APS NEWS

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

January 2007
Volume 16, No. 1
www.aps.org/publications/apsnews

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Particle Physicists Meet Halfway

Photo by Kay Kinoshita

The APS Division of Particles and Fields held a joint meeting with their colleagues from the Japanese Physical Society in Honolulu. The meeting, which ran from October 29 to November 3, was styled the Joint Meeting of Pacific Region Particle Physics Communities, with about 650 attendees, from not only the US and Japan but other Pacific Rim nations such as China, Korea, Canada and Taiwan. Shown here enjoying a moment of Hawaii sunshine on Waikiki beach are Junko Shigemitsu (Ohio State), Mavourneen Wilcox (U. of Hawaii), Hirokazu Ishino (Tokyo Institute of Technology), and Wei Wang (Boston University).

Task Force Suggests Enhancements for the APS April Meeting

The Task Force on the Future of the April Meeting reported to the Council at its November meeting. It had been constituted a year earlier to "examine the goals and outcomes of the April meeting from the point of view of its various constituencies." The charge to the task force allowed it to "suggest enhancements, changes in the structure of the meeting, or even termination of the meeting." In its report, the task force recommended that the April Meeting should continue, but could be enhanced with a new name and some highlighted themes.

The April Meeting, which covers particle physics, nuclear physics, astrophysics and related fields, plays a "unifying role for the physics community, and provides a valuable forum for the interplay between physics and society," says the task force report. Nonetheless, the task force members believe the meeting could benefit from greater coherence and could "serve more effectively as a celebration of our science and as an occasion to explore common interests with other scientific organizations."

The April Meeting serves several different purposes, said task force chair Chris Quigg of Fermilab. "For many physicists, it's the excellent scientific program that attracts them. People also appreciate the broader plenary talks, physics and society talks, education and outreach activities, and a sense of coherence that couldn't be had any other way."

The task force made several recommendations intended to raise the profile of the meeting and increase participation. While recommending that APS continue to sponsor a yearly meeting organized by the units traditionally associated with the April meeting, they propose giving the meeting a new title that evokes the main scientific motifs, such as "A Universe of Physics."

In addition, the task force recommends that each year, the program should identify a small number of themes. The themes will describe topics to be treated in depth, though the meeting as a whole would continue to cover the same diversity of topics. The task force believes that defining some key topics in advance would give potential participants an additional incentive to attend. They also note the success of the nine plenary lectures, and recommend giving them more emphasis in pre-meeting publicity.

The task force also recommends exploring opportunities for joint meetings with other societies, such as AAS, AAPT, AAPM, public policy organizations, divisional meetings, and IEEE divisions, and the occasional participation of APS units other than those traditionally represented at the April meeting.

They also want to encourage unit program organizers to experiment with different types of sessions. For instance, some units may want to try holding poster sessions instead of ten minute talks or creating themed mini-conferences within the meeting. "The hope is that by encouraging people to look at different ways of using this meeting we can make it better and more coherent," said Quigg.

As for location and scheduling of

TASK FORCE continued on page 5

Jacksonville Hosts 2007 April Meeting

The 2007 APS April Meeting will be held April 14-17 in sunny Jacksonville, Florida. The scientific program, which focuses on astrophysics, particle physics, nuclear physics, and related fields, will consist of three plenary sessions, approximately 75 invited sessions, more than 100 contributed sessions, and poster sessions.

Among the invited sessions will be a special Nobel Prize session at which both of this year's laureates, John Mather and George Smoot, will speak.

APS units represented at the meeting include the Divisions of Astrophysics, Nuclear Physics, Particles and Fields, Physics of Beams, Plasma Physics, and Computational Physics; the Forums on Education, Physics and Society, International Affairs, History of Physics, and Graduate Student Affairs; and the Topical Groups on Few-Body Systems, Precision Measurement and Fundamental Constants, Gravitation, Plasma Astrophysics, and Hadronic Physics.

In addition to the regular program, there will be a professional development workshop for women physicists, a high school teachers' day, a students lunch with the experts, and the presentation of several APS prizes and awards in a special ceremonial session. A public lecture, on the physics of NASCAR, will be given by Diandra Leslie-Pelecky of the University of Nebraska.

Further details of the program, and registration information, are available online at http://www.aps.org/meetings/april/index.cfm. The abstract submission deadline is January 12; post-deadline abstracts received by February 5 will be assigned as poster presentations. Early registration closes on February 23.

April Meeting Plenary Talks

Saturday, April 14

• *First Results from Gravity Probe B,* **Francis Everitt**, Stanford University

• *Two-Dimensional Electron Systems*, **Allan MacDonald**, University of Texas at Austin

• *New Measurement of the Electron Magnetic Moment and the Fine Structure Constant*, **Gerald Gabrielse,** Harvard University

Monday, April 16

• *Cosmology After WMAP*, **David Spergel**, Princeton University

• *The Energy Problem: What Can Physicists Do?*, **Steven Chu**, Lawrence Berkeley National Laboratory

• *String Theory, Branes, and if You Wish, the Anthropic Principle*, **Shamit Kachru**, Stanford University

Tuesday, April 17

• *The 21-cm Background: A Probe of Reionization and the Dark Ages*, **Jacqueline Hewitt**, Massachusetts Institute of Technology

• *The Threat to the Planet: Actions Needed to Avert Dangerous Climate Change,* **James E. Hansen**, NASA

• *New Results from RHIC on the Spin Structure of Proton*, **Steven Vigdor**, Indiana University

New Investments Needed in Defense Research, Says Task Force on Innovation Report

Increased support for defense basic research is needed for national security and economic competitiveness, says the Task Force on the Future of American Innovation in a report released in November.

The report, entitled *Measuring the Moment: Innovation, National Security, and Economic Competitiveness*, is a follow-up to the Task Force's February 2005 report, which presented benchmarks showing that the United States is in danger of losing its competitiveness in science and engineering. The new report shows that many of those trends continue.

At the November 16 report release event in Washington, the Task Force and several national security experts called for increasing defense basic research in particular. Defense basic research is central to both economic and national security, but federal spending on defense basic research has remained flat for over three decades, the Task Force says.

The Task Force on the Future of American Innovation is a coalition of businesses and business organizations, scientific societies, and higher education associations, including the APS. The task force advocates increased federal support for research in the physical sciences and engineering.

"Breakthroughs in basic science–such as those in radar, lasers, optics and microelectronics–have played a major role in establishing and maintaining our military superiority. To help American troops retain their advantage on the battlefield in the future, it is critical that new investments be made today in areas such as energy storage, materials research, nanotechnology and high-performance computing," says the report.

The Task Force calls for the administration to include defense basic research in the American Competitiveness Initiative. The American Competitiveness Initiative would double, over 10 years, the federal funding for basic research at NSF, DOE's Office of Science, and NIST.

Speaking at the November 16

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They liked it! They really liked it!

Photo by Ken Cole

Albert Einstein (aka Marc Spiegel) and Chris Andersen have every reason to get excited. Spiegel starred in, and Andersen directed, a 14-minute APS-produced video,"Einstein's Miracle Year," that was distributed to thousands of middle-school classrooms in 2005 and 2006. The video was awarded a coveted CINE Golden Eagle award (clutched in Spiegel's right hand) in the non-telecast children's entertainment and education category in the Spring 2006 competition. APS originally produced the video to accompany the PhysicsQuest project kits during the World Year of Physics, but the video proved so popular that copies were distributed independently the following year as well. Other recipients of CINE Golden Eagles in past years have included Steven Spielberg, George Lucas, Martin Scorsese, and Ken Burns.

Members in the Media

"You can fit a million of these crystals on the end of a human hair."

***John Lindl**, Lawrence Livermore National Lab, on a new form of man-made diamond, Tri-Valley Herald, November 10, 2006*

"I like the bad ones as much as the good. How can you know beautiful if you don't know ugly?"

***George Bissinger**, East Carolina University, trying to develop a guide to which features of a violin determine the qualities of a violin's sound, The New York Times, November 28, 2006*

"To give you a rough idea, when you have this huge amount of intensity, within the volume of a single atom, there are thousands of photons knocking at a single atom at the same time. So this is a very violent, wild process."

***Chunlei Guo,** University of Rochester, on his method of using a femtosecond laser to turn metals truly black, Toronto Star, November 26, 2006*

"If you watch that clock for 300 billion years, the error would be one second."

***Louis DiMauro**, Ohio State University, on a new atomic clock, Columbus Dispatch, December 4, 2006*

"What they'll be looking for is radioactive contaminants made at the same time. They'll do the best they can technically. But my guess is that it will take an informant."

***William Happer**, Princeton University, on the efforts to track down the origin of the polonium-210 used to poison Alexander Litvinenko, New York Times, December 3, 2006*

"It's good to have such an enthusiast like Griffin at NASA, but that whole messianic vision is pretty far from the current state of technology. Many of us worry that it will suck the juice out of other very promising projects to learn more about our universe."

