APS NEWS

January 2004
Volume 13, No. 1

http://www.physics2005.org

A Publication of The American Physical Society http://www.aps.org/apsnews

April Meeting Goes Mile-High in 2004

The "Mile High" city of Denver, Colorado, will host as many as 1500 physicists at the 2004 APS April meeting, to be held May 1-4 2004.

Attendees will be drawn from a wide range of research areas. APS units represented at the meeting include the Divisions of Astrophysics, Nuclear Physics, Particles and Fields, 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.

The scientific program will feature three plenary sessions and approximately 45 invited sessions. There will also be numerous contributed and poster sessions and a special public lecture by newly-elected APS Vice President John Bahcall (Institute for Advanced Study).

The plenary sessions will cover a broad range of topics, in-

See **APRIL MEETING** *on page 4*

Photo Credit: The Denver Metro Convention and Visitors Bureau

Denver has the 10th largest downtown in America.

Junior Members Respond to APS Ethics Survey

By Ernie Tretkoff

Few physicists received formal ethics training as part of their education, though many are concerned about professional ethics, a study by the APS Ethics Task Force has found.

The task force report was submitted to and accepted by the APS Council at its meeting in November.

The task force, which was convened in November 2002 in response to two highly publicized incidents of data falsification, used surveys and interviews of members of the physics community to ascertain the state of ethics education and awareness.

"Ethics" was defined broadly to include not just research misconduct such as data fabrication, falsification, and plagiarism, but also issues such as authorship, proper credit of previous work, and data handling and reporting. "This was an interesting and sobering project," said task force chair Frances Houle of the IBM Almaden Research Center in San Jose.

The surveys collected information from physics department chairs, APS unit leadership, undergraduates, junior members and corporations and national labs.

The task force decided to

See **ETHICS SURVEY** *on page 5*

Council Deplores Restriction of Non-Classified Scientific Information

At its meeting in November, the APS Council reaffirmed a statement passed originally in 1983 on the freedom of scientific communication, and added a preamble that specifically pointed out the ill effects of labels like "sensitive but unclassified", which have the potential to expand greatly the restriction of scientific communication. The motion passed by Council, in its entirety, reads:

Restricting exchange of scientific information based on non-statutory administrative policies is detrimental to scientific progress and the future health and security of our nation. The APS opposes any such restrictions, such as those based on the label "sensitive but unclassified", and reaffirms its 1983 statement that:

Whereas the free communication of scientific information is essential to the health of science and technology, on which the economic well-being and national security of the United States depend; and

Whereas it is recognized that the government has the authority to classify and thereby restrict the communication of information bearing a particularly close relationship to national security; and

Whereas members of the American Physical Society have observed the damaging effects on science of attempts to censor unclassified research results;

Be it therefore resolved that the American Physical Society through its elected Council affirms its support of the unfettered communication at the Society's sponsored meetings or in its sponsored journals of all scientific ideas and knowledge that are not classified.

House Resolution Recognizes Congressional Fellowship Programs

A resolution passed by the House on October 28 (H. Con. Res. 279) recognizes the 30th anniversary of the Congressional Science and Engineering Fellowship program of the American Association for the Advancement of Science (AAAS) and pledges continued congressional support for the program. The resolution, which has now been referred to the Senate, finds that "Fellows bring to the Congress new insights and ideas, extensive knowledge, and perspectives from a variety of disciplines."

Intended to honor the 30th anniversary of the AAAS program (the celebration of which was postponed until May 2004 because of a hurricane in Washington, DC), the resolution further states that "Members of Congress hold the AAAS Congressional Science and Engineering Fellowship Program in high regard for the substantial contributions that Fellows have made, serving both in personal offices and on committee staff." It reaffirms the House's "commitment to support the use of science in governmental decision-making" through the Fellowship program.

During discussion on the floor, several Members of Congress spoke in praise of the Fellowships. Rep. Fortney "Pete" Stark (D-CA), called the Congressional Science and Engineering Fellowships "a shining example of a collaborative program that benefits all who participate." The fellowships, he said, are "a remarkable partnership between Congress and the 30 or so participating professional societies that select and fund the Fellows."

APS, the American Institute of Physics, and numerous other scientific societies all sponsor Congressional Fellows under the auspices of the AAAS program. The APS was one of the original societies to participate in the program. The Congressional Fellowships enable qualified individuals to spend a year on Capitol Hill, working in the office of a Member of Congress or for a congressional committee. Fellows interview with personal offices and congressional committees to select an assignment that

See **FELLOWSHIP** *on page 2*

New Techniques for Controlling Fluid Flow Highlight the APS 2003 DFD Meeting

New techniques for predicting turbulent fluid flow, and modeling the transport of atmospheric contaminants were among the technical highlights presented during the 2003 meeting of the APS Division of Fluid Dynamics (DFD), held 23-25 November in East Rutherford, New Jersey. The meeting was jointly hosted by Syracuse University, Stevens Institute of Technology, Rensselaer Polytechnic Institute, Polytechnic University, and the City College of New York.

The scientific program featured lectures on nonlinear dynamics of fluid motion, and on "visiometrics," linking laboratory and computer simulated images to such artistic modes of expression as painting, photography, sculpture and digital animations. There were also eight invited lectures on such topics as non-diffusive gaseous ignition, aerosol dynamics, and the extreme fluid dynamics of white dwarfs and neutron stars. In addition, the meeting featured the 21st annual Gallery of Fluid Motion, showcasing images and graphics from computational and experimental studies of flow phenomena. The winning entries will be published in the September 2004 issue of the *Physics of Fluids*.

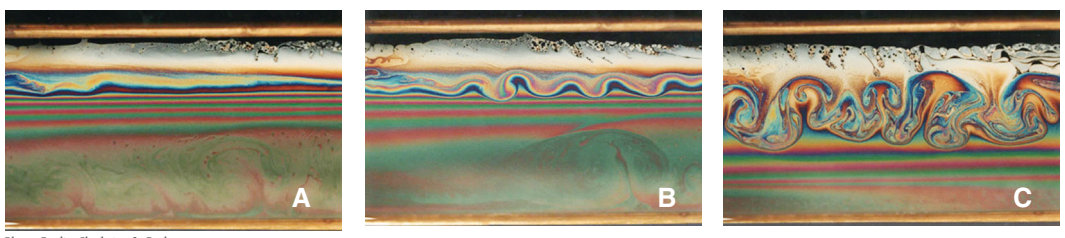


Photo Credit: Skotheim & Bush

Images A, B, and C: evaporatively-driven convection in a draining soap film.

Lessons Learned From Red Cells. Despite a difference in size of about 15 orders of magnitude, there is a remarkable dynamical similarity between a red cell gliding on the endothelial surface matrix (the glycocalyx) that lines human capillaries and a person skiing on fresh snow powder. That's the conclusion of Sheldon Weinbaum and his colleagues at the City College of New York, who are drawing on that observation to develop a new concept for high speed trains whose track mimics the properties of the endothelial surface layer. In both the red cell and the skiers, according to Weinbaum, one can generate lift forces three to four orders of magnitude greater than ordinary lubrication theory, but the red cell is a far more efficient skier since it does not dissipate its excess pres-

See **DFD MEETING** *on page 6*

Highlights

Members in the Media

"We felt that in the old way of doing it, too many things were covered and the essential features of physics as a science were getting lost in a sea of formulas. We had feedback that said students were having a hard time appreciating the essential connectedness of it all."

—Joshua Socolar, Duke University, on restructuring introductory physics classes at Duke, the Chronicle (the independent daily at Duke University), Nov. 3, 2003

✶✶✶

"Any astronomer or astrophysicist will tell you the same thing — as long as it doesn't get back to their local congressman. NASA thinks Americans will always support people in space rather than knowledge in space. But I think they've asked the wrong questions."

—Virginia Trimble, University of California, Irvine, Florida Today, Nov. 4, 2003

✶✶✶

"This is our first direct look at the incredibly dynamic activity in the solar system's outer limits,"

—Stamatios Krimigis, The Johns Hopkins University, on the Voyager spacecraft possibly having reached the edge of the solar system, New York Times, Nov. 6, 2003

✶✶✶

"You can always find some scenario where you can get a limited military advantage from new weapons. But you have to balance that against what you're doing to your security, especially if it invites other countries to go nuclear. We have to be able to reduce our reliance on these weapons, not make new missions for them."

—Sidney Drell, Stanford University, on "reduced collateral damage" weapons (mini-nukes), Oakland Tribune, Nov. 8, 2003

✶✶✶

"I think we are so confused that we should keep an open mind to tinkering with gravity,"

—Michael Turner, University of Chicago, New York Times, Nov.11, 2003

✶✶✶

"I wouldn't want my doctor thinking that intelligent design was an equally plausible hypothesis to evolution any more than I would want my airplane pilot believing in the flat Earth."

—James Langer, University of California, Santa Barbara, New York Times, Nov. 11, 2003

✶✶✶

"The sound is rather like a large jet plane flying 100 feet above your house in the middle of the night,"

—John Cramer, University of Washington, on what the Big Bang sounded like, New Scientist, Nov. 1, 2003

FELLOWSHIP *from page 1*

interests them. They do not act as representatives of their sponsoring organizations during their time on Capitol Hill; their only responsibility is to the congressional office in which they choose to serve.

