plants want to know that the seller has got the capability to deliver and is going to be there. So you've got to have people behind you who are going do that."

In 2011, Fluor Corporation agreed to invest in excess of $30 million in NuScale, which gives the company the financial security it needs to attract future purchasers. The next step will be gaining approval from the U.S Nuclear Regulatory Commission (NRC) to start construction. The company plans to submit its application to the NRC this year.

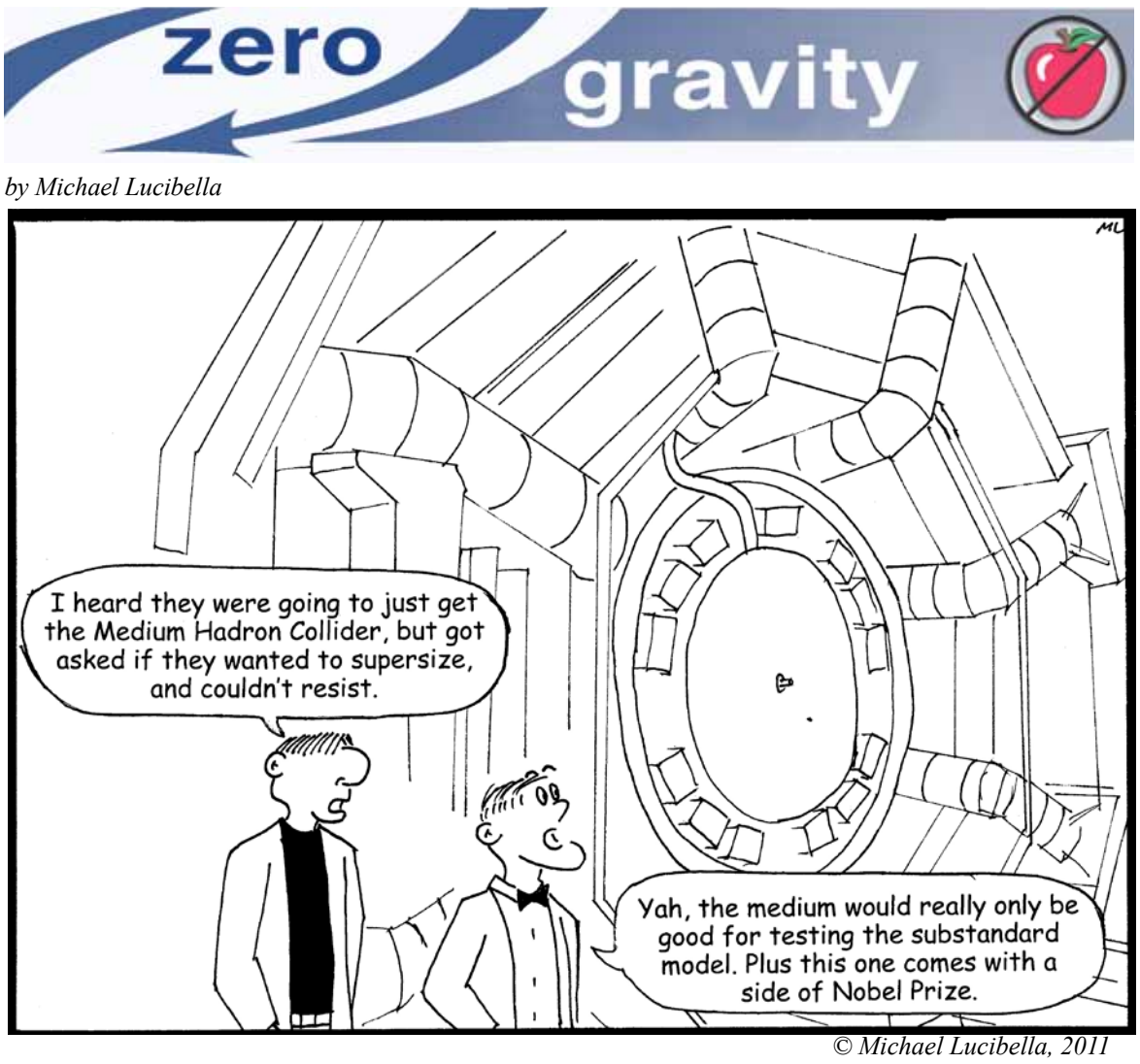
NuScale has a major advantage in its pursuit of approval from the NRC, because its design is based on current light water reactors. This may not be the case for companies working with more innovative designs, such as the traveling wave reactor (TWR) design by TerraPower.

The TWR reactor requires a small amount of enriched uranium to start the fission process, but the majority of its fuel is natural or depleted uranium 238: the most common isotope of uranium found in nature, and a waste product from the production of LWR fuel. Inside the TWR reactor, uranium 238, which is not fissile and cannot support a chain reaction by itself, turns into plutonium 239 which is also used as fuel. This would mitigate the threat of nuclear proliferation because the plutonium 239 is never separated from the uranium, and is used immediately. The TWR reactor can operate on one fuel supply for sixty or more years.

