APSNEWS

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APS Store Open for Business

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Apker Awards Go To Dovzhenko, Yoder

The Apker Award for outstanding research by an undergraduate is unique in that the selection committee chooses a number of finalists, who are then interviewed in person to determine the Award recipients, usually one each from a PhD-granting institution and a four-year college. The finalists were featured in last month's *APS News*. This year's recipients, pictured at left, are: Yuliya Dovzhenko of Princeton University, who did her work on "Coherent Control of a Semiconductor Charge Qubit" in the lab of Jason Petta; and Theodore J. Yoder of Franklin and Marshall College, who worked on "Applying the Non-Relativistic Standard Model Extension to Hydrogen" under the supervision of Gregory S. Adkins. Dovzhenko is currently pursuing graduate studies at Harvard, and Yoder is doing the same down the road at MIT.

March Meeting Heads for Crab Country

The APS March Meeting is coming to the Baltimore Convention Center from March 18 through 22. It is the largest yearly physics meeting in the United States and will feature 112 invited sessions, more than 500 contributed sessions and a total of more than 8,000 papers presented. Organizers are expecting at least 8,500 people to attend. The meeting highlights the latest research from the APS Divisions of Atomic, Molecular and Optical Physics; Biological Physics; Chemical Physics; Computational Physics; Condensed Matter Physics; Fluid Dynamics; Materials Physics; Physics of Beams; and Polymer Physics, as well as the topical groups on Statistical and Nonlinear Physics, Magnetism and its Applications, and Quantum Information.

This year's Kavli Foundation Special Session will take place on Wednesday. Titled "Forefront Physics for Real World Problems: Energy, Climate, and the Environment," it will focus on the physics of issues facing the planet, such as climate modeling, energy generation and storage.

Thursday's Nobel Prize session will feature at least one, and possibly both of this year's Prize winners, David Wineland and Serge Haroche.

The new Topical Group on the Physics of Climate will hold its first session at this year's March Meeting, as will the new Forum on Outreach and Engaging the Public. In addition, members of newest APS section, the Mid-Atlantic Section, will be holding a

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New APS Award to Recognize Advanced Lab Instruction

At its November meeting, APS Council approved the Jonathan F. Reichert and Barbara Wolff-Reichert Award For Excellence in Advanced Laboratory Instruction. The Award, made possible by a donation from Jonathan Reichert and Barbara Wolff-Reichert, will honor outstanding achievement in teaching, sustaining, and enhancing an advanced undergraduate laboratory course or courses.

"It's an award we feel very strongly about because… teaching an advanced lab is demanding, time-consuming, expensive and typically unrecognized by departments and deans," Reichert said.

The annual award will provide recipients with a $5,000 stipend, as well as travel expenses to attend an APS meeting to receive the award, and to deliver a lecture about their work.

Reichert and Wolff-Reichert have long been passionate advocates of the importance of undergraduate physics laboratories. The two started the company, TeachSpin, in 1992 to sell specialized educational equipment for undergraduate physics laboratories, an area of the market they saw in need of a supplier of robust advanced equipment like cosmic ray muon detectors and precision interferometers. In 2007, they founded the Advanced Laboratory

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Student Petition Pleads for Rational Congressional Action

More than 6,000 students have signed an APS petition calling on Congress to avoid billions of dollars worth of looming budget cuts to scientific research. As this article is being written, unless Congress acts, federal science funding will be cut by about nine percent, or about $15 billion, starting on January 2, 2013. The petition calls on the leadership of both parties to put aside their differences and work to protect the government's investments in science.

"Research is an integral part of a student's education in physics. And as research opportunities become restricted, it's more and more difficult for students to incorporate that into their education," said Tyler Glembo, government relations specialist at APS. "Students recognize how important research is and recognize that it's a worthwhile thing for the government to invest in."

Though the specifics of the cuts are unclear, it is likely that they would reduce federal money spent on grants across all scientific fields, including physics. Federal spending currently makes the single biggest contribution to research in fundamental physics, and many students get their start with support from federal grants and scholarships.

Known as "sequestration," the likely science cuts would be part of a broader, federal government-wide series of budget reductions. They were set into motion to spur the 2011 Congressional "super committee" to develop a workable plan to shrink the US budget deficit. The intent was for the cuts to be so unpalatable that the commission would be forced to come

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Communication Breakdown Played Role in Scientists' Convictions

By Michael Lucibella

In the early morning of April 6, 2009, a magnitude 6.3 earthquake decimated the ancient town of L'Aquila in central Italy. After the tremors stopped, 309 people were dead and a city was left in mourning. Three and a half years later, six scientists and a government official were convicted of manslaughter connected to those deaths.

Within the scientific community, the verdict sparked fear and outrage, but also reflection about the importance of effective communication. Many geologists and physicists who study the risks of rare events have criticized the government of Italy, but have called as well for more effort by scientists to educate the public about understanding the nature of risk.

Headlines around the world proclaimed the Italian government was persecuting scientists for not doing the impossible, predicting an earthquake. However, the case against them was more complicated than that, and from the outset, prosecutors denied that the scientists were being charged on scientific grounds.

"I'm not crazy… I know they

BREAKDOWN continued on page 6

APS Partners with New System to Create Unique Identifiers

The APS journals are incorporating a new system which lets researchers and contributors clearly identify themselves in their research papers. ORCID, short for Open Researcher and Contributor ID, will give every researcher who signs up a unique user number that they or anyone else can use to track their body of work.

"ORCID is a nonprofit community effort to maintain a record of unique identifiers," said Laurel Haak, the executive director of ORCID. "By providing that unique identifier, it provides that researcher with a handle to travel around the research world."

Inspired in part by the CrossRef digital object identifiers which have become ubiquitous for identifying academic papers, the ORCID numbers will let researchers attach their own personal code to their papers. It should also make determining an author's impact factor easier to calculate.

Making sure the right person is connected with the right paper has long been a tricky problem for publishers and institutions. In addition, anyone trying to track a researcher's past works sometimes can get bogged down by authors with common names, variations on individual authors' names, or by those who have changed their names or institutions.

"There's always been this prob-

ORCID continued on page 6

Having Fun With Physics

Photo by Ken Cole

This fall in Orlando, the Society of Physics Students held its quadrennial "PhysCon" congress, bringing together undergraduates from all over the country. APS and its outreach website PhysicsCentral contributed to the festivities by hosting "Club Congress", a dance party complete with DJ and liquid nitrogen ice cream bar. The event was a huge success, drawing over 400 students who packed the dance floor to capacity. In the photo, Rhodes College students kick up their heels to a catchy tune. SPS is a program administered by the American Institute of Physics.

Members in the Media

"For years, the United States has built itself with talented individuals from abroad. At the same time, many of our young people are not so interested in science and engineering. A number of us who came of age in the post-Sputnik and post-Apollo era are reaching retirement age. Something like 40 percent of the PhDs in science and engineering we turn out every year are born abroad. But we don't make it so easy to stay here anymore. And the world has changed. Many of the opportunities are now in their home countries. We also need to look at our domestic talent. Women, underrepresented minorities and boys, too. This is a quiet crisis. People don't pay attention until it creeps up on us. It can't be fixed overnight. It takes decades to fix."

***Shirley Ann Jackson**, Rensselaer Polytechnic Institute,* The Houston Chronicle*, October 16, 2012.*

"They're not breaking any laws of physics here, so they could be really clever chemists."

***Paul Padley**, Rice University, on the possibility of extracting gasoline from its byproducts in the atmosphere,* The Houston Chronicle*, October 23, 2012.*

"The situation created by the sentencing yesterday on the facts from L'Aquila is incompatible with a clear and effective performance of the functions of the commission and its role as a consulting body for the state."

***Luciano Maiani**, Università di Roma la Sapienza, after resigning in protest over the conviction for manslaughter of six geologists in Italy,* CNN.com*, October 23, 2012.*

"The vacuum energy or dark energy which is dominating the universe today is not eternal. It won't last forever… It's actually unstable, and when it decays, it will create the next big bang.… It's not a one-off universe, which started and will sort of last in empty eternity, dominated by dark energy. In fact, the universe cycles again and again through big bang after big bang after big bang."

