APSNEWS

A PUBLICATION OF THE AMERICAN PHYSICAL SOCIETY

WWW.APS.ORG/PUBLICATIONS/APSNEWS

August/September 2013 • Vol. 22, No. 8

We have a winner!
See page 5

APS Members Elect Homer Neal to Presidential Line

In Society-wide elections in June, APS members cast their ballots for Homer Neal of the University of Michigan to be the next vice-President. As the newest member of the Presidential Line, Neal will become APS President in 2016.

The members also voted for Kiyoshi Ueda of Tohoku University to be a new International Councilor, Nadya Mason of the University of Illinois at Urbana-Champaign to be a General Councilor, and Patricia McBride of Fermilab to be the Chair-elect of the Nominating Committee.

Neal will assume his office in January of next year, succeeding Sam Aronson of Brookhaven National Lab, who will become President-elect. This year's President-elect, Malcolm Beasley of Stanford University, will become President, while current President Michael Turner will remain on the APS Council and Executive Board as past-President.

Neal is currently the interim president emeritus and vice-president for research emeritus at the University of Michigan. He specializes in particle physics, and is a member of the ATLAS collaboration at CERN. He has also served as Regent of the Smithsonian Institution, served on both the National Research Council and the governing board of the National Science Foundation, and is

Homer Neal

NEAL continued on page 4

APS Set to Launch Applied Physics Journal

Following approval by the Executive Board in June, APS is gearing up to launch a new journal of applied physics. *Physical Review Applied* is slated to debut early in 2014, and will feature high quality applied research articles from all areas of physics.

"APS built its reputation on pure physics and it's important for us to reach out to the applied physics community and say that there is a home for applied physics here," said Gene Sprouse, APS Editor in Chief.

The Society conducted surveys of a cross section of its membership, which showed a strong desire for an APS-run applied physics journal. The Forum on Industrial and Applied Physics in particular showed great interest in such a journal. In addition, the Society's editors found that the new journal would likely benefit from about a thousand papers a year that are now submitted to APS journals but have to be rejected because they are outside the current scope of research covered by the *Physical Review.*

"We're constantly looking at how we should be growing our journals and it was clear that applied physics was a bur-

JOURNAL continued on page 7

Phys Rev X Debuts with Top-Ten "Impact Factor" Ranking

APS's newest journal is having a noticeable impact on physicists around the world, according to *Journal Citation Reports (JCR). Physical Review X* received an initial "impact factor" of 6.711, putting it alongside two other APS publications among the ten most influential multidisciplinary physics journals.

JCR, published annually by Thomson Reuters, seeks to objectively measure an academic journal's importance to the research community by tracking the number of citations each article receives. The impact factor of a journal is essentially calculated as the number of citations in a given year to articles published in the journal in the previous two years, divided by the total number of those articles.

Jorge Pullin

Two other measures, in which *PRX* also ranks in the top ten among broad-scope physics journals, reinforce the fact that *PRX* is having an impact throughout the physics community. *JCR* gave *PRX* a high score of 2.225 in its "immediacy index," which indicates how quickly work published in a journal is disseminated and cited.

In addition, another organization that tracks academic journal influence, Eigenfactor, gave *PRX* high marks for a journal of its size. Their "article influence" metric is similar to an impact factor, but at-

***PHYS REV X* continued on page 7**

APS to Participate in Multi-Publisher Open Access Research Clearinghouse

Following the June meeting of the Executive Board, APS announced that it would be working with the federal government and journal publishers to help develop a system for scientists to access publications resulting from federally funded research.

The Clearinghouse for the Open Research of the United States, or CHORUS, would be an online platform that links to open access journal articles stored on publishers' servers. Developed by the American Association of Publishers, it would use publishers' existing infrastructure to comply with recent federal open access mandates.

In February, the administration's Office of Science and Technology Policy issued a memo that would ultimately require all scientific papers stemming from federally funded research to be available for free to anyone after an embargo period. The specific form of the policy was not spelled out in the memo, and one of the biggest open questions was whether the papers would be hosted on

OPEN ACCESS continued on page 7

Meeting Helps Bridge Programs Interact

By Bushraa Khatib

The APS Bridge Program (APS-BP) is committed to increasing the number of underrepresented minority students who receive PhDs in physics. In late June, APS-BP hosted a meeting that involved a variety of programs and organizations with similar interests. More than 60 people attended the conference, which took place at the American Center for Physics in College Park, MD. Attendees included representatives from APS, the American Association of Physics Teachers (AAPT), the American Institute of Physics (AIP), bridge programs, and colleges and universities across the US.

Although just getting underway, the APS Bridge Program has been able to facilitate the placement of at least 14 students into physics bridge programs or directly into graduate programs. Seven students were named Bridge Fellows at two newly selected APS Bridge sites, University of South Florida and The Ohio State University (see the report in the July *APS News*). Each site was also able to admit one student directly into their graduate programs. Students who applied to APS-BP were considered by other graduate programs as well, with sixteen offers of admission made to ten students. Five of these students accepted offers, and at press time five students have offers pending, leaving the potential of APS assisting possibly up to 19 students to enter graduate programs in physics during the first year of the bridge program.

The meeting was the first opportunity for newly selected APS Bridge Fellows to meet each other and site leaders at their respective bridge sites. Students are beginning classes, research, and other programmatic activities this summer.

"The conference was a great opportunity for collaborations–especially for students to network with each other and faculty as they begin their bridge programs," said Brian Beckford, APS Bridge

BRIDGE continued on page 6

Executive Officer Kate Kirby Plans Strategically for 2nd Term

In April, the APS Council voted to extend Executive Officer Kate Kirby's term at the helm of the Society for another five years. Commenting on the vote, APS President Michael Turner said "She's been a terrific leader of APS. One of the most important things that she's done is to represent us to the outside world, whether it is working with other societies, or at meetings of young women physicists, or at a National Academy committee. She's done a tremendous job of being the face of the American Physical Society."

Much of Kirby's first term was devoted to developing APS's recently unveiled five-year strategic plan. Over her next term, she, along with the other operating officers, will oversee the implementation of the goals laid out in the plan. APS News *sat down with Kirby to talk about how the plan came to be, and what it will mean for the Society in the coming years.*

Kate Kirby

How did the development of the strategic plan help shape your first term at APS?

I gave myself a year in the Executive Officer position before laying the groundwork for starting strategic planning. It was internally initiated. I really feel that it's essential for any organization to have a strategic plan that lays out a vision and a roadmap. It helps shape priorities for the organization and also serves as a guide for assessing the importance and relevance of opportunities that we take advantage of in the future.

Laying the groundwork meant getting the APS Presidential Line and my fellow operating officers on board. Barry Barish, who was APS President in 2011, was very supportive of devoting considerable time to discussions between the Executive Board and the APS staff, which formed the basis of the Strategic Plan.

What ultimately did you produce?

We produced a ten-page document with four broad goals, which are: serving our members better, serving the physics community better, serving society better, and then an inwardly focused goal, which is to increase our organizational excellence. Under each of these goals are a number of specific objectives.

The plan was drafted in early 2012, the Executive Board adopted it, and Bob Byer, who was the President, was a fantastic advocate and worked tirelessly to get it out to members and to discuss it *with* unit executive committees. I enjoyed very much working with him.

KIRBY continued on page 6

Members in the Media

"This was conceptually unthinkable for cosmic rays.… There is no cosmic ray physicist I know who ever expected that they would not all be coming equally from all directions."

***Stamatios Krimigis**, Johns Hopkins University, on recent unexpected readings from the Voyager 1,* The Los Angeles Times*, June 27, 2013.*

"We're all sitting at the edge of our seats with what's going to happen there…. We expect discovery, but it doesn't always work out the way you expect."

***Nigel Lockyer**, Fermilab's new director, on the science coming out of the LHC,* The Chicago Tribune*, June 29, 2013.*

"We see a little bump in the data, so we take more data. The bump gets bigger and bigger, until we know that it could no longer be attributed to random chance."

***Paul Tipton**, Yale University, describing how the Higgs Boson was discovered,* ABCNews.com*, July 4, 2013.*

"What they have done is a major step, because they have been able to provide a much more complete description of what really happens near the black hole singularity using loop quantum gravity…. We still don't have a clear picture of the details of what happens. So it is opening a new door that other people will follow."

***Abhay Ashtekar**, Pennsylvania State University, commenting on new developments using loop quantum gravity.* NBCNews.com*, July 12, 2013.*

"We don't often connect what goes on in giant particle physics laboratories to what goes on in our everyday lives.… But that connection is there, and the story I try to tell in my book is a very human one, of people doing their best, working their hardest, taking risks and discovering something really amazing."

***Sean Carroll**, Caltech,* The Toronto Star*, July 13, 2013.*

"Cultural heritage, even by itself, is important.… It's something that we have to preserve for our children and the generations that will follow."