A major hurdle for a new and innovative nuclear technology is proving that it is safe. That's the responsibility of the NRC. The majority of designs that come through the NRC are based on light water reactor technology, and in those cases "the staff here at the NRC expects it to take about 5 years to go through all the work necessary to show that any given design is acceptable for use in the United States," said Scott Burnell, a spokesperson for the NRC. Burnell says the Commission is working to expand its knowledge base to keep up with more innovative designs on the horizon. But right now, the NRC may not have the expertise to evaluate all new technologies in the desired time frame.

"We have had conversations with vendors where we've said, 'you're going to need to do a lot of work to beef up the supporting case for this particular technology'," said Burnell. "It's not enough to simply run a computer model if you're going to offer some innovative feature. To some extent the NRC is going to have to see real-world empirical data to say that that particular new feature is going to do what you say it's going to do."

This appears to be the case with TerraPower, which, without the ability to build a test reactor, can't gather enough data to satisfy the NRC in the time frame they'd like. So the company wants to gain approval to build a reactor in a country that has the expertise to approve the TWR design. TerraPower will then return to the US with data to demonstrate the safety of the design.



Education Corner

A column on educational programs and publications

PhysTEC publishes book on teacher preparation. APS and AAPT recently published a compendium of articles on the preparation of physics and physical-science teachers. This book includes new reports reflecting cutting-edge research and practice, as well as reprints of previously published seminal papers. The book has three primary objectives: (1) to provide a resource for physics departments and faculty members who wish to develop and/or expand programs for pre-service or in-service teachers; (2) to encourage scholarly documentation of ongoing research and practice, in a form accessible to a broad audience of physicists; (3) to encourage recognition of teacher preparation as a scholarly endeavor appropriate for faculty in physics departments. The book is freely available online, and printed copies of the book will be available soon.

To view the electronic version of the book, please visit: http://www.ptec.org/webdocs/PtecBook.cfm

Career Workshop with Peter Fiske at APS March Meeting

Are you or someone you know a physicist who wants to take his or her job search to the next level? APS is proud to offer a FREE interactive workshop at the APS March Meeting with award-winning author and experienced science career coach Peter Fiske. Topics will include career planning, developing a compelling CV, and more! Space is limited, so anyone interested should RSVP to Crystal Bailey (bailey@aps.org)
www.aps.org/meetings/march/events/workshops/careers.cfm

Career and Diversity Events at the APS March Meeting

A variety of career and diversity events will be offered at the upcoming APS March Meeting in Boston.

- APS Job Expo, February 27-29
- COM/CSWP Diversity Networking Reception, February 28
- CSWP/FIAP Networking Luncheon, February 28
- Lunch with the Experts (for Graduate Students), February 28

Visit the March Meeting's Events & Activities site for times and locations: www.aps.org/meetings/march/events/

Special Undergraduate Events at APS March and April Meetings

APS and SPS are teaming up to bring a number of special events just for undergraduates. Come to Future of Physics Days 2012 to learn more about graduate programs, physics careers, cutting-edge research, and more! For more information on FPD 2012 events, visit: www.aps.org/programs/education/undergrad/students/futurephysics/fpd2012/

CSWP announces first recipients of the Woman Physicist of the Month Award.

The Committee on the Status of Women in Physics (CSWP) began a new program in 2012 to highlight exceptional female physicists. The Committee is pleased to announce Dr. Helen Caines of Yale University and Dr. Elizabeth Simmons of Michigan State University as the first two recipients of the award. Read about each recipient at: www.aps.org/programs/women/scholarships/womanmonth/2012.cfm

Nominations for the CSWP Woman Physicist of the Month are accepted on a rolling basis. For more information on the program and/or to submit a nomination, please visit: www.aps.org/programs/women/scholarships/womanmonth/

M. Hildred Blewett Fellowship

APS is now accepting applications for the M. Hildred Blewett Fellowship. This award is intended to enable women to resume physics research careers after an interruption. The deadline to apply is June 1, 2012. For more information and/or to apply, please visit: www.aps.org/programs/women/scholarships/blewett/

Laying on of Hands

Photo by Michael Lucibella/APS

On January 13, 26 physicists from around the country gathered at APS headquarters in College Park to sort more than 1000 abstracts for the April Meeting, which will take place this year from March 31 to April 3 in Atlanta, Georgia. In the photo, Bernard Kelly of NASA Goddard conducts the ritual blessing of the manuscripts while Vicky Kalogera of Northwestern University (left) and Manuela Campanelli of Rochester Institute of Technology (right) read abstracts.

Foundation Marks Its Centennial at APS March Meeting

The Research Corporation for Scientific Advancement (RCSA), the oldest foundation dedicated purely towards funding scientific research, is marking the centennial of its founding at a reception at this year's APS March Meeting. As part of the reception, Eric Mazur of Harvard will honor David Hall of Amherst College, recognizing him as the 2012 recipient of the APS Prize for a Faculty Member for Research in an Undergraduate Institution, a prize that is sponsored by RCSA.