***Neil Turok**, Perimeter Institute for Theoretical Physics,* CBC-News.com*, November 2, 2012.*

"Take an object. It's the mass of that object times it's velocity… When a coach says his team has momentum, or a political figure says, 'My campaign has momentum,' they mean it's moving. And they mean it's moving in a certain direction–like up, for example, rather than down."

***John Hauptman**, Iowa State University,* NPR.com*, November 3, 2012.*

"In the satellite maps, we can see a man-made texture on the soil, a huge band which seems created by relatively small holes or mounds… This curious texture on the desert soil was probably produced by the pinpointing of geophysical [research]."

***Amelia Carolina Sparavigna**, Polytechnic University of Turin, from her paper describing mysterious grid patterns in Western China,* FoxNews.com*, November 5, 2012.*

"I suspect the realities of the budget would mean that there isn't going to be a lot of difference between them… The Obama Administration has consistently understood the science, especially regarding Earth monitoring, more than the Republicans."

***Lawrence Krauss**, Arizona State University, on the future of NASA's budget under either president Obama or Romney,* CBSNews.com*, November 6, 2012.*

"It's a stepping stone on the development of new technologies."

***Anton Zeilinger**, Institute for Quantum Optics and Quantum Information, on reaching a new milestone for entangling photons,* CBSNews.com*, November 6, 2012.*

"Well, what's at stake for science is also what is at stake for the nation. If we go off the fiscal cliff, and I'm not sure that's the right term for it, but if we go off the fiscal slope, several things are going to happen. Number one, the economy is likely to contract. That means that federal revenues will decline, and that means there'll be less money available to spend on a variety of programs, including science."

***Michael Lubell**, APS,* National Public Radio*, November 9, 2012.*

MEMBERS continued on page 7

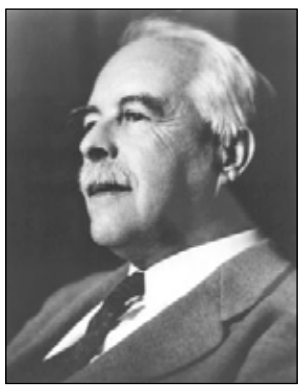
This Month in Physics History

December 18, 1926: Gilbert Lewis coins "photon" in letter to *Nature*

At the dawn of the 20th century, Max Planck and Albert Einstein turned physics on its ear by introducing the notion of quanta. Einstein's paper of 1905 dealt with the particle nature of light, but didn't call the particles photons. The coinage of that terminology comes from an American physical chemist named Gilbert Newton Lewis.

A native of Weymouth, Massachusetts, Lewis was largely educated at home by tutors, although he briefly attended public schools between the ages of 9 and 14, at which point he enrolled at the University of Nebraska. Three years later, at age 17, he transferred to Harvard College, completing his PhD in 1899 when he was just 24. He spent a year in Germany as a traveling fellow, studying under notable scientists like Wilhelm Ostwald and Walther Nernst, before returning to Harvard to teach.

In 1904, Lewis moved to the Philippines to head the Bureau of Science's unit on weights and measures, but he held the post for only a year. Instead, he returned to Boston and took a faculty position at MIT. In 1912 he joined the faculty of the University of California, Berkeley, where he spent the bulk of his scientific career.



Gilbert Newton Lewis

Early on, Lewis was fascinated by thermodynamics, particularly as it pertained to chemical equilibrium, and wrote a number of papers on the then-nascent theory of relativity, proposing an alternate derivation of mass-energy equivalence from that of Einstein. In 1913, he was elected to the National Academy of Sciences.

Lewis is best known for his work on chemical bonding, particularly the notion of the covalent bond as outlined in his classic 1916 paper, "The Atom and the Molecule," and a 1923 paper on the electron-pair theory of acid-base reactions. As early as 1902 he had been using rough sketches in his lecture notes, depicting cube-shaped atoms in which the corners represented possible positions of electrons. Eventually he realized that the electrons in an atom pair up around the nucleus, most commonly forming a tetrahedron, and that two bonding atoms could share paired electrons between them. These ideas later influenced the work of Linus Pauling, among others.

He was also the first to coin the word "photon" to describe the unit of light in a December 18, 1926 letter to *Nature*. Technically, his understanding of the term was that it described a carrier of "radiant energy"–not a particle of light per se: "I therefore take the liberty of proposing for this hypothetical new atom, which is not light but plays an essential part in every process of radiation, the name photon." In that sense, his concept differed from Einstein's 1905 quantum theory of light, but "photon" came to be used to describe what Einstein originally termed "light quantum" (lichtquant).

Lewis has a street in his hometown of Weymouth named after him, as well as a wing of the local high school library. Berkeley's Lewis Hall is so named in his honor, and he received many professional accolades for his research. But the Nobel Prize in Chemistry eluded him. Some have speculated that his bitter rivalry with Nernst was partly to blame, with the latter using his position on the selection committee to block Lewis's nominations.

It was especially disappointing because one of Lewis's own students, Harold Urey, won the 1934 chemistry prize for the discovery of deuterium–work which owed no small debt to Lewis's own contributions in using the Berkeley cyclotron to purify and characterize heavy water. Lewis resigned from the NAS that same year, possibly in a pique over this professional slight, although he may also have been frustrated by the failure of his own nominees to be elected to that august body. Another young physicist Lewis mentored, Glenn T. Seaborg, also went on to win the Nobel Prize in 1951. (Lewis did prefer to work with exceptional students, and their later success is, if nothing else, a testament to his excellent judgement.)

For all his scientific accomplishments, Lewis met with a tragic end. In 1946, one of his graduate students came to the Berkeley lab and found Lewis's body under a workbench, apparently the victim of toxic fumes of liquid hydrogen cyanide. He had been working on an experiment using the substance, but a broken line caused the cyanide to leak into his laboratory workspace. Officially, his death was attributed to coronary artery disease, but rumors have persisted over the years that Lewis committed suicide.

The chemist had been struggling with depression, possibly stemming from his snubbing by the Nobel Prize committee despite a record 35 nominations over his lifetime. On the day he died, Lewis had lunch with Irving Langmuir, who won the 1923 chemistry prize for his work on surface chemistry and was in Berkeley to receive an honorary degree. Colleagues recalled Lewis came back from that lunch visibly moody. A few hours later, he was dead.

We likely will never know for certain whether Lewis took his own life, but his legacy lives on–not just in his scientific papers, and his two sons (both of whom became chemistry professors), but in the nomenclature he coined. Every time we use the word "photon," we pay some small homage to Gilbert Lewis.

1. Coffey, Patrick. Cathedrals of Science: *The Personalities and Rivalries That Made Modern Chemistry*. Oxford: Oxford University Press, 2008.
2. Lewis, Gilbert Newton. (1926)"The conservation of photons," *Nature* 118 (2981): 874-875.
3. Lewis, Gilbert Newton. *Valence and the Structure of Atoms and Molecules.* New York: Chemical Catalog Co. Reprinted, New York: Dover, 1966.

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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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Double Whammy Doesn't Derail APS Plasma Physics Meeting

Overcoming both severe weather and new restrictions on travel reimbursement, the 54th annual meeting of the APS Division of Plasma Physics took place successfully in Providence, Rhode Island from October 29 through November 2. More than 1,300 physicists presented research highlighting the latest advancements in plasma physics.

The meeting opened with a plenary talk by the University of Wisconsin-Madison's Ellen Zweibel on the hundredth anniversary of the discovery of cosmic rays. John Edwards from Lawrence Livermore National Laboratory updated attendees on the National Ignition Facility's work to achieve an energy positive thermonuclear fusion reaction. For the James Clerk Maxwell Prize for Plasma Physics talk, Liu Chen from the University of California, Irvine spoke about his research on shear Alfven waves.

On Thursday and Friday, schoolchildren from the area toured the exhibit hall. In all, exhibitors showed off different physics demonstrations to about 3,000 children over the two days.

Tuesday's Teachers Day had to be canceled because of Hurricane Sandy. About a dozen teachers showed up nevertheless, and participated in an impromptu workshop where experts helped them integrate plasma physics into their lesson plans.