Some Fellows accept permanent positions on Capitol Hill or in federal agencies after their Fellowships, while others return to academia or industry, to share their experience of the legislative process with others in the science community. The APS 1982-1983 Congressional Science Fellow, Rep. Rush Holt (D-NJ), was eventually elected to the U.S. House of Representatives, where he is now serving in his third term.

"For 30 years, the fellowship program has brought together Members of Congress with leading scientific practitioners and scholars in a variety of scientific fields," said Holt (a co-sponsor of the resolution) during the floor debate. And this has provided a level of scientific expertise not otherwise found on most congressional staffs, and it presents the congressional fellows with an intimate role in the process of decision-making in public policy."

Holt is one of only two physicists to ever serve in Congress, along with Rep. Vernon Ehlers (R-MI), who introduced the resolution, and called the rarity of physicists in Congress "an indictment of the scientific community because we should have more scientists in the Congress, but most scientists tend to shy away from this particular type of activity." He praised the fellowship program for filling that gap. "They provide some very badly needed scientific advice....[and] are extremely important in maintaining the scientific competence of the Congress, both House and Senate."

—Audrey T. Leath, AIP

Editor's note: *For details on applying for the APS Congressional Fellowship Programs, see* http://www.aps.org/public_affairs/fellow/

All application materials must be postmarked by January 15, 2004.

This Month in Physics History

January 1884:First U.S. Patent for a Roller Coaster

Photo Credit: Paul L. Ruben Archives

LaMarcus Thompson

The unquestioned highlight for most people of any visit to an amusement park is the roller coaster, affectionately dubbed the "Great American Scream Machine." But coasters are more than just mere entertainment. They are based on fundamental physics principles such as gravitation, centripetal force, and acceleration. As such, roller coasters have become one of the most popular mechanisms for teaching these basic concepts to students.

Largely considered an American phenomenon, roller coasters actually have their roots in the ice slides that first appeared in the 17th century in Russia, near St. Petersburg. They were built out of lumber covered with a sheet of ice several inches thick, and featured drops of 50 to 80 feet. They were a big favorite among the Russian upper class—Catherine the Great is said to have been a fan, and even had a few built on her estate.

Most historians credit the French with building the first wheeled coaster—by 1817 there were two coasters in France, both of which featured cars locked to the track—and with building the first looping coaster at Frascati Gardens in Paris. An early attempt to bring a similar ride to the US in 1848 failed because of an accident during the trial run. It would fall to an American inventor named LaMarcus Thompson to revolutionize the amusement industry in the US, earning him the title of the "father of the American roller coaster."

Born in 1848 in Jersey, Ohio, Thompson was a natural at mechanics, designing and building a butter churn and an ox cart when he was 12. He attended Hillsdale College in Michigan and then worked briefly in the wagon and carriage business before making his fortune as a manufacturer of women' s seamless hosiery. After selling his stake in the hosiery business, he turned back to his first love: inventing.

Several years earlier he had ridden on the Mauch Chuk Switchback Railway in Pennsylvania, a former mine track used to transport coal down a mountainside that had become a popular tourist attraction. He decided to build his own Gravity Pleasure Switchback Railway at Coney Island, completed in 1884.

It was the first bona fide roller coaster to be built in the US, shaped like the early Russian ice slides (two hills parallel to each other), incorporating undulating hills and a flat steel track nailed onto several layers of wooden plank, connected to two 45 foot towers.

The maximum speed was 6 mph, and the cars had to be manually towed to the top of the hills at the start of both tracks. Nevertheless, the ride was an instant success with the public.

Within four years, Thompson had built approximately 50 more coasters across the nation and in Europe, and then began work on what became his most famous attraction, the Scenic Railway, designed with James A. Griffiths.

It opened in 1887 in Atlantic City and featured artificial scenery illuminated by lights triggered by the approaching cars—a precursor to the elaborate theme park rides at Disneyland and other parks today.

Thompson built numerous other scenic railways until his retirement in 1915. He died in 1919.

Of course, Thompson was not the only early designer of roller coasters, either in the US or abroad, and improvements and innovations were quickly made.

In 1884, Charles Alcoke designed a coaster with a continuous track, so that the ride ended where it began, and the following year Phillips Hinckle used a mechanical hoist to raise the cars to the top of the hill, rather than being towed manually. That same year saw the debut of the first experiment with loops with the Flip Flap, which rolled cars through a 25 foot diameter circular loop, but closed in 1903 because of the frequent neck and back injuries suffered by its passengers.

By the end of the 19th century, all the basic elements of the modern roller coaster were in place, although they were slow.

The early 1900s featured numerous innovations in roller coaster design, led by the rides at Coney Island, the success of which ultimately spawned the opening of amusement parks worldwide.

The 1920s was the "Golden Age" of roller coaster design and innovation, with more than 1500 rides opening in North America, and another 1500 overseas. But the Great Depression caused the number of roller coasters to decrease and many amusement parks to be torn down.

The technology languished until 1955, when the opening of Disneyland in southern California ushered in a new Golden Age for the roller coaster. Since then, further innovations have come fast and furious—new track elements, launch systems, seating, and elaborate ride themes —and today, roller coasters are more popular and pervasive than ever.

Further Reading:

Adams, Judith A. *The American Amusement Park Industry: A History of Technology and Thrills* (Boston: Twayne Publishers, 1991).

Cartmell, Robert. *The Incredible Scream Machine: A History of the Roller Coaster* (Bowling Green: Bowling Green State University Popular Press, 1987).

Online Resources:

- http://www.ultimaterollercoaster.com/
- *Build your own roller coaster*: http://www.learner.org/exhibits/parkphysics/coaster.html
- http://www.fearofphysics.com/roller/roller.html
- http://dsc.discovery.com/convergence/coasters/coasters.html
- PC Simulation software available at : http://nolimitscoaster.com

APS NEWS
Series II, Vol. 13, No.1
January 2004

Coden: ANWSEN ISSN: 1058-8132

Editor ..... Alan Chodos
Associate Editor ..... Jennifer Ouellette
Special Publications Manager ..... Elizabeth Buchan-Higgins
Design and Production ..... Stephanie Jankowski
Forefronts Editor ..... Neville Connell
Proofreader ..... Edward Lee

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

Letters to the editor are welcomed from the membership. Letters must be signed and should include an address and daytime telephone number. The APS reserves the right to select and to edit for length or clarity. All correspondence regarding *APS News* should be directed to: Editor, *APS News*, One Physics Ellipse, College Park, MD 20749-3844, E-mail: letters@aps.org.

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

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

Quinn Ponders Long Range Goals for APS in 2004

Editor's Note: *On January 1, 2004, Helen Quinn of the Stanford Linear Accelerator Center, became APS president, succeeding Myriam Sarachik of the City College of New York. Quinn is only the fourth woman to be elected to the presidential line in the Society's 104 year history. Born in Australia, she completed her PhD in physics in 1967 at Stanford University and is now a faculty member at SLAC. She has made significant contributions to particle physics theory, for which she has received numerous honors, including membership in the National Academy of Sciences. In the interview below, Quinn discusses her priorities for the APS during her presidential year.*

Q: *What are your priorities for the APS during your presidential year? What do you feel are the most important issues currently facing the Society, and what can the APS do to address them?*

A: My major goal for the coming year is to take a long range look at the Society. Where do we want to be five and ten years from now, and what do we need to do to get there? As an example, over the past ten years we have much increased our activity in Washington and our public outreach efforts. I expect the need for such activities will continue to grow, and we need to plan in order to have the capacity to staff this work adequately.

More immediate issues that I already know will claim my attention include ameliorating the visa situation for foreign scientists and students, and improving funding for the physical sciences. I will also continue the task force initiated by my predecessor, Myriam Sarachik, to explore how the APS can help bridge partnerships that improve the contacts for practicing scientists in Africa with scientists in the US with similar research interests. [*see APS NEWS Online,* August/September 2000]

What the APS can do towards improving the representation of women and minorities in physical science, and the (not unrelated) task of improving science education will certainly be part of the long range plan discussion. As President I will do what I can to advance the effectiveness of the Society in addressing these issues.

Q: *The APS journals several years ago were challenged by the revolution in electronic publishing. How has the APS adapted to this challenge? What can it do to further keep its publications strong and healthy as the trend continues?*

A: APS journals have made a giant step into the electronic world, with electronic access to all our journals now available back to the first issue. But we cannot rest on our laurels. We must continue to work to be at the forefront in both efficiency and technology in the production of our journals. We must also be always looking ahead to see how scientific publishing can and should evolve to better serve science and scientists, and to be leading rather than trailing developments in this area.

