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April Meeting Prize and Award Recipients

Photo by Ross DeLoach

At the April Meeting ceremonial session, attendees heard the retiring President's address from Barry Barish, and then watched as current APS President Bob Byer presented 15 APS prizes and awards to a total of 19 individuals. In addition, an AIP award was presented by CEO Fred Dylla. Seated in the photo are, left to right: APS past President Barry Barish; William B. Atwood; Lillian Hoddeson; Arian Pregenzer; Silvia Torres-Peimbert; APS President Bob Byer; Jean Trân Thanh Vân (AIP); and Törbjorn Sjöstrand. Standing, left to right, are: Andre Lessa; Emanuele Mereghetti; Ramon Lopez; David Ernst; Phillip Barbeau; John Madey; Witold Nazarewicz; Siegfried Hecker; Manuel Peimbert; Guido Altarelli; Daniel Jafferis; Gordon Kane; Djordje Radicevic; and Bryan Webber.

APS Unveils Five-year Strategic Plan

After a year of work by its leadership, the APS strategic plan for 2013 through 2017 has been completed and is being circulated to the membership. The plan sets forth a series of goals for the Society over the next half-decade.

"The value of a strategic plan is that it articulates a common vision for the Society," said APS Executive Officer Kate Kirby. "The process itself involves stepping back, looking at what we are doing, and identifying possible challenges and new opportunities in the future."

The planning process, involving extensive Executive Board and APS staff discussions, was started in 2011 by the Operating Officers and the Presidential Line, as a way to develop a roadmap for the Society over the next five years. The final version of the plan was adopted by the APS Executive Board in February, presented to Council in late March, and rolled out to the leaders of APS units at the unit convocation in April. "The overall goals are to better serve the members, the physics community and society," Kirby said.

Finding ways to better serve the members includes improving communication between the Society and its members, involving more international members in the Society's leadership, and making the membership itself more diverse and inclusive.

"It's important that the physics community and the APS reflects better the nationwide demographics," Kirby said, adding that being more inclusive means involving more underrepresented minority physicists and more women, as well as reaching out to physicists who are in careers that have been underserved by APS, such as industrial physics.

To better serve the physics community as a whole, the plan outlines goals to make the physics community thrive. First and foremost, the Society aims to keep its journals and meetings as prime sources of cutting-edge physics research. In addition, the Society will continue to advocate for physics to policy makers, and continue to promote physics education at all levels.

In order to serve society as a whole, APS aims to be the leading source of information about physics, and to build support for science amongst the public. This includes disseminating information about physics, continuing its outreach efforts aimed at building public appreciation, and improving the quality of STEM education generally.

While the plan outlines strategic goals and objectives, implementation ideas will be developed through discussions between the Executive Board and APS staff

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APS Action Helps Save Physics Program at Northern Iowa

By Michael Lucibella

Helped by a concerted grassroots effort, professors and students at the University of Northern Iowa (UNI) have succeeded in saving the Physics Bachelor of Science from elimination. Several other physics and physical science degrees, however, are being phased out because of a tightening budget.

UNI announced in late February that it would be closing down several of its physics programs as part of a broader restructuring effort. This sparked a backlash from the academic community, including APS, to protest the cuts. When the school's Board of Regents approved the closure of 58 programs on March 21st, the physics BS was spared, although subject to "restructuring."

Before the final vote by the Board of Regents, APS Executive Officer Kate Kirby sent an open letter to the school's president and provost, asking them to reconsider the decision to close down the physics program.

"The American Physical Society hopes that you will reconsider this action in light of the significant role played by UNI in educating high school physics teachers, providing physics education to all of the science and mathematics majors at UNI, and in providing a robust undergraduate physics program," the letter reads. "We recognize that budgetary challenges facing UNI and other universities force difficult choices. We welcome the opportunity to work with the UNI Physics Department and administration to provide a high quality physics program for Iowa and the surrounding region."

Provost Gloria Gibson said that the administration was swayed by the outpouring of support behind the BS, and the amount of external funding the program brought into the university, reportedly about $4 million in the last six years.

The action at UNI came in the wake of similar closings of several physics programs at universities in Texas, as reported in the December, 2011 *APS News*.

The other physics programs at UNI that are getting the axe include the applied physics Professional Science Masters, Bachelors of Arts in physics and the Bachelor of Science in applied physics. In addition, both the geology BA and

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Physics Methods Aid Cancer Research

By Calla Cofield

Physicists are assisting in the fight against cancer in a variety of ways, as illustrated by two examples that were presented at the APS March Meeting. Krastan Blagoev, director of the Physics of Living Systems program for the National Science Foundation, is applying theoretical physics knowledge to the analysis of clinical cancer data, and is working on a program to bring these two groups together. Lydia Sohn, at the University of California, Berkeley, is developing new techniques for cancer detection and imaging, while studying the fundamental mechanics of cancer cells.

The National Cancer Institute has already invested in bringing physicists together with cancer researchers. In 2009 the NCI established 12 Physical Sciences Oncology Centers at major institutions throughout the US (as reported in the March 2010 *APS News*). According to the PSOC website, "by merging the physical sciences with cancer biology and oncology, NCI aims to accelerate the pace toward a cure."

At a press conference at the APS March Meeting, Sohn showed reporters images that

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The Wild, Wild South

Photo by Sarah Davis

On March 28, APS hosted a reception for Fellows in the Atlanta area. The more than 40 attendees enjoyed refreshments and heard brief remarks from APS President Bob Byer, Executive Officer Kate Kirby, Treasurer/Publisher Joe Serene, Editor in Chief Gene Sprouse, and Director of Education and Diversity Ted Hodapp. In the photo, Bob Byer shares a light moment with Georgia Tech professor Rick Trebino (center) and Linda Trebino.

New Device Tells Bombs from Harmless Trash

Cleaning up a region after a bloody conflict can often take years or decades. One of the biggest long-term challenges to make an area safe are unexploded bombs, landmines and munitions. These often get buried and stay hidden for years until unearthed by a plow or other means.

"There are tens of millions of acres that have been polluted with bombs that haven't been exploded," said Eugene Lavely of BAE systems.

He is part of a team developing a device to find these hidden dangers. Team members presented their results at the March Meeting. The device uses what they call time domain electromagnetic (TDEM) induction methods to find dangerous buried munitions, and importantly, to differentiate them from benign buried garbage.

"Detection is not the biggest problem. The main problem is discrimination," Lavely said. "It becomes economically unfeasible to dig up every detection."

Lavely's device is essentially made up of 25 coils on a square platform that can be pushed across the ground. The apparatus looks a bit like a giant lawnmower about the size of a ping-pong table. Electric pulses are sent through the coils, which generate magnetic fields. These magnetic fields induce a slight current in any buried piece of metal the device rolls over. The buried object likewise emits its own signature magnetic field which can be picked up by detector coils. It's the same principle that a beach comber's metal detector uses.

"Think of these as fancy

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Members in the Media

"I am innocent… I will not be convicted. It is just that the Argentinean justice system is very slow. There is easily enough evidence that I didn't know there were drugs in the bag, and that will come out, I hope sooner rather than later."

***Paul Frampton**, University of North Carolina, speaking about his arrest in Argentina on drug smuggling charges,* Raleigh News & Observer*, March 11, 2012.*

"We've been in continuous contact by phone, particularly over the last month, and he has been doing all these things that I'd be depending on him for if he were actually here… I find that admirable."

***David Eby**, University of North Carolina-Chapel Hill, on his advisor, Paul Frampton's jailing in Argentina,* FoxNews.com*, March 20, 2012.*

"I always say I grew up in the 19th century…We had two maids –one to serve us and one to clean. We had a woman who came to wash, and a woman who came to iron. We had a cook–a real chef, with a toque. I didn't know a war was going on."

***Peter Freund**, University of Chicago, on growing up in Romania during World War II,* The Chicago Tribune*, March 25, 2012.*

"I look forward to visiting Amherst soon and then to returning to work shoulder to shoulder with our very talented students, faculty and staff."

***Kumble Subbaswamy,** University of Kentucky, on being named to head UMass Amherst,* The Cape Cod Times*, March 27, 2012.*

"We're looking in a small mass window…So, if the machine performs the way it's supposed to, this year's results should settle the question of whether there is a particle."

***Rob Roser**, Fermilab, on the LHC's hunt for the Higgs Boson,* The Washington Post*, April 2, 2012.*

Unless we're missing something in the existing data, a failure to find the Higgs boson would mean building an accelerator that can work at even higher energies."

***Lawrence Krauss**, Arizona State University, on the LHC's hunt for the Higgs Boson,* The Washington Post*, April 2, 2012.*

"The experience of two good years of running at 3.5 TeV per beam gave us the confidence to increase the energy for this year without any significant risk to the machine… Now it's over to the experiments to make the best of the increased discovery potential we're delivering them!"