RCSA is the second oldest private foundation in the US, after the Carnegie Foundation. Historically it has sponsored cutting-edge research, often with uncertain outcomes but with the potential to have a big impact on society. It was an early backer of Ernest O. Lawrence's development of the cyclotron, and of Robert Goddard's liquid-fueled rockets. Other technologies that have come out of basic research funded by RCSA grants include magnetic resonance imaging, nuclear medicine and lasers.

Over the years, the organization has supported more than 18,000 scientists, 40 of whom have gone on to win Nobel prizes including ten in physics.

A former physical chemist at the University of California, Berkeley, Frederick Gardner Cottrell established Research Corporation in 1912 using proceeds from his invention, the electrostatic precipitator, which helps to pull air pollutants out of smokestacks.

APS and RCSA have worked together to increase the participation of underrepresented groups in physics. The Corporation provided the seed money for the APS Edward A. Bouchet award, which each year recognizes the contributions of a distinguished minority physicist. In addition, the Corporation helped establish and continues to sponsor the Prize for a Faculty Member for Research in an Undergraduate Institution.

"RCSA and APS both believe in providing effective programs for the support and advancement of science," said RCSA president and CEO James M. Gentile in a press statement. "We both encourage collaboration–among researchers and among scientific organizations–and we are both focused on improving science education and creating new and productive communities of scientists."

RCSA has carved out a niche for itself as one of the premier sources of grants for students and researchers early in their career.

"Their idea is to help young scientists get started," said Judy Franz, who served as APS Executive Officer from 1994 to 2009. "A lot of people started with their first grants from Research Corporation."

She was among them. Franz got her research career started with a grant from Research Corporation in the late 1960s.

"It was wonderful because it was a way to get your first grant," Franz said. "It wasn't a huge grant but it was important to get it because at that point I was just starting, and I didn't have any other funding."

RCSA will hold its centennial event at the March Meeting in room 152 of the Boston Convention Center on February 28, from 5:30 to 7:30 pm.

INSIDE THE BELTWAY

The Circus Is Coming

by Michael S. Lubell, APS Director of Public Affairs

When the founders of our country dreamed up the concept of checks and balances, they didn't intend it to mean putting a police boot on the legislative vehicle. But last year, that's what happened.

By every measure, the first session of the 112th Congress was by far the least productive in the 60 years that such record-keeping has existed. The collective activity of our elected representatives yielded passage of only 68 substantive bill–compared to well over 100 in a typical year–and of those, half merely extended existing laws.

The second session is not likely to yield more fecund fruit, especially with members up for re-election already running scared. And in 2012, the power sharing enshrined in the Constitution is liable to look more like a four-ring circus than a tripartite government.

But before we look forward, where a deck of tarot cards might be as accurate as any Inside the Beltway forecast, let's take a look back, where we have some facts to guide us.

For science, 2011 ended with a legislative Christmas Eve gift, hardly imaginable at the beginning of the year. The draconian funding cuts threatened in January by a Republican House held hostage by a boisterous band of newly elected Tea Partisans vaporized during a series of near-death experiences for the federal bureaucracy.

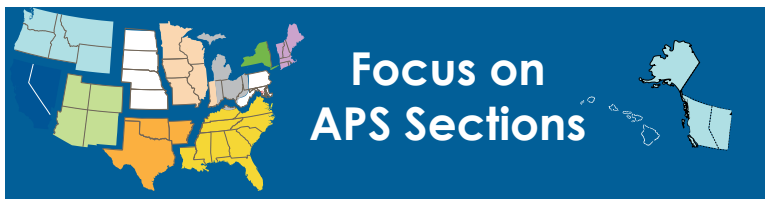
Each time money was on the congressional gaming table, Speaker John Boehner's grumpy GOP minions tried to rake it back into the House coffers, warning they would shut the government down if they didn't get their way.

They marched to the precipice twice during the struggle over the fiscal year 2011 Continuing Resolution needed to fund the government through September of last year. They went to the brink again over extension of the debt limit, and they nearly drove the government over the cliff during consideration of the fiscal year 2012 spending bills.

Each time, they pulled back, and although they fell far short of their fiscal austerity goals, they succeeded in wringing substantial concessions from Democrats on discretionary spending and thwarting White House efforts to increase federal revenues by raising taxes on the wealthy.

The bitter wrangling over the

CIRCUS continued on page 7



Four Corners Section Embodies Western Spirit

By Brian Jacobsmeyer

After seeing milk production from his cows dwindle, a farmer seeks out a theoretical physicist at the local university for help. Weeks pass, and the physicist finally comes back with a computer model that should help the farmer boost milk production. "I have your solution," says the physicist, "but it only works for spherical cows in a vacuum."

Add some western flair to this old physics joke, and the result is the APS Four Corners Section Spherical Cowboy Award: a student-awarded prize for the best non-student talk at the section's annual meeting. The joke alludes to the apparent disconnect between theoretical physics and practical applications, and the gimmicky prizes–such as a cowboy hat or stuffed spherical cow–reflect the joke's punch line. Unlike the physicist in the joke, the awardee is recognized for research that has had an impact on the students' lives.

