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Baltimore to Host 2006 APS March Meeting

More than 6000 physicists from around the world will descend on the Baltimore Convention Center for the 2006 APS March Meeting, to be held March 13-19 in Baltimore, Maryland. It is the largest annual gathering of professional physicists in the country.

This year, the scientific program will feature more than 90 invited sessions and 550 contributed sessions, on topics ranging from condensed matter physics, materials physics, high polymer physics, chemical and biological physics, fluid dynamics, laser science, computational physics, industrial and applied physics, and atomic, molecular and optical physics, as well as numerous other subfields. Special scheduled events include the annual prize and award session, a one-day workshop on professional skills development for women physicists, a panel discussion with AIP and APS journal editors, and a High School Teachers' Day on Tuesday, March 14.

In addition to the regular technical program, there will be eight half-day tutorials offered on Sunday, March 12, on spintronics; molecular magnetics; current interpretations of quantum mechanics; thermoelectric energy conversion; solid state implementations of cavity QED; spallation neutron sources; forefront methods and limits of lithography; and polymeric templating. There will also be a special workshop, sponsored by the APS Forum on Education, on teaching quantum mechanics with interactive computer-based tutorials. The workshop is free to all registrants.

On Saturday, March 11, the APS Division of Polymer Physics will host a special short course on polymers in existing and emerging patterning technologies, with a specific focus on the materials requirements. The ability to create high-resolution, periodic patterns within a polymer thin-film is the basis of photolithography in microelectronics processing, and polymers are among the best candidates for next-generation lithography technologies.

From a science policy standpoint, Baltimore is a particularly advantageous location for one of the largest physics meetings of the year. In addition to the usual "Contact Congress" booths at the meeting, the APS Office of Public Affairs (OPA) is organizing Congressional visits for Wednesday and Thursday, March

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2006 Policy for Printed Bulletin

Registrants for the 2006 APS March Meeting will receive a free CD-ROM of the March Meeting Bulletin. Those who pre-register and wish to have the two-volume printed Bulletin should add $50 to the registration fee at the time of registration. Individuals who register on-site at the meeting will have the option of purchasing the printed version for $50, based on availability. Prior to the meeting, the entire program and each individual day of the program will be available for downloading as pdfs.

Computer terminals will be available at the meeting so that attendees can look up abstracts. Free wi-fi will be available in the main lobbies of the convention center. Further details about the 2006 policy are available online at http://www.aps.org/meet/MAR06.

Conference Addresses Problems of Sustainable Development Worldwide

By Ernie Tretkoff

About 350 people from over 70 nations attended the World Conference on Physics and Sustainable Development from October 31 to November 2 in Durban, South Africa.

The purpose of the conference was to bring the international physics community together to develop plans for addressing some of the problems of sustainable development. The conference also served as a final international event for the World Year of Physics.

The conference was sponsored by the Abdus Salam International Center for Theoretical Physics (ICTP), the International Union of Pure and Applied Physics (IUPAP), and the South African Institute of Physics (SAIP) and the United Nations Educational, Scientific, and Cultural Organization (UNESCO).

At the conference, four main themes were discussed: Physics and Health, Physics and Economic Development, Physics Education, and Energy and Environment. These themes were chosen because these are areas where physics has made major contributions in the past and where physics can make significant contributions in the future, said Judy Franz, APS Executive Officer and Secretary-General of IUPAP.

After a day of opening plenary sessions introducing the four themes, participants divided into the four groups, and each group came up with three or four

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Plasma Turbulence, ELM Insights Highlight 2005 DPP Meeting

Using the solar wind to study the flow patterns of plasma, new insights into plasma instabilities, and the development of novel approaches to designing effective containment walls for fusion reactors were among the technical highlights of the 47th Annual Meeting of the APS Division of Plasma Physics (DPP), held October 24-28, 2005, in Denver, Colorado. More than 1500 attendees presented 1600 papers covering the latest advances in plasma-based research and technology.

In addition to the regular technical program, the meeting featured four mini-conferences throughout the week, on astrophysical explosions; reconnection and turbulence in fluids and plasmas; status and progress of the fast ignition concept for compressed fuel; and the dynamics of magnetic flux tubes in space and laboratory plasmas. Two special poster sessions focused on physics research at the high school and undergraduate levels, featuring presentations from summer and thesis research by participating students.

The DPP also scheduled a series

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Demonstrations of plasma, its mystery, beauty, and power, were available at the DPP-sponsored Plasma Sciences Expo.

Three Undergraduates Receive APS Apker Awards

Nathaniel Craig *Matthew Paoletti* *David Miller*

Photo credit: Shelly Johnston

The LeRoy Apker Award is given for outstanding research accomplishments in physics by an undergraduate. Two categories are recognized, one for an undergraduate at an institution that grants the PhD, and the other for an undergraduate at an institution that does not grant the PhD. Normally, there is one award each year in each category. This year, however, in an unusual but not unprecedented move, the selection committee recommended, and the APS Executive Board approved, three recipients: one in the non-PhD category, and two in the PhD category.

The non-PhD recipient is Matthew Paoletti of Bucknell University, who, working under the supervision of Tom Solomon, did his research on "Experimental Studies of the Effects of Chaotic Mixing on Advection-Reaction-Diffusion Systems." At Bucknell, Paoletti won the Lowry Prize for most outstanding physics major, the Phi Beta Kappa Award for most outstanding research, and the Miller Prize for the best honor's thesis. He is now pursuing graduate studies at the University of Maryland.

One of the PhD recipients is Nathanial J. Craig of Harvard, who did his award-winning work in the laboratory of Charles Marcus, on "Tunable Non-local Spin Control in a Coupled Quantum Dot System". In a display of versatility, he intends to work on string theory in graduate school at Stanford.

The other PhD recipient is David Miller of the University of Chicago. His research project, titled "Search for high energy axions with the CAST calorimeter" was carried out at CERN and was done under the supervision of Juan Collar. Like Craig, Miller will pursue his graduate work at Stanford, after completing his experimental work at CERN.

Fire When Ready, Gridley!

Photo credit: Vinaya Sathyasheelappa

As a capstone event of the World Year of Physics, APS is commissioning a work of art representing the WYP theme "Einstein in the 21st Century". The work is being executed by the Washington Glass Studio, and, in addition to being installed in a suitable venue, will be the subject of a poster that wll be distributed early in 2006. In the photo, Kendra Rand of the APS WYP team (left) watches as Michael Janis (center) of the Washington Glass Studio prepares a glass plate for firing in the kiln. His colleague Tim Tate (right) keeps a close eye on the proceedings.

Members in the Media

"It's such a very complicated thing that's hard to explain. That's what everybody kind of laughs at. They're all impressed it's such a complicated thing and then they ask, 'What do you need it for?' "

–Richard Steiner, NIST, on the electronic kilogram, The New York Times, October 16, 2005

"Even those of us who are doing these experiments usually just 'shut up and calculate.' But in our off-hours we do think about what it means."

–Paul Kwiat, University of Illinois, Urbana-Champaign, on quantum entanglement, The Wall Street Journal, October 14, 2005

"I hope the next three or four years will be our golden age. There are lots of young [physicists] losing sleep looking for the next great thing."

–Chris Quigg, on future discoveries at Fermilab, Chicago Sun-Times, October 21, 2005

"Many science professors aim only to produce more scientists when they teach. They teach to one-tenth of 1 percent of the students. That's not good for society. It's producing a citizenry that thinks of science as having no connection to their lives."

–Carl Wieman, University of Colorado, on science education, The New York Times, November 1, 2005

"The land is really flat and there is a good network of roads. The night sky is dark and clear."

– Pablo Bauleo, Colorado State University, on the Colorado site for the proposed Pierre Auger Observatory, Lamar Daily News (Lamar, Colorado), October 25, 2005

"I think they still may be ahead of physicists. I was amazed, going back to the 15th century, to see the appeals not just to a metaphorical spiritual world but to an extra-dimensional spiritual world.

–Lawrence Krauss, Case Western Reserve University, on the fact that artists and writers thought of extra dimensions ahead of physicists, the Cleveland Plain-Dealer, October 21, 2005

"It's not a trivial thing to do, build a dirty bomb. It's not simply a matter of tying a rod of cesium to a couple of sticks of dynamite and running away."

–Benn Tannenbaum, on dirty bombs, Associated Press, November 1, 2005

"It's a disaster looming – a time bomb, say. The scientific community knows very little about it. It scares me a lot."

– Gert Harigel, CERN, on chemical weapons dumped into the ocean, The Daily Press, (Newport News, Va.) November 2, 2005

"Is this a significant result? Is there an industry just waiting with bated breath out there for this? The answer is absolutely not."

–George Whitesides, on a study of "microoxen," microscopic algae which can be induced to carry loads, Boston Globe, October 31, 2005

"In my view, this was a singular event in the history of nanotechnology. It not only created a whole new field of 'fullerene chemistry,' it immediately made feasible the notion of making things from the bottom up, just as physicist Richard Feynman had predicted 50 years earlier."