***Steve Myers**, CERN,* The Christian Science Monitor*, April 6, 2012.*

"There are some facts and figures that are very disturbing, which show the United States might be losing ground in science and discovery, whereas other countries are gaining… We can't sit back and watch."

***Pushpa Bhat**, Fermilab,* MSNBC.com*, April 6, 2012.*

"Think about how much the invention of the transistor is worth… The fundamental science that went into that was understanding quantum mechanics, understanding the micro world. Bohr didn't get rich from it, Heisenberg didn't get rich from it. But society got rich from it."

***Frank Wilczek,** MIT,* FoxNews.com*, April 7, 2012.*

"We don't claim that our idea is conclusive… we found there had been remarkable tidal events around the globe–in England and New Zealand."

***Donald Olson**, Texas State, on his theory that rare tides may have contributed to the sinking of the Titanic,* The New York Times*, April 10, 2012.*

"I just really loved films… I was 25 and had really great opportunities in academia, but I kept thinking, 'I'm in L.A. Hol-

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This Month in Physics History

May 29, 1948: Results of first experiment on the Casimir effect

One wouldn't immediately suspect a connection between how gecko's feet adhere to surfaces and the friction that so often plagues tiny nanomachines. The first involves an unusual feature of molecular attraction, while the second arises from the "stickiness" of the quantum force of empty space. Yet both have their roots in the work of two Dutchmen: Johannes Diderik van der Waals and Hendrik Casimir.

The oldest of ten children born to a carpenter in Leiden, van der Waals' working class roots meant he didn't receive the classical education normally required to gain admittance to a university. But he did receive a decent primary education and became a teacher's apprentice, eventually heading an elementary school. He also took advantage of a special provision to enroll in classes at the University of Leiden in physics, mathematics and astronomy, although he wasn't allowed to matriculate as a full-time student. When the Dutch government founded a new type of secondary school aimed at educating middle class children, van der Waals qualified to teach at such schools.

Hendrik Casimir (left) with Victor Weisskopf in 1934.

By 1866, he was teaching at The Hague. Thanks to a special dispensation that waived the requirement for classical languages, he was finally able to be a regular student at the nearby University of Leiden, and pass the doctoral qualification exams in physics and mathematics. He completed his PhD in 1873, with a thesis on the continuity of gaseous and liquid states, in which he first introduced the notion that molecules will attract one another if they are sufficiently close together, even in the absence of an electric charge or magnetic dipole moment.

Van der Waals went on to become a professor at the Municipal University of Amsterdam, and won the 1910 Nobel Prize in Physics at the age of 72. Casimir was a nine-year-old boy living in The Hague at the time, who would grow up to study with some of the greatest physicists of his era, and to build on van der Waals' ideas concerning molecular attraction, as well as the work of Fritz London, who provided a quantum mechanical description of the van der Waals force in 1930.

Casimir received his PhD at the University of Leiden in 1931, under Paul Ehrenfest, with a thesis on the quantum mechanics of a rigid spinning body and molecular rotation. During that time, he also spent 18 months in Copenhagen, working with Niels Bohr. Then he worked as an assistant in Zurich to Wolfgang Pauli before accepting a professorship at Leiden University. His research centered on heat and electrical conduction.

His time at Leiden was interrupted by the outbreak of World War II; the university was shut down in 1942. So Casimir moved to the Philips Research Laboratories in Eindhoven, becoming one of three directors in 1946. It was here that he became intrigued by the possibility of measuring the van der Waals force between two parallel metallic plates. Two years later, he and a student, Dirk Polder, conceived of an experiment to do just that. The theory they developed to predict their result centered on London's reformulation couching the theory in terms of zero-point quantum energy fluctuations in an electromagnetic field. By then, physicists had ascertained that the quantum vacuum was not empty, but featured virtual particles popping into existence and annihilating just as quickly–so fast that they could not be detected.

The experiment involved two uncharged metal plates, ideal "perfect conductors," set perfectly parallel and just a few micrometers apart in a vacuum. There would be no external electromagnetic field in the vacuum. Yet Casimir and Polder reasoned that those virtual particles should induce equally short-lived electrical currents in the metal plates. Those currents, in turn, would generate magnetic fields, which would either pull the plates together or push them apart, depending on the direction of the respective currents and fields. But they predicted that once all these factors were accounted for, there would be a slight attractive net force, although depending on how the metal plates were arranged, there could also be a net repulsive force.

In May 1948, Casimir and Polder succeeded in building the experiment and reported on their results, which were encouraging, but not definitive, in part because their plates were not perfect conductors; indeed, no such material existed. It also proved difficult to achieve the precise proper alignment of the two metallic plates. Subsequent experiments to obtain more accurate measurements did not contradict the theoretical prediction either, but there were still large experimental errors. The best measurements that resulted from early experiments–such as the one performed by Marcus Sparnaay, Casimir's colleague at Philips, in 1958–were within 15% of the theory's predicted value, not quite sufficient to fully verify the theory.

So it remained an intriguing experimental challenge for decades, although progress continued to be made on the theoretical side: Casimir's theory was unified with London's earlier work in 1956 by Evgeny Lifshitz, whose analysis included more realistic material properties, rather than that unattainable perfect conductor. Finally, in 1996, a young scientist at the University of Washington, Steve Lamoreaux, succeeded in building an experiment sensitive enough to measure the Casimir effect to within five percent of its predicted value.

While the Casimir effect is insignificant at the macroscale, at the submicron level it becomes a dominant force. In microelectromechanical systems (MEMS), for example, it can cause ultra-small com-

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

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Washington Dispatch

A bimonthly update from the APS Office of Public Affairs

ISSUE: Budget and Authorization Environment
Fiscal Year 2013 Budget Resolution
In the past month, the House of Representatives passed Rep. Paul Ryan's (R-WI) budget plan along a party line vote, 228-191 with 228 Republicans in favor, 10 Republicans opposed, and 181 Democrats opposed. The Ryan budget plan sets a spending limit of $1.028T and lies in stark contrast with the President's Budget Request and Senate Plan that set a spending limit of $1.049T as is stipulated in the 2011 Budget Control Act. The disparity in top line spending suggest that the chances of the House and Senate appropriations committees agreeing on new funding bills this year are slim. The House will use the Ryan budget proposal as the framework in upcoming funding debates whereas the Senate leadership has stated it will use the Budget Control Act. Thus, the activity in Washington has essentially set up a stalemate over the budget in the year to come with the most likely outcome a continuing resolution that would maintain spending at FY2012 levels at least until after the November elections.

If Budget Committee Chairman Ryan's plan were adopted in place of the Budget Control Act it may preempt the need for sequestrations because of its lower spending limits through 2021. The spending limits proposed in the Ryan plan protect defense programs by assigning cuts to mandatory programs and non-defense discretionary spending. In the Ryan plan, the Function 250 accounts, a category that covers the physical sciences, would see a decrease in real dollar amounts until 2016, at which point it would begin to increase slightly each year until 2021. Over the next ten years, Function 250 accounts would grow by 0.5%, but after adjusting for expected inflation they would suffer a ~22% reduction in constant dollars. The Ryan budget proposes similar trajectories for most other accounts, except defense, which would see consistent growth.

The Ryan budget plan does not accord science accounts priority status. Although the Ryan budget only includes top line amounts for funding categories, if the spending cuts in Function 250 are enacted as across-the-board reductions, federal science agencies would be forced to eliminate thousands of federal grants for scientific research each year. It is not a positive sign that the starting point for the House appropriation process involves potential reductions to research programs at a time when the rest of the world is increasingly investing in science and innovation.

Be sure to follow the APS Washington Office's Blog, Physics Frontline (http://physicsfrontline.aps.org/), or Twitter feed (@APSPhysicsDC) for the latest news on the FY13 Budget.

ISSUE: POPA
Work continues on several study proposals: extension of nuclear reactor licenses from 60 to 80 years, the technical aspects of verifying tactical nuclear weapons reductions and science-backed federal standards. A study for the Department of Homeland Security's Domestic Nuclear Detection Office (DNDO) regarding trends in nuclear and radiological detection is in development.

POPA voted to approve a proposal for an APS Statement regarding Healing Energy. The proposed statement will now move on to APS Council for commentary and the APS Executive Board for a vote.

In February 2012, per normal APS process, the Panel on Public Affairs recommended four minor copy-edits to the 2007 APS Climate Change Statement Commentary so that the identification of sentences and paragraphs correspond to the Statement as posted at http://www.aps.org/policy/statements/07_1.cfm

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

ISSUE: Media Update
Capitol Hill Quarterly recently published an op-ed by U.S. Rep. Chaka Fattah, who touted the importance of federally funded scientific research to America's global economy.