"Our section is unique because there are so many national labs," said Four Corners Chair-Elect John Cumalat of the University of Colorado-Boulder. "Many lab scientists don't see students often, so our meeting is a good opportunity for them to interact."

With three national Department of Energy laboratories and several major universities, the section features an eclectic mix of researchers, professors and students. Since the first meeting in 1998, the section has become one of the fastest growing in APS. Total membership for the section rose from 1,500 to 1,700 over the past two years. And student membership has grown even faster–over the same period student members jumped from 377 to 452, a 20 percent increase.

"While we encourage all members to present at the annual meeting, it has evolved into a very student-friendly atmosphere," said Jean-Francois Van Huele from Brigham Young University-Provo, the section's treasurer and one of the first meeting's attendees.

Aside from deciding the Spherical Cowboy Award winner, students frequently present their own research at the section's meeting. Attendees vote for four separate student awards covering posters and papers for both graduate and undergraduate students.

While presenting research can be nerve-wracking, one of the biggest challenges for some students can simply be making it to the meeting due to the section's large geographical area. To help encourage student participation, section leaders grant several travel stipends for students and even organize group trips.

"One time, we rented a coach bus, gathering students across Utah for the meeting," said Van Huele. "It was a great road trip."

Upon arriving at the meeting, students are exposed to a variety of experts presenting research ranging from physics education to high energy physics. Invited speakers have included top national laboratory scientists, industry leaders and even former astronauts.

The annual meeting has become the main event for the section, but organizers have also focused their efforts beyond the section's borders. For instance, the section held a joint meeting with the Texas section several years ago. At first, people questioned whether the organizers could bring together people from such a large area. The meeting was a great success though, and the two sections hope to hold a similar joint meeting in the future, said Van Huele.

In addition to organizing meetings, section members have also arranged for students to meet political leaders in Washington, DC every year. The experience allows students to step outside of the classroom and conduct lobbying on science funding.

"It was a really good experience for a graduate student," said Eric Sorte from the University of Utah, a former Four Corners student-at-large member who travelled to Washington in 2009 and 2010. "The senators and representatives liked to interact with the students as well."

The next section meeting will be held in the late fall of 2012.

MIT continued from page 2

etching what he called "microminiature printed systems."

Other researchers built on his research over the ensuing years, leading to the invention of a cryotron catalog memory system in 1956, IBM's Crowe Cell, patented by James W. Crowe in 1957, the Josephson junction, and the first superconducting quantum interference device (SQUID). Today neuroscientists are able to map brain activity using magnetoencephalography (MEG) because of these groundbreaking developments, as well as applications in maglev trains, high-efficiency wind turbines, and particle physics accelerators.

Buck's scientific star was very much on the rise, which makes his sudden death from a "mysterious illness" in May 1959, at the age of 32, all the more tragic. He had received his PhD only the year before. "Dudley was not ambitious in the meaning that word is usually used," his MIT classmate, Charles Crawford, recalled after Buck's passing. "Dudley was not ambitious for himself; he was ambitious for the human race."

HEADLINES continued from page 3

eral Hospital in Boston created the first living organism that can generate laser light. To generate the beam, the team first engineered a human kidney cell to produce green fluorescent protein as a gain medium, the same protein that makes jellyfish glow and that is often used in labs to label cells. The team then shone a blue light on a single cell placed between two mirrors, and found it emitted a weak green glow, but still an order of magnitude brighter than natural jellyfish fluorescence.

"Seeing" a Wave Function

Wave functions of quantum particles represent probability amplitudes in an abstract space, so directly detecting one is tricky, to say the least. However in June, physicists at the National Research Council of Canada in Ottawa devised a way to eke out just enough information about the wave functions of polarized photons to map out their wave function, without violating the Heisenberg uncertainty principle. By repeatedly weakly measuring the carefully angled path of identical photons, the team was able to glean a little bit of information about each one's position or speed without collapsing its wave function. The averaged results then painted a complete picture of the photon's wave function, a technique the team thinks can be scaled up to larger quantum particles including electrons, ions and even molecules.

Faster than Light Neutrinos

There may only be two things that travel faster than light, muon neutrinos from CERN's Super Proton Synchrotron, and the news about them. Within minutes of the announcement that the OPERA experiment in Grand Sasso, Italy had detected evidence of neutrinos breaking the ultimate speed limit, word spread around the world of this seemingly impossible result. Physicists mostly greeted the news with skepticism, as the results seemed to fly in the face of the tenets of special relativity. A veritable cottage industry sprang up finding theoretical holes in the results, but OPERA reran the experiment with shorter neutrino pulses, and found the same results. Fermilab is set to run its own experiments to test whether it can reproduce the results; if not, the answer may lie buried in some as yet unknown systematic error in OPERA's setup.

Tevatron Shutdown

After 28 years and countless trillions of particle collisions, the Tevatron smashed its last atoms on September 30th. Just past 2:30 pm, following a brief ceremony, renowned physicist Helen Edwards, who helped design the great accelerator, pushed two specially constructed buttons, shutting down the power to the machine forever. Capable of colliding particles up to energies of a trillion electron volts, the 4-mile-round particle accelerator was for years the most powerful in the world, until the Large Hadron Collider came online in 2008. With the Tevatron's capabilities eclipsed by the new European machine, the Department of Energy opted to redirect Fermilab's focus from the energy frontier to the intensity frontier. Researchers at Fermilab still have about a year's worth of data to sift through from the last runs of the Tevatron and they are also moving on to help CERN crunch data from the LHC.