Volker Rose*, Argonne National Laboratory, on using his lab's particle accelerator to save old daguerreotypes,* The Chicago Tribune*, July 15, 2013.*

"If the four-quark explanation is confirmed, our particle physics zoo will need to be enlarged to include new species.… And our understanding of quark taxonomy will have expanded into a new realm."

***Eric Swanson**, University of Pittsburgh, on an unusual particle seen at the Belle experiment in Japan, and BESIII in China,* FoxNews.com*, June 19, 2013.*

"This is a process that particle physicists have been trying to find for 25 years…. [it's a] rare process involving a particle with a mass that is roughly 1,000 times smaller than the masses of the heaviest particles we are searching for now."

***Joe Incandela**, CERN, after measuring the decay time of the B_S meson,* The Associated Press*, July 19, 2013.*

"By my read, the idea of a functioning warp drive remains far-fetched, but the real take-away is that people are thinking about it–reminding us all that the urge to explore continues to run deep in our species."

***Neil deGrasse Tyson**, American Museum of Natural History, commenting on theories for building a faster-than-light warp drive,* The New York Times*, July 22, 2013.*

"So you have vanilla ice cream, you throw it into space—some time later, it turns into chocolate ice cream, or strawberry ice cream…. This is a very, very weird phenomenon."

***Chang Kee Jung**, State University of New York at Stony Brook, describing how neutrinos change flavors,* Los Angeles Times*, July 24, 2013.*

"[W]e need different people in Congress… Congress is a place that's filled with lawyers. Now the law is an honorable profession, but lawyers are trained to argue and trained to dispute facts. What we need are people who work with facts."

***George Gollin**, University of Illinois at Urbana-Champaign, declaring his candidacy for the House of Representatives,* The Champaign/Urbana News-Gazette*, July 23, 2013.*

This Month in Physics History

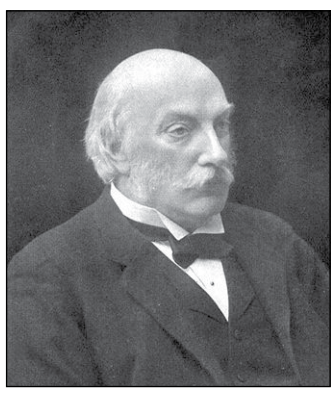
Lord Rayleigh and the Discovery of Argon: August 13, 1894

"A searcher obedient to truth," he found a truth he was not searching for.

***Ed. Note:** This column has been contributed by guest author Richard Williams.*

Lord Rayleigh was the title borne by John William Strutt, 1842-1919, who succeeded to the Barony of Rayleigh in 1873. He served as Professor of Experimental Physics at Cambridge University from 1879 to 1884, as the successor to Maxwell, and served from 1887 to1905 at the Royal Institution, London. Much of his research was done in his private laboratory at his home in Terling.

His work covered much of physics. Among the things named for him are Rayleigh Scattering, the Rayleigh-Jeans Equation, the Rayleigh Refractometer, and the Rayleigh Criterion for Resolution. His two-volume book *The Theory of Sound*, 1042 pages in all, published in 1877, was definitive at the time and is still in print. He was among the most eminent physicists of his era. What ultimately brought him the Nobel Prize was the discovery of argon. How this happened is one of the most remarkable stories in the annals of science.



John William Strutt, 3rd Baron Rayleigh

As a physicist, Rayleigh tended to be direct and decisive, with a clear goal in mind. In the argon discovery, however, things were quite the opposite. His experiments were not aimed at the final result. He began by working to test Prout's Hypothesis from 1815, that the atomic weights of many elements were integral multiples of the atomic weight of hydrogen taken as unity.

The unusually difficult experiments are described in the biography, *Life of John William Strutt, Third Baron Rayleigh,* by his son Robert John Strutt. Rayleigh began by weighing hydrogen and oxygen gases to determine their densities. A 2-liter flask was evacuated, weighed, and then weighed again after being filled with the gas. Buoyancy of the room air affected the observed weight, and in turn was affected by the room temperature and barometric pressure. The experiments were done by a trusted assistant, closely supervised by Rayleigh himself, and went on for several years. His result for the ratio of the density of oxygen to hydrogen was 15.882, which appeared to Rayleigh to contradict the weight of 16 for oxygen.

To complete the study he then turned to what seemed like an easier problem, weighing nitrogen. The easiest way of obtaining the "pure" gas was to remove the other then-known constituents of air, oxygen, carbon dioxide and water vapor, by chemical means. His result was in good agreement with a measurement published several years earlier. At this point, he made the decision that changed the entire course of the investigation. "With characteristic caution he wished to confirm the result by a different method of preparing the gas." He obtained the nitrogen by chemical reactions of ammonia or other nitrogen-containing compounds. The result was a surprise. After two years of work he had to conclude that nitrogen of chemical origin was always about 0.5% less dense than that obtained from air, well beyond experimental error. He was unable to explain it. His first report of it in *Nature*, 46, 512 [1892], began "I am much puzzled by some recent results as to the density of nitrogen, and shall be obliged if any of your readers can offer suggestions as to the cause." None was forthcoming.

Finally, William Ramsay, a chemist from University College, London, learned of Rayleigh's results. He proposed that air might contain a previously unknown heavy gas that was not removed by the chemical methods used to remove the other constituents. Around this time Rayleigh learned of an experiment by physicist Henry Cavendish in 1795 that hinted at an unknown constituent of air. Cavendish had mixed air with additional oxygen and passed electric sparks from an electrostatic generator through the gas, in contact with an alkali solution. This removed the nitrogen and oxygen. At the end of a long experiment a tiny bubble of gas remained. He suggested that the bubble was a non-reactive gaseous constituent of the atmosphere. The experiment was never repeated and was forgotten for nearly a hundred years. Rayleigh repeated the experiment with equipment that produced a stronger electrical discharge. This worked, and about a cubic centimeter of gas was accumulated. It did not show the slightest trace of the nitrogen spectrum nor did it show any chemical reaction.

Meanwhile Ramsay showed that red-hot magnesium removed both nitrogen and oxygen from the air. He accumulated enough of the residual gas to measure the spectrum, specific heat and other properties. Rayleigh and Ramsay combined their efforts and confirmed the existence of a new, inert, monatomic constituent of the atmosphere. Lord Kelvin called this the greatest discovery of the year. They announced their discovery at the August, 1894, meeting of the British Association for Science. These meetings were similar to APS meetings, with many contributions, all with abstracts of a hundred words or so. The Association's report of their research was curiously brief for such an important discovery. It read, in its entirety:

Monday, August 13 "1. A joint meeting with Section A was held, at which Lord Rayleigh, Sec. R.S., and Professor W. Ramsay, F.R.S., gave a preliminary account of a New Gaseous Constituent of Air."

Ramsay went on to discover He [known from the solar spectrum, but not previously known on Earth], Ne, Kr, and Xe.

This discovery brings to mind Alexander Pope's epitaph for Isaac Newton: "Nature and Nature's

RAYLEIGH continued on page 7

APSNEWS

Series II, Vol. 22, No. 8
August/September 2013

Coden: ANWSEN ISSN: 1058-8132

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

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

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

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

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

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

Washington Dispatch

Updates from the APS Office of Public Affairs

POLICY UPDATE

Fiscal Year 2014 Appropriations

The House and Senate are proceeding with consideration of the Fiscal Year 2014 (FY14) appropriations bills. The Commerce, Justice, Science appropriations have just been voted on by the full appropriations committees in the House and Senate. For NASA, the House appropriated $16.6B, a decrease of $943M, and the Senate appropriated $18.0B, an increase of $458M. For NIST, the House appropriated $784M, a decrease of $25M, and the Senate appropriated $948M, an increase of $140M. For NSF, the House appropriated $7.0B, a decrease of $259M, and the Senate appropriated $7.4B, an increase of $148M. Details of NASA, NIST, and NSF subaccounts are forthcoming. All comparisons are to FY13 pre-sequester appropriations.

The next step in appropriations is for the bills to come up for a full floor vote. After that, however, the most likely scenario is that drastically different spending numbers stemming from ideological divides between Democrats and Republicans will stall any attempt to pass full appropriations and that FY14 will operate under yet another Continuing Resolution (CR).

Disagreement over the Budget Resolution, which by law Congress must pass, highlights the ideological divides. The Resolution is supposed to establish spending priorities by government function and provide a top-line overall budget number that dictates total appropriations for the coming year. Unable to agree on a common Resolution this year, the House and Senate have adopted dramatically different budget plans. The House Resolution provides a total of $966B for discretionary spending, consistent with the 2010 Budget Control Act (BCA), assuming continuation of across-the-board sequestrations for FY14. But the House Resolution provides more money for Defense ($552B) and less for Non-Defense ($414B) than the BCA stipulates. By contrast, the Senate Resolution does not assume continuation of sequestration and provides a total of $1,058B for discretionary spending, $552B for Defense and $506B for Non-Defense, both slightly above the BCA caps.

