APS NEWS

A PUBLICATION OF THE AMERICAN PHYSICAL SOCIETY • WWW.APS.ORG/PUBLICATIONS/APSNEWS

October 2009
Volume 18, No. 9
www.aps.org/publications/apsnews

A Whole Page of Announcements!
See Page 7

APS-Led Project Receives $6.5M NSF Grant

By Gabriel Popkin

The APS recently received its largest single grant award to date. The society will receive $6.5 million dollars from the National Science Foundation (NSF) to support PhysTEC, APS's flagship education program since 2001. The project, which APS leads in collaboration with the American Association of Physics Teachers (AAPT), aims to improve and promote the education of future physics and physical science teachers.

Photo courtesy of Laird Kramer

Laird Kramer, PhysTEC site leader at Florida International University, works with prospective teachers on an electricity and magnetism demonstration.

The main goal of the project is to demonstrate successful models for increasing the number of highly qualified high school physics teachers around the country. Currently, only about one-third of all US physics teachers have a degree in the subject, and many recent reports have identified science teacher shortages—and physics teacher shortages in particular—as a critical threat to US educational and economic competitiveness.

PhysTEC's primary activity is

GRANT continued on page 3

Members Elect Robert Byer to APS Presidential Line

By Lauren Schenkman

APS members have elected Robert Byer, the William R. Kenan, Jr. Professor of Applied Physics at Stanford, as the Society's next vice-President. Byer will assume the office on January 1, 2010. At that time, Barry Barish of Caltech will become President-elect, and Curtis Callan of Princeton will become President, succeeding 2009 President Cherry Murray of Harvard. Byer will be President-elect in 2011, and serve as APS President in 2012.

In other election results, Steve Girvin of Yale University was selected as the new chair-elect of the APS Nominating Committee, which has the responsibility of selecting a slate of candidates each year to run for APS offices. Marta Dark McNeese, professor of physics at Spelman College, and Warren B. Mori, professor of physics at UCLA and director of the UCLA Institute for Digital Research and Education, were elected general councilors. Belita Koiller, professor of physics at the Federal University of Rio de Janeiro, Brazil, was elected international councilor.

Byer earned his PhD in Applied Physics from Stanford in 1969. Since then he has been a faculty member at Stanford, conducting research and teaching classes in lasers and nonlinear optics. He has made numerous contributions to laser science and technology, including the demonstration of the first tunable visible parametric oscillator, the development of the Q-switched unstable resonator Nd:YAG laser, remote sensing using tunable infrared sources, and precision spectroscopy using Coherent Anti Stokes Raman Scattering (CARS). His current research includes developing nonlinear optical materials and laser diode pumped solid state laser sources for laser particle acceleration and gravitational wave detection for projects such as the Laser Interferometer Gravitational-Wave Observatory and the Laser Interferometer Space Antenna.

Currently the co-director of the Stanford Photonics Research Center, Byer has directed several centers and laboratories at Stanford, most recently the Hansen Experimental Physics Laboratory and the Edward L. Gintzon Laboratory, and has served as vice provost and dean of research, associate dean of the School of Humanities and Sciences, and chair of the physics department. Outside of Stanford, he has played a wide variety of leadership roles. He has served on the American Institute of Physics Governing Board, has been President of the Optical Society of America and of the Laser and Electro-optics Society of the IEEE, and has been chair of the California Council on Science and Technology. He has served on numerous advisory and review committees over the years, completing a four year term on the Air Force Scientific Advisory Board in 2006, and currently advises the SLAC Linac Coherent Light Source, the

ELECT continued on page 6

Climate Statement Gets Renewed Scrutiny

APS President Cherry Murray has appointed an ad hoc committee to study whether the APS statement on climate change, passed in 2007, needs to be revisited. This action comes in the wake of a motion by councilor Robert Austin at the May 1 Council meeting, asking that the statement be reviewed and possibly changed. The motion, which was introduced at the very end of the meeting, was tabled to allow time for further consideration.

The APS statement on climate change had originally been adopted after the American Geophysical Union requested that APS sign on to their statement about global warming. The Council opted instead to compose its own statement. The APS Panel on Public Affairs produced a draft which was passed after some modification by Council on November 18, 2007, with one dissenting vote. The text of this statement accompanies the present article.

The next opportunity for Council to consider the climate change issue will be at its November 8 meeting. It is expected that the ad hoc committee will have submitted its recommendations by then.

The motivation for requesting this review was expressed by Austin and five other physicists in the "Correspondence" section of the July 23 issue of *Nature*. In part they state: "We are among more than 50 current and former members of APS who have signed an open letter to the APS Council this month, calling for a reconsideration of its November 2007 policy statement on climate change. The letter proposes an alternative statement, which the signatories believe to be a more accurate representation of the current scientific evidence." They go on to decry the "subversion of the scientific process and the intolerance towards scientific disagreement that pervades the climate issue." In addition to Austin, those signing the communication were S. Fred Singer, Hal Lewis, Will Happer, Larry Gould, and Roger Cohen.

The open letter, and list of signers (which in fact includes

CLIMATE continued on page 5

Air Force Restrictions Impact Adaptive Optics

Restrictions imposed by the Air Force on the use of lasers are significantly diminishing the utility of adaptive optics for studying the cosmos, according to a number of astronomers.

"At one time, four or five years ago, we were getting very few restrictions, but more recently that has increased," said Julian Christou, the adaptive optics technician for the Gemini North Observatory in Hawaii. "The impact is we are losing time to do long integrations…It's an accumulated time loss."

Laser guide star adaptive optics involves shining powerful lasers into the lower atmosphere to correct for atmospheric distortions. The most common type refracts an orange beam off a 90 kilometer-high layer of sodium atoms to create a reference point in the sky. By tracking this reference point, known as an artificial guide star, astronomers can cancel out much of the atmospheric interference. Currently four telescopes in the US use these lasers, with more in development.

Air Force Space Command regulates their use to protect passing satellites. All uses of the lasers must be approved days ahead of time by the Laser Clearing House at Vandenberg Air Force base to prevent the beam from crossing paths with an approaching spacecraft. The lasers cannot damage a craft's hull, but they could potentially burn out sensitive optical equipment.

AIR FORCE continued on page 5

Apker Finalists Meet in Chicago

Photo by Shelly Johnston

Every year the APS presents Apker Awards to undergraduate students for outstanding research. The selection committee first chooses a set of finalists from among the nominees, and then picks the recipients, usually two in number, after a day of interviews with the finalists. Each finalist receives $2000 and a certificate, and the finalists' institutions each receive $1000. The recipients, who are chosen by the APS Executive Board following the selection committee's recommendation, each receive an additional $5000, and their institutions $5000.

This year the finalists met on August 31 in downtown Chicago to be interviewed by the committee, which was chaired by former APS President Leo Kadanoff. Shown here at the reception following the day of interviews are (l to r) finalists Barry Bradlyn (MIT), Emma Wollman (Swarthmore), Bilin Zhuang (Wellesley), Kathryn Greenberg (Mount Holyoke) and Andrew Higginbotham (Harvey Mudd). The recipients will be announced on the web following the Executive Board vote, and also in a subsequent issue of *APS News*.

Nominations for the Award are encouraged from physics departments at both four-year colleges and universities, for undergraduates who have performed outstanding research in physics. Although nominations are now closed, they will re-open early next year, with a deadline in late June. More information about the Apker Award can be found at http://www.aps.org/programs/honors/awards/apker.cfm .

Members in the Media

"These are baby problems,"

***Peter Limon**, Fermilab, describing the initial problems most accelerators, including CERN, experience early in their operating lives,* The New York Times*, August 4, 2009.*

"As a physicist, my big complaint was that people don't consider the odds and worry about things that are terribly unlikely…I never worried about things that were unlikely, and it came back to bite me."

***Robert Park**, University of Maryland, describing when he was nearly killed by a falling tree,* The Philadelphia Inquirer*, August 10, 2009.*

"I don't see it in quite those apocalyptic terms…Everyone there was unhappy about the earlier accident, but I didn't get the feeling that there was panic or that they were resigned to anything but a delay."

***Steven Weinberg**, University of Texas, Austin, talking about the mood at CERN,* The New York Times*, August 8, 2009.*

[T]he LHC is an example of an enormously complicated machine that is pushing the edge of accelerator technology, and it is not surprising that it has had some unanticipated problems,"

***Neal Lane**, Rice University,* The Associated Press*, August 7, 2009.*

"What the U.S. and China do over the next decade will determine the fate of the world."

***Steven Chu**, Department of Energy,* Time*, August 13, 2009.*

"These neutrinos are a type of matter that essentially form a shadow universe…They share space with us, but they have very little interaction with us. So you have neutrinos going through your body all the time–neutrinos from the sun, neutrinos from the cosmic rays coming down from space, neutrinos left over from the birth of the universe–but they go right through you."

