APS NEWS

October 1999 | The American Physical Society | Volume 8, No. 9

[Try the enhanced APS News-online: http://www.aps.org/apsnews]

APS 100 years — celebrate a century of physics

APS and AIP Initiate *Inside Science News Service*

The American Physical Society has teamed with the American Institute of Physics to create *Inside Science News Service*, a new resource for journalists that will make it easier for them to uncover, understand, and explain important science that adds depth to news stories. *Inside Science News Service* offers resources and fingertip access to thousands of experts in all fields of science, free-of-charge. Randy Atkins, the APS Senior Media Relations Coordinator, asks for members help in getting coverage in the popular press by alerting him of new and noteworthy scientific advances. Randy can be reached at 301-209-3238 or via email at media@aps.org.

Here are a few examples of recent science stories *Inside Science News Service* helped place in the media –

- **Statistics and the Perfect game** at the top of Tony Kornheiser's nationally syndicated ESPN radio show. After NY Yankee pitcher David Cone pitched a perfect game this summer, he off-handedly said: "You probably have a better chance of winning the lottery than this happening." We released a tongue-in-cheek explanation of why he was way off (with all due respect, he had a much better chance of pitching a perfect game).
- **US Physics Olympiad Team's excellent third-place finish** in the worldwide competition was placed in the following newspapers: *USA Today, Dallas Morning News, The Denver Post, Denver Rocky Mountain News*, and *The Record-Journal* (Hartford, CT). [See IN BRIEF, page 3]
- **Why power outages occur during heat waves** explanation with APS member quotes was used in a *Chicago Tribune* article.
- **Matter and string theory** supplement to appear with ABCNews.com: *A Nightline in Primetime: A Brave New World*.
- **Communications-based theory about epilepsy** that may lead to treatments will appear in *The Economist, Reuters Health, the Associated Press* and, possibly, *USA Today*.

Playground Physics

- **Fun things parents can do with children to teach science over the summer** on ABC's *Good Morning America*. ABC News.com linked to the APS webpage *Playground Physics* [www.aps.org/playground.html]

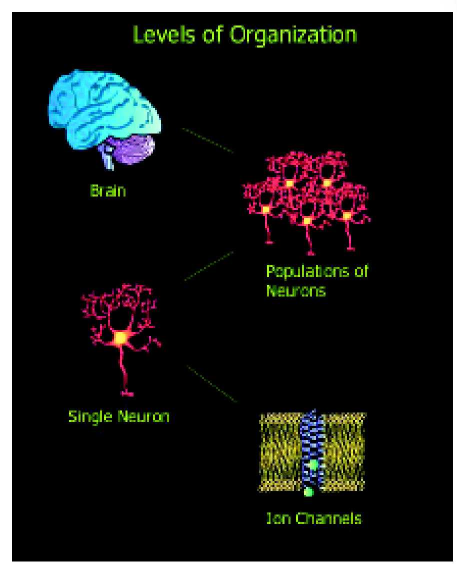


Photo from http://www.aip.org/physnews/graphics/html/epilepsy.html

Figure at left: The brain as a whole can be scanned non-invasively with magnetic resonance scanning or with detectors sensitive to magnetic fields arising from electro-chemical signals. At the next organizational level, surface and depth electrodes have been used to monitor the electrical activity of a group or population of neurons. Microelectrodes can also be used to monitor the activity of a single neuron. At yet another smaller scale, patch-clamp techniques are used to measure the electrical current of a single ion channel.

Inside...

Fermilab Grad Students Hold Conference

Fermilab New Perspectives Conference attendees.

Physics graduate students at Fermilab had the opportunity in July to participate in the 1999 New Perspectives conference held at the facility, organized by the laboratory's Graduate Student Association (GSA) and endorsed by the APS and the Division of Particles and Fields (DPF). Conference topics covered all physics subjects of interest to the laboratory, including QCD, electroweak physics, heavy flavor, CP violation, particle astrophysics, detector developments and accelerator technology, among others.