The debate over federal spending is about both top-line numbers and how those numbers are distributed. For example, President Obama requested and Senate appropriators have proposed $5,152M for the Department of Energy Office of Science. The full House has approved only $4,653M, a difference of almost $500M, which alone would make it difficult to conference the bills. But House spending for Fusion is $50M higher than the Senate plan, while the Senate plan includes $300M more for Basic Energy Sciences than the House has approved. Furthermore, the House would eviscerate ARPA-E, reducing it to only $50M as compared to the Senate which would fund ARPA-E at $379M. The House would also reduce funding significantly to Energy Efficiency and Renewable Energy (EERE), paring it back to $982M whereas the Senate would fund EERE at $2,280M.

Congress pushes back against STEM-Ed realignment

The President's request included a massive realignment of STEM-Ed programs. Both chambers of Congress have included language in appropriations that severely limits the STEM-Ed realignment, and in some cases outright forbids parts of it. The Senate explained, "The President's budget was based on the administration's proposal to reauthorize the ESEA [Elementary and Secondary Education Act, more recently known as The No Child Left Behind Act], but no such bill has passed the Senate. As a result, programs in this account are based generally on current law, as authorized under the ESEA."

The result is significant confusion. Many programs slated for cancellation or consolidation under the President's Budget request stopped taking grant proposals at the direction of the administration. Congress is now directing those programs to continue as before, while giving some leeway to internal reorganization. An unfortunate result may be that at year's end, there will be a lot of unspent STEM-Ed money that will be returned to federal coffers and applied to deficit reduction.

WASHINGTON OFFICE ACTIVITIES

POPA

The review processes for several POPA Reports are nearing conclusion. The final documents will be published in the upcoming months and will be posted on the POPA Reports website: http://www.aps.org/policy/reports/popa-reports/index.cfm

APS membership commentary regarding the proposed APS Statement on K-12 physics education is currently being reviewed and the statement will be considered by POPA at its October meeting.

Discussions are underway to host a joint international workshop on tactical nuclear weapons, with sister physics societies in Europe. The idea for an international workshop stemmed from a recent US workshop on the subject, held jointly by APS and the Center for Strategic and International Studies. That report is available on the POPA Reports website.

DISPATCH continued on page 5

International News

...from the APS Office of International Affairs

Brazil: I taught, I learned, I lived!

By Kathleen Foote

Photo courtesy of Katie Foote

Katie Foote and host, Dr. André Vieira at the SCALE-UP classroom during his visit to North Carolina State University

As a physics PhD candidate at North Carolina State University specializing in physics education, I love to see how people teach and learn science, especially in other countries and cultures. The US-Brazil student exchange program—sponsored by APS and the Sociedade Brasileira de Física—immersed me in an exploration of Brazilian education at the secondary and university level, while I shared information about American educational innovations.

In May of 2011, another APS travel grant sponsored my trip to India to survey and interview women about studying and working in science. I enjoyed talking to students, women and high school teachers so much that I sought out the opportunity to collect similar data upon my return to North Carolina. There were remarkable similarities in the stories I heard, but the differences were intriguing. I decided to go to Brazil to add a South American perspective to these findings. While I was there, I gave three colloquia on SCALE-UP [Student-Centered Active Learning with Upside-down Pedagogies] to share my dissertation work. Along the way, I traveled to four cities and talked to representatives from five schools and universities.

My trip began with ten days in Brasilia, the capital of the country that was built in the middle of nowhere in 1960. It was carefully planned to look like an airplane from above and is filled with unique, modern architecture. Reva Garg, a physics professor at the University of Brasilia (UnB) was my primary host and she welcomed me into her home as a long-lost daughter. Her primary research is in non-linear optics, but she has also published and presented work on women in physics. Her Indian background made her a perfect host for this cross-cultural project. After work, she and her husband would take me on cultural excursions to the national theatre and the famous Metropolitan cathedral, and make me the most delicious local foods and juices. Banana pizza with a side of freshly squeezed pineapple juice was probably my favorite, but it was a tough call!

While at UnB, I interviewed and surveyed dozens of undergraduate students and faculty members, compiling a collection of remarkable stories from women whose participation in physics spanned a half a century. Just as in the US, Brazilian women are dramatically outnumbered in the natural sciences. Recently, a couple of professors have been volunteering to develop programming to interest women in these fields, despite minimal outside support.

At UnB, I also met with the relatively new physics education group. They develop teacher-training programs, connect schools to community resources and engage students in research projects, mostly at the secondary level. They have also compiled over a hundred hand-made experiments and demonstrations as a physics-learning lab for visitors.

BRAZIL continued on page 6

All Five US Physics Olympians Come Home with Medals

By Michael Lucibella

Photo courtesy of Paul Stanley

Proudly displaying their medals after the competition in Copenhagen are US team members (l to r): Kevin Zhou (gold), Jeffrey Cai (silver), Jeffrey Yan (gold), Calvin Huang (gold) and Samuel Zbarsky (silver).

The United States placed high in the standings at the annual international competition of high school physics students. The five-person US team brought home three gold medals and two silver medals from the International Physics Olympiad held this year in Copenhagen, Denmark.

"It was a good year," said coach Paul Stanley of Beloit College in Wisconsin. "We probably did slightly better than we did last year."

Officially the Olympiad is an individual competition between students, and the national rankings are informal standings. This year the United States tied with Thailand and Taiwan in unofficial medal count standings. China placed first overall with five gold medals, while Russia and Singapore tied for second each with four gold and one silver.

Individually US students did well, with one student placing fifth overall and another placing eighth overall out of the roughly 400 students attending.

"It's been a while since we've had two students in the top ten like that," Stanley said.

Over the course of a week, the students were given a series of theoretical and experimental physics problems to solve. They're judged not just on whether they wound up with the correct answer, but the process they used to derive it as well.

"This is fun for them," Stanley said. "It's nice that they have an outlet for this form of enjoyment."

The test itself makes up only a small portion of the student's Olympiad experience. All together, the students spend five hours on the experimental problems, and five hours on the theoretical problems over the course of the week. Much of the rest of the time was spent seeing the city and meeting other students from around the world.

"The most exciting thing is definitely the people from other countries," said Kevin Zhou,

OLYMPIANS continued on page 7

Letters

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

More on Physicists and Their Shirts

The letter by Tor Laankan in the June *APS News* on how physicists lose their shirts reminds me of a time when they didn't.

It was at the 1986 March APS Meeting in Las Vegas. The casinos and locals were not happy about our lack of participation in the many activities that are offered to visitors. It was reported that one pit boss said, "They came with a single twenty dollar bill and one shirt, and they changed neither."

Marvin L. Cohen
Berkeley, CA

Sir Christopher Wren and His Prize

"This Month in Physics History" for July, 2013 discusses scientific wagers, specifically those made by Stephen Hawking. The column discusses the reward of a book worth 40 shillings that Sir Christopher Wren offered in January, 1684 to "the first person able to demonstrate that Kepler's laws could be derived from the inverse-square law."

However, in *The Life of Sir Isaac Newton* by David Brewster (J. & J. Harper, New York 1833), pp. 145-146, the author writes that Sir Christopher, at a January, 1684 meeting with Halley and Hooke, offered that book to "either of the two philosophers who should, in the space of two months, bring him a convincing demonstration of it." I think this qualifies more as a prize than as a wager, as both Halley (who was able to demonstrate it for circular orbits) and Hooke (who claimed he had a general proof) believed it was true. Moreover, the prize was not generally announced: it was a private competition between Halley and Hooke.

Only seven months later, in August, 1684, did Halley go to Cambridge to present the question to Newton, after the term of the promise that Sir Christopher made already had expired. Newton of course had the solution. Halley announced on December 10, 1684 to the Royal Society that he saw Newton's solution in his treatise "De Motu Corporum in gyrum," and the rest is history.

Incidentally, Mordechai Feingold in *The Newtonian Moment* (Oxford University Press, Oxford 2004), pp. 29-30 writes that it was "probably" Hooke's suggestion to Halley to go to Cambridge to ask Newton, as Newton had already told Hooke some three years earlier that he knew that the shape of the orbit in an inverse-square force field was an ellipse. It appears that Newton could have won Sir Christopher's prize already over three years before it was proposed!

Lior Burko
Huntsville, AL

Physics History and the Department of Terrestrial Magnetism

I was pleased to see the headline "APS Honors Vera Rubin and Kent Ford at Carnegie Institution" in the July *APS News*. On more than one occasion, I have had the pleasure of meeting Vera Rubin, who represents astrophysics in a fashion all can aspire to. Michael Turner's presence at a place where the existence of dark matter got an early nod makes perfect sense both in his role as APS President and as a distinguished astrophysicist and cosmologist.