***Robert Kirshner**, Harvard University, on NASA's vision for space exploration, Washington Post, December 4, 2006*

"It's kind of funny. No two grains of sand are exactly alike, either. But nobody cares about that."

***Kenneth Libbrecht**, Caltech, on snowflakes, Chicago Sun-Times, December 1, 2006*

INSIDE THE BELTWAY: WASHINGTON ANALYSIS AND OPINION

Democrats in Control: What's Next?

By Michael S. Lubell, APS Director of Public Affairs

Divided government! For the next two years, that's how Washington will function. Of course, looking back on the "Do-Nothing" 109th Congress, if gridlock does develop, you will hardly notice the difference.

It's far too early for anyone to make any serious forecasts, but to prepare myself for the inevitable post-election dinner conversations I decided to drop in on a former Republican member of the House shortly after the November election. He left the Hill some years ago and turned lobbyist. But he has remained an astute political analyst and is still passionate about research.

Our meeting was private, and for that reason I will simply call him P.D. Jones. All you need to know is that Mr. Jones is a moderate, and that, despite his centrist philosophy, he was able to achieve prominence in the 1990's in a Republican Conference heavily dominated by conservatives. His success was a tribute to his political acumen and his ability to achieve consensus across the ideological spectrum.

P.D. and I found that we agreed that the November 7th outcome was not very surprising. Both of us had long believed that a flip in House control was a virtual certainty. Tracking polls had predicted the Democratic takeover very clearly for many months. But we both admitted that we had not foreseen a real possibility of takeover in the Senate until a few days before the election.

Our conversation quickly turned to what had really caused the Republicans to lose control of both chambers.

In the lead-up to November 7th, most TV talking heads, from Eleanor Clift on the left to Tony Blankley on

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This Month in Physics History

January 1925: Wolfgang Pauli announces the exclusion principle

The year 1925 was an important one for quantum physics, beginning with Wolfgang Pauli's January announcement of the exclusion principle. This well-known principle, which states that no two identical fermion particles can be in the same quantum state, provided for the first time a theoretical basis for the structure of the periodic table of the elements.

Wolfgang Pauli was born in Vienna in 1900, the same year that quantum mechanics itself was born with Planck's announcement of the idea of the energy quanta. Pauli's father was a physician and chemistry professor at the University of Vienna, and his godfather was Ernest Mach. As a young prodigy, when he found himself bored during class, Pauli would read Einstein's papers on relativity. By age 20 Pauli, then a student of Arnold Sommerfeld at the University of Munich, had published papers on relativity and written an encyclopedia article on relativity which greatly impressed other physicists, including Albert Einstein himself. Having learned classical mechanics and relativity, Pauli was disconcerted by quantum mechanics upon being introduced to it by Sommerfeld, and at first he found the subject rather confused.

Wolfgang Pauli

Possibly because of his brilliance, Pauli's professors and colleagues tolerated some of his more annoying habits, such as his custom of sleeping extremely late and rarely showing up for lectures before noon. He was also extremely critical, and famous for deriding his colleagues' less-than-coherent work as "not even wrong." His tendency to criticize often spurred others to clarify their ideas. Pauli also had such an amazing propensity to cause accidents that scientists began to believe that even to have him come close to one's lab meant doom for the experiment.

After receiving his doctorate in 1921 and spending some time in Gottingen and then Copenhagen, Pauli took a position at the University of Hamburg in 1923. He gave his first lecture there on the periodic table of elements, which he found unsatisfactory because the atomic shell structure was not understood. In 1913, Bohr had proposed that electrons could occupy only certain quantized orbitals, but there seemed to be no reason why all the electrons in an atom didn't simply crowd into the one lowest energy state. There was no convincing explanation of the structure of the periodic table. Pauli had also recently worked on trying to explain the anomalous Zeeman effect, (a consequence of electron spin) and was convinced that the two problems were somehow related.

In late 1924, Pauli made a big leap by suggesting the idea of a adding a fourth quantum number to the three that were then used to describe an electron's quantum state. The first three quantum numbers made sense physically, since they related to the electron's motion around the nucleus. Pauli called his new quantum property of the electron a "two-valuedness not describable classically." Soon after making this proposal, Pauli realized that it could lead to the solution of the problem of the closed orbitals.

Then in January 1925, he announced the exclusion principle, stating that no two electrons in an atom can occupy a state with the same values for the four quantum numbers. Each electron had to be in its own unique state. Other possibilities are excluded.

Pauli's proposed fourth quantum number puzzled physicists at the time, because no one could explain its physical significance. Pauli himself was troubled by the idea. Pauli was also bothered by the fact that he couldn't give any logical explanation for the exclusion principle or derive it from other laws of quantum mechanics, and he remained unhappy about this problem. Nonetheless, the principle worked–it explained the structure of the periodic table and is essential for explaining other properties of matter.

Later in 1925, Samuel Goudsmit and George Uhlenbeck, inspired by Pauli's work, interpreted the fourth quantum number as the electron's spin. Pauli originally applied the exclusion principle to explain electrons in atoms, but later it was extended to any system of fermions, which have half integer spin, but not to bosons, which have integer spin.

In the two years after Pauli's announcement of his exclusion principle, the new quantum mechanics took off, with Heisenberg's formulation of matrix mechanics, and Schrödinger's wave mechanics, which was based on de Broglie's idea that matter can have wavelike properties.

In 1928 Pauli moved to Zurich. He spent time during World War II in the United States, and returned to Zurich after the war. In 1931, Pauli proposed the existence of a new particle, the neutrino, as a solution to the apparent lack of energy conservation in beta decay. After his many research accomplishments, he spent much of his later years thinking about the history and philosophy of science.

Pauli always insisted on having a clear and coherent explanation of a phenomenon, and always strove to find both an intuitive understanding of an experiment and a rigorous mathematical scheme. Max Born once commented that, "I knew he was a genius, comparable only to Einstein himself. But he was a completely different type of man, who in my eyes, did not attain Einstein's greatness." In 1945, Pauli was awarded the Nobel Prize for the discovery of the exclusion principle. He died in 1958.

APS NEWS

Series II, Vol. 16, No.1
January 2007

Coden: ANWSEN ISSN: 1058-8132

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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.

Kadanoff Stresses Education, Outreach Initiatives

Leo Kadanoff (University of Chicago) assumed the APS presidency on January 1, 2007. In the following interview with APS News*, he discusses his priorities for the Society during his presidential year.*

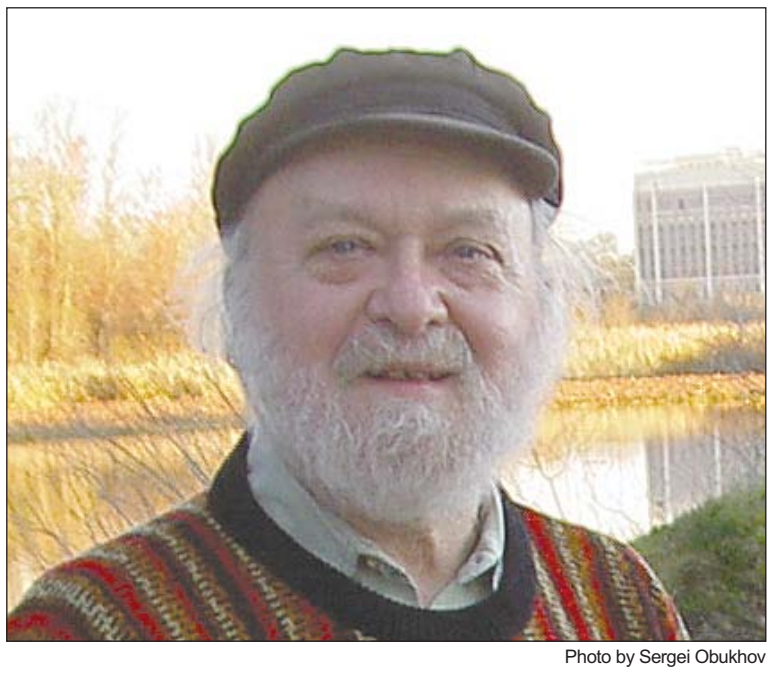

Photo by Sergei Obukhov

Leo Kadanoff

Q: *What do you see as some of the most important issues facing the physics community today, and how can the APS address some of these issues?*

A: This year (and last year as well) US physicists have had the duty and pleasure of responding to the recommendations in the National Academy of Sciences Report, *Rising above the Gathering Storm*. That report pointed out that the long-term economic health of this country required additional investment in research and education related to the physical sciences. This report represents views which have gained considerable support from both houses of Congress, both sides of the aisle, and the executive branch as well. All last year, under John Hopfield's leadership, APS worked hard to advocate the adoption of the research-related recommendations of this report. Mike Lubell and the whole Washington office pitched in to support this report, as did the APS and March Meeting leadership, together with many members of APS.

