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Fisics and Phynance
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Super Bowl of Physics Comes to Baltimore

The APS March Meeting, the largest annual physics meeting in the country, will take place from March 18 through 22 at the Baltimore Convention Center in Baltimore, Maryland. Physicists from across the globe will present over 8,000 papers at more than 500 sessions, 112 of which are invited sessions. Total attendance is expected to exceed 8,500 scientists, who will hear about the latest developments in areas including condensed matter, computational physics, chemical and biological physics, new materials, polymers and fluids. A number of sessions will also look to explore the role of physics in different segments of society, including its role in industry, national security, human dynamics, sustainable energy and energy storage.

Nobel Prize

The winners of the 2012 Nobel Prize in physics will speak about their research on Thursday evening. Serge Haroche from the Collège de France, École normale supérieure, will discuss his method of trapping photons and putting them into a superposition. Afterward, David Wineland from the National Institute of Standards and Technology, Boulder, will share how he developed his ion trapping technique that similarly places the trapped particles into a superposition state. (Session X1)

Kavli Session

Nobel laureate Steven Chu, who announced he would be stepping down after 4 years as US Secretary of Energy, will be headlining Wednesday afternoon's Kavli session "Forefront Physics for Real World Problems" about energy, climate change and the environment. Chu will speak about the promise of photovoltaics, Lonnie Thompson from The Ohio State University will discuss how scientists can reconstruct the history of Earth's climate from ice core samples, while Stephen Harris from General Motors will highlight his company's battery development for electric vehicles. Other speakers in the session include Graeme Stephens and Amy McKenna. (Session R0)

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TV to Cover the Action at March Meeting

The British television production company WebsEdge will add a new dimension to this year's March Meeting. A camera and editing crew will be on site to do studio interviews and location filming. Daily one-hour segments will be aired on screens at the meeting, on hotel TV circuits, and online. The segments will also be archived for future viewing.

WebsEdge specializes in producing television spots from meetings for meeting attendees. Among others, they have produced shows in conjunction with conferences of the American Psychological Association, the Materials Research Society and the American Historical Association.

"We're pioneers in conference TV," said Veronica Vaquer, a senior producer at WebsEdge. "We target specific issues for specific audiences."

Terri Gaier, Director of Meetings for APS, said that bringing in WebsEdge is as much for APS members who aren't at the meetings, as the ones who are.

"I think it'll make them

TV continued on page 6

Six APS Fellows Among National Medal Recipients

On February 1, President Obama presented the National Medal of Science and the National Medal of Technology and Innovation to 23 scientists, engineers and researchers, six of whom are Fellows of the APS.

"Success depends on the ideas that you can dream up, the possibilities that you envision, and the hard work, the blood, sweat and tears you're willing to put in to make them real," President Obama said at the ceremony at the White House honoring the recipients. "[T]oday, it's clearer than ever that our future as a nation depends on keeping that spirit of curiosity and innovation alive in our time. So these honorees are at the forefront of that mission."

Photo by Michael Lucibella

President Obama congratulates James Wynne and Rangaswamy Srinivasan who were honored, together with their late colleague Samuel Blum, for the invention of excimer laser surgery, the technique that makes LASIK surgery possible.

The National Medal of Science was founded in 1959 by an act of Congress, and is administered by the National Science Foundation to honor individuals who have made significant contributions to science. The National Medal of Technology and Innovation was founded in 1980 and is administered by the U.S. Patent Office.

RECIPIENTS continued on page 6

Panel Says Flat Funding Could Doom RHIC

By Michael Lucibella

A Department of Energy panel has reluctantly concluded that unless budgets for nuclear science increase, the DOE will not be able to afford to keep Brookhaven's RHIC accelerator running. Because of projected budget shortfalls, the agency likely will not have the money to keep its three nuclear science projects going at the same time.

The Office of Nuclear Physics (NP) within the DOE Office of Science operates three major facilities, and is in a financial bind. Funding for the three has been effectively declining while simultaneously costs have been increasing because of inflation, planned upgrades and new construction.

NP is in the middle of upgrading the Continuous Electron Beam Accelerator Facility (CEBAF) at Jefferson Lab, building the new Facility for Rare Isotope Beams (FRIB) at Michigan State University, while running the Relativistic Heavy Ion Collider at Brookhaven.

The issue has been looming for some time. Last year, at the request of the DOE's Office of Science and the National Science Foundation, the Nuclear Science Advisory Committee (NSAC) appointed Robert Tribble of Texas A&M University to head a subcommittee charged with recommending a plan for the next five years of nuclear science. Tribble, who is past-Chair of the APS Division of Nuclear Physics, presented his team's report on January 28 at an NSAC meeting in Bethesda, Maryland, concluding that if increased funding for nuclear physics is not forthcoming, CEBAF and FRIB should receive priority over RHIC.

"In light of the substantial commitment that's been made to upgrade CEBAF under all budget

RHIC continued on page 6

Six Local Sites Host Diverse and Vibrant Conference for Women

By Halleh B. Balch

To organize the most successful annual Conference for Undergraduate Women in Physics, the plan was to divide and conquer, explained Shannon Glavin.

Glavin, a physics major at the University of Illinois Urbana-Champaign, was one of four undergraduate students who led the organizing committee for this year's Conference for Undergraduate Women in Physics at UIUC. Glavin said that key to their success in orchestrating over two hundred students, thirty volunteers, and twenty-five speakers was delegating responsibilities among four college students and three faculty advisers—and seeing every responsibility through.

Now in its eighth year, the 2013 Conference for Undergraduate Women in Physics brought together almost nine hundred undergraduate students at six host universities across the country. This year's six universities were California Institute of Technology (198 attendees), Colorado School of Mines (129), Cornell University (135), University of Central Florida (87), University of Illinois in Urbana-Champaign (235), and University of Texas at Austin (88). The Conference aims to provide women in physics mentorship, opportunities for networking, and motivation to pursue graduate work and careers related to physics. While maintaining these founding principles, each host site assumed complete responsibility for the conference planning.

"Part of the experience of the conference is that these undergraduate women are organizing it," said Daniella Bortoletto, a professor of physics at Purdue University and the present chair of the Conference faculty committee. "Undergraduate women

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Photo courtesy of Kevin Pitts

Student organizers of the University of Illinois CUWiP event demonstrate their unity of purpose. Left to right: Shannon Glavin (UIUC), Remmi Baker (Millikin University), Hannah Tanquary (Eastern Illinois University), and Novarah Kazmi (UIUC).

Members in the Media

"It's really boring when all the measurements and theory agree with each other. This kind of disagreement gives us something to talk about that isn't the Higgs boson."

***Chad Orzel**, Union College, on the changing diameter of the proton,* MSNBC.com*, January 27, 2013*

"The long-term civic and economic welfare of the country depends heavily on a robust public higher education system."

***Robert J. Birgeneau**, University of California, Berkeley, on heading a national effort to study and help public universities,* The Los Angeles Times*, January 28, 2013.*

"The folks that are running the agencies aren't in a position to know what the best science may be to go after; they have to put together plans. One of the issues we are really facing in the Department of Energy, and perhaps other places, is what is a reasonable trade-off between research that takes place with a very short-term goal versus research that takes place with a very long-term payoff?"

***Robert Tribble,** Texas A&M University,* The San Francisco Chronicle*, January 31, 2013.*

"I believe we should be judged not by the money we direct to a particular state or district, company, university or national lab, but by the character of our decisions… The Department of Energy serves the country as a Department of Science, a Department of Innovation, and a Department of Nuclear Security."

***Steven Chu**, Department of Energy, in a letter announcing that he is stepping down as Secretary,* The Washington Post*, February 1, 2013.*

"I hope we can hold hearings where people can hear about Darwin and science and the jobs it creates, the lives it saves, everything."

***Rush Holt**, U.S. House of Representatives, on designating February 12th as Darwin Day,* The New York Times*, February 1, 2013.*

"They're flocking."

***Paul Chaikin**, New York University, describing microscopic particles his team was able to self assemble into a crystal,* The Los Angeles Times*, February 1 20133.*

"Could it be possible to use this idea to make a material that shrinks to a very small volume when exposed to light and expands to fill a large volume in the dark? Maybe."