–Neal Lane, Rice University, on the discovery of buckyballs, Associated Press, October 30, 2005

"The existence of these molecules in interstellar space was considered impossible 20 years ago. Now, we know better.... As a class, they are more abundant than all other known interstellar polyatomic molecules combined."

–Louis Allamandola, NASA Ames Research Center, on the discovery of nitrogen-carrying aromatic hydrocarbons throughout the universe, Christian Science Monitor, October 26, 2005

"The reason foreign governments would like this technology is if they reverse-engineer it, they can apply this to their fighter aircraft. If you do that, our air-to-air missiles don't work very well. They can't find the target."

–Dean Wilkening, Stanford University, on stealth technology that hides US warplanes from enemy missiles, Honolulu Advertiser, October 28, 2005

This Month in Physics History

Einstein's Quest for a Unified Theory

After having become famous for several brilliant breakthroughs in physics, including Brownian motion, the photoelectric effect, and the special and general theories of relativity, Albert Einstein spent the last thirty years of his life on a fruitless quest for a way to combine gravity and electromagnetism into a single elegant theory.

Einstein was motivated by an intellectual need to unify the forces of nature. He felt very strongly that all of nature must be described by a single theory. "The intellect seeking after an integrated theory cannot rest content with the assumption that there exist two distinct fields totally independent of each other by their nature," Einstein said in his Nobel lecture in 1923.

In addition, he believed there was a link between the need to resolve apparent paradoxes of quantum mechanics and the need to unify electromagnetism and gravity. Einstein always insisted that quantum mechanics could be derived from some more complete theory. For Einstein, who was never satisfied with the weirdness and randomness inherent in quantum theory, any acceptable unified field theory had to have quantum mechanics as a consequence.

In the 1920s, when Einstein began his work on a unified field theory, electromagnetism and gravity were the only known forces, and the electron and the proton were the only known subatomic particles. Most physicists at the time were excited about the newly discovered quantum theory, and spent their time absorbed with exploring its bizarre and interesting consequences. They didn't see any great need for a theory uniting electromagnetism and gravity.

But Einstein, and several other scientists, did work on the problem of unification. In 1918, Hermann Weyl proposed a unification scheme based on a generalization of Riemannian geometry. Inspired by Weyl's work, Theodor Kaluza showed that by extending space-time to five dimensions, one could produce the Einstein equations in four dimensions, plus an extra set of equations that is equivalent to Maxwell's equations for electromagnetism. The fifth dimension would be compact, curled up so small that we can't detect it. Oskar Klein later refined this idea.

Photo credit: Alan Richards

Einstein's last blackboard, Institute for Advanced Study (1955).

Einstein liked the five-dimensional approach. In 1919, he wrote to Kaluza, "The idea of achieving unification by means of a five-dimensional cylinder world would never have dawned on me...At first glance I like your idea enormously." Kaluza published his paper in 1921, and Einstein published his first paper on unified field theory, with Jacob Grommer, following a similar approach, in 1922.

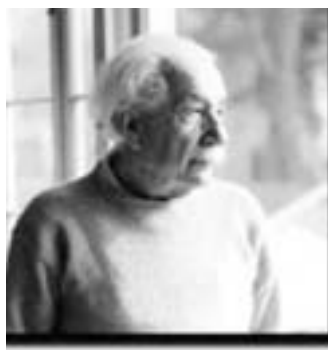
Another approach Einstein tried involved extending general relativity to include the equations of electromagnetism by generalizing the metric tensor while keeping the 4-dimensional geometry.

Einstein worked on these two basic approaches persistently for the last thirty years of his life, but neither method ever produced the complete unified theory he was looking for.

He pursued and then soon rejected idea after idea. "Most of my intellectual offspring end up very young in the graveyard of disappointed hopes," Einstein wrote in a letter in 1938.

But he never gave up on his quest for a unified theory. Even while lying on his deathbed, he continued his work. The day before he died, he asked to have his latest notes brought to him.

One reason for Einstein's failure to discover a unified theory may be his rejection of quantum mechanics, which caused him to ignore new developments in physics and distance himself from the rest of the physics community. Einstein was aware of his position, and commented in 1954 that "I must seem like an ostrich who forever buries its head in the relativistic sand in order not to face the evil quanta." But the more he worked on unification, the farther away Einstein drifted from the rest



of the physics community.

He also became more and more absorbed in formal mathematical arguments, rather than following the physical intuition that had guided him in his youth to his great discoveries.

Many people say that Einstein failed because he was simply ahead of his time. The knowledge and tools needed to complete a unified theory simply hadn't been developed before Einstein died in 1955.

Today, many physicists are taking up his quest. The most promising approach appears to be string theory, which requires 10 or more dimensions and describes all elementary particles as vibrating strings, with different modes of vibration producing different particles.

String theory has not yet made any testable predictions, and some scientists worry that string theorists have, like Einstein in his later years, strayed too far from physical reality in their obsession with beautiful mathematics. But many others believe string theory does indeed hold the key to completing Einstein's quest, and researchers are hoping to find ways to test some of the predictions of string theory.

Though his own work never produced a useful physical theory, Einstein established unification as an important goal of physics. Indeed a theory of everything is commonly called the "holy grail" of modern physics. Einstein would probably be pleased that so many physicists are enthusiastically devoting their careers to pursuing his dream.

Ed. Note: As the World Year of Physics draws to a close, we are ending our series of history columns concentrating on Einstein. We are also changing authors. For five years, "This Month in Physics History" has been written by associate editor Jennifer Ouellette; upcoming columns (as well as this one) will be the work of science writer Ernie Tretkoff.

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Achim Richter Replaces George Bertsch as Editor of Reviews of Modern Physics

Achim Richter

Editors in charge of APS journals have, until now, always been based at institutions in the United States. With authorship and readership of these journals becoming increasingly international, APS has appointed the first editor of one of its journals who is based abroad.

Taking over in January as the new editor of *Reviews of Modern Physics* will be Achim Richter, Professor at the Technische Universität, Darmstadt. He will succeed George Bertsch of the University of Washington.

Commenting on this move, APS Editor-in-Chief Martin Blume said, "We are very pleased to have attracted Professor Richter, a physicist of great accomplishment, to the position. Now that our editorial processes are completely electronic it is possible and efficient to have editors in any part of the world, and it is very appropriate for our highly international journals to have a senior editor based in Germany. We look forward to the continuation, under Professor Richter's leadership, of the outstanding journal that is *Reviews of Modern Physics*."

The 65-year-old Richter is a Fellow of APS. He has a distinguished record of research in several different areas, including nuclear reactions, nuclear structure, atomic physics, accelerator physics, and non-linear dynamics. He has been a professor at Darmstadt since 1974. As editor, he will be responsible for editorial standards, policies, and direction of the journal, and leadership of a board of associate editors.

Bertsch is retiring after 10 years as editor of RMP. "George Bertsch has served with distinction, wisdom and great energy," said Blume, "and he leaves RMP in a secure and enviable position. We were fortunate to have a number of excellent candidates for his replacement, and are grateful to the RMP search committee for undertaking the difficult task of making a final recommendation."

The chair of the RMP search committee was Robert Siemann of SLAC.

Physicist Does Star Turn in TV Reality Show

Timothy Gay of the University of Nebraska often engages in what he calls "physics propaganda." He says, "As working scientists, we need to explain to the public why what we're doing is cool and interesting." In fact, this fall Gay has promoted physics while appearing on a primetime reality TV show with rocker Tommy Lee (though Gay says "reality is overstating the case").

In the show, "Tommy Lee goes to College" (NBC), middle-aged rocker Tommy Lee attends the University of Nebraska as a student, in order to capture the college experience he skipped in order to start the rock band Motley Crue when he was 19. Some University of Nebraska faculty and administrators were initially nervous about the show, and about having the notorious Tommy Lee on campus, says Gay, but "the rest of us were like, 'Rock on, dude!'" So Gay agreed to have Tommy Lee attend his class, and to play the role of Tommy Lee's academic advisor.

Gay says he got along well with Lee, who actually did seem interested in Gay's physics lab. "He was intrigued by all the apparatus. I talked to him about how a research group actually works," says Gay. On the show's first episode, Gay shows Tommy Lee his lab, and explains some of the equipment. "We got in about five minutes of physics, and I'm actually describing to him my lab. Real physics got put on TV for three or four minutes. I was describing polarized electrons."

Polarized electrons, which Gay's lab studies, are basically electrons that are all spinning along one direction. One of Gay's research projects involves investigating polarized electron scattering by chiral molecules. Like a right and left hand, chiral molecules cannot be superimposed on their mirror images, no matter how you rotate them. A DNA spiral is an example of a chiral molecule.

Although a right-handed molecule might be the mirror image of a left-handed one, they don't always behave in perfect mirror image ways. Gay is working to measure some of these slight differences, such as in the way chiral molecules scatter polarized electrons. One motivation for this research, explains Gay, is that all DNA happens to be right-handed, and scientists don't understand why, though there are some theories. Gay hopes his research may help shed some light on the problem.

