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Tampa To Host 2005 April Meeting

Photo Courtesy of Tampa Bay CVB

The 2005 APS April Meeting will be held in Tampa, Florida, April 16-19. Approximately 1500 physicists are expected to attend. The meeting will also serve as the divisional meeting of the Division of Particles and Fields (DPF).

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.

Beside DPF, APS units represented at the meeting include the Divisions of Astrophysics, Nuclear Physics, 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.

Nine plenary talks are scheduled on a broad range of topics including rare isotopes and thermonuclear explosions in the crust of an accreting neutron star, the collision between research and teaching, fundamental science and nanostructures, probing subatomic matter with polarized electrons, mysteries of heavy quarks, envisioning particles and fields, probing supernova remnants, black holes and dark matter with TeV gamma rays, the standard model of cosmology: successes and challenges, and the black hole information paradox.

Other special events include a high school physics teachers' day, a meet the editors of Physical Review session, and receptions for students and minorities, women, and industrial physicists. More information about the APS April Meeting can be found at http://www.aps.org/meet/APR05.

We Know, We Know..... He's German

Pictured here is Wilhelm Conrad Röntgen, the discoverer of X-rays and the winner of the first Nobel Prize in Physics in 1901. He was born in Germany, and educated in Holland and Switzerland. He spent his career in Germany, most notably at the Universities of Würzburg and Munich. His career and achievements were correctly described in the "This Month in Physics History" column of November, 2001. However, we falsely identified him as British in the opening sentence of "This Month in Physics History" for November, 2004. This was an inexplicable error that must have been caused by a mysterious infestation of gremlins, who were also undoubtedly responsible for another error in the same column: Allan Cormack and Godfrey Hounsfield received the 1979 Nobel Prize for Physiology or Medicine, not for Physics. Both mistakes have been corrected in the online version of the column in the archives at http://www.aps.org/apsnews/index.cfm

We thank Kurt Busch, Hristo Hristov, Rainer Weiss, Robert Weinstock, Jim Napolitano, Stan Kocimski, Klaus Rieckhoff, Yongkang Chen, Joe Wong, Yong Kong, Wolfgang Eisenmenger, Rudolf Huebener and Udo Pernisz for pointing out these errors. We also thank an indeterminate number of other readers who stifled the impulse to tell us that they, too, had detected our abysmal lack of historical accuracy.

The Twin Paradox, Redux

Two Einsteins mysteriously showed up at a December meeting of the National Science Teachers Association in Richmond, Virginia, to advertise the World Year of Physics. In the photo at left, one Einstein, dressed casually in 21st-century clothes, had aged normally. The other one, dressed in clothes more typical of the early 20th century, had been travelling close to the speed of light. Furthermore, due to the Lorentz contraction, he was as thin as a piece of cardboard.

In the photo at right, the modern-day Einstein (aka Marc Spiegel) explains the fine points of general relativity to Logan Lee of Savannah, Georgia and his father, Jason Lee.

Photo Credits: Jessica Clark

APS Report says Moon-Mars Initiative Jeopardizes Important Science Opportunities

Shifting NASA priorities toward risky, expensive missions to the moon and Mars will mean neglecting the most promising space science efforts, says the APS Special Committee on NASA Funding for Astrophysics, in a report released on November 22, 2004.

The committee points out that the total cost of NASA's ill-defined Moon-Mars initiative is unknown as yet, but is likely to be a substantial drain on NASA resources. As currently envisioned, the initiative will rely on human astronauts who will establish a base on the moon and subsequently travel to Mars.

The program is in contrast to recent, highly successful NASA missions, including the Hubble

See MOON/MARS *on page 7*

Joint Unit Neutrino Study Sets Research Priorities

Top priorities for future neutrino physics research should be a program to search for neutrinoless double-beta decay, and a comprehensive US program to study neutrino mixing and to search for CP violation among neutrinos, according to the final report of an interdisciplinary study conducted by four of the Society's divisions: astrophysics, nuclear physics, physics of beams, and particles and fields.

Neutrinos are an ancient relic of the Big Bang, and millions of them fill every corner of the cosmos. But scientists have been puzzled by their true nature ever since the surprising discovery that fewer neutrinos came from the sun than expected from the nuclear fusion that produces the sun's energy. We now know that this is due to neutrino oscillations: neutrinos can change flavor on their way from the sun to the Earth. This means that neutrinos must have mass.

Initiated in early in 2004, the study's primary purpose was to help set priorities to answer some of the most vital open questions in neutrino physics. Since it is such a broad, interdisciplinary field, the study was divided into six working groups: solar and atmospheric neutrino experiments; reactor neutrino experiments; superbeam experiments; neutrino factory and

See NEUTRINO STUDY *on page 6*

Council Articulates Vision for APS

Under the leadership of Helen Quinn, who was APS President in 2004, the APS Executive Board and Council devoted a significant part of their meetings last year to discussing long-range issues for the society.

As one element of this activity, the Board and Council developed a vision statement for the APS. It was passed in final form at the November meeting of Council. Quinn remarked that "no one argues about whether APS needs a clear vision for its future. But why do we need a vision statement?

"The exercise helped us discuss and clarify some issues about the roles of APS. The statement stresses the multiple roles that APS must play in order to serve our mission well. It provides a way to communicate succinctly what these roles are, both to members and staff, and to those outside the society."

The text of the vision statement follows:

The American Physical Society strives to:

1. *Be the leading voice for physics and an authoritative source of physics information for the advancement of physics and the benefit of humanity;*

2. *Collaborate with national scientific societies for the advancement of science, science education and the science community;*

3. *Cooperate with international physics societies to promote physics, to support physicists worldwide and to foster international collaboration;*

4. *Have an active, engaged and diverse membership, and support the activities of its units and members.*

Almost as good as being there...

Follow the WYP Kickoff on the Web

APS News writer Ernie Tretkoff will attend the International Year of Physics launch conference, "Physics for Tomorrow," in Paris, January 13-15, 2005. [See story on page 5 and announcement on page 7.]

She plans to share her thoughts, impressions, and comments about the kickoff event on a new World Year of Physics weblog,

You can get the latest at http://www.physics2005.org/wypblog.

Highlights

Members in the Media

"We have great ideas at what we need to do. . . . But it's an experimental science, so we have to go out there and measure things and to measure those things, we have to build facilities,"
—Pier Oddone, remarks on being appointed director of Fermilab, Chicago Sun Times, November 21, 2004

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"What physicists bring to economics is not new concepts but rather the determination to put these concepts to quantitative tests."
—Eugene Stanley, Boston University, San Jose Mercury News, November 26, 2004

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"Look at light, electricity, TV waves, and X-ray. Everything we enjoy comes from basic research. But the return of a basic research is sometimes 20 to 30 years. Industries are now turning to projects that can make profits in three or five years. The government should make more investment to support basic researches."
—Jerome Friedman, MIT, The Korea Herald, November 23, 2004

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"I've got big plans. I'm going to change the way everyone learns science."
—Carl Weiman, University of Colorado, on being named Professor of the Year by the Carnegie Foundation for the Advancement of Teaching and the Council for Advancement and Support of Education, Denver Post, November 18, 2004.

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"We have always been open to proposals that have scientific merit as determined by peer review. We have never closed the door to cold fusion proposals."
—James F. Decker, DOE, on the DOE's review of cold fusion, The New York Times, December 2, 2004

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"This was a very, very scientific, very levelheaded, review by everybody," But "I don't think we've made much progress since '89 in really nailing down the parameters that make it reproducible."
—Kirby Kemper, Florida State University, on the DOE review of cold fusion (Kemper was one of the reviewers), The New York Times, December 2, 2004

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"I don't think anyone has considered that extrasolar planets would be in our own solar system."
—Scott J. Kenyon, Harvard-Smithsonian Center for Astrophysics, on the possibility that objects in our solar system could have originated in another solar system that collided with ours, The New York Times, December 2, 2004

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"Massive computing does not provide the answers so much as it provides an extension of our imagination. For some years there has been talk of computing as being the third 'leg' of science: theory, experiment, computer simulations."
—David Arnett, University of Arizona, on a computer simulation of a supernova, The New York Times, November 9, 2004

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"For the first time, we will be observing [bursts] when they are really bright. Swift is fine-tuned to quickly locate these bursts and study them in several different wavelengths before they disappear forever."
—Neil Gehrels, NASA, on Swift, a recently launched telescope for observing gamma ray bursts, Los Angeles Times, November 21, 2004

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"The thing that matters is not the mass, it's the mass times the velocity squared. You never get past three or four yards per second when you're a lineman. With a running back you're up to 10 yards per second. So right there you're talking 10 times more kinetic energy. It's that V-squared that's a killer."
—Timothy Gay, University of Nebraska, explaining why relatively lightweight running backs and receivers tend to be injured in collisions more often than huge linemen, The New York Times, November 16, 2004

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"It's beyond most people's imagination that we can support something that weighs over 50 tones on something as soft as a pillow."
—Sheldon Weinbaum, City College of New York, on his study showing that it is possible to overcome friction by exploiting the properties of porous surfaces, New Scientist, November 13, 2004

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And finally, some comments on the American Institute of Physics list of top physics stories of the year (see http://www.aip.org/pnu/2004/split/711-1.html) in the San Francisco Chronicle, December 6, 2004:

"The detection of large galaxies

See IN THE MEDIA *on page 6*

This Month in Physics History

Einstein and The Photoelectric Effect

Editor's Note: *With the January 2005 issue of* APS News, *we begin a year-long series of columns devoted to the work and legacy of Albert Einstein—our humble contribution to the World Year of Physics. Columns will appear in chronological order of Einstein's work, regardless of the month associated with the topic at hand.*

In 1887, German physicist Heinrich Hertz noticed that shining a beam of ultraviolet light onto a metal plate could cause it to shoot sparks. It wasn't the emission that was surprising. Metals were known to be good conductors of electricity, because the electrons are more loosely attached to the atoms and could be dislodged by a sudden burst of incoming energy.