Overall, attendance at this year's meeting was down a few hundred from last year's, which organizers attributed primarily to Hurricane Sandy. The so-called "Superstorm" hit the Northeast on the night of the first day of the conference. Attendees in Providence said that the storm itself was relatively mild compared to its impact across other parts of the eastern seaboard, but that transportation to the meeting was difficult.

"Flights were cancelled, people couldn't get here. It was chaos for the first couple of days of the meeting," said Don Wise, the senior meetings registrar at APS.

As reported in the August/September *APS News*, last May the Office of Management and Budget issued new restrictions on travel to scientific conferences for government scientists. As applied to the Department of Energy, the new policy stipulated that in order to spend more than $100,000 to send scientists who are federal employees to a meeting, the Deputy Secretary needed to sign off, and more than $500,000 would require the Secretary's signature. Conference organizers worried this would mean a significant decrease in attendance, especially at a meeting like DPP, which draws heavily from national laboratories.

"I think attendance was down from some of the bigger labs," Wise said. "It's hard to tell with the storm and the DOE restrictions happening at the same time."

Wise added that if attendance continued to be low next year, it would likely be the result of the new DOE travel policies, and that he would be watching the March and April meetings numbers carefully, looking for any noticeable impact.

Early-Career Task Force Gets Underway

Photo by Halleh B. Balch

As reported in last month's *APS News*, there are several task forces currently working to implement the APS Strategic Plan. Among them is the Task Force on Early-Career Physicists, which held its first meeting on October 15 at APS headquarters in College Park, MD. In the photo, left to right, are Task Force Chair Brad Conrad, and members Megan Comins, Cynthia Aku-Leh, Meghan Anzelc and Greg Meisner. Not pictured are Amber Stuver, Tom Baer, and Heather Galloway.

Foster Victory Adds 2nd Physicist to Congress

On Election Day, physicist Bill Foster regained an Illinois Congressional seat, after having been defeated in 2010. The Democrat joins Rush Holt (D-N.J.), thereby doubling the number of physicists in Congress. He unseated Republican Judy Biggert, who had been a member of Congress for fourteen years, serving during all that time on the House Science Committee.

Foster started as a researcher at Fermilab in 1984. He was part of the team that wrote the software for the CDF detector collaboration that discovered the top quark in 1995. He also helped design and manage the construction of the Tevatron's recycler ring.

Foster was first elected to the Illinois 14th Congressional district in a special election in 2008 after former house speaker Dennis Hastert (R-Ill.) stepped down. The district encompassed the cities of Aurora and Batavia, home to many of the physicists who work at nearby Fermilab.

In 2010, Foster lost his seat to Randy Hultgren as part of the Republican takeover of the House.

Following the 2010 census, the Congressional district lines were redrawn, splitting up Biggert's old district and reforming the 11th over some of the areas that used to encompass Foster's 14th. The redrawn district abuts Fermilab and Argonne National Lab. After a campaign that focused on the importance of science, Foster won the district with 56 percent of the vote.

In his victory speech, Foster thanked Biggert for her years of service in the House, and called for more bipartisanship and cooperation in the legislature.

"Our nation faces tough problems–more than a decade in the making. And there is no doubt that compromise will be required to resolve these problems," Foster said in his speech.

In her concession speech, Biggert echoed Foster's call for bipartisanship.

"Our county has faced so many challenges and the only way that they will be met is by reaching across party lines, setting aside the differences and caring more about the solutions than the sound bites or the next election," she said.

The importance of scientific research to America's economy was a central theme of Foster's campaign. Previously he served on the House Science, Space and Technology Committee, and will likely return.

"Investments in basic scientific research are among the highest return on investment of any that our society can make," his website read. "[K]eeping the technological pipeline full–from basic research, to technology development, to market driven deployment of advanced manufacturing technologies–is crucial to our country's long term economic health."

INTERNATIONAL News
...from the APS Office of International Affairs

Russian-American Scientist Association

By Vladimir Shiltsev (President of RASA and Director of Accelerator Physics Center, Fermilab, Batavia, IL)

As the number of APS Fellows elected from Russia has been increasing since 1995 (with 16 elected in 2011), I want to take this opportunity to introduce APS members to a US-based organization representing the Russian science community–the Russian American Scientists Association (RASA).

The Russian American Scientists Association (http://www.rasa-usa.org) is a nonprofit organization working to consolidate the Russian scientific diaspora, to advance the career development and qualifications of its members, and to provide opportunities for social and cultural exchanges. RASA represents over 300 members, including scientists, engineers and hi-tech entrepreneurs in academia, national laboratories and industry in the United States and throughout the world. Together with European branch, RASA-USA is an integral part of the international Russian-speaking Academic Scientists Association (http://www.dumaem-po-russki.org). The objectives of the RASA include:

- Organization of a world-wide network of Russian-speaking scientists, engineers and hi-tech entrepreneurs working outside Russia.
- Exchange of knowledge and experience, initiation of joint projects and coordination of research programs.
- Dissemination of information on research achievements and innovations.
- Organization of conferences, seminars, research schools.
- Provide information regarding job opportunities, permanent and temporary position openings, graduate and postdoc fellowships, etc.
- Share knowledge of teaching programs and lecture materials.
- Mentoring of junior scientists, engineers and entrepreneurs by successful established colleagues.

RASA is governed by a Coordinating Committee comprised of leading US scientists representing a wide spectrum of research areas–physics, biology, mathematics, biomedicine, chemistry, etc., as well as those working in many high-tech and IT areas. We hold annual conferences–e.g., in 2012, the conference took place in Philadelphia on November 9-11. In addition, RASA actively interacts with Russian scientific-educational and governmental organizations. At the request of the Russian Corporation of Nanotechnologies (RUSNANO) and the Ministry of Education and Science (RMES), many members of RASA provided scientific expertise on applications for various supporting grant programs. Some dozen members of RASA actively collaborate with individual Russian institutions and lead research groups in Russia. In 2010 RASA along with RMES started the program of the International Center of Advanced Science. Under this program, undergraduate and postgraduate students from Russian universities compete for scholarships from the President of the Russian Federation for training in several dozens of different research centers abroad in fields such as biotechnology, energy, nuclear technology and software, medical equipment and pharmaceuticals, aerospace and telecommunications, nanotechnology, etc. In 2012 Argonne National Laboratory and Fermi National Accelerator Laboratory (both in Illinois) hosted three ICAS physics students for six months each. Stony Brook University (New York) is expected to join ICAS in 2013.

Since 2011 RASA has actively participated in and coordinated activities aimed at cooperation with the Skolkovo Institute of Science and Technology (SkTech), which is formed as part of a cooperative agreement between the Russian Foundation of the Center of Research and Commercializing of New Technologies "Skolkovo" and the Massachusetts Institute of Technology–see https://sktech.mit.edu/. RASA members take an active part in the reviews of the proposals for the organization of the SkTech / MIT research centers.

Together with the Russian Centre of Science and Culture in Washington, DC, RASA organized a tercentennial celebration of the great Russian polymath Mikhail Lomonosov in November 2011. RASA members are actively involved in lectures, seminars, writing articles and other educational activities in the United States (for example, several articles appeared in scientific and popular journals on great Russian scientists such as M. Lomonosov, L. Shtern, N. Gurvich, etc.), and in Russia.

RASA is seeking new members–so, if you want to join, please, contact us at mod.rasa.usa@gmail.com

New APS Online Store Sells Items with a Physics Theme

APS recently launched an online store where both members and the public can buy items with a physics theme.

The website opened on August 30 and has been doing brisk business since then. The store features clothing with the "APS Physics" logo, posters, brochures and physics toys and demos.

Jennifer Pirnat, APS's membership communication program manager and administrator of the store, said that in the first month and a half they had received more than 100 orders.

"It's about showing the fun side of physics," Pirnat said. She added that some of the best selling items so far were the "Flirt Harder, I'm a Physicist" T-shirts and a red bumper sticker that reads "If this sticker is blue, then you are driving too fast."

The store brings together items from different branches of APS, such as brochures about careers in physics from the Education Department, and a science kit from the Outreach Department that transmits sound using a laser. The store also carries nine different clothing designs, including the popular "Don't Drink and Derive" shirt as well as a child-sized "Future Physicist" shirt.