Timothy Gay (right) with Tommy Lee

Gay's group is also working on several other research projects, including experiments to measure the details of how angular momentum gets divided up among the collision fragments when photons or charged particles hit an atomic or molecular target. These fundamental studies will help give physicists a better basic understanding of the scattering process, says Gay.

When he's not hanging out with rock stars, teaching classes, or doing physics research, Gay might be found out rooting for his favorite football team, the University of Nebraska Cornhuskers, or explaining the physics of the game to other football fans.

"The basic problem that we have as physicists is that people don't want to do the work to understand physics," says Gay. People might be more interested in physics if they see how it relates to something they care about, says Gay, and "In Nebraska, what people care about is football."

So he has put together a series of short lessons that Cornhuskers fans watch on large television screens during breaks in the action. The lessons explore topics such as Newton's laws, energy and momentum, air resistance, and atoms and photons, as they relate to football. In 2001, NFL Films hired Gay to do a series of five-minute television segments on the physics of football. He has even written a popular book called *Football Physics*.

Gay grew up in a small town in western Ohio, where the only school had grades k-12 all in one building. In kindergarten, he would peer through the window of the chemistry lab across the hall, and was fascinated by what he saw. He was also inspired by Marie Curie, and read several biographies of her. Though initially intrigued by chemistry, Gay soon became even more interested in physics, because, he says, "physics seemed like it had cooler toys." By age 8 he felt quite certain that he wanted to be a physicist, and he never changed his mind. He majored in physics at Caltech, and then completed his PhD at the University of Chicago, before becoming a professor of physics. Gay agrees it is very unusual for someone to have found his passion for physics at such a young age. He points out that many of the undergraduates he teaches still have no idea what they want to do with their lives.

Some fellow physicists might worry that he spends too much time promoting physics, or that he promotes physics in a less than serious a way, says Gay, but he doesn't see it that way. "The point is that you can be a serious scientist, and still try to make it available to the public," he says. "You can do both."

-Courtesy of Physics Central.com

INSIDE THE BELTWAY: WASHINGTON ANALYSIS AND OPINION

Living with the Clout of Religious Conservatives

by Michael S. Lubell, APS Director of Public Affairs

"Fringe politics" used be a disease that mostly afflicted Democrats and left Republicans untouched. No more.

For science especially, the GOP's loss of that immunity has immense implications. Like it or not, scientists will have to learn to engage the religious right with a positive message. Here's why.

During the last forty years, Republicans have generally been able to campaign and govern nationally from the center, while Democrats, more often than not, have been held hostage by the liberal left. This has left Democrats with a pretty shoddy record in presidential elections and Republicans with a fairly reliable White House address.

But recent events prove that the GOP's resistance to "fringe politics" is largely history. Harriet Miers' failed Supreme Court candidacy and the President's choice of Samuel Alito as the replacement nominee should put to rest any lingering doubts. Alito–whom liberal critics have given the moniker Scalito after Antonin Scalia, arguably the most reliable conservative among the nine sitting Supreme Court justices–has a fifteen-year appellate court track record of judicial conservatism that makes moderates and liberals squirm.

Miers was no darling of the left either, but when President Bush tapped his legal counsel to fill Sandra Day O'Connor's seat as Associate Justice of the United States Supreme court, it wasn't the left that first hauled out the howitzers. It was Kansas Senator Sam Brownback, a leader of socially conservative Republicans, who began firing away. His Senate colleague, Minority Leader Harry Reid, a Nevada Democrat, by contrast had cautious praise for the President's selection.

Miers' lack of experience with constitutional law didn't help her cause, but she wouldn't have been the first associate justice to have had a thin résumé in that arena. Since 1941, ten nominees who had no prior judicial experience received Senate confirmation. They include Chief Justices William Rehnquist and Earl Warren, and well respected jurists Lewis Powell, Tom Clark, Byron White and Arthur Goldberg.

But for social conservatives, especially religious fundamentalists, Miers didn't have the right stuff. Yes, almost two decades ago she had joined the growing numbers of Americans who self-identify as "Born Again Christians." Yes, she had campaigned for a Dallas City Council seat in 1989 as a staunch pro-life candidate. But as a high-level corporate attorney, she had never appeared before the court on the key issues social conservatives hold dear. In the end, that proved to be her undoing.

Faced with unrelenting, withering criticism by the conservative right, President Bush eventually capitulated and asked Miers to withdraw her name. She became only the seventh Supreme Court nominee in the history of the country to do so, and the first since Douglas Ginsburg, a Reagan nominee, withdrew in 1987 after admitting that he had smoked marijuana as a member of the Harvard Law School faculty.

The way most political analysts read the Miers debacle, it was evidence of a gross miscalculation by the President, a lack of focus on the selection process by the President's principal domestic policy advisor, Karl Rove – who was distracted by his own legal problems–and Miers' own inattentiveness to the details of her nomination.

From my perspective, though, there is something more fundamental at work. The numbers tell the story.

According to recent polls, 20 percent of Americans are hard core social liberals, and they vote consistently Democratic; 33 percent are hard core social conservatives, and they vote Republican; 47 percent , a clear plurality, are moderates, and they are the swing-voters who ultimately determine the outcome of any election. However, within the political parties, the moderates have less clout than their national plurality status might suggest, in part because they tend to be less passionately involved, but in the case of the GOP, additionally because of simple math.

In the last four presidential elections, Republican and Democratic candidates split the popular vote almost evenly. That means that while only about 40 percent of the Democratic vote came from liberals, a whopping 67 percent of the Republican vote came from conservatives.

So although conservatives, like liberals, still lie in the wings or "fringes" of the American political spectrum, their numbers, which have grown substantially in the last two decades, now allow them to control the GOP agenda. They demonstrated it by forcing President Bush to substitute a proven conservative, such as Alito, for Miers who remained suspect, despite her religious conversion two decades ago.

For science advocates, the dominance of social conservatives in the Republican ranks poses a significant challenge. Relying solely on the influence of industry to promote federal support of science with the new GOP is not a winning strategy. Nor is pitting science against religion, as some prominent members of the science community have done repeatedly, to the delight of the major media. Instead, scientists must learn to engage conservatives by emphasizing the benefits science brings to all Americans, regardless of social or religious preference. For the next three years, at least, it's the only winning strategy.

Letters

Chemists are to Moles as Physicists are to.....?

Today I was treated to free cupcakes to celebrate "National Mole Day" as part of National Chemistry Week. Mole Day is celebrated every October 23 in recognition of Avogadro's number (the connection is obvious if you think chemical constant and not small tunneling animal), and there is even a National Mole Day Foundation.

I was asked by a chemist (the one who makes such excellent cupcakes) why physicists don't have a similar celebration, and if we did what constant we would celebrate. Not having an immediate answer, I checked the back of an introductory physics text for possibilities. There I found quite a number of constants (beginning with Avogadro's number, but that's taken). My chemist friend suggested perhaps celebrating Pi on March 14, but that seems to be more appropriate for mathematicians.

Has the APS has ever asked the physics community which constant we would consider to be the most noteworthy for physics? In what units should it be expressed? (Planck's constant could be a problem in MKS units, even if you ignore the negative sign in the exponent.) Do we need a National Speed of Light Day? Or maybe a National Fine Structure Constant Day? On which day would our constant be celebrated? How would we find a name that competes with "Mole Day?"

Fred DeAngelis
Spartanburg, SC

Ed. Note: Another reason to celebrate Pi day on 3/14 is that it also happens to be Albert Einstein's birthday.

Hurricane Prediction Misses by 2 Orders of Magnitude

Let me get this straight - in the October "Inside the Beltway" column, scientific studies dealing with a major hurricane hitting New Orleans "predicts more than 100,000 people could die" and "extensive evacuations would be impossible" and these studies are celebrated as predicting "just the sort of outcome southern Louisiana would suffer." Hail science! Since only slightly more than 1,000 people actually died and the majority of New Orleans residents were evacuated, shouldn't we be applauding the government for the much better result than the revered scientists predicted? Hail Nagin, Blanco and Bush! Perhaps the author's viewpoint is a little skewed.

Mark Campbell
Annapolis, MD

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I feel compelled to write you concerning Michael Lubell's article "The Avoidable Tragedy of New Orleans" in the October, 2005 issue of *APS News*. Lubell misses a crucial point in his criticism of the Bush administration. He refers to scientific studies that predicted tens (if not hundreds) of thousands of people could be killed if a big storm caused the levies to fail. If the government deserves scorn for failing to prepare for such an event, does it not also deserve praise for a rescue effort that resulted in far fewer deaths than anticipated? A fair critique should consider the good as well as the bad.

As an aside, towards the end of his article, Lubell ponders whether "Perhaps scientists and engineers are too arrogant." He then writes, "Perhaps science is too complicated for policy makers to understand." I'd say the latter sentiment proves the former.