Turner contributed some remarks on pp. 8-9 of the September 2008 issue of *Physics Today* about the work of my father, Ralph A. Alpher, together with Robert C. Herman, and George A. Gamow in the 1940s. The article bore the catch title "From abg to Precision Cosmology: The Amazing Legacy of a Wrong Paper," but in fact it recognized the beginning of *modern precision cosmology* on April 1, 1948 with the *first* publication emerging from Alpher's dissertation on nucleosynthesis. Few citing the Alpher-Bethe-Gamow letter to *Physical Review* recognize just what it is, or where it came from. The addition of Hans Bethe's name, in homage to the Greek alphabet, and the submission itself, were purely Gamowian. Alpher's first dissertation, involving theoretical work on galaxy formation, was "scooped" by E. Lifshitz in 1946 in the *Journal of Physics USSR* (E. Lifshitz, 10, 116-129). Gamow likely wanted this not to happen again–hence the publication even before Alpher's dissertation defense. This second dissertation on nucleosynthesis work emerged from the "hot big bang" proposed by Gamow in 1946 (G. Gamow, *Physical Review*, 1946, 70, 373-375). It took Alpher's mathematical genius to bring the idea to fruition as a precise theory of nucleosynthesis. This is noted by prominent historians of physics including Helge Kragh and Stephen G. Brush, among others.

I urge anyone interested in this history to read Turner's short article, Alpher and Herman's accounts, or one of my recent publications (e.g., V.S. Alpher, "Ralph A. Alpher, Robert C. Herman, and the Cosmic Microwave Background Radiation," *Physics in Perspective*, 2012, 14, 300-334.) Ralph Alpher published, along with colleagues at the Johns Hopkins University Applied Physics Laboratory (JHUAPL), the first estimates of the temperature of the Cosmic Microwave Blackbody Radiation (*Nature*, 1948, 162, 774; *Physical Review*, 1949, 75, 1089). This work was done independently of Gamow, who opposed the concept theoretically but did publish an estimate himself in 1953. JHUAPL had been the administrative arm of DTM from 1942 through 1945. DTM helped Alpher get his start in applied physics. Herman joined JHUAPL in 1942. Gamow, a consultant to the Navy's Bureau of Ordnance during the war, as was Alpher, passed through the doors at DTM and JHUAPL many a time.

The Department of Terrestrial Magnetism (DTM) deserves much broader recognition. In 1940 President Roosevelt authorized the establishment of the National Defense Research Council (NDRC), headed by Vannevar Bush. Ralph A. Alpher was at the time working at the Carnegie Institution of Washington (CIW) and assigned to the Department of Terrestrial Magnetism under Scott Forbush. They were analyzing geomagnetic data gathered from around the globe. Suddenly, everyone was working for the NDRC under the Office of Scientific Research and Development, which had the task of bringing applied technology up to the level of eventual adversaries Germany and Japan.

There was not a moment to lose in this effort, and DTM, with its wartime development efforts headed by Merle Tuve, was the epicenter not only of recruiting and hiring the best scientific and technological minds from across the country under the cloak of secrecy, but also of the early development of new methods in naval degaussing and the first "smart bomb" known as the proximity fuze, which made its debut in January, 1943 in the USS Helena's anti-aircraft guns. After deployment, it neutralized most kamikaze attack on naval vessels. Deployed finally by the Army in the Ardennes, the proximity fuze helped turn back Hitler's last, desperate offensive. The work at DTM made a decisive difference in the outcome of the war as recognized by the plaudits given the work done there by Secretary of the Navy James Forrestal, General George S. Patton, Admiral George Hussey, Jr. and others.

The DTM has often been at the forefront of scientific work, whether it be pure science, science in the public interest, or science applied to national defense. The Department itself maintains a finding aid of more than a century of magnificent achievements that would rival any academic research university (Department of Terrestrial Magnetism General Files, 1904-Present, carnegiescience.edu/legacy/findingaids/DTM-2005-07-General.html). I suggest we take note again of the singular role of the DTM in service to the nation, as well as a place where the existence of dark matter received a valuable lift.

Victor S. Alpher
Austin, TX

NEAL continued from page 1

currently a board member of the Ford Motor Company, chairing its committee on sustainability.

"I hope to contribute relevant portions of my life experiences to the continued advancement of the APS as it navigates the difficult times ahead," Neal said. "For several decades I have been actively working on many of the issues that now face the APS, including improving funding for research, addressing the competitive role of the US in science, fostering cross-communication between our sub-disciplines and with other science fields...focusing concern about the state of our national laboratories, addressing the challenges of outreach and science education, encouraging young people to consider careers in physics, helping the public appreciate the enormous contributions physics has made to their quality of life, highlighting the role of high school physics teachers, and many other issues."

Kiyoshi Ueda first arrived at Tohoku University in 1982. His research has been in areas of atomic, molecular, and optical physics. He has helped organize multiple international conferences in his and related fields. He said in his candidate statement that science is becoming more and more borderless, and it's important to foster both international and inter-disciplinary collaborations.

"I hope to make a bridge among scientists all over the world and from different fields, believing that sharing different ways of thinking brings us breakthroughs in science," Ueda said.

Nadya Mason is a condensed matter experimentalist who has focused on carbon nanotubes, graphene, topological insulators and nano-scale superconductors. She has been a strong advocate for diversity in the field. She is a member of the APS Committee on Minorities and chairs the Physics Diversity Committee at Illinois.

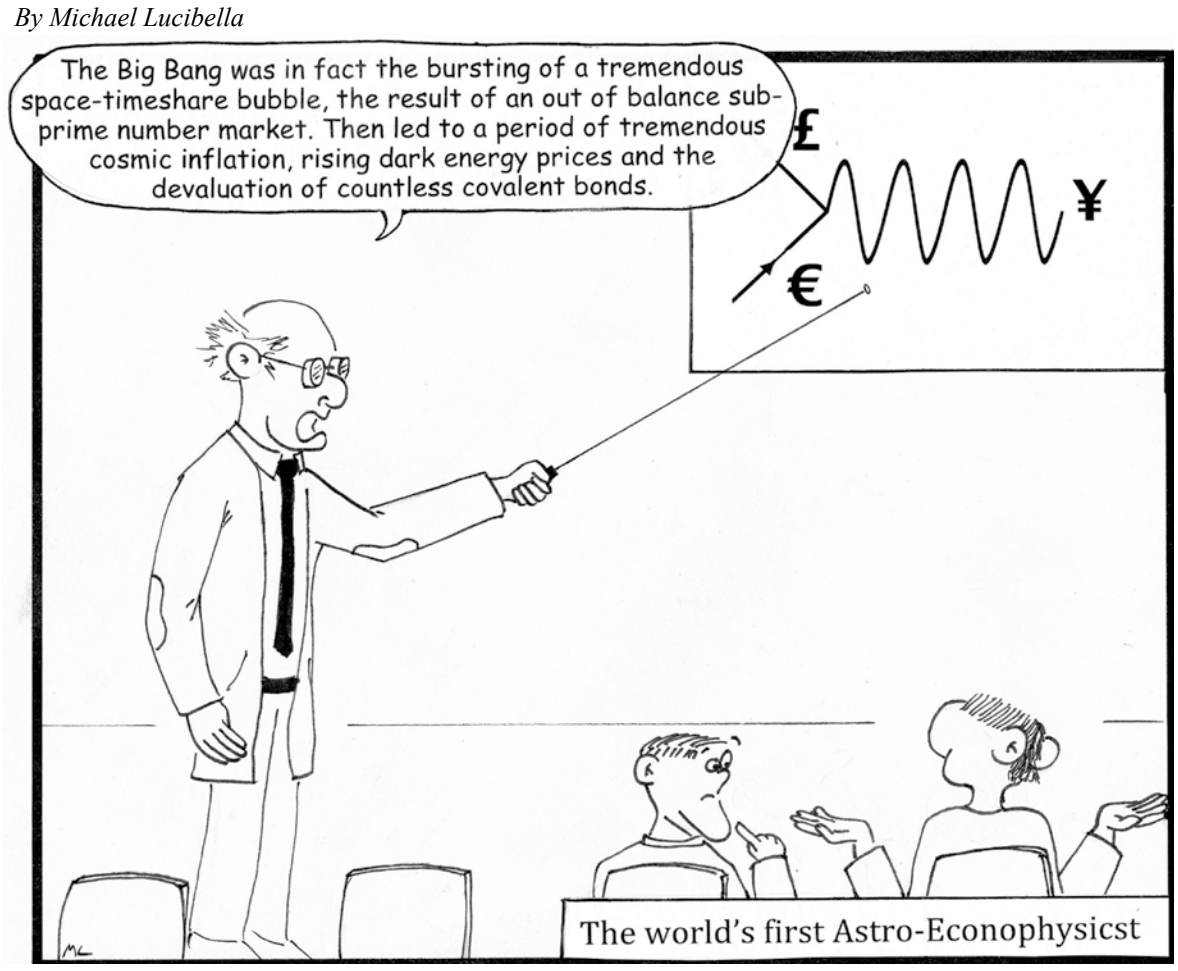
"The things that are important to me are increasing the pipeline in physics, especially for women and underrepresented minorities," Mason said. "And also just things like making sure that the public, especially policy makers, recognizes the importance of physics."