Q: *The APS, along with scientific societies around the world, is gearing up for the upcoming World Year of Physics in 2005, celebrating the seminal contributions of Albert Einstein to physics in 1905. What is the Society's role in the grand scheme of things? What do you hope this major event will do to foster an international spirit of cooperation and collaboration among scientists in every country, at a time when international relations with the US government are particularly strained?*

Photo Credit: Dan Quinn

Helen R. Quinn

A: The World Year of Physics provides an opportunity for public outreach that will be the major focus of APS efforts for this year. We will work with our neighboring countries in this outreach effort, but it is not about relationships between scientists, but rather, about enhancing public awareness of the role of physics and interest in the ideas of physics. Physics is already international, and we do not need a world year of physics to get scientists of all countries to cooperate and collaborate.

The international nature of the science community is something scientists know and value. We know that the US will pay a terrible price if it becomes isolated, by its visa policies, from full participation in the flow of scientific information and scientific activity. We need to educate others to the possible costs of such isolation, and to work to achieve paths that keep open the flow of foreign scientists into and out of this country, both for meetings and for collaborative work. As an immigrant scientist who arrived here as a student, I know very well that the flow of foreign students is also important. That too needs attention in order to maintain the vitality of our science community.

Q: *Much attention is being paid of late to fostering the "future workforce" for the science and technology sector, which has a direct bearing on science. What do you see as the primary challenges in this area, and what can the Society do to help?*

A: I guess the future workforce issue is the issue of getting good students into our grad schools in physics. That has two parts, the first is doing a better job of educating and attracting US students to these careers, and the second is the issue of allowing foreign students accepted as grad students to come to this country, and indeed to stay if offered jobs here. Both parts need attention.

Education has long been a concern of mine. I am the founding president of the nonprofit Contemporary Physics Education Project, which produces materials for high school and college physics teachers, and I manage SLAC's outreach programs. We all know the necessity of building on one another's research, but too often we go it alone when it comes to changes within our departments, or outreach to K-12 education. The Society's education activities help promulgate successful innovations and prevent replication of failures.

Q: *You are only the fourth woman in APS history to serve as president of the Society. What are the changes you've witnessed over your career in the representation and overall treatment of women in science? What have been the gains? Any perceived losses?*

A: The changes in the acceptance of women in physics, as well as in other professional careers, that Myriam [Sarachik] and I have seen during our careers, are huge. The proportion of women in high school physics classes is getting close to 50%, and that change should with time move up through the profession, but we are still a long way from that. There is still much to be done. For minorities we are still further from achieving participation proportional to population, which I think should be a goal.

Q: *On a more personal note, when did you first become interested in physics, and what made you decide to make it your career? What advice would you give to young women today with similar aspirations?*

A: I started at the University in Australia with a cadetship (student internship/scholarship) from the weather bureau. So if my father had not decided to move to the US to join the parent company of his Australian company, I would have been a meteorologist. When I arrived in the US, it turned out that I was closest to completing a physics degree, so I chose that major, and settled in for one year and one quarter as an undergrad at Stanford. That was about the time SLAC was being completed. I guess I got caught up in the excitement this new facility was generating and decided to stay on for grad school.

I cannot remember any moment when I decided that physics was my career. When I applied to grad school I thought I'd quit after a Masters degree and become a high school physics teacher, but applied to a PhD program because I knew that Stanford and other leading schools would not accept me if I told them that. By the end of my first year of grad school I knew I did not want to quit.

I think a major factor that affects young women entering physics careers is that they tend to question their own competence more than do young men with similar qualifications.

So my advice to young women is to believe in yourself and your capabilities, and go for whatever you want, you will be surprised what happens—I was!

Lerch Retires as Head of APS International Affairs

After over eleven years as the first APS director of international scientific affairs, Irving Lerch is retiring to pursue more personalized interests in the global science arena. During his tenure with the Society, he headed a fledgling program to provide aid to the physics community of the former Soviet Union, distributing about $18 million, and developing an Internet access program and journal distribution program, as well as acting as a catalyst in establishing the International Science Foundation to monitor and implement such programs.

Lerch was born in Chicago, IL, in 1938, the same year physicist Enrico Fermi was awarded the Nobel Prize in physics. So it should not be surprising that Lerch chose to become a physicist himself. "It didn't hurt that physicists could control the energy of stars and thereby engulf the world in a pall of fear," he recalled.

After attending West Point, Lerch served as an officer in the 101st Airborne Division. He then attended the University of Chicago for advanced studies in physics, becoming a medical physicist.

Photos Credit: Jessica Clark

Irving Lerch enjoys, and responds to, a friendly roast at the APS Council meeting in November.

He wrote his PhD thesis on radiation damage to enzyme systems, and subsequently joined the research faculty at the university's Argonne Cancer Research Hospital (which later became the Franklin McLean Memorial Institute). He built a laboratory to measure the transmission spectra of low energy x-rays used for medical imaging, and also became involved in biological modeling and computational studies, as well as researching radiation effects in tissues and dosimetry systems.

His long involvement with international activities began when he accepted an appointment to the International Atomic Energy Agency in Vienna, Austria, where he served from 1973 to 1976. In 1976, he moved to New York University, where he spent the next 18 years administering a program in radiation oncology physics.

By 1991, the world had changed dramatically with the fall of the Berlin Wall and the dissolution of the Soviet Union. Lerch's involvement with the APS began as a sabbatical from NYU, during which he was to begin building an international program for the Society. The objectives were ambitious: minister to the growing foreign APS membership, save the physics enterprise of the newly emerging states of the former Soviet Union, develop a partnership with China, and invigorate APS relations with European, Latin American and Asian physicists, all while finding external resources to accomplish these far-reaching tasks.

It was far more than could be accomplished in a single year, so Lerch accepted a permanent position with the Society and he retired from NYU when the APS relocated from NYC to the new American Center for Physics in College Park, MD. The problems plaguing the scientific enterprise in the former Soviet Union occupied the majority of his efforts for the first few years. "Because the former SSR scientific establishment was so large and well integrated, there was fear that its loss would have a deleterious impact on the international scientific enterprise, and ultimately on our domestic enterprise in the US," said Lerch.

This was especially critical given the fact that the scientific community had become increasingly international since the end of World War II. By the 1990s, two thirds of the science being carried out was being done outside the US. Therefore, "integrating the US enterprise with the international community was absolutely essential," said Lerch. "Because if we don't have that type of integration, then our domestic enterprise is balefully imbalanced."

Ironically, while the world scientific community is facing a wide variety of issues today, in Lerch's eyes, "it's still the same sort of problem. We've become so globalized and the international community is so integrated, that any tendency within the world scientific community to regionalization must inevitably isolate the US" As evidence, he points to the formation by large laboratories of regional coalitions for the more efficient

See* LERCH *on page 5

LETTERS

Ethical Principles Not Determined by APS

I was distressed to read the new "Ask the Ethicist" column in the November *APS News*. I would hope the author of such a column would display a higher level of ethical sensitivity than this author has displayed in the first concocted contribution.

In my view it was never ethical to add an author to a paper without permission, or at least a very serious effort to get permission, whether this person is an influential senior figure or a Research Experience for Undergraduates summer visitor.

I can remember one case of unauthorized addition of well-known coauthors (by other well-known authors), when I was a graduate student, and the people who told me about this were shocked that it should happen.

It has happened every now and then since then, but there has never been to my knowledge, a community acceptance of such practice that might justify the disrespect implied by failing to allow an author to dissociate himself from a paper. This occasional form of malpractice is, to a senior person like myself, particularly unwelcome when it associates a respected author with a dubious piece of work.

I think I would also have disliked when I was a student having my name attached to a paper I did not understand just because I had done some technical work for it.

Of course anyone, even an ethicist, can make mistakes, although it is better not to make serious mistakes in a first performance. What offends me deeply is the suggestion that the explicit statement made by the APS in 2002, "Every coauthor should have the opportunity to review the manuscript before its submission", rendered an action unethical which was up to that point ethically acceptable. When I conducted a seminar on scientific ethics last spring I had arguments with a Jesuit-educated student who tried to persuade us that ethical principles were universally recognized, while I was arguing for determination by culture. However, none of us thought that ethical principles were determined by the University, the APS, the NAS, or any other such body.

David Thouless
Seattle, WA

Two Major Problems Face Hydrogen Economy

Susan Ginsberg's article "Revolutionary Breakthroughs Needed for Hydrogen Economy" (*APS News*, November 2003) is a reminder of a woeful and widespread misunderstanding in the public regarding hydrogen as a potential for fueling vehicles. Hydrogen is touted as the "ultimate clean energy source," a phrase that hides not just one, but two fundamental errors.

In the first place, hydrogen is not an energy source but a means of transmitting energy from one place to another. It would be an energy source if pure hydrogen were available somewhere in the atmosphere, or on the surface of the Earth, or in the bowels of it. But such is not the case, for hydrogen is always bound, to oxygen as water, or to innumerable other compounds, organic and inorganic. To obtain it from these, say water, an input of energy is needed, equal to the energy that will be gained by "burning" the hydrogen back to its compound form. And that energy must *eo ipso* be obtained from some conventional source—coal, oil, natural gas, nuclear, or hydro. Thus a "hydrogen economy" is no panacea for those who worry about exhaustion or undesirability of these conventional energy sources.