Roll Call printed an op-ed titled, "Fix the Hollowing Out of the Supply Chain" on April 17th by Michael S. Lubell, APS Director of Public Affairs.

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

Community Recognizes Beverly Berger

Photo by Michael Lucibella

The APS April Meeting featured a special session in recognition of the achievements of Beverly Berger (center), who recently retired after more than ten years as a program officer at NSF in the area of general relativity and gravitation. In addition to remarks from Berger herself, attendees at the session heard Kip Thorne of Caltech (right) speaking on geometrodynamics, and John Friedman of the University of Wisconsin, Milwaukee (left) talking about relativistic astrophysics.

Plant Roots, Mechanical Diggers Both Need Flexibility

By Calla Cofield

Cramped inside booming urban centers, and forced into farmland that is depleted, compacted or sandy: life, for plants, is getting harder. With the human population taking up more space, while also demanding more food, both humans and plants have something at stake in the understanding of how plants flourish or die in these new soils, many of which are granular materials.

"Cultivated sandy soils have not been studied much," said Christian Hartmann, a researcher in soil science at the French Institute of Research for Development (IRD). "[In the past] it was not worth it to invest [in]… research in poor soils as long as rich, clay-filled soils were available. But now we have reached the limit of soil resources and we need to study marginal soils including … sandy soils. But the physics of these granular materials is still not well understood by physicists, and even less understood by soil scientists."

Models of clay-rich, healthy soil systems often treat the soil as a single object with a high plasticity. While roots cut their way through natural channels, the soil compacts at microscales and leaves larger channels for plants that follow. Sandy soils and other granular materials have vastly different physical properties. Granular materials often don't compact. Instead they reorganize, causing changes to the system on a larger scale. For small roots, these changes are on the scale of millimeters; but larger tree roots can displace concrete sidewalks and paved roads. So-called "pioneer" plants might be able to navigate through sandy soils and pave the way for a wider variety of plants, but first scientists will need to know how these soils impact the growth and life of different plants. Hartmann, who studies how compact soils can be rehabilitated, says he thinks moving the field forward will require more collaboration between plant and soil scientists and granular materials scientists.

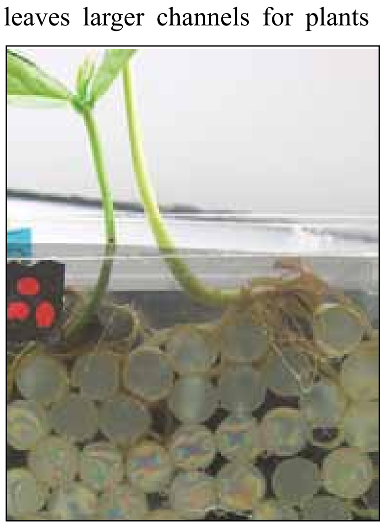

Photo courtesy of Dawn Wendell, Katherine Luginbuhl and A. E. Hosoi

Photoelastic disks mimic granular soils, where young plant roots may have trouble surviving.

At the APS March Meeting, Hartmann's colleague Evelyne Kolb, a physicist at PMMH-ESPCI in Paris, presented measurements of the radial forces of plant roots as they grow in granular environments. Most studies of root forces, says Kolb, measure the ax-

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BS are slated to be canceled along with the geology and astronomy minors. The physics education degree was not affected.

Students already enrolled in the programs will be able to finish their degrees, but no new students will be accepted. According to statements from the president's office, no tenured faculty positions should be affected. It is unclear how many non-tenured positions might be cut.

Physics professor John Deisz said that the extent of the cuts and the speed with which they were implemented came as a surprise.

"It's like a meteorite hit here; nobody knew it was coming. We're kind of assessing the wreckage," Deisz said.

He added that although there had been indications that cuts were coming, the full extent was unexpected. Earlier this year the Board of Regents voted to close the university's Malcolm Price Laboratory School, part of its College of Education, on June 30.

"Over the past several months, the administration has said they were going to chart a new course to meet budget constraints," Deisz said.

On Monday, February 27, the faculty senate was called into a meeting with the administration where the heads of departments were given a preliminary list of which degrees would be cut. In general, undergraduate programs that graduated fewer than 10 students a year at the 11,000 student school were to be cut. The list was not released to the general student body or faculty at first, but the list of cut programs soon was leaked broadly.

The following Friday, more than 250 faculty assembled and passed a motion of no-confidence in the school's administration. In addition, they released a statement denouncing the proposed cuts, and the way the administration put together its list of terminated programs.

"Let it be known that the UNI Faculty Senate does not endorse or condone any recommendations being made for program closures nor does it fully understand the criteria or justifications for specific recommendations," the letter reads. "The UNI Faculty Senate condemns the process used to arrive at these recommendations as contrary to the accepted practices for an institution of higher learning."

Members of the faculty, including Deisz, began appealing to local media and politicians to find a way to minimize the impact on the university's academic programs.

"Certainly the budget has been cut a lot, but the decision to make these cuts is more of a strategic decision," Deisz said. "They want to spend more money on high enrollment programs."

Representatives from the school's administration were unavailable to comment about the closings. In a statement dated March 8th, university president Ben Allen explained the reason behind the cuts. "The academic program closures and restructuring are needed so we can re-allocate resources to high-demand and potential-growth programs. On average, the programs listed for closure graduated fewer than two students per year over the last five years."

In addition to APS, other national organizations weighed in on the proposed cuts as well. The American Association of University Professors said in a statement that it would be opening an investigation into the planned cuts at UNI.

"That investigation should begin soon. One possible outcome is the listing of UNI on AAUP's national list of censured institutions," the statement reads.

The university president responded to the AAUP's concerns in a three-page letter, saying the university acted in accordance with its faculty's employment contracts.

"In summary, UNI fully intends to honor its obligations to faculty, as specified in the collective bargaining agreement negotiated with the faculty union. The University is also highly committed to principles of academic freedom and shared governance, and it believes that the process leading up to these closure decisions honored these principles," President Allen wrote.

Letters

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

Lazarus's Little-Known Contribution

The late David Lazarus was editor in chief of the American Physical Society from 1980 to 1991. His recent passing brings to mind a bit of APS history that not many members know about. Prior to July 1, 1985 (or just possibly 1986), there were no extra membership fees for APS members who wished to join a subgroup, which, in those days, comprised Divisions and the two Topical Groups that had just been formed in 1984. At an APS Council meeting I attended in 1985, Lazarus pointed out that almost all professional and technical organizations did have an additional charge for subgroup membership. He proposed that APS do the same, adding an extra $5 dues for each such membership. The motion passed easily because the feeling was that this would be a minor bump in the road. Turns out that in the very first year after the fee was instituted, subgroup membership dropped ~55% across the board!

One could postulate that Lazarus was being prescient in his doubts about the seriousness of the commitment APS members had to the entities that had been formed to acknowledge their interests in specific fields. However it's come about, the net result stemming from a fortuitous–in light of the consequences–suggestion made a quarter-century ago has been positive: the additional dues collected each year have been almost completely returned to the subunits providing much needed help to maintain their operations.

Larry Rubin
Mercer Island, WA

Scholarship and Cyberspace

In a letter in the January *APS News*, Gil Paz endorsed the idea that talks be posted online along with the plethora of slides and Power Point presentations that already exist in cyberspace. The subject of posting "talks" in addition to meeting slides online concerns me. I am not opposed to wide dissemination of new ideas–rather, it is the methods we use to do so, and the consequences thereof, that I am responding to.

Standards for posters, talks, symposia, and the like are quite variable. Slides are provocative and catchy, but rarely refer to peer-reviewed literature, which provides the needed context. If one is not a member of the "in-group" in a particular topic, they are not very useful. People working in very competitive areas are not likely to post their formative ideas online.

The material of which Gil Paz speaks pops up as more chaff even in carefully considered internet searches. Years may have gone by, and the individual who presented may or may not be identified well enough to be tracked down–or the ideas may have been long abandoned, for good reason.

Most scholars would agree that the study of the history of ideas and breakthroughs on important questions is supported by the written word. In the past twenty years or more, the increasing use of email has left much of this communication in the dark. How many scholars consistently print communication with colleagues and editors so that they may be examined?

We are in an era when free access to cyberspace is in doubt. Many organizations and societies charge additional fees for online access to journals. If one is not close to a participating library, it may cost $30 or more to download or read a single journal article. This provides a great advantage to those working in the formal academic setting where subscriptions and licenses are bought at great expense. This is the same setting that judges the worthiness of projects based on the availability of funding. This brings politics directly to bear on the competition, giving the academic some lesser degrees of freedom and introducing more conflicts of interest.

It is well known how political forces affect the tenure process and the referee system–the "in-group" religion receives preferential treatment. The Ivory Tower is no utopia.