Patricia McBride has been at Fermilab for nearly 20 years. Her research focus is on the instrumentation of particle physics experiments, and she has been involved in the design of several experiments at Fermilab and CERN. In the past she has served as chair of the Commission on Particles and Fields under International Union of Pure and Applied Physics, and was a vice-president of the IUPAP Executive Council. "It's a job that I take seriously and I understand that it's important for the organization to have strong leadership," McBride said. "I'm a firm believer that these kinds of organizations have to reinvent themselves to stay current."

Zero Gravity

the lighter side of science

By Michael Lucibella



Education Corner

APS educational programs and publications

2013 Learning Assistant Program at the University of Colorado
The PhysTEC project will be co-sponsoring its fifth workshop focusing on the University of Colorado's Learning Assistant program October 27-29, 2013. The Learning Assistant program is a highly supported peer teaching experience that has been shown to improve students' learning and attitudes toward science in undergraduate lecture classes and recruit talented science and math students into teaching careers.

Information on the 2013 program will be published as it becomes available at http://www.ptec.org/conferences/cula13/. For resources and more information on the CU LA Program, visit the Learning Assistant Alliance at http://www.learningassistantalliance.org/.

APS releases new poster on Quantum Information
"Quantum Information" is an attractive and informative introduction to cutting-edge quantum physics technology for high school and undergraduate students. The poster highlights how quantum mechanics could revolutionize computing, communication and cryptography. A copy of the poster will be sent to every physics department chair in August. Additional copies can be ordered online at: http://www.aps.org/programs/education/highschool/teachers/quantum.cfm

Physics and Instructional Resources (PAIR) Project Update
20 teams consisting of a high school physics teacher and a physicist are concluding their participation in the Physics and Instructional Resources (PAIR) project. A private donation enabled APS staff to run this teacher/scientist alliance project in schools across the United States. Teams received funds to purchase classroom equipment for the high school teacher, and the pair worked collaboratively to integrate that equipment into the classroom. Projects included building large-scale classroom demonstrations, purchasing iPads for computer data collection, and building a bicycle-powered electric generator. Participating teachers reported increased confidence in their ability to teach physics concepts as well as enthusiasm on the part of their students.

Topical Group on Education Research: New APS unit for advancing the learning and teaching of physics
The objective of the Topical Group on Physics Education Research (GPER) is the advancement and diffusion of knowledge concerning the learning and teaching of physics. This knowledge is based on studies ranging from individuals to institutional practices, from neural and cognitive processes to social and contextual components of education, from basic research to educational practices in physics. The objectives of this research include the integration of scientific knowledge and analysis methods across disciplines to address the dynamical complexities and uncertainties of learning and teaching physics. Learn more at: http://www.aps.org/units/gper/index.cfm

DISPATCH continued from page 3

A Climate Change Statement Review Subcommittee has been formed. The Subcommittee will be reviewing the current APS Statement on Climate Change to determine if revisions are necessary, based in part on the report of Working Group 1 of the Intergovernmental Panel on Climate Change (IPCC) due for release this fall.

POPA considered and approved a proposal, suggested by the APS Committee on Education, for a Society-endorsed statement on undergraduate research. The proposed statement will now move to the APS Council for comment, and then on to the APS Executive Board for review.

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

Media Update
The push for the passage of the Helium Stewardship Act was bolstered by two op-eds recently published in *Politico* and *Roll Call*, two leading Capitol Hill newspapers.

APS President Michael S. Turner and Moses Chan, physics professor at Penn State University, authored the *Politico* piece on June 18, stating the bill is necessary to support cutting-edge research for scientists and high-tech products developed by the nation's advanced manufacturing sectors. Chan also wrote a commentary in support of the bill on July 9 in *Roll Call*.

To read the op-eds, click on the following links: http://www.aps.org/policy/upload/Helium-op-ed-Politico-6-18-2013.pdf and http://www.aps.org/policy/upload/Helium-commentary-RollCall-6-2013.pdf

In other news, Michael S. Lubell, director of public affairs for APS, wrote an op-ed in *Roll Call* on July 25 titled "Why Social Science Matters." In the piece, Lubell states that social science has become a "punching bag for conservatives" even as they use the research for political purposes such as public polling.

For more information, log on to the APS Public Affairs website:
http://www.aps.org/policy/

...and the abstract was t-h-i-s long ...

In late July, 22 physicists convened at APS headquarters in College Park to sort abstracts for the upcoming meeting of the Division of Plasma Physics. In the photo, Nikolai Gorelenkov of Princeton Plasma Physics Laboratory (left) converses with Mark Koepke of West Virginia University (center) and colleague Igor Kaganovich of PPPL. The DPP meeting will take place in Denver, November 11-15.

Photo by Michael Lucibella

Winners Selected in APS Middle-School Science Program

APS has announced the winners of this year's PhysicsQuest competition for middle school students. Taking the grand prize is Robert Capanna's fourth-period class at the Kiski Area Intermediate School in Vandergrift, Pennsylvania. The class won an assortment of physics gear from APS, and a $500 gift certificate to be redeemed at the school science suppliers Educational Innovations. In addition, each student received an iPod Touch.

"This year the class that won had been doing it for several years and were excited to get iPods for the whole class," said Rebecca Thompson, head of the APS Public Outreach Department.

Each year, APS sends out 13,000 free kits, one per classroom, to more than 3,500 teachers across the country. Each kit contains the materials for four experiments and a comic book starring the original APS superhero Spectra. Classes perform the experiments and send in their answers for a chance at winning the randomized drawing.

This year's theme was fluid dynamics and granular materials. The kits featured experiments about how cornstarch in water is a shear thickening non-Newtonian fluid while ketchup is shear thinning. Other experiments included investigating the "Brazil nut effect," building a vortex cannon, and testing the hydrodynamics of different shapes.

"One of the things that we did that was new this year was the Facebook group," Thompson said. "The discussion between teachers was extremely valuable.… It allowed everyone to see interesting uses for the kits and experiments."

The experiments are designed to teach physics, and get students interested in learning how science works at the same time.

"Kids open the kits and get excited about the toys inside," Thompson said. "It's also teaching not just fluid dynamics but also broader ideas like how to design an experiment, the scientific method and investigation."

Second place this year went to the 2013 Henry Owen Science Students from the Shore Educational Collaborative in Chelsea, Massachusetts. They received assorted physics gear and a $300 gift certificate.

Third place went to Linda DeCarlo's eighth grade physical science class at the Sawgrass Springs

WINNERS continued on page 6

APS Committee Endorses Next Generation Standards

By Michael Lucibella

The APS Committee on Education voted to endorse a set of science standards aimed at bringing some uniformity to the patchwork of standards adopted by state boards of education across the country. The committee signed off on the physics content of the Next Generation Science Standards (NGSS), and voted to encourage states to adopt them.

The standards were in part inspired by the Common Core set of standards for math and language arts which have been adopted by more than forty states. The science standards were first released in April and so far three states have adopted them while others are in the process of considering them.

"My guess is more than half of the states will have adopted the standards in a couple of years," said Helen Quinn of SLAC, who chaired the National Research Council's Board on Science Education which helped author the standards.

Authors of the standards point out that though many state boards of education have expressed an interest in the NGSS, it is neither a national set of standards nor mandatory. States can voluntarily adopt or reject the standards.

"The Next Generation Science Standards is a project to get states hooked together on their expectations for learning science," said Paul Cottle, chair of the APS Committee on Education. "They're appropriate for setting topics that every student should know."

The National Research Council, the National Science Teachers Association, the American Association for the Advancement of Science and the educational nonprofit Achieve worked together to develop the standards along with representatives of 26 state boards of education. The Carnegie Institute of New York helped fund the effort.

The standards are composed of a number of "performance expectations" that students should be able to achieve. Such expectations emphasize teaching how science works and what scientists do rather than a list of scientific facts and equations.

"It's a whole shift in thinking about what standards are and what they are not," Quinn said.

The aim of the standards is to set a minimum bar for students to understand the scientific process after graduating from high school. The standards are not for students who have taken a physics-specific course, as many states don't require more than two years of basic science.

Textbook manufacturers in particular have been supportive of the effort because it is easier to print textbooks that conform to a broadly adopted set of standards than to the amalgam of disparate state standards that exists today.

"There are many ways in which scientists working with teachers could help the implementation phase," Quinn said, adding that the APS involement in teacher training is one way that the Society can help states adopt the standards. "Adoption is one step; implementation doesn't happen overnight."

Education standards have historically been a controversial idea. Oftentimes state boards of education object to the idea of having national standards imposed on them, which is why the Next Generation standards are voluntary and have been organized with much input from states.

In addition, some boards find the content of some of the standards objectionable.

"There's always the issue of evolution, and there are people who aren't happy that there's the issue of anthropogenic effect on climate," said Ramon Lopez, a professor at the University of Texas at Arlington. "We're not trying to preach to students, we're asking them to evaluate the evidence."

Though the physics community has been generally positive towards the standards, some concerns have been raised within that the standards aren't expansive enough.