Nobel Prizes

The Nobel Prizes always make a big splash in the press, and this year was no exception. Saul Perlmutter of Lawrence Berkeley National Lab, Adam Riess of The Johns Hopkins University and Brian Schmidt of the Australian National University shared the physics prize for discovering the accelerating expansion of the universe. By studying the redshifts of distant supernova, the two teams made the shocking finding that not only is the universe expanding, a fact that's been known since the 1920s, but it's speeding up as it goes. This revelation shook cosmology at its core, and later computations found that it could mean that three-quarters of the universe is likely made up of some as yet unidentified "dark energy."

In addition, the prize for chemistry was awarded to Dan Shechtman of the Technion–Israel Institute of Techonology for his discovery of quasicrystals, research first published in *PRL* in 1984. Shechtman's work turned crystallography on its head, and completely revolutionized the way scientists thought about how the structures of crystals could form. So controversial were his findings, it took a long time for the scientific establishment to come around and accept his results. Initially, after he announced he'd found crystals that didn't form repeating identical patterns, his bosses at NIST asked him to leave the lab where he was employed. Now he has a Nobel Prize validating his work.

Biggest Black Hole

A newly discovered interstellar behemoth shattered the record of biggest black hole in the known universe. In December, astronomers from the University of California, Berkeley announced that the black hole at the center of the galaxy NGC 4889, 336 million light-years away, tips the scales at almost 21 billion solar masses, and is ten times the size of our solar system. The previous record holder weighed in at a mere 6.3 billion solar masses. At the same time, the research team announced the discovery of another black hole, this one 9.7 billion times the size of the Sun in the Virgo cluster. The two black holes were discovered after analyzing data from the Hubble Space Telescope, and the Gemini North and Keck telescopes. Astronomers hope that a better understanding of these black holes will yield insight into how galaxies formed in the early universe.

REVIEW continued from page 3

jects DOE funding request for Pu-238 production used to fuel deep space probes.

August

Department of Commerce issues report stating that there are significant benefits to pursuing jobs in STEM disciplines. Blue Ribbon Commission on America's Nuclear Future declares U.S. approach to the handling of nuclear waste as a "deeply flawed program." President signs legislation setting discretionary spending caps through FY 2021.

September

The Office of Management and Budget issues general budget guidance for FY 2013, citing need to invest in areas critical to job creation and economic growth. House hearing held on NSF merit review process. White House holds event on NSF Career-Life Balance Initiative. Key House appropriator chides Administration for not identifying spending offsets for increased cost of James Webb Space Telescope. House Science Committee roundtable discusses proposed Deep Underground Facility.

October

NRC committee issues report on NASA's Meteoroid and Orbital Debris programs. Some of America's most prominent business executives call on Congress and the Administration to "improve the effectiveness of the U.S. energy innovation program." NRC report concludes little firm evidence exists about how to improve K-12 STEM instruction. Senior House Democratic appropriator warns the deficit reduction "super committee" about the impacts of automatic spending cuts on health, science, and innovation programs. Republicans on House Science Committee recommend $1.5 billion in spending reductions on S&T programs in FY 2012.

November

Almost 70 scientific societies and associations, universities, and organizations sign a letter urging a special congressional committee charged with developing a deficit reduction plan to avoid cutting R&D funding. First FY 2012 appropriations bill is passed: NSF funding increases 2.5 percent, NASA funding declines 3.5 percent, NIST funding increases 0.1 percent. Appropriators approve funding for James Webb Space Telescope. Senate passes medical isotope production bill. House committee passes bill requiring disclosure of peer reviewers.

December

GAO issues a report on alternatives to using helium-3 neutron detectors. The second and last of two major FY 2012 appropriations bills is passed: DOE Office of Science funding increases 0.6 percent, National Nuclear Security Administration funding increases 4.5 percent, U.S. Geological Survey funding declines 1.3 percent, NIH funding remains level, National Institute of Biomedical Imaging and Bioengineering increases 8.0 percent, Mathematics and Science Partnership funding declines 14.3 percent and a new program is funded, and Defense basic research funding increases 16.6 percent. Conference held on enhancing collaboration between the United States, and the European Union and its Member States.

ANNOUNCEMENTS

INDIA-U.S. Travel Grants

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

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

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

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

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

APS physics

Deadline: Friday, 30 March 2012

IUSSTF Indo-US Science and Technology Forum

Brazil-U.S. Exchange Program

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

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

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

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

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

APS physics

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

SBF SOCIEDADE BRASILEIRA DE FÍSICA

LECTURES continued from page 1

recipients as well.

"I am pleased to have been selected," Quinn said. "The financial support has been welcome in my coming to Boston and presenting my lecture."