Second, would then the "hydrogen economy" be clean? A byproduct is produced, namely water vapor. But water vapor is not nothing. In large enough quantities it may, for instance, influence the climate. Until a detailed and scientifically quantitative investigation of this effect is done, it is far from clear that carbon dioxide emission—treated as such a menace in some quarters—is more harmful than water vapor would be. But that is not all. As pointed out above, to obtain hydrogen, some conventional energy source is needed. And if that source is to be fossil hydrocarbon burning (coal, oil, natural gas), then even if one ignores the possible effect of water vapor emission, there remains the old carbon dioxide emission problem. Again, a reliable, unbiased study is needed to compare the benefits or otherwise of burning extra hydrocarbon fuels in hydrogen factories, versus burning the hydrocarbon, as now, in the internal combusion engines themselves.

These reflections are not intended to throw cold water on research on hydrogen as a means of transmitting energy; quite the contrary. They are only intended to call attention to a great need to disseminate the basic facts to the public in order to forestall false hopes and prevent disappointment.

What organizations are better suited to this task than the APS or the AIP who in the past have not shied away from initiating studies in important and major areas where science impinges on public concern?

Andrew Lenard
Bloomington, IN

No Need for "Capsule" Degrees

In her informative analysis of the job market [*APS News* Back Page, November 2003], Merrilea J. Mayo states that "a once-per-lifetime degree no longer makes sense, when a complete turnover in technology occurs in a fraction of a lifetime." As a solution she proposes the accredited ("capsule") degrees in a form of "specialization modules."

The introduction of a system of extra accredited degrees would be a step in the wrong direction. First, not all active professionals are (or will be) in a position to pursue extra degrees. Thus, regardless of their actual competence, those without fresh capsule degrees may find themselves with an aura of inferiority ("your PhD is too old").

Second, an industry (largely for-profit) of extra short-term accredited degrees will almost certainly develop typical shortcuts such as credits "earned" on-line or other similar practices of questionable validity.

Undoubtedly, with the exponential growth of the body of knowledge and the fast advent of new methods and technologies, a practice of lifetime learning becomes an integral part of a professional life in almost all areas. However, the habit of upgrading professional skills through self-education (including informal workshops when needed) is quite different from the pressures of earning extra formal accredited degrees.

While I see a great merit in the former, the latter, in my view, is largely an unnecessary waste of time and resources.

Alexander A. Berezin
Hamilton, Ontario

✶✶✶

Undergrad Enrollment is Key Factor

One factor that Merrilea Mayo [Back Page, November 2003] should consider is that the need of teaching assistants by Physics Departments depends upon undergraduate enrollment, which is not tied to the job market.

Bruce W. Wessels
Evanston, Il

APRIL MEETING *from page 1*

cluding studies of DNA packaging using Optical Tweezers; the Microworld of Solar Corona; the spontaneous emergence of order in vibrated sand; boost-phase defenses against ICBMs; cosmology; tests of Newton's inverse-square law; and the possible discovery of a new kind of matter at Brookhaven's Relativistic Heavy Ion Collider.

In addition, a number of special receptions are being organized for students, women, minorities and international physicists.

More information about the APS April Meeting can be found at http://www.aps.org/meet/APR04/.

Ask the Ethicist

Editor's Note: *This is the second in our series of* "Ask the Ethicist" *columns, designed to highlight ethical issues of interest to the physics community. We are pleased that the first column stimulated several letters with new questions, one of which is dealt with below. The continued success of this column depends on our readers letting us know either of situations within their own experience, or more general questions with ethical implications.*

Please send your questions or comments to: ethics@aps.org, *or by mail to Jordan Moiers, c/o APS News, One Physics Ellipse, College Park, MD 20740.*

Contributors should identify themselves, but their names and addresses will be held strictly confidential unless they request otherwise. The opinions expressed in this column are not necessarily those of either the APS or APS News.

✶✶✶

The new column is an excellent and timely addition to *APS News*. The following is my ethical dilemma. It is not conjecture; it is from personal experience. I used to work as a research scientist at a government laboratory. While there, I was pretty much on my own in terms of the experiments: I thought them up, did the design, built the apparatus, wrote the data acquisition programs, analyzed the results, presented the results at conferences, and wrote the papers. I was obligated, however, to include manager types as co-authors on publications despite the fact that they did not even remotely meet the APS guidelines for co-authorship. In addition, they were in a position to block manuscripts from getting the necessary security clearances if I felt aggressive enough to push for sole authorship. That hurdle would have been the least of my potential problems - such a posture would likely have cost me my job. I took the low road and made them co-authors.

I know this type of situation happens all the time. I've been told by colleagues to accept it as part of the game. Since these unqualified co-authors have little scientific reputation to protect, the only harm I see is the perceived dilution of credit for what was entirely my own work.

(Name and address withheld)

Jordan Moiers responds:

Beyond any doubt, it is a violation of the APS ethical guidelines for managers to insist that they be included as coauthors on papers that they did not contribute to in a material way. I'm not sure I agree with you, however, that the only harm is the perceived dilution of your credit for your own work. Coauthor status conveys real responsibility for the research presented in a paper, and it should not be treated as a gold star to be slapped onto a manager's annual performance review.

Clearly, you have little recourse as long as the culture of the laboratory allows managers to hold your career hostage. What is unclear is just how pervasive this problem is. Although there is probably little advice that we can give people facing the sort of administrative arm-twisting that you suffered, this column is intended to raise awareness of ethical issues in the physics community by printing letters such as yours.

In order to help gauge the pervasiveness of the problem, *Ask the Ethicist* would like to hear from other *APS News* readers who have been coerced to include unqualified coauthors on their papers.

Employment Data Show Interesting Leads and Lags

Regarding Merrilea Mayo's Back Page on physics workforce issues (*APS News*, November 2003), I was especially interested in the lead-lag experimental data, since feedback loop delay line time was part of a discussion with George McClure, Chair of the IEEE Career Policy Committee, about my paper, "Toward an Analog Circuit Model of Engineering Employment", given at the fall 2003 meeting of the APS Texas Section in Lubbock.

It appears that the shift from a one-year lag in '63-'68 to a one-year lead in '81-'85 could have been due to the slow recovery from the '73-75 recession, although there seems to be zero-lag during '70-'75 just as there is from 1992 to 1996 (perhaps due to the 1990-1992 jobless recovery?).

E.G. (Jerry) Bylander
Sherman, TX

Woody Allen Column Deemed Inappropriate

Woody Allen's column in the November issue of *APS News* (under the Zero Gravity banner) perpetuates stereotypical attitudes of men towards women. Insofar as one of the goals of the APS is to involve more women in physics, we think it was inappropriate to include this column in an APS publication.

Members of the Colby College Physics Department:
Virginia Long
Duncan Tate
Murray Campbell
Charles Conover
Brett Fadem
Waterville, ME

✶✶✶

I can accept that the editors of the *APS News* found Woody Allen's "Zero Gravity" column (November 2003) amusing, but I am not amused that they found it acceptable.

Tevian Dray
Corvallis, OR

LERCH *from page 3*

exchange of information—a worthy goal, but US participation is minimal, which Lerch finds troubling.

Even before the 9/11 tragedy, US policy was becoming increasingly restrictive, with export control laws, technology alert lists, and most recently, tighter restrictions on issuance of visas to foreign scientists. "While these are designed to protect the US homeland, they do not take into account the fact that the US benefits enormously from international exchange," said Lerch. "Once you have a system that is absolutely dependent on the free exchange of information, any impediment to that information flow is bound to cause considerable injury."

Despite his retirement, Lerch plans to remain active in international affairs. He is helping organize a scientific workshop in Azerbaijan this April in conjunction with the Civilian Research and Development Foundation, and will continue to be deeply involved in the ongoing restructuring of the science program at UNESCO. He is also considering joining a National Academy study of the science enterprise in Armenia. "Things are not looking that leisurely at the moment," he said. "But a number of us 'senior citizens' are convinced that science, technology, engineering, and science education can and should be harnessed to accelerate economic and cultural growth in developing countries."

ETHICS SURVEY *from page 1*

focus on junior members (those within the first 3 years after receiving a PhD) because they have recently come through the educational system and are starting their professional careers. "We targeted that group because they really capture both worlds," said Houle.

Overall, the survey found professional ethics education was informal. Two-thirds of junior members said they had never had any formal ethics training, and more than 80% of undergraduates said they had received no training.

Many did receive instruction on acceptable methods of data recording, handling, and reporting, most often in laboratory courses. Seventy-eight percent of undergraduates and 52% of junior members said they had received such instruction in lab courses, and 75% of department chairs said professional ethics was addressed in lab courses at their institutions.

Though ethics is not included in formal education, it is clearly an area of concern in the physics community. Most members, including 78% of undergraduates and 87% of junior members, said they had discussed ethics issues informally. About half of department chairs said ethics had been discussed more than casually within their departments in the past two years.

"I think that the two most important results are that training in professional ethics is largely informal in physics, and that the junior members, who are the future of the field, care passionately," said Houle.