***Aparna Baskaran**, Brandeis, commenting on Chaikin's study,* The Los Angeles Times*, February 1 2013.*

"I had a new car and put 35,000 miles on it in one year. It just wasn't worth it… The ferry is the only game in town."

***Thomas Ullrich**, Brookhaven, on commuting to work using a ferry,* The Connecticut Post*, February 3, 2013.*

"Physicists study phenomena that have no relevance to race, so one might expect that black physicists would be silent on issues regarding race. This would be incorrect. Organizations like the National Society of Black Physicists have spoken out on issues of inclusivity. Still, in my opinion, some members of the black physics community are silenced by fear of exacerbating their alienation from the majority community that still holds the power to grant access to faculty jobs."

***Stephon Alexander**, Dartmouth College,* The New York Times*, February 4, 2013.*

"It'd be great if more scientists wanted to become regular contributors, to at least try to explain their most recent work."

***Sean Carroll**, Caltech, talking about his blog,* MSNBC.com*, February 6, 2013.*

"We saw an incredible opportunity to measure the dynamic properties of language at the microscopic scale of individual particles, and to observe how the system coevolves in response to external socio-technological forces."

***Alexander Petersen**, Boston University, on using Google Books to study the evolution of language over time*, The Boston Globe, *February 9, 2013.*

This Month in Physics History

March 23, 1882: Birth of Emmy Noether

One of the most significant 20th century mathematicians is also one of the most obscure when it comes to public recognition: Emmy Noether, whose work provided a fundamental connection between symmetry in nature and the laws of conservation.

The eldest of four children, Noether was born on March 23, 1882, in Erlangen, Bavaria, and showed an early aptitude for logic when she quickly solved a brain teaser at a children's party. Her father, Max, was a mathematician who taught at the University of Erlangen, where Emmy eventually enrolled. Initially, however, she studied French and English and qualified to teach those languages at girl's schools.

Emmy Noether

She soon changed her focus to mathematics, however, enrolling at her father's university. She was one of only two women students; just two years prior, the school's Academic Senate declared that allowing women to enroll would "overthrow all academic order." In fact, Noether was allowed only to audit classes, and then only after acquiring permission from the professors to attend their lectures. But it was sufficient to enable her to pass the graduation exam in 1903 and qualify for the equivalent of a bachelor's degree. She spent the next year studying at the University of Göttingen, but returned to Erlangen when the university finally revoked the restrictions on women students, completing her dissertation on invariants for ternary biquadratic forms in 1907.

While the university may have relaxed its restrictions on women students, it continued to exclude women from holding faculty positions. Noether taught at Erlangen for the next seven years with no salary, sometimes substituting for her father. David Hilbert sought to bring her into the mathematics department at the University of Göttingen in 1915, but other faculty objected. "What will our soldiers think when they return to the university and find that they are required to learn at the feet of a woman?" one professor complained. Hilbert was indignant. "I do not see that the sex of the candidate is an argument against her admission," he retorted. "We are a university, not a bath house." Instead, Noether lectured there unofficially under Hilbert's name for the next four years without pay; her family provided living expenses.

Noether is best known for her contributions to the development of the then-new field of abstract algebra, as well as ring theory. But one of the reasons Hilbert pushed to bring Noether to Göttingen was the hope that her expertise on invariant theory –numbers that remain constant even though manipulated in different ways–could be brought to bear on Albert Einstein's fledgling theory of general relativity, which seemed to violate conservation of energy.

Noether did not disappoint, devising a theorem that has become a fundamental tool of modern theoretical physics. One of its consequences is that if a physical system behaves the same regardless of its spatial orientation, the system's angular momentum is conserved. Noether's theorem applies to any system with a continuous symmetry. When Einstein read Noether's work on invariants, he wrote to Hilbert: "I'm impressed that such things can be understood in such a general way. The old guard at Göttingen should take some lessons from Miss Noether. She seems to know her stuff."

As World War I ended, the German Revolution of 1918-1919 resulted in improved rights for women, and the University of Göttingen relented a little in its stance on women faculty, eventually granting her an untenured professorship. Noether even received a small salary beginning in 1923. She never did achieve the rank of tenured professor, however, nor was she elected to the Göttingen academy of sciences, despite her academic accomplishments.

Noether rarely followed lesson plans in her lectures, preferring spontaneous discussions with her students, and often became so passionately engrossed in the subject that her hair came loose. She showed unusual devotion to her job, once teaching class at a local coffee house when the building was closed for a holiday. Most of her students were male, dubbed the "Noether boys," although Noether mentioned her pleasure, upon meeting Czech mathematician Olga Taussky, that more women were pursuing studies in the field.

The rise of the Nazi government brought an end to Noether's academic career in Germany with the enactment of a law to remove Jews from government and university positions unless they had proven their loyalty to Germany by serving in World War I. (One student protester proclaimed, "Aryan students want Aryan mathematics, not Jewish mathematics.")

Noether was among the first to be dismissed from the University of Göttingen. Initially, she gathered students at her home, but eventually was forced to flee Germany, along with many other Jewish academics in Germany. She wound up taking a position at Bryn Mawr in the United States in 1933. She also lectured at the Institute for Advanced Study in Princeton, although she felt less welcome at Princeton, describing it as a "men's university where nothing female is admitted."

Her new life in the US did not last long. In 1935, doctors found a tumor in Noether's pelvis, and during surgery uncovered an ovarian cyst and two smaller tumors in her uterus. Although the surgery was successful, Noether died of complications four days later at 53. One of her physicians thought her death may have been due to "some form of unusual and virulent infection." Friends and associates held a memorial service a few days later. Her ashes were buried under the walkway in the Bryn Mawr library's cloisters. Einstein wrote to the *New York Times* after her death, declaring Noether to be "the most significant creative mathematical genius thus far produced since the higher education of women began."

Reference:

Noether, E. (1918) "Invariante Variationsprobleme," Nachr. D. König, Gesellsch. D. Wiss. Zu Göttingen, *Math-phys. Klasses* 235-257.

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AMERICAN PHYSICAL SOCIETY
MOVING PHYSICS FORWARD
APS STRATEGIC PLAN IMPLEMENTATION

Digital Strategy Enhances APS Online Presence

In the coming months, the APS online presence will undergo an overhaul to make the many APS-run websites better coordinated and more user-friendly. The changes were prompted by the strategic plan, which called for "seamless integration across the APS web sites" so users can have a more personalized experience.

"It's an effort to bring all of the digital initiatives of the Society together in support of the strategic plan, so we're not doing things in such a fragmented way," said Tracy Alinger, APS's Director of Information Technology at College Park.

Currently, different departments of the Society operate a variety of websites, including the Society's homepage at www.aps.org, and ones run by education, outreach, meetings and the journals. The plan is to develop a system that more closely ties the sites together, both through common branding and content sharing.

"We want to have a lot more consistency and we want to put cross-site navigation in place," Alinger said. "The long term goals are to have more personalization, to make it easier to get around our sites, and to increase members' awareness of all the things that we do."

Over the last several months, the Society has been working with consultants to study ways to improve branding and to make the content transferrable from one site to another. In addition, APS is developing a universal login for both the membership site and for access to the journals.

"In the long run if we do our job correctly, users will be more engaged with APS, they will be better able to find the content and activities that best suit them," said Mark Doyle, Director of Journal Information Systems. "The idea is to build more of a community to better serve our members."

Other improvements that are in process include making the APS webpages more compatible with mobile devices, and increasing social media presence.

Sorters Meet for Assorted Meetings

On two recent occasions, groups of physicists assembled at APS headquarters in College Park to sort abstracts for upcoming meetings. On January 18, twenty-two April Meeting sorters met, and on February 4 it was the turn of 16 sorters for the DAMOP Meeting. In the upper picture, sorters Tatjana Curcic (Air Force Office for Scientific Research), Georg Raithel (University of Michigan), and Randy Hulet (Rice University) put DAMOP abstracts in order, while in the lower photo, Amitabh Lath (Rutgers University) and Kaustubh Agashe (University of Maryland) decide the fate of an April Meeting abstract.