The Beller lectureship was endowed by Esther Hoffman Beller to bring eminent physicists from abroad to speak at APS meetings. The Marshak lectureship was endowed by Ruth Marshak in honor of her late husband, Robert Marshak, to bring physicists to the APS meetings from "developing nations or the Eastern Bloc." 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.

"It is my great honor and pleasure to be selected," Min said. "I hope this opens more wide communication within the world science community on seeking… more effective way[s] of collaboration and cooperation."

Yavaş echoed this sentiment, adding that he was excited to share the work of the Turkish Accelerator Center with physicists from around the world.

"[I]nternational exposure at a large meeting like the APS March Meeting is a golden opportunity to inform your scientists about the status and future plans of physics in Turkey," Yavaş said.

Sessoli said that she planned to use some of the funds to help bring a student from her lab to the meeting who would not have been able to attend otherwise.

"Beyond the economic support, which is always welcome as it will allow [us] to use the saved funds to allow [a] younger researcher of the lab to attend [the] international meeting, the major benefit is that the lectureship will probably allow my presentation to stand out from a very rich program," Sessoli said.

At the March Meeting, Sessoli will deliver her talk on "Single Molecular Magnets on Conductive Surfaces" on Tuesday in session H13 at 8:36 am. Quinn will give his lecture titled "From Artifacts to Atoms: The Origins and Early Years of the International Bureau of Weights and Measures" on Thursday in session X2 at 3:06 pm. Yavaş will speak about The Turkish Accelerator Center on Monday in session B2 at 1:03 pm. Min will deliver his talk titled "The Korea Project" in an April Meeting session that has yet to be determined.

CIRCUS continued from page 5

debt ceiling culminated in the Budget Control Act (Public Law 112-25)–or technically the amendments to the 1985 Gramm-Rudman-Hollings Act (Public Law 99-177)–which cleared the Senate on August 12 and immediately received President Obama's stamp of approval. The legislation established annual discretionary spending caps that would save $917 billion over a ten-year period. It also set up a 12-member bipartisan joint select committee and charged it with finding $1.5 trillion additional in deficit reductions. If the committee failed to do so, $1.2 trillion across-the-board reductions in discretionary spending would begin on January 2, 2013.

Failure, the president said, would be an intolerable outcome. Failure, House Speaker Boehner, said would be unacceptable. Failure, Senate Majority and Minority Leaders Reid and McConnell, said was unthinkable. But in the poisoned partisan atmosphere the intolerable, unacceptable and unthinkable happened. And in a year's time, the triggered reductions will kick in, with defense spending taking an 11-percent hit and non-defense activities, including almost all of science, looking at an 8-percent buzz cut.

For now, though, research budgets are benefiting from a small uptick, largely because last-year's chaos and confusion allowed science champions to push the spending envelope in an unexpected way.

Here's how it happened:

House appropriators began their work last spring under the $1.019 trillion Ryan budget plan, $35 billion below the previous year's spending. They completed much of their work before the ink was dry on the Budget Control Act (BCA). And although the BCA reined in discretionary spending, for fiscal year 2012, it provided $24 billion more than the Ryan budget. That proved to be a boon to Senate appropriators, who hadn't even started their dithering until midsummer.

The Democratic Senate majority immediately seized on the unexpected largess and began filling holes in social programs, knowing that they would have to strike deals with their House counterparts during end of the year conferences. And when the conferees finally met, House appropriation subcommittee chairs, Frank Wolf (R-VA 10th) and Rodney Frelinghuysen (R-NJ 11th), both science boosters, used the higher BCA cap to rescue the research budgets under their purview.

For fiscal year 2013, science will confront a much thornier thicket. Facing the mandated BCA reductions, every interest group will be battling to boost its favored account. And without strong advocacy, scientists should be prepared for federal spending on research and education to tumble.

This year is unlikely to see the Washington partisan atmosphere become any less toxic. President Obama is expected to use a "Republican do-nothing Congress" as his political foil. Democrats, fearful of losing control of the Senate, will focus their ire on intransigent obstructionist House Republicans. And Republicans will blast the President and congressional Democrats for fiscal irresponsibility and economic ineptitude.

In the midst of the partisan war, the Supreme Court will launch its own rocket-propelled-grenade: a judgment on the constitutionality of the individual health care mandate. P.T. Barnum would love it–a four-ring circus on the banks of the Potomac.

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the report. In the case of the Energy Critical Elements report, the committee, after several teleconferences throughout early 2010, held a conference in April where each member presented a white paper on their subjects in the report, then gathered in Washington, DC in September to meet with those who might be affected by the study, such as people in the Department of Energy and the Office of Science and Technology Policy as well as executives in the mining industry. Between October and November the report was written up and finally presented publicly at the annual meeting of the American Association for the Advancement of Science in February of 2011.

However, the process does not stop with the publication of the report. Members of the APS media and public affairs team then work to get the word out to members of Congress, industry regulators, scientists and the general public. Editorials are written and sent to news outlets. If there is congressional action on the subjects of the report, the lead author is often called before the Senate or House committee that oversees the matter.