Now, following APS Council and Executive Board action, we are prepared to work as well for the education and outreach based recommendations of the *Gathering Storm* report. The APS will contribute to making the public better aware of the nature and importance of physics research, starting with a DOE and NSF program for explaining particle physics and moving outward to the entirety of physics. Alan Chodos, APS Associate Executive Officer, will lead these efforts. We shall continue to expand our programs to better prepare high school and middle school teachers of physics and other sciences. Education at all levels, formal and informal, will form a major part of our advocacy and outreach efforts.

Q: *Why do you believe improving education is so important?*

A: I believe that what we are facing in the United States, and probably in many other countries, is a crisis. Many people who feel that they're educated don't really know anything about science. They also don't really know anything about how the world works. They're not fully able to think logically and form conclusions based on the evidence. I'd like to see evidence-based thought more commonplace among the educated population. Science can play an important role in helping people think logically. There is a perception among the public that science is mainly important because it produces drugs and medical benefits. In my view, science is important because it enables us to better understand the world. In addition, science brings large long run effects on the quality of life, which tend to be ignored in the short-ranged thinking endemic to individuals, businesses, and governments. One potential effect of better education might be to produce increased awareness of long-term consequences of present actions and inactions.

Scientists have an opportunity and a responsibility to bring our knowledge of the world to a broader public. That means improving the quality of education from kindergarten through high school, college and graduate school. That also means making the public aware of scientific values and of the long-run value of attempts to understand the world.

Q: *What do you plan to focus on during your term as APS President?*

A: Of course, I shall support Ted Hodapp (APS Director of Education) in his fine work on teacher training programs. We intend to expand these programs to include work with more universities and colleges. The APS work has the very exciting characteristic of bringing together professional physicists with education researchers, schools of education, and professional teachers. I want to see this work continue and reach more students. I also wish to make us a leader across the board in advocating for education. Good citizens need to use evidence-based thinking. Consequently, I will argue that APS should advocate for spending aimed at improving educational attainment in mathematics and across the sciences.

Back home at the APS, I intend to work on coordinating the work of the three different APS work-places and on coordinating the work of the three operating officers of the APS. Our organization is based upon the work of three equal operating officers, the Executive Officer (Judy Franz), the Publisher and Treasurer (Joe Serene), and the Editor-in-Chief. Joe is new to his job, replacing the retiring Tom McIlrath. Gene Sprouse is soon to replace the retiring Marty Blume as Editor-in-Chief. With two new officers, it behooves the President to pay lots of attention to helping coordinate the work at the top. Luckily I can do that because during my term both the jobs of Past President and that of President Elect will be filled by people with a major interest in and knowledge of the legislative branch and the executive branch of US government. I therefore hope and expect to lean upon these elected officers, John Hopfield and Artie Bienenstock, asking them to each take a major role in our outreach to Washington. As soon as our new Vice President, Cherry Murray, grabs hold (and tells me what kind of work she wishes to do) I shall try to have all four of us work in parallel, each thinking particularly about his or her special area. With advice and guidance from my fellow members of the presidential line, I hope to be able to make wise suggestions to the operating officers.

Q. *What challenges do you see facing the APS in the next year?*

A: Each operating officer and each function of the APS faces major challenges. The editor-in-chief must work to improve the journals to meet the very high quality of our competition and the difficulty brought about by the wide dissemination of preprints and reprints. We have a major project in which we can produce extra value for the reader and subscriber to our journals by having a website that has lots more stuff in it than you can directly find in a given *Physical Review* article. I argue that this website development should be supplemented by an increased effort to improve the editorial process by having more editors devoting more editorial effort to each paper.

The Publisher and Treasurer also comes into this in that the journals must continue to pay for themselves, despite the fact that we continue to face new models for how the costs of scientific publication will be repaid. So, working in combination, the Editor-In-Chief and the Publisher and Treasurer must keep our journals excellent and self-supporting. The people in these offices have done a wonderful job in recent years. The new people are poised to continue this fine record.

I have already described some of the increase in our outreach and educational work. The new outreach work of Alan Chodos is a kind of advocacy rather new to APS. Fortunately we have excellent means for coordinating APS advocacy and outreach work in the Physics Policy Committee (PPC). I have asked PPC to oversee this outreach and advocacy program.

Another major portion of our work is the various meetings we sponsor. A committee on the April Meeting under Chris Quigg has thought out ways of giving that meeting additional focus by adding a topical component, the topic varying from year to year. Integrated over different years and different topics, the impact of the meeting will be broader than before. This year we shall begin to put their recommendations into practice. Next, the *Bulletin of the APS* serves all meetings. It is in the process of a major revision that will make it more accessible in our electronic and web-based age. This year the APS will decide just how this will be done. Lastly, the March Meeting is always a major challenge. It is our largest and most complex meeting. Last year it grew to more than 7000 attendees. We have to run hard just to keep it going on an even keel. The biggest and most immediate challenges involve the behind-the-scenes support system for that meeting. I believe that we must develop better electronic support for the meeting and devote more staff time to pre-meeting support.

All the responses I have mentioned cost money. I expect to see the Treasurer keep on top of the whole process, seeing that our additional expenditures match the needs involved, coordinating the work in the different APS offices (particularly on the computer and web side), and making sure that the expenditures do not exceed the available funds.

Q: *What can APS do better for its members?*

A: We run excellent meetings, which are very well attended. We run not only the big meetings in March and April, but also smaller meetings for the units and smaller groups. The journals are among the best journals in the world and we're very proud of them. In addition, we have important programs in which we help colleges and universities around the United States train high school teachers. We have important activities in which we bring knowledge of physics to the general public. We work with all kinds of subgroups of the members. We work with new faculty; we work with chairs of departments. We provide opportunities for job fairs and other places where our members can go to find appropriate employment. We provide information about the employment situation. We do as much as we can, but we're always looking for new ways to serve the members. And we hope to find some in this period.

Our major activity will be focused on providing better classes of information to the public and to Congress.

At the moment we are particularly working to serve the community of physicists who work in industry. We have not directed enough particular attention to their special needs. We put a task force together to find out what those needs were, and now we're beginning to try to implement its recommendations.

Q: *Science is an international enterprise. Are there ways APS can better serve its international members and promote international collaboration and information exchange?*

A: Most APS work, for example on our journals, equally well serves people in the US and people abroad. Even some specifically "international" work produces better exchange of scientific information, hence better science everywhere. Amy Flatten's plugging for better implementation of US visa policy falls into this category. Along these lines, we have been very active in expanding the possibilities for international exchange, both supporting American students learning abroad and helping people from everywhere to go to our meetings.

We have been working especially hard to bring the full benefits of our journals to people outside the US. We look forward to extending our range of activities for the developing world and for all of Africa.

Q: *Why did you decide to run for APS President?*

A: I was interested in seeing the APS concern itself more with issues of education and how the community related to science. I had been involved in informal education. I ran a program for developing materials for science in museums at the University of Chicago. I thought working with the APS was a natural outgrowth of that kind of program.

Physics Departments Urged to Preserve Their Histories

The APS Forum on the History of Physics (FHP) is encouraging department chairs and colleagues to help preserve the history of their department and its accomplishments by updating an existing history or preparing a new one and by depositing it with the Niels Bohr Library and registering it with the Forum's new Register of Departmental Histories and Records.

Preparing a history is a big job, but it's an important job, said David Jackson, a member of the Executive Committee of PHP.

If starting from scratch on a history, it may help to sample some existing ones, the Forum suggests. Several can be found in the Niels Bohr library catalog, which can be searched online by going to www.aip.org/history, clicking on Book Catalog and then clicking on the tab labeled "archives keyword." In the "general" box, enter "physics departments" and highlight "institutional histories held at AIP" in the Limits box.

If an up-to-date historical record is not already on file at the Niels Bohr Library, the Forum urges a department to prepare or update a history of the department and/or research laboratories, and send a copy to the Library, in care of Spencer Weart, AIP Center for History of Physics, One Physics Ellipse, College Park MD 20740-3843 (sweart@aip.org).

Separately, the Forum is establishing a Register of Departmental Histories and Records to be published periodically in the FHP Newsletter and on the Forum's web site. Register entries should be standard bibliographic citations with indications of availability in institutional or departmental libraries, through web links, and/or the Niels Bohr Library.

The register will provide another tool for finding information about past activities in physics research and education as a starting point for more focused searches.

Register entries for histories and other materials should be sent to: J.D. Jackson, 50A5104, Lawrence Berkeley National Laboratory, Berkeley CA 94720 (jdjackson @lbl.gov).The materials themselves should be sent to the Niels Bohr Library.

Letters

Local Chapters Could Help Industrial Members

The article in the November *APS News* about the APS Task Force on industrial physics is correct in stating that "industrial physicists, who do not often attend APS meetings, need improved ways to network." Local chapters of APS with frequent meetings are one possible way to encourage networking. A dozen local chapters of IEEE here in Silicon Valley have well-attended monthly meetings and there's no reason that APS members couldn't do the same. Local meetings could increase industrial members' feeling of connection to APS as well as being a potential route to recruitment of new members. The regional divisions of APS are a step in the right direction but their meetings are too far-flung, too infrequent and too focused on undergraduates to serve industrial physicists well.