Photos by Michael Lucibella

Conference Examines Many Facets of Graduate Education

By Bushraa Khatib

The 2nd Graduate Education in Physics Conference, held January 31-February 2 at the American Center for Physics in College Park, generated in-depth discussion on topics such as preparing graduate students for non-academic careers, improving on diversity, and debating graduate school admissions policies, including use of the GRE.

The conference, organized by APS and the American Association of Physics Teachers (AAPT), followed on the success of the first such conference, held in 2008.

One hundred seven participants represented 74 universities, including PhD-granting physics departments across the United States, both large and small. Department chairs and directors of graduate studies attended, as did graduate students and members of the physics community from industry, funding agencies, and professional societies.

Renee Diehl, professor of physics from Pennsylvania State University and a conference organizer, remarked, "Sessions included active discussions by participants clearly interested in improving their own graduate programs."

A session on "Building Successful Graduates" discussed the GRE as an admissions tool. Frances Hellman, UC Berkeley, presented data that suggests that there is almost no correlation between GRE scores and future success as a researcher. Diehl said that one of the messages to drive home was that not everyone can be measured in the same way, especially by the GRE. "If we want to increase the diversity of physicists, we need to find ways to tap into and build on the strengths of individuals," she commented. (See the Back Page article on the GRE in last month's *APS News*, http://www.aps.org/publications/apsnews/201302/backpage.cfm).

Photo by Michael Lucibella

At the session on "Promoting Diversity in Physics", Kathy Prestridge (left) of Los Alamos listens while Zelda Gills of Lockheed-Martin makes a point.

Meg Urry, chair of the physics department at Yale University, started the conference with a plenary on "Some Thoughts on the Future of Graduate Education." Cherry Murray, Dean of Engineering and Applied Science at Harvard University and 2009 APS President, gave a keynote address titled "Reflections on Getting a PhD in Physics." Murray presented data on PhD enrollments and employment.

A significant conference focus was the importance of educating

CONFERENCE continued on page 5

INSIDE THE BELTWAY

Taking Procedural Stock

by Michael S. Lubell, APS Director of Public Affairs

For a time, it seemed as though Republicans and the White House might have an opportunity to cozy up. After all, during their January GOP House retreat, Speaker John Boehner and Majority Leader Eric Cantor decided to heed the advice of Newt Gingrich and a posse of economists who had urged Congress not to hold the world's economy hostage to partisan wrangling over the debt ceiling.

Fresh from their Kingsmill sanctuary, a tony resort in Williamsburg, Va., Boehner and Cantor, who were close to splitsville last year, presented themselves to the media as newlyweds, taking their vows to make Washington work. They announced a three-month reprieve for the GOP's debt-ceiling crusade and committed the Republican House Conference to producing a plan for long-term deficit reduction through "regular congressional order."

I found the chords of Copland's "Fanfare for the Common Man" echoing in my ears as good-government trumpets sounded throughout the nation's capital. In short order, the House and Senate got down to legislative business and with alacrity unprecedented in recent years passed a bill in less than 10 legislative days, one that allows federal red ink to flow until May 18. The president had been pressing for raising the nation's credit card limit enough to cover two more years of planned spending. But he accepted the short-term compromise with a pledge to work for a long-term bipartisan "balanced" solution to the debt threat.

Niceties they were indeed, but the discourse contained a major barb aimed squarely at the Senate.

Although somewhat weakened by a nascent insurrection that nearly cost him his speakership in early January, Boehner cobbled together a bipartisan bloc by cajoling Democrats into swallowing a potentially poisonous legislative pill. Noting that the Senate hadn't passed a budget in four years, as required by law, he and Cantor proposed that if either chamber missed the April 15 deadline, that chamber's members would have their paychecks placed in escrow until the day of budgetary reckoning or until the end of the calendar year, whichever came first.

Across the Capitol grounds, Senate Majority Leader Harry Reid was dealing with his own band of insurrectionists. Jeff Merkley, of Oregon, and Tom Udall, of New Mexico, two young parvenus, had mobilized a majority of their Democratic colleagues to address the dysfunction that

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Letters

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

U238: Fissionable but not Fissile

Ed. Note: On the Back Page of the January *APS News*, in a box headed "A Primer on the Technical Issues" we stated that U238 is not fissionable. This confuses the terms "fissionable" and "fissile". U238 is fissionable, in that it can undergo fission, but unlike U235 it is not fissile, i.e., it cannot be induced to fission with low-energy thermal neutrons. We thank Eric Ottewitte, Marshall Blann, and Jim Fuller for pointing out this distinction.

January 1851: First Reference to Photography in Literature

In connection with the article January 2, 1839: First Daguerreotype** of the Moon [This Month in Physics History: *APS News* January 2013], the following note may be of some interest.

The first reference, of which I am aware, to photography in literature, both as a science and as a profession, occurs in Nathaniel Hawthorne's romance *The House of the Seven Gables*, which was completed for publication in Lenox, Massachusetts, in January, 1851. In chapter 6 of this work, the author, who does not dwell on technical details, develops the notion that the daguerreotype is capable of drawing out and revealing intrinsic human characteristics normally not visible–in this case the true nature of Judge Pyncheon. A man of "exceedingly pleasant countenance, indicative of benevolence ..." is revealed as "sly, subtle, hard, ..., cold as ice." Oscar Wilde was later to develop a similar theme in more extreme form in his novel *The Picture of Dorian Gray* (1891).

***Hawthorne's spelling follows that of the surname Daguerre, without abbreviation.*

John Douglas Hey
Calgary, Alberta

STOCK continued from page 3

had become the Senate's third millennium signature.

For almost 200 years, senators had used the filibuster to extend debate only on rare occasions. And when they did, the chamber's rules required them to hold the floor. What they said or read was immaterial, but they had to be present in body if not in mind. When their stamina eventually waned or a supermajority of their colleagues voted to terminate their oratory, the chamber would return to legislative business.

In more recent years, the Senate had relaxed its filibuster rules, allowing members simply to express an intention to hold the floor and requiring 60 votes in the 100-member body to break the promised legislative disruption. For the minority, the temptation to halt action on a bill it opposed became increasingly seductive, and during the last four years, 60 votes has been the norm for achieving any legislative progress.

Republicans may have taken advantage of the mere threat of a filibuster to thwart the will of the majority, but so, too, have Democrats used the arcane process of "filling the amendment tree" to prevent the minority from even trying to modify a bill. Under current Senate rules, the majority leader has the power to give his party's amendments priority and exhaust all the allowable modifications to a piece of legislation. The late Robert Byrd (D-WV) originated the formula when he was in charge, and Reid has become a master at using it, effectively casting Republicans in the objectionable role of objecting obstructionists.

The combination of the majority and minority practices has tied up the Senate in procedural knots, and their continual use helped make the 112th Congress the least productive in history. Last summer, Reid spoke out in favor of Merkley and Udall's request to allow a simple majority vote on changing the Senate rules when the 113th Congress convened. But under pressure from Republicans and a handful of Democratic old bulls, he backed off in January, with the Senate ultimately adopting only minor rule modifications. Those changes, Capitol Hill experts say, will barely scratch the Senate's dysfunctional skin.

Whatever respite from hyperpartisanship might have existed in early January disappeared last month when President Obama delivered an aggressive State of the Union address, and Republicans, predictably, delivered an in-kind response. Add to that the GOP's Senate filibuster of Chuck Hagel's confirmation as defense secretary, and an odor of toxicity once again is emanating from the shallow well of bipartisan good will.

If the state of the nation weren't so in need of sound policy making, the relapse into partisan strife might be simply a footnote on the state of Washington. But economic growth, fiscal health and national security are in desperate need of cooperation. And sadly, collaboration and comity are becoming scarce commodities once again.

If there is any hope for a new dawning in America, science could provide it. It knows no partisan boundaries, and it is central to the nation's future. But it isn't always so recognized. Now, more than ever, its practitioners have an obligation to hammer home its benefits: to the public and to Washington–if not for the future of science, then for the future of the country and the world.

Anxiety Over Peer Review Somewhat Exaggerated

On the basis of my own recent experience of submitting, as a joint author, a paper which challenged accepted dogma, to a well-regarded journal, I wonder if Arthur Cohn's letter in the January *APS News* is not expressing a bit too much anxiety about peer review.