"This is a benefit that previously we had available only at meetings," Pirnat said, pointing out that until the store opened there was no way for potential customers to buy the items except at the meetings. "We would receive probably 50 emails throughout the year from people who had seen a product at the meetings and wanted to purchase it," she added.

The store can be found at http://store.aps.org/

Four Departments Gain Distinction in Improving Physics Education

The APS Committee on Education has announced the 2013 recipients of its Award for Improving Undergraduate Physics Education. The four programs that are recognized range in size from the very large to the rather small.

The newly announced recipients are the Colorado School of Mines, Kettering University, the Massachusetts Institute of Technology, and the University of Wisconsin–LaCrosse. Their citations, which explain the particular features of their programs that gained them this award, are on the web at www.aps.org/programs/education/undergrad/faculty/award.cfm

The award is given to physics departments and/or undergraduate-serving programs in physics that support best practices in education at the undergraduate level. Programs are recognized for three years, acknowledged on the APS website, awarded a plaque, and recognized at an APS national meeting. The award was initiated in 2011, and the current recipients are the second group to be announced.

These awards are intended to acknowledge commitment to inclusive, high-quality physics education for undergraduate students, and to catalyze departments and programs to make significant improvements. The annual deadline for departments to apply for the award is July 15. More information is available on the award website.

Matching Funds Bring Bouchet Endowment Campaign Closer to the Finish Line

APS has secured matching funds that will boost the campaign to endow the Edward A. Bouchet Award, given annually to a distinguished minority physicist.

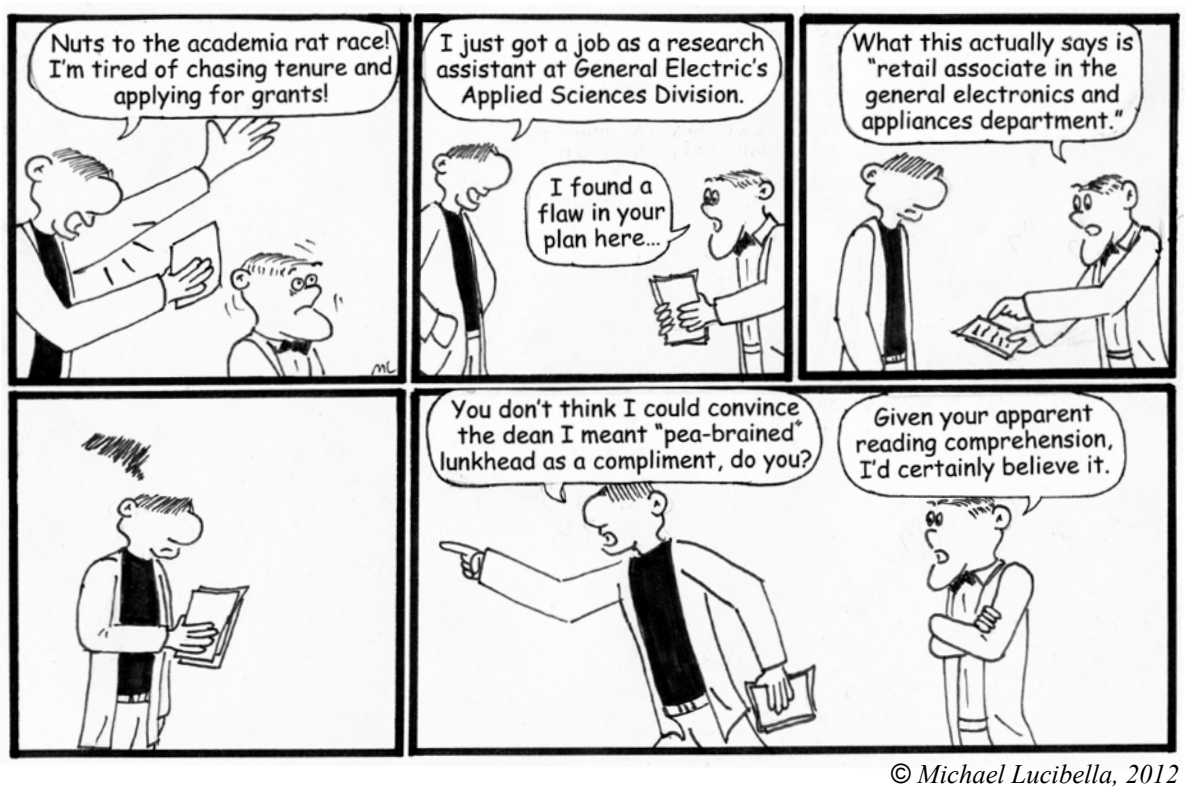
The Award carries a stipend of $3500, and provides travel funds to allow the recipient to visit up to three different academic institutions. The purpose of these visits is for the recipient to deliver technical lectures about his or her specialty, to visit classrooms when appropriate, to assist in pre-college outreach efforts where appropriate, and to talk informally with both faculty and students about research and teaching careers in physics. In doing so, the recipient serves as a role model for others interested in pursuing a career in physics.

Established in 1994 by the APS Committee on Minorities, the Award had been supported by annual contributions from the Research Corporation for Science Advancement, but these funds are no longer available. To fully endow the Award requires $140,000, of which $55,000 has already been raised. If another $42,500 can be raised, this amount will be doubled by the matching funds, bringing the endowment to its target level.

A high-level fundraising committee has been formed, with co-Chairs Beverly Hartline of Montana Tech and S. James Gates, Jr. of the University of Maryland. In a letter to potential donors, Gates stated that "as the first Bouchet Award recipient, I can attest to the increase in exposure and visibility it provides, which in turn opens doors of physics to diverse members and minority groups."

Gifts or pledges that can be paid over a three-year period are welcome. More information about the campaign can be obtained from APS Director of Development Darlene Logan at 301-209-3224, or logan@aps.org, and also at the campaign website, http://www.aps.org/about/support/bouchet/

By Michael Lucibella



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Letters

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

Famous Experiment Can be Misinterpreted

Torricelli and most of his contemporaries (and possibly guest author Richard Williams as well) might have thought that the famous experiment demonstrated the existence of a vacuum. That is incorrect. Namely, the empty-looking closed space above the liquid mercury in the barometer is occupied by mercury vapor at the equilibrium vapor pressure of liquid mercury, which corresponds to the temperature at which the experiment is carried out. Although the equilibrium vapor pressure of mercury is small (1 Pa at 315 K), it is not zero. Nowadays we know that all condensed phases have equilibrium vapor pressure. Consequently, we cannot create and maintain a vacuum on a macroscopic scale. Unfortunately, numerous textbooks perpetuate the incorrect notion that the empty-looking space in closed-end barometers (using mercury or any other liquid) is a "vacuum." Thus in retrospect, besides its great historic significance, Torricelli's elegant experiment had actually demonstrated the existence of an equilibrium vapor pressure of mercury, rather than the existence of a vacuum.

Zoltan A. Schelly
Arlington, TX

Treat Science More Like Carpentry and Less Like Magic

In response to the Back Page "Why Communicate Science?" by Carl Safina, that appeared in the October *APS News*: as far as I know, most people could not name the leading lawyers, the line of succession to the Presidency, leaders in Congress, the leading physicians, etc. In general, people know "the celebrities"–those people paraded daily by the media–and some don't even know those.

No other profession has people like Einstein, Darwin, and Newton that people generally know were "important." So it is untrue that science is unknown or unrecognized. The problem is that people have the same regard for scientists that they once had for clergy, which is appropriate because academic degrees began as "holy orders" for members of the clergy back in the day when all scientists were clergy. That regard is dramatized by the reason the Pope silenced Galileo. It wasn't a theological problem. It was a public perception problem. The public wasn't interested in theology, but it saw clergy as magicians who had "the remote control to the universe" and when it heard clergy debating whether the sun circled the Earth or vice versa, it thought they were contemplating making the Earth circle the sun and they rioted in fear. Nowadays, people have discarded theologians, ordinary clergy, lawyers, and politicians. They have focused upon scientists, who are believed to have the remote control to the universe. They do not like us. They are scared witless by us. But they will tolerate us as long as we give them iPods, iPads, remote controls, and pills to fix stuff so they do not have to "eat right and exercise." This is not so different from not having "to pray and behave," which was what the clergy required.