Fermilab's GSA was formed in 1994 and is intended to provide a common association among grad students in all the laboratory's experiments and divisions. To this end, the GSA organizes and conducts activities deemed beneficial to graduate student life, among them the annual *New Perspectives Conference Series*. "The New Perspectives conference is an opportunity for graduate and undergraduate students at Fermilab to present their work to the entire lab

Continued on page 3

APS Intern Learns the Ropes on the Hill

Attending Congressional hearings on federal funding priorities for science was a new experience for physics graduate student Helene Grossman, who spent this past summer as an intern in the APS Office of Public Affairs (OPA) in Washington, DC. And, she says, that was the point. In addition to simply being "a lot of fun," having the chance to interact with Congressional offices and learn the basics of public policy has given her a broader perspective about her future career options.

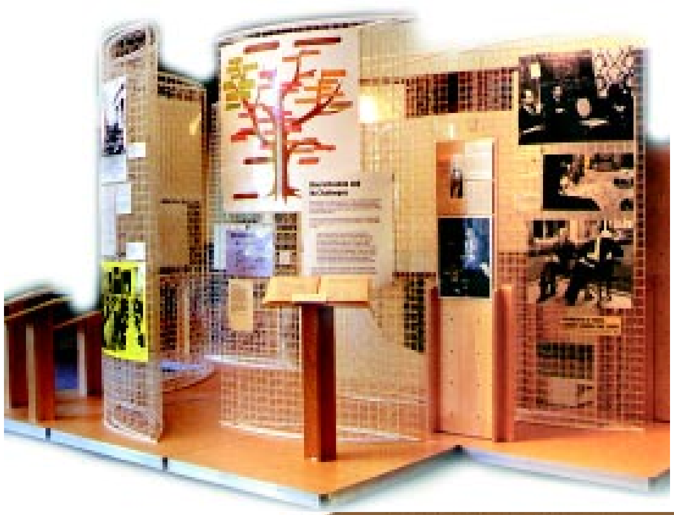
Grossman grew up in Waltham, MA, graduating from Yale University in 1996 with a BS in physics. She is presently pursuing graduate studies at the University of California, Berkeley, under the purview of Dr. John Clarke, having completed her MA in physics in 1998. Clarke, a pioneer of superconducting quantum interference device (SQUID) technology, most recently the developed a scanning SQUID microscope capable of imaging room temperature samples from as near as 15 microns. Grossman current project involves the study of bacteria tagged with magnetic nanoparticles and employing a SQUID detection system. She was an invited speaker at the APS Ohio Section meeting in May, which highlighted not only scanning probe technology, but also women in physics. It was there that she met APS Associate Executive Officer, Barrett Ripin, who encouraged her to apply for an internship with the APS.

To supplement her studies, Grossman has actively sought out a variety of summer jobs and internships, of which the OPA internship is the most recent. "Basically I reached that middle point of graduate school where you do a lot of introspection about what you want to do for a career," she says. "I felt that, before I embarked on three more years of graduate work, I should get a better idea of where I was going and learn about some different career paths that might be available after getting my PhD," she says.

Helene Grossman

Her responsibilities at the OPA included compiling and organizing the multitude of data related to the APS Congressional Visits program, but Grossman also had the opportunity to attend several Congressional hearings on pending legislation, reporting her findings to the OPA staff. "It helps us to tailor our lobbying efforts," she explains. Key issues this summer included federal funding for science in the proposed FY2000 budget, and the restructuring of the nuclear weapons