Against the odds, including the high cost of journal subscriptions, leading some college and university libraries to cut subscriptions, the refereed journal article remains the staple of most of academia. Journals with lesser "citation impact" already are threatened. A leisurely walk to the college or university library is still a worthwhile endeavor. The computer does not encourage critical thinking.

Many years and precious resources are spent training good scholars. Travel, expense accounts, and attendance at professional meetings decline and costs soar. I am not yearning for some "good old days" when a single keyword search on Medline cost $400 for a five year time block at the Medical Library. However, we should beware that posts on the internet do not necessarily reflect "the free exchange of ideas." We should be concerned with the quality and accessibility of such exchanges.

The Academy is beset by numerous new problems. Computer resources that appear "free" should be carefully considered in the broader context of society.

Victor S. Alpher
Austin, TX

How to Increase Research Productivity

Dimitri Kusnezov and Wendell Jones, authors of the Back Page "Beyond the Endless Frontier: A 20th Century Model faces 21st Century Realities" [*APS News*, March 2012] see science and technology as a homogeneous activity, and, while they are concerned with changing the governance structure of research, they seem unconcerned with the nature of research itself.

Research projects operate in a multidimensional space: Some require hundreds or even thousands of investigators, while others can be carried out by a single person; some can be guaranteed to obtain the desired result, others have only a small chance of success; some seek results that (while necessary) will not change anyone's worldview, others may change the way a whole field is developed; some may take years or decades, some may take weeks or months; some require only the salaries of the investigators, others require additional, expensive resources; some fall within areas the importance of which can be seen by all (including those who operate the sources of funding), the importance of other projects may not be clear to most people until much later; and so on.

The most effective way to improve the productivity of research would be to make the system more sensitive to these differences. For example, let us not have a system in which an inexpensive, highly-speculative piece of research (which, in the unlikely event of success, would change the world) competes for funding (as it largely does today) with a piece of research that, at considerable expense, will gather valuable data that are needed for a variety of projects but will increase nobody's understanding of anything.

Alwyn Eades
Bethlehem, PA

Kusnezov and Jones Reply:

We agree with Eades that a healthy research enterprise is a rich ecology of elements across a range of risks and benefits, from basic to applied. Our core concern is that the 20th century model of governance for enterprises at the national level inexorably produces decisions that are sub-optimized against today's challenges. Accordingly, broader issues of system health are increasingly orphaned. As Eades rightly states, the goal would be "to make the system more sensitive to those differences." This complex nature of the research "commons" is what drew us to this challenge. Our hope is that the creative work done thus far by Ostrom and others on governance of shared and complex systems can be built upon for this national security S&T commons to help the nation build and sustain a robust and responsive research enterprise.

Bohr Helped Rescue Danish Jews

The March "This Month in Physics History" *APS News* column on Bohr notes that when "Hitler's army invaded Denmark, Bohr fled with his family to Sweden in a fishing boat." In Sweden, Bohr played a critical role in the rescue of Danish Jews by persuading the Swedish government to issue a declaration by radio in October of 1943 that Sweden would provide sanctuary for Jews fleeing Denmark. As a direct result of Bohr's intervention, the Danish resistance ultimately succeeded in bringing 7,000 Jews to Sweden, rescuing all but 500 who fell into the hands of the Gestapo. Unlike most other European countries, Denmark was one of the very few that saved most of its Jewish population from the Holocaust. As a scion of a well-to-do Danish-Jewish family on his mother's side, Bohr would certainly have well understood the threat to Danish Jews after the Nazi occupation of Denmark in April of 1940.

David Siminovitch
Lethbridge, Alberta

PLAN continued from page 1

and the work of various task forces and committees, and informed by suggestions from unit leadership and APS members.

"One area of concern is to make sure our Society is financially sound and that it has a good foundation," said Robert Byer, President of APS. "[And to] look for new revenue streams outside just journals."

A Development Task Force, headed by APS vice-President, Mac Beasley, is in the process of being formed.

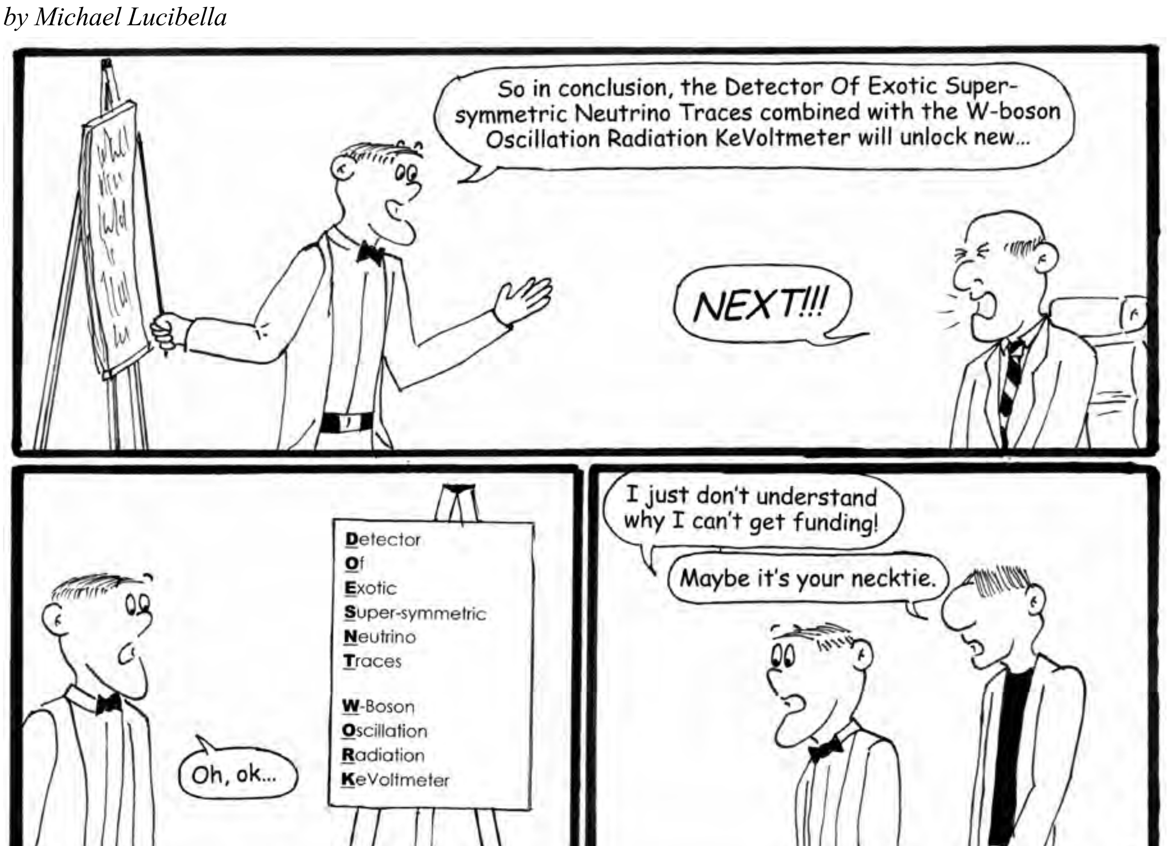
One of the other task forces will look at ways APS can better serve early career physicists including students, postdocs and physicists starting their first job. Also being considered are task forces on "International Engagement" and "Re-imagining Meetings."

A complete version of the plan is being emailed to the membership this month with a link for members to enter comments. All of the input will be read and sent to the leadership in charge of implementing the plan. The plan can also be accessed online directly through the APS website at www.aps.org.

"It's remarkable how engaged the membership of this Society is," Byer said.

zero gravity

by Michael Lucibella



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

The Starting Grants given by the European Research Council (ERC): a tremendous boost to the careers of young scientists

by Michèle Leduc

I am a member of one of the European panels which every year selects the best candidates for an ERC Starting Grant. My panel is focused on fundamental physics; there are nine such panels altogether for the "hard sciences" and two other sets for life science and for humanities. Being a panel member for the ERC Starting Grants implies a great commitment and very intensive work, but it is a highly rewarding job. The reason is that these grants effectively boost the research of the best young scientists in Europe, providing them with appropriate means for meeting international competition in their field.

The ERC program has unique features among all those funded by the European Community for supporting research and innovation. It is fully in the hands of the scientists, with very modest administrative support. It is devoted solely to fundamental research, and all proposals are of the bottom-up sort. There is a call once a year and the proposals are reviewed by a panel of experts who are high-level scientists of different European nationalities. The winners receive an award of order 1.5 million euros, to be spent over the five years of the contract. Allowed costs cover personnel (usually PhD students and postdocs, and even partial or total salary of the Principal Investigator), as well as equipment and other items needed for the project.