I agree that we should make an effort to do something about this perception. However, many of us are, shall we say, not socially adept and thus not fitted for the task. Perhaps instead of focusing on how science provides more stuff, we should focus on the fact that, unlike theology, science changes when the next piece of this infinite puzzle is placed. Also, science does not pretend to tell anyone who they are or why they are, just how, physically they came to be. By emphasizing the discipline and limitations, we might not get more funding, but the "other guys" might let us into "their group" and stop treating us like wacky magicians who must be tolerated. Rushing around pontificating on this or that controversy (about which we only know the physics and do NOT know about the millions who could be fired, displaced, or otherwise abused) is not likely to help the cause of "science." Science should be treated more like carpentry–something we can do to be useful and helpful in return for farmers feeding us, manufacturers clothing us, and construction workers housing us.

J. W. Lane
Tallahassee, FL

Washington Dispatch

A bimonthly update from the APS Office of Public Affairs

ISSUE: Election Update

The election is over and the makeup of Congress has been decided for the next few years. President Obama won re-election by winning the popular vote and the electoral vote by a clear margin. The Democratic majority was increased in the Senate by two seats in a year when they were expected to lose four seats. The Democrats earned an overall larger number of votes than Republicans for House seats but due to district lines Republicans maintain control of the House. Exit polling during the election indicated that 70 percent of the public support a tax increase for wealthier Americans and also expect Congress and the President to cooperate on dealing with the deficit.

While the macrostate of a Democratic controlled Senate and White House, and a Republican controlled House has not changed, it appears as though the microstate has. The election clearly expressed to politicians that the public is unhappy with the current state of affairs in Washington D.C. and expects leadership to work together rather than allow for continued ideological divide.

Speaker Boehner and Senate Minority Leader McConnell have both stated willingness to compromise on important issues regarding the "fiscal cliff"; issues such as tax reform, entitlement reform, and the looming sequestration. Messaging from Democratic leadership, however, has been one of flexing political capital gained in the election, stating that certain compromises on tax and entitlement reform are off the table, though with the expectation that a grand bargain will be struck. Whether such a compromise will be achieved in the remaining days of the lame duck session is not yet clear.

There is, at this point, cautious optimism for both significant legislation to be passed during the lame duck session and also for increased cooperation in the 113th Congress.

ISSUE: Media Update

Michael Lubell, director of public affairs at APS and professor of physics at the City College of the City University of New York, appeared on NPR's *Science Friday* on November 9. Lubell discussed what is at stake for science and the nation if we go off the "fiscal cliff" next year–an eight percent drop in federal funding affecting critical research projects. The conversation then turned to issues that included whether climate change will be addressed by the next Congress; the future direction of NASA; and the dire need for qualified physics teachers to educate future scientific leaders. You can tune in to the audio recording of the interview at sciencefriday.com.

On November 12, Lubell was quoted in a *New York Times* article about the future of science under President Obama's second term in office. Lubell said it would be catastrophic if the nation goes off the "fiscal cliff" because fewer scientific grant proposals would be funded, among other issues. He also stated that the president might address climate change.

Roll Call, one of three main newspapers on Capitol Hill, published Lubell's regular guest column on November 20 concerning federal travel regulations that make "it very difficult, and in some cases nearly impossible, for scientists to attend major conferences."

ISSUE: POPA

A study of the technical issues surrounding the extension of nuclear reactor licenses from 60 to 80 years is under way. The Study Committee has been selected, and a meeting will be held in Washington, D.C. in early 2013.

A study for the Department of Homeland Security's Domestic Nuclear Detection Office (DNDO) regarding trends in nuclear and radiological detection, is near completion and will be released in early 2013. APS and the Institute of Electrical and Electronics Engineers (IEEE) are joint sponsors of the study.

Plans are under way to hold a tactical nuclear weapons workshop, sponsored by the State Department and in conjuction with the Center for Strategic & International Studies (CSIS), in early 2013.

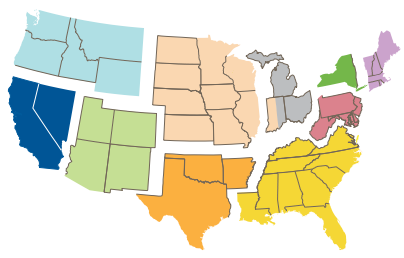
POPA approved a template for all future study proposals at its February 2012 meeting. The template can be found online, along with a suggestion box for future POPA studies, by visiting http://www.aps.org/policy/reports/popa-reports/suggestions/index.cfm

Log on to the APS Public Affairs website (http://www.aps.org/policy) for more information.

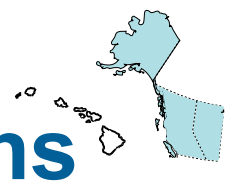
Plaque Recognizes U. of Minnesota

Photo by Alex Schumann

On October 29, as part of the APS Historic Sites Initiative, APS President-elect Michael Turner presented a plaque honoring the Tate Laboratory at the University of Minnesota. The citation reads: "At this site, from 1936 to 1994, Alfred Nier designed and developed mass spectrometers with which he pioneered critical research in nuclear physics, isotopic and chemical analysis, biochemistry, geophysics, geochemistry, earth and planetary atmospheres, diagnostic devices, and industrial applications." In the photo, Ronald A. Poling, Head of the Department of Physics and Astronomy at Minnesota, signs the APS Ledger of Historic Sites, while Turner (center) and Chair of the APS Historic Sites Committee Ben Bederson (right) look on.



Focus on APS Sections



California Section Has Strong Focus on Students

By Halleh B. Balch

The banquet speech, "A Life Not in Physics," by California news science and weather reporter Brian Hackney captured the spirit of innovative careers in physics at this year's annual meeting of the California Section of the APS. The meeting, which took place November 2-3, 2012 in San Luis Obispo, took as its guide one of the missions of the APS sections: to increase communication between professions in academic physics and professions in fields allied to physics.

"We've definitely taken to heart the aspect of bringing together people who don't necessarily interact at the national meetings," said Lynn Cominsky, the section's chair-elect and chair of physics and astronomy at Sonoma State University. "One of the unique aspects of our annual meetings is our career panel, which focuses on a subfield of non-academic jobs."

The topic of this year's career panel was aerospace science, featuring speakers from Lockheed Martin, Northrop Grumman and SpaceX, the first private company to dock at the International Space Station. "They were treated like rock stars–and almost mobbed by the students," said Cominsky, "it was very exciting."

Previous career panels have focused on medical physics and how to get a job in a start-up company.

Students are at the focus of the California Section, whose name belies its span of California, Nevada, and new-inductee Hawaii. The California Section was proposed and founded in 2001 under the leadership of then APS Executive Officer Judy Franz, who sought to provide opportunities for the large number of physicists in California to present their research outside the national meetings. At the time, the national meetings were rarely hosted away from the east coast, explained Daniel Cebra, the founding section chair and professor at the University of California, Davis. Today, the California section is the largest of the nine sections of the APS.

From its founding, one of the primary goals was to offer students and junior scientists the opportunity to present and talk, said Cebra. "For me [as a professor], it was incredibly valuable because I could have my students drive and carpool to the meeting, which reduced travel costs and enabled more students to attend," he said.

The section is able to provide travel and housing reimbursement for every student who gives a talk, dramatically increasing the opportunity for junior graduate students and undergraduate students to attend. Of this year's 178 attendees, half were undergraduates. "We hope to encourage students to learn how to give talks and provide mentoring and networking opportunities for them as they embark on their careers," said Cominsky.

"I really think the APS section works beautifully in California because it brings the three levels of higher education in California together," Cebra said. Higher education in California has three kinds of schools: the University of California schools, the California State schools–which do not grant PhDs–and the Community Colleges, which offer the first two years of higher education to twenty-eight percent of University of California graduates and over fifty percent of California State graduates (data from the California community colleges chancellor's office).