Continued on page 5

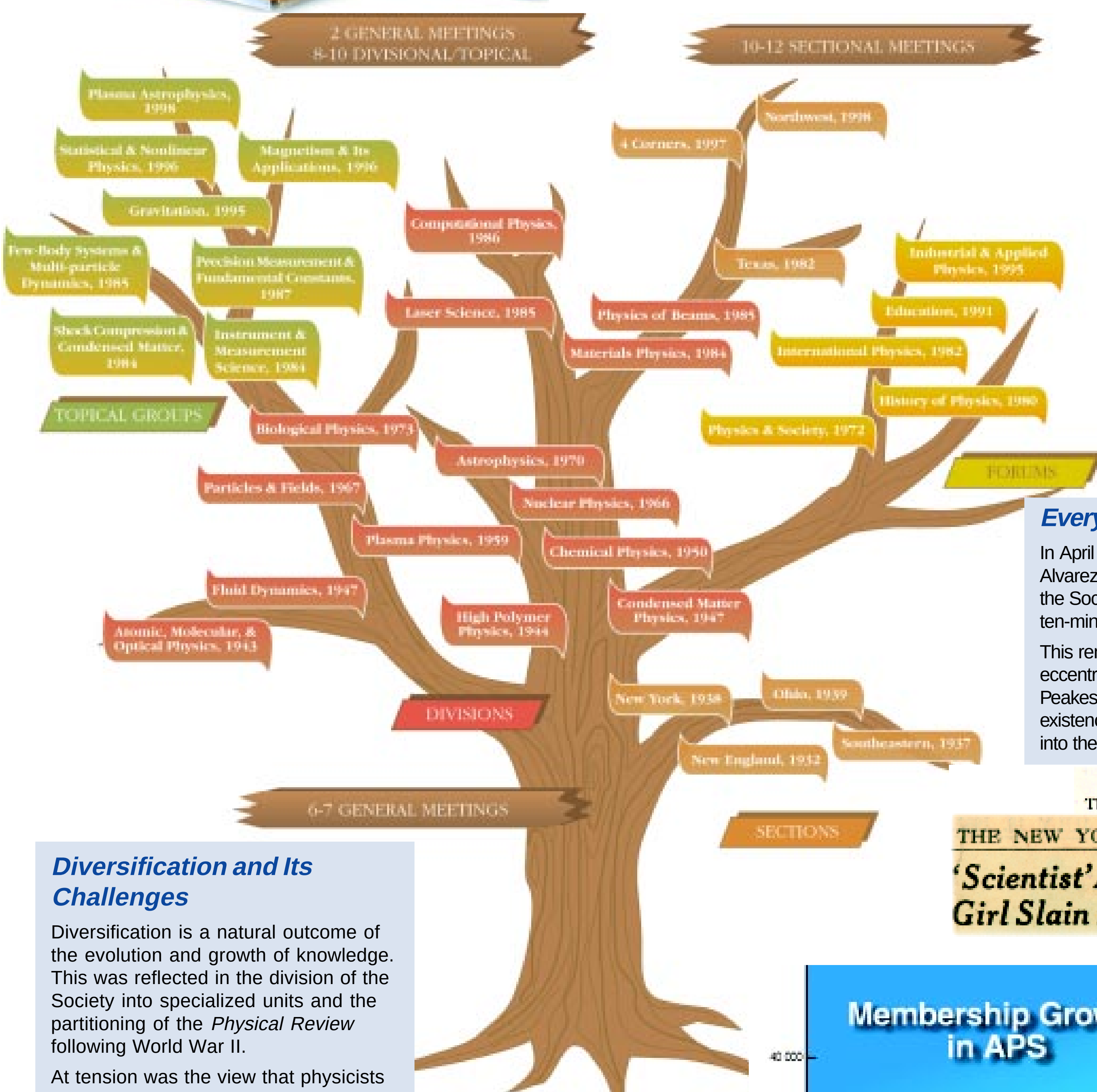


To Advance & Diffuse the Knowledge of Physics

100 Years of the American Physical Society

Excerpts from an exhibit displayed at the APS Centennial Meeting.

Curator: Sara Schechner, *Gnomon Research*
Exhibit Director: Barrett Ripin
With contributions by Harry Lustig, R. Mark Wilson, and others.



Growth

The mid-years of the century were a time of rapid growth for APS and its publications.

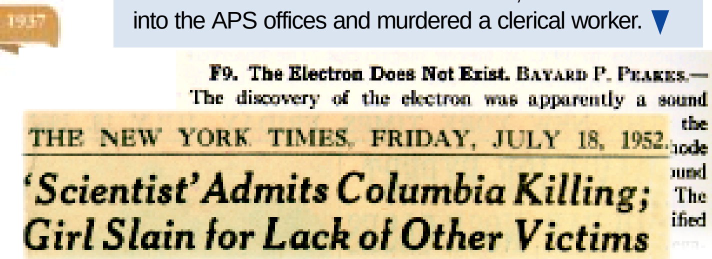
The Society's membership grew by a factor of 10, in part due to the expansion of physics research during and after World War II. With growth came specialization and the advent of divisional groups and specialized meetings.

More physicists meant more research to be published. The *Physical Review* grew rapidly in size, quality, and prestige.

Every Voice Heard

In April 1952, APS Council—on a motion of Luis Alvarez—proclaimed that henceforth every member of the Society would have the right to submit abstracts of ten-minute papers which would not be refused.