"Breadth versus depth has been the ongoing tension in the process," Cottle said. "As physicists we naturally favor a much deeper understanding."

Writers of the standards said that coming up with a final version was a balancing act.

"They are by no means perfect," said Lopez, "but I think it would be very difficult to do a whole lot better."

KIRBY continued from page 1

Implementation ideas were not part of the strategic plan document because we wanted to involve more of our members in this phase of the planning process–through our units, APS committees, and ad hoc task forces. Over the next several years we will continue to lay out an implementation; we can't do everything at once.

What are the broad aims of the strategic plan?

It is not an accident that goal number one is serving our members better. From what I understand in the past, APS perhaps defined itself in terms of serving the physics community broadly. So emphasizing serving our members was a bit of a change. But I think our members are our strongest asset. We need to be thinking about how we communicate better with them, and how we engage them better in the activities and programs of the Society.

In addition we have objectives to increase diversity and foster inclusiveness in our membership and in the physics community as a whole. We need to be serving our early-career members (graduate students, postdocs, and those moving into their first jobs) better. We also need to be recognizing the important contributions that physicists in the private sector (industry/high-tech companies) make and to understand how better to serve this cohort and connect this community with our early-career physicists. As physics has become more of a global enterprise, it is important for APS to increase its international engagement.

We want to continue to lead in the dissemination of physics, both through our journals and meetings, as well as serving the physics community and society through our programs in education, diversity, outreach and advocacy for physics.

What's next?

Perhaps it's important to lay out what's happened since we rolled the plan out to the members in May 2012. One of the first task forces that we formed focused on early-career physicists. Serving this community with more extensive career information and creating opportunities for them to network with a diversity of people working in physics and physics-related areas is a top priority for APS. The Task Force, chaired by Brad Conrad (Appalachian State University) enthusiastically recommended moving forward to initiate a program of early-career "chapters" and the Executive Board approved this in June. We expect that in a year's time we will have started up 5 early-career chapters located around the U.S., and hope that there will be interest from many more groups to start one.

The Development Task Force, chaired by APS President-Elect Mac Beasley, has recently completed its work. We had realized that we were going to have to ramp up our development efforts in order to fund important new activities in the future. This Task Force looked critically at our development efforts and made some valuable recommendations, which we will be starting to implement immediately.

How will the membership see the strategic plan impact them in the near future?

I hope the early-career physicists see that we are moving to serve them much more effectively and to provide a supportive community within which they can really flourish. We've also hired an industrial physicist who will start work in mid-September. He will help to build our relationship to physicists working in the private sector, because I think we need to raise the profile of industrial and applied physics within the APS, which will also serve our early career physicists better. Most of our students will ultimately not go into academia, but they will find rewarding work in the private sector. Including that community more within the APS membership and APS programs and activities is really important in terms of creating a community of opportunities for young physicists.

APS is just in the process of starting a new journal focusing on applied physics. It aligns with our interest in terms of raising the profile of industrial and applied physics.

Another thing that I hope our membership sees in the future is the fact that our website is going to be undergoing considerable improvement. We recently formulated a digital strategy, which should result in vast changes to our website in terms of searchability across all journal and meeting content, and an improved overall user experience.

What are some of the longer-term plans?

We're very concerned about making our meetings more innovative. We've just formed a Task Force to look at the APS April Meeting and see if there are ways we can make that meeting more of a "must-attend" meeting. We've moved to increase the content on the web from our meetings by video-recording plenary talks at both the March and April Meetings and also posting invited talks from most of our meetings on the web (with the speaker's cooperation). We will be continuing to look at ways to bring innovative changes into our meetings.

We will form a Task Force on International Engagement this fall to make recommendations on programs that will help us serve our international members better, identify opportunities to partner with other physical societies around the world, and will generally raise the level of our international engagement.

Finally, in each new endeavor, we will be looking at ways to assess impact and measure success.

Are you excited for your second term, and having the chance to implement all this?

Absolutely, I am very energized. I think it's important to build on the commitment of all our members to this organization. I think we can always improve our effectiveness, our member communications, and we need to be focusing constantly on serving our members and the physics community in ways that are valued. We need to be sure that we are advancing physics, whether it's advocating for research funding from the federal government, or whether it's communicating to the public the importance of the contributions of physics research in their daily lives. These are all opportunities that we are currently pursuing, trying to make sure that we do things that have the greatest impact.

BRAZIL continued from page 3

What I saw at UnB made me realize the ingenuity of individuals who wanted to share their love of science without many resources or much financial support, since improving education is only starting to become a priority for the Brazilian government.

I visited the private American School of Brasilia to see the "best-case" scenario of high school education in Brazil. The physics class felt like a SCALE-UP classroom: students worked in groups to collect real-time lab data, solve problems on whiteboards and present results to classmates. Unfortunately, active and collaborative learning opportunities are rare in Brazil, especially in public schools, because financial resources are tight and often, teachers are not trained appropriately. This was true even back in 1950, when Richard Feynman complained about the shallowness of education here, since he found students could only recall facts, not apply information.

Realizing that students need to do more than memorize information to be innovative, productive members of today's workforce, physics professors at the University of Sao Paulo (USP, South America's best university) applied for funding to implement SCALE-UP's minimal lecture, technology-rich, highly collaborative approach. I wanted to make sure to visit and see how they use this reformed pedagogy and classroom design. SCALE-UP has been spreading rapidly (currently to almost 200 institutions worldwide) and André Vieira had been inspired to try it at USP after talking to a collaborator at Duke University.

Sao Paulo's 12 million residents make it the biggest city in Brazil and one of the most diverse, blending indigenous, African, European and Asian heritages. Sao Paulo actually contains the largest population of Japanese people outside of Japan. I asked if ethnic diversity provided motivation for adopting SCALE-UP, since at NC State it significantly reduced failure rates for women and other traditionally underrepresented groups. USP professors are more concerned with handling differences in economic background and incoming knowledge, especially after recent affirmative action efforts. Universities are required to accept a certain percentage of students from public high schools, which historically provide a notoriously poor education, thus the preparation of students varies significantly.

My last meeting was with the Chemistry Education Group at Brazil's largest Federal University in Rio de Janeiro (UFRJ). The disparity between rich and poor is especially apparent in Rio, a city infamous for its favelas (slums). Educating these students is a challenge, since many struggle with drugs, gangs, and lack of food and healthcare. The Chemistry Education Group has rapidly expanded its facilities to include computer labs and rooms for experiments for students whose schools cannot afford these supplies, and their outreach efforts keep growing.

Overall, Brazil and the United States face similar challenges as large, diverse countries trying to stay competitive in an increasingly technological age. I enjoyed the opportunity to share dialogue with Brazilians in a variety of positions about educating the next generation of scientists and engineers. I expect these collaborations to last a lifetime–I am working with my UnB host on a paper and Andre Vieira from USP came to visit my University to see SCALE-UP in action. Every time I said goodbye to someone in Brazil, they wanted me to promise to come back. I hope I will be able to return soon!

Kathleen Foote is a physics PhD candidate in the Physics Education Research Group at North Carolina State University.

BRIDGE PROGRAM continued from page 1

Program Manager.

Newly selected Bridge Fellows also had the opportunity to interact with students from existing bridge programs at MIT, Columbia, Michigan, and Fisk-Vanderbilt. These students participated in a panel in which they candidly described their experiences, talked about how they fared with the GRE, and shared defining moments, among other topics.

Peter Henderson, Senior Advisor to the President at University of Maryland, Baltimore County, delivered the opening plenary at the meeting. Henderson discussed the National Academies Report "Expanding Underrepresented Minority Participation: America's Science and Technology Talent at the Crossroads." He explained why broad participation matters, and presented recommendations from the report. He also discussed UMBC's Meyerhoff Program, designed to increase diversity among future leaders in STEM.

William Sedlacek, University of Maryland, gave a talk on "What more do I need besides grades, test scores, and the right courses?" Sedlacek described the GRE as an insufficient predictor of graduate school success, and advocated using non-cognitive variables in measuring prospective graduate students. These variables include demonstrating leadership, having long-range goals, taking advantage of support networks, and being involved in the community, among others.

Leaders from bridge programs from around the country presented the nuts and bolts of their programs during a session on bridge program logistics. Summer Ash, Assistant Director of Columbia University's "Bridge to the PhD" Program, described the two-year non-degree program, in which students are hired as research assistants as they prepare for graduate school in the natural sciences. Çagliyan Kurdak explained that the University of Michigan Applied Physics Imes-Moore Fellows Program emphasizes program flexibility and personalized mentoring in preparing students to complete doctoral degrees in applied physics. Keivan Stassun said that the Fisk-Vanderbilt bridge program looks for basic content preparation and "grit" in students accepted into its two-year master's sequence, designed to lead to a Vanderbilt PhD.

The conference also featured sessions on research on mentoring, building community, generating administrative and faculty support, being a successful mentee, research/evaluation questions on increasing diversity, and admissions criteria and their correlation with success.