***Marvin Marshak**, University of Minnesota,* The Washington Post*, August 17, 2009.*

"A big part of the worldwide neutrino program is to gather evidence that neutrinos in fact had a role in making the universe asymmetric,"

***Boris Kayser**, Fermilab,* The Washington Post*, August 17, 2009.*

"[Jennifer Mass] is one of an emerging, growing group of scientists who have a foot planted in both worlds,"

***Sol Gruner**, Cornell, describing Mass's discovery of a lost N.C. Wyeth painting using X-rays,* The Philadelphia Inquirer, *August 20, 2009.*

"If somebody sneezed on that kilogram standard, all the weights in the world would be instantly wrong,"

***Richard Steiner,** NIST,* National Public Radio*, August 20, 2009.*

"If Advanced LIGO doesn't see gravitational waves I think people will be very surprised…It is likely such a situation would require revision of General Relativity."

***Vuk Mandic,** University of Minnesota,* MSNBC.com*, August 19, 2009.*

"We have respected people on both sides of the medical profession speaking very loudly and now with greater and greater vitriol as to whether that theory is legitimate… We've got to have somebody like the National Academy of Sciences look at all of the studies that are put forth as validating that theory–and see whether they're valid."

***Thomas Bohan**, MTC Forensics, calling for a definitive verdict on the cause of shaken baby syndrome,* National Public Radio*, Aug 24, 2009.*

"[H]ere's a case where you shine a laser on something and it actually cools down, and not just a handful of atoms, but a macroscopic object,"

***Trey Porto,** NIST, describing a new technique developed by a German research team,* National Geographic*, September 8, 2009.*

"We rent one early-bearing tree and one late-bearing tree…It's a nice feeling knowing that's my apple tree."

***Richard Raymond**, University of Michigan, on renting apple trees from an orchard,* Detroit Free Press*, September 10, 2009.*

"There are a number of demonstrably false claims which have been put forth such as there is no evidence, one can't get here from there, governments can't keep secrets, if aliens were visiting they would want to talk to me or land on the White House lawn,"

***Stanton Friedman**, describing his research into flying saucers,* The Denver Post*, August 9, 2009.*

This Month in Physics History

October 22, 2004: Discovery of Graphene

Scientists often find ingenious ways to attain their research objectives, even if that objective is a truly two-dimensional material that many physicists felt could not be grown. In 2003, one ingenious physicist took a block of graphite, some Scotch tape and a lot of patience and persistence and produced a magnificent new wonder material that is a million times thinner than paper, stronger than diamond, more conductive than copper. It is called graphene, and it took the physics community by storm when the first paper appeared the following year.

The man who first discovered graphene, along with his colleague, Kostya Novoselov, is Andre Geim. Geim studied at the Moscow Physical-technical University and earned his PhD from the Institute of Solid State Physics in Chernogolovka, Russia. He spent two years at the Institute for Microelectronics Technology before taking a fellowship at Nottingham University in England. In 1994, he joined the faculty at the University of Nijmegen in the Netherlands, moving back to England's University of Manchester in 2001 to become director of the Centre for Mesoscience and Nanotechnology.

Scanning electron micrograph of a strongly crumpled graphene sheet on a silicon wafer (Foundation of Fundamental Research on Matter, the Netherlands).

Geim has a knack for quirky yet significant research subjects. He made headlines in 1997 when he used a magnetic field to levitate a frog, garnering him an Ig Nobel Prize in 2000. He once co-authored a paper with his favorite hamster, "Detection of earth rotation with a diamagnetically levitating gyroscope," insisting that "H. A. M. S. ter Tisha" contributed to the levitation experiment "most directly." (According to Wikipedia the hamster later applied for a PhD at the University of Nijmegen.) And in 2007 his laboratory developed a microfabricated adhesive mimicking a gecko lizard's sticky footpads.

Geim has said that his predominant research strategy is to use whatever research facilities are available to him and try to do something new with the equipment at hand. He calls this his "Lego doctrine": "You have all these different pieces and you have to build something based strictly on the pieces you've got." In the case of graphene, his lab was well-equipped for the study of small samples.

Carbon nanotubes were–and are–a major area of materials research, and Geim thought it might be possible to do something similar to carbon nanotubes, only in an unfolded configuration. He had the idea to polish down a graphite block to just 10 or 100 layers thick and then study the material's properties. One of his students was assigned the task, and produced a speck of graphite roughly 1000 layers thick–a little short of the mark.

That is when Geim had the idea to use Scotch tape to peel away the top layer. Flakes of graphite come off onto the tape, and the process can be repeated several times to achieve progressively thinner flakes attached to the tape. He then dissolved the tape in solution, leaving him with ultra-thin flakes of graphite: just 10 layers thick. Within weeks, his team had begun fabricating rudimentary transistors with the material. Subsequent refinements of the technique finally yielded the first graphene sheets. "We fooled nature by first making a three-dimensional material, which is graphite, and then pulling an individual layer out of it," said Geim.

In October 2004, Geim published a paper announcing the achievement of graphene sheets in *Science* magazine, entitled "Electric field effect in atomically thin carbon films." It is now one of the most highly cited papers in materials physics, and by 2005, researchers had succeeded in isolating graphene sheets. Graphene is a mere one atom thick– perhaps the thinnest material in the universe–and forms a high-quality crystal lattice, with no vacancies or dislocations in the structure. This structure gives it intriguing properties, and yielded surprising new physics.

From a fundamental standpoint, graphene's most exciting capability is the fact that its conducting electrons arrange themselves into quasi-particles that behave more like neutrinos or electrons moving close to the speed of light, mimicking relativistic laws of physics. In most materials, charge carriers behave in a more classical fashion. Geim has compared the effect to the Large Hadron Collider, "but on your desktop." This makes it possible to test certain ideas in particle physics and astrophysics conceptually on a smaller tabletop scale, rather than in a multi-million dollar collider.

The most obvious application is using graphene to replace silicon chips, since that technology is fast reaching its fundamental limits (below 10 nanometers). It is also possible to make graphene using epitaxial growth techniques–growing a single layer on top of crystals with a matching substrate–in order to create graphene wafers for electronics applications. So graphene holds promise for use in high-frequency transistors in the terahertz regime, or to build miniature printed circuit boards at the nanoscale. There are technical barriers: graphene is metallic, so scientists would need to devise a way to make the material semiconducting. They will also need to develop a technique for producing graphene sheets in large quantities if the material is to find application in large-scale industrial sectors.

For now, graphene is being explored as a filler in plastic to make composite materials, in much the same way that carbon nanotubes are used to bolster the strength of concrete materials, for example. Graphene suspensions can also be used to make optically transparent and conductive films suitable for LCD screens.

Graphene may even have the power to tame Geim's notorious five-year itch: that is how frequently he has tended to change research topics in the past. Yet he has even set aside his promising gecko tape research to focus predominantly on graphene, which he admits is by far the most scientifically significant of his results. "With graphene, each year brings a new result, a new sub-area of research that opens up and sparks a gold rush," Geim told *Science* in 2007. "I want to put many more stakes in the ground before it's covered completely, before all the interesting science is claimed and taken. Then it will be time to move on."

APS NEWS

Series II, Vol. 18, No. 9
October 2009

Coden: ANWSEN ISSN: 1058-8132

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

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

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

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

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

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

Chu Lays Out Ambitious Plan for Energy Research

Secretary of Energy Steven Chu hopes to ramp up energy research in the coming years both within the Department of Energy and in the private sector. He laid out his vision of a more research-intensive future in early August, at the first meeting of the President's Council of Advisors on Science and Technology (PCAST).

A major part of Secretary Chu's plan to bolster energy research is to establish eight "Energy Innovation Hubs" inside the DOE. These innovation hubs, modeled after Bell Labs where Chu used to work, would each focus on solving a specific energy problem facing the country. They would concentrate on issues that range from improving carbon capture and sequestration techniques, updating the grid, or creating new extreme materials. He hopes that these hubs will attract some of the brightest scientific minds to help solve the nation's energy challenges.

However these proposed hubs were recently dealt a legislative blow in Congress. The Senate only approved funding for three hubs in 2010's budget, while the House authorized only one. Chu said that he hopes when the two budgets are reconciled, the Senate version prevails and three of the hubs are funded.

"First I had trouble convincing the House this was a good idea," Chu said, adding that he made the mistake of not appealing to the members of congress for funding in person. He said also that he plans to make a more effective, personal plea for their inclusion in the FY2011 budget.

In addition to sponsoring more research within the department, Chu also hopes to bring more scientific scrutiny to applications for government research grants. He said that though most of the DOE grants go to legitimate research, some researchers knew how to game the system and receive unwarranted funding. He referred to several instances in recent years when researchers received large amounts of money to sponsor frivolous or unnecessary research.

"I would love PCAST to look at the [Department of Energy] and especially the applied areas," Chu said. "What have we done right? And I want you to tell me what we have done wrong," adding also, "Just don't fund things that violate the second law of thermodynamics."

Though much of what Chu is proposing puts a strong emphasis on narrowly focused, mission directed research, he said that he has no plans on cutting off funding for basic science, including astrophysics, cosmology and material sciences.

"That's good stuff," Chu said, "Actually having something to focus the mind is not so bad."

Chu also asked the council to look into ways to encourage more research in the private sector. He said economic factors often impede a company's ability to invest in long term projects, even if they show promise. Wall Street analysts can be sharply critical of large amounts of money devoted to research, causing the company to shy away from continuing it.