The Back Page

To POPA: A Former Chair's Farewell

by Robert Socolow

Ed. Note: *Robert Socolow, a Professor of Mechanical and Aerospace Engineering at Princeton University, was Chair of the APS Panel on Public Affairs (POPA) in 2010. Upon completing his term on POPA in the fall of 2011, he delivered the following farewell address.*

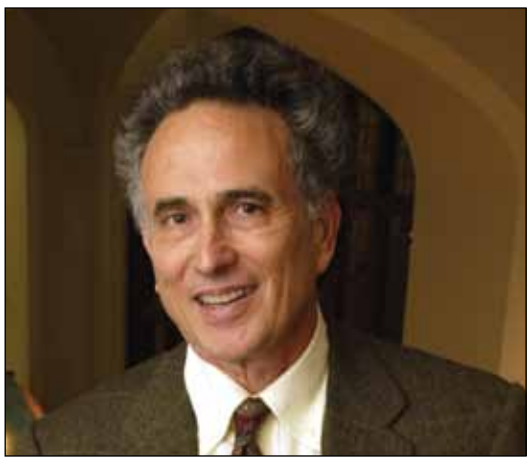
It has been a privilege to be associated with the Panel on Public Affairs for the past four years. This remarkable unit has no counterpart in other professional societies. It is a product of the 1960s and 1970s, a time when physicists were particularly inclined to scrutinize their motivations for being physicists. Our first answer was that we hoped to discover a few of nature's secrets. But many of us, nearly as much, hoped to use our specialized knowledge to address social problems. We had a broad agenda, starting with but going beyond nuclear weapons and nuclear power. The slogan was "science for the people."

I was a physics major at Harvard when Sputnik raced overhead in October 1957. Immediately, President Eisenhower summoned scientists to Washington to explain this new accomplishment. From Cambridge came James Killian, George Kistiakowsky, Norman Ramsey and one of my teachers, Edward Purcell. Late in the afternoon, Purcell and Ramsey would return to the physics building, after having written pamphlets about why a satellite can't fall straight down, and after working out the implications of Sputnik for strategic weapons delivery systems. To those of us who were hanging around doing problem sets, they said: "Somebody has to do this full time." Twelve years later, after seven joyful years with quarks, I acted on their advice. In my generation, many did.

Numerous institutions designed to encourage "science-based decision-making" emerged in the following two decades. Among the important ones still with us are the President's Council of Advisors on Science and Technology, the Council on Environmental Quality, the Natural Resources Defense Council, the Environmental Defense Fund, and our own POPA.

During the past four years, APS and POPA have been re-examining their communication strategies. A Hegelian process is under way: Thesis, Antithesis, Synthesis. Consider the incautious 2007 APS Statement on climate change, with its famously ill-chosen word, "incontrovertible." The Statement produced a bitter minority response; then, two years ago, a moderate Commentary; and then, still under way, the codification of a tightened process for producing Statements. The deep message we can all extract is that physicists care passionately about what their Society tells the world. However, passions inflamed can destroy an institution. I am proud of how APS, and POPA, preserved themselves while encouraging debate and producing a credible Commentary.

At the level of studies rather than statements, an APS



study, *Direct Air Capture of CO_2 with Chemicals*, which I co-chaired, is generating its own Hegelian process. Some POPA committee members and staff did not find the report congenial. A principal concern was that the report does not make recommendations to governments. Like the original APS statement on climate, in the aftermath of an adversarial process POPA and APS are now codifying the kinds of studies POPA should and shouldn't conduct.

For both APS statements and POPA reports, in my view, the danger during the current Synthesis stage is too much codification. Be careful not to suppress the lively interloper.

When I became Vice-Chair of POPA four years ago, I exhorted POPA members to invent studies in which they were willing to invest serious time. It seemed to me that POPA then was less committed to conducting studies and producing reports than it had been. I argued that studies and reports are the principal reason for POPA's existence, a statement that I think is not controversial now. POPA meetings are now mostly about studies.

The questions I brought with me onto POPA were: 1) What kinds of studies are professional societies in general –and POPA in particular–well suited to conduct? 2) What kinds of studies does the broader society need *somebody* to conduct?

Technology assessments constitute one important class of needed studies. In 1972 the U.S. created the Office of Technology Assessment (OTA) within Congress to do such studies. OTA was shut down in 1995. The needs OTA filled are not being filled to this day. Studies are sorely needed, in particular, that address the world's future energy system. The energy system over the next few decades may well be traded in for another one–with lower carbon intensity and with new strategies related to transport. Both the public and policy makers need help as they contend with a discourse riddled with self-interest. Who will provide independent advice about the promise of new technologies, such as batteries, geothermal energy, and small nuclear power plants?

Not long ago, one could presume that the general public, as well as decision makers, welcomed the engagement of scientists. We were regarded as uniquely able to conduct impartial and authoritative studies. Right now, it seems to me, any such special standing is in jeopardy. Think hard about Governor Rick Perry's mental model that led him to invoke Galileo in the way that he did in a debate last month. He associates the current science establishment with the 17th century Catholic Church–and himself with those who, like Galileo, challenge established wisdom. In places like POPA, we scientists need to examine that charge, not write it off. He is giving us a wake-up call.