Robert Hueckstaedt
Los Alamos, NM

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Michael Lubell's article in the October *APS News* was not very helpful. His main thesis is that the Corps of Engineers was not given all the money it requested for flood control work. And, oh yes, scientific studies and computer modeling had been forecasting what was going to happen and were ignored. The obligatory blame is placed on the Bush administration.

Preliminary reports from the engineering teams sponsored by the National Science Foundation and the American Society of Civil Engineers tell a different story. There were dozens of levee breaks that resulted from poor design and construction where the failure could not have been associated with over-topping the levees. This was

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Students Asked to Take Science on Faith

It is a mistake to identify the motivation to do science with the science itself. After all, Newton proceeded from a deeply religious point of view, and would likely assert a belief in intelligent design. Such an assertion is not science, but may be the inspiration to do science.

Religion can motivate both art and science, but only the arts have made religion the subject of the discipline. Science has had very little to say about religion in any constructive sense. However religion cannot ignore science the way science ignores religion.

Religion cannot ignore the fact that science continues to make statements about the world which turn out to be true. Intelligent design has nothing to say about global warming, but science is fully expected to yield useful results in the long run. Because science solves difficult problems which religion cannot, it is easy to see science as a competing, and more effective, religion. (See "Philosophy, Rhetoric, and the End of Knowledge" by Steve Fuller.)

The physics community contributes to this image when it puts forward the Bernoulli explanation of the picture on page 1 of the October issue of *APS News*. If the student blowing on the ping pong balls walks away with the idea that high velocity causes low pressure, she is infected with a magical view of the world. With such a view, she cannot understand; she can only hope to ask authority.

John W. Dooley
Millersville, PA

Viewpoint...

International and US Efforts to Regulate Civil Society Participation

By Irving A. Lerch

Science is the most universal of intellectual enterprises with a common lexicon and universal standards. Yet the social structure of science is complex with overlapping entities, missions, authorities, alliances, connections to government and institutions, interests, areas of expertise, governance, agreements and outreach. It consists of non-governmental organizations, the private sector, governments, intergovernmental agencies such as the UN system (to include specialized agencies, the World Bank and World Monetary Fund and regional development banks), OAS and OECD, large regional science organizations such as the high-energy research center CERN, regulatory organizations such as ITO, international commissions such as the International Oceanographic Commission, and multilateral agreements such as the Kyoto Protocol.

The UN family has recognized science and engineering as important cultural enterprises with profound impact on economic development and security. Two agencies serve to illustrate the importance of the UN to such issues as environment, education, energy and national security: the United Nations Educational, Scientific and Cultural Organization (UNESCO) and the International Atomic Energy Agency (IAEA). The international face of the scientific community is the International Council for Science (ICSU).

In recent years, a consortium of national science academies has formed the Inter-Academy Panel to coordinate efforts to influence science-based policy for development and other cross-cutting international issues. The subsequent organization of the Inter-Academy Council to serve as an operating arm similar to the role played by the National Research Council for the National Academy complex, has begun to take on a more active role by publishing studies for delivery to governments and the UN.

In the early 1990s, the international physics community began to look to UNESCO as an instrument to unify and coordinate the international outreach of the global physics enterprise (even though the US and the UK had withdrawn from UNESCO in 1984). The Physics Action Council (PAC) convened an organizing meeting in April, 1994. The PAC remained an active component of the Organization's programs throughout the period of 1994-1999.

Almost immediately, the council's working groups began an aggressive program of international outreach, organizing meetings and workshops on telecommunications, access to large international research facilities and new approaches to invigorate physics education. In all cases these efforts were directed to complementing and strengthening the programs of the Science Sector and ICTP. Today, the afterglow of the council's activities may be seen in the UNESCO-supported SESAME project, the programs of the telecommunications and informatics sectors of the Organization, and in the awareness that science education plays a crucial role in developing the intellectual capacity of nations. At no time did the governments of any participating expert intervene or demand prior notice.

However, over the past few years, a troubling pattern of US government interference with the traditional lines connecting UN intergovernmental programs with civil society has arisen in the guise of demands that government officials be consulted and informed in advance of contacts between agency secretariats and US citizens and residents. This now threatens to transfer authority for expert appointments to UN committees, conferences and commissions from the learned and professional communities to officials in the US government. The threat arising from such a transformation is that appointments will no longer be based on merit but on bureaucratic and political considerations. The independence and integrity of such fora, committees and commissions will thus be compromised.

In analyzing these trends, the operative word is "consult." What constitutes consultation? During the Cold War, the Soviet government closely controlled interactions between UN secretariats and Soviet citizens. It was not uncommon for the organizing committee for an expert meeting to proffer invitations to a known scientist only to find his or her place taken by an unknown Soviet government official. By contrast, US government officials when asked to approve such

Viewpoint continued on page 5

Many Scientists are Religious, Too

Regarding the comment by Steven Weinberg in the "Members in the Media" section of the October 2005 *APS News*: while his anecdotal experience of scientists not being religiously inclined may not be disputable, several studies have shown that it is not necessarily accurate on the large scale. Larson and Witham reported in *Nature* in 1997 that 39% of scientists believe in a personal God. An article in the Washington Times in the same year reported that "many scientists see God's hand" in evolution and cosmology. As a religious person and a scientist myself, I will add my own anecdotal experience of being acquainted with many scientists of a religious persuasion, including an entire organization, the American Scientific Affiliation.

Brian Thomas
Topeka, KS

Scientists: "Smarter Than Thou"?

Marshall Berman's back page article raises three important questions. (1) Why are Americans so anti-science? (2) Why is the furor focused upon the theory of evolution? And (3) what, if anything, should members of APS do about any of this? Here are my opinions.

People resent being coerced or ridiculed. Evolution is a required topic in a required subject in a required public education. Controlling biological texts is coercion. Evolution has been deliberately used to ridicule certain religious ideas, and vice versa. None of this helps anyone.

Scientists are perceived as having "smarter than thou" attitudes, which invokes either a "so who elected you God" or a "don't

Smarter Than Thou continued on page 7

Religious Bathwater May Contain Scientific Baby

The October 2005 Back Page article by Marshall Berman on opposing the Intelligent Design (ID) movement–which threatens to destroy science, secular democracy and public science literacy – prompted me to write this letter. I wish to aid Berman's holy cause by critically examining and expunging the so-called contributions to physics of ID-quacks, since believing in a designer obviously invalidates all of one's scientific ideas.

Faraday and Maxwell were devout Christians who believed in a Creator, so remove electricity and magnetism. Newton wrote extensively about his scientific findings glorifying the Great Designer, so calculus and mechanics and gravitation have to go. Even Einstein talked a lot about the "old one." Just to be careful, in case he was a closet ID guy, we'll expunge his contributions to physics, too. One must also worry about Galileo and Kepler, but I'm running out of space.

After getting rid of ID-tainted ideas, our remaining physics will be ideologically pure, democracy will be safe for our time, and

Scientific Baby continued on page 7

No One Person Invented the Laser

The matter of "inventorship" of something as important as the laser is rarely suited for a short summary such as found in "This Month in Physics History", *APS News*, August/September, 2005 or in Paul Zweifel's letter ["Invention of the Maser and Laser Clarified"] in the October *APS News*. Our paper, "Who invented the laser: An analysis of the early patents", [*Historical studies in the Physical and Biological Sciences 34*, 115 (2003)] provides a more detailed account for readers who want to look at the primary sources.

It is generally understood that "inventorship" is determined by patent priority and the matter of Gould v. Townes et al. was extensively litigated. To the extent that

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WCPSD CONTINUED FROM PAGE 1

Photo credit: Roy Reed

South Africa Minister of Science & Technology Mosibudi Mangena officially opens the conference

recommendations.

In Physics and Education, recommendations include: making physics teaching resources and materials available through a website and equipment resource center; developing instructional materials that highlight the relationships between physics and sustainable development; presenting workshops for teacher-trainers in Latin America, Asia, and Africa; and supporting mobile physics projects.

Out of the Physics and Economic Development theme came a proposal for a facility that would train physicists in business skills to help them apply physics for economic development, a network on physics and agriculture that would make materials and resources available online, and a network on nanoscience for economic development, focusing on air, water, and energy.

The Energy and Environment session recommended investigating ways to enhance efficiency and reduce pollution in transportation, including studying new battery and internal combustion technology, promoting the use of solar energy, and developing biomass energy for small communities. Energy and Environment co-chair Osman Benchikh, of the Division of Basic and Engineering Sciences of UNESCO pointed out that 77 percent of people in the developing world do not have electricity, so energy is an extremely important area for development. A global program on renewable energy is needed, he said.

The fourth theme, Physics and Health, produced recommendations that included developing a collection of web resources for education, development of guidelines for medical physics education programs, development of regional training centers for radiation physicists, and increased recognition of physicists in medicine and collaboration with other physicists.

APS President Marvin Cohen said he felt there had been many good discussions at the conference. He emphasized that the proposals should be viewed as preliminary, and they will probably evolve as conference participants move forward with implementing them.