When the late Ken Hass was chair of FIAP, he encouraged me to form an experimental local APS chapter. Anyone interested in helping to start a Silicon Valley chapter should contact me.

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Words and Warfare Follow Zipf's Law

In his Back Page in the November *APS News*, Neil F. Johnson should have perhaps mentioned that what he discovered regarding global terrorism is yet another example of Zipf's law (see George K. Zipf, Human Behaviour and the Principle of Least-Effort, Addison-Wesley, Cambridge MA, 1949). Zipf, a Harvard linguist, discovered some 70 years ago that when English words are ranked according to how often they are used, the frequency f_k of use of any word is roughly inversely proportional to a power of its rank k, $f_k = Ck^{-\alpha}$. This power law correlation has since been observed in many facets of human activities and social structure (see, for example, the entry under Zipf's Law in Wikipedia).

Mikolaj "Mik" Sawicki
Carterville, IL

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the right, had said that the election was going to be a referendum on Iraq. Clift said that President Bush's war negatives were enough to take down Republican candidates. Blankley said that, despite the dismal White House approval rating, Republicans still had a shot at retaining control because they had a superior "Get-Out-the-Vote" operation.

As it turned out Clift was right about the outcome but not for the right reason, at least not entirely. In exit polls throughout the country, voters said that scandals and ethics violations had been their prime rationale for kicking out the Republicans. The Iraq war was second and the economy third.

"You know," P.D. said, "they got what they deserved! When you lose the trust of the public, you're finished."

"Of course," he added, "they also screwed up in another way: they tilted so far right, they marginalized themselves. If you lose the center, you lose the election." To validate his conclusion, he noted that both Democrats and Republicans had turned out at the polls in roughly equal numbers and, by and large, they had voted along party lines. But Independents had voted Democratic by margins as large as two to one in many districts.

"If House Democratic leaders take away one lesson from the last twelve years," P.D. said, "it should be that you have to govern from the center. The question is, will they?"

"I suspect so," I told P.D., "if only because many of the new members are not ideologues. They won in conservative districts by advancing a moderate philosophy."

"In fact," I noted, "many new House members have already allied themselves with the Blue Dogs, [fiscally conservative and, in most respects, socially moderate]. And despite the warning Republicans had issued during the election, the new Democratic House leadership is fairly balanced between liberals and moderates."

What is in store for science is yet uncertain, we both agreed, but it's a good bet that Congress will exert far more oversight over the executive branch. During the last three weeks, three House committee chairs have indicated that they will delve into the Administration's alleged misuse of science and gagging of agency scientists who disagreed with White House policies.

The Democratic leadership in both chambers has also indicated that committee chairs will have more latitude in developing their priorities than their Republican counterparts had during the last twelve years. And the leadership has vowed to be more respectful of the Republican minority and to accord them more of a role in formulating legislation. Time will tell.

During the 2006 campaign, Democrats pledged not only to clean up the ethical mess but also to reinstall pay-as-you-go budgeting. What "Pay-Go" means is either providing budgetary offsets for any new programs or enhancing revenues. With the physical sciences slated for big percentage increases in the American Competitiveness Initiative, "Pay-Go" could spell trouble, although Speaker Pelosi has said that the Democrat's Innovation Agenda remains one of the top priorities.

But whatever else they do down the road, Democrats must immediately pass the FY 2007 budget, which the Republicans "irresponsibly" dumped in their lap, as P.D. put it. Otherwise, government will operate under a yearlong Continuing Resolution with the science increases vaporizing into political smoke. "And that," we agreed, "would be reprehensible."

Microfluidics, Bubble Logic, Robosnails Featured at 2006 DFD Meeting

New microfluidic explosive detectors, an all-fluidic logic family based on bubbles, and robots that mimic the movement of snails, slugs, and jellyfish were among the many fascinating highlights of the 2006 fall meeting of the APS Division of Fluid Dynamics (DFD), held November 19-21 at the University of Florida in Tampa Bay. The conference also featured a special US-Mexico Mini-Symposium on geophysical fluid dynamics, as well as mini-symposia on quantum turbulence, connections between fluid dynamics and plasma physics, and education.

Much Ado About Microfluidics. A collaboration between scientists at Philips Research and Eindhoven University of Technology has developed "artificial cilia": polymer micro-actuator devices, made with standard micro-technology processing techniques, which respond to an applied electrical or magnetic field by changing their shape. The size and shape of the polymer actuators mimics that of the beating cilia covering the external surface of micro-organisms such as paramecium. The team hopes to eventually apply this new method of microfluidic actuation to the building of biosensors.

At the same session, researchers from Stanford University reported on their development of a novel microfluidic, remote-sensing chemical detection platform for real-time sensing of airborne explosive agents. The key enabling technology is a newly developed concept termed Free-Surface Fluidics (FSF), where one or more fluidic surfaces, confined by surface tension forces, are exposed to the surrounding atmosphere. Combining the FSF architecture with surface-enhanced Raman spectroscopy allows real-time profiling of atmospheric species and detection of airborne agents–most notably of 4-aminobenzenethiol, a chemical species similar in size and structure to TNT.

Bubble Logic. MIT's Neil Gershenfel and Manu Prakash presented their concept of microfluidic bubble logic: specifically, a new all-fluidic logic family based on two-phase flow in micro-scale geometries that exploits hydrodynamic interactions as a primary mechanism to introduce non-linearity. For instance, the presence or absence of a bubble would represent a bit, so a bubble could carry both information and a material payload at the same time. The researchers presented rudimentary microfluidic bubble logic gates (AND/OR/NOT), memory, and cascaded boolean circuits, which they believe could one day be applied as a control scheme to large-scale integrate biochemical processors.

Controlling bubbles is a critical aspect of many applications involving fluid systems, such as ink-jet printing. Researchers continually seek to improve their understanding of bubble formation and interactions to better control such systems. Detlef Lohse of the University of Twente in The Netherlands reported on a new technique that enables him to quantitatively study bubble-bubble and bubble-surface interactions. He found that in piezo-acoustic ink-jet printing, bubbles can become entrained, grow by rectified diffusion and eventually seriously disturb the jetting process by counteracting the pressure build-up at the nozzle. He also demonstrated that bubble nucleation at surfaces–commonly associated with randomness–can in fact be perfectly controlled in both space and time.

Locomotive Robosnails. Snails and slugs have a very energy-efficient means of adhesive locomotion, producing muscular waves of shear stress on a viscoelastic mucus to propel themselves along a solid substrate. MIT's Anette Hosoi described recent work on applying a simple mechanical model to derive criteria for favorable fluid material properties to lower the energetic cost of locomotion. She and her MIT colleagues, Brian Chan and Theresa Guo, have designed robotic machines–dubbed "Robosnail 1" and "Robosnail 2"–that use a waving foot to propel themselves over viscous fluid. Robosnail 2 can climb walls and move upside down on a layer of Carbopol, a gel-like water-based polymer solution. They presented new 3D modeling of finite-width snails and a design for future snails capable of moving faster than their own waving velocity.

Drawing on similar locomotive examples in nature, scientists from Tokyo University proposed building a micro-robot out of soft material to resemble a jellyfish. The robot would propel itself much like its biological counterpart, so a greater understanding of the creature's swimming motion is desired –particularly how it produces thrust in its "expanding phase" of its swimming motion. The Tokyo team studied those motions via a motion-capture camera and measured the vector field of flow around the jellyfish. It is known that the jellyfish is principally pro-

DFD MEETING continued on page 7

Saffman-Taylor instability in a Hele-Shaw cell. This image was a winner in the 2004 Gallery of Fluid Motion.

APS Presents Plaque to Honor Millikan

Photo by Dan Dry

On November 30, APS President-elect (now President) Leo Kadanoff (left) presented a plaque to the University of Chicago, to honor Robert A. Millikan, as part of the APS Historic Sites initiative (see *APS News*, May and October 2005, January and February 2006, all available online). Millikan received the Nobel Prize in 1923 in recognition of two major achievements: measuring the charge of the electron in his famous oil-drop experiment (see "This Month in Physics History," *APS News*, August/September 2006), and verifying Einstein's prediction of the relationship between light frequency and electron energy in the photoelectric effect. Kadanoff is himself a faculty member in the Chicago physics department. Accepting on behalf of the University was Thomas Rosenbaum (right), Vice-President for Research and for Argonne National Laboratory

US Signs on as Non-Host Partner for Restructured ITER Project

"The world is counting on us to make ITER a success," Under Secretary for Science, Department of Energy, Raymond Orbach said at the November signing ceremony for the ITER agreement. Joining Orbach at this ceremony in Paris were representatives of China, the European Union, India, Japan, the Republic of Korea, and the Russian Federation.

The ceremony occurred almost four years after the Bush Administration announced that the US would rejoin the ITER negotiations. The US had withdrawn from participation in ITER during the design phase in 1998 because of concerns about the facility's predicted costs and project management. The project was significantly restructured after the US withdrawal.