What was puzzling was that different metals required bursts of different minimum frequencies of light for the electron emission to occur, while increasing the brightness of the light produced more electrons, without increasing their energy. And increasing the frequency of the light produced electrons with higher energies, but without increasing the number produced. This became known as the photoelectric effect, and it would be understood in 1905 by a young scientist named Albert Einstein.

Einstein's fascination with science began when he was 4 or 5, and first saw a magnetic compass. He was enthralled by the invisible force that caused the needle to always point north, and the instrument convinced him that there had to be "something behind things, something deeply hidden." He spent the rest of his life trying to decipher the arcane mysteries of the universe.

Photo Credit: The American Institute of Physics

Einstein in the Patent Office years.

Today, the name Einstein is synonymous with genius, but for years his parents thought their son was a bit "slow" because he spoke hesitantly and wasn't a stellar student. Einstein was just plain bored with the rote teaching methods of formal education, with its emphasis on memorization and blind obedience to an arbitrary authority. He preferred to study at home with books on math, physics and philosophy. "It's almost a miracle that modern teaching methods have not yet entirely strangled the holy curiosity of inquiry," he later said. "For what this delicate little plant needs more than anything, besides stimulation, is freedom."

Einstein found both when he attended a local Swiss school in Aarau, having failed the entrance exam for the more prestigious Swiss Federal Institute of Technology. For the first time, he had teachers who gave him the freedom and latitude to pursue his own ideas, and he threw himself into studying the electromagnetism theories of James Clerk Maxwell, which were rarely taught at universities at the turn of the century. Then he studied physics at the Institute of Technology in Zurich, but graduated with an undistinguished academic record, and failed to obtain a university post teaching mathematics and physics. Instead, he worked as a patent clerk in Bern, doing theoretical physics on the side, and occasionally meeting with a group of friends to read and discuss books on science. They called themselves the "Olympia Academy."

In March 1905, Einstein—still a lowly patent clerk in Switzerland—published a paper explaining the photoelectric effect. Five years earlier, Max Planck had solved the problem of black body radiation by showing that each atom making up the walls of the cavity could only absorb or emit radiation in discrete "quanta" such that the energy of each quantum is an integer multiple of its frequency times a new fundamental constant.

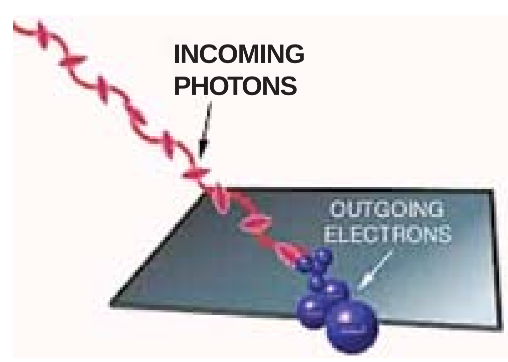

Illustration: http://www.colorado.edu/physics/2000/quantumzone/photoelectric.html

Einstein noted that careful experiments involving the photoelectric effect could show whether light consists of particles or waves.

Planck thought his concept of quanta was just a mathematical "trick" to get theory to match experiment. But Einstein extended Planck's quanta to light itself. (Planck had assumed that just the vibrations of the atoms were quantized.) Light, Einstein said, is a beam of particles whose energies are related to their frequencies according to Planck's formula. When that beam is directed at a metal, the photons collide with the atoms. If a photon's frequency is sufficient to knock off an electron, the collision produces the photoelectric effect. As a particle, light carries energy proportional to the frequency of the wave; as a wave it has a frequency determined by the particle's energy. Einstein won the 1921 Nobel Prize in physics for this work. But it was just the beginning.

Next month: special relativity.

See an online exhibit about Albert Einstein by the American Institute of Physics at http://www.aip.org/history/einstein/.

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Cohen to Stress Outreach, Continuity in 2005

Marvin Cohen, University Professor at the University of California, Berkeley, and Seniors Scientist at the Lawrence Berkeley National Laboratory, assumed the APS presidency on January 1, 2005. In the following interview with APS News, *he outlines his concerns and priorities for the year.*

Q: *What are your priorities for your presidential term?*

A: I think I would separate my priorities into two parts. One is to continue major thrusts started by the past three presidents who I have worked with. For the other part, I think it's likely that the largest component will be a focus on outreach, partly because 2005 is the World Year of Physics.

Alan Chodos is directing our efforts in the WYP. He and his staff are doing an excellent job. I've been partly involved with this project since 2003, and now it's here! I think that the WYP activities are going to be a big part of my activities in 2005.

Q: *What do you hope the World Year of Physics will accomplish?*

A: We're hoping to bring more talented students into physics and to enhance our efforts to promote diversity and inclusiveness. Programs to attract more women to choose physics careers are doing quite well. But the African American and Hispanic components of the American Physical Society are too small. There's a lot to be done if we plan to achieve an APS population which more closely represents the diversity in our country's population.

With the World Year of Physics, APS and other organizations hope to bring the message to students that physics is an exciting field, and that a physics education is valuable even if they choose another field for their ultimate career. We will try to get the message out about the current developments in modern physics.

In our outreach to the general public, we want as many members of APS as possible to get involved. If we could get members to go to K-12 schools and levitate a magnet using a superconductor or to give public lectures, we think these efforts could bring great rewards.

The WYP is an international event. We will have opportunities to maintain and expand the wonderful international cooperation and goodwill physics has had in the past. Even when governments have had limited communication, scientists have continued to communicate and collaborate.

I hope that we can foster even more collaborations in the future. During the World Year of Physics we can communicate the international flavor of science to the public and world governments. Hopefully, the importance of this aspect of science will be appreciated.

Q: *One of the American Physical Society's missions is education. What needs to be done to improve science education?*

A: For K-12 education, part of our concern is the training of science teachers. It's been my experience that when you get dedicated, well-trained teachers working with the students, even if they use different methods, the fact that they're involved and care makes an enormous difference. The trouble is that the effort in this area isn't big enough. We really have to do much more. One way to get more dedicated teachers would be to raise the salary of teachers. This would indicate to the public and also to the teachers themselves that society values them. We also need to support good research on education in science to create better programs. In addition, the country as a whole has to have the expectation that there is a certain level of math and science that everybody ought to know—boys, girls, whites, African Americans, Hispanics, everyone.

At the college level, I hope to see an expansion of some of the successful experiments in broadening the physics major. There are new programs where undergraduate majors have the opportunity to take not only the standard physics courses but can use courses in other fields to satisfy requirements for their major in physics. For example, subjects such as biology, chemistry, materials science, psychology, sociology, engineering, computer science and history have been "mixed" with physics successfully. One important objective is to allow students to prepare for careers in fields like biological physics and nanoscience where one needs training in chemistry and biology and materials science.

The physics major is an excellent background for many fields because of its emphasis on problem solving. If one of the by-products of loosening up on the major is ending up with lawyers who know physics, physicians who know physics, and people in all walks of life, particularly government, who know physics, I think that's a step in the right direction. So I hope we think and act along those lines.

Q: *You said that one of your priorities would be to continue the work of the past three APS presidents. What were some of the important aspects of their work?*

A: When I first joined as Vice President, Bill Brinkman was Past President. One of the important achievements of his term was the boost phase missile defense study initiative. I think that the fact that the American Physical Society can counsel government and can do a really first-rate job of analysis is important. I think Bill did an excellent job, and I would like to keep my eye on how we can continue to interact effectively and counsel government.

Myriam Sarachik focused on diversity and inclusiveness. She is still very active in trying to help our African colleagues get into the modern age of physics and science. I think that's very important. She also took on the task of trying to bring the various subareas of condensed matter physics together. Condensed matter is the largest branch of physics, and it is probably the most diverse. It is also strongly coupled to hybrid fields like nanoscience. Myriam has organized workshops and discussions to try to strengthen interactions within the field and between fields, I hope that I can keep this effort alive, and further her work on bringing physicists in developing countries into the fold.

Helen Quinn's emphasis has been on planning. She made us take a closer look at ourselves and ask hard questions about where we are and where we're going. She asked us to examine what our values are, and what our vision is. This was not just a simple task of creating a mission statement. Helen's questions had ramifications related to the kind of committees that we have and the types of programs that we support.