This remarkable act was prompted by the review of eccentric abstracts from a psychopathic member, Bayard Peakes who had submitted a paper denying the existence of the electron. Still frustrated, Peakes stormed into the APS offices and murdered a clerical worker. ▼


F9. The Electron Does Not Exist. BAYARD P. PEAKES.—The discovery of the electron was apparently a sound ... the ...node ...ound ... The ...ified

THE NEW YORK TIMES, FRIDAY, JULY 18, 1952.

'Scientist' Admits Columbia Killing; Girl Slain for Lack of Other Victims

Diversification and Its Challenges

Diversification is a natural outcome of the evolution and growth of knowledge. This was reflected in the division of the Society into specialized units and the partitioning of the *Physical Review* following World War II.

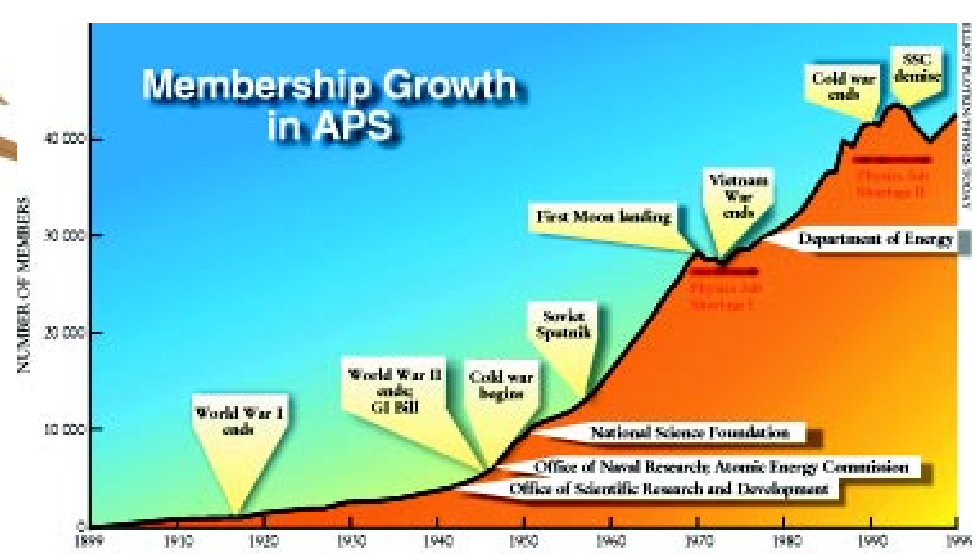
At tension was the view that physicists ought to be generalists. As Eugene Wigner told J. H. Van Vleck in 1945, "The charm of physics consists for me, and I am sure for most of our colleagues, is the fact that it comprises all the phenomena of the non-living world and that a Society which has abandoned general interest in all this is not a physical society any more."

Today, plenary sessions at meetings, and journals such as *Physical Review Focus,* are efforts to counteract centrifugal tendencies.

Competition for Resources

Plans for the Superconducting Super Collider opened deep fissures within the physics community in the 1980s and 1990s, pitting "big science" against "small science."

APS learned that the health of science depends on raising support for all active areas of basic and applied physics.



Next Month: Growth of the Journals and the Birth of RMP & PRL

APS News

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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.

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Fermilab Student Conference, *continued from Page 1*

community," says Maria Spiropulu, a current Fermilab grad student and GSA representative who organized this year's scientific program. This year featured the first George Michael Memorial Poster Award, with new lab director Michael Witherell bestowing a sum of $500 on the three best posters presented in the NP poster session.

Students responded with enthusiasm to the keynote address by J.D. Jackson, who expressed concern about the increasing specialization of physics and its impact on the unity of the field. "I see the physicist as generalist becoming the physicist as specialist, which in my view is a bad thing," he said, decrying the fact that physics has grown so rapidly in the last 50 years that many schools "skimp on the bread and butter to get to the sexy stuff at the frontier."

Jackson peppered his lecture with several dynamic demonstrations to illustrate dimensional analysis, including the "falling honey" demo to derive the frequency of the layout of the coils using dimensional analysis. He also demonstrated how to calculate the energy of a nuclear explosion using dimensional analysis, as well as using pieces of wood floating at different angles to demonstrate the principle of symmetry breaking. "We had a lot of fun, and needless to say, the room was packed," said Spiropulu.