The agreement was subject to a 120-day review by Congress as required by the Energy Policy Act of 2005. On September 29, 2006, House Science Committee Chairman Sherwood Boehlert (R-NY) wrote to Energy Secretary Samuel Bodman, stating his satisfaction with the revised agreement. Boehlert had threatened in 2005 to kill US participation in ITER if a satisfactory funding mechanism was not implemented.

The funding requested for the Office of Science in the Administration's FY 2007 American Competitiveness Initiative alleviated concerns about ITER's financial impact on the domestic fusion program. Under this request, funding would increase 10.9% for the Fusion Energy Sciences Program, which both the House and Senate versions of the FY 2007 DOE appropriations bill would provide (although the Senate bill proposes shifting some funding to a new office of High Energy Density Science).

ITER will be built at Cadarache, France and is scheduled to be completed in 2015. The US, as a non-host partner, will participate in the construction phase at the level of 9.09%. The total value of the US contribution is $1.122 billion. The European Union, as ITER's host, will provide 45.46% of construction phase funding.

Orbach described the signing ceremony as representing "both a conclusion and a beginning. It is the final closure of the negotiations. And, it is the beginning of the ITER International Organization and the construction phase of the ITER Project. It is also the beginning of a commitment to solve the world's energy problem by scientists representing more than half of the world's population."

He concluded, "As we move forward to implement this agreement, let us all keep in mind the enormous responsibility we all share. The world is counting on us to make ITER a success. The [DOE] will work with you to achieve that success, to providing to succeeding generations a source of unlimited, environmentally benign, energy. There is no greater contribution to world security and prosperity."

Courtesy of FYI, the American Institute of Physics Bulletin of Science Policy News (http://aip.org/fyi).

New Congress Presents Challenge for APS District Advocates

With many new faces in Congress and a shift to a Democratic majority in both houses, the APS Washington Office is planning to expand its District Advocate program in order to reach those new Members of Congress. The DA program, now in its second year, targets and trains APS members in key states and congressional districts to advocate for science funding throughout the year.

On January 2, nine new senators and 54 new representatives took the oath of office in the US Capitol. In the shake-up, science lost several supporters as appropriations chairs, including Pete V. Domenici (R-NM) in the Senate and David Hobson (R-OH) in the House on the Energy and Water Subcommittees. In addition, Sherwood Boehlert (R-NY) retired as chairman of the House Science Committee, and Frank Wolf (R-VA) stepped down from the House Science, Commerce, Justice and State Appropriations Subcommittee due to Republican term limits.

"It's a challenge every two years," says Steve Pierson, Head of Government Relations in the APS Washington Office, "but we look forward to it." Pierson noted that despite the change in party control, science funding remains a bipartisan issue. Nancy Pelosi (D-CA), the new Speaker of the House, has assured scientists that innovation and competitiveness are high on the Democratic agenda. Basic research and science education are likely to remain priorities for the 110th Congress. But Democrats have said that any new spending must be offset by cuts to other programs or by new revenues.

With new members and new leadership come new needs and new opportunities for science advocates to educate Congress on the importance of science policy and research, the APS Washington Office notes. New representatives and senators are often unaware of just how important science is, not only nationally, but also, more importantly, in their home districts. With such a large freshman class, beginning the dialog on the support of science research and education takes on a serious urgency, the Washington Office says. To meet this need, the Washington Office is planning to beef up the District Advocate Program in its second year.

In its first year, three dozen APS members volunteered their time to meet with their Members of Congress and their staff and to organize grassroots activities in their home districts and in the nation's capital. For example, H. Dieter Hochheimer of Colorado State University conducted a successful meeting in the office of Congresswoman Marilyn Musgrave (R-CO), and followed up by hosting her on the Colorado State campus and escorting her on a laboratory tour. Hochheimer, who is chairman of his department, also organized a successful letter-writing campaign by his faculty members to all of Colorado's representatives and senators, urging federal support of science research.

Another successful District Advocate was Michael Tuts of Columbia University. Reacting to the possibility of significant budget cuts at Brookhaven National Laboratory last year, Tuts embarked on a lobbying mission to impress members of the New York congressional delegation how vital the laboratory's programs are to the science and innovation future of their state and the nation. Tuts began his campaign during the APS Units Congressional Visits Day in February. He kept the pressure on in the following weeks and months, and, in the end, many of the offices he contacted agreed to support the American Competitiveness Initiative.

The APS Washington Office plans to recruit and train more members for the District Advocate network. "We are especially looking for more APS members in areas where we have only received sporadic support over the years," says Pierson. "It's relatively easy to get support from elected officials in Maryland and California because they have large science constituencies and major federal facilities, but it's much harder to convince a representative from a district where science funding is not a top tier local issue."

The District Advocates Program augments other activities orchestrated by the APS Washington Office, including letter writing campaigns at the March, April and DAMOP meetings, numerous Capitol Hill visits by APS members and occasional Washington e-mail alerts to the Society's members. The DA Program can enhance the effectiveness of these efforts. "Through the DA Program a constituent can make an issue top tier and more appealing," says Pierson.

INNOVATION continued from page 1

event, former House Speaker Newt Gingrich said that innovation is certain to occur at a rapidly increasing rate. He predicted a massive increase in total knowledge in the next 25 years. "The question is not will it occur, but how much will occur in the US," said Gingrich. "For the first time in 100 years we are at a crisis point in American science," he said. Gingrich called for increased investment in science and technology. "It is not a question of money, it's a question of priorities," he said. He also suggested the government could inspire innovation by offering prizes for developments such as a hydrogen car.

If we don't invest in science and technology, warned Gingrich, we will end up in a situation in which China and India will have scientific abilities we won't even understand. "We will be in a nightmare," he said.

At the November 16 event, David Abshire, president of the Center for the Study of the Presidency, said that in order for the United States to remain competitive, we must elect a president in 2008 who will be a strategist and an innovator.

Also speaking at the November event, Larry Wortzel, chairman of the U.S.-China Economic and Security Review Commission, emphasized that China is increasing its support of scientific research, attracting more and more research and development, and providing incentives to attract back Chinese scientists who trained in the United States. He said that if the US doesn't invest more in science, all the innovation work is going to China.

Federal investment in physical sciences and engineering as a share of GDP has been in significant decline for decades, according to the report. The US share of patents and scientific publications is shrinking. China in particular is rapidly increasing its output of research articles, the report notes. In addition, the high tech trade deficit is continuing to widen, and more R&D facilities are being located abroad. China has overtaken the United States as the largest exporter of information technology.

Troublesome education trends continue as well, the report says. American teenagers continue to lag those in most developed countries in math and science literacy, and the percentage of US students earning undergraduate degrees in science and engineering fields has fallen behind many other countries. While American universities are still the best in the world, China has made it a priority to make its universities world class, the report says. US production of PhD scientists has been essentially flat, while Asian production of PhD scientists has been increasing rapidly.

Increasing numbers of people are working in science and technology. From 1994 to 2003, the proportion of the workforce in those fields increased from 17% to 23%, but the United States is relying on foreign- born talent to fill many of those positions, the report says. Unlike in many areas of science and technology where we rely on foreign talent, defense and national security work requires US citizens who can obtain clearances, the task force notes.

The full report can be found at http://futureofinnovation.org/.

TASK FORCE continued from page 1

the meeting, the task force members did not agree on the location and date, but encourage experimentation. They recommend a four year trial of holding the meeting alternately in Washington and then elsewhere at dates between January and May. This trial would begin with the February 2010 meeting, to be held in collaboration with AAPT.

Some examples of possible themes would be: "first light" from the Large Hadron Collider, neutrinos, the chemical history of the universe, the high-energy gamma-ray sky, physics and homeland security, global warming and physics of energy, nuclear weapons and proliferation, implications of the string-theory landscape, observation of gravitational waves, physics in medicine, computational physics, symmetry and symmetry violations, and the National Ignition Facility.

Members of the Task Force:

James A. Isenberg (GGR; University of Oregon)

Benjamin F. Gibson (DNP; Los Alamos)

Bradley M. Sherrill (DNP; Michigan State)

John F. Beacom (DAP; Ohio State)

Joan Centrella (DAP; Laboratory for Gravitational Astrophysics,NSAS/GSFC)

Andrew G. Cohen (DPF; Boston University)

Chris Quigg , Chair (DPF; Fermilab)

Vincent S. Chan (DPP; General Atomics)

Lawrence M. Krauss (FPS; Case Western Reserve)

PHYSICS AND TECHNOLOGY FOREFRONTS

MIT Team Devises Scheme for Wireless Non-Radiative Energy Transfer

Many consumers long for the day when they can recharge laptops, cell phones and other ubiquitous electronic gadgets without having to lug around a separate bulky charger for each. That day might be closer than we think. A team of MIT physicists, led by Marin Soljacic, has been investigating the physics of electromagnetic fields, and has devised a demonstrable scheme for using wireless energy to power future gadgets.