In a plenary talk, Valerie Purdie-Vaughns of Columbia addressed stereotype threat–the well-documented effect of scoring below ability in high-stakes measures when seeing oneself through the lens of a negative stereotype. She presented values-affirmation as a way of reducing stereotype threat by reminding people of sources of their self-worth.

Mandana Sassanfar described the two-year non-degree Biotechnology Biology Bridge (B3) Program at MIT, which provides students with research training in industry as well as rigorous academic preparation at MIT.

Philip Kutzko, University of Iowa, spoke about the National Alliance for Doctoral Studies in the Mathematical Sciences, which has similar goals to the Bridge program. It seeks to increase the number of students from "families, regions and ethnic backgrounds that have had little prior contact with the profession and culture of the mathematical sciences" who enroll in doctoral studies, earn doctoral degrees, and enter the workforce. The Alliance has built a sizable community of faculty mentors, math sciences students, and math sciences departments committed to promoting a diverse workforce.

The APS Bridge Program is funded by a grant from the National Science Foundation. The project anticipates holding another meeting next June, featuring the role of master's degrees in improving diversity.

WINNERS continued from page 5

Middle School in Coral Springs, Florida. They received a $100 gift certificate and physics gear.

"It's really refreshing to find an organization that supplies a resource that is usable by itself," DeCarlo said. "This comes completely encapsulated…. I wish more companies would do something like this."

ANNOUNCEMENTS

Physicists, physics graduate students, and postdocs 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 Graduate Student and Postdoc Visitation Program,** U.S. and Indian graduate students and postdocs may apply for travel funds to pursue a breadth of opportunities in physics.

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

Application Deadline: Friday, 1 November 2013

Application information: www.aps.org/programs/international/us-india-travel.cfm

BRAZIL-U.S. Exchange Program 2014

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

Accepting applications from U.S. applicants for the Brazil-U.S. Exchange Program.

Through the **Brazil-U.S. Physics Graduate Student and Postdoc Visitation Program**, graduate students and postdocs can apply for travel funds to pursue a breadth of opportunities in physics. 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 deadline for U.S. applicants traveling to Brazil is Friday, 1 November 2013.
http://www.aps.org/international/programs/brazil.cfm

Information for Brazilian applicants: www.sbfisica.org.br/v1/

CORRECTION: In the Back Page in the February *APS News*, in the discussion about use of the GRE as an admissions criterion for graduate school, it was stated that in "the US News formula, the weight given to the mean GRE score is 12%." This is incorrect for physics; their science department rankings are based solely on peer surveys. The National Research Council includes the GRE as 8% of the department rankings.

RAYLEIGH continued from page 2

laws lay hid in night: God said, Let Newton be! and all was light." Argon and four other elemental gases lay hid in plain sight, there in every breath. Rayleigh's diligent physics and Ramsay's savvy chemistry brought all to light.

The name "argon" was proposed by H.G. Madan, from the Greek word, aergon meaning "inert" or "lazy". It is a contraction of two words, "a" and "ergon." The "a" is a prefix negating the following word, as in "apolitical," or, indeed, "atom." The "ergon" is "energy," as in the "erg" of physics.

Rayleigh and Ramsay each received the Nobel Prize in 1904, Rayleigh for Physics and Ramsay for Chemistry.

OLYMPIANS continued from page 3

of the High Technology High School in Lincroft, New Jersey. This was his second time competing at the Olympiad, and he placed fifth overall. "The test is not the big emphasis."

The students were treated to trips to local museums and historical sites around Copenhagen. Researchers from the Niels Bohr institute came and spoke to the Olympiad participants.

Calvin Huang from Gunn High School in Palo Alto, California, placed first overall in the experimental competition, which had two parts. The first dealt with the speed of light, and in the second, students were given solar cells and a related series of questions.

"I feel quite good about it. It's nice to think that I'm the best experimental physicist in the world," Huang quipped. He added that he particularly liked the last question dealing with solar cells, which asked the students to determine water's index of refraction by measuring the change in current when a container of water is placed between the solar cell and the light source.

Stanley said he felt that over the last five years Olympiad questions have gotten more creative for the students. Instead of what he calls "cookbook" questions, where students plug in a long series of prescribed equations into their calculators, he's seen more abstract questions where students have to infer their own problem-solving methods.

"It was kind of neat dealing with questions that the organizers tried to make practical yet good," Stanley said. He said also that his favorite question asked the students to estimate the power of a meteor by analyzing video of it taken by a security camera.

OPEN ACCESS continued from page 1

the publishers' websites, other non-governmental repositories or a government server akin to PubMed Central, which is managed by the National Institutes of Health.

"The OSTP memo has a set of requirements that are going to be met one way or the other. The question is how," said APS Treasurer/Publisher Joseph Serene. "We would prefer people to find papers on our own sites."

He added that he would like to see federal funds spent on science research rather than on maintaining a server for journal articles, similar to those already maintained by the publishers. "Publishers have been hosting their content for a long time; we know how to do this."

A significant feature of CHORUS is a central web portal through which researchers can link to open access articles stored on the publishers' servers. The CHORUS website would cross-reference metadata of the papers to make them more easily discoverable.

A new standardized metadata tag that identifies the funding source of research has been developed. Everyone would be able to more easily track which papers received federal funding and are therefore subject to the requirements outlined in the OSTP memo.

The inclusion of the funding information is as effortless as possible for the authors.

"All they have to do is put the proper acknowledgement in their paper and they're done," Serene said.

If all goes well, it is likely that a proof of concept version of CHORUS will be running by the end of summer and a full version by the end of the year.

In another action by the Executive Board, APS decided not to participate in the proposed SCOAP3 open access initiative. Based at CERN in Geneva, the initiative intends to redirect institution subscription revenue to participating publishers to make high-energy physics papers available open access.

JOURNAL continued from page 1

geoning area," said Kate Kirby, APS's Executive Officer. "I hope it becomes the journal in which to publish high quality applied physics papers."

In the last ten years, applied areas of physics research have seen tremendous growth. Both the number of articles in applied physics, and the number of journals devoted specifically to it have been growing substantially, particularly in condensed matter and materials.

"The journal is going to be very broad in scope," Sprouse said, adding that all fields with an applied component are encouraged to publish in the new journal.

The push for *Physical Review Applied* stems also from the APS strategic plan, which calls for more effort to reach out to, and to serve, applied and industrial physicists.

"It aligns very well with the aims of the strategic plan," Kirby said. "To have a journal of applied physics research within the *Physical Review* family is an important statement that applied physics and industrial physics is valuable research that advances physics frontiers."

"There's a broad goal of the strategic plan that we should have a place in our journals for all of our members to publish," Sprouse said.

APS has constituted a search committee to find an editor for the journal. Following the selection of the editor, the committee will begin recruiting associate editors. If all goes according to plan, researchers will start submitting papers in the fall, and the journal will publish its first issue sometime early next year.

***PHYS REV X* continued from page 1**

tributes more weight to the highly cited journals while it controls for self-citations and for journal size. Eigenfactor gave *PRX* an article influence score of 5.001.

"The articles in *PRX* are clearly making an impact," said the journal's editor, Jorge Pullin, in a statement. "The physics community has been very supportive. We are eager to continue *PRX's* current momentum and take it to an even higher level in terms of quality and influence."

Launched in 2011, *PRX* is an online-only author pays open access journal, featuring research from all physics disciplines. It is one of three APS journals that are entirely open access. The rest are hybrid journals that include some open access content.

In the same report, *Reviews of Modern Physics* received an impact factor of 44.982 while *Physical Review Letters* came in at 7.943 (both published by APS).

More information about the impact factor, and a discussion of the pros and cons of using it as a measure of significance, can be found in Wikipedia under "Impact Factor", and in E. Garfield, "The history and meaning of the journal impact factor", *J. Amer. Med. Assoc.* 295, 90 (2006)."

The Back Page

The Role of Physics Departments in High School Teacher Education

By David E. Meltzer, Monica Plisch, and Stamatis Vokos

The Task Force on Teacher Education in Physics (T-TEP) was convened by APS, AAPT and AIP to examine high school physics teacher education in the United States and make recommendations for its improvement. T-TEP found that, except for a handful of isolated pockets of excellence, the national landscape of physics teacher preparation shows a system that is largely inefficient, mostly incoherent, and completely unprepared to deal with the current and future needs of the nation's students.* Physics departments have an indispensable role to play if every high school student is to have the opportunity to learn physics with a qualified teacher. However, most physics departments currently avoid playing an active role in physics teacher education. We believe this avoidance is not in the best interests of the physics community.