"For higher education in California to work well, and for physics in California to work well, the students in the Community Colleges and California State schools need to know the research going on at California State and University of California schools and make contacts," Cebra said.

"I was tremendously impressed when I went to this year's section meeting at CalPoly," he said, "this is the vision I hoped for when I pushed to get the section started."

In the future, the section hopes to draw an even larger membership from the California State and Community Colleges and offer more junior graduate students from the University of California schools the opportunity to present. Cominsky notes, "These friendships that you make as an undergraduate or graduate are the people you'll end up sharing your professional life with."

Having their cake...

Photo by Michael Lucibella

Michael Brabanski, Walter Faust and Andrew Seacord enjoy a bite of cake at the 15th anniversary celebration of the APS Mid-Atlantic Senior Physicists Group. Made up of mostly retired physicists and researchers, the group meets once a month at APS headquarters for science talks and social events.

ORCID continued from page 1

lem with author names… that really often the only thing we have to go by is the name," said Arthur Smith, manager of the database group at APS. "The idea [of ORCID] is you can actually generate a CV out of the information you've collected about yourself."

ORCID isn't aimed only at physics, or even just science, but all academic research. In addition, the organizers hope to expand the program to include grants, patents and any other work that participants create.

"We're trying to create a switchboard that connects different datasets," Haak said. "Right now we're focusing on our very core mission, which is our registry."

ORCID's registry first went live in October, and about 8300 researchers signed up in its first two weeks. Authors of APS papers are now prompted to sign up and to include their ORCID numbers when they submit a new paper. Smith said that he hopes in the next year or two to provide the ability for authors to go back and claim past papers.

The system is voluntary, and free to register. It requires an email address to create a profile.

"Once you've created an ID, you can use it anywhere that requests an ORCID ID identifier," Haak said.

Other organizations have adopted the system. The academic publishers *Nature* and *Copernicus* have also adopted the identifiers and Elsevier has a system in place for researchers to input past work.

"There's so much enthusiasm for ORCID throughout the research community. We haven't had to work ultra hard to get people interested in the system," Haak said.

An announcement that appears on the APS journals website, publish.aps.org, includes a link that allows authors to register with the ORCID service.

AWARD continued from page 1

Physics Association, or ALPhA, a society dedicated to advancing undergraduate physics laboratories. The October *APS News* (available online) carried a story about a recent ALPhA meeting in Philadelphia.

"There wasn't a way for them to find each other," Wolff-Reichert said. "This is a group of incredibly generous people who are anxious to make sure the next generation of experienced grad students has the hands-on expertise to really jump into the lab."

Renee Diehl, professor of physics at Penn State and chair of the APS Forum on Education, said that having a good advanced laboratory program gives students a well rounded introduction to the diverse fields of physics.

"Experimental physics is a part of physics training that you just can't get away from," Diehl said. "I think it's a really important component, and if you don't have that, if you don't have a background in learning how to tackle a problem, it shuts you out from a large number of the jobs that are out there."

She added also that at many universities and colleges, the contributions of people running undergraduate physics labs often get overlooked by their departments.

"It's this huge job, so Jonathan and Barbara had this idea that it would be really nice to honor the people that do this job because it's sort of a thankless task," Diehl said. "What we're looking for is people who have done a fantastic job at doing that, making the lab modern and relevant to the students that are going though now; basically providing the best kind of preparation for their careers."

The deadline for nominations is July 1, 2013 for the first award, which will be presented at either the March or April meeting the following year. A webpage describing the award and providing the opportunity to submit nominations should be available on the APS website by the beginning of January.

PETITION continued from page 1

up with an alternative solution. However, in a virtuoso display of dysfunctionality, the commission failed to agree upon any single plan and the budget reductions that were never supposed to take effect are less than a month away.

The idea for a student petition grew out of a webinar in July about the potential impact of sequestration on physics students. APS reached out to its student members through the Forum on Graduate Student Affairs, email, Facebook and Twitter. In addition, 28 other scientific and engineering organizations mobilized their student members to participate.

"What began as a webinar with an idea for an activity for involvement grew into something much larger," Glembo said.

Students started hand-delivering physical copies of the petitions in person to influential members of Congress in early November. The text of the petition is on the web at http://ultron.aps.org/forms/aps.cgi?ID=1084 .

BREAKDOWN continued from page 1

can't predict earthquakes. The basis of the charges is not that they didn't predict the earthquake. As functionaries of the state, they had certain duties imposed by law: to evaluate and characterize the risks that were present in L'Aquila," L'Aquila's public prosecutor Fabio Picuti told *Nature News* before the trial.

The victims' family members, who brought the case against the scientists, echoed this sentiment, saying that the scientists offered little information about the earthquakes and what was disseminated was contradictory and confusing.

What Happened in L'Aquila

In the months leading up to April 6, the city of L'Aquila had been repeatedly shaken by tremors, sparking fears that "the big one" would soon come. Many residents were sleeping outside, worried that their homes would collapse around them if a large earthquake hit. Adding to this anxiety, a technician at Gran Sasso National Laboratory, Giampaolo Giuliani, had been grabbing headlines by predicting a big quake was just around the corner, alarming the residents. However, Giuliani based all of his predictions on a supposed increase in radon levels, a method that geologists and seismologists say has no basis in science and is not a reliable predictor of earthquakes.

The government of L'Aquila convened a special session of the National Commission for Forecasting and Predicting Great Risks essentially to debunk Giuliani's claims. The commission agreed that Giuliani's radon technique was not a reliable method to predict earthquakes, and added that there was only a one to two percent chance that the cluster of quakes was the precursor to a big devastating quake.

There was no formal written statement issued by the group, leaving the public to rely on statements to the press made by its members before and after the meeting. The most notorious statement to the press was made by the government official Bernardo De Bernardinis, formerly the Vice-Director of the Department of Civil Protection. When asked if the tremors meant a bigger earthquake was coming, he said "the scientific community continues to assure me that, to the contrary, it's a favorable situation because of the continuous discharge of energy."

There is some debate as to whether he made this statement before or after the meeting. According to the meeting's minutes, the energy discharge theory was not addressed and no scientists publicly disputed his statement. During the trial, several of the scientists said that they strongly disagreed with this interpretation and that it was not scientifically accurate.

The committee did not release any risk assessments of the local buildings and infrastructure, or recommendations to the public on what to do if a large earthquake did hit. The essential message the public seemed to get in the information vacuum after the meeting, was that there was no danger.

A week later, however improbably, a 6.3 magnitude earthquake did strike, leveling 20,000 buildings, leaving 65,000 people homeless and 309 dead. Civil parties to the case against the scientists claimed that they and their loved ones didn't evacuate their houses because of the apparent assurances reported in the press.

The Scientific Community Reacts

Scientists and scientific societies the world over have denounced the verdict. The American Association for the Advancement of Science and the American Geophysical Union (AGU) have both released statements criticizing the trial.

"For scientists to be effective, they must be able to make good faith efforts to present the results of their research without the risk of prosecution," the AGU statement reads. "Outcomes such as the one seen in Italy could ultimately discourage scientists from advising their governments, from communicating the results of their research to the public, or even from studying and working in various fields of science."

The fear is that the verdict will have a chilling effect on science in Italy.

"I'm really scared to do anything, to say anything," said Warner Marzocchi, a seismologist at the Istituto Nazionale di Geofisica e Vulcanologia in Rome. He added that what worried him the most were the charges of negligence against the accused scientists because there are no real best practices for communicating a forecast.

"Negligence to me sounds very strange. You can talk about negligence when there is best practice, like with doctors," Marzocchi said. "In almost all countries there are essentially no protocols to deal with such a problem."

Laws about public speech in Italy are different from those in the United States, and few think that the verdict has the same chilling potential here.

"In the geophysics community, we are all sort of making the joke that Italy is the one place we're not going to be doing predictions because of this," said Joel Tenenbaum of Boston University.

However, many scientists feel that the public response highlights a lack of comprehension about risk and rare events, such as not understanding that saying something is unlikely does not mean it will never happen.

"The fact is that the public is not educated at all about risk when something is random like earthquakes," said Gene Stanley, who studies statistical physics and rare events at Boston University. "The public has to become educated about risk."