Led by Helen, we did a lot of soul-searching. Even though one doesn't come out of these exercises with a few final statements of purpose, it gets you thinking and acting in a more constructive and effective manner.

I hope not to drop the balls handed to me by Bill Brinkman, Myriam Sarachik, and Helen Quinn.

Q: *What role can APS play in public policy?*

A: I think it's important for us to develop the best possible relationships with the various agencies of government. It's very hard to avoid politics, but we have to be aware that the polarization that comes from politics can be dangerous because it affects funding for future science and future scientists. I think we have to proceed in an orderly, ethical, and thoughtful manner. One of the recent successes, which I hope will be maintained, is that the visa situation is getting better, and that's due in no small part to the efforts of the American Physical Society and other scientific organizations.

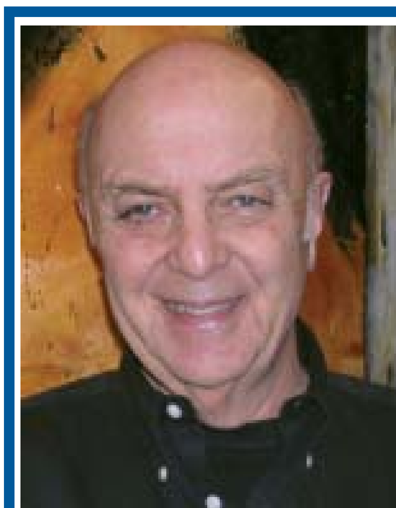
I think it would be of great importance if we could do more to expand our opportunities to give advice to government. We need to strive to give absolutely the best advice with the highest credibility. I hope that over the next four years that the Bush administration will work closely with the scientific community, and that we all work together for security, for economic development, for education, and for the general welfare of society.

Q: *Recently it has been suggested that the US might be "losing its dominance" in science. How do you view the issue?*

A: I think that's a hard question, because it is hard to quantify. If you look at numbers, it's clear that in some of our best journals, the number of papers coming from Asia and Europe has gone up, while the number of papers from the US has remained almost constant.

On the other hand, I think that we have attracted some of the best talent worldwide to the United States. A major reason is because education at the graduate level in this country is excellent. Although we're still the unchallenged leader in this arena, this may change if the visa problems continue. Foreign graduate students and postdocs have enhanced the whole picture of American science. Having foreign graduate students has been a win-win situation. If they come here for an education and stay, that's great. And if they come and then go home, that's great too because they often remain our friends and collaborators for life. Having said that, we still want to encourage American students to choose physics for their career. It's worrisome that we went through a period where the number of undergraduate physics majors went down, but that's turning around. Hopefully we'll get more Americans going into physics. I think it's inevitable that as the economies in countries like China and India get better, more of their people will be going into science and engineering. More worldwide competition in science is inevitable; hopefully this will foster better progress in science.

See COHEN *on page 7*



"If we could get members to go to K-12 schools and levitate a magnet or something, we really think these efforts could bring great rewards."

Fun Facts about Cohen

- Completed PhD in physics from University of Chicago in 1963.
- Joined the faculty of the University of California, Berkeley in 1964 after one year as a postdoctoral researcher at Bell laboratories.
- Senior Faculty Scientist at Lawrence Berkeley National Laboratory since 1965.
- His research covers a broad range of subjects in theoretical condensed matter physics. He is known for his work with pseudopotentials with applications to electronic optical and structural properties of materials, superconductivity, semiconductor physics and nanoscience. "I have arrested development—I still think my best work is ahead of me."
- Recipient of the APS Buckley Prize and the APS Lilienfeld Prize.
- Received the National Medal of Science in 2002.
- Hobbies include playing the clarinet and running.
- Has been interested in physics since childhood. "I have thought about physics every day for the past 50 years."

Photo Credit: Ken Cole

Fellows and Board Members Mix It Up

When the APS Executive Board met in Seattle in November, they hosted a reception for APS Fellows in the area.

In the top photo, Board member Jerry Mahan (center) and his wife Sally chat with Fellows Lonnie Edelheit and Fred Brown.

In the bottom photo, Fellows (right to left) David Bodansky, Robert Williams, Isaac Halpern, Vitaly Efimov, Ernest Davidson, and Hans Bichsel enjoy the refreshments and each other's company.

LETTERS

More to "Einstein in the 21st Century" than Science

In an article on the front page of the October issue of *APS News*, Ernie Tretkoff discusses a list of speakers available from GGR and FHP to present a broad range of topics regarding Albert Einstein, including "Einstein the person". Richard Price is quoted as saying, "Anything that's associated with Einstein is something that we can cover." I wonder if this includes his sociopolitical beliefs and writings.

While it may run counter to *APS's* nonpartisan status, discussion of his open and fervent endorsement of civil liberties, democratic rights, economic justice, world federalism, *etc.*—let alone the freedom of scientific investigation from political manipulation—could not be more timely. He courageously opposed the fear-mongering in the 50's that culminated in the McCarthy hearings.

The social aspects of the theme "Einstein in the 21st Century" are arguably at least as significant for this "World Year of Physics 2005" as the implications of relativity theory or photons.

Ted Einstein
College Park, MD

[Ed. Note: A session on "Einstein and social responsibility" has been organized by the APS Forum on Physics and Society at the March Meeting.]

Need more Anti-Matter than NASA Thinks

"This Month in Physics History" (August/September 2004) states: *"In 2000 NASA scientists announced early designs for an antimatter engine that might be capable of fueling a spaceship for a trip to Mars using only a millionth of a gram of antimatter".*

The total energy of a weight P at rest on the Earth's surface is U=-PR, where R is the Earth's radius. The total energy outside the Earth's gravitation is zero. Thus, the antimatter mass m must provide at least the energy $2mc^2$ =PR.

In the case of 100% efficiency such energy will fuel a spaceship of weight P=$2mc^2$/R. So, a millionth of a gram of antimatter allows for P~3 tons maximum. Isn't it too little for a spaceship?

Mark Azbel
Tel Aviv, Isreal

Cormack Spent Career at Tufts

Celebrating the invention and development of the CAT scanner in the November "This Month in Physics History" underscores the essential contributions to medicine made by those trained in the physical sciences.

Allow me, however, to make two corrections: First Cormack and Housfield did not win the 1979 Nobel Prize in Physics; their prize was in the category of Physiology or Medicine. [*see story on page 1—Ed.*] Second, through the article leaves the impression that Cormack returned as a faculty member to South Africa upon graduation from Cambridge, he, in fact, spent the balance of his career as a faculty member at Tufts University—from 1958 until his retirement in 1998. The two [*Journal of Applied Physics*] papers alluded to in the article were published while he was at Tufts, and he constructed apparatus at Tufts to show tomography proof of principle.

Robert P. Guertin
Medford, MA

Caltech Ivy Stays on the Ground

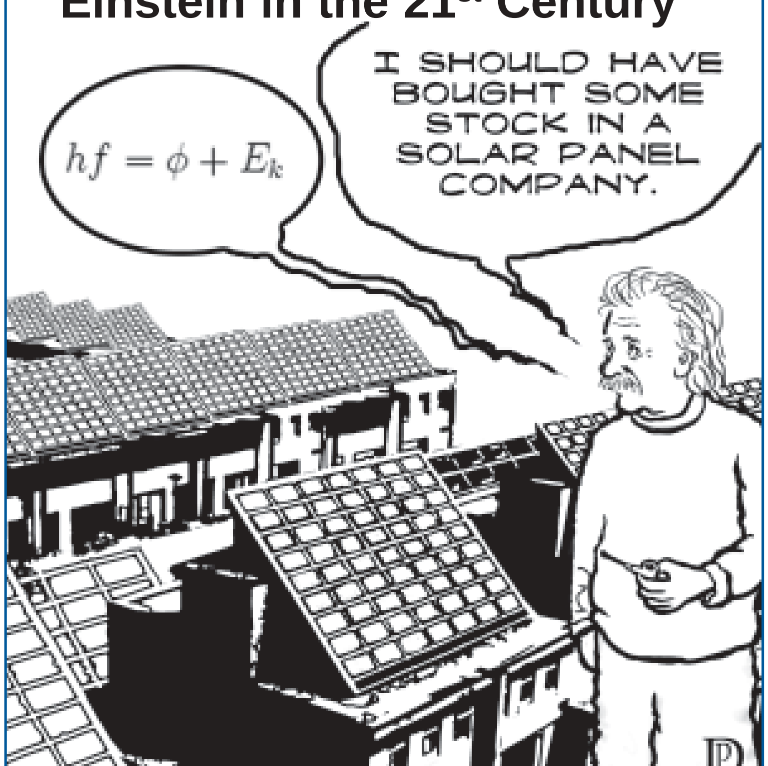
While speculating on the reasons for the appearance of Einstein's field equations at the beginning of "The Triplets of Belleville" in the October *APS News*, Harold Cohen referred to "the famous photo of Einstein riding his bike around the Princeton campus."

Possibly there is more than one famous photo of Einstein on a bike; the one I'm familiar with (http://www.bhsi.org/images/palbert.jpg) was taken in 1933 while Einstein was visiting Caltech.