Participants will follow up by continuing to meet with each other, forming task forces, finalizing proposals, and seeking funding. Each of the four themes will have an online bulletin board for participants to meet and discuss follow-up issues.

Amy Flatten, APS director of International Affairs, said that the conference went extremely smoothly. Participants were pleased that everyone was able to come together and produce concrete recommendations. "There was a lot of energy. The conversations were dynamic. There was a real sense of moving forward," said Flatten.

Osman Benchikh, co-chair of the Energy and Environment theme, echoed those thoughts. "There was a lot of enthusiasm from the developing countries," he said. Participants from developing countries seemed to think the conference was helpful, and they believed they would be able to carry out the recommendations. For instance, Phuc Xuan Nguyen, a condensed matter physicist from Vietnam said the conference was useful and noted that economic development, energy, health, and education are all important areas where there are problems to be solved in the developing world.

Photo credit: Roy Reed

Amy Flatten, APS Director of International Affairs, welcomes delegates at the Energy & Environment break-out session.

Case Contest Seeks 27 Great 20th-Century Physicists

To celebrate the World Year of Physics, the physics department at Case Western Reserve University in Cleveland is organizing the "27 Physicists Contest," open to participants in 3 categories: high school students, high school teachers, and college undergraduates.

The World Year of Physics, commemorating Einstein's miracle year of 1905, also coincides with the centennial of the physics building at Case. In 1905, the names of 34 great pre-1905 physicists were engraved on the Case physics building. The names include the well-known, such as Archimedes and Newton to Ben Franklin and Maxwell, and also others not so widely familiar.

There is room on the building for 27 more names. The challenge of the contest is to vote for great 20th-century physicists from a list of over 100 candidates prepared by the Case faculty. Participants in each of the three categories mentioned above can vote for up to 20 candidates. Three prizes will be awarded in each category to the participants whose lists most closely match the final list of 27 names. The deadline to participate is December 31st.

The Case campus, the location of the famous 1887 Michelson-Morley ether-drift experiment, has been designated an Historical Physics Site by the APS (see *APS News*, May 2005).

To learn more about the contest, and to participate in it, visit the website http://www.phys.cwru.edu/events/WYOP/contest.php.

Hopfield Receives Albert Einstein World Award of Science

APS President-elect John Hopfield of Princeton received the Albert Einstein World Award of Science at a ceremony in Saltillo, Mexico on November 12. The award is administered by the World Cultural Council, and has been given since 1984 across all fields of science, "as an incentive to scientific and technological research and development. It takes into special consideration those researches, which have brought true benefit and well being to mankind." Previous physical science recipients have included Ali Javan, Martin Rees, Martin Kamen, and Margaret Burbidge.

In making the award to Hopfield, the Council cited "his valuable contributions to all three of the major disciplines of modern science: physics, chemistry and biology, and his ability to cross the interdisciplinary boundaries to discover new questions and propose answers that uncover the conceptual structure behind the experimental facts. He has, in recent years, combined the insights of physics and biology to shape our understanding of how the neural circuits of the brain perform complex calculations."

John J. Hopfield

The Council added "Professor John J. Hopfield today is considered the leading theoretician of biology, both in terms of accomplishment and influence. His ability to think broadly as well as deeply about science is a characteristic shared by very few scientists in modern times."

The award consists of a Diploma, a Commemorative medal, and $10,000.

VIEWPOINT CONTINUED FROM PAGE 4

appointments and invitations usually demurred pointing out that the US did not interfere in the professional work ofits citizens.

In these cases, consultation was taken to mean "informed." In the case of invitations to government delegations for treaty discussions, consultation meant both informed and government approval as is always the case when policy and intergovernmental deliberation is contemplated.

In any event, all correspondence to UN secretariats is copied and distributed to relevant program managers and the resident representatives of the nations whose interests are at stake or whose citizens are being contacted. This is the parochial meaning of "consult."

On May 5 of this year, the US Resident Representative to UNESCO, Ambassador Louis Oliver, sent a remarkable memorandum to the UNESCO Director-General demanding a series of steps that included the following:

•Any correspondence from outside the Commission or Resident representative's (RR) office is to be copied and circulated to her office.

•Invitations to scientists and engineers must be cleared in advance.

•Contracts are subject to US oversight and consultation.

•Planning of events require advance consultation.

•Fundraising is not to be undertaken without consultation with the RR.

•Private citizens and organizations calling upon UNESCO must be told to contact the national commission first.

Of these bullets, the first is routine procedure and I doubt that the UNESCO secretariat has failed to do this simple administrative task. The other bullets are astounding and would make interactions with civil society difficult and, perhaps, impossible. The last bullet is especially troubling since the State Department considers the US National Commission as consultative only–to act at the volition and direction of Commission staff. As for fundraising, most expert consultants who have worked with the UN agencies are well-aware that their ability to function depends on their ability to raise funds to supplement the inadequate budgets of the UN system.

In a similar vein, the Department of Health and Human Services demanded that WHO not invite US scientists to participate in meetings or projects. They insisted that the nature of the problem be conveyed to NIH and NIH would assign scientists. Happily WHO refused to accede to this stipulation.

Equally troubling was the decision last year by the State Department to object to the recruitment of US Social Scientists to participate in the work of UNESCO and the subsequent withdrawal of appointments and invitations.

This is unprecedented interference over the participation of civil society in the scientific and technological work of the UN system and is unworthy of a democracy. It abridges the right of US citizens to develop and maintain associations with whomever they choose. It concentrates the authority for such associations within a bureaucracy unable to deal with the substance of the issues before it. It confuses the difference between experts and government representatives, between knowledge and policy. It undermines community self-governance and community standards and undermines the integrity of mechanisms designed to express scientific and engineering consensus.

In short, there is evidence that the US government is moving to superintend the association of scientists and their professional and learned societies within the UN agencies in an effort to control scientific input to programs that have influence over policy debates. While intergovernmental discussions in convention negotiations require the participation of certified government representatives, scientific advice has traditionally been the province of the science and engineering civil sector. The intrusion of government into access to scientific and technological expertise constitutes an abridgement of scientific freedom and self-governance of the scientific community and threatens the integrity of international science organs.

Irving Lerch is chair-elect of the APS Forum on International Physics and a member of the Board of Trustees of Americans for UNESCO. The opinions expressed are personal and do not represent the official views of either organization.

Featured PhysTEC University: Arkansas Ramps Up Teacher Preparation

By Ernie Tretkoff

In the ten years before the University of Arkansas PhysTEC program got started, only one teacher in the entire state had become certified to teach physics. That is changing, in part thanks to the PhysTEC program at the University of Arkansas.

PhysTEC, an APS/AAPT/AIP –led project, encourages physics and education departments at participating institutions to work together to improve the education of physics teachers. Schools that participate in PhysTEC commit to implementing several reforms to improve teacher preparation, including increasing collaboration between the physics and education departments, revising introductory courses to be more inquiry-based, and having a "teacher-in-residence" from the local school system, who mentors students and provides advice to the faculty.

The University of Arkansas PhysTEC program turns out two or three new physics teachers a year, says Gay Stewart, a physics professor and director of the University of Arkansas PhysTEC program. These new teachers are better prepared and more enthusiastic about teaching physics.

Stewart has long been interested in education, but teacher preparation hadn't been as much of a priority for some members the Arkansas physics department. "When we first heard about PhysTEC, we were very excited, because I've always felt that physics departments are responsible for education," said Stewart. "Before PhysTEC, I was the one interested in education, so if something came in, it was handed to me. I was the lead person for all worrying about education," she says. Now, the whole department is more interested and aware of the importance of teacher preparation, she says. "Having this APS-sponsored program that focuses on better teaching and learning has really raised the awareness," said Stewart.

One of the key components of PhysTEC is revising introductory physics courses to be more inquiry-based. The University of Arkansas has revised physics courses and created many new materials to support the new courses, with a special focus on making laboratories more exploratory. One of the most important changes, says Stewart, has been a new teaching assistant preparation program, which trains TAs to run the new inquiry-based labs.

Tests show that the students in the revised courses are indeed learning more, says Stewart. Some students initially feel uncomfortable with inquiry-based learning because they are used to being fed information, rather than discovering things for themselves. Stewart said that one unhappy student wrote in a course evaluation, "Of course I learned more in this course than in others–I had to figure everything out myself."

The revised introductory classes have also led more students to consider teaching as a career, even if they had not previously thought about teaching. These students see a model of good teaching, they see that teaching is important, and they begin to think about becoming teachers themselves. "We've had several cases where people had never considered being a teacher, and they said the class was a lot of fun, and they came and asked 'how could I get involved in teaching'?" said Stewart. Some students who plan to teach other subjects, including chemistry and math, have said they were motivated to go into teaching by the introductory physics class, said Stewart.

Future teachers of all subjects have become more comfortable with physics as a result of the new courses, said Stewart. "Before we revised courses, when teachers who were not trained in physics would get leaned on to teach physics, they were uncomfortable, but now the ones we've trained are more enthusiastic about it. Before we revised the courses, no one was happy when they got asked to teach physics. Now they're happy," said Stewart.