Ethics violations are far from unheard-of: About 10% of department chairs said their institutions had experienced cases of misconduct in the past 10 years, and about 40% of junior members said they had observed an ethics violation.

The most common problems cited were putting non-authors on a paper or excluding student's names from papers to which they had contributed. Only 4% of junior members knew of falsification of data.

Many survey respondents (23%) considered falsification of data as the most serious ethics violation, and another 23% listed treatment of subordinates in research groups as one of the most serious issues.

Some respondents worried that the pressure to publish "flashy" research in high profile journals can result in improperly analyzed data and overstated claims.

Another frequently mentioned concern was the refereeing process, in which scientists often review papers by their competitors, possibly leading to conflicts of interest.

The APS has statements on ethics and guidelines for professional conduct, which can be found at http://www.aps.org/statements. However, about 80% of department chairs did not know if their faculties were aware of or had read the APS ethics guidelines. Most junior members (61%) were aware of APS statements but only 20% had read the statements.

There is a well-defined process for handling ethics violations in APS journals, and 67% of department chairs said their institutions had procedures for handling professional misconduct.

When asked what could be done to improve professional ethics, some survey respondents said ethics education was key, while others questioned whether training could change people's behavior.

Based on these survey results, the task force made several recommendations, which include: expanding APS ethics statements to include treatment of subordinates, social responsibility of physicists, and intellectual property issues; developing short-term and long-term ethics education programs; working with the International Union of Pure and Applied Physics (IUPAP) and other organizations to develop international ethics standards; and considering having a formal standing committee on ethics.

In January two Ethics Task Force members will meet with the Panel on Public Affairs (POPA) to review the report. POPA will be involved in determining an action plan.

zero gravity

The Lighter Side of Science

Curve Balls

By Tom Sheahen

What makes a "curve ball" curve? This is one of the truly enduring topics of discussion among scientists. It's not widely known, but physicists like to sit around watching the world series and sharing a six-pack, and during the commercial breaks the subject of curve balls often comes up. A lot of people think that science is a sedate, arcane way of thinking; but watch a group of physicists arguing about what makes a curve ball change directions, and you'll discover otherwise.

It goes something like this:

Profound Theoretical Physicist # 1 (**Huey** Bernouilli): Look, I told you guys a dozen times, the ball is spinning and it drags along the air molecules right alongside in a *boundary layer*. On one side, the boundary layer is moving in the same direction as the ball, toward home plate, and on the other side the boundary layer is moving in the opposite direction.

Alright?

Right!

So, what happens when the velocity is higher? The pressure goes ***down***. On the other side, where the velocity is lower, whaddaya got? A ***higher*** pressure!

Still with me?

The ball has some area, right?

So:(pressure) times (area) equals (force).

With the pressure high on one side and low on the other, there is a net ***force*** in one direction on the ball, which means, by Newton's Second Law… Hey, pass the pretzels this way… that the ball is going to ***move*** in the direction the force is pushing it—off to the side.

That's a curve ball!

Profound Theoretical Physicist # 2 (**Dewey** Magnus): Yeah, but you forgot all about turbulence!

What you're talking about only applies in little league, where the ball's going slow. In the Major Leagues, ya gotta remember turbulence!

That boundary layer you're spoutin' about doesn't stay in contact with the ball perfectly—it ***separates*** and the air behind the ball forms a ***wake***, sorta like a boat. The air inside the wake gets turbulent. The point on the ball where the boundary layer separates is different on the fast side of the ball compared to the slow side of the ball, and so the wake bends off to one side.

Now it's time for Newton's Third Law: bend the wake one way and the equal and opposite reaction requires that the ball bends the other way.

Hey! Can anybody get me a beer!

Profound Theoretical Physicist # 3 (**Louie** Maxwell): How can you guys forget about torque? You've seen a gyroscope or a spinning top, don't you remember?

The ball is spinning, right?

So it's got ***angular momentum***, right?

Exert a force F, from some direction R, on something with angular momentum and you a ***torque*** T, which gives the ball a twist and sends it toward a different direction!… look, I gotta drive a long way tonight—better just gimme a Pepsi… You don't see a spinning top fall over, do you?

No, it ***precesses*** around in a circle!

Didn't your grandfather give you a *draedel* when you were a kid?

Huey: You're tryin' to tell me the ball precesses like a top?

You don't know anything!

Dewey: Look, one thing we can all agree on: gravity is going to pull the ball down toward the earth…

Louie: Yeah, well, what about the effect of the stitching? That's sure gonna mess up that pretty little boundary layer!

Dewey: … so a curve ball can either make it sink faster or stay up higher and not fall as fast.

Huey: How many beers have you had? We're not talking sinkers here, this is about a curve ball.

Louie: No, Dewey's right—if the spin-axis of the ball is horizontal to begin with, the motion of the ball will be along the plus or minus Z axis, either up or down.

Huey: So how do you make it curve sideways?

Louie: We got any more potato chips?… The curving motion is going to go in whatever direction the front side of the ball is rotating toward. If you want it to curve sideways, flick your wrist and twist the axis of rotation just as you release the ball.

Huey: You do that and it won't be moving as fast when you let go of it.

Dewey: So what?

The whole idea of a curve ball is to have the ball go one place while the bum swings somewhere else! If you're just trying to fan him, throw a fast ball down the middle at 100 miles an hour.

Louie: Where you gonna find somebody who can throw that fast?

Trade one of our Nobel Prize winners to Japan for a left-handed closer?

Dewey: What if the ball isn't spinning at all?

Louie: I never did understand knuckle-balls… gee, these cheese doodles must be six months old.

Dewey: Why do curve balls only move suddenly when they get near the plate?

Huey: Actually, the force of the differential air pressure is there all along, from the mound to the plate. But although the force causes an ***acceleration*** sideways, the sideways ***motion*** is very tiny for the first 75 feet, and only really gets to be noticeable in the final 15 feet. We say the curve ball "breaks." The batter hasn't got enough time to react.

Dewey: I'm gonna get me another beer. Anybody else want one?

Louie: Hey, how'd they get three runs that inning?

Huey: While you were busy yakking, they were hitting curve balls, I guess.

Council Approves a New Prize and a New Award

At its November meeting, Council gave approval to a new APS prize and a new award. In both cases, they will begin to be awarded only after the necessary funds have been raised for their endowment.

The new prize is the Sakharov Prize, named after the late Russian physicist and human rights activist Andrei Sakharov.

The purpose of the prize will be "to recognize outstanding leadership and/or achievements of scientists in upholding human rights."

It 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."

It is intended that the prize will be awarded every other year and will carry a stipend of $10,000.

A minimum endowment of $100,000 must be raised before the first recipient can be chosen.

The new award is for excellence in physics education. It was proposed jointly by the APS Forum on Education and the Committee on Education, and, like the Sakharov Prize, received the endorsement of the Prizes and Awards Advisory Committee and the APS Executive Board before being passed by Council.

The award is distinctive in that it is intended to be given primarily to a team or a group (such as a physics department), rather than to a single individual.

The American Association of Physics Teachers already gives numerous awards for excellence in education to individuals.

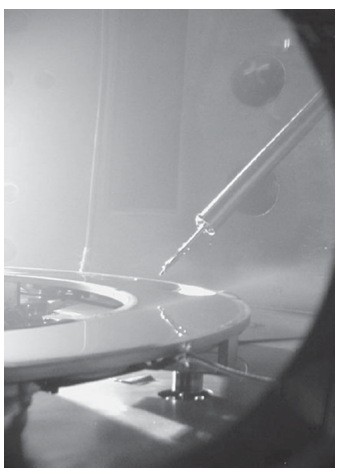
Among the accomplishments to be recognized by this new award are outreach programs and outstanding teacher enhancement or teacher preparation programs. It is envisaged that the award will be given yearly and carry a stipend of $5000.

A minimum endowment of $100,000 will have to be raised.

Quiet Microwave Ovens, Liquid Lithium Walls Among DPP Meeting Highlights

Improvements in fusion plasmas via liquid lithium, quieter microwave ovens, and a "plasmatron" that reduces smog from buses were among the highlights of the 45th Annual Meeting of the APS Division of Plasma Physics (DPP), held from October 27-31, 2003, in Albuquerque, New Mexico. Around 1600 papers were delivered at this meeting.

Liquid lithium makes solid improvement in fusion plasmas. Fusion reactors get hot—really hot. Designing a wall that can take the heat requires clever thinking. Scientists at the DOE Princeton Plasma Physics Laboratory (PPPL) have taken important first steps toward a very clever solution to this problem: the idea is to fashion the wall from liquid. Results of the first fusion experiments with liquid components facing the plasma made a splash in fusion research at the DPP meeting. In addition to offering the hope for a better material for reactor walls, the Princeton experiments show that liquid lithium at the plasma boundary absorbs contaminants and excess fuel, and improves the overall efficiency of performance.



Pool of liquid lithium in the tray that encircles the bottom of the CDX-U device. The tip of the liquid-lithium injector, which is removed before plasma operations, is reflected on the shiny surface of the liquid lithium.