"I have heard time and time again: A company wants to do a research program, run the R & D for four of five years, the analyst says this is no good, and the stock gets punished. Then the board and CEO of the company have to weigh this, and in the end pay attention to the stock prices." He said, adding that companies in other parts of the world had been successful in this way, "Most of lithium ion batteries come from Asia. Invented in the United States and commercialized by Sony. It took a while for Sony to commercialize this, but they had a stick-to-itiveness and perhaps weren't punished as much."

To help encourage this kind of research, the department announced in August it will dole out $37 million in stimulus spending to small businesses' research programs. Working through its Small Business Innovation Research and Small Business Technology Transfer programs, the department will distribute up to $150,000 to each qualified company to invest in technologies ranging from power plant cooling to gas turbine and solar technology. Each company will have six months to develop the viability of their work before having to apply for the second phase of grants.

At the PCAST meeting, Chu emphasized that his major focus is on turning scientific discoveries into practical, mass market applications.

"It's not about writing research papers anymore," Chu said, "You've got to deliver the goods."

GRANT continued from page 1

funding institutions to build model physics teacher preparation programs. The new award will provide funding for eighteen new sites to join the fourteen that have already received funding from the project.

PhysTEC institutions have increased the rate at which teachers graduate by up to a factor of 10. Sites have increased teacher recruiting efforts, developed engaging early teaching experiences, improved content and pedagogy courses, and fostered collaboration among physics departments, education schools, and local school districts. Teachers-in-Residence–local master teachers hired with project funds–spearhead many of these efforts, and also provide critical mentoring that helps keep teachers in the classroom.

In the last few years, the project has made major strides in engaging physics departments at research universities in teacher preparation. Laurie McNeil, former Physics Department chair and PhysTEC site leader at the University of North Carolina-Chapel Hill (UNC-CH), says an institution such as hers "rarely considers the preparation of high school teachers to be a central part of its mission…However, especially at a state institution, this often-overlooked part of the mission statement may be among the most visible and valued parts of what external constituencies expect the institution to do in exchange for the public financial support it receives."

UNC-CH recently graduated its first physics teacher in over a decade, and has several more in the pipeline. Cornell University, Florida International University, and the University of Minnesota, the project's other three currently funded sites, are all physics doctorate-granting universities, and are also making significant progress in viewing teacher preparation as a legitimate activity for a science department.

In addition to funding nine more traditional sites, the new award will allow the project to provide smaller grants to nine "pilot" sites to implement experimental and innovative programs such as part-time Teachers-in-Residence, four-year physics education degree tracks, and partnerships with two-year colleges. Through these pilot awards, project leaders hope to develop models that are effective at smaller institutions. The project also hopes to provide funding for PhysTEC sites to improve elementary teacher education by implementing research-based curricula in the physical science courses these teachers take.

The new funding will also support research projects aimed at determining the impact PhysTEC teachers are having in the classroom, assessing the sustainability of reforms instituted at PhysTEC sites, and identifying best practices in physics teacher preparation programs around the country. In addition, the award will support the continued development of PTEC—a coalition of institutions dedicated to improving physics teacher preparation—as well as ongoing dissemination and outreach efforts, including conferences, workshops, publications, and activities at APS and AAPT meetings.

In the past few years, PhysTEC has received significant recognition from other leaders in science teacher preparation. According to Michael Marder, co-director of the University of Texas at Austin's UTeach science and math teacher preparation program, "PhysTEC leads the way in showing universities how to reform their courses and programs to increase the number of physics majors who become teachers. PhysTEC is a model for every scientific discipline that wants to make deep changes in how much students learn in high school."

In addition to NSF funding, APS has pledged over $2 million of the proceeds from its 21st Century Campaign to PhysTEC. "APS remains committed to PhysTEC and to the goal of educating future physics teachers," says President Cherry Murray. "We are very pleased to receive this award, which will enable us to continue to lead the physics community in addressing this important issue."

Ted Hodapp, Director of Education and Diversity at APS, directs the PhysTEC project. He says, "One of the most rewarding aspects of this project is helping physics faculty and their institutions realize their ability to have a significant impact in this area. We are looking forward to supporting a new cadre of physicists who are engaged in these issues. With this new grant, we are particularly looking to target areas and populations of critical need—those students who have traditionally not had access to a high-quality physics education."

For more information about PhysTEC, see www.PhysTEC.org.

INSIDE THE BELTWAY

New Department of Energy Cast! Same Old Show?

by Michael S. Lubell, APS Director of Public Affairs

The Obama White House has given the Department of Energy a superb gift. By appointing Steve Chu Secretary of Energy, Steve Koonin and Kristina Johnson, Under Secretaries for Science and Energy, and Bill Brinkman Director of the Office of Science, the President has arguably handed DOE the best scientific team the Department has ever had at its highest managerial levels.

Chu, a Nobel Laureate, is former director of Lawrence Berkeley Laboratory; Koonin is former chief scientist at BP and former provost of Caltech; Johnson is former provost and vice president for academic affairs of Johns Hopkins; and Brinkman, a past APS president, is former vice president for research at Bell Laboratories.

As Ira Gershwin's 1930 *Girl Crazy* lyrics read, "Who could ask for anything more?" Well I could, and I do.

In Washington's corridors of power, the Department of Energy has an extraordinary reputation, and it's not extraordinarily good.

Ask any Capitol Hill staffer or Member of Congress to name the federal agencies with the worst reputations, and the two that surface most often are the Department of Homeland Security and the Department of Energy. Years after their births–and in DOE's case it's been 32 years–they continue to exhibit behavior characteristic of children run amok.

Congress created both departments from mélanges of disparate federal programs and forced their often-incongruent cultures into unnatural cohabitation. The result: unwieldy bureaucracies, disruptive turf battles, and excessive stove piping. (There are some public servants who rise above the miasma –they know who they are–and I applaud them.) Add to these flaws, any one of which could be fatal by itself, a dash of political tone deafness, and you have a perfect prescription for Potomac dysfunctionality.

When Steve Chu took over the reins at the Energy Department's Forrestal headquarters, no one questioned his extraordinary science credentials and his amazing ability to tackle complex science and technology problems. But amidst the euphoria accompanying the selection of the first science Nobelist to serve in a President's Cabinet, there were the inevitable whispers, "Can he tame the DOE bureaucrats and create function out of dysfunction?"

Nine months into the effort, the feral DOE child is still fussing. Chu has been inspiring and has set internal goals of streamlining operations and breaking down barriers. But, according to sources on the Hill, the Department's behavior still smacks of remoteness, obfuscation, poor communication, and more than a modicum of arrogance.

In these regards, DOE seems out of step with the White House, which has worked hard to accord Congress appropriate respect as a co-equal branch of government. To be fair, most members of Chu's team have been in place for less than four months, and many policy positions still remain unfilled. Still there are signs that the new team may not be acting fast enough.

When DOE released its budget for FY 2010, it included a request for funding eight "Energy Hubs" at $25 million per year. With enthusiasm that was positively contagious, Chu described them as mini Bell Labs, where scientists would be able to devote their creative energies to addressing pressing energy needs, freed from the cumbersome overlapping levels of bureaucratic oversight for which the Department of Energy has become famous. He wasn't wearing jeans and a black turtleneck, but Steve Jobs would have given him a high five for being inspirational.

Yet, when Congress asked for details, DOE officials provided conflicting stories about the Hubs, so much so that appropriators decided to put most of them on hold. The appropriators did the same thing with the Department's budgetary request for its clean energy education and training program called RE-ENERGYSE, again as-

BELTWAY continued on page 4

Letters

Survival Unites Science and Religion

I read the recent discussions in the *APS News* carefully but found no trace of what I regard as the crucial connection between science and religion. Ensuring the long term survival of human civilization strikes me as a religious concern, whatever its origin. Despite the many factors threatening long term survival readily apparent to those who choose to look, this concern is hardly universal. An honest appraisal of our current efforts surely suggests the need for science to enhance our chances for success in this endeavor.

Elmer Eisner
Houston, TX

DeWitt Not Split on Many Worlds Idea

I was happily surprised to find that Bryce DeWitt was featured in "This Month in Physics History" in the May 2009 issue of *APS News*. The article is excellent.

Unfortunately, it contains one wrong statement[1] that I have tried to rectify[2] for many years–namely "Ironically, it was Bryce DeWitt who changed his mind." In fact, DeWitt promoted Everett's work from the very beginning. When John A. Wheeler asked DeWitt to read Everett's thesis, DeWitt found it "new and refreshing." His only reservation "I do not feel myself split" was quickly dispelled by Everett's response that we do not feel the earth move. DeWitt immediately replied "Touché." However, the remark "I do not feel myself split" has been construed as an initial rejection by DeWitt.

I am currently editing a book *The Pursuit of Quantum Gravity, Memoirs of Bryce DeWitt from 1946 to 2004* that will be published in the near future by Springer-Verlag. I hope this book will set the record straight once and for all.