In addition to the other reforms, PhysTEC has brought physics and education faculty together. For instance, says Stewart, they have a "teacher of teachers luncheon," which gets physics and education professors together to discus ways to betters serve students who may be interested in teaching.

This year, the University of Arkansas' PhysTEC Teacher-in-Residence is an elementary school teacher, unlike previous years when a high school teacher has filled the position, said Stewart. Consultations with the education department made it clear that they needed to work on elementary education as well, she said. Future elementary school teachers are now learning some physics for elementary school, and the Teacher-in-Residence is working with the education department on ways to use science to address multiple standards. Elementary school is an especially good time for kids to learn science, says Stewart, "All kids like science until we teach them that it's hard."

PhysTEC future teacher Matthew Jones, a student in the Master of Arts in Teaching program at the University of Arkansas, works with a middle school student on an inquiry-based science project.

Coalition Provides Latest Information On Teacher Education

The PhysTEC project at Arkansas is using many results from physics education research and sharing them through the coalition of schools brought together by the PhysTEC grant. This coalition, the Physics Teacher Education Coalition (www.ptec.org), provides a central clearinghouse for information, ideas and innovations in developing and maintaining teacher preparation programs. Institutions, departments or individuals who would like to hear about some of the most successful innovations throughout the country should contact Ted Hodapp (hodapp@aps.org), APS's lead in this project as well as the Director of Education and Outreach.

MEETING BRIEFS

• The APS Ohio Section held its annual fall meeting October 14-15, at Cleveland State University in Cleveland, Ohio. This year, the meeting was organized around the theme of the World Year of Physics: "From Brownian Motion to the Physics of Complexity." Plenary talks covered such topics as cell motility, fluctuations in flowing foam, Brownian motion as a probe of polymer dynamics, 37 years of the Flying Circus of Physics, and a special Einstein Centennial session. High school teachers also had the opportunity to participate in a free optics workshop during the meeting.

• The APS Northeastern Section also held its annual fall meeting October 14-15 at the University of Vermont in Burlington, Vermont. The technical program focused on the areas of soft condensed matter and nanoscience and featured both invited/plenary sessions and contributed sessions, as well as numerous workshops and the chance to visit the university physics museum. Lecture topics included exploring how polymer chains organize into crystals; organic semiconductors and devices; the physics of DNA; a century of physics teaching; microfluidics; molecular fluids; and solid particles, liquid droplets and new materials.

• The APS Four Corners Section also held its annual fall meeting October 14-15 at the University of Colorado, Boulder. Invited talks covered such subjects as climate change; localization of electrons in amorphous silicon; entanglement and quantum computation; nanothermal-dynamics in disordered materials; and the prospect for technical careers after academia. Friday evening's banquet featured a lecture by Allan Franklin of UC-Boulder on Lisa Meitner and the early history of beta decay. His talk was followed by a planetarium show.

• The APS Texas Section held its annual fall meeting October 20-22 at the University of Houston in Texas. The meeting kicked off Thursday evening with a special Society of Physics Students BBQ, featuring a talk by Mario Diaz of the University of Texas, Brownsville, on "Beyond Einstein: One Hundred Years Later." Friday and Saturday featured both invited and contributed sessions. The former covered such topics as developments in nanotechnology (with a regional focus on research conducted in Texas), including a new lithography approach for nanomagnetic system manufacturing; industrial applications of physics; and ultracold physics. Friday evening's banquet speaker was Rice University's Neal Lane, who shared his experiences as a former presidential science advisor and views on the future of science policy in Washington.

• The APS California Section held its annual meeting October 21-22 at California State University, Sacramento, which featured numerous general sessions on a broad range of topics. Friday evening's banquet speaker was Albert Haldemann, deputy project scientist of the Mars Exploration Rover Mission Jet Propulsion Laboratory at Caltech, who gave an overview of the mission project to date.

zero gravity
The Lighter Side of Science

Little Known Conversion Factors, Explained

1: the ratio of an igloo's circumference to its diameter = Eskimo Pi
2: 2,000 lbs. of chinese soup = won ton
3: 1 millionth of a mouthwash = 1 microscope
4: the time between slipping on a peel and smacking the pavement = 1 bananosecond
5: the weight an evangelist carries with God = 1 billigram
6: the time it takes to sail 220 yards, at 1 nautical mile per hour = knotferlong
7: 365.25 days of drinking low calorie beer = 1 lite year
8: 16.5 feet in the Twilight Zone = 1 Rod Serling
9: half a large intestine = 1 semicolon
10: 1,000,000 aches = 1 megahurtz
11: basic unit of laryngitis = 1 hoarsepower
12: shortest distance between two jokes = a straight line
13: 453.6 graham crackers = 1 pound cake
14: 1 million microphones = 1 megaphone
15: 1 million bicycles = 1 megacycle
16: 365.25 days = 1 unicycle
17: 2,000 mockingbirds = two kilomockingbirds
18: 10 cards = 1 decacard
19: 52 cards = 1 deckacard
20: 1 kilogram of falling figs = 1 fig Newton
21: 1,000 grams of wet socks = 1 literhosen
22: 1 millionth of a fish = 1 microfiche
23: 1 trillion pins = 1 terrapin
24: 10 rations = 1 decaration
25: 100 rations = 1 C-ration
26: 2 monograms = 1 diagram
27: 8 nickels = 2 paradigms
28: 2.4 statute miles of intravenous surgical tubing at Yale University Hospital = 1 I.V. league

BALTIMORE CONTINUED FROM PAGE 1

15-16, so that attendees from districts and states all over the US will have the opportunity to meet with their Congressional representatives. Those interested in participating may contact Kimberly Regan, science policy fellow, OPA, regan@aps.org, or sign up online at http://ultron.aps.org/forms/aps.cgi?ID=3000.

LETTER CONTINUED FROM PAGE 4

apparently the case for the 17th Street and London Avenue canals, which led to most of the flooding in central and western New Orleans.

The Corps of Engineers did not ask for money to rebuild those levees, which would have required recognition that they were not designed and built properly in the first place. Furthermore, the Corps of Engineers were not asking for money to undertake large construction projects to protect against water surges produced by hurricanes stronger than Category 3.

It's difficult to see how restoring the office of science advisor to Cabinet rank, as proposed by Lubell, is the way to fix problems of this sort.

Joseph Sternberg
Woodbury, Connecticut

Science and Engineering Are Hidden Stars in *Stealth*

Hollywood actors take a back seat to science and engineering used in the movie *Stealth*, which opened in theaters nationwide in August. In the movie, the science of artificial intelligence is taken to new heights as three U. S. Navy pilots face their toughest fight yet when an Unmanned Combat Aerial Vehicle named Extreme Deep Invader (EDI) becomes too smart for its own good.

In artificial intelligence, a machine imitates traits seen in human behavior, such as making a decision, but artificial intelligence expert James Hendler at the University of Maryland says that artificial intelligence will always need a human touch. "No matter how 'smart' the machine is, you still have to tell it what to do," says Hendler.

While artificial intelligence is the science featured in the plot of the movie, it's the science and engineering hidden behind the scenes in the movie's production that is truly impressive.

Stealth director Ron Cohen worked with industrial designers drawing from the latest naval jet patterns to create the three talon planes and "EDI." Then, the talons were tweaked to look "beautiful as well as powerful," while "EDI" was designed to be "cool yet terrifying," explained Cohen.

In order to capture all angles of the planes and look realistic flying, the planes had to be able to move in all directions. So, engineers designed and built a one-of-a kind gimbal, which allows the plane to incline at different angles. "The gimbal weighs 100 tons, has the ability to pull five G's and can work on a very wide range of motion," said Cohen. "In terms of our mechanical technology, we designed a gimbal the likes of which had not been seen before."

With the planes ready for any camera angle, Cohen had to worry about how the planes would look flying over the landscape. So, he turned to the computer scientists and technical experts at Digital Domain to try out their brand new technology call Tergen (terrain generator) which creates virtual backgrounds using actual topographic maps of that area. For example, Tergen could pull up a map of Arizona and "EDI" could appear to be flying over the Grand Canyon.

"I think it will be a long time before a movie of this magnitude comes along again where they'll be able to use this type of technology," says John Frazier, *Stealth's* special effects expert.

–Inside Science News Service

LASER CONTINUED FROM PAGE 4

litigation settles anything, that case resolved Gould's claim to the inventorship of the laser. He didn't. He did, however, receive some valuable patents, of which the patent for the Brewster angle window is perhaps the most brilliant [Gordon Gould, US patent 4,746,201], and he died a relatively wealthy man from his royalties. The first reference we found to the parallel mirror configuration, in fact, was in a patent of Robert Dicke's [R. H. Dicke, US patent 2,851,652, filed May 21, 1956, issued Sept. 9, 1958].