A new entry in the science X-games. The emerging field of high-energy-density physics has been described by a recent National Academy of Sciences report as the "X-games" of contemporary science. The term high energy density is used to describe matter with pressures more than 1 million times the pressure on the surface of the earth. While high energy density matter is extreme by terrestrial standards, it can be found throughout the universe in a number of astrophysical settings and can be made for short times and within small volumes in the laboratory. In an invited talk on Monday morning, Mark Herrmann of Lawrence Livermore National Laboratory described recent experiments that provide a new entry for the "X-games": the laser-driven dynamic hohlraum.

The laser-driven dynamic hohlraum consists of a spherical, laser-driven implosion of a plastic shell filled with xenon. As this thin shell implodes it sweeps up the xenon and causes it to radiate x-rays. When enough radiating xenon has been swept up, the xenon begins to trap x-ray radiation on the inside, creating a time-evolving cavity of intense x-rays—a dynamic hohlraum. With this technique, it may be possible to achieve very high energy densities on experiments at the National Ignition Facility, which began initial physics operations this year.

A Little Chaos May Go a Long Way in Future Fusion Energy Reactors. In work that makes practical, large-scale fusion energy production increasingly feasible, plasma physicists working at the DIII-D National Fusion Facility in San Diego are using a little chaos to prevent precious energy from escaping fusion energy devices. In a magnetic fusion device, or tokamak, one of the most crucial regions for reducing the loss of heat and particles is at the plasma region's edge. Particles crossing this edge leave the plasma and carry energy with them, degrading the fusion reactor's walls and making it harder for the desired fusion energy production to occur. This problem will only increase for next-generation fusion energy machines such as the proposed ITER facility.

As the energy content of the fusion fuel increases, plasma in the edges has a tendency to become unstable, exhibiting a kind of turbulence that physicists call "Edge Localized Modes," commonly referred to as ELMs. In experiments presented this week, an international team of researchers applied chaotic magnetic fields, in which the field lines point in unpredictable directions, to a small edge region of the plasma in the DIII-D experiment. With the chaotic magnetic field they applied, the researchers significantly reduced the ELM instabilities in the DIII-D plasma, enabling more heat to stay trapped in the fusion fuel and preserving the favorable conditions that allow fusion energy production to occur. Assuming that this approach can be extended to next-step fusion energy devices, it holds the promise of increasing the lives of materials that make up fusion-energy device walls without degrading the performance of the plasma fuel.

Microwave ovens that won't mess with your cordless phone and wireless computer. A new invention removes noisy microwave signals from microwave ovens and prevents them from interfering with cordless phones and wireless computer networks. The new technology, developed by plasma physicists at the University of Michigan, is also expected to lead to more efficient microwave ovens, with little or no addition to the ovens' cost.

Microwave ovens heat food by emitting microwaves from a device called a magnetron. Those microwaves then heat and cook the food. One problem with magnetrons is that they emit extra "noisy" microwaves at frequencies that can interfere with other devices. Microwave ovens share an unlicensed part of the microwave frequency band with cordless phones and computer communications systems such as Bluetooth and IEEE 802.11b,g (the standards for wireless networks). The new magnetron produces a "clean" signal with essentially zero emissions apart from the 2.45 GHz frequency it is designed to emit. The secret is arranging the magnetic fields in the magnetron in just the right way. Fortunately, this configuration can be implemented very inexpensively in practically all magnetrons of different makes, ages and power outputs, making it feasible for use in consumer microwave ovens.

MIT "plasmatron" drastically reduces smog emissions from a diesel bus. MIT physicists reported a new advance with the plasmatron, a small device that converts part of a fuel into a hydrogen-rich gas that reduces the emission of pollutants from vehicles. Developed by MIT researchers, the plasmatron was tested on a diesel-engine bus in Columbus, Indiana. The bus was tested by a team of engineers from ArvinMeritor, a major automotive and heavy truck components manufacturer which has licensed the plasmatron technology from MIT.

At the meeting, the MIT researchers reported that the plasmatron device, used with a special catalyst that treats the exhaust, reduced nitrous oxides from the vehicle by 90%. Nitrous oxides (NOx) are a major component of smog. In development for a half-dozen years, the plasmatron is showing special promise for early commercialization in diesel engines, which power many buses and trucks. The MIT researchers believe the plasmatron may provide an excellent means for those vehicles to meet stricter EPA standards planned to go into effect by 2007 for buses and heavy trucks. The plasmatron technology can also be used in gasoline engines, and makes them run potentially 30% more efficiently while also being affordable and very clean.

NIH Announces New Roadmap Funding Opportunity in Metabolomics

A recently released NIH Roadmap initiative, "Metabolomics Technology Development," http://grants1.nih.gov/grants/guide/rfa-files/RFA-DK-04-002.html, is aimed at stimulating development of innovative technologies to enhance understanding of metabolic pathways and networks.

For more information about this initiative, please visit the Frequently Asked Questions at http://www.nihroadmap.nih.gov/grants.

For general information on the NIH Roadmap, including other funding opportunities, please visit: http://www.nihroadmap.nih.gov/index.asp

Southeast Section Holds 70th Annual Meeting

The Southeastern Section of the American Physical Society held its 70th annual meeting in concert with the Society of Physics Students and the American Association of Physics Teachers at Wrightsville Beach NC on November 6-8 hosted by the University of North Carolina at Wilmington. Four members were presented with awards for outstanding contributions to physics in the region. They are (r to l): Jerzy Bernholc, Beams Award winner, and William Hamilton and Warren Johnson, Slack award winners, and John Foley, Pegram award winner.

DFD MEETING *from page 1*

sure at its lateral edges.

LES Is More. Large eddy simulation (LES) is a promising technique for the prediction of turbulent fluid flows, in which the largest scales of turbulence are solved directly while the effects of the discarded small scales are modeled. However, some vital flow situations, such as turbulence near walls, cannot be simulated reliably using LES. Robert Moser of the University of Illinois described a new approach to LES modeling, incorporating stochastic estimation techniques—specifically, direct numerical simulation (DNS)—to optimize the LES model.

Improving Liquid Transfer Processes. Gravure coating and printing are common processes for producing micron scale coatings and patterns in a continuous manner, and may be well suited for the large scale fabrication of nano and microdevices on flexible substrates. It is crucial to understand the fundamental principles that govern the liquid transfer process in order to have precise control over the thickness of coatings and printed features, and to avoid defects due to incomplete liquid transfer. A team of scientists at the University of Minnesota have mimicked the process using a glass top with a curved surface that is passed over scaled-up gravure grooves and cells, and performed flow visualization studies.

Piezoelectric Printing. Piezoelectric printing of gold nanoparticle suspensions offers a promising solution for the production of fine line conductors in low cost, large area electronics, such as radio frequency ID tags and display drivers, according to a collaboration of scientists from the University of Illinois, Chicago, and Motorola. To create such conductors, a liquid suspension containing homogeneously dispersed nanosized spherical gold particles is printed using a single orifice, piezoelectric printhead to create continuous beads on flat target surfaces. The printed structures are subsequently processed thermally to yield conductive thin film gold patterns.

Bacterial Carpets for Microfluidics. Scientists from Brown University presented experimental results showing the use of bacterial carpets to achieve enhanced mixing and pumping in microfluidic channels. Bacterial carpets are formed by flowing a high concentration of bacteria into a microfluidic network. The cells stick to the surface while most of their flagella remain free to rotate in the fluid. The team observed significant enhancing of diffusion due to the carpet flagella motion, as well as the functioning of the bacterial carpet as an effective microfluidic pump.

Tracking Atmospheric Contaminants. Paritosh Mokhasi and Dietmar Rempfer of Illinois Institute of Technology are interested in modeling the transport of contaminants in the atmospheric boundary layer. A primary goal is to predict contaminant dispersion based on flow and concentration measurements using a minimum number of sensors. This precludes a direct approach, because atmospheric flows are almost always turbulent. They believe the Proper Orthogonal Decomposition (POD) method is a promising alternative because it allows them to describe a turbulent flow using a minimum amount of information, by decomposing the flow field into temporal coefficients and spatial functions. This enables them to reconstruct the entire 3D flow field exactly. Based on this method, they believe it will be possible to develop a practical approach to estimating the 3D turbulent flow field using velocity information from a small number of sensors.

Designing Winglets for MAVs. Since the mid 1990s, there has been growing interest in developing so called Micro Aerial Vehicles (MAVs) for both military and civilian uses. A team of scientists at the Arizona State University is performing a computational study of the effect of winglets on MAV performance, most notably in reducing drag. They found that the increase in lift obtained through the addition of winglets is more important for the enabling of low speed flight, and that winglets can lead to an increase in lift that is sufficiently large to improve the lift-to-drag ratio.

ANNOUNCEMENTS

DRAFT WORDING — Open for Comment
APS Constitutional Amendment
Regarding Topical Groups

In 2002, the APS President appointed a Task Force on Topical Groups to review the role played by Topical Groups in the overall APS structure and make any recommendations it felt necessary. One of the recommendations of the Task Force in its report, which was accepted at the April 2003 Council meeting, called for modifications to the mechanisms for the formation and termination of topical groups. Below are the recommendations of the Task Force, followed by the suggested changes to the APS Constitution. The changes are intended to implement the Task Force recommendations and have been approved by the APS Committee on the Constitution and Bylaws. They will be subject to a vote by the entire APS membership next summer.