The evaluation is based both on the high scientific level of the candidate and on the excellence of his or her project. These two criteria are weighted equally by the panel. Four members of the jury scan each proposal for the selection at the first step. At the second step a restricted number of applicants make an oral presentation in front of the members of the jury, who listen to all the candidates selected for this second round, ask questions for 15 to 20 minutes, and are therefore able to evaluate the degree of maturity of the candidate. About 20 % of the applications are ultimately selected. The number of proposals keeps growing each year; the global funding of this very popular program has been increased several times.

A unique feature of the ERC is that excellence is the only criterion used for the selection. There is no attempt to reach an equilibrium between countries; as a consequence the countries of western Europe benefit much more from the program than do the eastern ones, at least in physics and in "hard sciences" in general. The same university and even the same laboratory is entitled to obtain more than one grant, if they put forward the most deserving proposals. Another rule is that no domain of science is privileged: in the fundamental physics panel, cold atoms or quantum information often receive a higher score than other fields. This fact only reveals that some fields today have a stronger power of attraction than others on the most brilliant minds. Of course one can object that "sexy" subjects are more likely to make it through… true enough, but this is how science makes a move and one has to trust the vision of the young scientists.

A constant subject of worry at ERC is to avoid conflicts of interest. The management of the panels is very strict on this matter: for instance, as a CNRS employer I could not participate in any discussion about French applicants, since all the best French laboratories are affiliated with CNRS: This is perhaps going to an extreme, but it is better than the other way round. Minimizing the spread of ideas is another subject of concern, much more difficult to control and in a way unavoidable. Panel members agree to respect confidentiality and are not supposed to talk to anyone about the proposals that they report on. Their names are not revealed until the end of the selection procedure so as to keep them away from any kind of pressure. I am convinced that at the ERC in Brussels ethical issues are taken very seriously.

Finally, one can lament the fact that there is a low rate of success for women in obtaining ERC Starting Grants. In physics, engineering or mathematics, it is not much better than 15%; however this mainly reflects the low number of proposals submitted by women scientists. I can testify that there is absolutely no discrimination against female applicants by the panel I am in, even if there is not gender equality on the jury panel. The percentage of women taking physics as a research subject is still low. In addition, at ERC the problem raised here clearly results from difficulties that women have to face in reaching the required excellence level: multiplicity of burdens in their private life–children, support of their husband's career, forced mobility, etc. It could also be related to a lack of support in the male-dominated environment of their home laboratory, and perhaps, but more difficult to detect, a lack of self-confidence at equal levels of competence compared to their male colleagues.

In short, whatever the difficulties, the ERC Starting Grant program gives a real boost to research in Europe. Let's hope that the European Community decides to keep on with it in the future.

Michèle Leduc is a physicist at CNRS, and director of the IFRAF Institute for research with cold atoms.

DEVICE continued from page 1

metal detectors on the beach," Lavely said.

The TDEM takes the detection one step farther. Using the multiple coils, the device measures not just the presence of another magnetic field, but also the shape of one as it decays. This is key to identifying whether a buried object might be a dangerous unexploded bomb, or a harmless piece of trash. By analyzing the way the field decays, the device can characterize the buried object's conductivity, shape and size, all important characteristics for identification. The operator of the device can compare the signature of the field picked up by the device to the signatures of known munitions, and make a determination as to what might lie under the surface.

Lavely said that even improvised explosive devices, or IEDs, the scourge of forces in Iraq and Afghanistan, can be picked up by the device.

"IEDs have very well established forms," Lavely said, adding that the downside is that one needs to be close to an object in order to detect it.

Lavely's team has already done tests on dummy mortar rounds with much success. They have also tried the device out on a hollow sphere, but he says that they still need more refinement to better identify if a metal object is hollow, another key characteristic of unexploded bombs.

The device also needs further work to reduce its size. The 25 coils are spread over a wide base, making it impractical for forests and other constricted environments.

CASIMIR continued from page 2

ponents to stick together. Separate the metallic plates at just 10 nanometers, for example, and the force of the sticking effect will be on a par with roughly 1 atmosphere of pressure. So dealing with the Casimir effect is essential to further technological progress at the nanoscale.

Researchers at the University of St. Andrews have suggested that it may be possible to manipulate the Casimir effect so that the "stickiness" becomes a repulsive force instead, simply by placing a specially designed lens between two objects. This would mean that, instead of sticking together, micromachined parts could levitate instead, solving the friction problem.

Nobel Laureates Fill Plenary Session

Photo by Michael Lucibella

The speakers at one of the plenary sessions at the APS April Meeting were all Nobel laureates. 2011 laureate Saul Perlmutter of UC Berkeley (right) spoke about the work of his collaboration, the Supernova Cosmology Project, in discovering the acceleration of the expansion of the universe. He was followed by Adam Riess of The Johns Hopkins University (left), also a 2011 laureate, who described the work of the High-z Supernova Search Team in their independent discovery of the acceleration. The third speaker was 2004 laureate Frank Wilczek of MIT (center), who talked about the current status of the Higgs particle and its relationship to supersymmetry.

The Physics of Creepy Crawlies and Ravenous Plants

By Michael Lucibella

For those attending the APS March Meeting in Boston, it might have seemed like Halloween came early this year. Scientists at the meeting presented work on the physics of a menagerie of things that go bump in the night, including the silk of spiders, the slither of snakes and the bite of a Venus flytrap.

The Amazing Spider-Materials

Spider silk is an amazing substance, stronger than steel and more stretchy than rubber. Scientists at the March Meeting reported on its electrical properties, which had never been previously investigated.

Eden Steven from the National High Magnetic Field Laboratory in Tallahassee found that spider silk can be used to make very small flexible wires. When nanoparticles of gold and carbon adhere to spider silk, they maintain their electrical conductivity, while at the same time the silk keeps its mechanical properties.

"To our surprise, gold really likes spider silk," Steven said.

Tiny wires of gold on their own are rigid, which is not ideal for making wires. However gold-coated spider silk wires are flexible, stretchy and could be used to make flexible electronics.

Unlike silk from silkworms, spider silk is difficult to harvest. Spiders cannot be kept in close proximity as they are prone to attack each other. The only way to industrialize this application is to start synthesizing artificial spider silk, a long sought after Holy Grail of materials physics. Peggy Cebe of Tufts University has made a significant first step towards that goal by synthesizing polymers based on the silk of the golden orb weaver spider.

The polymers she and her team synthesized are very short; she described the length of the molecules they produced as "barely a polymer." At its basic level, however, the molecules are the same. The longest molecules they have been able to produce are about 13,000 atomic mass units, while the polymers that make up spider silk are hundreds of thousands of amus.

"We're trying to scale up to make longer molecules," Cebe said. "We're working towards that, but the synthesis … becomes more difficult."

The polymers that the team has developed so far can be used to make microscopic hollow nodules that could be used for drug delivery.

Snakes on a Plane

Snakes are skilled climbers and researchers at the meeting unveiled a new aspect of their abilities. Hamidreza Marvi and his team from Georgia Institute of Technology found that snakes can toggle the scales on their belly between being grippy or slippy depending on whether they need to climb a tree or slide quickly across a surface.

"Snakes can actually change their frictional properties," Marvi said. "Snakes can modify their scale's angles of attack to change their frictional coefficients."

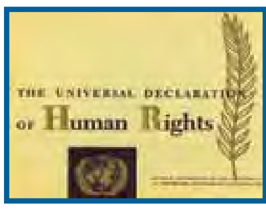
There are several factors that affect the snake's ability to slide around. Biologists had already identified tiny microstructures on the surface of each belly scale. The structures are directional, designed to grip the ground and prevent a snake from sliding backwards. Physicists found that there has to be another aspect that a snake can consciously control as well.

They put live snakes on slippery inclined planes and measured the angle at which the snake loses traction and slides down. The team first tried the experiment with a fully conscious snake, then again with one that had been knocked out with isoflurane. Sleeping snakes slid down at much lower angles than fully alert ones, showing there must be some way the snake is controlling its friction.

"When the snake is conscious, it can get a sense, feedback…and adjust accordingly," Marvi said.

There is a ventral muscle that runs down the length of the snake's belly that can make its scales stand on end. The researchers found that a change of just 5

CRAWLIES continued on page 7



APS Committee on International Freedom of Scientists

CIFS Briefs: Highlighting the Connection Between Human Rights and Science for the Physics Community

Since its creation in 1980, the APS Committee on International Freedom of Scientists (CIFS) has advocated for and defended the rights of scientists around the globe. As an APS standing committee, CIFS is charged with advising the APS leadership about "problems encountered by scientists in the pursuit of their scientific interests or in effecting satisfactory communication with other scientists." In this column, CIFS describes some of the issues that the Committee is monitoring as well as the Society's other human rights activities.

Loss of Physicist and Human Rights Dissident Fang Lizhi

On April 6, the physics community lost a great scientist and human rights advocate (see article on this page). In 1994, Fang chaired the APS Committee on International Freedom of Scientists. He also was awarded the Society's Dwight Nicholson Medal for Human Outreach in 1996 in recognition of his efforts to promote human rights and democracy in China. In 2010 he was elected a Fellow of the APS.