I. The impact of pre-college science education on the physics community

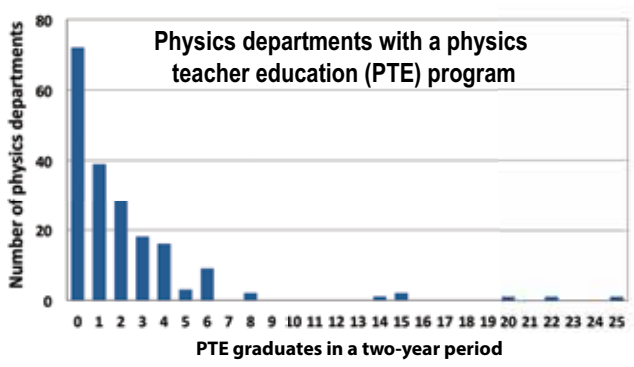
The US physics community has become habituated–perhaps unconsciously–to a pre-college science education system that is relatively weak by international standards. Several studies have confirmed that, when comparing equivalent student populations, US science students rank no better than middle-of-the-pack among developed nations, and indications are that physics students rank even lower. There is no great mystery regarding the cause: pre-college students in other countries study science–including physics–for more years than they do in the US, and other nations tend to put substantially more resources into preparing highly qualified science teachers for those students. Five years of study by T-TEP have shown that, despite the presence of many devoted and highly qualified high school physics teachers, the *overall* situation for US high-school physics students is not good.

The impacts of our weak pre-college science-education system are visible to varying degrees. Despite recent growth in the number of physics bachelor's degrees, the proportion of students who elect to major in physics has been shrinking: in fact, the number of physics bachelor's degrees awarded in 2010 was virtually identical to that in 1970, even though the overall number of bachelor's degrees had more than doubled. Among the consequences of this shrinking proportion is an increasingly successful campaign by some state education administrators to eliminate the physics major from "lower producing" departments. While there are many factors behind the low and declining proportion of physics majors, there can be little doubt that pre-university science education has a significant influence. Several studies have shown that students' decisions to major in science fields, including physics, are usually made well before their departure from high school. Moreover, college students who receive inadequate physics preparation in high school are at a substantial disadvantage when trying to complete a standard physics-major curriculum within four years. Studies have shown that US students beginning undergraduate work are not as well prepared in physics as are many of their foreign counterparts.

Many physics faculty are aware that, among US physics Ph.D graduates, US citizens are outnumbered by foreign citizens. An important contributing factor is that the number of US citizens who go on to physics graduate study tends to follow trends in the number of physics majors; fewer majors means a smaller pool to fill openings for graduate students. One might argue that there is no problem so long as foreign citizens are available to fill gaps left by domestic students. However, the supply of foreign graduate students is not assured long term as global investments in R&D continue to rise relative to US levels of spending. A weak science-education system is a potential liability in seeking to increase the domestic supply of physics students.

There are additional impacts of the science-education system. It is reasonable to assert–though difficult to prove–that weaknesses in pre-college science education undermine potential social support for the US science research enterprise. It is difficult to cultivate respect and support for a field that is neither well understood nor well liked by citizens who were denied an enjoyable and rewarding science education during their schooling. Weak science education also limits production of high school and college graduates with the skills needed for an increasingly high-tech economy.

Efforts to improve the US science-education system must include dramatic changes in physics teacher education; such changes may not be sufficient, but they are certainly necessary. T-TEP has found that the present system of U.S. physics teacher education is inadequate. To start with the most obvious problem, most physics teachers don't have adequate physics content backgrounds; about two-thirds of them did not major in physics or physics education. Of the minority who do have adequate content knowledge, only a small portion actually had specialized preparation in physics teaching, not merely in "general science" teaching. Not coincidentally, physics teacher preparation is scattered among hundreds of institutions, only a few of which can and do devote the resources necessary to do a good job.



II. The role of physics departments

Physicists tend to regard the situation of weak pre-college science education in the US with some resignation, believing that it is neither their job to deal with this situation directly, nor that it has any significant impact on the effectiveness of their own work or on the physics community. To the contrary, we argue, it does have an impact, and–while it may not be their "job"–university physics faculty bear some responsibility for both the causes of and the potential remedies for this unsatisfactory state of affairs. For one thing, most US. physics teachers received their physics education though US physics departments, if they received one at all. More to the point, if physics departments don't take substantial responsibility for this process, they can be sure that no one else will either: education schools have little motivation and few resources to address deficiencies in physics teacher education; neither do state education departments. There simply is no other "responsible" party, like it or not.

To be sure, in such a complex system as teacher education, there are plenty of potential culprits to hold responsible for poor outcomes. And, in our experience, our tendency as physicists is to do just that and engage in finger pointing at others. Though perhaps justified, this ignores a zeroth-order explanation: the typical university physics department neither actively recruits nor culturally supports prospective physics teachers, nor provides specialized preparation for their future endeavors. According to a T-TEP survey of all US physics departments, the typical department graduates exactly zero physics teachers every two years (see figure).

As long as physics departments place primary responsibility for the preparation of physics teachers somewhere else, abdicating their own role in the process, future teachers lose the guidance of the only community able to communicate the unique habits of mind that physicists possess. Worse still, high school physics education loses its most natural and ardent advocate. Physics is a relatively small player in STEM precollege education. Although physicists see physics as a special way of knowing–not just a collection of facts and formulas–policymakers tend to view physics as just another package (among many competing packages) of stuff to be learned, and therefore a dispensable luxury. The argument goes as follows: Students have to take science. Physics teachers are scarce. Let students take environmental science or more biology to fulfill their generic "science" requirement. Who, then, will stand up for the importance of physics education, if not the physicists themselves?

Many physics departments convey to their students (often unintentionally) the message that teaching is a second-class career option, that being a physics teacher is a compromise someone would make if their first option–graduate school–did not pan out. After all, the thinking goes, aren't a decent command of content, tolerance toward adolescents, and willingness to jump through education hoops the only requirements for becoming a teacher? Isn't the life of a researcher the only true and noble calling for a physics major? We want to believe that no university physics faculty member consciously communicates these shortsighted views to students. Yet, they are what many students pick up.

We envision a very different situation, one in which most physics departments see part of their mission as encouraging talented students to consider physics teaching as a career, and in which many physics faculty are actively engaged in the education of future teachers. Many of these physics departments would partner with expert practicing teachers to provide students with diverse role models of high-quality physics teaching, and together they would mentor bright students who sought careers as physics teachers. As a consequence, increasing proportions of high school students would experience exhilarating physics courses from inspirational, knowledgeable teachers before they even began university study. Moreover, at this time of national emphasis on the need for more and better prepared STEM teachers, a physics department that aligns itself with such institutional and national priorities is likely to upgrade its perceived value both within the university, and within society as a whole.

We believe that physicists and physics departments are capable of addressing the problem of high-quality physics teacher education quite effectively. Indeed, there are physics departments that graduate relatively large numbers of teachers from excellent programs; some of these are indicated by the outliers in the histogram distribution (see figure). The T-TEP recommendations for physics departments center on (i) developing strong content-knowledge background, (ii) cultivating early physics teaching experiences under expert mentorship, and (iii) developing special courses focused specifically on physics pedagogy. The US has never come close to meeting these recommendations for the great majority of its physics teachers.

III. What can be done

As physics faculty we can begin by asking: How many of our students have thought about becoming a teacher? If we do not know the answer, we should ask the students; their responses may be surprising. Our experience has been that a significant fraction of students consider teaching at some point in their undergraduate program. A physics department that offers an encouraging and supportive environment for future teachers can make a difference in what career students ultimately decide to pursue (and in the overall number of students pursuing a physics degree).

There are a number of steps physics faculty can take to get started. Many of these actions do not require a lot of time:

- Find out what courses and other requirements are needed to earn a physics degree and teaching certification at your institution. Make this information widely available, for example, on the department website, in the course catalog, and as a handout for advising.
- Make an announcement in introductory classes about physics teacher education and whom to contact if students are interested. The contact should be knowledgeable about certification pathways and prepared to help students navigate the requirements.
- Ask students with an aptitude for teaching if they have considered becoming a teacher. Share personal values about teaching and why it is important.
- Invite a local physics teacher to give a presentation and meet with students interested in teaching. It is even better if the teacher is an alumnus of the department or is close in age to the students.
- Go to lunch with the education faculty member in charge of the secondary science education program. Learn more about the certification program and look for opportunities to work together. Showing respect for the expertise of education colleagues can help build the relationship and open doors.
- Consider making early teaching experiences available through the physics department. Such opportunities can help students identify a passion for teaching and experience its intellectual challenges and rewards

An important resource is the Physics Teacher Education Coalition (PhysTEC) project, led by APS with AAPT since 2001. PhysTEC-supported sites have collectively more than doubled the number of their graduates prepared to teach physics, primarily by changing what happens in physics departments. PhysTEC has over 280 member institutions, and organizes an annual conference To learn more or become a member institution, visit ptec.org and phystec.org.

Meltzer, Plisch and Vokos are the editors of the T-TEP report. Meltzer is an APS Fellow and a faculty member of the Mary Lou Fulton Teachers College at Arizona State University. Plisch is Associate Director of Education and Diversity at APS. Vokos is T-TEP chair and professor of physics at Seattle Pacific University.

* The complete T-TEP report may be downloaded at www.ptec.org/taskforce