Our paper, as submitted, naturally had a pretty hard time from the referees and had to be extensively revised. But after a couple of passes one referee agreed, regretfully, that we had a point and that the paper should be published. Another referee felt that our conclusions were so misleading as to be damaging and so the paper should not be published. The Editor then stepped in and said he had decided that the paper should be accepted, as it was important that it should be realised more generally, that there were problems with the accepted dogma.

Since publication we have received a number of emails commenting on the paper. They range from one saying that the paper was "crazy nonsense" to another saying that our article was "a rehash of old stuff that has been known for a long time." But all were courteously expressed.

Our experience was not what your correspondent seems to fear and, as expected, the reactions to our dogma-questioning were varied. But even those who felt that we were wrong, expressed themselves in measured terms.

As an aside, I do not quite follow the analogy with the Lysenko affair, made in the letter. It was the intervention of the state authorities and not peer review that got Lysenko's views to become dogma, as I understand it.

Brian Sutcliffe
Brussels, Belgium

Interview left questions unanswered

Regarding the interview with new APS President Michael S. Turner (*APS News*, January 2013) in view of the needs of the nation and the role that should be expected of our physics community, I would have specifically liked to hear his opinions on the following topics:

1. What should be the role of APS in preparing its physics trained constituents (e. g. graduate students) for permanent employment?
2. Since most physicists in this country do not work in academia, what should be the relation between APS and its industrial colleagues?
3. When the money runs out in Washington (the current Congress, no matter what we try to ask of them, has no intention of increasing funding for science), how will our APS academic colleagues receive the funds they need? Who will provide the money that Congress does not intend to provide?
4. What role should physicists play in restoring the nation's manufacturing base?
5. Once its publications' generated income dries up (with the inevitability of open source publishing), how does APS intend to support itself? (Fewer than a couple of hundred APS members donate annually to the APS general fund.)
6. Should the APS restructure its meetings formats to bring them into a more efficient and realistic structure such as has been implemented by our older sister organization, the American Chemical Society? (Among the absurdities is splitting the national meeting into two somewhat arbitrary, though closely related, groups. The enormous energies and costs devoted with "sorting sessions" should certainly be reduced; probably by asking each abstract author to sort his/her own.)

Philip J. Wyatt,
Santa Barbara, CA

Planck is a European Mission

The article on "April Meeting features latest research and more" in the January issue of *APS News* speaks about "NASA's Planck satellite." The Planck satellite is an ESA mission, which has been launched by ESA, with mission teams led by European Institutes. The contribution of NASA to Planck is important, but to speak about "NASA's Planck satellite" would be like talking about ESA's Hubble mission–an unnecessary case of mis-information...

Tanja Rindler-Daller
Austin, TX

Beltway Column Reflects Bias

I look forward to reading Michael Lubell's Inside the Beltway columns. They are so "over the top" and humorous, they make me laugh. In his column in the January *APS News*, New Directions or More of the Same, he manages to insert inflammatory expressions and partisan bias into 8 of the 32 sentences he wrote, e.g., "overt or threatened obstructionism," "peddles our nation's future prospects for a fire sale price," "tea party ideologues" (as contrasted with "determined democrats"), "push our nation into default," "opposition to compromise," "far right ideologues," "rebellious rabble," and "hold the nation's credit worthiness hostage." It would be funny except that the column comes under the banner of the APS Director of Public Affairs where one might expect real professionalism and insightful analysis.

William R. Ott,
Gaithersburg, MD

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The article 'New directions or more of the same' by Michael Lubell that appeared in the January *APS News* is another example of biased journalism. I will give Lubell credit for managing to get through four paragraphs before veering sharply to the left. His characterization of the Tea Party as "rebellious rabble," 'ideologues" dedicated to "obstructionism" and responsible for the "downgrading of US Treasury bonds" is absurd, pure leftist propaganda.

I think the idea of a column such as 'Inside the beltway' is a good one, but we need an unbiased journalist to write it.

Thomas Wolfram
San Clemente, CA

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Michael Lubell replies:

To readers who found some of the rhetorical flourishes in my January column to be over the top, I apologize for the offense. But in my defense, I note that although I often take credit for smart turns of phrase, in my last piece I cribbed many of the objectionable terms from nonpartisan Washington publications such as *National Journal*, *CQ*, *Roll Call*, *Politico* and the *Hill*.

One note I struck that some readers found objectionably discordant was my assertion that Republican strategy had coalesced around obstructionism. Anyone who doubts the truth of my claim I direct to the PBS Frontline program, "Inside Obama's Presidency," which aired on Jan. 15. The narrative included on-camera statements from top political strategist Frank Luntz, who took credit for organizing a meeting of Republican luminaries the night of the 2009 inaugural to discuss how the GOP could "obstruct" the new president's policies. And in their thoughtful Jan. 26 *National Journal* piece on how to reboot the Republican Party, Tim Alberta and Jim O'Sullivan noted that "Republicans on Capitol Hill have been rebranded since 2008 as the reliable obstructionists, a group known more for its reflexive opposition … than its proactive problem solving."

Finally, on my observation that the Tea Party wing of the House Republicans–often called "raucous," "rebellious" and "ideological" by the Washington media–had threatened to hold the credit of the United States hostage to their demand spending cuts, I note that former House Speaker Republican Newt Gingrich used a similar turn of phrase in urging them to abandon that strategy.

Diversity Corner

A column on programs related to diversity

M. Hildred Blewett Fellowship
APS is now accepting applications for the M. Hildred Blewett Fellowship. This award is intended to enable women to resume physics research careers after an interruption. The deadline to apply is June 1, 2013. For more information and/or to apply, please visit: www.aps.org/programs/women/scholarships/blewett/

Save the Date: APS Bridge Program Summer Meeting
The APS Bridge Program Summer Meeting will bring together experts to discuss efforts to increase the number of underrepresented minorities who receive PhDs in physics. The meeting will be held June 27-29, 2013 at the American Center for Physics in College Park, MD. Workshops, panel discussions, and presentations will address topics such as: mentoring, bridge program logistics, cultivating faculty/administrative support, and building a sense of community for students.

The conference is designed for faculty, administrators, and students from prospective and existing bridge program sites, as well others who might be interested. To receive more information about the meeting as it becomes available, please email bridgeprogram@aps.org.

Nominate a Women or Minority for APS Fellowship, Prizes and Awards
The APS Fellowship Program recognizes members for exceptional contributions to pure or applied physics or physics education, or for exceptional leadership or service in physics.

Further information on the fellowship nomination process can be found online at http://www.aps.org/programs/honors/fellowships/

For information on nominating women and minorities for APS prizes and awards, please visit http://www.aps.org/programs/honors/nomination.cfm

Climate Site Visits
The APS has had a long-standing interest in improving the climate in physics departments for underrepresented minorities and women. The Committee on the Status of Women in Physics (CSWP) and the Committee on Minorities (COM) both sponsor site visit programs.

For more information on the Climate for Women in Physics Site Visit Program, visit: http://www.aps.org/programs/women/sitevisits/index.cfm

For more information on the Climate for Minorities in Physics Site Visit Program, visit: http://www.aps.org/programs/minorities/sitevisits.cfm

Update Your Department's Female Friendly Graduate Program Survey
CSWP provides responses to a series of questions about graduate programs in physics that should be helpful to those interested in assessing the climate for women at various graduate schools. You can find department responses to a short series of questions at: http://www.aps.org/programs/women/female-friendly/index.cfm

All responses are self-reported by department chairs (or their assignees). To update your responses, please contact women@aps.org.