Trial of Physicist Adlène Hicheur

In October 2009, Adlène Hicheur was arrested by French authorities after having exchanges with an alleged member of al-Qaida in the Islamic Maghreb. He was detained in prison for over two years without being formally charged with a crime. A two-day trial was held in March, accusing him of plotting terrorist attacks. A verdict will be announced on May 4.

Imprisonment of APS Member

APS member Omid Kokabee has been in jail in Iran since early 2011. A graduate student pursuing a degree in optics at the University of Texas at Austin, Kokabee was arrested during a trip home to Iran to visit with family. He has been accused of "communicating with a hostile government" and "illegal earnings," presumably in connection with his studies in the United States. As of April, his trial had been postponed on three occasions and it was unclear when he would be tried. Read more about Kokabee in the August/September and October 2011 issues of *APS News.*

Omid Kokabee

Mulugeta Bekele

Richard Wilson

AAAS Science and Human Rights Coalition

APS has been a member of the AAAS Science and Human Rights Coalition since the coalition was established in January 2009. The Coalition is a network of scientific associations and societies as well as individual scientists that recognizes the important role that science has to play in the realization of human rights. It aims to enhance communication on human rights not only within the scientific community, but also between the human rights and scientific communities. One component of the Coalition in which CIFS is active is the Working Group on the Welfare of Scientists, which is dedicated to increasing the effectiveness of scientific organizations in protecting and defending the rights of scientists under threat.

Andrei Sakharov Prize

Mulugeta Bekele and Richard Wilson–the 2012 recipients of the APS's Andrei Sakharov Prize–were honored during a session organized by the Forum on International Physics (FIP) and the Division of Physics of Beams (DPB) at the APS March Meeting in Boston. The Prize "recognize[s] outstanding leadership and/or achievements of scientists in upholding human rights."

View the presentations from the session on the March Meeting website at: http://meetings.aps.org/Meeting/MAR12/sessionindex2/?SessionEventID=162559.

ROOTS continued from page 3

ial force (straight along the length of the root) by placing some type of scale directly beneath it. Measuring the force exerted by plant roots moving between grains poses more of a challenge. Kolb and her colleagues are preparing a paper for publication that, she says, mostly demonstrates the effectiveness of the technique for continuously measuring the forces developed by growing roots, in situ.

The technique utilizes a method called photoelasticity, which is familiar to many granular materials physicists. Photoelastic disks, 9 millimeters in diameter, act as 2-dimensional grains that a plant root might encounter in sandy soil. If one tries squeezing one of the disks while viewing it through crossed polarizers, the disk is suddenly covered in fringes of light, which move and change as a result of the force they experience. Similarly, young chickpea roots sprout and find their way to a narrow gap between two photoelastic disks, and as the roots try to pass through the opening, they exert a force, and create a visual fringe pattern. Analysis of those fringes using a computer program yields a determination of the force. Eventually, the studies will shed light on how mechanical forces in granular soils impact the growth of roots, as well as how the roots couple with the soil and deform it.

Soil and plant science has much to gain from physics, but the reverse is true as well. At the March Meeting Dawn Wendell, a mechanical engineering postdoc now working at the CNRS/Saint-Gobain Aubervilliers in France, discussed her graduate research at MIT on how to make mechanical diggers, inspired by plant roots, that can penetrate granular soils.

Using a photoelastic disk system, complementary to Kolb's, Wendell studied how well young plant roots moved through granular spaces.. When the plant roots couldn't force their way in between the disks, they would deviate to a different path. A stiff, inflexible root won't make it very far. The same seems to be true of mechanical diggers: flexible diggers succeed at making their way through sandy soil, and potentially through other granular environments like layers of rubble. In her graduate research Wendell also found that flexible diggers also save up to twice as much energy finding their way. That will be important for robots attempting to use these types of diggers in extreme environments, like disaster areas covered in rubble, areas prone to avalanche, or sandy frontiers like the bottom of the ocean. But diggers with too much flexibility will buckle in tight situations. The challenge now, said Wendell at a press conference, is finding the right degree of flexibility for a particular environment.

Wendell is a mechanical engineer, Hartmann is a soil scientist and Kolb is a physicist. No single field has all the answers to these questions. Instead it is the combined expertise that leads to the greatest progress; and, as Wendell says, flexibility is key.

Ode to an Astrophysicist: Fang Lizhi, 1936-2012

By Alaina G. Levine

Photo by Jacqueline Gerjuoy

Fang Lizhi (left) in Beijing in 1988, with Edward Gerjuoy of the University of Pittsburgh.

On April 6, 2012, Fang Lizhi, a prominent astrophysicist and Chinese dissident, passed away in Tucson, AZ. He was 76.

Fang had been a professor of physics and astronomy at the University of Arizona (UA) for 20 years. He was well known for his work in cosmology, but perhaps even more recognized for his advocacy of government changes in China. His outspoken activism contributed to the student revolt and protests in Tiananmen Square that resulted in a massacre which left the whole world riveted.

After Tiananmen on June 4, 1989, he and his family found sanctuary at the US Embassy in Beijing. By 1990, he was able to leave the country, stopping for a short time at the University of Cambridge and Princeton University, before settling at the UA.

Fang was my first research advisor and mentor, and influenced my career like no other person. In fact, it was Fang's decision to leave Princeton to head west, which ultimately solidified my choice to attend the UA for undergraduate studies.

In 1992, I was living in West Windsor, NJ, a stone's throw from Princeton, getting ready to graduate from high school. I was certain I wanted to be an astrophysicist but was unsure about where I wanted to go to school. I had narrowed it down to three selections, including the UA. But one day that winter, my mother brought home the local paper. When we casually glanced through it we noticed a tiny speck of an article announcing that Fang Lizhi, a world-famous astrophysicist, was leaving Princeton to become a professor at the UA. Living in Tiger Country, we couldn't get over the fact that someone so distinguished would trade in the Ivy for cactus. But that sealed the deal. The next day, I signed the papers to confirm I would attend the UA.

When I got to campus that fall, I felt somewhat intimidated by the idea of knocking on this internationally known scientist's door. But a few days later, I visited the UA Honors Program's offices and was flipping through a book of faculty who had volunteered to be mentors to honors students. Fang's name leaped off the page. Now I had an excuse to email him–I could ask him to be my mentor. When I contacted him, he was so friendly and personable and insisted I come by his office as soon as possible. And when I told him that I pined to be an astrophysicist, and had come to the UA because he was there, and really wanted to work with him, he smiled and graciously offered me a chance of a lifetime: he invited me to work with him AND he happily arranged for me to get a NASA Space Grant to pay for my research. I wasn't old enough to vote, but suddenly I was collaborating with an international superstar, analyzing Lyman-alpha cloud and quasar data, in a quest to unlock the mysteries of the universe's birth.

I continued working with Fang throughout my first year and into my second, even after I switched my major from physics to mathematics. He supported me, and after I graduated, and began my career as director of communications in the UA Physics Department, he served as a source of inspiration. Even though I didn't become an astrophysicist, Fang's mentorship made a world of difference to me. He taught me to be fearless in my career, to always ask questions, and to look beyond the obvious for answers. Fang was an architect of a revolt that changed the course of China, but to me he was the architect of a revolt that changed my career in innumerable positive ways. I miss him already.

Alaina G. Levine is a science writer and President of Quantum Success Solutions, a science careers and professional development consulting enterprise. She can be contacted through www.alainalevine.com.

MEMBERS continued from page 2

lywood's not far away!' I had an encouraging experience with a screenplay so I decided to take a chance."

***Leonard Mlodinow**, Caltech, on being a science consultant for Hollywood in the late '80s and early '90s,* The Los Angeles Times, *April 14, 2012.*

"In fact, he was sneezing while approaching the stop sign. As a result he involuntary pushed the brakes very hard. Therefore we can assume that the deceleration was close to maximum possible for a car."

***Dmitri Krioukov,** University of California, San Diego, quoted from his paper which used physics to argue out of getting a speeding ticket,* NPR.org, *April 16, 2012.*

ANNOUNCEMENTS

Senior Editor
Physical Review E

The American Physical Society is conducting an international search for a successor to the current Editor of *Physical Review E (PRE)*. The position is that of the senior Editor of the journal, responsible for editorial standards, policies and direction of the journal, and leadership of the staff of about 15 editors. *Physical Review E* is a large multidisciplinary journal specializing in statistical, nonlinear, and soft matter physics.