The program also featured lectures by senior faculty at Fermilab and surrounding institutions, among them Hugh Montgomery, who summarized current physics being done at the Main Injector.

Fermilab theorist Joe Lykken closed the meeting by attacking the notion that "particle physics is almost done." He decried the naysayers who argue that string theory is the one True Theory of Everything, or that the Standard Model will reign forever. "There is no reason to imagine that we are near the end of this process, barring the collapse of our civilization."

IN BRIEF

Meserve Nominated as Chair of the Nuclear Regulatory Commission

In August, President Clinton nominated Richard Meserve, a partner at the law firm of Covington & Burling in Washington, DC, and long-term APS legal counsel, to serve as a member and chairman of the Nuclear Regulatory Commission (NRC).

The NRC is a bipartisan, independent regulatory commission with responsibility to ensure adequate protection of public health and safety, common defense and security, and the environment with respect to the use of nuclear materials for civilian purposes in the US Meserve earned a PhD in applied physics from Stanford University and his law degree from Harvard Law School. He served as law clerk to Justice Harry A. Blackmun of the US Supreme Court in the early part of his career.

His practice over the years has focused on legal issues involving substantial technical content, including environmental and toxic tort litigation, nuclear licensing, and the counseling of scientific societies such as the APS and the American Institute of Physics. Among his many services, he guided the two organizations through the drawn-out litigation with scientific publisher Gordon & Breach, finally won in the US this year. (See *APS N*ews, March 1999) From 1977 to 1981, he served as legal counsel to the President's Science and Technology Advisor. Past committee service has focused on such efforts as examining the cooperative threat reduction program with the former Soviet Union, and declassification of information at the DOE. He currently is a member of DOE's SEAB as well as chair a committee of the National Academy of Sciences seeking to upgrade the protection of nuclear weapons material in Russia.

US Physics Olympiad Team Places Third in World

At the International Physics Olympiad, held in July, the US team had its second-best showing since it started competing in 1986, with three gold medals and two silver medals brought home by the five high school students who participated. In informal rankings, the US placed third out of the 62 countries that competed, after Russia and Iran. Taking place this year in Padua, Italy, where Galileo discovered the four Jupiter moons named after him, the Olympiad contains two days of grueling theoretical and experimental problems amounting to what is the world's most difficult high-school physics test.

For example, the students had to compute the precise trajectory of a space probe that uses Jupiter's gravity as a slingshot—a technique used in real-life spacecraft such as Cassini. US gold medalists included Peter Onyisi (Arlington, VA), who had the tenth highest overall score out of the approximately 300 competitors at the Olympiad, Benjamin Mathews (Dallas, TX), and Andrew Lin (Wallingford, CT). Silver medalists include Jason Oh (Baltimore, MD) and Natalia Toro (Boulder, CO), who earlier this year also became the youngest person (at 14 years of age) ever to win the top prize of the Intel (formerly Westinghouse) Science Talent Search. (See *APS News*, August/September 1999)

More information can be found online at http://www.aip.org/releases/1999/release05.html.

[*Item contributed by Philip F. Schewe, AIP Public Information*.]

FESTIVAL PROFILE

Come Blow Your Horn: Exploring the Physics of Brass Instruments

The day before his scheduled talk at the APS Centennial meeting on the physics of brass instruments, physicist/musician/composer Brian Holmes found himself dashing about downtown Atlanta desperately searching for a trumpet in music and instrument repair shops. The instrument he normally uses for lectures had been sent via trunk two weeks before, but somehow didn't arrive on the appointed day. Fortunately he acquired a suitable replacement in time, and the lecture came off without a hitch.

Having an appropriate instrument is critical to his demonstrations, because Holmes likes to build a trumpet piece by piece, to better explain the acoustical significance of each part: the mouthpiece, a conical leadpipe, a cylindrical section, and a flared bell. This helps emphasize the unique nature of the instrument, which does not simply transmit sound into a room. Instead, most of the sound stays inside the trumpet, forming standing waves that draw energy from the player's lips. Holmes also likes to conclude by performing Beethoven's Sonata in F, Op. 17 for horn and piano on a valveless horn, similar to those used in the composer's time. "In the era before valves, horn players learned to augment their meager supply of open notes by partially or completely blocking the air column with their hands," he explains, a technique that is now obsolete, although modern players still keep one hand on the bell. In fact, there has been a resurgence of interest in authentic period instrumentation, evidenced by the existence of such groups as the Philharmonia Baroque Orchestra and the Baroque Orchestra of Boston.