John Rundle, a geophysicist at the University of California, Davis who also runs the risk assessment group Open Hazards, said that when talking about earthquakes and other hard-to-predict catastrophes, scientists need to emphasize the statistical nature of a prediction, and how a rare event is not an impossible event.

"Be careful how you phrase your warnings and forecasts, phrase them probabilistically," he advised. "It's our job to educate the public and we need to just put a lot of data out there… If they can't sort through it, it's our job to help sort through it."

How best to communicate this kind of nuanced information to the public is not plainly obvious. Overzealous warning can unnecessarily frighten the public, or worse lead to distrust of experts after too many unrealized warnings. At the same time, experts don't want to conflate unlikely with impossible.

"It's very easy to be flip," said Kristy Tiampo, a professor of earthquake hazard assessment at Western University in Ontario. "The real issue is how you communicate what you think might happen. But how do you put a number on that, and how to communicate to the public the error on that?"

There's no single simple answer, but it's a subject the scientific community is taking seriously and addressing in the wake of the Italian convictions.

"We're going to explore this a little bit more," said Christine McEntee, Executive Director of the AGU. At the society's meeting this month, they're planning on having a special session about communicating geological risk assessment. "There's a lot of room for improvement in communicating science in effective ways."

An important part of this communication is explaining the limits of what science can do.

"The average person is attracted to science because of the desire we all have for certainty," Stanley said. "Science is a reassuring thing, but there are things scientists work on that are anything but assured."

ANNOUNCEMENTS

APS Congressional Science Fellowship 2013-2014

THE AMERICAN PHYSICAL SOCIETY is currently accepting applications for the Congressional Science Fellowship Program. Fellows serve one year on the staff of a senator, representative or congressional committee. They are afforded an opportunity to learn the legislative process and explore science policy issues from the lawmakers' perspective. In turn, Fellows have the opportunity to lend scientific and technical expertise to public policy issues.

QUALIFICATIONS include a PhD or equivalent in physics or a closely related field, a strong interest in science and technology policy and, ideally, some experience in applying scientific knowledge toward the solution of societal problems. Fellows are required to be members of the APS.

TERM OF APPOINTMENT is one year, beginning in September of 2013 with participation in a two week orientation sponsored by AAAS. Fellows have considerable choice in congressional assignments.

A STIPEND is offered in addition to allowances for relocation, in-service travel, and health insurance premiums.

APPLICATION should consist of a letter of intent of no more than two pages, a two page resume, with one additional page for publications, and three letters of reference.

All application materials must be submitted online by January 15, 2013, 5:00 pm. EST.

http://www.aps.org/policy/fellowships/congressional.cfm

MEETING continued from page 1

welcome reception on Wednesday to introduce themselves to meeting attendees.

Several events are aimed at students attending the meeting. A special industrial physics outreach session is planned to give students a chance to see what jobs might be available in industry. Graduate students can sign up for Lunch with the Experts, where they can enjoy a boxed lunch while having an informal, freewheeling discussion with an expert on any topic that interests them. A reception for students is planned for Wednesday evening, along with the student job fair and a graduate school fair.

The annual PhysTEC conference will be held in conjunction with the March Meeting. From March 16 through 17 at the nearby Sheraton Inner Harbor Hotel, teachers from kindergarten through grade 12 will gather for a series of workshops about mentoring, recruitment, course reforms and assessment. The PhysTEC conference this year is also collaborating with the American Chemical Society to feature sessions aimed at chemistry teachers.

The APS prize ceremony will be held on Monday evening honoring researcher's contributions to their fields.

Before the start of the meeting, DPOLY will hold a two-day short course titled "Membranes for Clean Energy and Water" about the physics of polymers that can filter out different impurities. The course will highlight the recent theoretical and experimental results in the field in both academia and industry.

Also on Sunday, the National Science Foundation is sponsoring a professional skills workshop for women postdocs and more senior women physicists. The workshop focuses on negotiation, communication and leadership, with the goal of producing more women leaders in the field.

Tutorials on some of the most exciting fields in physics will also be held on Sunday. Aimed especially at graduate students and postdocs, the tutorials are designed to give any researcher an introduction to the fundamentals of the field. The tutorials will cover topics in biophysics, quantum information, graphene, jamming and metamaterials.

The exhibition hall this year will run from Tuesday through Thursday.

As always, the APS Contact Congress booth, attendees are invited at any time to send a letter to their members of Congress about the importance of federal research funding.

MEMBERS continued from page 2

"Right now, the central value of the measurement is remarkably close to the central value of the Standard Model prediction… That means that masses of these supersymmetric particles are either heavier than optimists had suspected before, or there's something funny about the spectrum [of supersymmetric particle masses] that suppresses these signals."

***Lance Dixon**, SLAC National Accelerator Laboratory, on results from the LHC that seem to reduce the likelihood of supersymmetry,* NBCNews.com*, November 12, 2012.*

The Back Page

Inquiry Science rocks: Or does it?

by David Klahr

Although "inquiry teaching" has been a hot topic in science education for many years, it may be useful to reflect on some unresolved issues associated with it. The main point of this essay is that the relative effectiveness of different types of instructional "approaches" is not always investigated with the same rigor that permeates all strong scientific disciplines–clear definitions, well-defined empirical procedures, and data-driven conclusions. The second–and more contentious–point is that for many aspects of science instruction, "discovery learning" is often a less effective way to teach than a direct, didactic, and explicit type of instruction. Some in the physics education community may view this assertion as a foolhardy heresy, while for others it may be a dark secret that they have been reluctant to share with their colleagues. But heresies and secrets are hardly the way to discover and implement maximally effective instructional methods for teaching science.

I am not alone in suggesting that common practices in physics education may have scant empirical support. Several years ago Handelsman, et al. (1) asked: " … why do outstanding scientists who demand rigorous proof for scientific assertions in their research continue to use and, indeed, defend on the basis of their intuition alone, teaching methods that are not the most effective?" (p. 521) The specific lament in Handelsman et al. is the claim that much science education is based on a traditional form of didactic lecturing. However, one could just as well use that very same critique about the lack of "rigorous proof" to challenge the current enthusiasm for "inquiry approaches" to science education.

For example, an influential report from the NAS on inquiry approaches to science education (2) states that "…studies of inquiry-oriented curriculum programs … demonstrated significant positive effects on various quantitative measures, including cognitive achievement, process skills, and attitudes toward science." This would seem to be clear evidence in support of inquiry-approaches to science instruction, except that the report goes on to note, parenthetically, that "there was essentially no correlation between positive results and expert ratings of the degree of inquiry in the materials (p. 125)." Thus we have an argument for the benefits of a particular pedagogy, but no consensus from experts about the "dose response", i.e., the extent to which different "degrees of inquiry" lead to different types or amounts of learning.

One wonders about the evidential basis for the widespread enthusiasm for inquiry science, given the lack of operational definitions of what constitutes an "inquiry-based" lesson–or entire curriculum–and what specific features distinguish it from other types of instruction. There is a particular irony here in that the very field that has developed extraordinarily clear norms and conventions for talking about methods, theories, instrumentation, measurement, underlying mechanisms, etc. often abandons them when engaging in research on science education.

Although the NRC and AAAS continue to favor inquiry approaches to science instruction, many researchers in the emerging field of "Education Sciences" are not so sure. Controversy about the purported universal superiority of constructivist approaches to science teaching has been growing over the past decade, culminating in an entire volume of pro and con perspectives on the issue (3). However, my aim here is not to resolve the issue, but rather to note that the evaluation of one approach versus another is all too often made, as Handelsman et al. (1) put it, "on the basis of … intuition alone", rather than on the results of replicable experiments, designed around operational definitions of instructional methods being investigated.

I will illustrate with examples from my research: on different ways of teaching a topic in elementary school science known as the "control-of-variables strategy" (CVS). The procedural content of CVS instruction constitutes a method for creating experiments in which a single contrast is made between experimental conditions while "controlling" for other potential causal factors. The conceptual content includes an understanding of the inherent indeterminacy of confounded experiments. CVS is the basic procedure that enables children to design unconfounded experiments from which they can make valid causal inferences and it is invariably included in high stakes science assessments such as TIMMS and NAEP.