What *are* the similarities between the current scientific enterprise and an established church? We scientists are remote, we believe we deserve deference, we extract considerable financial resources from the general population to run our affairs, and we intrude on people's lives with conclusions about evolution and the vulnerability of the planet that many people don't want to hear.

We must not underestimate the threat now looming in the form of a growing public disenchantment with the scientific enterprise. Scientists believe that the scientific way of knowing is privileged relative to other ways of knowing that are rooted in myth. We must not take for granted that others do. Over the next decade, the highest priority for the APS and POPA is to retain the public's trust by demonstrating the worth to society of the fundamental values of science.

The second P of POPA stands for "public." It has two meanings: the government and everybody. Be careful not to forget the second meaning, especially now. This is never easy for an organization based in Washington.

I will close with thanks to the POPA staff and all the POPA members I have worked with. The commitments of time and energy and the resulting creativity emerge from deeply personal commitments to connect physics with public service. POPA is a force for good in this world.

Robert Socolow's research interests include global carbon management, carbon dioxide capture from fossil fuels and storage in geological formations, nuclear power, energy efficiency in buildings, and the acceleration of deployment of advanced technologies in developing countries. He was a member of the National Academies' Committee on America's Energy Future (2007-2009) and its Committee on America's Climate Choices (2009-2011). He received the APS Leo Szilard Lectureship Award in 2003.

POPA Reports Bring Physics Perspective to Public Policy Debate

APS's Panel on Public Affairs, more commonly known as POPA, has been an important part of the Society's advocacy arm for many years. It has weighed in on many issues of public policy important to the physics community, as well as more general issues that would benefit from the perspectives of physicists.

"It is the body within the American Physical Society that delivers the opinion of the physics community on issues being debated by the Congress and within the administration," said Francis Slakey, APS Associate Director of Public Affairs, and the staff advisor to POPA. "In particular it's energy, environment and national security."

POPA has been in existence since the early 1970s, but in the early 2000s it took on a new, more focused approach to putting together reports. This new paradigm emphasizes relatively short but detailed evaluations of technical subjects, usually resulting in about two reports a year. The reports generally concentrate on evaluating or exploring in depth a specific aspect of a technical subject where physics expertise can offer fresh insights. The idea is to produce reports aimed at national decision makers, within a timeframe that can influence the debate on an important subject. Reports vary in length from about 15 to 25 pages, and take approximately a year to produce.

Past reports have weighed in on a range of subjects including nuclear weapons and energy, NASA's moon and Mars program, helium and hydrogen policy, missile defense, and the energy needs of the upcoming century.

"The concept is that we could fill the gap between long term research studies that the National Academy of Sciences does…and short quick research issues the Congressional Research Service does," Slakey said.

This method of putting reports together has been effective. Information and recommendations in recent reports by the panel have made their way into the legislative process and regulatory policy. An example is the report, *Energy Critical Elements: Securing Materials for Emerging Technologies*, written in collaboration with the Materials Research Society and released in February of 2011, which found that the US needed to do more to secure its supply lines of rare and exotic elements critical to future scientific research.

The report's findings, which included having the Department of Energy work with the Department of the Interior to put together a comprehensive report on better ways to produce, collect and recycle these rare elements, were incorporated into several bills working their way through Congress. Slakey said that although report findings can often take between five and six years before becoming legislation, the recommendations from the Energy Critical Elements report were brought up before Congress in just a matter of months.

"That's the thing about POPA studies," said Robert Jaffe, vice chair of POPA and chair of the group that produced the Energy Critical Elements report. "They're really done with a conscious effort to fold them into the policy development process as easily as possible."

Similarly, a POPA report issued in 2008 about the uncertain state of nuclear forensics research in the US prompted congressional action. Representative Bill Foster, himself a former Fermilab physicist, brought the issue to the floor of the House. Many sections of his bill were later incorporated into the Defense Authorization Act of 2009 and passed into law. In conjunction with the report, POPA put together an education module for high schools which taught students about what nuclear forensics is and how it's done. The kits were distributed to about 1000 classrooms across the country.

"Outcomes of POPA reports are not just limited to Congress or the administration," Slakey said.

A typical POPA study starts as an idea or proposal at one of the three annual meetings of the panel. The ideas are first discussed in one of its subcommittees, then brought forward to the full committee for further evaluation and refinement.

During these group discussions, issues are weighed such as the proposed report's relevance to physicists and public policy, whether the study can be put together in time to have an impact, and whether there could be a well defined route for the report to affect public policy.

If the proposed idea makes it through the full committee, a taskforce is appointed to put together a small study, only a few pages long, that outlines the areas of research a full report might go into. Once the preliminary study is assembled, it's circulated among the members of POPA, and followed by a presentation and discussion at the next meeting. The committee then votes on whether to go forward with a full report.

Once a report gets the green light, a full report committee is assembled, bringing in experts from across the relevant areas of sciences and public policy. How the committee then proceeds varies somewhat depending on the needs of

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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