Holmes' interest in science was evident early on, coinciding with his love of music and proficiency as a horn player. He took courses in both as an undergraduate. But ultimately he decided to major in physics, not just because he wanted to teach, but because "my earliest physics courses taught me how unobservant I was about the universe, and how observant I should have been." But he admits that the decision wasn't easy. "I wasn't brave enough to major in music," he confesses, nor did he have his parents' approval, or any professional musicians to serve as role models. "Somehow I imagined that profess ional horn players were godlike creatures who never missed notes." It wasn't until his graduate studies at Boston University, when he signed up for a subscription to the Boston Symphony, that he realized how many notes professional musicians actually miss in public, and that "I was only a couple of years' practice from that level myself."

Brian Holmes employs various brass instruments to demonstrate the basic physics principles behind them.

By then, of course, he was well on his way to a career as a physicist, earning his PhD in experimental low temperature physics in 1980. Holmes joined the faculty of San Jose State University 14 years ago, and has remained there ever since, carrying on the business of a professor of physics, teaching, and publishing the occasional research article or textbook. But physics hasn't dampened his love for music, or kept him from performing. He still teaches the occasional course in the physics of music, and as a graduate student in Boston, he played at various downtown theaters and occasionally sat in with the Boston Pops and Opera. And he performed regularly on a freelance basis for the San Jose Symphony and San Jose Opera until quite recently, when family obligations began to impinge on his availability for auditions and scheduled performances.

As his ability to perform has waned, composing original music has taken center stage, because "it doesn't depend on how good my lip is feeling that day." Holmes first attempted to write music in the 7th grade, a self-described "fiasco." Nor did he find his musical theory courses in college very inspiring, since the instructor was an advanced academic who believed strongly in atonal music. Holmes wrote the score for the school show instead of signing up for a composition course. "It's only in the last 10 years that I learned not to feel guilty about writing tonal music, and it was a very liberating thought," he says. The healthy number of commissioned works and public performances of his pieces attest to his success in following his musical instincts.

Holmes is particularly interested in exploring the relationship between words and music in his compositions, and hence rarely writes purely instrumental pieces. Occasionally he even manages to work physics into the musical equation: he recently completed a six-song cycle entitled *Updike's Science*, with lyrics drawn from novelist John Updike's comments on science. "There's physics in music and there's music in physics," he says of his increasingly dualistic career. "I've managed to straddle that boundary."

Northwest Section Meeting Addendum

In the article on the first meeting of the APS Northwest Section (*APS News*, July 1999), we inadvertently omitted a fifth invited talk at the special session on education organized by Lillian C. McDermott (University of Washington). In her talk, Paula Heron of the University of Washington focused on the use of research on the learning and teaching of physics as a guide to improving instruction. "There is by now ample evidence that many students emerge from traditional introductory physics courses without having developed a functional understanding of some basic topics," she said, "but it is important to recognize that even innovative instructional approaches can fail to engage students at a sufficiently deep level for real understanding to develop." Heron

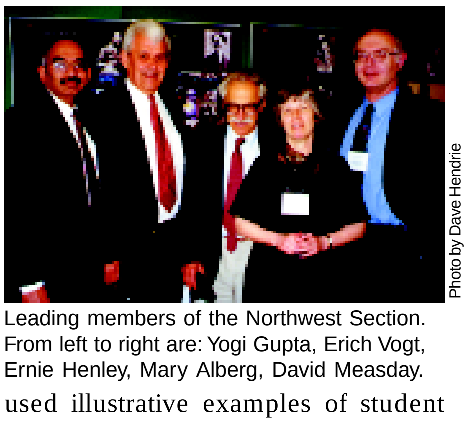

Photo by Dave Hendrie

Leading members of the Northwest Section. From left to right are: Yogi Gupta, Erich Vogt, Ernie Henley, Mary Alberg, David Measday.

used illustrative examples of student difficulties with the equilibrium of rigid bodies in introductory college physics and engineering courses. "There is a need for continued deep and detailed research on student understanding of specific topics to inform the development and assessment of curriculum," she concluded.