At least that's the story I've heard, supported by the Caltech copyright on the poster and the lack of ivy on the walls. (Unlike Princeton, Caltech keeps its ivy on the ground.)

Mark Jackson
Webster, NY

Einstein in the 21st Century



©2005 Paul Dlugokencky (aDailyCartoon.com) for *APS NEWS*

ID, OEC and YEC: Beware Them All

The letter from Douglas Keil in the October *APS News* is representative of the views of Old-Earth Creationists (OEC), who are similar to the advocates of Intelligent Design (ID). Many physicists have the incorrect idea that all creationists advocate a 6,000 year-old Universe based on Biblical lineages.

First, many are merely evolution deniers, who take issue with one or more portions of biological evolution. Many others are Young Earth Creationists, or YECs, but have agreed to be quiet about it, under the "Big Tent" strategy of the Discovery Institute, the well-funded (http://www.geocities.com/lclane2/discovery.html) national coordinator of the ID movement.

This strategy is to avoid discussion of issues such as a young Universe in order to focus on getting the teaching of evolution watered down in public schools.

Having creation science ruled as religion and inappropriate for science classes, ID was invented as a less overtly religious (they avoid naming the Designer unless they are speaking to sympathetic audiences) alternative. Since attempts to inject ID into curricula have been generally rebuffed as well, they are now focusing on "teach the controversy" or "introduce critical thinking to science students". For some reason this kind of critical thinking practice is focused on evolution.

The idea of having a "debate" helps elevate ID to the level of a competing theory in the eyes of the public, including students. Keil's letter is an example of this strategy.

It also shows some other familiar buzzwords and characteristics. A paper by Davies is mentioned with regard to macroevolution. Macroevolution is a word emphasized by creationists in the pretense that many small changes cannot add up to big changes. The Davies paper is not at the place given in Keil's letter, but a paper by Davies (same journal same year) discusses the question of the large of amount of information needed to start life. Conflating the origin of life with its evolutionary development is another, probably deliberate, confusion.

It would be valuable for many physicists to support the National Center for Science Education (http://ncseweb.org/) who are the only national organization primarily focused on defending the teaching of evolution and cosmology in K-12 public schools.

Adrian Melott
Lawrence, Kansas

Correction

In the November "Members in the Media," Jeffrey Hangst is described as being from CERN. His correct institutional affiliation is the University of Aarhus in Denmark. *APS News* regrets the error.

INSIDE THE BELTWAY:
Washington Analysis and Opinion

Time for Building Bridges

By Michael S. Lubell, APS Director of Public Affairs

In a few weeks George W. Bush will be sworn in as president of the United States for another term. To many on the left that is nothing short of a supernatural disaster. But if liberals are in a funk, the heartland of America is celebrating.

Whether W chooses to govern from the center or the right during his second term will become evident to every American in a matter of months. To Beltway denizens, the signs are already becoming clear. My advice to any of you poker players out in the hinterland, go all in on the right.

As W said in his first post-victory press conference, he gained a lot of political capital, and he intends to spend it. Translation: conservatives put him into the White House, and he won't forget them. My prognosis: Democrats will be wandering in the desert for at least the next four years. Unfortunately, so too will scientists unless they learn to speak the language.

Among pollsters there is little argument that regular church goers, in general, and evangelicals, in particular, played a major role in electing George W. Bush to a second term. Karl Rove, who is a saint to his admirers and evil incarnate to his detractors, laid out the President's campaign strategy early on: turn out the Christian right base and the president wins reelection. Present a secular centrist image the way Bush Senior did, and W joins his daddy as a one-termer.

John Kerry, saddled with an image as a gay marriage advocate, which he wasn't, a supporter of a woman's right to choose, which he was, and the choice of the "Hollywood amoralists" (except for Ahnold) was dead meat. On election night Democrats asked how it was possible for an incumbent president to be reelected with a 3.5 million vote margin when he was mired with approval ratings that barely broke 45%, a public that had become disillusioned with a $100 billion a year war in Iraq, an economy that couldn't produce enough employment to keep pace with population growth, health care and energy costs that were skyrocketing and job-outsourcing overseas that his former economic advisor said was good for America.

Michael S. Lubell

Some Kerry apologists argued the case that the public didn't want to change its commander-in-chief in the midst of a war. But then, how to explain the Republican pickup of four seats in the Senate and five in the House.

The exit polls conducted on Election Day provided the answer—"moral values". More than one voter in five said that was the key issue, and most of them voted for George W. Bush. On all other major issues—the economy and jobs, health care, terrorism and the war in Iraq—the public split its vote between the two candidates, giving Kerry the nod on healthcare and Bush the advantage on terrorism. But on "moral values", the Christian right, in particular, weighed in dramatically, as Karl Rove had predicted it would if W played up his faith-based beliefs.

The voters to whom the President was appealing on the basis of religion firmly believe that one of theirs is in the White House for four more years.

The election results should cause scientists to consider their own image. In many ways, it mirrors Kerry's: elitist, arrogant, hopelessly liberal and Democratic, seemingly dismissive of religiosity and out of touch with middle America.

For a White House that is tilting right and that owes its electoral success to religious conservatives, scientists may well be viewed as the political enemy. That's bad for science and bad for the nation.

It was the right thing for scientists to get political, as the late Representative George Brown argued they should, but science, itself, should not be a partisan enterprise, as he reminded his colleagues in the House. Senators Domenici (R-NM), Alexander (R-TN), Reid (D-NV) and Bingaman (D-NM) and Representatives Hobson (R-OH), Biggert (R-IL)and Visclosky (D-IN) proved that with their unswerving support for Department of Energy's Office of Science, which against all odds posted a four percent gain in the FY 2005 appropriation.

The election is over, and it's time for building bridges: to the White House and to middle America. Too much is at stake nationally for the scientists who supported Kerry to remain in a political funk. And the President must accept the reality that science knows no partisan province.

APS, AAPT and AIP Sponsor Students at WYP Kickoff Event

APS, the American Association of Physics Teachers, and the American Institute of Physics are sponsoring four former members of the US Physics Olympics Team to attend the kickoff for the International Year of Physics 2005. This launch conference, "Physics for Tomorrow," will be held at the UNESCO headquarters in Paris, France, January 13-15.

Over 1,000 people are expected to attend, including Nobel laureates, political leaders, established scientists, and several hundred students from over 60 countries.

"We wanted students with good physics knowledge and insights, and we also wanted students who would represent the United States on a very interactive level, so they would be able to discuss the future of physics, which is one of the purposes of the conference," said AAPT Executive Officer Bernard Khoury.

More information about the World Year of Physics launch conference is available at www.wyp2005.org/unesco.

The four students sponsored by APS, AAPT and AIP are:

Natalia Toro: Toro attended Fairview High School , CO, and participated in the Physics Olympiad competition in 1998 and 1999. Toro was one of the youngest female students on the US Physics Team. She brought home a silver medal. Toro enrolled at MIT and graduated with a bachelor's degree in physics and math in 2003. She is currently enrolled in the physics PhD program at Harvard University and is hoping to graduate in 2007 or 2008.

Benjamin Schwartz: Schwartz attended Staples High School, CT, and participated in the Physics Olympiad competition in 2001 and 2002. In the fall of 2002, he enrolled at MIT and expects to graduate in 2006 with a double major in physics with electrical engineering and math. Schwartz is spending this year at Fitzwilliam College in Cambridge University, Cambridge, UK. In his spare time, Schwartz rows for the MIT Varsity Lightweight Crew Team and sings with the Chorallaries of MIT, an a Capella group.

Sean Markan: Markan attended Roxbury Latin School, MA, and participated in the Physics Olympiad competition in 2002. In the fall of 2002, Markan enrolled at MIT and expects to graduate in 2006. He has been studying physics, math and computer science. This past summer, he worked at CERN with the group building the data acquisition system for one of the detectors that will be part of the Large Hadron Collider.

Chintan Hossain: Hossain attended The Charter School of Wilmington, DE, and participated in the Physics Olympiad competition in 2002 and 2003. At the 2003 competition in Taipei, Taiwan, he ranked 19th among all the students and received a gold medal. Hossain is enrolled in MIT and expects to graduate in 2007 with a double major in physics and brain and cognitive science.

Plasma Window 'Force Field' Featured at 2004 DPP Meeting

New wakefield acceleration techniques for electrons and X-ray movies of Z-pinch explosions were among the research highlights at the 46th annual meeting of the APS Division of Plasma Physics, held November 15-19, 2004 in Savannah, GA. The DPP meeting is the world's largest yearly gathering of plasma physicists, with more than 1500 attendees presenting 1425 papers covering the latest advances in plasma-based research and technology.

In addition to the technical program, the conference included a free Plasma Sciences Expo on November 18, open to teachers, students, and the general public.

The objective was to introduce the local community to the excitement of plasmas and the benefits of plasma research. Scientists from around the country and the world were there, ready 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, watch an electromagnetic wave demonstration, and confine a plasma in a tokamak video game.