The ideal candidate should possess many of the following qualifications: stature in a field of research within the scope of *PRE*; stature in the *PRE* 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. 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 July 2012. 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 June 2012 to: K. Sreenivasan, PRE Search Committee Chair, edsearch@aps.org

Reviews of Modern Physics

Cold and trapped metastable noble gases

Wim Vassen, Claude Cohen-Tannoudji, Michele Leduc, Denis Boiron, Christoph I. Westbrook, Andrew Truscott, Ken Baldwin, Gerhard Birkl, Pablo Cancio and Marek Trippenbach

Cold atomic gases have numerous applications, ranging from matter-wave interferometry to many-body physics. Atoms from the noble gas family play a special role in this research. Indeed each atom must be prepared in a metastable electronic state in order to be manipulated by laser light, and it thus carries a large internal energy. This article surveys the specific properties of these metastable noble gases, such as their unique collision dynamics. The relevance of these gases for metrology is also discussed.

▶ **http://rmp.aps.org/abstract/RMP/v84/i1/p175_1**

http://rmp.aps.org

Distinguished Traveling Lecturer Program
IN LASER SCIENCE

The Division of Laser Sciences (DLS) of the American Physical Society announces its lecture program in Laser Science, and invites applications from schools to host a lecturer in 2012/2013. Lecturers will visit selected academic institutions for two days, during which time they will give a public lecture open to the entire academic community and meet informally with students and faculty. They may also give guest lectures in classes related to Laser Science. The purpose of the program is to bring distinguished scientists to colleges and universities in order to convey the excitement of Laser Science to undergraduate students.

The DLS will cover the travel expenses and honorarium of the lecturer. The host institution will be responsible only for the local expenses of the lecturer and for advertising the public lecture. Awards to host institutions will be made by the selection committee after consulting with the lecturers. Priority will be given to those predominantly undergraduate institutions that do not have extensive resources for similar programs.

Applications should be sent to the DTL committee Chair Rainer Grobe(grobe@ilstu.edu) and to the DLS Secretary-Treasurer Anne MyersKelley (amkelley@ucmerced.edu). The deadline for application forvisits in Fall 2012 is May 30.

Detailed information about the program and the application procedure is available on the DLS-DTL home page:

http://physics.sdsu.edu/~anderson/DTL/

Lecturers for 2012/2013:

Laurie Butler, University of Chicago
Hui Cao, Yale University
Eric Cornell, University of Colorado
Jim Kafka, Spectra Physics
Fleming Krim, University of Wisconsin
Christopher Monroe, University of Maryland
Luis A. Orozco, University of Maryland
Carlos Stroud, University of Rochester
Ron Walsworth, Harvard University

METHODS continued from page 1

looked vaguely like shots of the night sky: speckles of light scattered against a dark blue background–a vast frontier to be explored. In this case, those bits of light are fluorescent markers attached to a particular type of biomarker called CCR7 that appears on the surface of breast cancer cells. CCR7 is of particular interest to cancer researchers because its high expression is associated with lower survival rates among patients. Sohn and her group are the first to attempt to map the spatial distribution of those markers on the surface of breast cancer cells.

To individually image the receptors, Sohn and her group used a technique called STORM (stochastic optical reconstruction microscopy), developed by a group at Harvard led by Xiaowei Zhuang. STORM allows the user to stack images of the same sample area, and reconstruct them into a 2-D or 3-D image with nanoscale resolution. In Sohn's research this means looking at individual biomarkers to study their distribution. Now Sohn and her group will grow breast cancer cells in different microenvironments. The group would like to find out how mechanical forces and chemical cues change the spatial distribution of markers like CCR7, and eventually understand how their presence is linked to patient survival rates.

"Right now we have no idea what the spatial resolution will tell us, because no one's had the opportunity to do this," said Sohn in an interview. "But I think it's going to tell us something; I think you should check back with me in a month."

Sohn did her PhD work at Harvard working on superconductivity. She says her background and her training have proved valuable as she pursues the grand challenge of fighting cancer.

"What I've always brought with me when I've been working in the bio arena is the techniques that we use," she said. "Whether it is actually doing lithography, making devices, to actually how we take measurements. And I think what we're bringing in is a very quantitative technique, quantitative way of looking at things. In the end, the biologists still know how to do it best, but physicists bring new and innovative things to the table."

Sohn is an applied physicist, tackling cancer from the laboratory. Krastan Blagoev is a theoretical physicist working on cancer via the clinic.

Blagoev is director of the Physics of Living Systems program at NSF. According to the program website, the Physics of Living Systems supports research with a focus on "understanding basic physical principles that underlie biological function." He is also a theoretical condensed matter physicist by training. In a press conference at the March Meeting Blagoev, speaking as an individual, argued that theoretical physicists can not only be helpful, but might even be necessary to unearth the driving forces behind cancerous tumor growth.

Blagoev and colleague Tito Fojo, a medical oncologist in the Center for Cancer Research at the NCI, are analyzing data from clinical trials in oncology in order to study tumor growth. Most clinical data shows tumors under the influence of trial drugs, but when tumor cells become resistant to a drug, normal tumor growth may begin again. These growth rates are recorded in the data until the patient is removed from the trial. That window of natural growth rate provides the data Blagoev and Fojo want to study.

The growth rate of tumors depends on the characteristics of cancer stem cells (although whether or not these cancer cells are technically stem cells is still not clear). A linear rate of tumor growth would suggest that cancer "stem cells" share characteristics with adult stem cells, which divide into a single stem cell and a second progenitor cell that produces only a few generations of daughter cells before dying off. Exponential tumor growth suggests that the cancer cells are dividing more like embryonic stem cells, into two new cells that survive long-term and continue to divide. The indication–a faster rate of tumor cell production–is grim. It is these "dividing cancer cells" as Blagoev labels them, which would need to be targeted with new therapies.

The next step in evaluating this theory is to show that this exponential growth occurs across all patients. Blagoev says he has found a technique to rescale patient data into a single analysis. He is preparing his results for publication.

Theoretical physicists specialize in the analysis of complex systems, and can provide unprecedented expertise in data analysis. Blagoev also believes that because of the complexity of cancer–the incredible variety of cells that can arise even in a single patient–that a physics approach might help identify more fundamental drivers behind cancer behavior.

"This idea of creating simple theories is the essence of physics," said Blagoev. "I think that what physics can bring here is to try and find common things rather than the differences between different cancers. We sort of have to forget about the details and look at the forest."

Now Blagoev wants to start a program to bring theoretical physicists interested in cancer research together with clinical cancer researchers and oncologists, to share ideas and develop project proposals. Blagoev says he is waiting to find a mechanism to make the program a reality.

"It seems to me, based on my experience and what I know of the work of others, that there is a big need for theoretical physicists to enter the labs of clinical oncologists to work with them, and look at the data that's never been published but that's available in their labs. We're looking for people who would be interested to come for 5 or 6 days and actually spend 8 to 10 hours a day working with colleagues from the other field to develop ideas," said Blagoev. "In my experience, when clinical oncologists work with theoretical physicists I think they understand the power of quantitative thinking in terms of simple models. And they see the value this can have to cancer research."

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degrees can affect the snake's frictional coefficient by up to 50 percent. When climbing, a snake's scales stand on end and dig into whatever surface it's trying to scramble up. However when it needs to slip quickly across a plane, it pulls its scales parallel to its body to reduce friction.

Little Slap-Bracelet of Horrors

The chomp of a Venus flytrap is surely one of the most terrifying spectacles in the plant kingdom. New research into their infamous bite indicates that they might have a lot in common with popular toy jewelry from the 1980s.

"There could be these slap-bracelet type bi-stable structures embedded in the hinge," said Zi Chen from the Washington University of Saint Louis. "We think the hinge is something that most people haven't been paying attention to because most studies focus on the change of shape of the leaves."

Slap-bracelets work because embedded in them, are thin sheets of stainless steel that act as springs. When the bracelets are unrolled, tension is built up in the spring, and it develops a slight negative curvature. When the bracelet is slapped against someone's wrist, it releases the spring causing the bracelet to curl. Chen and his colleagues showed that the quick chomp of the flytrap comes from a similar spring-like structure that holds the leaves that make up the jaws of the flytrap.

"The hinge starts as a straight rod and then, as it grows and opens, the hinge slightly develops this negative curvature shape," Chen said.

They tested this by taking high speed film of flytraps chomping down on insects, and observing how the hinge deformed. A flytrap is set off when small sensor hairs on the inside of its jaws are prodded twice by unsuspecting prey. The team was also able to get the trap to engage by poking the hinge with a needle, causing its spring to release and the trap to shut.

"It's amazing to think that nature has figured out this complicated mechanism millions of years ago, to couple these dramatically different bi-stable behaviors in one species to function," Chen said.