OPINION

VIEWPOINT

National Security Concerns Reflect Shortage of American Physicists

by Alan Chodos

Last July, I wrote an article that appeared on the Op-Ed page of the *New York Times* under the headline: *Wanted: American Physicists*. The article was motivated by the recent security crisis at some of our national laboratories, which has been fueled in part by the large number of foreign-born scientists who are employed there or who pass through as visitors. My point was that this reflects the acute shortage of American-born physicists (and other scientists). I further blamed this state of affairs on the systematic underfunding of basic physics research by Congress over the intervening decades, and suggested that matters had gotten even worse in the 1990s after the end of the Cold War.

In the wake of the article, I was exposed to a variety of different opinions. I am grateful for the opportunity afforded by the pages of *APS News* to amplify my own views.

First let me stress that, despite the decline in numbers among American physicists, I am certainly not advocating the practice of any discrimination towards their foreign counterparts. By and large, the foreign students who are being educated in American graduate schools are well qualified and fully deserve to be here. They generally turn into excellent scientists, and many of them choose to remain in this country, thereby contributing to American society either as physicists or in other jobs where their scientific training can be put to good use. Science traditionally has been, and should continue to be, an international enterprise in which the ideas are important and their source is irrelevant. In that spirit, we should welcome qualified students into our graduate programs no matter where they come from.

On the other hand, some of the people I heard from did take what was to me a distressingly rigorous economic view. To them, physics is a commodity, and our supply of physicists coming, increasingly, from abroad is seen as completely analogous to the same situation with regard to athletic shoes or television sets. Opinion among them divides into the free-traders who think global market forces should rule the day (let's get the most physics at the cheapest price) and those who, detecting a sinister plot among government, industry and universities to keep down the cost of physics research by fomenting a glut of foreign physicists, call for a protectionist remedy.

My guess is that most Americans would perceive more forces at work than just the competition between them and foreigners for the same physics jobs. For one thing, there are many other avenues that a technologically oriented American undergraduate can pursue. The expanding world of computers, the Internet and the Web offer more and better paying jobs than the world of academic physics. Hardly any of the sons and daughters of my colleagues are becoming basic scientists, but many of them are going into the computer industry or to Wall Street. These choices are generally not available to students who come from abroad directly after their undergraduate years.

In addition, there are less tangible factors that influence the career choices of American undergraduates. My memory of the 1960s is not perfect, but I retain a sense that those of us who went into basic science did so with the expectation that our work would be valued by the nation as a whole. This was partly due to the space race with the Soviet Union, partly to the general ambience of the cold war, and partly, perhaps, to a starry-eyed idealism that was a legacy of the rhetoric of Camelot.

There were also the heroes of the recent past, still alive or not long dead, principally Einstein, but others too like Bohr, Heisenberg, Lee and Yang, Oppenheimer—great scientists who had done great things, and who inspired us to try for greatness ourselves. One wonders whether there are analogous figures today who might have a similar ability to kindle the imagination of potential young scientists and seduce them away from their preordained career paths in the commercial world.

There can be no doubt that the decrease in the population of American-born physicists is a genuine effect. The question remains, however: do we have a real problem here? Or should we just let nature take its course and watch as the American physicist heads for extinction?

Certainly this effect creates a difficulty for those of our national laboratories that deal with classified information, as amply illustrated by the uproar over the possible spying incident at Los Alamos. But perhaps these labs can tighten their security procedures and be extra careful whom they hire—these are the kinds of remedies that Congress is proposing. Are there any other reasons to worry?

I think there are other security issues involved, beyond the safeguarding of nuclear secrets. One simply has the feeling that an adequately trained supply of American physicists is a good investment, perhaps even a crucial one, in the event of unexpected challenges to our national security. These could be threats from other nations, new scientific discoveries environmental problems, or even all those irresponsible asteroids speeding through the solar system.

One would expect universities to be relatively free of any bias having to do with the national origin of their students and faculty, and to a large extent it is true. But even here, one detects among the members of graduate admissions committees an uneasiness that is directly proportional to the fraction of foreign students being admitted. The abundance of foreign students is not the problem, but rather the absence of Americans.

But of course the ability to change this situation rests very little with professors in universities, or even with teachers of physics in high school and junior high. There has to be a renewal of the idea that the goals that drive basic research are important to the nation as a whole.