Compact Particle Beams for Science and Medicine. New techniques for accelerating electrons are producing tightly focused, energetically uniform beams in compact devices that will be ideal for numerous scientific and medical applications. The accelerators, known as laser wakefield devices, are only meters in length and could replace accelerators that are currently miles long. Because of their compact size, laser wakefield accelerators are likely to find applications in laboratories that lack space for conventional accelerators. In laser wakefield machines, electrons in a plasma are accelerated when they ride the wake of an intense laser pulse, much like dolphins riding the wake of a ship on the ocean. Typically, the laser pulses in such machines spread out as they pass through a plasma, leading to diffuse beams with few energetic electrons.

Researchers at the Lawrence Berkeley Laboratory have improved the quality of laser wakefield beams by injecting preliminary pulses into a gas to create a plasma channel that guides a subsequent, accelerating laser pulse. The result is a nearly uniform, 100 million electron volt bunch of electrons only 10 femtoseconds long. The devices should fulfill applications in research and medicine that rely on accelerators to produce pulses of x-ray and infrared radiation, including high resolution imaging and treatments for certain types of cancer.

Plasma Window Leads to New Welding Technique. Electron Beam Welding (EBW), which relies on beams of electrons to melt and join metal pieces, provides the highest quality welds currently achievable. However, the technique requires parts to be kept under vacuum during welding because the electron guns that produce the beams cannot function in normal atmospheric conditions. EBW, therefore, has not typically been an option for welding of large structures such as cars, airplanes, or ships. Researchers with Brookhaven National Laboratory and Acceleron Inc. have developed a novel plasma window that separates the vacuum of EBW beam sources from ambient pressures while allowing electron beams to pass through.

The plasma window is formed of electric and magnetic fields, effectively leading to something resembling "force fields" trapping a plasma that separates an evacuated electron beam source from the atmosphere.

Taming Plasma Bursts. Creating a fusion "sun" on Earth, in plasma fusion machines such as tokamaks, will provide a critically needed, environmentally acceptable long-term source of energy. However, the task is complicated by the bursts from the 100-million-degree plasma that reach and threaten the life of the chamber surrounding the man-made sun. International teams of scientists at the PPPL National Spherical Torus Experiment (NSTX) and the General Atomics DIII-D National Fusion Facility carried out a series of investigations of these bursts, their varieties, and their dependence on the plasma conditions.

A new type of burst is identified to be particularly interesting, with much higher frequency and lower energy, and therefore delivers much weaker punches than the more studied varieties. Multiple ultra-fast high-resolution cameras (up to one million frames per second), infrared cameras, spectrometers, edge probes, fast gas puffs, and modern computing and modeling codes helped reveal the detailed nature and conditions of these bursts. An advanced diagnostic using atomic lithium beams has been developed to provide information on our understanding of when these bursts arise. Maintaining the proper fusion plasma conditions now holds the potential of taming these "astrophysical" bursts to ensure the fusion chamber survival.

Progress in Direct-Drive Inertial Fusion Research. Significant advances on the route to inertial confinement fusion have been achieved by researchers at the University of Rochester's Laboratory for Laser Energetics (LLE). Laser inertial confinement fusion consists of heating and compressing fuel in millimeter-sized capsules irradiated with powerful laser beams. In a series of papers presented at the meeting, LLE researchers reported on tests at the OMEGA, 60-beam laser facility that are helping to set the stage for the National Ignition Facility—the nation's premier fusion laser facility scheduled to be completed

See DPP MEETING *on page 7*

AIP Reports Upturn in Number of Physics Graduate Students

By Ernie Tretkoff

The number of first-year physics and astronomy graduate students climbed to 3,076 in 2003, the highest number since 1994, according to a report released in October by the American Institute of Physics Statistical Research Center. While the total number of new physics and astronomy graduate students has increased, the number of foreign students declined in the past two years, according to the report.

The report surveyed first-year graduate students for the academic years ending in 2002 and 2003. First-year students were defined as those entering a particular department for the first time, including those who had completed previous graduate study at another institution and transferred to their current department.

First-year graduate student enrollment has been rising steadily in the past few years. The number of graduate students fluctuates over time, the report points out. "The enrollment has never been steady. It has always been on the rise or on the fall. It's a roller coaster," said Patrick Mulvey, one of the authors of the report.

Several factors, including economic outlook and the ease with which foreign students can enter the US, influence graduate student enrollment, the report says. "Frequently, increasing graduate student enrollment coincides with poor economy. Students exiting an undergrad program sometimes, rather than entering the work force, seek shelter in a graduate program," said Mulvey. The number of students receiving bachelor's degrees in physics has also been increasing in recent years, which may explain some of the increase in first-year graduate student numbers, Mulvey added.

In the past several years, the percentage of incoming graduate students who are US citizens has increased, to 54% in 2003, up from a low of 47% in 2001. This upturn comes after a nearly 30-year decline in the percentage of students who were from the US, from a high of 80% in 1976.

The report points out that while it might be tempting to attribute this change to the impact of the events of September 11, 2001, the shift actually started with students who entered graduate school before that date.

Visa difficulties may have had an impact on the number of foreigners studying in the US, but according to the report the full effect may not show up until the class that entered in the fall of 2003, which was not included in this data set, because of delays in implementing new regulations. "The report doesn't really address enrollment changes due to visa issues," said Mulvey, "Because the report only goes up to the fall of

See GRADUATE *on page 7*

APS California Section Holds Fall Meeting

The APS California Section held its annual fall meeting December 3-4, 2004 at Harvey Mudd College in Claremont, California. Topics covered in the technical program included exploring the quantum vacuum through the Casimir effect, particle physics and dark energy, nanoscale applications for scanning tunneling microscopy, and satellite navigation and the ionosphere.

Friday evening's banquet speaker was Gregory Benford of the University of California, Irvine, who spoke of his experiences as a scientist in Hollywood, attempting to adapt his own novels for film and television.

Among the other invited speakers was David Pine of the University of California, Santa Barbara, who described new methods for making small clusters of colloidal particles with very well-defined symmetries, ranging from tetrahedral and octahedral to more exotic clusters with very complex symmetries. Such clusters can be used to create new nearly spherical colloidal particles that promote the growth of crystals or glasses with those same local symmetries. Pine calls such clusters "colloidal atoms."

In addition, the Jet Propulsion Laboratory's Dayton Jones described some of the expected advances in fundamental physics and astronomy research that could be achieved using the new Square Kilometer Array (SKA).

SKA is an international radio astronomy instrument planned for the next decade, which will be nearly 100 times as sensitive as any existing radio telescope or array.

Among the questions SKA could help resolve are the equation of state of the dark energy and its possible evolution with time, as well as the distribution of matter in the universe during the early stages of large-scale structure formation. Strong-field gravity will be probed through the discovery and timing of pulsars orbiting stellar mass black holes.

Insect Flight, Modeling Blood Flow Highlight 2005 DFD Meeting

Insect flight, granular mixing, and new models of blood flow that could lead to better understanding of the cause of aneurysms were among the featured highlights at the annual fall meeting of the APS Division of Fluid Dynamics, held November 21-23, 2004, in Seattle, Washington.

This year's technical program included three award lectures, seven invited lectures, five mini-symposia, and a special session in honor of physicist Bill Reynolds, who coined the term "large eddy simulations" 30 years ago and pioneered the proper mathematical field definition of the large scale field, as well as critical numerical simulation techniques to model turbulence physics.

A special conference reception was held at the world-famous Museum of Flight. In addition, the meeting featured the 22nd annual Gallery of Fluid Motion. The gallery features aesthetically pleasing, insightful displays of still pictures, computer graphics, and video clips submitted by meeting attendees.

A panel of referees selects the most outstanding entries, based on artistic content, originality and the ability to convey information. Winning entries will be displayed at the upcoming 2005 APS March Meeting in Los Angeles, California, and will be published in the September 2005 issue of *Physics of Fluids*.

Understanding Aneurysms. Our understanding of the factors that contribute to the development and rupture of aneurysms has developed rapidly over the last 15 years, accompanied by the development of new materials and devices for treatment.

For instance, scientists from the University of California, San Diego, described their recent clinical study of multiple Neuroform stents to regulate blood flow in the aneurismal sac. The team used a digital particle image velocimetry technique to measure how fast blood flowed at the entrance and inside the sac. They found that the use of stents can effectively reduce the strength of the vortex forming inside the sac, with a subsequent decrease in the magnitude of the shear stresses acting on the aneurismal wall.

Other speakers described new modeling and computer simulation techniques to study the dynamics of blood flow in aneurysms. The new knowledge could lead to improved interventional devices and an increase in patient survival rates.

Insects Flex Their Wings. The largest flying insects manage to stay airborne by relying on their ability to flex their wings, according to Thomas Daniel of the University of Washington. This ability to instantaneously reshape their wings has, in turn, a profound effect on the airflow forces they can generate. But to what extent is the surface shape of the wings controlled by structural mechanics versus fluid dynamic loading?

Daniel and his colleagues used a variety of methods to explore insect flight performance. They have demonstrated that for certain combinations of wing stiffness, wing motions, and fluid density, fluid pressure stresses play a relatively minor role in determining wing shape when the insect is moving in the air. Using this approach, they have demonstrated that even modest levels of passive elasticity can affect thrust for a given level of energy input. Insects appear to be able to tune their wing elasticity for optimal flight performance.