After extensive investigation, we concluded that there is no single inventor of the laser. There is no argument that Townes is the inventor of the maser, and Townes and Schawlow certainly deserve much of the credit for the invention of the laser, but–perhaps surprisingly–a good deal of the credit should also go to Bloembergen.

Richard W. Dixon and Robert A. Myers
Bernardsville, NJ

Ed. Note: Dicke's patent is the subject of a letter in the November APS News by John Hopfield.

SMARTER THAN THOU CONTINUED FROM PAGE 4

question authority" response. The result is a mean-spirited public exchange between those who insist evolution is bunk and those who insist evolution is fact.

The hallmark of theological statements is unchanging truth. By definition, a fact does not change, but theories are supposed to be subject to change. When a scientific theory is presented to the public as "fact," the public hears this as a theological statement and responds accordingly. Evolution is the only theory being defended as not subject to change. I think that is why it has attracted the furor.

Unless we teach the public the difference between a theory and a fact, and make it clear that even the most accepted theory (including evolution) is subject to change when new facts are discovered, things will get worse.

J.W. Lane
Tallahassee, Florida

SCIENTIFIC BABY CONTINUED FROM PAGE 4

public science literacy can only improve by not being hampered anymore with the crackpot ideas of scientific imposters like Kepler, Galileo, Newton, Faraday and Maxwell.

Edward J. Garboczi
Gaithersburg, Maryland

2006 APS Journal Policy Change

Starting in 2006, *Physical Review A-E* will no longer be available to members in a print version. Online only subscriptions will be available for these five titles. There are exceptions to the new policy, and current subscribers will be contacted with more information.

Subscription options for *Physical Review Letters, Reviews of Modern Physics, Physical Review Online Archive* (PROLA), and/or *Physical Review Index* will remain unchanged for 2006.

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M. Hildred Blewett Scholarship for Women Physicists

This scholarship has been established to enable women to return to physics research careers after having had to interrupt those careers for family reasons. The scholarship consists of an award of up to $45,000. The applicant must currently be a legal resident or resident alien of the US or Canada. She must be currently in Canada or the US and must have an affiliation with a research-active educational institution or national lab. She must have completed work toward a PhD.

Applications are due June 1, 2006. Announcement of the award is expected to be made by August 1, 2006.

Details and online application can be found at http://www.aps.org/educ/cswp/blewett/index.cfm

Contact: Sue Otwell in the APS office at blewett@aps.org

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

Quantum cloning
Valerio Scarani, Sofyan Iblisdir, Nicolas Gisin, and Antonio Acín

Classical information can be copied as many times as one wants. In the quantum world, however, some degradation is inevitable when one tries to copy the quantum state of a system into another one. This fundamental property of quantum physics is at the center of this article, which reviews copying methods from the point of view of minimizing the degradation. Possible applications might appear in quantum cryptography and light amplification.

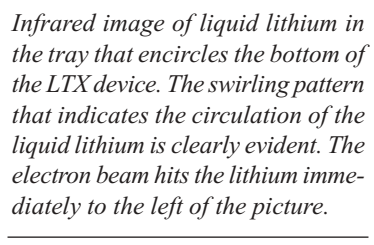
2005 DPP MEETING CONTINUED FROM PAGE 1

of educational events to encourage teachers, students and the general public to explore plasma. At the Plasma Expo, offered without charge to teachers and their students, scientists from around the world were on hand to engage participants in lively hands-on demonstrations and explorations. Those attending were able to create arcs of lightning, observe their fluctuating body temperature on a special monitor, manipulate a glowing plasma with magnets, and learn how to confine a plasma by playing a tokamak video game.

Turbulence of the Solar Wind. Researchers at Los Alamos National Laboratory are using the solar wind and Earth's magnetosphere as a planet-sized "wind tunnel" to study the flow properties of plasma, much as engineers use wind tunnels to study airflow when designing aircraft. A recent study has shown that turbulence in the solar wind affects the way the wind interacts with Earth's magnetosphere, just as turbulence in the air affects airflow around an aircraft. This research is important if astronomers are to understand the large-scale flows of plasma throughout the universe.

Where Do Magnetic Fields Come From? Research on the Madison Dynamo Experiment at the University of Wisconsin at Madison has provided new insights into the behavior of the magnetic fields generated by Earth and other rotating objects, including planets, stars, and galaxies. The experiment uses a spherical vessel –a dynamo–that holds a cubic meter of molten sodium. Under experimental conditions, propellers drive flows of the sodium and create conditions necessary to generate a magnetic field in a similar manner to the the processes that generate fields surrounding Earth and the Sun. The device's operating parameters can be manipulated to yield experimental data on a range of magnetic-field-generating systems–including entire galaxies, stars, and Earth and other planets–that previously could only be observed and modeled.

Ripples at the Edge of Hot Plasma. Physicists have opened a new window into the complex behavior that occurs at the edge of a 100 million-degree fusion plasma, of the type that will be produced in Tokamak fusion reactors, revealing the mechanisms behind fusion plasma instabilities. Using advanced high-speed cameras, physicists obtained very detailed, three-dimensional images of plasma instabilities known as Edge Localized Modes (ELMs).



Infrared image of liquid lithium in the tray that encircles the bottom of the LTX device. The swirling pattern that indicates the circulation of the liquid lithium is clearly evident. The electron beam hits the lithium immediately to the left of the picture.

Additional images also provided researchers with their first glimpse of how particles and energy are transported during an ELM instability, which can hamper a Tokamak's operation. The images captured by researchers on the DIII-D Tokamak at General Atomics in La Jolla, California, have led to a much better understanding of ELM instabilities, with several theoretical predictions verified by these measurements.

Keeping the Fusion Fires Burning. In research with important implications for the development of the International Thermonuclear Experimental Reactor (ITER), recent experiments on the DIII-D fusion facility at General Atomics in La Jolla, California, and on the National Spherical Torus Experiment (NSTX) at the Princeton Plasma Physics Laboratory in Princeton, New Jersey, have simulated the behavior of alpha particles and Alfvén waves expected in the plasma of a fusion reactor. NSTX and DIII-D researchers can now address whether super Alfvénic ions interacting with short-scale Alfvén waves can lead to loss of energetic particles in ITER and how these Alfvén waves might affect thermal plasma particles.

Accelerating Electrons with Bright Sparks. A train of ultra-intense radiation spikes can be created for use as an advanced electron accelerator with potential medical and physics applications. Scientists at the University of Texas have discovered a new method to amplify and compress laser power, which uses a plasma of ions and electrons. The researchers directed two laser beams, with slightly different frequencies but traveling in the same direction, into a series of plasmas, eventually creating sparks that produce plasma wave "buckets." The buckets grab and accelerate low-energy electrons up to hundreds of millions of electron volts. If this method is proven in experiments, the technique could lead to tabletop electron accelerators for portable X-ray sources in medical applications or for gamma-ray radiography of tiny objects.

Up Against the Wall. Experiments at the Massachusetts Institute of Technology and Princeton University have demonstrated novel approaches to designing effective containment walls for fusion reactors. The new methods, coating wall materials with an ultra-thin layer of boron and using liquid metal lithium as a wall material, have important implications for the design of fusion reactors.

When subjected to heat loads greater than those expected in a fusion reactor, the lithium liquefied and began to swirl rapidly, distributing the heat in much in the same way stirring makes all of the soup in a pot reach the same temperature. The "self-stirring" of the lithium observed in the Lithium Tokamak Experiment (LTX) at the U.S. Department of Energy's Princeton Plasma Physics Laboratory suggests a simple and efficient technique for heat dissipation without the use of expensive pumps and complex plumbing. It is a new concept that has potential to solve the heat load challenge in fusion reactors and other high heat load environments, such as "dumps" for high intensity beams.

The Back Page

Intrigues in Work Collectives: The Story of MentorNet

By Brymer H. Chin

"Brymer, do you have intrigues in work collectives?" That intriguing question was posed to me by Lara[1], a physics grad student in Russia. How I came to be introduced to Lara, as well as five other female students, is the subject of this story. This is the story of MentorNet.

MentorNet is an organization that matches female students[2] majoring in science and engineering with mentors working in industry or government to provide them with a perspective different from that viewed in academics.[3] The program is based on the use of e-mail to make communication more convenient, to accommodate different locations, schedules, and time zones. I am a PhD physicist who joined MentorNet in its first full year of operation (1998–1999 academic year), while I was working for AT&T, a founding sponsor. I have been matched with six students now, and I would like to summarize my overall experiences. In discussions of mentoring, sociological aspects often dominate. The core essence of mentoring–the special personal bond between a mentor and a student–is often lost. In this article, you will not find a formal treatise on the mentoring process. You will not find statistical distributions of the number of women and minorities in various technical fields. What you will find is a personal story of the impact that MentorNet has had on my life, and on the lives of some of my students.

Not all matches will yield positive benefits, for either the students or the mentors. I can tell you what has worked for me and my students. My matches have represented a broad international cross-section. Four were foreign students at universities in the US: a Polish grad student majoring in materials science, a Bosnian undergrad student majoring in physics, a Brazilian grad student majoring in physics, and a Chinese grad student majoring in aeronautical engineering. The other two were students at foreign universities: a German grad student majoring in physics in Sweden and a Russian grad student majoring in physics in Russia.