Help Endow the Bouchet Award
For the past 18 years, the Edward A. Bouchet Award has connected exceptional minority physicists with students from the US and abroad. The award will lose its annual funding in 2013, so APS needs your help. Our goal is to endow this award by raising $140,000 to continue to mentor and inspire underrepresented minorities as part of the next generation of scientists. Learn more and donate at: http://www.aps.org/about/support/bouchet/index.cfm

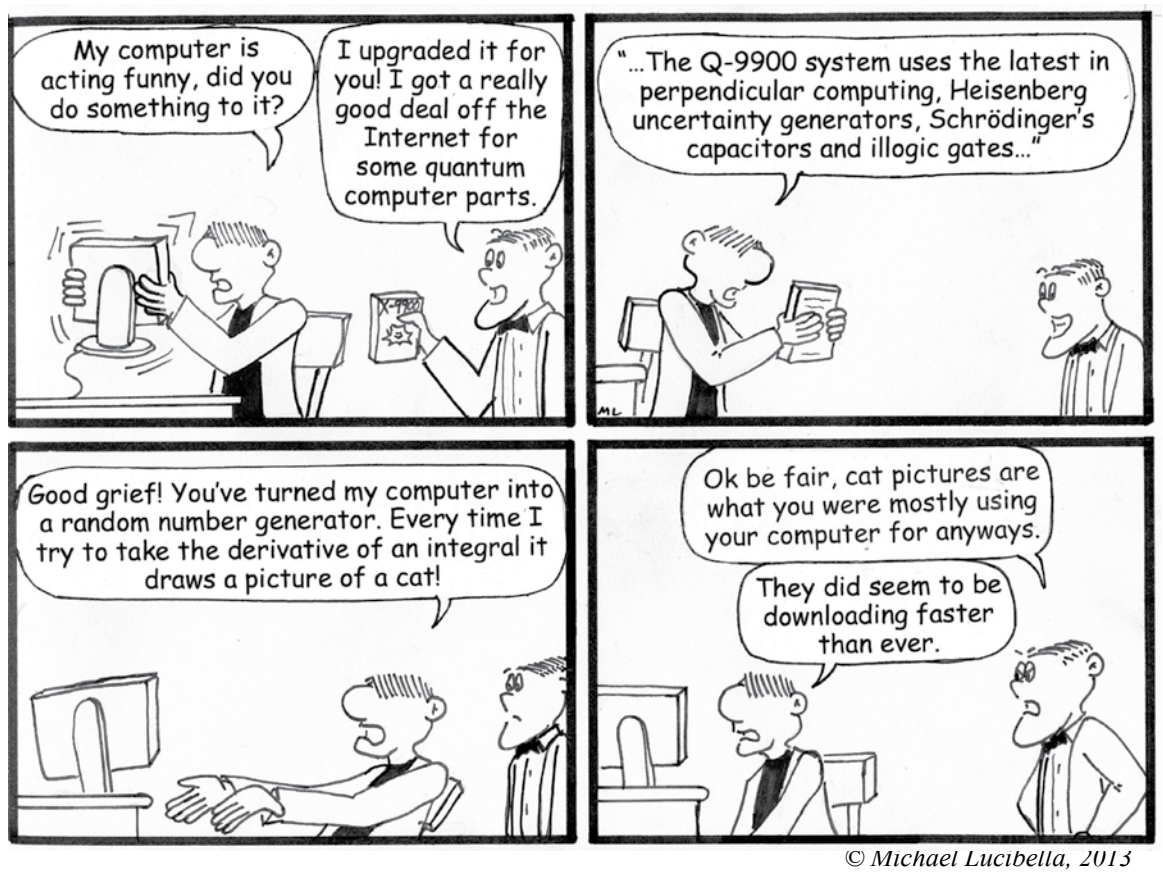
APS Bridge Program Now Accepting Student Applications
The mission of the APS Bridge Program (APS-BP) is to strengthen physics in the United States by increasing the number of underrepresented minority students who receive doctoral degrees in physics. The APS-BP is open to prospective students who meet the eligibility criteria, exhibit academic promise, plan to pursue a doctoral degree in physics and can enhance the diversity of doctoral students in physics.

Students enroll in a one- to two-year Bridge Experience in a post-baccalaureate program that provides research experience, advanced coursework, mentoring, and coaching in preparation for graduate school. The Bridge Experience aims to improve access to and culture of graduate education for *all* students, with emphasis on those underrepresented in doctoral programs in physics. Successful applicants will be fully supported through a combination of funding from the Bridge institution and the APS Bridge Program.

Complete applications to the APS Bridge Program are due by April 15. Learn more and apply at: http://www.apsbridgeprogram.org/about/students.cfm

zero gravity

By Michael Lucibella



CONFERENCE continued from page 3

students for a wide variety of careers, given that a small percentage of PhDs in physics find permanent employment within academia. A panel on non-academic careers agreed that interdisciplinary experiences and resume-writing skills are important for graduate students to master. Stefan Zollner, physics department chair at New Mexico State University, said the fact that only 20% of PhDs go on to become permanent faculty must be communicated to students. He urged institutions to stay in touch with alumni, find out what skills they find useful, and invite non-academic graduates back to give colloquia.

Increasing the diversity of the graduate student population was a major discussion topic during the conference. Anthony Johnson, Director of the Center for Advanced Studies in Photonics Research and Professor of Physics, Computer Science and Electrical Engineering at the University of Maryland Baltimore County, gave a plenary talk on his personal perspective on promoting diversity in physics. Johnson described research fellowships and programs available to underrepresented minority students since 1972 and shared his own observations from his experience at AT&T Bell Laboratories.

The discussion on diversity also included an afternoon breakout session on Bridge Programs to Improve Diversity. Bridge programs are typically one- to two-year post-baccalaureate or master's programs that seek to enhance student's chances of success in a PhD program. These programs offer a combination of coursework, research experience, and mentoring to strengthen applications to graduate school in physics. Theodore Hodapp, APS, and Marcel Agüeros, Columbia University, gave presentations on their respective bridge programs. The APS Bridge Program seeks to increase the number of underrepresented minorities, including African Americans, Hispanic Americans, and Native Americans, who receive PhDs in physics.

Sessions at the conference also emphasized the fact that employers need PhDs who can work well with others. Panelist Kathy Prestridge, Los Alamos National Laboratory, said she could not hire people who would not work in teams. Roel Snieder, Colorado School of Mines, led the session General Professional Skills, Leadership, Team Building and Communication, where the participants concluded that such "soft skills" are critical for success in many physics jobs today.

A session on University, Industry and National Lab Partnership for Graduate Education mentioned that awareness of national lab programs needs to increase. The session also encouraged candidates to form personal connections with PIs.

This year's conference featured strong participation by the 12 graduate students in attendance. Diehl was surprised by how large the contribution was from students at this year's conference. "They obviously have thought a lot about graduate programs and they expressed themselves eloquently," she said. For example, graduate students made a strong case for better-defined family policies.

Christopher Salvo, a graduate student at University of California, Riverside, found the conference as a whole extremely valuable, but especially enjoyed the series of breakout sessions. "This mechanism allowed for many topics to be covered in a highly intense and focused manner," he said, citing sessions on non-academic careers as most useful.

Chandralekha Singh, a conference organizer and Professor of Physics at the University of Pittsburgh, said the conference was very successful in achieving its goals. She said the most valuable part of the conference was the "great exchange of ideas on how to maintain excellence in graduate education in physics." This includes keeping in mind changing demographics and increased competition for the best graduate students.

Lawrence Woolf, a conference organizer from General Atomics, drew attention to another takeaway message from the conference: graduate students need improved communication with their thesis advisors regarding progress towards their PhD. This might include setting up a mutual understanding between students and their advisors, reviewing this understanding annually, and assigning mentors independent of thesis advisors.

Several organizers said they would like to see the conference occur more than once every five years so that there is enough time to have detailed discussions on issues related to graduate education in physics.

The conference was supported by a grant from the National Science Foundation and organized by Renee Diehl, Theodore Hodapp, Chandralekha Singh, Michael Thoennessen, R. Steve Turley, and Lawrence Woolf. The organizing committee anticipates issuing a conference report in 2013.