Granular Mixing. It is well known that granular mixtures segregate under flow, according to Julio M. Ottino of Northwestern University, who described his recent work modeling the dynamics of segregation, mixing, and coarsening of granular matter.

At a fundamental level, all such effects are due to particle-level interactions. But how does the entire ensemble behave? He is applying a wide range of modeling approaches to explore this question, including such discrete models as cellular automata and particle dynamics simulations that provide "realistic" details of the particle interaction processes.

Vortex Rings in Biological Propulsion. Caltech's Morteza Gharib is looking to squid and jellyfish—as well as cardiac blood transport—for insight into the dynamics of vortex formation and how it can be used as an underlying principle for biological propulsion.

Both species employ "pulsed-jet swimming" methods, which rely on the generation of vortices to maximize thrust and/or propulsive efficiency. Gharib plans to extend his studies to organisms, such as fish and birds, that generate more complex vortical structures.

IN THE MEDIA *from page 2*

IN THE MEDIA from page 2

located at a very early period in the history of the universe was over-hyped" in original news coverage.

—Joel Primack, UC Santa Cruz

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"I have the impression that physics is actually accelerating. This is because of powerful new tools that are becoming available, such as the magnetic resonance force microscope used in the (list's) top discovery. ... On the theoretical side, powerful new computers are enabling physicists to solve problems that were previously intractable."

—Chris McKee, University of California, Berkeley

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"We have as yet no idea what ... 95% of the universe is made of or what its properties are. This means that all of the physics we know — and this includes all the ... subjects selected by the (institute)—are only the properties of 5% of the universe. It is a sobering and exciting thought, how much we still have to learn."

—Gerson Goldhaber, Lawrence Berkeley National Laboratory

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"Many of the stories (on the list) are about things I don't understand—physics is a very large field nowadays."

—Richard Taylor, Stanford University

Lights, Camera, Action…

Photo Credit: Vinaya Sathyasheelappa

In November, a film shoot took place on the University of Maryland campus for a video that will be distributed as part of the World Year of Physics PhysicsQuest project for middle school students. Portrayed in the video are Jessica Clark of APS, played by Sarah Fox, and Albert Einstein, played by Marc Spiegel (see photos on page 1). In the photo at left, "Jessica" (back to camera) watches as (l to r) Ernie Tretkoff of APS, Martha Heil of the American Institute of Physics, and James Riordon of APS demonstrate some of the PhysicsQuest experiments. In the photo at right, director of photography Jeff Baker and director Chris Andersen work out some fine points of lighting and camera angles as Ernie Tretkoff stands in for Sarah Fox. Clips from the video will be available for viewing on the World Year of Physics web site, www.physics2005.org, *sometime in February.*

NEUTRINO STUDY *from page 1*

beta beam experiments; neutrinoless double beta decay and direct searches for neutrino mass; and what cosmology and astrophysics and neutrino physics can teach each other.

"It's more than just arguing for some experiments," study co-chair Stuart Freedman (University of California, Berkeley) said of the neutrino study's purpose. "It's an attempt to provide background information to people who would be in a position to argue to the higher levels of government that this is important science. This study will help the people who do the funding to get a coherent view of the field, especially since there are so many facets, because the field is so cross-disciplinary."

According to Freedman, the study members framed their view of the future of neutrino physics along three overarching themes: the impact of neutrino research on the Standard Model; the fact that neutrino physics has been marked to date by anomalous unexpected results; and the potential of neutrinos to probe the cosmos, including the generation of the sun's energy.

The report's first recommendation calls for a phased program of sensitive searches for neutrinoless double beta decay, a rare process in which one atomic nucleus turns into another by emitting two electrons. This is the only way to determine if the neutrino is its own antiparticle, and is also critical to our understanding of the origin of mass.

A second high priority should be establishing a comprehensive US program to improve our understanding of neutrino mixing, as well as to determine the nature of the neutrino mass spectrum, and to search for CP violation among neutrinos. Such a program would include several experiments, including one located a few kilometers from a nuclear reactor and a beam of accelerator-generated neutrinos directed towards a detector several hundred kilometers away.

Future plans should also include a neutrino "superbeam" program using a megawatt proton accelerator. New technologies will also be needed, including massive new detectors capable of producing the largest and most precise samples of neutrino data yet recorded, and a new neutrino factory with very pure neutrino beams.

Less pressing, but still important, is the need to develop an experiment to make precise measurements of the low-energy neutrinos from the sun. Thus far, only solar neutrinos with relatively high energy have been studied in detail, and that's only a small fraction of the total. Being able to precisely measure lower-energy solar neutrinos could help us better understand how they change their flavor. It may also enable scientists to predict how bright the sun will be tens of thousands of years from now.

Freedman emphasized that these three primary recommendations assume continued strong support of the existing neutrino programs still in progress. And because neutrino interactions are extremely rare, many of the proposed experiments will need to be carried out in a deep underground laboratory facility. The study report also stresses the importance of international cooperation with the neutrino programs of other nations and geographical regions.

The full text of the joint unit neutrino study can be found at http://apsreactor.uchicago.edu/archive/0045.html. The full text of the reports from each of the six working groups can be found at http://www. interactions.org/neutrinostudy

APS Seeks Endowment for Sakharov Prize

By Ernie Tretkoff

In November 2003 the APS Council approved a new prize named for Andrei Sakharov, in recognition of his work on behalf of human rights. A fund-raising committee is currently seeking donations to secure an endowment for the prize. The first Sakharov Prize will be awarded once they have finished their work.

The Sakharov Prize is named "in recognition of the courageous and effective work of Andrei Sakharov on behalf of human rights, to the detriment of his own scientific career and despite the loss of his own personal freedom."

The purpose of the prize is "to recognize outstanding leadership and/or achievements of scientists in upholding human rights." The prize normally will be awarded to one or more physicists, but scientists in other fields may be eligible if the selection committee feels their qualifications are appropriate.

The stipend will consist of $10,000, and it is intended that the prize will be awarded in alternate years, beginning after the endowment has reached a level sufficient for supporting the prize.

Andrei Sakharov spent about 20 years working on the Soviet top-secret nuclear weapons project, and became known as the father of the Russian hydrogen bomb. Though he initially believed his work on nuclear weapons was necessary for the balance of power, he became increasingly aware of the dangers of nuclear fallout and atmospheric testing. He advocated for nonproliferation, and was instrumental in convincing the Soviet Union to sign the partial test ban treaty of 1963.

Sakharov also worked to defend human rights and in 1968 wrote an essay entitled "Reflection on Progress, Coexistence and Intellectual Freedom," which was published in The New York Times. In 1975, Sakharov was awarded the Nobel Peace Prize for his efforts for human rights. The citation called him the "conscience of mankind."

After speaking out against the Soviet invasion of Afghanistan in 1980, Sakharov was arrested and exiled to Gorky. He returned to Moscow in 1986, and continued to push for democratic reforms in the Soviet Union. He died in 1989.

ANNOUNCEMENTS

APS CONGRESSIONAL SCIENCE FELLOWSHIP 2005-2006

THE AMERICAN PHYSICAL SOCIETY is currently accepting applications for the Congressional Science Fellowship Program. Fellows serve one year on the staff of a senator, representative or congressional committee. They are afforded an opportunity to learn the legislative process and explore science policy issues from the lawmakers' perspective. In turn, Fellows have the opportunity to lend scientific and technical expertise to public policy issues.

QUALIFICATIONS include a PhD or equivalent in physics or a closely related field, a strong interest in science and technology policy, and, ideally, some experience in applying scientific knowledge toward the solution of societal problems. Fellows are required to be US citizens and members of the APS.

TERM OF APPOINTMENT is one year, beginning in September of 2005 with participation in a two-week orientation sponsored by AAAS. Fellows have considerable choice in congressional assignments.

A STIPEND of $50,000 is offered in addition to allowances for relocation, in-service travel, and health insurance premiums.

APPLICATION should consist of a letter of intent of approximately two pages, a list of key publications, a two-page resume, and three letters of reference. Please see the APS website (http://www.aps.org/public_affairs.fellows.html) for detailed information on materials required for applying and other information on the program.