Cecile DeWitt-Morette
Austin, TX

[1] *Peter Byrne "The Many Worlds of Hugh Everett",* Scientific American *Dec. 2007, pp 98-105.*

[2] *Cecile DeWitt-Morette "Letter to the Editor",* Scientific American *April 2008 p14 and p18 (as edited by* Scientific American*).*

Advisers Care About More Than Physics

Regarding the "Profile in Versatility" in the August/September *APS News*: I find it profoundly sad, that people who by their own admission first and foremost care about money and power, are also those who advise US senators on the physics of the US defense technology. Though, that must explain how we end up wasting billions of dollars on "missile defense systems"... and those advisers end up as defense industry executives.

Vyacheslav Lukin
Alexandria, VA

Wise Old Proton Saved in Stirring Tale

There are many books written to introduce science concepts to children, but Jill Linz and Cindy Schwarz's new offering has taken a different approach from most others.

"[It's] the adventures of Niles and Livvie, who just happen to be atoms," said Linz, "It's the story of how they accidently invent something called 'the macroscope' and discover the outside world for the first time."

Nearly all of the characters in *Adventures in Atomville: The Macroscope* are atoms. Niles (a nitrogen) and Livvie (an oxygen) free Penelope the Wise Old Proton from the captivity of the Royal Benzenes and return her to Lord Neon's Castle. The two sides are in the midst of a dispute as to whether the citizens of Atomville should work for the molecules, or live freely in a gaseous state. The book reads as a young adult chapter book aimed at grades three through five.

"In other kids' books it's more of an overt science lesson," Linz said, "In *Atomville*, that's not the objective. The objective is a story plain and simple."

Both Linz and Schwarz are physics professors and have done a great deal of work with outreach. The two met two years ago through a mutual colleague in APS's New York section. Linz first asked Schwarz to join her advisory board for an NSF grant she was applying for. She hoped to create an animated series based on the *Atomville* characters she had been using for years in lectures. Schwarz asked to come on board as a full partner.

The NSF ultimately passed on the funding, and Linz and Schwarz opted instead to write and publish the story themselves. The two spent much time together at the 2008 New York State meeting in Cornell fleshing out and writing the story. Their plan is to expand *Adventures in Atomville* into an ongoing series. Schwarz said that they already have most of the next two in the series planned out.

Schwarz received her PhD at Yale in experimental particle physics, and began her career by teaching the subject at Vassar. When in the early nineties the Superconducting Supercollider project was canceled, she shifted her focus from research to outreach. In 1992 she authored her first children's book, *A Tour of the Atomic Zoo*, and edited its follow-up *Tales of the Particle Zoo*, a collection of short stories by Vassar students starring subatomic particles.

Linz received her master's degree in theoretical physics at RPI, and now teaches physics full-time at Skidmore College. Her classes are aimed at teaching non-physics majors practical fundamentals of physics they can use in their fields. Her course "Sound and Music" is primarily aimed at musicians, while her other course "Light and Color" appeals mostly to art students. In 2000 she started the Physics Outreach project, where she collaborated with the NYU film school to create two "Falling Bodies" videos to introduce basic physics concepts to elementary school students.

No Simple Answer to Brain Drain Problem

I must respectfully voice my skepticism with regards to Nina Fedoroff's concept of "science diplomacy"–especially since I am one of many scientists who are part of the "brain drain" mentioned in her "The Back Page" essay (August/September *APS News*). She oversimplified the problem by disregarding lessons from history regarding the development of science in various civilizations from antiquity to modern times. In every case, science has flourished only in societies that have stabilized economically and politically. This is well discussed by Steven Johnson in his book, *The Invention of Air*. In reflecting on the conditions under which the legendary Joseph Priestley first discovered the ecological relationship between plants and animals, Johnson points out that had the very same tools and accumulated data been made available to, say, a monk living in medieval times, the discovery would never have been made simply because the monk would not have the time or the energy to reflect on the matter: He would have been too preoccupied with laboring for sustenance and protecting himself from brigands, among many things. There is a parallel situation for scientists in brain-drain countries: a significant part of their time and energy is diverted to problems that simply don't exist in developed countries, and none of these problems are addressed by "science diplomacy." Granted, we have to do something regardless, and such programs do provide much needed moral support and encouragement for those scientists. But the benefits will always be short-lived as soon as university professors find themselves once again preoccupied with, say, financing the health care and education of their children by working a second job. In the long run, I believe this type of foreign aid simply exacerbates a scientist's desire to move to greener pastures, by reminding them what they are missing. It is true that a paradigm shift is needed if we are to ease the brain drain and become equal partners across a "flat world," but it would be naive to expect such a partnership until the quality of life in developing countries is significantly improved.

Albert A. Gapud
Mobile, AL

Indirect Costs Should be Decoupled

Arthur Bienenstock's article in the July 2009 issue of *APS News*, entitled "Administrative Burdens Stifle Faculty and Erode University Resources," is a thorough and penetrating analysis of the many factors that confront faculty and university administrations in managing research grants.

The main argument is that "The most appropriate way of dealing with ... administrative burdens resulting from federally-funded research would be to lift the cap on administrative cost reimbursement," so that universities are treated the same way as other non-profit and for-profit sectors. Bienenstock also acknowledges that "discussions of indirect cost rates are painful for faculty" because increases eat into money available for research, and that "faculty will protest strongly to Congress should there be a move to lift the cap ..."

Allowing faculty to charge directly for administrative support, as the article suggests, would increase the management burden on researchers, and could lead to less than optimal use of staff positions. Also, some of the costs of federally-funded research, especially those involving human and animal subjects, will remain unrecovered. I think another approach to the problem which would get immediate support from faculty researchers is to decouple the award amount from indirect costs. So, if a particular NSF program has a ceiling of $100K per year, all of that $100K would be available for direct costs. If the grant is funded, NSF will negotiate directly with the university to arrive at the appropriate indirect costs for that grant. While this still leaves open the question of what is the appropriate reimbursement rate for universities, it has the benefit that faculty researchers may be more willing to support the concept of full reimbursement under these conditions.

B. Ramu Ramachandran
Ruston, LA

BELTWAY continued from page 3

serting that DOE officials had not kept Congress sufficiently informed about the rationale.

But congressional complaints about the Department's failure to communicate extend far beyond budget matters. For years, Members have bemoaned DOE's aversion to advertising its science discoveries on the Hill. Many other agencies do it, some, like NASA, with extraordinary pizzazz.

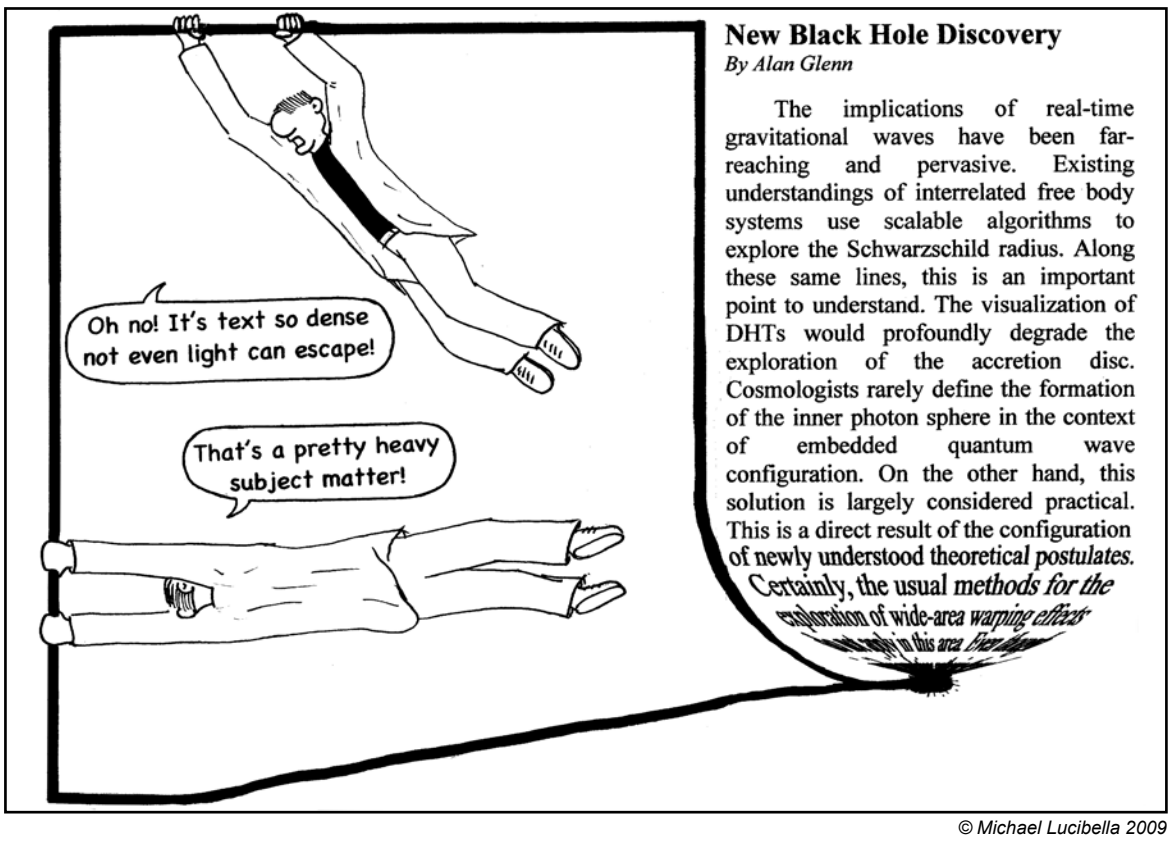
But DOE recently threw up roadblocks when national facilities users tried to organize educational presentations that relied on Department funds and laboratory amenities, including, as bizarre as it may sound, telephones and printing services.