BOWL continued from page 1

***Physical Review* Centennial**

The *Physical Review* is celebrating 100 years of publishing cutting edge scientific research under APS. A special session will both reflect on its history and look ahead to its future role at the forefront of physics. Special for this meeting, for the first time, Daniel Kennefick from the University of Arkansas, Fayetteville will reveal the name of the referee that rejected Einstein's third and last submission to the journal. (Session B10)

Prizes and Awards

On Monday afternoon, at a ceremonial session, the APS President will present prizes and awards to a number of researchers whose discoveries and careers have broken new ground, challenged assumptions and broadened their fields. (Session D1)

Play

On Wednesday evening, there will be a special reading of the one-act play "Farm Hall" by David Cassidy of Hofstra University, about captured German nuclear physicists at the end of World War II. Cassidy based the piece on transcripts of conversations between Werner Heisenberg, Otto Hahn and Walter Gerlach as they awaited their fate at the hands of the Allies. (Session S50)

Soft Polymers Strengthen Steel

Researchers are developing a way to make steel more bulletproof using rubber polymers. When a projectile hits the rubber polymer developed by the Naval Research Lab, the rubber undergoes a phase change. For the ten microseconds or so of an impact, the material become about 1000 times harder than its natural state, temporarily becoming a protective barrier. (Session G34.10)

Batteries

Researchers are always trying new chemical combinations to squeeze more life and charge out of batteries. However more recently, the nanostructure of the battery's storage materials has been the focus of much research. Gary Rubloff from the University of Maryland has been considering whether an organized nanostructure of batteries and capacitors can improve on disordered networks. (Session C39.04)

Fracking

Hydraulic fracturing for natural gas, or "fracking," has been both hailed as the solution to the country's energy needs and decried as a tremendous environmental threat. Tuesday morning's session, "The Impact of Hydraulic Fracturing" will help researchers sort through the controversies of the booming energy extraction technique. Francis O'Sullivan will speak about how the new extraction method is transforming the energy market. Researchers from the EPA and Duke University will present their assessment of the environmental impacts of fracking. Murray Hitzman from the Colorado School of Mines will delve into his recent report on the connection between fracking and earthquakes. (Session F9)

DNA Nano Motors

DNA codes for the building blocks of life, but it can also be used to motorize very tiny machinery. Andrew Turberfield from the University of Oxford developed a way to turn DNA into a nanoscale motor. What's more, his tiny motorized submarine can be programmed to navigate a network of tracks. (Session F43.01)

Majorana Fermions

Scientists have been hunting for Majorana fermions, particles that are also their own antiparticle, since they were first predicted in 1937. Last year at the March Meeting researchers from Delft University in the Netherlands announced strong evidence that they'd found the elusive particles. Since then, the team has been improving their technique and will present their latest research at this year's meeting. (Session T13.08)

Cancer Physics

Physicists are working alongside doctors and oncologists to better understand and fight cancer. Three sessions throughout the meetings are devoted specifically to how physicists are helping to develop treatments and map its spread. On Thursday morning Jan Liphardt from the University of California, Berkeley will speak about remaining unresolved issues where physics and biology overlap. That afternoon, Eshel Ben-Jacob from Rice University will describe the different ways that tumor cells navigate through the body. Friday morning Amy Wu from Princeton University will present her research into the ways that cancer develops resistance to common drugs. (Sessions T45, W47 and Y45)

Random Vaccinations

Preventing the outbreak of disease relies a great deal on the efficient distribution of a scarce resource, vaccines. Lora Billings from Montclair State University found that randomly distributing vaccines might be more effective than current methods on a finite population. This may lead to better public health campaigns during the outbreak of a contagion. (Session C44.06)

TV continued from page 1

feel like part of the meeting," Gaier said. "If they're not there, they get to see what they missed and maybe come the next year."

After they're filmed and edited, the videos will be uploaded to the WebsEdge website and YouTube.

"We're working to get the meeting to be a 'must attend' event and show the people who aren't there what they're missing," Gaier said. "[It's] to create a buzz about the meeting."

WebsEdge will be setting up a studio in the Baltimore Convention Center, and will be walking throughout the meeting for on-the-spot interviews.

"We'll be interviewing people in the exhibit hall and by the registration desk," Vaquer said. She added that the aim of the spots is to go into more depth with the researchers than a single sound bite. "It is more thoughtful and they have more time."

Similar to network TV, WebsEdge finances its operations by recruiting sponsoring institutions who are featured in pre-produced videos that are included in the daily segments. There is no cost to APS, nor any increased charges to meeting attendees.

RECIPIENTS continued from page 1

James Wynne and Rangaswamy Srinivasan, both at IBM, were honored with the National Medal of Technology and Innovation for experimenting on the effects of lasers on biological tissue, laying the groundwork for Lasik eye surgery. Their team started by shooting pieces of their own fingernails and hair with an excimer laser and found it made very precise cuts.

"If the laser made a really clean incision in your skin, without any collateral damage, it would heal without scarring," Wynne said. The day after Thanksgiving 1981, the team tried slicing up small pieces of leftover turkey skin. "When I put this sample under a microscope, I had my 'aha' moment."

He added they didn't immediately think of using it for eye surgery.

"I thought it was going to revolutionize brain surgery, and I thought it might revolutionize skin surgery," Wynne said. Instead, it revolutionized eye surgery. Steven Trokel of Columbia University was the first to publish a paper about using Wynne's laser discovery on a human eye. "Once that paper was published, the whole ophthalmology community heard about it, and then it was off to the races."

S. James Gates Jr. of the University of Maryland was awarded the National Medal of Science for developing the theory of supersymmetry, and for sharing theoretical physics with the public.

"When I was a graduate student at MIT I was the first person at the Institute who recognized the possible importance of supersymmetry," Gates said. "Now 30 years later, supersymmetry is right at the center of the class of ideas as to how the universe functions and the standard model."

Gates has also appeared on numerous popular TV shows about science, he is currently a member of the President's Council of Advisors on Science and Technology, and he is serving on the Maryland state board of education.

John B. Goodenough at the University of Texas at Austin was awarded the National Medal of Science for his work on cathodes that lead to the invention of the lithium ion battery.

"It's a nice surprise," Goodenough said. "I'm very happy for the recognition that it gives to the particular field of electrochemistry."

Longtime SLAC Deputy Director Sidney Drell received the National Medal of Science for "contributions to quantum field theory and quantum chromodynamics, application of science to inform national policies in security and intelligence, and distinguished contributions as an advisor to the United States Government." Arthur Rosenfeld, Scientist Emeritus at Lawrence Berkeley National Lab, won the National Medal of Technology and Innovation for his work developing energy efficient building technologies and standards.

RHIC continued from page 1

scenarios, the subcommittee recommends completing the upgrade and capitalizing on the science that it enables," Tribble said. "The subcommittee vote, while closely split, resulted in a slight preference to the choice that proceeds with FRIB."

Officially, the report's primary recommendation is that funding for nuclear science be increased.

"The report does not recommend shutting down RHIC. It recommends a modest growth budget that would allow CEBAF and RHIC to operate for the highest impact science and proceed with FRIB construction," Tribble said in an email. "It is only under no-growth budgets that something as dire as shutting down RHIC might occur."

The proposed FRIB will shoot a beam of stable ions at a fixed target, creating rare isotopes usually only found in the extreme temperature and pressure of supernovae. CEBAF is the crown jewel of the Thomas Jefferson National Accelerator Facility in Newport News, Virginia. It accelerates a continuous beam of electrons, which can be directed at targets in any of three different experimental halls. The experiments are mainly designed to provide greater understanding of quantum chromodynamics. RHIC is a 3.8-kilometer accelerator that collides heavy gold and lead ions to create hot quark gluon plasma. RHIC was the first facility to create this new phase of matter, but CERN recently claimed to have surpassed RHIC's milestone, creating plasma almost 40 percent hotter.

The committee first looked at two budget scenarios, one that included increases that kept up with inflation, and a "flat flat" budget, which kept the budget the same, but with its buying power slightly reduced because of inflation. Tribble and his team found that neither scenario could keep all three facilities running, and it would take at least a 1.6% increase over inflation to keep them open, what Tribble termed the "Modest Growth Option."

Office of Science Director Bill Brinkman is worried that there may be even more cuts coming. Unless a budget plan is worked out, automatic 6% cuts, known as sequestration, are to set in on March 1.

"We have a situation in which the Congress [and] the administration now are starting to take the idea that sequestration might happen more seriously. And so we're starting to really look at impact," Brinkman said. "It strikes me as a dangerous thing if it happens."

NP wound up in this financial crunch after coming up with a long-term plan in 2007. The plan predicted increasing annual budgets and called for new construction and upgrades. A year later the recession hit, resulting in constricting science budgets while construction and upgrades went forward.

Congress allocated $547 million for nuclear sciences in 2012. That amount is in total about $20 million higher that what was allocated for 2011, but most areas saw slight cuts, offset by allocations specially for FRIB's construction, CEBAF's upgrade and small business investments.