ALL APPLICATION MATERIALS MUST BE POSTMARKED BY JANUARY 17, 2005 AND SHOULD BE SENT TO THE FOLLOWING ADDRESS:

APS Congressional Science Fellowship Program
c/o Jackie Beamon-Kiene
APS Executive Office
One Physics Ellipse
College Park, MD 20740-3843

APS Mass Media Fellowship Program

Applications are now being accepted for the 2005 summer APS Mass Media Fellowships. In affiliation with the popular AAAS program, the APS is sponsoring two ten-week fellowships for physics students to work full-time over the summer as reporters, researchers, and production assistants in mass media organizations nationwide. Information on application requirements can be found at **http://www.aps.org/public_affairs/massmedia/index.html.**

DEADLINE: JANUARY 15, 2005

Visit APS News Online

http://www.aps.org/apsnews/

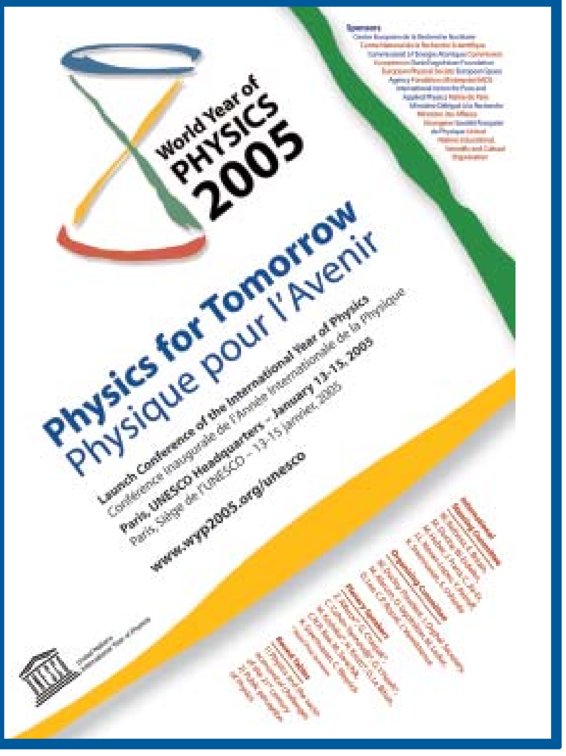
APS Council and Committee Position Nominations

VICE-PRESIDENT; GENERAL COUNCILLOR (2); NOMINATING COMMITTEE;
Vice-Chairperson-Elect • Members; PANEL ON PUBLIC AFFAIRS; Vice-Chairperson-Elect • Members • International Councillor

Please send your nominations to:

American Physical Society; One Physics Ellipse; College Park, MD 20740-3844; Attn: Ken Cole; (301) 209-3288; fax: (301) 209-0865; email: cole@aps.org. A nomination form is available at **http://www.aps.org/exec/nomform.html**.

DEADLINE: JANUARY 31, 2005



GRADUATE *from page 5*

2002, it doesn't deal with all that post-9/11 stuff."

Asia sends far more students to the US than any other region, with China and India sending the most students. In 2002 and 2003, 29% of foreign first-year graduate students came from China, up from 25% in 1999 and 2000. The percentage of foreign students coming from Europe declined during that time period, from 37% to 25%.

The report also found that women are increasing their representation among physics and astronomy graduate students. In 2003 women made up slightly more than 20% of first- year students, up from about 16% in 1995.

Over 90% of first-year physics and astronomy graduate students reported that they considered themselves at least adequately prepared for graduate work, and most considered themselves "well prepared" or "very well prepared."

Foreign students rated their preparation for graduate school slightly higher than US students did. Almost half of the foreign students surveyed had completed some graduate study in physics or astronomy before entering their current departments, compared with about 10% of US students.

Among US students, the most popular subfields were astronomy and astrophysics (16%), followed by condensed matter (14%), and particles and fields (11%). Condensed matter was the most popular subfield among foreign students (22%), followed by particles and fields (10%) and astronomy and astrophysics (7%). Almost a quarter of first-year students have not yet chosen a subfield.

The vast majority (93%) of students entering physics or astronomy graduate school say they are aiming for a PhD.

"Though such a large proportion may set their sights on a PhD, every year at least a third of the graduate degrees are masters, most exiting from PhD departments, indicating that a significant number of students do not reach the goal they had when they began their graduate studies" the report says.

Most students who plan to earn a PhD hope to work in academia (70%) followed by industry (17%) and government or national labs (9%). The full report is available at www.aip.org/statistics.

COHEN *from page 3*

Q: *In recent years, biology has been called by some the "science of the 21st century," while physics is viewed as the science of the past century. Do you think this is true?*

A: No! First of all no one knows where the big scientific discoveries are going to come. Biology has had tremendous growth and extremely exciting science is being produced. As biology develops, there may be more in the way of underlying principles discovered. Perhaps the observed science will be interpreted in terms of physics.

I think it is possible that there will be more coalescing of the fields, so maybe by the end of this century, this will be a non-question as the fields will be so intertwined.

I can predict that there are going to be a lot of discoveries in physics in the next 95 years. That's a safe prediction. The 21st century like the 20th is going to be a great century for physics, too.

Q: *Why did you decide to take on the task of being APS president?*

A: It's a question of giving something back. I care about physics, the welfare of physicists, physics education, and students. I'm happy to report that up to now, almost everything that I have been asked to do or that I have chosen to do with the APS has impressed me as important.

One of the main reasons for this is the marvelous trio, Marty Blume, Judy Franz, and Tom McIlrath. They are extraordinary. They are the secret of the success of this organization.

DPP MEETING *from page 5*

later in the decade.

X-Ray Vision for the Z-Pinch. X-ray movies of wire-array z-pinch implosions on Sandia National Laboratories' Z-machine have been made for the first time, revealing a rich array of implosion phenomena. Wire-array z-pinches at Sandia National Laboratories' "Z-machine" are the world's most powerful laboratory x-ray sources, producing 1-2 million Joules of x-rays in 100-200 TW bursts.

Researchers presenting at the APS meeting successfully took x-ray pictures of z-pinch plasmas on the Z facility using a special crystal imaging diagnostic.

Now, for the first time researchers are able to study the growth and evolution of plasma instabilities during the z-pinch implosion. Z pinches begin as a cylindrical array of wires, each thinner than a human hair, that are vaporized into plasma by 20 million amperes of current. This plasma is then "pinched" to the axis of the array where it rapidly heats up and radiates soft x rays. Until now, very little information existed for the earliest stages of the z-pinch implosion. Each stage of this process has now been imaged, providing quantitative information about the mass distribution of the plasma that is being used to constrain existing physical models and simulations of z-pinch implosions.

New Measurements in Plasma Heating. In plasmas that include multiple species of ions, like those expected in potential fusion devices, the long wavelength, penetrating radio waves used to heat the plasma can spontaneously convert into short wavelength waves. It's important to identify where and how these waves convert to understand heating in machines such as tokamaks, which are likely to lead to the first practical fusion energy sources. Researchers at MIT have now succeeded in simultaneously measuring both the short wavelength and long wavelength waves in a tokamak for the first time on the Alcator C-Mod tokamak. The experimental results are consistent with theoretical predictions, bolstering physicists' confidence that they are on the right track in developing models for the complex interactions in plasma fusion machines.

— James Riordon, Ben Stein and Phil Schewe contributed to this story.

MOON/MARS *from page 1*

Space Telescope, the Mars Rover, and Explorer missions, which have revolutionized our understanding of the universe while relying on comparatively cheap, unmanned and robotic instruments.

It is likely that such programs will have to be scaled back or eliminated in the wake of much more expensive and dangerous manned space exploration, according to the committee.

The report concluded that these recent spectacular successes amply demonstrate that we can use robotic means to address many important scientific questions. And while human exploration has a role to play in NASA, it should be within a balanced program in which allocated resources span the full spectrum of the space sciences and take advantage of emerging scientific opportunities and synergies.

"Astronauts on Mars might achieve greater scientific returns than robotic missions, but they would come at such a high cost that scientific grounds, alone, would probably not provide a sufficient rationale," says Joel Primack of UC Santa Cruz, who headed the committee.

The committee maintained that the scope of the proposed initiative has not been well-defined, its long-term cost has not been adequately addressed, and no budgetary mechanisms have been established to avoid causing major irreparable damage to the agency's scientific program.

To accommodate the Moon-Mars initiative, NASA has already begun to reprogram its existing budget, resulting in indefinite postponement or serious delay of science programs that were assigned high priority by the National Academy of Sciences (NAS) decadal studies.

The APS report includes three recommendations regarding the Moon-Mars initiative:

1. NASA should continue to be guided by the priorities recommended in the NAS decadal studies for its science programs.

2. Before the US commits to the Moon-Mars proposal, a review of the initiative's science impact should be carried out by the National Academy of Science.

3. Before the US commits to the Moon-Mars proposal, the likely budgetary impact should be estimated by the Government Accountability Office.

The Back Page

Outreach is an Orphan

By Alan Chodos

In the 1990's, physics was in the doldrums in Germany. Enrollments in physics among college students had been declining throughout the decade. As the millennium approached, the German physics community resolved to do something about it.

The German Physical Society, working with the Federal Ministry for Education and Research, declared 2000 to be the Year of Physics, in part commemorating the centennial of Max Planck's quantum hypothesis. Five major events were planned, in Bonn and Berlin, and a budget of roughly half a million dollars per project was allocated. The five projects were titled: "Beyond the Milky Way"; "Trip to the Big Bang"; "Tamed Light"; "The Philosopher's Stone" [referring to silicon, as used in computers and information technology]; and "The Discovery of Chance". In addition to the main events, over 200 satellite activities in schools, universities and laboratories brought the year of physics to the entire country.

A description provided by the German Physical Society of one of the main events, "Tamed Light", gives a good idea of how these projects were conducted and what they achieved: " 'Don't wait for the people to come to us, go to where they are' was the motto of the physicists organizing the year's third event, held in June. They erected a marquee on Bonn's market square and filled it with experiments on lasers and quantum physics. They did not have to wait long for visitors. The first ones came even before the exhibits were ready and the idea of attracting passersby from the city center was wildly successful. A total of 15,000 people visited the exhibition tent in three days.