Please send any questions or comments to Ken Cole at cole@aps.org. They will be shared with the Council at its meeting in April.

From the TF on Topical Group Report:

Mechanisms for Start-up of a New Topical Group

- Petition for a new group must have 200 signatures from APS members who state an interest in forming and joining the topical group. Supporters must list their current APS Divisional and Topical Group affiliations. With a valid petition submitted, Council would consider the criteria above for justification of a new topical group. If a substantial majority of the petitioners come from a single Division, then Council would initiate a deeper review to gather more information and justification for the potential topical group. Upon approval of the petition by Council, the group could begin to organize and enroll members.
- The new group would have 18 months to enroll 200 members. When 200 members enroll, the new topical group would automatically come into existence.
- The new group has three years following Council approval to increase its enrollment to 300 members.

Mechanism for Termination of a Topical Group

- After the initial three years, all topical groups would be required to maintain 300 active members. If a group membership fell below 300, it would become inactive. "Inactive" means that invited session slots for meetings and fellowship slots would not be allocated. If the topical group's membership returned to 300, it would be reactivated immediately.
- If a topical group remained inactive (membership under 300) for three years, it would be automatically terminated.

SUGGESTED CONSTITUTIONAL REWORDING:

ARTICLE VIII - DIVISIONS, TOPICAL GROUPS, AND FORUMS

1. Organization.—If at least two hundred members wish to advance and diffuse the knowledge of a specific subject or sub-field of physics, they may petition the Council to establish a Topical Group. The Council shall distribute to the Chairperson and the Secretary-Treasurer of each existing Division and Topical Group a statement of the areas of interest of the proposed Topical Group for review and comment. **Following Council approval, the new Topical Group shall be officially initiated and considered active when at least 200 members have enrolled. This must occur within 18 months. To remain active, a Topical Group must increase its enrollment to at least 300 within three years of approval. If at any time after the initial three-year period membership drops below enrollment of 300, the Topical Group shall become inactive and no longer allocate invited sessions at meetings or fellowship slots. If a Topical Group remains inactive for three years, it shall be automatically terminated.**

If the membership of a Topical Group exceeds X percent of the total membership of the Society for two consecutive calendar years, it shall become a Division following application to and approval by Council. A Division shall have one Councillor. If the membership of a Division falls below 0.7X% for four consecutive years, it shall revert to the status of a Topical Group. ~~If the membership of a Topical Group falls below two hundred for four consecutive years, it shall cease to exist.~~

Prize & Award Nominations

Otto Laporte Award
DEADLINE: 02/10/04
Established as an APS award in 1985, but existed as a division lectureship prize for twelve previous years. The award is to recognize outstanding contributions to fluid dynamics and to honor Otto Laporte.

Purpose: To recognize outstanding research accomplishments pertaining to the physics of fluids.

Fluid Dynamics Prize
DEADLINE: 02/10/04
Established in 1979 with support from the Office of Naval Research.

Purpose: To recognize and encourage outstanding achievement in fluid dynamics research.

Marshall N. Rosenbluth Outstanding Doctoral Thesis Award
DEADLINE: 04/01/04
Established in 1985 (originally as the Simon Ramo Award) and endowed in 1997 by General Atomics Inc.

Purpose: To provide recognition to exceptional young scientists who have preformed original thesis work of outstanding scientific quality and achievement in the area of plasma physics.

As of December 5, 2003, the number of physics departments that have endorsed the APS/AIP/AAPT Joint Statement on the Education of Future Teachers (APS News, November 2003) had grown to 254.

The APS has posted an up-to-date list of endorsements on its website. The list can be found at http://www.aps.org/educ/joint.html.

APS Mass Media Fellowship Program

Applications are now being accepted for the 2004 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 30, 2004

APS SEEKS HEAD OF MEDIA RELATIONS

The APS anticipates an opening for a media relations professional to promote physics in the popular media. Based at APS Headquarters in College Park, MD, this position will develop and coordinate all media relations for APS.

Responsibilities include working as part of a team that identifies physics news stories, locates press contacts in the physics community, and pitches the stories to the national media.

Opportunities to travel exist.

The qualified applicant will have at least a bachelor's degree in science, and preferably additional scientific work experience (physics a plus).

Considerable experience interacting with the media is necessary. Excellent oral and written communication skills are required. Competitive starting salary and outstanding benefits package offered. Visit our website at: www.aps.org.

To apply, send cover letter including salary requirement, resume, and contact information for three professional references via e-mail, fax or conventional mail to:

American Physical Society
One Physics Ellipse
College Park, MD 20748-3844
Attn: Joe Ignacio, Director of Human Resources
E-mail to: personnel@aps.org
Fax to: (301) 699-8144

American Physical Society, Washington Office, Senior Science Policy Fellow

Responsibilities: Craft and advocate for key science policy issues. Develop grass roots activities for one of the nation's largest scientific societies. Organize congressional visits programs, "APS Alerts," and letter-writing campaigns. Represent APS Washington Office at selected APS national and divisional meetings, APS committee meetings and science advocacy coalition meetings.

Requirements: Excellent verbal, writing and interpersonal skills. Hill experience desirable. Science PhD strongly preferred.

Salary: Commensurate with experience.

Serious consideration of candidates will begin December 15, 2003.

For more information, please contact the American Physical Society, 529 14th Street, NW, Suite 1050, Washington, DC 20045, Attn: Michael Lubell, opa@aps.org (202) 662-8700 [voice], (202) 662-8711 [fax].

APS/AIP CONGRESSIONAL SCIENCE FELLOWSHIP

The American Physical Society and the American Institute of Physics are accepting applications for their 2003-2004 Congressional Science Fellowship programs. Fellows serve one year on the staff of a Member of Congress or congressional committee, learning the legislative process while lending scientific expertise to public policy issues.

Application deadline is January 15, 2004.

For more information, visit:
http://www.aps.org/public_affairs/fellow
or
http://www.aip.org/pubinfo

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

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, 2004

APS Membership Department News

• New Member Benefit for 2004 •

APS will offer a new journal benefit to members in 2004. APS Member Article Packs will be available for $50, allowing members 20 APS journal article downloads (*excluding PROLA and RMP*). This is a considerable savings on single APS article downloads. *Look for more information in your 2004 Renewal Packet.*

In addition, APS members can already purchase AIP Journal Packs at a 50% discount on https://store.aip.org/articlepacks/.

• 2004 APS Member Directory •

Members will be contacted at the end of the year and asked to request either a paper or cd-rom copy of the 2004 Directory. Members will have to notify APS of their choice by February 23, 2004, to receive one of the available versions. Online directory access is always available at http://www.aps.org/memb/enter-directory.html.

• APS Bulletins •

Starting in 2004, the APS Membership Department will no longer be processing orders for APS Bulletins. The paper version will be distributed onsite at meetings to attendees. Open access to all APS Bulletins (current and archived) will be available online at http://www.aps.org/meet/.

Contact Information:
• 301-209-3280 • membership@aps.org •

The Back Page

Albert Einstein on His Seventieth Birthday

By Robert A. Millikan

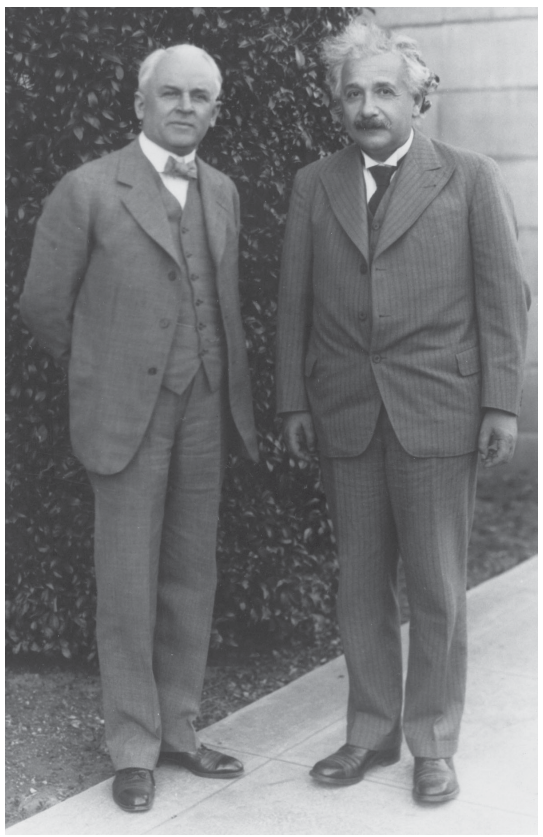
Editor's Note: *In 1949, the* Reviews of Modern Physics *devoted an issue to a celebration of Albert Einstein's seventieth birthday. It contains articles by many of the most eminent physicists of that period. The introductory article, by Robert A. Millikan, is especially noteworthy because it describes the content and significance of Einstein's three great papers of 1905, the centennial of which will be commemorated in the World Year of Physics (WYP) in 2005. The entire issue, which is of course accessible to subscribers to the* Physical Review Online Archive (PROLA)*, will also be made available soon on the WYP web site, www.physics2005.org. We reprint Millikan's article here for its intrinsic interest, and also perhaps to pique our readers' interest in participating in the events of 2005.*

The year 1905 was a notable year in that at the age of 26, Einstein published in that year's issue of the *Annalen der Physik* three brief but remarkable papers that were on the following subjects: (1) the special theory of relativity; (2) the Brownian movements; and (3) photoelectric stopping potentials.