Soljacic isn't the first to pursue this concept. In the late 19th/early 20th century, Nikola Tesla conducted experiments in which he was able to light gas discharge lamps from over 25 miles away, without using wires. The recent Hollywood blockbuster film, *The Prestige*, depicts a fictional Tesla using a form of wireless energy transfer to light hundreds of electric light bulbs planted in an open field some 25 miles from his energy source.

That scene is based on contemporary accounts of such an incident. But Tesla had a more ambitious goal than merely powering light bulbs from a distance. He envisioned the construction of a global system of interconnected towers for wireless telegraphy, telephony, and power transmission, and began building a prototype, Wardenclyffe Tower in Long Island, New York. He was forced to abandon the project for lack of investment funds, and the structure was ultimately razed and sold for scrap metal.

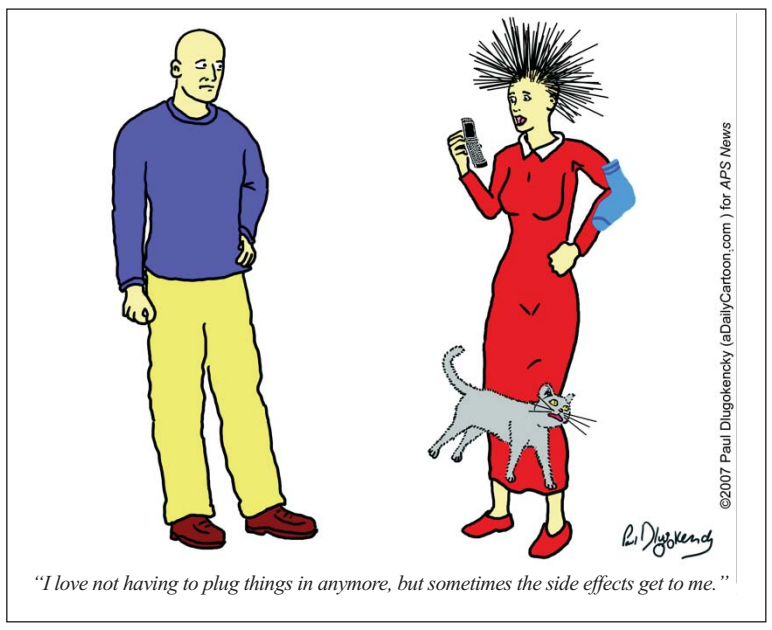
However, the notion of the so-called "Tesla effect"–a type of high field gradient between electrode plates for wireless energy transfer –has endured. The effect uses high frequency alternating current, producing potential differences between two plates. Because of the surrounding magnetic flux, power can be transferred to a conducting receiving device–such as Tesla's wireless bulbs.

Physicists have long known that it is possible to transfer energy wirelessly using this powerful near-field effect. The oscillations of the magnetic field that surrounds a charged loop of metal can induce an electric current in another nearby metal loop, which can act as a battery or recharger. There are a few applications already for wireless recharging, most notably electric toothbrushes that use wireless transfer to recharge their batteries; the transcutaneous energy transfer (TET) systems used in some artificial hearts; and some cellular phones.

A British company called Splashpower has designed wireless recharging pads that also exploit electromagnetic induction. Users simply place their gadgets (cell phones, MP3 players) on the pads to charge them. *BBC News* quoted Splashpower co-founder James Hay pronouncing the MIT work interesting for future applications. "Consumers desire a simple universal solution that frees them from the hassles of plug-in chargers and adaptors," he said, although challenges still remain to ensure efficient conversion of power into a form useful as input for electronic gadgets.

That is the primary stumbling block. Wireless energy transfer in such products is far from efficient: the emitted waves spread in all directions, and dissipate too rapidly over distance. Only a small fraction of the emitted energy is picked up by the receiver. That's why most such approaches require the device to be extremely close to –or in direct contact with–the recharging pad or similar element.

So there was considerable buzz in the physics community when it was announced that Soljacic and his colleagues–Aristeidis Karalis and John Joannopoulos–had come up with a scheme for wireless non-radiative energy transfer. They investigated a special class of non-radiative objects that demonstrated long-lived resonances. When energy is applied to such objects, it remains bound to them as "tails" that flicker over the surface, rather than dissipating into space. The phenomenon is known as evanescent coupling, and strongly resembles quantum tunneling.



"I love not having to plug things in anymore, but sometimes the side effects get to me."

Specifically, Soljacic and his colleagues propose boosting the induced current via resonance, by introducing a short gap in a metal loop and attaching two small disks at either end. Such an object, when charged, has a natural resonant frequency–a byproduct of the current flowing back and forth along the loop from one disk to another. In theory, at least, two loops with the same frequency would mean that one should be able to receive energy from the other through the magnetic near field.

Soljacic's key insight is that the close-range induction occurring inside a typical transformer could potentially transfer energy over short and mid-range distances, such as from one end of a room to another. A power transmitter would fill the space with a non-radiative electromagnetic field. This power would be picked up by a copper antenna that radiates at a frequency of 6.4 MHz. "Tails" of energy from the antenna would be able to "tunnel" up to 5 meters. This electricity would be detected by the gadget's antenna, which must also resonate at 6.4 MHz, and that energy would be used to recharge the device.

Only objects designed to resonate with the frequency of that field would be able to detect and absorb that energy. Any energy not transferred to the gadget would be reabsorbed by the source antenna. There would still be substantial losses, but the rate of transfer could reach tens of watts, sufficient to recharge a laptop within a few meters of the power source, according to Soljacic's simulations. His team is now embarking on a series of experiments to test those simulations.

Currently, this method of wireless non-radiative energy transfer works over distances between three to five meters and shows between 30 to 60 percent energy efficiency –not ideal, but certainly an improvement over prior methods. Soljacic believes he can improve on these efficiencies, so that his approach can be adapted in the future for application in a factory, or scaled down to the microscopic or nanoscale realms. Thus, such a scheme could power not just small consumer electronics, industrial applications or electric vehicles (including helicopters), but also freely roaming nanorobots and macroscale robotic factory workers.

In fact, Soljacic foresees a day when there is a far-ranging infrastructure of such "midrange" energy nodes–akin to the wireless hot spots that provide laptop users with easy high-speed Internet access–in which entire buildings or other large areas would be able to automatically recharge wireless devices whenever they come within range. Perhaps one day it will be possible to send power to electric buses traveling along a highway.

While numbers in the team's simulated calculations are encouraging, Soljacic cautions that it would be premature to start constructing homes without wall plugs of any kind. "We fairly strongly believe in our theory, based on previous experience. But experiments will be the ultimate judge," he said.

For more information, see the original paper: http://arXiv.org/abs/physics/0611063

Charging Ahead

Sometimes scientific inspiration can come from the most mundane unlikely sources. In Marin Soljacic's case, it was his wife's Nokia cell phone that inspired his approach to non-radiative wireless energy transfer. She continually forgot to recharge the device, and whenever the battery ran too low, the phone would emit a loud noise to alert the user to the impending battery death.

This often happened late at night or in the wee hours of the morning, to Soljacic's annoyance. He thought it would be nice if the cell phone could recharge itself. To do so, however, would require a wireless means of transferring energy, with minimal energy loss. So he set about making that vision a reality. And the most obvious physical phenomenon for such a purpose, he decided, was strongly coupled resonance.

Soljacic grew up in Croatia before moving to the US after finishing high school, and is a fervent admirer of fellow Serbo-Croation, Nikoa Tesla. He is also a big fan of iRobot's Roomba robotic vacuum cleaner, but laments, "It does a fantastic job, but after it cleans one or two rooms, the battery dies." That's why he owns several Roombas, but he envisions a day when Roomba could recharge using wireless energy transfer.

Lab's Past and Future Featured at 2006 SESAPS Fall Meeting

The APS Southeastern Section held its annual meeting November 9-11 in Williamsburg, Virginia, offering a broad program of presentations in fields ranging from neutrino physics, gamma-ray bursts, nanostructures, biomaterials and NMR measurements with sessions enumerating the past successes and future aspirations of the nuclear physics program at the Thomas Jefferson National Accelerator Facility (JLab). Special events included a tour of JLab, and the traditional banquet.

The keynote banquet speaker was Philip Bogden, program director for the SURA Coastal Ocean Observing and Prediction (SCOOP) program and CEO of Gulf of Maine Ocean Observing System (GoMOOS), who spoke of creating a virtual national laboratory for predicting hurricane impacts. A national, multi-agency initiative called the Integrated Ocean Observing System would combine the knowledge, data-integration capacity, and computational power necessary for real-time environmental prediction and hazard planning. Collectively, hurricanes in 2005 caused more than 2280 deaths and record damages of over $100 billion.