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Emergent Physics at the Mesoscale

Report from the special Kavli Session at the 2012 APS March Meeting

by Sam Bader

This year the APS March Meeting put a focus on the Meso realm, featuring a special session devoted to the topic. The session was special for many reasons. First, it was made possible by the generous support of the Kavli Foundation. It was arranged with a plenary flavor in that a number of other invited symposia that might have competed for an audience were moved to other time slots. The largest ballroom on the top level of the Boston Convention Center was used for this event alone, providing seating for over 2,000. Most importantly, the event was special because of the outstanding presenters who participated, and the atmosphere that they created. This report provides an overview of the session and what the topic of Meso can motivate in the future.

In 2011, the Kavli Foundation underwrote special superconductivity centennial sessions, a pure love-fest for the March Meeting, hailing a history of accomplishments that took us back to the laboratory of Kammerlingh Onnes, while also bringing us into the future with the recent mysteries of the pnictide materials. The 2012 special session was different. It took us a bit away from our comfort zone to occupy new space by thinking Meso. In 2012 we could have celebrated 50 years of the Josephson junction, or 25 years after the Woodstock of Physics that occurred at the 1987 March Meeting where the discovery of cuprate superconductivity unfolded in real time in an all-night session where new results were being called in, and graphs were faxed in only minutes before being presented. But superconductivity was covered in 2011, so 2012 seemed the right time to stretch, to renew our field, and think broadly and strategically of the new horizons ahead that Meso might represent.

Meso denotes the middle, thus it was appropriate for the session to be held in the middle of the March Meeting, on Wednesday, February 29th. APS Executive Officer Kate Kirby moderated the session, introducing the distinguished speakers in turn, but first making history with the memorable statement that, unlike the nanometer (for the nanoscale), "there is no mesometer." Mesoscale is, in other words, not a length scale, nor is it a time scale. What is it? It's any physical realm between endpoints, such as the transitional realm between micro and macro scales, between quantum and classical, between biomolecular components and living structures. It has enough of an elusive quality to it that it might just become a new way to capture our essence.

Bob Laughlin regales the audience with tales of "Mesoscopic Lawlessness".

The official title of the session was "Emergent Physics at the Mesoscale," its purpose to initiate a dialogue to define scientific opportunities at the Mesoscale for the next decade. A goal was to reinvent Meso science and to create an engaging narrative to inspire the next generation of researchers, much as Nano did this past decade. The organizers also hoped to energize science policy makers, our sponsors, and an enlightened public as to the deep and intriguing questions posed by Mesoscale science. We hoped to embrace opportunities that are theoretical, computational and experimental, basic and applied, and that span the areas of condensed matter, complex functional materials, quantum information science, and biological, chemical and medical physics, including soft-matter self-assembly. Examples of seminal questions include: are there as yet undiscovered rules that govern mesoscale phenomena? On the road from Nano to Macro, what challenges does the mesoscale pose? What new scientific tools and facilities are needed to explore the Meso realm? How can mastering the Meso realm benefit society at large?

Those approached to speak were mostly stunned for one reason or another, and hesitant, not realizing that they were engaged in mesoscale science, or finding it verging on sacrilege that their science would be presented under a banner that invokes Emergence. But all agreed to participate despite their various disavowals. Bob Laughlin of Stanford was the first speaker. He described and embraced the concepts of Emergence and the Middle Way with great eloquence and humor. As the person who literally wrote the book on Emergence, and thus, the need to realize that there are organizational principles on every scale, he defined Meso in an all-encompassing way that reached out to include much of nano, bio, and correlated electron physics. Individual nano objects interact giving rise to new behavior. Biomolecules form into organelles and then organize into cellular structures. Correlated electron systems undergo various collective condensations with characteristic correlation lengths that generally are neither on the atomic nor macroscale. Laughlin made it clear that to embrace the concept of Emergence implies leaving reductionism behind. His presentation totally captivated a full house.

Yet, is it really possible that our diverse community could speak with one tongue, could gather under a single banner, much like the particle physicists who, in lockstep, tout the quest for the God particle? Not so fast…Reality soon set in as Bill Phillips of NIST took the podium. He approached his task as a boxer would enter the ring, first climbing through the (imaginary) ropes of the arena, then warming up (his laptop) as he was introduced. He made short shrift of the concept of emergence, discarding it mercilessly, and with it our hopes of unity. He presented his elegant experimental work on ultra-cold trapped atomic gases, simple ingredients that display complex and unexpected collective behaviors. But, wait… are these not perfect examples of Emergent behavior on the Mesoscale? Of course they are. But as two towering giants of physics, Laughlin and Phillips, Nobelists separated in their award dates by a mere year, disagreed profoundly, their audience was left suspended, unable to adopt a single voice. Simple ingredients–two speakers–and already those who gathered witnessed a fundamental aspect of Emergence, the inability, the impossibility of control.

How to proceed? I think back to the early days of Nano, and how physicists greeted it with a thud because we had been engaging in atomic scale research for the past thirty years at least. Atomic scale certainly transcended Nano. What was the big deal about Nano? But the funds appeared, and no one even remembers now what an Ångstrom is. Nanotechnology is written about regularly in magazines, and there are even commercial products, such as clothing, that bandy around the name Nano.

Angela Belcher of MIT was the next speaker. Avoiding the philosophical duel, she mesmerized the audience with the wonders of virus-assisted self-organization. The slender, cigar shaped M13 bacteriophage was her favorite. She was too busy, rushing to create new composite materials with energy applications in the real world, to be slowed down by polemics. She painted a picture on a broad canvas of a dazzling array of bio-inorganic material opportunities that await exploration. Is it possible that a spokesperson for the Nano realm could so seamlessly transition to the Meso realm? Angela Belcher showed that it is not only possible, it can readily become fashionable to do so, without sacrifice, without letting go of Nano. Belcher is a fiery speaker, delivering in a fast paced cadence. But the effect was to calm rather than stir the audience. The storm had passed. Belcher ushered in the pure sense of fulfillment and joy of discovery, irrespective of didactic labels.

Bill Bialek of Princeton then took the stage to universal acclaim, demonstrating the integral relationship between experiment, theory and simulation. His message was one of forgiveness. He was not on a quest for the ultimate path to the truth. Even imperfect theories and assumptions can ultimately lead to proper descriptions, because the laws of nature are strong attractors. As a theoretical biophysicist he could take rigorous but minimalist approaches to complex problems and yield delightful insights because he made sure never to stray far from experiment. Thus, his feet are grounded in reality, but his head could still be peering up into the clouds, dreaming of order in the biosphere, due to the action of messenger RNA.

Following the clear and steady message of reason of Bill Bialek, George Whitesides of Harvard rushed in from teaching his large undergraduate class to arrive just on time to present his talk and wrap the session into a tidy bundle. He took the biochemical molecules that Bialek treated via equations and algorithms and put them in multiple settings, discussing their non-equilibrium thermodynamics, the role of entropy, of molecular recognition, of the downfall of the familiar lock-and-key model and of binary approaches in general. He stressed the complexity over the simplicity that Bialek found. He highlighted the role of new tools to open new doors in order to effect scientific revolutions. He covered an enormous stretch of territory, reaching back to reinforce points that Bob Laughlin made earlier about simple laws of Newtonian physics, as well as the unpredictability and surprises that science presents and that fans the flames of our passion for our field.

Regardless of one's interests, hard matter or soft matter, experiment, theory or computation, there is the possibility to reinvent ourselves through the new scientific paths we pursue.

All in all it was one heady experience. But it wasn't over when it was over. The Kavli session was followed by another session that was billed as a Town Hall meeting. At this satellite-type event the role and future of mesoscale science was discussed informally in order to help funding agencies (specifically the Office of Science at DOE) to decipher the opportunities and promise of Meso. A website is available to obtain input from the community: www.meso2012.com Regardless of your interests, hard matter or soft matter, experiment, theory or computational science, there is the possibility to reinvent ourselves through the new scientific paths we pursue. There is the opportunity to open new sources of research funding if the narrative is sufficiently engaging. Although as a community we do not, and perhaps don't even aspire to talk with a single voice, our many voices, heard on February 29th, can enable us to leap to new heights.

In closing it is important to thank all of those who contributed to the success of the experience, most notably the speakers, the Kavli Foundation, and the folks at the American Physical Society. The unit organizers of the March Meeting provided input and suggestions that guided the creation of the program. Special thanks go to Barbara Jones of IBM, 2012 Program Chair for the Division of Condensed Matter Physics (DCMP), who worked tirelessly to help bring the special session to fruition. Nandini Trivedi of Ohio State, a member of the DCMP Executive Committee, is credited with recommending the session title, "Emergent Physics at the Mesoscale." The APS and the physics community are extremely grateful to the Kavli Foundation for its generous support of a special session at the March Meeting for a second year in a row.

Sam Bader, Argonne National Laboratory, was 2012 Program Chair of the APS March Meeting, and Chair (now Past Chair) of the Division of Condensed Matter Physics.