Everyone of these three papers represented new and far-reaching *generalizations* of immense importance. For the first and second of these the stage had already been set and the *experimental* foundations on which all sound generalizations must rest had already been built. In the case of relativity the prime experimental builder had been my own chief at the University of Chicago, Albert A. Michelson, who made his first experiment on aether-drift at Berlin in 1881, only two years after he had risen to fame by making in 1879 a very great improvement upon Foucault's rotating mirror method of determining the speed of light.

But it was not until 1887 that this experiment, repeated at Case School of Applied Science with great care and refinement by Michelson and Morley, began to take its place as the most famous and in many ways the most fundamentally significant experiment since the discovery of electromagnetic induction by Faraday in 1831. The special theory of relativity may be looked upon as starting essentially in a generalization from Michelson's experiment. And here is where Einstein's characteristic boldness of approach came in, for the distinguishing feature of modern scientific thought lies in the fact that it begins by discarding all *a priori* conceptions about the nature of reality—or about the ultimate nature of the universe—such as had characterized practically all Greek philosophy and all medieval thinking as well, and takes instead, as its starting point, well-authenticated, carefully tested *experimental* facts, no matter whether these facts seem at the moment to be reasonable or not. In a word, modern science is essentially empirical, and no one has done more to make it so than the theoretical physicist, Albert Einstein. That, in a sentence, is, I take it, his greatest contribution to modern thought. It will stand out repeatedly in this brief review of the contributions I shall here touch upon.

Throughout the nineteenth century we had been building up what seemed a wonderfully consistent "natural philosophy" as to the nature of radiant energy—a beautiful wave-theory of light. This theory required that it be possible, by noting the difference in time *required* for a beam of light to get back to the observer when, on the one hand, it was sent forth in the direction of the earth's motion and back by reflection from a mirror to the observer, and when, on the other hand, it was sent a like distance forth and back at right angles to the earth's motion, to find the speed with which the earth is moving through the aether. But this experiment, after it had been performed with such extraordinary skill and refinement by Michelson and Morley, yielded with great definiteness the answer that there is no such time-difference and therefore no observable velocity of the earth with respect to the aether. That unreasonable, apparently inexplicable experimental fact was very bothersome to 19th century physics and so for almost twenty years after this fact came to light physicists wandered in the wilderness in the disheartening effort to make it seem reasonable. Then Einstein called out to us all, "Let us merely accept this as an established experimental fact and from there proceed to work out its inevitable consequences," and he went at that task himself with an energy and a capacity which very few people on earth possess. Thus was born the special theory of relativity.



Robert Millikan and Albert Einstein, Caltech, 1931.

My early contact with it came only because when I went to Chicago as a young assistant in 1896, Mr. Michelson was making elaborate experiments in the Ryerson Laboratory to see whether, though the earth at its surface "carried the aether along with it without slip," that slip might appear if the path taken by the light went to a considerable distance above the earth's surface.

I was only an onlooker in this experiment but later when I was struggling with cosmic ray effects I found I couldn't get anywhere without the use of the Einstein special relativity equation $m=m_0(1-\beta^2)^{-½}$. Furthermore, out of that same equation, also as a result of Einstein's boldness, came the stupendously important concept for 20th century physics that matter "m" itself might be transformed into radiant energy *E* through the relation $E=mc^2$. This Einstein equation has now become the most important relation in nuclear physics.

Turning now to the second of Einstein's great 1905 generalizations, the kinetic theory of gases had first been put on a quantitative basis by Joule's development in 1848 of the equation $p=1/3nmc^2$ and out of that came the first statement of the principle of equipartition of energy generally accepted in the case of gases by all modern atomists but vigorously denied by the school of so-called "energetikers" led by Ostwald and Helms and followed somewhat haltingly by so great a natural philosopher as Ernst Mach—a group which asserted that the facts of observation did not need the postulate even of the existence of atoms, to say nothing of their motions.

This principle of equipartition, however, under conditions of temperature and pressure not too far removed from the normal, had received, as most physicists thought, the best of *experimental* credentials through its success in predicting correctly the relative values of atomic weights, diffusion coefficients, and viscosities of different gases, the atomic weights of which ranged from that of the lightest atom, hydrogen, up to close to those like mercury, a hundred times heavier.

But though the Brownian movements had been experimentally discovered as early as 1827, we physicists before the time of Einstein had been extraordinarily blind in our failure to realize that there could be no reason to limit the principle of equipartition to bodies of atomic or molecular dimensions; that instead it should make no difference, on the basis of equipartition, whether the particles which were exchanging impacts with the molecules of a gas or a liquid which surrounded them were as big as an atom or as big as an orange—the average square of the particle-displacement in a time τ along a given axis *X* should in any case be given by the gas equation $\Delta x^2=(2RT/NK)\tau$ in which *R/N* is a gas constant and *K* is a resistance factor depending upon the viscosity of the medium and the size of the bombarded particle.

This quite obvious assumption or generalization was first made independently about 1905 by Einstein in Switzerland, Smoluchowsky in Poland and Sutherland in Australia. Furthermore, during the next few years Perrin in Paris had measured with the aid of the foregoing equation the extent of the random movements of emulsion-particles in liquids, and Harvey Flecher and I in connection with my oil drop experiments had done the same with much greater precision with suspended particles in gases, and thus verified experimentally the validity of Einstein's generalization.

As a result of these new researches the whole attack of the school of the "energetiker" upon the kinetic and atomic hypotheses had collapsed. Ostwald himself showed the greatness of his mind by publicly admitting that he had been wrong. Indeed in the preface to the next edition of his *Outlines of Chemistry*, published about 1913, he made the following clear and frank avowal of his changed position in the following words:

"I am now convinced that we have recently become possessed of experimental evidence of the discrete or grained nature of matter for which the atomic hypothesis sought in vain for hundreds and thousands of years. The isolation and counting of gaseous ions on the one hand… and on the other the agreement of the Brownian movements with the requirements of the kinetic hypothesis… justify the most cautious scientist in now speaking of the experimental proof of the atomic theory of matter. The atomic hypothesis is thus raised to the position of a scientifically well-founded theory."

Einstein's third 1905 paper reveals more strikingly than either of the foregoing his boldness in breaking with tradition and setting up a photoelectric stopping potential equation $PD \bullet e=½mv^2=h\nu-p$ which at the time seemed completely unreasonable because it *apparently* ignored and indeed seemed to contradict all the manifold facts of interference and thus to be a straight return to the corpuscular theory of light which had been completely abandoned since the times of Young and Fresnel around 1800 A.D.

I spent ten years of my life testing that 1905 equation of Einstein's, and, contrary to all my expectations I was compelled in 1915 to assert its unambiguous experimental verification in spite of its unreasonableness since it seemed to violate everything that we knew about the interference of light. The contradictions between this equation could not be removed by any considerations which were available at that time to Planck, to Einstein or to any of the rest of us. These contradictions have now partially disappeared, however, through the development of the so-called "wave mechanics" by the work of Louis De Broglie, Schroedinger, Heisenberg, and Dirac. In accordance with these new concepts every material particle of mass *m* moving with a velocity *v* im,s describable by a series of waves of wave-length given by $\lambda=h/m\nu$. But Planck's universal constant *h* is so small $(6.62 \times 10^{-27}$ erg cm) and the *m* of all possible material particles or even of electrons is so large that these wave-lengths λ are in general infinitesimal in comparison with ordinary light or other electromagnetic waves. The result of their interference therefore produces essentially straight-line or particle-like propagation. In other words the *apparent* contradiction between particle and wave concepts now disappears and for the same reason as it did in the particle-wave controversy of a hundred fifty years ago, between Newton and Huygens.

In closing my tribute to Einstein I wish to say that much as I honor him for his immense contributions to physics, his greatest qualities lie in the field of character and morals. I worked with him for some years on a committee of the League of Nations and I also saw much of him in the two winters which he spent with us at the California Institute of Technology, and I came to admire him most for his extraordinary open-mindedness, his modesty, his honesty, and his complete readiness to admit that he had been wrong and to change his position entirely in the light of new conditions. His two-page statement found in a small pamphlet entitled "My Faith," printed and distributed by the *American Weekly* (New York, 1948) reveals a greatness of soul and keenness of intelligence and understanding rarely found in the history of mankind.

Robert Andrews Millikan (1868-1953) was professor of physics at the University of Chicago and at Caltech. He received the 1923 Nobel Prize in Physics for his measurement of the charge of the electron and for his work on the photoelectric effect.