For inexperienced mentors, MentorNet offers structured services, such as on-line training. To foster a smooth relationship, it periodically sends out suggested topics and checks for any problems. Staff is available for personal counselling. My style is more spontaneous; in my first e-mail, I tell my students that they can discuss anything at all with me, professional or personal...whatever they are comfortable with. Many of the suggested topics come up as a matter of course: life in industry vs. life in academics, significance of a PhD degree, balance of career and family life. If you simply check off a menu, though, you will gain little more than a perfunctory experience. The key to a successful relationship is to develop a personal rapport, implicit trust, with your students. We have discussed careers, grad schools, favorite recipes for etching titanium thin films, problems at home, rheology and colloidal physics, favorite music and poetry, death in the family, the relationship between spins in figure skating and rotational dynamics–everything from second harmonic generation to sexual harassment to sledding down hills on cafeteria trays.

Brymer H. Chin

Although generic advice and guidance may be helpful, the true value of MentorNet lies in tailoring the type and degree of assistance to a student's specific needs. For prospective mentors, a major issue is the time required. That is ill-defined. It can vary by orders of magnitude depending on the student, her particular circumstances, her receptiveness–and the extent of personal involvement and dedication by her mentor. Prospective mentors should not shy away from the program for concern that it may sap up too much time. Successful, satisfying, effective relationships may require as little as 30 minutes per week. With e-mentoring, that time does not need to be a single block scheduled in advance; it may be broken into convenient chunks distributed over the week. At the beginning of the relationship, though, it's especially important to write frequently (for example, three brief exchanges a week for the first two weeks) to quickly develop rapport. This is not difficult because there are many introductory topics to touch upon...career, major, family, sports, music, books; these can be discussed in further detail later on. This critical phase creates the tone for the rest of the relationship: whether strict and formal or light and breezy.

I have volunteered considerably more time because I did not want to miss the opportunities to develop unique friendships. An hour of discussing R&D jobs in the US with Rosalie, an hour of discussing the pluses and minuses of a PhD with Seila, an hour of discussing grad schools in the US with Lara – all these interactions were helpful. But planning and arranging job interviews for Rosalie, collecting academic and career statistics for Seila, and reviewing applications and essays for Lara produced far more concrete results.

Throughout, we have had lots of fun and laughs. Fun and laughs sustain a relationship; fun and laughs are key elements in facing serious problems. Mentor-student relationships develop like all other relationships. Some falter from the start and never recoup, some mature gradually over the course of the year–others click instantly.

Seila, in her introductory e-mail, sent me some quotes; one from a Hungarian philosopher, one from a German poet, and then the following,

"Because I'm evil, e-v-i-l, evil."
–Spike

I knew she was toying with me. She expected me to think, "Hmmm. Hungarian philosopher. Hmmm. German poet. Hmmm. Very impressive young lady." But I also knew she expected me to write back, "OK, who the hell is Spike?" Instead, along with passages from Schiller and Wordsworth, I fired back the following:

"OK, OK, so you're evil, do we have to chat about it all day?"
–Buffy

So here she was, a physics undergrad who wanted to go to MIT for grad school. So here I was, a physicist who had attended MIT. So here we both were–fanatics of *Buffy the Vampire Slayer*. It was a match with nearly 100% correlation.

Although much humor doesn't translate well across different languages or different cultures, some instances are transparent. Lara, a competitive ping-pong player, had applied for a PhD program in the States. One professor here called her to discuss his research projects; unfortunately, he overlooked the time-zone difference between the US and Russia and woke her in the middle of the night. After he had talked for a while, he asked her whether she had any questions. She was still half-asleep; the first thing that popped into her mind was, "Do you play ping-pong?" He laughed because ping-pong was a popular sport in his department, and there was intense rivalry among the labs. Lara could very well have become the first student admitted to a PhD physics program on a ping-pong scholarship.

In forming a student-mentor relationship, the critical step is the matching process. When students and mentors first sign up, they fill out profiles with basic information such as (for students) major and year in school and (for mentors) academic training and current career. A computer program produces the best matches from the available pool of students and mentors.

Initially I thought that a match with a grad student would be more effective and satisfying for both of us because she would already have focussed, well-defined, goals. Seila proved that my first instincts were dead wrong; she was a sophomore when we were first matched. Besides vampire jokes, we discussed what technical fields would stay viable in the future. Over the last four years, we have covered course selection, undergrad thesis research, applications for grad school, and–the most agonizing–choosing a grad school. Since her interest lies in soft condensed matter, and my concentration had been solid-state physics, we have discussed the physical properties of silica suspensions, as well as the vampire-staking properties of wood (I personally prefer birch). Seila received her bachelor's degree in May 2004, and has started her PhD program. So stay flexible in your matches.

My first student, a grad student in her fifth year, didn't like to write much. Suddenly I got a desperate plea from her; she was being sexually harassed by a professor, and her department failed to provide her with urgently needed support. Her situation was precarious since she had already invested five years in a PhD program. And as a foreigner on a student visa, she could not simply walk away. I spent many anxious hours on the phone with her.

My second year with MentorNet, I was matched with Rosalie, who had just started her graduate program. After the initial round of introductions, she suddenly announced that she had decided to quit. I had gone through a rough time in grad school, and I also had almost quit. That was over 20 years ago. I had buried those memories, and I was scared–terrified, if I care to admit it–to unearth them. She was reluctant at first to give me details. With a little nudging, though, she told me the whole story. It was the same as my story 20 years ago. Rosalie told me she wanted to get an industrial R&D job in the US. After much discussion with her, I called up a number of my friends and colleagues, circulated her resume, and helped arrange a job tour for her in the US. She is now working in a major R&D lab. We have become good friends and stay in regular touch. Personal friendship is the ultimate culmination of a successful MentorNet relationship.

It is easy to see how students may benefit from MentorNet, but the question always arises, "How do you as a mentor benefit from this program?" Some mentors will pause and then give some generic, impersonal answers. But I don't have to pause, again because of my close personal ties with my students. They have taught me much. When the Berlin wall came crashing down, we in the West saw images of people dancing among the ruins, and we viewed the event positively; only good could arise from it. But Lara was a young girl in Russia at the time–and she has a far different story to tell. The Soviet system crashed so abruptly that there was no other to take over. Food was in short supply. People received ration coupons, but the coupons were often useless; there simply was no food to ration. Many went hungry for long spells.

Lara is a grad student in the US now. I smile when she tells me that her research is flourishing. I laugh when she tells me of the latest ping-pong tournament she has won. Her current e-mails to me are especially poignant since I know the difficulties of her past. I'm lucky that MentorNet brought us together.

My participation in MentorNet has helped me take more initiative than I would have before; I did things that I would never have imagined doing before. When I later transferred to another company, which was not a sponsor, I decided to make it become one. I approached the VP of HR, made an appointment, and gave her a presentation. I never had such confidence before. Life at many hi-tech corporations these days is extremely stressful. Even senior engineers and researchers such as I often feel powerless to resolve their own problems. I function on a low layer of the corporate hierarchical architecture, but, relative to students, I function on a high layer, high enough to improve their situations. MentorNet has helped me find satisfaction outside the workplace. MentorNet has helped restore my sense of self-worth.

MentorNet has helped me become less self-absorbed. Over the course of the hi-tech crash, we have often heard "I have survived working at … <pick one or more of your favorite companies that have been decimated>." And we boast of our resilience. Wall Street speaks of red ink dripping like blood from corporate balance sheets. And we cry when our company stock drops below a buck a share. Seila, however, was trapped in Sarajevo during the horrific bloodshed there. "Surviving" a layoff and "blood" on stock portfolio summaries are meaningless, maudlin metaphors to me now. As for the "Intrigues in Work Collectives" that Lara had asked me about, whether we are in Russia, Sweden, Bosnia, or the States, whether we work in academics, industry, or government, we are all, unfortunately, subjected to intrigues in work collectives–corporate politics, academic rivalries, internal competition, power struggles, personal jealousies. A mentor cannot eliminate these but can at least strive to help a student deal with them better.

Lara once asked me whether I've ever felt completely alone. She then went on to tell me the details of why she felt that way. Her concluding sentence was, "As I am finishing writing this letter, Brymer, I realize that I feel a lot better now." As I was finishing reading her letter, I realized that I felt a lot better too. And *that* is the story of MentorNet.

At the time this article was written, Brymer Chin was a Distinguished Member of the Technical Staff at Lucent Technologies. Ironically, as this article was going into press, "intrigues in work collectives" overtook him, and he is currently unemployed. He may be reached at bhchin@alum.mit.edu. For more information about MentorNet, see http://www.mentornet.net.

[1]Name has been changed from the real one.

[2]Although the primary focus of MentorNet is on female students, male students are eligible to participate.

[3]MentorNet has since added an academic mentoring program.