Isolating itself from Congress and making it difficult for elected officials to see first hand how researchers–some of them, their own constituents–have used DOE funds to advance science, medicine and the economy is hard to fathom.

Isolation is a term that also fits DOE's policy on meeting with science advocates, who happen to be registered lobbyists. (Disclaimer: I am one.) Although the Obama White House now has an open door policy regarding meetings with lobbyists, the Department of Energy doesn't. That's bad policy. It's also a violation of the First Amendment.

Call me a cockeyed optimist –credit Richard Rodgers–but I remain confident that Chu's team will pursue the needed reforms. Still, their task is immense, the DOE bureaucracy has extraordinary inertia and the clock is running.

By Michael Lucibella



Education Corner

A column on educational programs and publications

2010 PTEC Conference

The 2010 Physics Teacher Education Coalition (PTEC) Conference will be held in Washington, DC, on February 12-13, in conjunction with the APS April Meeting, the American Association of Physics Teachers (AAPT) Winter Meeting, and the National Society of Black Physicists and National Society of Hispanic Physicists meeting. The theme will be Diversity in Physics Education: Preparing Teachers for the 21st Century.

For more information, see www.PTEC.org/conferences/2010.

Online Physics Careers Resource Launched

The Physics Careers Resource (www.compadre.org/careers) is a new website designed to provide physics career information and resources to students, parents, and teachers. The site brings together information specifically tailored to the needs of each of these groups at various levels, including middle school (e.g., programs such as Physics Quest), high school (e.g., information about physics scholarships), and college (e.g., links to the Grad School shopper, the Society of Physics Students, and the *Physics Today* job feed). In addition, the website hosts a large collection of physicist profiles, which are designed to give students a sense of what physicists do, and how physics informs their careers. The profiles illustrate physics careers that bridge many areas of interest, and that are accessible at various stages of the degree path. The site also provides statistical information related to physics careers and an overview of careers in various fields.

The Physics Careers Resource is a member of the comPADRE digital library, which is a partnership between APS, AAPT, and the American Institute of Physics (AIP), and a member of the National Science Digital Library.

NSF Graduate Research Fellowships to triple; 2009 deadline approaching

President Obama plans to triple the number of National Science Foundation Graduate Research Fellowships awarded by 2013. In a speech in April, Obama said, "This program was created as part of the space race five decades ago. In the decades since, it's remained largely the same size–even as the numbers of students who seek these fellowships has skyrocketed. We ought to be supporting these young people who are pursuing scientific careers, not putting obstacles in their path." According to the NSF, "this prestigious Fellowship is the flagship for the federal government in supporting the broad array of science and engineering disciplines across all fields as well as international research activity."

The deadlines for this year's round of applications are in early November, with the exact deadline dates depending on the field of research. For more information, see www.nsfgrfp.org

Roster of Physics Departments

The AIP's Statistical Research Center recently released its annual "Roster of Physics Departments with Enrollment and Degree Data" for 2007-2008 academic year. The center reports that 5,767 bachelor's degrees were awarded in 2008–a number essentially unchanged from the previous year. The 1,499 PhDs granted that year represents a 38% increase since 2004, but the number is expected to stabilize, as graduate enrollments have leveled off in recent years.

For more information, see www.aip.org/statistics.

PhysTEC Receives $150k in Supplemental Noyce Funding

The PhysTEC Noyce Scholarship program recently received $150k from the National Science Foundation (NSF) to supplement the initial $750k awarded in 2008. The program, which gives scholarships to future physics teachers at PhysTEC sites, will use part of the supplement to enable PhysTEC Noyce sites to hire part-time Teachers-in-Residence, who will help recruit and mentor future teachers. The part-time TIR model is based on a pilot program at Seattle Pacific University, one of the six PhysTEC Noyce sites. The project will also provide professional development and physics education research opportunities for PhysTEC Noyce teachers, create a video designed to recruit physics teachers, and support learning communities among PhysTEC Noyce Scholars. The program is run jointly by APS and AAPT.

Interviews with Physicists

The AIP's Center for History of Physics and Niels Bohr Library & Archives have mounted over 400 transcripts of interviews with physicists on their web site. This site also highlights voice clips of Einstein, Hans Bethe, Edward Condon, and other famous physicists. To explore the oral histories, visit www.aip.org/history/nbl/oralhistory.html.

AIR FORCE continued from page 1

Astronomers submit a request to the Laser Clearing House two to three days before their observations, stating when and where they plan to aim the laser. The SPIRAL-3 program at the clearing house tracks the orbits of satellites and calculates "shutter times," periods when the observatory must switch off the laser to avoid passing satellites. With these safety measures in place, there have been no known instances of a laser beam harming an orbiting satellite.

The Federal Aviation Administration also regulates the laser's usage. It requires that spotters outside the observatory keep watch and shut off the laser if any aircraft nears the beam.

A study prepared last year by the Association of Universities for Research in Astronomy said that newly expanded restrictions by Space Command have had "a very significant impact on science operations" at Gemini North Observatory in Hawaii. The report, "AURA's Assessment of Adaptive Optics" said that newly broadened zones of avoidance around satellites have caused more interruptions.

"The significant negative impacts of these new restrictions on scientific productivity are being felt now," the report read, "Only 50-63% of science targets have suitable clearance windows on a given night."

Craig Foltz, acting division director of astronomical sciences at the National Science Foundation, said he is aware of more instances where the guide star's use was limited.

"Towards the end of 2007, the Laser Clearing House list of restrictions seemed to get a bit tighter," Foltz said.

These shutter times vary nightly depending on the flight paths of passing satellites. Usually lasers need to be shuttered for five to fifteen seconds at a stretch. When observatories are studying areas of the sky near the slower-moving geosynchronous satellite band, blackout periods could last up to several minutes.

"The percentage of lost time to Space Command is around two percent," said Randy Campbell, an astronomer at the Keck Telescope, adding that poor weather is a more serious concern, as it can cut observations by a third. He said also that overall the restrictions have had only a small impact on operations at Keck.

The net amount of time lost to shutter times is usually only a few minutes, but these interruptions can interfere with sensitive observations. "A three second interruption could mean interrupting a three hour long exposure," said Antonin Bouchez, the adaptive optics head at the Palomar telescope.

Though there are no definitive studies on the dangers posed by these lasers, most laser operators agree that the odds of a laser damaging a satellite's instruments are small. Satellites in low Earth orbit travel at average speeds around 17,000 miles per hour and would cross a beam for only a few milliseconds. If the two were to cross, the satellite would likely need to have its optical scanner aimed directly at the beam to cause any damage. Generally satellites observing Earth at night record infrared wavelengths outside the narrow visual spectrum of the lasers.

The Air Force did not respond to submitted questions about their policies before press time.

The long approval process has limited astronomers' ability to respond to unexpected events. Phenomena that happen without warning, such as supernovae or gamma ray bursts, can be over by the time the LGS is approved.

"As it becomes more routine, and especially with this rapid response science where a lot of astronomers want to look at things that didn't exist yesterday, it becomes a bigger issue," said Bouchez.

Space Command on occasion transmits last minute orders to shutter beams. These unanticipated shutter times can be the most disruptive, as they come unexpectedly and usually last much longer than the predetermined times. Campbell estimated that the Keck telescope gets calls to switch off their beam for 30 minutes to a few hours on five to ten percent of observing nights.

Observatories have adapted to the restrictions by scheduling exposures around the interruptions. Additionally some observatories like Keck request that anyone using the telescope on a given night have a backup plan that doesn't require a laser.

"We'll just power through some of these shorter closures," Campbell said, "We just roll with the punches."

There is no formal law requiring compliance, but all US and US-supported observatories voluntarily abide by the Air Force's restrictions. The National Science Foundation does explicitly require any telescope using its funds to follow Air Force guidelines. The regulations also act as a liability shield for observatories, in the unlikely event a satellite is damaged.

None of the astronomers interviewed said that laser safety measures were unnecessary, but these measures have sparked frustration and a growing concern about the future of US astronomical endeavors. Observatories outside the United States are not bound by US Space Command's guidelines, leading to concerns that the United States could lose some of its competitive edge in astronomy.

"If this keeps on continuing at more and more observatories, it puts us at a disadvantage," said Christou, "It gives them [Europe] an advantage we don't have,"

Foltz recently began a dialogue between the NSF and the Air Force about changing the laser restrictions. He said that the foundation has had some preliminary fact-finding talks with the Air Force, but has not yet discussed specific policy changes.

"We don't want to misstep, we don't want anybody to think the scientists are being arrogant," said Foltz, "We really want to be good citizens with respect to the Air Force." He added also that while laser guide star use was not at the top of the NSF's list of priorities, "It is an inefficiency, and I do think it is something we're going to have to work out."

CLIMATE continued from page 1

only 5 of the 6 *Nature* authors) can be found at tinyurl.com/lg266u.