DNA Self-Assembly for Computing. How might the migration of circuit fabrication from the microscale to the nanoscale change the way computer systems are engineered, in light of the fundamental physics limitations on the materials being used? Chris Dwyer of Duke University described recent advances in programmable DNA self-assembly that offer several new methods for synthesizing complex nanostructures suitable for logic circuitry. They could lead to new modes of computation that would be impractical with conventional technologies.

Proton Radiotherapy on the Rise. Cynthia Keppel of Hampton University and JLab spoke about the upcoming proton therapy center being set up at Hampton Roads. It is the sixth and largest of its kind for treating cancer patients. According to Keppel, proton therapy provides radiation oncologists with a highly exact method of localizing treatment within a patient, thereby minimizing side effects as well as controlling the progression of the disease. The result: maximal radiation doses for cancerous tumors, with minimal doses to surrounding healthy tissue.

New Frontiers. One session focused on current and near-future facilities for performing cutting-edge high energy physics experiments. Talks naturally focused on the Large Hadron Collider, slated to come online at CERN in 2008. Another session focused on the search for gravitational waves, with status reports on the Laser Interferometer Gravitational-wave Observatory (LIGO), its next-generation counterpart, the upgraded Advanced LIGO, and the space-based Laser Interferometer Space Antenna (LISA). Yet another session focused on recent advances in neutrino physics, featuring status reports on numerous experiments, including MINOS, Borexino, KamLAND, and MiniBooNE.

JLab Upgrade. JLab is in the process of its own major 12 GeV upgrade, which will enable numerous key experimental measurements over the next five years, according to JLab's William Brooks. For instance, the energy-doubled CEBAF electron accelerator will allow for more precise measurements of the generalized parton distributions (GPDs) that first emerged in the mid-1990s, which is revolutionizing how physicists think about the intrinsic structure of the proton. Also, the GlueX project will map the spectrum of gluon excitations with photons.

ANNOUNCEMENTS

Don't Miss the American Physical Society's Largest Job Fair!

Looking for the perfect job?
Looking for the ideal job candidate?

Let the APS March Meeting Job Fair do the work for you!

March 5-7, 2007
Denver Convention Center Exhibit Hall
Denver, CO

Register today at:
http://www.physicstoday.org/jobs/APSMarch_jobfair.html

For more information contact
Alix Brice at 301-209-3187 or at jobfairs@aps.org.

Professional Skills Development for Women Physicists

Do you want to improve your negotiation skills? Do you have great ideas that you want to communicate to your colleagues?

***

If so, the **Committee on the Status of Women in Physics** invites you to attend one of the workshops entitled "Professional Skills Development for Women in Physics." These workshops will:

- Coach women in key skills that are needed to enhance their careers.
- Provide training in persuasive communication, negotiation, and leadership presented by experienced professionals, with an aim towards increasing the influence of female scientists within their own institutions.
- Provide a special opportunity for networking among participants.

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Workshops in 2007 will be aimed at women physicists in industry and government labs. Workshops will be offered on Sunday, March 4 (Denver) and on April 13 (Jacksonville, FL) in association with the APS annual meetings. Deadline to apply for the March workshop was December 4, 2006 and is January 10, 2007 for the April workshop.

Workshops will be limited in size for optimal benefits. Participants are eligible to receive a stipend to help cover the cost of travel and up to two nights lodging.

These workshops are funded by the National Science Foundation.

Details at http://www.aps.org/educ/cswp/index.cfm .

Now Appearing in RMP: Recently Posted Reviews and Colloquia

You will find the following in the online edition of *Reviews of Modern Physics* at http://rmp.aps.org

Electrostatic modification of novel materials
C. H. Ahn, A. Bhattacharya,M. Di Ventra, J. N. Eckstein, C. Daniel Frisbie, M. E. Gershenson, A. M. Goldman, I. H. Inoue, J. Mannhart, Andrew J. Millis, Alberto F. Morpurgo, Douglas Natelson and Jean-MarcTriscone

The classic example of electrostatic modification of material properties is the silicon-based field-effect transistor, in which the external field of a gate electrode controls the conductivity of the substrate. In recent years there has been much effort devoted to making and observing field-effect behavior in new materials, such as correlated oxide films, organic films, single-molecule devices, and ferromagnetic materials. This article reviews the progress on different materials, drawing attention to the challenges for future research.

APS Bylaws Amendment Related to the Establishment of a Standing Budget Committee

An ad hoc committee was first established in 2003 to work with the Treasurer to establish goals and objectives of the budget for the next fiscal year and to review the budget carefully in the final stages of its preparation. The committee was chaired by the President-Elect and consisted of three Council members. After 4 years of using this procedure, it was the view of the Treasurer and others who were involved that the committee was a help and did provide valuable assistance in crafting new budgets. It has been recommended that the Budget Committee become a permanent, standing committee of the Society. Below is proposed language to establish a standing Budget Committee.

ARTICLE III - STANDING COMMITTEES

A. OPERATING COMMITTEES

11. Budget Committee: The membership of the Budget Committee shall consist of the President-Elect and four members of the Council appointed by the President to staggered two-year terms. The President-Elect shall serve as Chairperson. The Committee shall meet with the Operating Officers during the initial budget planning process to establish overall goals and objectives for the next fiscal year and again as the budget is in the final stages of preparation. The Committee shall provide the Treasurer with strategic guidance and with critical consideration of fundamental budget assumptions.

DFD MEETING continued from page 4

pelled by a vortex ring ejected at the contracting phase, and the researchers found that a similar vortex ring with an opposite vorticity seems to be at work in the expanding phase.

Booming Sand Dunes. For centuries desert explorers have heard the booming sounds of the desert–low frequency sustained tones that accompany the avalanching of sand on large dunes. These desert travelers, including Marco Polo, attributed the sounds to beating drums or harps, voices of spirits, lost horsemen or other superstitions. Melany Hunt of Caltech discussed her recent work involving field and laboratory measurements of the booming sound at several locations and on different days as part of the US-Mexico mini-symposium on geophysical fluid dynamics.

It is not a noise composed of many frequencies but instead contains a dominant audible frequency and several higher harmonics. The sound can be heard after a naturally occurring slumping event or triggered by forcing sand down the leeward face of a large dune. In the later case, the dune will continue to boom and vibrate even after the sand has visibly stopped moving. Hunt's field measurements show that the frequency ranges from 75 to 110 Hz depending on the desert location and time of the year. Her measurements suggest that the physical features (such as a moisture barrier) of the sand dune plus the characteristics of the shearing on the surface may contribute to a wave-guide phenomena that results in a resonate behavior at a characteristic frequency.

Also featured at the US-Mexico mini-symposium was a talk on granular flows in volcanic environments –multi-phase system flows that involve some combination of solid, liquid and air in response to applied shear stress–by Lucia Capra (National University of Mexico, Juriquilla), drawing on examples from several active Mexican volcanoes. Other UNAM scientists reported on their proposal to flush a polluted lagoon in Cancun using a wave and tide driven seawater pump. They believe their approach could improve the lagoon's natural "flushing time" form two to four years, down to six months, so the ecosystem could better cope with the large amount of waste and thick layer of accumulated organic matter on the lagoon bed–the result of decades of Cancun's thriving tourist industry.

Reading Einstein's Tea Leaves. Among Albert Einstein's lesser-known interests was his paradoxical observation of tea leaves centrally accumulating at the base of a stirred teacup. A team of scientists from Monash University has applied this basic concept to the fluid flow patterns observed when they applied a voltage to a sharp electrode tip above the liquid surface of a microfluidic chamber. This generates an electrohydrodynamic air thrust that shears the liquid surface and induces liquid recirculation. The recirculation sweeps colloidal particles suspended within the liquid in a helical swirling motion and deposits them at a stagnation point located centrally at the bottom of the chamber. The scientists believe the phenomenon can be exploited for bioparticle trapping and concentration. At the DFD meeting, they demonstrated the rapid separation of red blood cells from blood plasma, for possible application in miniaturized blood diagnostic kits.

Inside a Bamboo Flute. Wind instruments produce sound from the vibration of the air flow inside the wind instrument. Trumpets or clarinets use a mouth or reed to produce variable sounds, but there is no mechanical vibration mechanism in a flute. A team of researchers at the University of Tokyo are working to measure in greater detail the air flow and vibration inside and outside the flute to improve the manufacture of quality instruments. They used a traditional Japanese bamboo flute in their experiments. First they measured the argon gas flow at 5000 Hz using a high-frequency pulse laser, employing oil mist as tracer particles. They also tried to measure the flow when a human played the instrument using a CW laser. They succeeded n measuring the oscillating flow, finding that near the hole of the bamboo flute, the air went out from ad came into the instrument at about 500 Hz depending on the tone.

Photo by Melany Hunt, Caltech

Booming sand dunes

The Back Page

Sound Science or Sound Bite?

By Michael Bugeja

I direct a journalism program at a science-oriented university where my colleagues are modern-day alchemists, turning corn into fuel, conjuring twisters in wind tunnels, or morphing visitors at our virtual reality lab into plant cells during photosynthesis. These professors rank among the most ingenious, passionate people I have ever met. Put some of them in front of a reporter, however, and all bets are off.