Three types of instruction: operational definitions. Our goal is to teach CVS. But the experimental variable in our research is the method of instruction. In our first CVS study (4), we compared the relative effectiveness of three different types of instruction for teaching CVS to 3rd to 5th grade students. We used simple physical materials (such as balls on ramps, springs and weights, pendulums, or objects sinking in water).

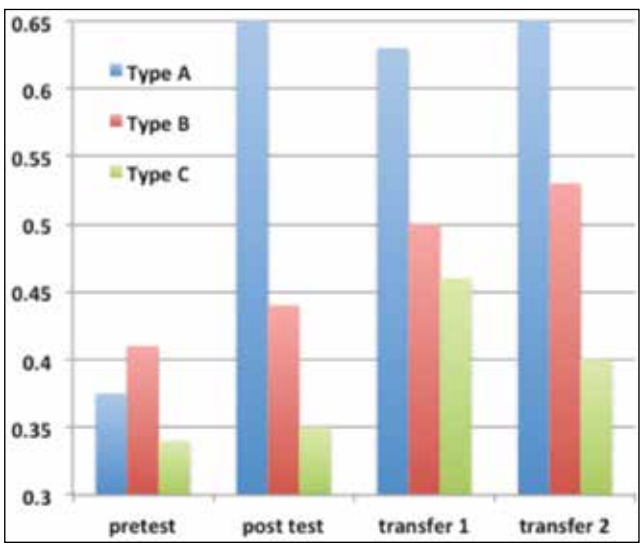


Figure 1. Proportion of unconfounded experiments designed by children in each phase after having been taught by one of the three types of instruction. See (4) for statistical analyses.

The three types of instruction ranged from explicit, teacher-directed instruction to more open-ended learner-directed discovery. Note that in the previous sentence, I have used the kind of terminology ("teacher-directed", "learner-directed") that I criticized earlier for its inherent ambiguity. However, the solution to this problem is to be extremely explicit about the features of specific instructional procedures. Furthermore, one can remove the baggage-laden terms, and describe the three different instructional methods simply as Type A, B, and C.

Instructional Feature	"Type A"	"Type B"	"Type C"
Goal Setting	By Teacher: "Can you find out whether X makes a difference in how far the ball rolls?"		
Hands on materials	**YES**	**YES**	**YES**
Design of each experiment	TEACHER	STUDENT	STUDENT
Probe questions	YES	YES	NO
Explanations	YES	NO	NO
Summary	YES	NO	NO
Execution of experiments	NO	YES	YES
Observation of outcomes	NO	YES	YES

Table 1 Features of each type of instruction

The essential aspects of each of the three types of instruction are depicted in Table 1, where each column corresponds to one of the instructional procedures, and each row describes a particular feature. (In our full scientific report on this study, of course, each of the cell entries in the table was augmented by a detailed "script" for how that component of the instruction was actually implemented, so that it could be replicated in other labs.)

For all three types of instruction, children dealt with the same materials. For example, we used a pair of identical adjustable ramps that had four binary-valued features (height, surface, length, and ball type). In all cases, (a) children were presented with the same goal: to design a "good experiment" (i.e., "Can you set up the ramps to find out for sure whether the height of the ramp makes a difference in how far the ball rolls?"), (b) this goal was provided by the teacher, not generated by the student, and (c) we used "hands on" instruction, as children manipulated the materials.

At this point, the different types of instruction summarized in Table 1 begin to diverge. In Type A instruction, the teacher presented explicit instruction regarding CVS (i.e. how to design an unconfounded experiment by varying the "focal variable"–such as the surface of the ramp) while making sure that all the other variables (ramp height, type of ball, length of the run) were held constant on each ramp. In contrast, in Type B and C instruction, the student, not the teacher, designed the experiment. Next, in Type A and Type B instruction, students were presented with probe questions: "Is this a smart way to find out whether the surface of the ramp makes a difference?" "Can you 'tell for sure' from this experiment whether <the variable being tested> makes a difference in the outcome?" "Why are you sure or not sure?" In Type C instruction there was no corresponding probe question. Other crucial features, and their presence or absence in each particular type of instruction, are indicated in the remaining rows. Note that this description is substantially condensed from the descriptions and details in our paper. But the point is clear: each column in the table, and the associated elaboration of what its contents mean, provides an operational definition of the three types of instruction being contrasted in this study.

The results of this training experiment (Figure 1) revealed that (a) only Type A instruction led to immediate gains in children's mastery of CVS, and (b) when tested on different physical materials several days later (such that children initially trained with ramps were now asked to design experiments with springs, and so on), children were able to transfer their CVS knowledge to materials with completely different physical dimensions. Other studies like this one showed that children presented with Type A instruction remembered and used what they learned about CVS in substantially different contexts (i.e., they transferred their CVS knowledge), and they retained it for several months, and even several years, after their instruction.

What's in a name? One important part of any operational definition is the name given to the construct being defined. And in sciences that are still in the process of developing unambiguous operational definitions, the name may carry unintended baggage beyond the specifics of the operational definition. Moreover, to the extent that the terms may be widely used in everyday language, they may be interpreted in different ways by different people.

To avoid this possible terminological confusion, in our first report on our three types of training (4), we used somewhat inelegant phrasing. We dubbed Type A, B and C instruction, "Training–Probe"; "No-training–Probe"; and "Probe", respectively. However, in subsequent studies, we began to call Type A "Direct Instruction" and Type C "Discovery Learning". The consistent finding was that the Direct Instruction condition produced substantially more learning and transfer than did the Discovery Learning condition.

For example, in one study, after a brief training session, 75% of the students in the Direct Instruction condition mastered CVS, whereas only 25% of the students in the Discovery condition did so. We also found that when challenged a few weeks later to judge science fair posters involving simple experiments created by other children–the children who had mastered CVS in the training phase were much better judges than those who had not mastered CVS–regardless of how they had been instructed. That is, the many children who learned CVS via direct instruction performed as well as those few children who discovered the method on their own. There was no long term advantage to having "discovered" CVS rather than having been "directly instructed" about it (5).

Nevertheless, although these results seemed to indicate that we had identified an effective instructional procedure for teaching young children how to master CVS, the everyday labels we had begun to use led to substantial disagreement within the field about which of our conditions was "really" Direct Instruction, which was "really" Discovery Learning, and whether one or the other was a parody of the corresponding method. The problem, of course, is that those arguments were about vague labels, rather than about the relative effectiveness of well-defined instructional procedures.

Approach Avoidance. The terminological proliferation in the area of science education is daunting. It includes such "approaches" as: constructivism, explicit instruction, Piagetian approach, inquiry science, direct instruction, adaptive instruction, student centered instruction, authentic instruction, hands on instruction, didactic instruction, drill and kill, minds-on instruction, etc. But these imprecise slogans convey little of substance because they are so loosely defined and interpreted. Specifying a "Newtonian approach" doesn't get you very far on the journey to Mars. Only a determined and consistent effort to better define and evaluate our instructional methods will ensure coherent discourse about educational experiments, and ultimately to improved physics education.

David Klahr is the Walter van Dyke Bingham Professor of Cognitive Development and Education Sciences in the Department of Psychology at Carnegie Mellon University. He is a member of the National Academy of Education.

1. Handelsman, J., Ebert-May, D., Beichner, R., Bruns, P., Chang, A., DeHaan, R., Gentile,J., Lauffer, S., Stewart,J., Tilghman, S.M., & Wood, W.B. (2004) *Science* 304(5670), 521-522. 2. Inquiry and the National Science Education Standards: A Guide for Teaching and Learning (2000) Board on Science Education (BOSE) 3. Tobias, S. & Duffy, T. M (Eds.) (2009) Constructivist Theory Applied to Instruction: Success or Failure? Taylor and Francis. 4. Chen, Z. & Klahr, D., (1999) All Other Things being Equal: Children's Acquisition of the Control of Variables Strategy, *Child Development*, 70 5. 1098 - 1120.5. Klahr, D. & Nigam, M. (2004) The equivalence of learning paths in early science instruction: effects of direct instruction and discovery learning. *Psychological Science*, 15, 661-667.