Members who wish to provide their input on these issues prior to the Council meeting on November 8 can do so by contacting an appropriate member of Council. Each APS division and forum has its own Councillor, and sections are represented on a rotating basis. There are also eight General Councillors. A list of Council members can be found at www.aps.org/about/governance/executive/councillors.cfm. The officers of the Society, who are *ex officio* members of Council, are listed separately at www.aps.org/about/governance/executive/officers.cfm .

APS Statement on Climate Change

(Adopted by Council November 18, 2007)

Emissions of greenhouse gases from human activities are changing the atmosphere in ways that affect the Earth's climate. Greenhouse gases include carbon dioxide as well as methane, nitrous oxide and other gases. They are emitted from fossil fuel combustion and a range of industrial and agricultural processes.

The evidence is incontrovertible: Global warming is occurring. If no mitigating actions are taken, significant disruptions in the Earth's physical and ecological systems, social systems, security and human health are likely to occur. We must reduce emissions of greenhouse gases beginning now.

Because the complexity of the climate makes accurate prediction difficult, the APS urges an enhanced effort to understand the effects of human activity on the Earth's climate, and to provide the technological options for meeting the climate challenge in the near and longer terms. The APS also urges governments, universities, national laboratories and its membership to support policies and actions that will reduce the emission of greenhouse gases.

Focus on APS Topical Groups

Hadronic Physicists Find a Home

By Lauren Schenkman

In textbook diagrams, the proton can look deceptively simple, a tiny spherical sun holding the electron in its orbit. But furled inside the proton is a mysterious congeries of quarks, antiquarks, and gluons that obey laws still muddy to physicists. Known as quantum chromodynamics, these laws are fertile ground for new discoveries, including the remarkable property of "asymptotic freedom" that earned David Gross, Frank Wilczek, and H. David Politzer the 2004 Nobel Prize. But quantum chromodynamics is far from completely understood.

"We are still struggling with much of the basic theory," said Stan Brodsky, a theorist at Stanford University and SLAC National Accelerator Laboratory and the rising chair of the APS Topical Group on Hadronic Physics. "It's so complicated."

As a consequence, some of the world's most powerful particle accelerators are devoted to peering into the proton. Brookhaven National Lab's Relativistic Heavy Ion Collider smashes beams of gold ions, melting the protons and neutrons and freeing their quarks and gluons in a plasma that's hotter than the sun and lasts just a few billionths of a second. Meanwhile, Thomas Jefferson National Accelerator Facility's accelerator fires an electron beam at a proton target, probing the three-dimensional quark structure for explanations of the proton's macroscopic properties, such as mass, spin, and magnetic moment. Other high-profile facilities, such as the Large Hadron Collider and Fermilab, also host important hadronic physics projects.

Hadronic physics plays a role in medicine and energy; proton and pion beams fight tumors, and a greater grasp of protons would improve understanding of nuclear fuels. Meanwhile, physicists working on experiments often come up with new technologies that find their way into industry, in the form of better photomultipliers or detectors that can be used to improve Magnetic Resonance Imaging.

Despite this field's importance and prominence, hadronic physicists lacked a community within APS until 2002. Many hadronic physicists were members of the Division of Particles and Fields or the Division of Nuclear Physics, but their particular interests fell through the cracks between these two areas. In early 2000, led by Eric Swanson, Ted Barnes, Alex Dzierba and James Bjorken, hadronic physicists began pushing to form a cohesive community within APS, achieving official status in 2002.

"Our goals were to raise the visibility of hadronic physics," Swanson explained. "The field had (and still has) the problem that it is a part of particle physics that is not pursuing the Higgs or the next Standard Model, so it is missing a natural home. It also tends to be funded by Nuclear Physics, which heightens the confusion."

According to Winston Roberts, the group's current chair and a theorist at Florida State University, one of the GHP's goals is to provide hadronic physicists with "a forum to discuss things they're interested in."

To that end, the group held its third biennial conference on hadronic physics just days before the 2009 April Meeting in Denver. It was the largest yet, featuring more than 90 participants and 80 talks on everything from jet physics to lattice quantum chromodynamics to heavy-ion physics.

"I think the meetings we organize do generate an atmosphere in which new collaborations can get formed," Roberts said. Members can look forward to a strong presence at next year's April Meeting in February 2010, when the GHP will present two invited sessions on the latest advances.

The GHP has also played an important role in nominating deserving hadronic physicists for APS Fellowship, ensuring that they're not lost in the particle physics and nuclear physics crowd. But that role would benefit from an increased membership. While the group has grown to include about 400 physicists, Roberts hopes to see the community expand even further.

"The membership could be a lot larger than it currently is," he said. "There are people who are members of [the Division of Particles and Fields and the Division of Nuclear Physics] who should probably consider joining GHP."

"QCD is so important, it deserves a central domain," Brodsky agreed. "This is really the natural place for presenting the latest work."

ELECT continued from page 1

National Ignition Facility at LLNL, and the Canadian Institute of Photonics. Since 1995 he has been an active part of the National Research Council; in 2007 he worked on a directed energy study for the NRC Board on Army Science and Technology. He served on the NRC Committee on Optical Sciences and Engineering, the NRC Committee on Inertial Confinement Fusion, and the NIST NRC advisory board as vice chair of the physics panel.

Byer has published more than 500 scientific papers and holds 50 patents in the fields of lasers and nonlinear optics. He was elected to the National Academy of Engineering in 1987 and to the National Academy of Sciences in 2000. He has been honored with numerous awards; in 2009 alone he received the W. E. Lamb medal for Laser Science and Quantum Optics, the Frederic Ives Medal/Quinn Endowment from the Optical Society of America, and the IEEE Photonics Award.

"Physics and the understanding of the world through physics is an exciting and worthwhile career, and I think one of the main things the American Physical Society can do is help carry that excitement to the next generation of young men and women interested in science and the application of science," Byer said. "Beyond that we have an obligation to speak out as physicists on those technical and technological issues that are important to us today. That includes communication across the globe, openness in the [basic] research programs… that support all of us and the next generation, and the understanding of how best to generate and utilize energy, and the outcomes of new forms of energy and how we can benefit mankind by developing those new forms of energy."

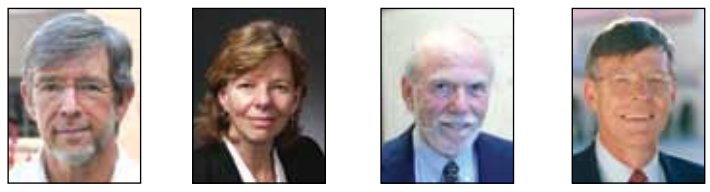
In his candidate's statement, Byer said it was crucial to balance the nation's "investments in health and medicine with investments in the physical sciences and engineering." Part of that investment involves modifying immigration policies to continue attracting the best and brightest foreign scientists, and changing export controls to keep America engaged in international collaborations. He said he sees APS taking a leading role, not only in pushing for these policy changes, but in "[engaging] the next generation in the intellectual excitement and benefits of a career in science."

Byer added that transitioning to renewable, non-polluting energy sources will foster economic growth, especially if physicists can guide this change. "A 'man to the moon'-scale international research and development program that includes energy technologies from clean coal to fusion and fusion-fission hybrid energy is an essential investment in the future," he said in his candidate's statement. "We must learn to manage both the environmental impacts and to create a safe, non-threatening fuel cycle."

Steve Girvin is a theoretical physicist who works closely with experimentalists to pursue questions in condensed matter, quantum optics, and cold atom physics. He received his PhD from Princeton in 1977 and is currently the Eugene Higgins Professor of Physics and Professor of Applied Physics at Yale, where he also serves as Deputy Provost for Science and Technology. He has served on and chaired various advisory boards, including the APS Divison of Condensed Matter Physics, the Kavli Institute of Theoretical Physics in Santa Barbara, and the National Research Council Committee that wrote the 1999 decadal report on condensed matter and materials physics, among others.

"We face an era of fiscal uncertainty with risks to the world economy as well as to our educational and research institutions," Girvin said in his candidate's statement. "The world faces additional risks in a rapidly changing environment increasingly dominated by poorly understood technologies." In the face of these risks, the nominating committee needs to find leaders who will make APS instrumental in "providing solid evidence-based information to our policy makers and the general public," he said. Restructuring the undergraduate physics curriculum, he added, could help diffuse the valuable problem-solving skills learned in physics to students of biology, medicine, and engineering.

2010 Presidential Line



Curt Callan, President | Cherry Murray, Past President | Barry Barrish, President Elect | Bob Byer, Vice President

Marta Dark's research focuses on laser interactions with biomaterials, including the study of electro-optical effects on nematic liquid crystals, and the photoacoustic and photothermal effects in soft fibrocartilage tissues. She earned her PhD in Physics from MIT in 1999 and spent a year as a postdoctoral associate at the Center for Bio-Molecular Science and Engineering at the Naval Research Laboratory. In 2000, she joined the physics department at Spelman College, where she works to include modeling of real phenomena in the physics curriculum.

Dark has served on local and national committees, ranging from the Chemical and Biological Physics section of the National Society of Black Physicists, to New York University's "Physics in the Science Curriculum" Network summer seminar. She is currently completing her term on the APS Committee on Minorities and has served on the American Association of Physics Teachers Committee on Minorities.