Being misquoted in the media is commonplace, especially when the topic concerns science. Depending on the error, a quotation out of context can catapult a scientist into the national spotlight where the person gets to clarify the remarks and do it again, only this time for a mass audience.

Analyzing cases of foot-in-mouth disease, I came to this conclusion: When researchers simplify science, they often end up providing sound bites that overstate findings. Sound bites bite back. As early as 1993 Dorothy Nelkin, author of *Selling Science: How the Press Covers Science and Technology* (W.H. Freeman), warned that scientists tend to oversell research when explaining it to reporters.

Journalists also are partly to blame for overselling science. Big national newspapers and broadcast outlets have seasoned correspondents, but science happens everywhere, including college towns like Ames, Iowa, where agricultural biotechnology is on display in fields and on shelves of supermarkets. Many reporters who cover science do not fully grasp it, interviewing sources with polar viewpoints on genetically modified products or exotic animal diseases.

Unintelligible Design

The language of science has many dialects. Much is lost in translation. Once I collaborated with a microbiologist who kept referring to "p53" while I frantically paged through a medical report that had 45 pages, only to realize that he was speaking about a tumor suppression gene that encodes a protein with an atomic mass of 53 kilodaltons. (As everyone knows, a kilodalton is 1000 times 1/12 of the mass of one atom of Carbon-12.) I also collaborate with scientists across disciplines, helping them communicate with the public.

Perhaps you have followed the debate at Iowa State University about intelligent design. *Inside Higher Ed* reported the conclusion of that debate last year when 120 of my colleagues signed a statement urging the rejection of intelligent design as science. My intention in referencing the debate is not to rekindle it but to call to your attention to a citation in the *Ames* (Iowa) *Tribune* made by a famous scientist who delivered a speech here, titled, "Why intelligent design is not science." He reportedly told the audience that "the origin of life could have come from a sequence of emergent chemical events, each one more complex than the last."

Upon reading that statement, I sent an e-mail to a few scientists on campus who believe that intelligent design is philosophy rather than science. (So do I, by the way.) The statement as reported seemed to use the same type of overreaching argument often associated with creation science. On reading that someone had identified a sequence of chemical events accounting for the origins of life, my immediate reaction was jealousy. Apparently, the scientist had spoken to God, and I wanted an interview, too.

"This is why the public and media put a stop to all manner of scientific projects," I messaged my colleagues. "Cloning research is a case in point. People believe that geneticists are engineering life–a hyperbole, at best; the cell is engineering life. To state otherwise is to believe that the US Corps of Engineers created water, not the dam."

My colleagues generally agreed. Based on the statement at the Iowa State speech, which came off as sound bite (or "pull quote," in newspaper lingo) rather than as sound science, the speaker subsequently was taken to task in letters. One noted that his view was "conjectural and unsubstantiated" because no scientist "has been able to synthesize a single nucleotide from a prebiotic environment. Amino acids yes, but nucleotide, no."

I had forgotten about all this. Then I received a journal in the mail called *In Character* funded by a grant from the John Templeton Foundation. One article in this edition stood out as exemplary: "Creation Myths: What scientists don't–and can't–know about the world":

What's the first thing that comes to mind when you hear the word "scientist?" Chances are it isn't "modesty or humility." A simple experiment underscores this conclusion. Type "modest scientist" or "humble scientist" into the Internet search engine Google and you'll be lucky if you get more than a couple of hits. Then do the same thing with "arrogant scientist" and the number of hits increases by an order of magnitude.

Arrogance is something both journalist and scientist seem to have in common because they also share another trait, a passion for truth. Journalistic objectivity is partly based on scientific fact-finding. The great 19th century British essayist Matthew Arnold wrote about "genuine scientific passion" in the 1869 essay, "Culture and Anarchy." In it, he used the phrase–"to see things as they are," not as we wish they were. This, he wrote, was a "social idea" that made such persons, scientists especially, "the true apostles of equality" who "have a passion for diffusing, for making prevail, from one end of society to the other, the best knowledge, the best ideas of their time."

This also was the intent in the Ames lecture. However, the passion for truth, condensed into a pull quote in the newspaper, often is mistaken for arrogance, especially when we attach pop cultural notions to topics as controversial as evolutionary theory being able to substantiate the complex chemical sequences responsible for the origins of life.

To put this into perspective, consider this: The scientist who visited my university and who reportedly made that comment happens to Robert Hazen, author of the extraordinary book, *Gen-e-sis: The Scientific Quest for Life's Origins*, and a professor of earth science at George Mason University.

His comment as reported in the *Ames Tribune* actually is based on the molecular fossil record. Most reviews of his work note how fair and balanced his theories actually are. You can't deduce that, however, by reading the 387 words in the story about his talk at Iowa State University on February 3, 2006. You need to glean the 339 pages in Hazen's hard cover book.

Book Bites

Below are some of the most influential books that helped shape a century of science, according to *The American Scientist*. I have reduced each work's premise or conclusion into a sound bite–an excerpt taken out of context–the way many reporters do speeches by scientists. Sometimes those reporters jot down the premise and leave before the conclusion, to make deadline, especially if the speech is scheduled between 7-8 p.m., allowing little time to write and file the report. Sometimes reporters working on multiple stories show up for the conclusion and miss the premise, asking a few quick questions afterward and then scooting.

What would be the outcome, I wondered, if reporters attended lectures by authors of these great books, quoting them out of context in the year of publication, given the social mores of those times?

1. Aldous Huxley, *The Doors of Perception & Heaven and Hell* (1954): "Although obviously superior to cocaine, opium, alcohol and tobacco, mescaline is not yet the ideal drug. Along with the happily transfigured majority of mescaline takers there is a minority that finds in the drug only hell or purgatory" (p. 66).

2. Pierre Teilhard de Chardin, *The Phenomenon of Man* (1959): "[M]an is seen not as a static centre of the world—as he for long believed himself to be–but as the axis and leading shoot of evolution, which is something much finer" (p. 36).

3. Rachel Carson, *Silent Spring* (1962): "Future historians may well be amazed by our distorted sense of proportion. How could intelligent beings seek to control a few unwanted species by a method that contaminated the entire environment and brought the threat of disease and death even to their own kind?" (p. 8.)

4. Benoit B. Mandelbrot, *Fractals* (1977): "Why is geometry often described as 'cold' and 'dry'? One reason lies in its inability to describe the shape of a cloud, a mountain a coastline, or a tree.… Mathematicians have disdained this challenge, however, and have increasingly chosen to flee from nature by devising theories unrelated to anything we can see or feel" (p. 2).

5. Jane Goodall, *In the Shadow of Man* (1988): "Who knows what the chimpanzee will be like forty million years hence? It should be of concern to us all that we permit him to live, that we at least give him the chance to evolve" (p. 252).

6. Steven Weinberg, *Dreams of a Final Theory* (1992): "If there is a God that has special plans for humans, then He has taken very great pains to hide His concern for us. To me it would seem impolite if not impious to bother such a God with our prayers" (p. 251).

7. Denise Schmandt-Besserat, *How Writing Came About* (1996): "[W]riting emerged from a counting device.… Each change of reckoning device–tallies, plain tokens, complex tokens–corresponded to a new form of economy: hunting and gathering, agriculture, industry" (p. 122).

Those excerpts make great pull quotes in print or sound bites on air. However, taken out of context, they also provoke as much as inform. That is why I caution scientists to at least qualify similar remarks with humbler disclaimers, especially if they believe passionately in their assertions.

Straight to the Source

How, indeed, do scientists successfully condense the data of their passionate truths and convey them dispassionately to non-scientist reporters on a topic that is sure to spark controversy and debate?

I put that question to Robert Hazen, who responded at length in this e-mail:

"[S]cientists must be ever so careful when talking to reporters, especially those not trained in science or who are working on a tight deadline. Scientific progress can be halting, technically dense, often incomplete and filled with caveats. The scientific story is often messy, with lingering doubts, rival hypotheses, and always lots more work to be done (because the more we learn, the more we realize we have yet to learn).

"Reporters, on the other hand, want a neat story, simply told and unambiguous in its meaning. Reporters also love a controversy, and (in the interests of 'fair and balanced' reporting) will often present two opposing viewpoints with equal weight, even when the scientific community overwhelmingly endorses just one conclusion.

"So what's a scientist to do? My approach is to explain three things:

"First, describe what we think we know about the topic (and, if possible, provide a little background about the measurements and theory that support that knowledge). How do we arrive at our conclusions?

"Second, explain what we DON'T know about the topic, including the uncertainties, the controversies, and a sense of how much weight to place on different ideas. It's always best to be honest about our imperfect state of understanding.

"Third, and equally important, explain what we're doing to find out more."

According to Dr. Hazen, science is a never-ending adventure. I feel the same way about journalism. It is the task of journalist and scientist to communicate that sense of adventure to the public without misquotation or overstatement. After all, in both our disciplines, the facts should speak for themselves.

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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