"As at the other Year of Physics events, the research staff was there (up to 16 hours a day) to explain the exhibits. Young undergraduate as well as graduate students joined with full professors, talking themselves hoarse to explain the mysteries of their branch of science to the visitors. These never ceased to marvel at the fact that the scientists were taking the trouble to bring their knowledge and enthusiasm literally to the marketplace."

The impact of the Year of Physics can be seen in the dramatic increase in physics and astronomy enrollments among first-year university students, as shown in the graph in *Figure 1*.

According to data provided by the German Federal Statistical Office, the number of freshmen enrolled in physics doubled from 1998 to 2003, with the biggest annual jump occurring between 2001 and 2002. The graph also shows the total number of freshmen taking all kinds of science (including mathematics and engineering) in each year, for comparison.

As a result of the success of the Year of Physics, there have been annual "Highlights of Physics" programs in Germany following 2000, and years structured similarly to the Year of Physics devoted to other sciences. Most importantly for other countries, the Year of Physics inspired the European Physical Society to suggest that 2005 be declared the World Year of Physics, celebrating the centennial of Einstein's miraculous year of 1905. This has been taken up by the International Union of Pure and Applied Physics, by UNESCO, by the Congress of the United States, and by the General Assembly of the United Nations, which declared 2005 the International Year of Physics last June.

The goal of the World Year of Physics, in the United States and elsewhere, is to reach out to the public in much the same way as the Germans did in 2000.

As readers of *APS News* know, in the US the APS is spearheading much of the activity, together with its sister societies, the American Association of Physics Teachers (AAPT) and the American Institute of Physics (AIP). Considerable effort has gone into publicizing the World Year in the physics community, with the goal of stimulating local activities analogous to the "satellite events" that occurred in Germany in 2000; these could be public lectures, open houses, Saturday morning physics demonstration shows, physics on the road activities, science cafés, and similar activities that local organizers think would be most effective in their communities.

APS is also working hard on four of its own projects, roughly analogous to the five major projects in Germany listed above. Two of these are aimed at middle school and high school respectively.

In addition, at least 16 Physics on the Road teams will be funded to undertake special World Year of Physics programs, and the distributed computing project Einstein@home will use LIGO data to search for gravitational waves. All these projects are described on the US World Year of Physics web site, www.physics 2005.org.

But there is a pronounced difference in scale. The four APS projects have received federal funding totaling a little over half a million dollars, whereas in Germany the funding was half a million dollars for each of their five projects. We hope that the APS projects will be very successful, but since the population of the US is more than three times that of Germany, they probably will not have quite the impact that the Germans achieved in 2000.

That is not to say that the APS projects should have received dramatically more funding. The level of support provided, primarily from NSF and DOE, with a smaller amount from NIST, was commensurate with the staff and other resources that were available at APS, AAPT and AIP. A more interesting question relates not to the quantity of funding, but rather to the funding pathways, or lack thereof, that this country possesses to support outreach activities.

The two major activities of the physics community are research and education. Outreach plays an important supporting role for each of these, but it is a special case of neither. In thinking about where outreach belongs, it is useful to catalogue the benefits that, ideally, it brings to both the physics profession and the wider community:

most of the basic research and many of the educational programs in physics are funded by the federal government. By informing the public about recent developments in physics, outreach helps the taxpayers understand what they are paying for;

outreach oriented toward students can be an important motivator. Students find a subject more interesting when they appreciate what the larger questions are, and what the potential applications may be. Well-designed outreach can bring these issues vividly to life;

at least one Nobel Prize winner in physics was attracted to the subject by a "physics on the road" demonstration. Those with the talent to become outstanding physicists often possess equal talents in other directions. Outreach can inspire them to consider physics as a career;

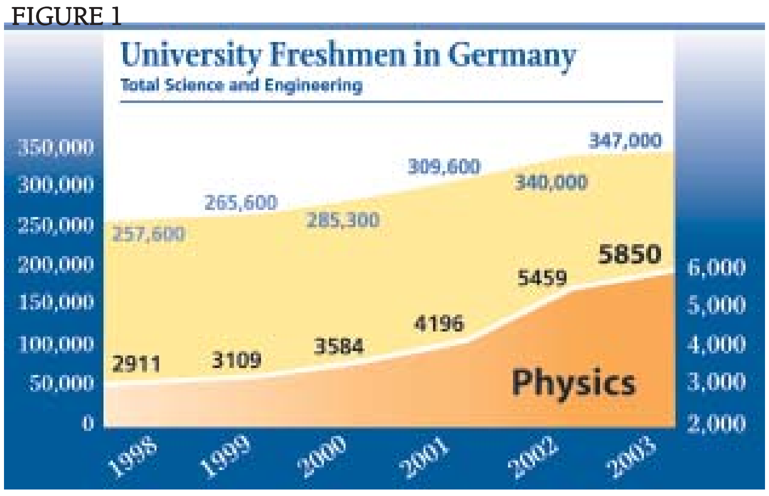
outreach geared to the public and to legislators and other decision makers can enhance the support that physics is likely to receive in the budget process.

To summarize: outreach aids research by informing the public about the results of research, and conversely by encouraging support for the research enterprise. Outreach aids education by raising students' interest in and enthusiasm for physics, and by inspiring talented students to pursue the subject in more depth. Given these benefits, however, one finds that in this country, unlike the situation for research or education, there is no dedicated program of support for outreach activities.

The way the system is structured, outreach must be funded either from within programs that primarily fund research, or those that primarily fund education. Because outreach is a distinct activity that is neither research nor education, this system functions in an *ad-hoc* manner. Despite the best of intentions, excellent programs can be left unfunded, while, paradoxically, outreach funds can be awarded to recipients who did not ask for them and may not have any interest in using them.

If a proposal for outreach is submitted to what is primarily a research agency, the proposal may well get a sympathetic hearing and good reviews. But in a tight budget environment, the proposal will be competing directly with research, which is, after all, the core mission of the agency. It is only natural, then, for outreach proposals asking for substantial sums to be the first victims of budget pressures.

FIGURE 1



On the other hand, these agencies do recognize the value of outreach. In fact, all NSF proposals require the investigator not only to address the "intellectual merit" of the proposal, but also the "broader impacts", which includes answering questions like "Will the results be disseminated broadly to enhance scientific and technological understanding? What may be the benefits of the proposed activity to society?"—questions that suggest outreach as a part of the proposed activity.

Attempts have been made to incorporate outreach into some of the regular research grants. Investigators have been required to show that a specified fraction of their time has been spent on some type of education or outreach. Sometimes this works out well: scientists who would not otherwise do so are forced to think about communicating their results to a general audience, and some of them find the experience enjoyable and the outcome successful. But often the effort is wasted because the investigators are focused on their research and resent the mandated diversion of their energies from their primary task.

If funding through a research agency can lead to problems, why not try an agency whose primary interest is education, such as the Education and Human Resources Directorate of the NSF? This can be a bumpy ride if one is accustomed to the standards and protocols that prevail in the world of research. Education proposals must incorporate rigorous processes of evaluation, according to criteria that are relevant to education, and more particularly to innovation in education. The investigator must put in place procedures that will measure the quality and quantity of information that has been transmitted to the target audience. While this may be the primary goal of an experimental educational project, it is often not so for one dedicated to outreach. The investigator may want to spend his or her time designing a project to excite enthusiasm for physical science in middle school children. An important part of the goal might be to reach as large a group of students as possible. But the funding agency would rather spend less money to reach a large group, and more to collect data from a smaller group on the educational benefits of the activity. The investigator finds that the project has been skewed away from outreach and toward a study of the educational outcomes. This is not necessarily bad—it is just peripheral to the interests and aims of the original project.

In the current system, outreach has no natural home. It is an orphan. There are many examples of good projects that struggle or that are never realized because of lack of even minimal funding. Physics on the road teams, based mainly at universities but also at science museums and other institutions, operate on a shoestring, getting by on the enthusiasm and dedication of the team members. A small amount of extra support would go a long way to increasing the number of teams and the level of their activity. But there is no place for them to apply for funds.

In my opinion, a necessary step is to bring outreach out from under the umbrella of research and education, where it doesn't belong. The funding agencies each need a separate office for outreach, with an independent budget. This budget will, of course, be vastly smaller than the corresponding ones for research and education. But its independence will allow proposals to be reviewed, and their outcomes to be evaluated, according to criteria that are relevant for outreach. Funds can be channeled to those who have the enthusiasm and the talent to do the outreach effectively.

As the German experience shows, outreach can be a powerful tool to enhance enrollments and to raise the visibility of physics dramatically. The World Year of Physics is an excellent opportunity to bring the excitement and importance of physics to the public, but to sustain that effort and to produce significant results, we need a system in this country in which outreach joins research and education as a recognized independent activity within the physics profession.

As Associate Executive Officer of APS, Alan Chodos is heavily involved in the US plans for the World Year of Physics. The opinions expressed in this article are his alone and do not reflect any official position of the APS.

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.