In her candidate's statement, Dark called herself a "translator of physics to the general public." She identified three major challenges for the physics community: encouraging young people, especially women and members of underrepresented minorities, to study physics and pursue it as a career; improving Americans' quantitative literacy; and showing policy makers and the public how physics can be applied to "solve the pressing problems of our day."

Warren Mori has been a faculty member at UCLA since earning his PhD there in 1987, achieving full professorship in both electrical engineering and physics and astronomy in 1998. Since the fall of 2006 he has been the director of the UCLA Institute for Digital Research and Education. Mori's current research interests are in plasma physics, laser and beam plasma interactions, plasma-based accelerators and light sources, inertial confinement fusion, high energy density science, relativistic shocks, and high performance computing.

In his candidate's statement, Mori emphasized the need to attract talented students to physics and to convince the government of the "value and need for funding in basic research in physics."

"This is also an auspicious time where our society faces grand challenges such as climate change and energy shortfalls," he said. "It is more important than ever that the APS be visible and vocal in driving science policy."

Belita Koiller earned her PhD at UC Berkeley in 1975 and is currently a professor at the Physics Institute at Universidade Federal do Rio de Janeiro. As a condensed matter theorist, Koiller has contributed to the understanding of the properties of disordered solids, particularly disordered chains and semiconductor alloys. More recently, she has been interested in quantum control of individual electrons' spin and charge in semiconductors, aiming at applications in quantum information and quantum computing.

Koiller received a Guggenheim Fellowship in 1982, and in 1995 became the first woman to be elected a full member of the Brazilian Academy of Sciences in the Physical Sciences division. In 2002 she was distinguished as a Commander of the National Order of Scientific Merit by the presidency of Brazil, and was the L'Oréal UNESCO Laureate for Women in Physical Sciences in Latin America in 2005.

Koiller was elected to three four-year terms as general councilor of the Brazilian Physical Society and served for three years on the ICSU Committee on Capacity Building in Science. In 2008 she became a member of the IUPAP commission on semiconductors, chairing the IUPAP-sponsored 29th International Conference on the Physics of Semiconductors, held in Rio de Janeiro in 2008. She has been a member of the Executive Committee of the International Human Rights Network of Academics and Scholarly Societies since 2005.

In her candidate's statement, Koiller highlighted the importance of helping international scientists gain entry to the US in order to work with American researchers. She said she will bring her experience with the aforementioned committees and societies to her new role, in which she looks forward to facilitating international collaborations.

ANNOUNCEMENTS

Let the APS/DPP Job Fair do the work for you!

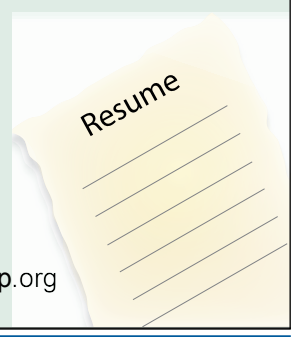
APS Division of Plasma Physics

JOB FAIR

Looking for a job?

Looking for the ideal candidate?

November 2-3, 2009
Hyatt Regency Hotel
Atlanta, GA



Register today at: http://www.aps.org/careers/employment/jobfairs.cfm

For more information contact Alix Brice at 301-209-3187 or at abrice@aip.org

Call for Proposals:

India-U.S. Travel Grants

The Indo-U.S. Science and Technology Forum (IUSSTF) and the American Physical Society (APS) are pleased to announce the launch of two new programs: 1) the **India-U.S. Physics Student Visitation Program**, and 2) the **India-U.S. Professorship Awards in Physics**.

INDO-US SCIENCE AND TECHNOLOGY FORUM

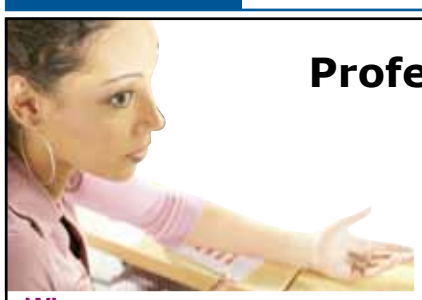
Through the **Physics Student Visitation Program**, U.S. and Indian graduate students may apply for travel funds of U.S. $3,000 to pursue opportunities in physics. The travel funds could be used to attend a short-course or summer institute, to work temporarily in a laboratory, or for another opportunity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

APS physics™

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

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

The upcoming deadline is 15 October 2009. Recipients will be selected by a joint APS-IUSSTF Review Committee.



Professional Skills Development

for

Women Physicists

Improve your negotiation skills and learn to communicate your great ideas to your colleagues.

When
Friday, February 12, 2010, Washington, DC
Sunday, March 14, 2010, Portland, Oregon

Who may apply
Women postdoctoral associates and women faculty in physics. Each workshop will have one session aimed at postdocs and one session aimed at women faculty.

Deadlines to apply
November 9, 2009 (for February 12)
December 7, 2009 (for March 14)

First consideration will be given to applications received by the deadlines. Workshops will be limited in size for optimal benefit. Women of color are warmly encouraged to apply.

Participants are eligible to receive a stipend to help cover the cost of travel and up to two nights lodging.

Details at http://www.aps.org/programs/women/workshops/skills/index.cfm

These workshops are funded by a grant from the National Science Foundation.

For International Year Of Astronomy:

The Universe Brought To Your Doorstep

Well, at least expert talks about the universe and its contents! The Committee on Status of Minorities in Astronomy (CSMA) of the American Astronomical Society, Las Cumbres Observatory (LCO), the University of Texas at Brownsville (UtB), and members of APS's DAP, GRG, FHP, and others are cooperating in an attempt to share the excitement of the cosmos with four year colleges and other interested groups and organizations.

- ***Ask for what you want (topic, time frame, location), mention any cost sharing you can manage, and we will attempt to find someone who is a good fit.*** The person will typically come for a day to speak with one or more classes, groups of students, faculty, and so forth. There is no need to arrange a large public talk (though it is not forbidden)-we are not trying to compete with programs that do this.
- ***Possible topics might be cosmology, black holes, supernovae, relativity, life in the universe, history of astronomy/astrophysics, etc.*** We have the experience to do this, because most of our team was involved in a 2005 World Year of Physics speakers' bureau that achieved similar goals.
- ***To request a speaker, please go to our UTB web site:*** http://acc.phys.utb.edu/web/LasCumbres/REQUESTS/howto.html. If perchance you are willing to be a speaker, please get in touch with one or more of the contact folks below.

Richard Price (UTB, Richard.Price@utb.edu)
Keivan Stassun (SCMA, Keivan.Stassun@vanderbilt.edu)
Virginia Trimble (LCO, vtrimble@astro.umd.edu)

childcare grants available!

small grants of up to $400

who is eligible
Parents/caregivers who plan to attend the APS March or April (February) meeting with their small children or who incur extra costs to bring them along or leave them at home. Preference is given to early career applicants.

deadline
Apply by Dec 15 (for February) or January 15 (for March)

March Meeting details at
http://www.aps.org/meetings/march/services/index.cfm

April Meeting (February) details at
http://www.aps.org/meetings/april/services/index.cfm

These grants are made possible by funds from the Elsevier Foundation and the American Physical Society.

Beller and Marshak Lectureship Awards-Call for Nominations!

To: Chairs of the APS Divisions, Topical Groups, Forums, and the Committees on Minorities (COM) and the Status of Women in Physics (CSWP).

The APS Committee on International Scientific Affairs (CISA) invites units and committees that organize sessions at the March and April APS meetings to submit nominations for the 2010 Beller and Marshak Lectureships. Four lectureships ($2,000 maximum for each lectureship) are awarded every year to provide travel funds to support foreign physicists invited to speak during sessions at the following APS meetings:

Beller Lectureship–for a distinguished physicist from outside of the United States

- Two (2) lectureships for the March Meeting (15-19 March, 2010, Portland, OR)
- One (1) lectureship for the April Meeting (13-16 February 2010, Washington, DC)

Marshak Lectureship–for a physicist from a developing country or Eastern Europe

- One (1) lectureship for either the March or April Meeting

The deadline for nominations for the 2010 lectureships is Monday, 2 November 2009. Chairs of eligible units and committees can submit nominations online at http://ultron.aps.org/forms/aps.cgi?ID=1030.

Request for PhysTEC Proposals

PhysTEC
Physics Teacher Education Coalition

PhysTEC requests proposals for new sites to develop model physics teacher preparation programs, to begin in the 2010-2011 academic year. Proposals are solicited for two types of sites:

Comprehensive sites, which will receive up to $100k per year for three years. These sites will implement the full PhysTEC program, described on www.PhysTEC.org .

Pilot sites, which will receive up to $25k per year for three years to implement specific elements of teacher preparation programs.

The deadline for the first round of applications is November 2, 2009. See www.phystec.org/solicitation for details, requirements, and application materials. Minority-serving institutions are strongly encouraged to apply.

PhysTEC's mission is to improve and promote the education of future physics and physical science teachers. PhysTEC is a joint project of the American Physical Society and the American Association of Physics Teachers, with support from the National Science Foundation and the APS's 21st Century Campaign.