The president's budget requested $526 million for 2013 for all nuclear sciences, but because of political gridlock it is unclear when or how much of it will pass. It is possible that Congress will pass a continuing resolution keeping the funding the same as 2012, resulting in flat flat funding. If sequestration sets in after March 1, NP stands to lose between 5.5% and 8% of its budget.

Brinkman urged scientists to lobby Congress to protect funding for these programs.

"To me these [cuts] represent permanent damage to the field and I don't think you'll easily recover from them," Brinkman said. "I think it's extremely important for everyone in the room to understand that they need to be talking to their Congressmen and people on the Hill to get some action on this subject."

After Tribble's announcement, Brookhaven's interim laboratory director Doon Gibbs released a statement expressing concern. He pledged to work to keep RHIC operating.

"I have been in touch with the leadership of each of the other two affected facilities, and we have agreed to work together to realize the modest growth path," Gibbs said.

Tribble reflected Gibbs's sentiments in his presentation to the Advisory committee.

"To me it would be a disaster for the US nuclear science program. It's a clear short-term problem that I think could likely result in the start of a longer-term decline of the field as a whole," Tribble said. "So consequently I think we all must work together to do our best to keep it from happening to preserve our field."

Brinkman also expressed concern about the long-term prospects of the United States' nuclear science program.

"It seems to me that we're heading in a direction that is totally the wrong direction," Brinkman said. "Everywhere I look I see international competition in almost every sub-field that we have. And so it strikes me that if we keep heading in this wrong direction, we could really lose our position in the world."

ANNOUNCEMENTS

Editor–*Physical Review Letters*

The American Physical Society is conducting an international search for the leading Editor of ***Physical Review Letters (PRL)***. The leading Editor is responsible for editorial standards, policies and direction of the journal, and leadership of the staff of 20 editors. *PRL* is the leading multidisciplinary letters journal in the field of physics.

The ideal candidate should possess many of the following qualifications: stature in a field of research within the scope of *PRL* and within the *PRL* author community; experience with scholarly journals; management and interpersonal skills to deal effectively with an international array of authors, referees, and editors and with the APS; advocacy, integrity, and wisdom to lead the journal in responding to important matters and issues.

The Editor may maintain his/her present appointment and location and devote at least 20% of his/her time to the position. A higher level of commitment would be desirable in the initial year of service; several possible levels of long-term commitment, from 20% to 50%, are possible. Candidates who can be physically present at the APS editorial office (Long Island, New York–adjacent to Brookhaven National Lab and near Stony Brook University) at least once a month are preferred. The initial appointment is for three years with renewal possible after review. Salary is negotiable and dependent on time commitment. **The desired starting date is 1 August 2013.** The APS is an equal employment opportunity employer and especially encourages applications from or nominations of women and minorities. The search is not limited to residents of the United States.

Inquiries, nominations, and applications should be sent by 1 May 2013 to:
U. Heinz, PRL Search Committee Chair, edsearch@aps.org

Reviews of Modern Physics

Dynamics of Bose-Einstein condensates in optical lattices
Oliver Morsch and Markus Oberthaler

Cold atoms stored in optical lattices display a great variety of quantum phenomena, similar to those found in certain solid state systems. However, by using external fields the atoms can be brought to new experimental regimes and thus allow one to explore novel phenomena. This article contains a theoretical description of such a system, as well as the results of the most recent experiments in this area.

▶ **http://link.aps.org/doi/10.1103/RevModPhys.85.219**

http://rmp.aps.org

Now accepting applications

India - U.S. 2013 Travel Grants

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

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

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

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

Application deadline: Sunday, March 31, 2013

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

IUSSTF Indo-US Science and Technology Forum

2013 BRAZIL-U.S. Exchange Program

Accepting Applications

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

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

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

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

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

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

SOCIEDADE BRASILEIRA DE FÍSICA

SITES continued from page 1

know what is best for undergraduate women–and that keeps evolving a little bit. By keeping it grass roots, we are keeping it current, young, and vital."

As in years past, the independence of the local conference sites produced a diverse and vibrant conference weekend.

At the University of Central Florida, co-coordinators Asma Amjad and Tracy Becker organized a Science Café where eight physicists spoke about their research with small groups of attendees. In tandem with the larger talks, workshops on graduate schools, CV writing, and a poster presentation of student research, the Science Café provided a "very interactive environment in which the speakers could talk about their research and also about their lives," said Becker.

Glavin and her co-organizers at UIUC shared this goal: "There are very strong male science role models," she said, noting scientists like Carl Sagan and Bill Nye. "These conferences are a great way to share female role models as well." Glavin hoped that students would return to their home universities with a greater sense of their part in the network of women in physics.

This vision was realized when Maggie Xiao received an email from a professor of materials science she had met at the Cornell conference. "About a week after the conference, a professor from materials science wrote me an email with literature she recommended I pursue for further studies," said Xiao, a sophomore at Bryn Mawr College. "She had some insights that we didn't even think about in my own lab."

The conference, Xiao noted, also gave her a great opportunity to learn to collaborate and reach out to students and faculty at schools across the country. Xiao has since reached out to faculty at Bryn Mawr and at the University of Pennsylvania for more research opportunities. "The conference solidified my determination to pursue graduate work in physics," she said.

Also emphasized in this year's conferences were careers in industry or in fields related to physics. At UIUC and Colorado School of Mines, the organizers included a career panel that had physicists who were almost exclusively in industry. Every student has role models in academia from classes, noted Glavin, but undergraduates get much less exposure to careers in industry. The University of Central Florida held a well-attended industry fair, and after the industry career panel at the Cornell conference, Xiao said that she "was able to see the applications of physics knowledge to a wide range of industries."

"You always hear that you can do anything with a physics degree," noted Glavin, "but it was really interesting to meet people who actually do."

This year, the Colorado School of Mines hosted the conference keynote address by University of Colorado Boulder physicist Margaret Murnane. The keynote was webcast to the other five sites, offering an opportunity for conference attendees across the country to realize their common experience. While many of the conferences included student presentations, faculty talks, and graduate and career workshops, the decisions of the local organizing committees made each host conference unique.

For example, the Mines conference had a 22 percent male attendance. Mines organizer Nicole Johnson explained that the organizing committee at Mines had attended the 2012 conference hosted at Stanford University and had noticed that there weren't any men. "Mines is 75 percent male across campus," said Johnson, "and we thought that all of the lessons at Stanford were completely applicable to men too."

Johnson and her peers used blind admissions and an application that promoted a diverse and engaged conference attendance at Mines. Applicants wrote a personal statement of their goals for attending the conference. "We wanted to look for people who really understood the mission of the conference and we were looking for applicants to speak a bit about diversity in physics and across the sciences," said Johnson. "One of the most interesting things we noted," she said, "is that some of the best essays on diversity were written by men."

A physics and mechanical engineering double major at Colorado State University, Forrest Craft says he applied to attend the conference at Mines to learn how he could help increase the diversity in physics. "I thought that one of the main goals of the conference was to put people together with different viewpoints–I think that that is very necessary for science," Craft said. "For example, the question and answer session was awesome," he said, "having both men and women made for some really interesting discussions and I met some really great people."

As reported in last month's *APS News*, this year for the first time the Conference received sponsorship, and administrative support, from APS.

The Back Page

Fisics and Phynance

By James Owen Weatherall

The untold riches of a career on Wall Street have loomed large in the physics community these last few decades. Most physicists know someone–a friend from graduate school; a former student–who left academia to pursue a career in finance. And we have heard quite a bit, too, about the damage wrought by the so-called "quants" that these physicists morph into when they take investment jobs. Quants, along with the mathematical models and algorithmic trading strategies they helped to develop, have been blamed for three decades of market crashes, from the 1987 Black Monday crash, to the 1998 crisis at Long-Term Capital Management, to the 2007-08 worldwide financial collapse.

Many commentators have argued that these crashes and crises reveal the hubris of physicists on Wall Street. They are outsiders convinced they are smarter than everyone else, using models that are doomed to fail. After all, markets rise and fall on the whims of human beings. People are not as predictable as quarks or pulleys. It was Isaac Newton himself who, after losing his shirt in the South Sea Bubble, allegedly fretted "I can calculate the motions of the heavenly bodies, but not the madness of men." What could methods developed to understand inclined planes ever tell us about something so complex as the economy?