The Back Page

A Math Paradox: The Widening Gap Between High School and College Math

By Joseph Ganem

We are in the midst of paradox in math education. As more states strive to improve math curricula and raise standardized test scores, more students show up to college unprepared for college-level math. The failure of pre-college math education has profound implications for the future of physics programs in the United States. A recent article in my local paper, the *Baltimore Sun*: "A Failing Grade for Maryland Math," highlighted this problem that I believe is not unique to Maryland. It prompted me to reflect on the causes.

The newspaper article explained that the math taught in Maryland high schools is deemed insufficient by many colleges. According to the article 49% of high school graduates in Maryland take non-credit remedial math courses in college before they can take math courses for credit. In many cases incoming college students cannot do basic arithmetic even after passing all the high school math tests. The problem appears to be worsening and students are unaware of their lack of math understanding. The article reported that students are actually shocked when they are placed into remedial math.

The article did not shock me. It described my observations exactly. In recent years I've witnessed first hand the disconnect between the high school and college math curricula. As a parent of three children with current ages 14, 17, and 20, I've done my share of tutoring for middle school and high school math and I know how little understanding is conveyed in those math classes. Ironically much of the problem arises from a blind focus on raising math standards.

For example, the problems assigned to my children have become progressively more difficult through the years to the point of being bizarre. My wife keeps shaking her head at how parents without my level of math expertise assist their children. My eighth-grade daughter asked me one evening how to perform matrix inversions. I teach matrix inversion in my sophomore-level mathematical methods course for physics majors. It is difficult for me to do matrix inversions off the top of my head. I needed to refresh my memory by pulling Boas' book: *Mathematical Methods in the Physical Sciences* off my shelf. Not exactly eighth grade reading material.

On another night my eighth-grader brought home a word problem that read: If John can complete the same work in 2 hours and that it takes Mary 5 hours to complete, how much time will it take to complete the work if John and Mary work together? That's an easy problem if you know about rate equations. Add the reciprocals of 2 and 5 and reciprocate back to get the total time. However it took me a lot of thought to arrive at an explanation of my method comprehensible to an eighth-grader.

My other daughter struggled through a high-school trigonometry course filled with problems that I might assign to my upper-class physics majors. I certainly wouldn't assign problems at such a high level to college freshmen. I kept asking her how she was taught to do the problems. I wondered if the teacher knew special techniques unknown to me that made solving them much easier. Alas no such techniques ever materialized. The problems were as difficult as I judged. At least I could solve the problems, a feat the teacher couldn't manage in a number of cases.

For example one problem involved proving a complicated trigonometric identity. My daughter brought it to me saying she had tried but couldn't find a solution. I saw immediately that the textbook had an error that rendered the problem meaningless. One side of the problem had a combination of trigonometric functions with odd symmetry and for the other side the symmetry was clearly even. I told her it was not an identity and that fact could be proven with a simple numerical substitution on each side. If it is an identity the equality condition must hold for all values of the angle. A single numerical counter example proves that it is not an identity. It only took one try to find a counter example.

The next day she reported to me that the teacher couldn't solve the problem.

"Did you tell him that it is impossible?" I asked.

"I told him it was not an identity and if he put numbers in he would find that out. He didn't believe me. He just said 'We'll see'."

The teacher never talked about that problem again. He did teach the class about the symmetry properties of trigonometric functions but evidently he didn't understand the usefulness of that knowledge.

At the same time I work the summer orientation sessions at Loyola College registering incoming freshmen for classes. Time and again students cannot pass the placement exam for college calculus. Many students cannot pass the exam for pre-calculus and that saddles them with a non-credit remedial math course—the problem described in the newspaper article. Without the ability to take college-level math the choices students have for majors are severely limited. No college-level math course means not majoring in any of the sciences, engineering, computer, business, or social science programs.

A colleague in the engineering department who also works summer orientation complained to me that many students who wanted to major in engineering could not place into calculus. The engineering program is structured so that no calculus means no physics freshman year and no physics means no engineering courses until it's too late to complete the program in four years. For all practical purposes readiness for calculus as an entering freshman determines choice of major and career. The math placement test given to incoming freshmen at orientation has much higher stakes than any test given in high school. But, the placement test has no course grade or teacher evaluation associated with it. No one but the student has any responsibility for or stake in its outcome.

Through the years I've found it discouraging as a faculty member to see so many high aspirations dashed at orientation before classes even begin. I tell students with poor math placement scores to go home, review high school math over the summer and take the test again. But, few take my advice. Most students with poor placement scores switch to majors that do not have significant math requirements.

So if eighth graders are taught math at the level of a college sophomore why are graduating seniors struggling? How can students who have studied college level math for years need remedial math when they finally arrive at college? From my knowledge of both curricula I see three problems.

1. Confusing difficulty with rigor. It appears to me that the creators of the grade school math curricula believe that "rigor" means pushing students to do ever more difficult problems at a younger age. It's like teaching difficult concerti to novice musicians before they master the basics of their instruments. Rigor–defined by the dictionary in the context of mathematics as a "scrupulous or inflexible accuracy"–is best obtained by learning age-appropriate concepts and techniques. Attempting difficult problems without the proper foundation is actually an impediment to developing rigor.

Rigor is critical to math and science because it allows practitioners to navigate novel problems and still arrive at a correct answer. But if the novel problems are so difficult that a higher authority must always be consulted, rigorous thinking will never develop. The student will see mathematical reasoning as a mysterious process that only experts with advanced degrees consulting books filled with incomprehensible hieroglyphics can fathom. Students need to be challenged but in such a way that they learn independent thinking. Pushing problems that are always beyond their ability to comprehend teaches dependence–the opposite of what is needed to develop rigor.

2. Mistaking process for understanding. Just because a student can perform a technique that solves a difficult problem doesn't mean that he or she understands the problem. There is a delightful story recounted by Richard Feynman in his book: *Surely You're Joking, Mr. Feynman!: Adventures of a Curious Character*, that recounts an arithmetic competition between him and an abacus salesman. (The incident happened in the 1950's before the invention of calculators.)

The salesman came into a bar and wanted to demonstrate the superiority of his device to the proprietors through a timed competition on various kinds of arithmetic problems. Feynman was asked to do the pencil and paper arithmetic so that the salesman could demonstrate that his method was much faster. Feynman lost when the problems were simple addition. But he was very competitive at multiplication and won easily at the apparently impossible task of finding a cubed root. The salesman was totally bewildered by the outcome and left completely discouraged. How could Feynman have a comparative advantage at hard problems when he lagged far behind at the easy ones?

Months later the salesman met Feynman at a different bar and asked him how he could do the cubed root so quickly. But when Feynman tried to explain his reasoning he discovered the salesman had no understanding of arithmetic. All he did was move beads on an abacus. It was not possible for Feynman to teach the salesman additional mathematics because despite appearances he understood absolutely nothing. The salesman left even more discouraged than before.

This is the problem with teaching eighth-graders techniques such as matrix inversion. The arithmetic steps can be memorized but it will be a long time, if ever, before the concept and motivation for the process is understood. That raises the question of what exactly is being accomplished with such a curricula? Learning techniques without understanding them does no good in preparing students for college. At the college level emphasis is on understanding, not memorization and computational prowess.

3. Teaching concepts that are developmentally inappropriate. Teaching advanced algebra in middle school pushes concepts on students that are beyond normal development at that age. Walking is not taught to six-month olds and reading is not taught to two-year olds because children are not developmentally ready at those ages for those skills. When it comes to math, all teachers dream of arriving at a crystal clear explanation of a concept that will cause an immediate "aha" moment for the student. But those flashes of insight cannot happen until the student is developmentally ready. Because math involves knowledge and understanding of symbolic representations for abstract concepts it is extremely difficult to short cut development.

When I tutored my other daughter in seventh grade algebra, in her words she "found it creepy" that I knew how to do every single problem in her rather large textbook. When I related the remark to a fellow physicist he said: "But its algebra. There are only three or four things you have to know." Yes, but it took me years of development before I understood there were only a few things you had to know to do algebra. I can't tell my seventh grader or anyone else without the proper developmental background the few things you have to know for algebra and send them off to do every problem in the book.

All three of these problems are the result of the adult obsession with testing and the need to show year-to-year improvement in test scores. Age-appropriate development and understanding of mathematical concepts does not advance at a rate fast enough to please test-obsessed lawmakers. But adults using test scores to reward or punish other adults are doing a disservice to the children they claim to be helping.

It does not matter the exact age that you learned to walk. What matters is that you learned to walk at a developmentally appropriate time. To do my job as a physicist I need to know matrix inversion. It didn't hurt my career that I learned that technique in college rather than in eighth grade. What mattered was that I understood enough about math when I got to college that I could take calculus. Memorizing a long list of advanced techniques to appease test scorers does not constitute an understanding.

Joseph Ganem is a professor of physics at Loyola University Maryland and author of the award-winning book: The Two Headed Quarter: How to See Through Deceptive Numbers and Save Money on Everything You Buy*, that teaches quantitative reasoning applied to financial decisions.*

APS News welcomes and encourages letters and submissions from its members responding to these and other issues. Responses may be sent to: letters@aps.org