Quite a bit, as it turns out. Wall Street became a viable option for physics PhDs during the mid-to-late 1970s, and they arrived en masse during the 1980s. But physicists have played a significant and influential role in the development of economics and financial theory since the beginning of the twentieth century, and even before.

For instance, Jan Tinbergen, co-recipient of the first Nobel Memorial Prize in Economic Science, was trained as a physicist under Paul Ehrenfest. Irving Fisher, perhaps the first great American economist, was a doctoral student of J. Willard Gibbs, the pioneering statistical mechanist. Paul Samuelson, winner of the second Nobel and the first American to receive the prize, was also a descendent of Gibbs, trained by Gibbs' protege Edmund Bidwell Wilson. In his wildly influential book, *Foundations of Economic Analysis*, published in 1947, Samuelson explicitly acknowledged his Gibbsian roots, developing a mathematical theory of economic equilibrium with significant debts to thermodynamics.

Much of modern economic theory rests on the foundations laid by these physicists. And surely economics has provided some insight into the workings of the economy. So if you want to reject the idea that physicists have anything important to contribute to understanding markets, you need to dismiss far more than the quant models behind high-frequency trading. This sort of engagement by physicists with core economic questions continues under the guise of "econophysics". Nowadays most economists take econophysicists to be heterodox, but their work is part of a long tradition that is tightly entwined with mainstream economic theory.

Still, Wall Street quants are not econophysicists in the sense of Tinbergen, Fisher, or Samuelson–or contemporary researchers such as H. Eugene Stanley, Joseph McCauley, or Eric Weinstein. Very few quants are trying to develop economic theory. Instead, the physicists on Wall Street are closer to the markets. They are trying to develop predictive algorithms that can drive investment strategies, or to identify and control the risk associated with an investment portfolio, or construct models relating the prices of some financial products to others–and especially, models for pricing financial products known as "derivatives", which are securities that are built out of more traditional products such as stocks or commodities.

It is these projects that strike many–even many physicists–as implausible. Physicists are good at predicting the outcomes to experiments. But predicting markets? It seems like a different business altogether–one where physics is of little help.

Until you delve deeper, that is, and look at just how physicists have contributed to financial modeling and investment practice. Because in addition to their contributions at the birth of modern mathematical economics, physicists have been responsible for several major developments in finance. And at least some physicists have been phenomenally successful as fund managers. Indeed, the fund that is widely viewed as the most successful hedge fund of all time, the Medallion Fund, was run for twenty years by mathematical physicist James Simons–the same James Simons who lent his name to Chern-Simons theory, which has been

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studied extensively by string theorists. Simons' firm only hires people with backgrounds in fields like physics, mathematics, and computer science–and not economics or financial engineering.

The reason physicists are especially good, or at least can be especially good, at financial modeling is not that markets are somehow subject to physical laws. Nor is it that physicists have developed some detailed theory of investor behavior. The connection is at a higher level than that. Physicists have a distinctive way of thinking about mathematical problems. They are experts in approximative thinking, in building toy models and effective theories. This sort of reasoning is just what is needed to take a problem that appears hopelessly complex and find the simplifying assumptions and idealizations necessary to make it tractable. And it is for this reason that physicists have made, and can continue to make, significant contributions to finance. In fact, if Wall Street banks want to use mathematical models more effectively, they would do well to learn to think of models the way physicists do.

To take a concrete example, consider a model for pricing options. Options are a class of derivative contract that give the bearer the right to buy (or sometimes sell) some underlying security–a stock say, or a commodity like grain–at some fixed time in the future, at a pre-determined price called the "strike price." The million dollar question facing an options pricing model is this: how much should you be willing to pay now for the right to buy or sell something in the future, at a price you decide today The standard model for pricing options is known as the Black-Scholes-Merton model, for three economists who developed it in the early 1970s But in fact, the model had essentially been discovered twice before, both times by mathematical physicists–though the physicists' route to the model was different from the economists'.

The first of these physicists was a Frenchman named Louis Bachelier, whose dissertation, written in 1900 under the guidance of Henri Poincare, presented a "Theory of Speculation" on the French stock market. The second was an American named Edward Thorp, who independently discovered a slightly modified version of the formula around 1964, and then went on to start the first modern quantitative hedge fund. There is little evidence that Bachelier ever traded on the basis of his research, but Thorp certainly did–and with considerable success. (Thorp's trading strategy was based in part on the work of yet another physicist, named John Kelly, who applied information theory to the question of how one should bet when receiving unreliable, but relevant, information. Thorp learned of Kelly's work from Claude Shannon, with whom Thorp successfully built a computer to beat roulette!)

There are two basic ideas behind the Bachelier-Thorp model. The first is that an option can be thought of as a kind of bet. Consider an option to buy a stock (this is known as a "call option"). This sort of option is a bet that at the time the option expires, the market price of the underlying security (a stock, say) will exceed the strike price by more than the premium, which is the amount you paid for the option. If the price of the stock does exceed the strike price plus the premium, then you win the bet, since you can buy the stock at the strike price and then turn around and sell it at market value and pocket the difference. Meanwhile, if the market price is below the strike price, you lose the premium, but no more. (There's a third regime as well, where the market price at expiration is higher than the strike price, but less than the strike price plus the premium. Then you lose somewhat less than the full premium.)

From this point of view, a "fair" price for an option is precisely the premium at which the expected value of the bet is zero. (I am glossing over a subtlety here regarding the value of money over time.) This observation allows one to write down an equation with the fair premium as an unknown quantity, for which you can then solve–so long as you know the probability distribution governing the price of the stock at the future time.

But how can one ever know what the probability is that a stock will take a certain price in the future? Answering this was the second piece in the puzzle. As a first approximation, one might just assume that markets undergo some sort of stochastic process. Here Thorp built on ideas developed by a physicist named M.F.M. Osborne, who in a 1959 paper called "Brownian Motion in the Stock Market" showed that under reasonably generic assumptions one should expect the returns on a stock to follow a random walk. This suggests returns should be normally distributed with variance proportional to the square root of time, and that prices should be log-normally distributed. (Bachelier developed a similar thesis, that prices, not returns, should undergo a random walk. This is mistaken because it implies that prices have a non-zero chance of falling below zero.)

Putting these two pieces together gives a solution to the problem. But it bears reflecting on what this solution looks like. For one, it does not depend on a "theory" of investors or of markets. It is much more modest than that: it is a limited solution to a particular problem. More importantly, it rests on some strong simplifying assumptions–most significant of which is that returns follow a stationary stochastic process.

Of course, it is possible to test this assumption. Indeed, Osborne did test it, and found some evidence to support it–though other researchers, most notably Benoît Mandelbrot, later argued that analysis of historical returns shows that this assumption is flawed, and that returns actually exhibit excess kurtosis (fat tails). This distinction is extremely important, but it should be kept in perspective. Thorp and Bachelier developed a rough and ready model that, to first order–i.e., neglecting tail effects–provided an entirely novel, clearly useful solution to an investment problem. And at least Thorp was aware of the limitations of the model, in the sense that he understood when the model could be expected to fail (in the presence of tail effects), and what would happen when it did.

This last point is crucially important. Lots of fields use mathematical models to understand the world. But physicists have a particular way of thinking about approximation and idealization. To make progress on interesting problems, physicists always have to make assumptions and approximations. They work with the zero temperature limit, or the thermodynamic limit, or the mean field approximation. They are trained to think these approximations through–to justify their assumptions with physical arguments. Most importantly, physicists are taught how to think about what happens when their assumptions fail. They are taught to calculate, or at least estimate, the second order corrections to their first order equations.

This cautious, assumption-focused reasoning is what guided Thorp during the 1970s and 1980s when he used the options model as the basis for a trading strategy at his hedge fund, Princeton-Newport Partners. He, and a handful of others, understood that the pricing model that Black, Scholes, and Merton introduced–and everyone in finance used–was not a Final Theory of options. It was at best an effective theory, an approximate model whose higher order corrections could come to dominate in certain market regimes. And in October 1987, when the Black Monday stock market crash hit, many options traders were wiped out. But not the ones who thought like physicists.

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