Partly this can be achieved by an increase in funding. The continual decline of funds for basic research since the 1960s has had a demoralizing effect on research, which has been exacerbated by occasional dramatic events, like the termination of the Supercollider project in 1993. One cannot credibly improve the attractiveness of doing basic research without a substantial reversal of the decades-long record of indifference and neglect.

But there is a spiritual side to this issue as well, and therein lies my biggest concern. As a discipline, physics is dedicated to asking fundamental questions about how the world works and how the universe has evolved. A nation that has lost interest in these questions, or that is willing to delegate that interest to scientists recruited from abroad, is in danger of degenerating into a state of meaningless self-absorption. One hopes it is not too late to summon the collective will to renew our commitment to basic science, and thereby to help restore the sense of national spirit and purpose that will keep us strong and prepared as we embark on the challenges of the new millennium.

Alan Chodos is a senior research physicist at Yale University and Chair of the APS Publication Oversight Committee.

LETTERS

Happer Contributions to MRI Imaging Overlooked

The article on MRI rare gas imaging [*APS News*, July 1999] overlooks the contributions of William Happer of Yale University. I would like to add some background.

By concentrating on optical pumping processes while atomic physicists rushed into laser spectroscopy in the early 1970s, Happer paddled into what many regarded as a backwater of atomic physics. However, from his studies of relaxation and polarization transfer emerged a new understanding of atomic collision processes, and also powerful techniques for polarizing rare gases that were of value in nuclear physics. What was totally unexpected was the application of this new knowledge to MRI. It was through Happer's imagination and persistence that rare gas MRI imaging was conceived and developed into a useful medical tool. He pioneered its clinical medical applications and the company mentioned in the last paragraph was founded by him. Rare gas MRI imaging offers a paradigm of basic research, illustrating why good scientists pursue their own stars, and why the government should support them.

Daniel Kleppner, *Massachusetts Institute of Technology*

Getting Physical

I liked the small box "What's in a Name?" in the July issue pointing out the sometimes misunderstood significance of "Physical" in American Physical Society, *Physical Review*, and *Physical Review Letters*. It reminded me of a colleague (to remain nameless) who addressed his latest scientific contribution to "The Physical Revue" — that is until his mother, noticing the envelope waiting for the mail, asked if that was really the journal to which he was sending his communication?

Michael E. Fisher

Institute for Physical Science and Technology, University of Maryland, College Park

Readers Question "What is Science?"

The rules of scientific exchange that you list in the June issue of *APS News* are not applicable to those working in cosmology and on question of origins. Replication is not something that we can do with unique events. I believe that you ought to use "physical universe" rather than "world" in your definition of science. Experimental data can be gathered entirely by means of mechanical devices. However, the whole of reality may encompass more than the physical. For instance, man is a "detector" of the spiritual. Science is amoral. Its use determines whether "science extends and enriches our lives." The latter requires human moral/ethical decisions that lie outside of the purview of science.

Moorad Alexanian, *University of North Carolina at Wilmington*

I would like to call attention to a flaw in the definition of science as adopted by POPA, as an activity that requires "condensing the knowledge into testable laws and theories." This sounds much like the definition of physics high school teachers love to use with beginning students, and is intrinsically myopic. Were that criterion applied, most of what we sincerely believe constitutes the practice of science would be disqualified. Let us not fall into the trap of proposing a silly statement because it is brief and sounds significant.

S.H. Bauer, *Cornell University*

I think the publicization of an agreed definition of science will help to combat "the growing influence of pseudoscientific claims," and that this is a worthwhile objective.

David T. Read, *National Institute of Standards and Technology*

Although the proposed APS statement on "What is Science?" mentions the importance of testing theories in the scientific process, it does not elaborate on the nature of those tests, which needs to be understood. As scientists, many of us regard the ability to explain what has already been observed as an insufficient test of scientific understanding. We need to emphasize the role of experimentally verifiable predictions with quantified levels of ambiguity in our work. By itself, prediction is not a sufficient indicator of true understanding, although it is a necessary indicator. Personally, I would maintain that anything which otherwise has the appearance of science, but which lacks this element of testable prediction, should not be called science. It might be demagoguery, or it might be social science. It might even be one of those discussions about the wave function of the universe which occasionally appear in the *Physical Review*. But it is not really modern science. I urge POPA to consider rewording the proposed statement to reflect the importance of experimentally verifiable predictions when carrying out scientific inquiry.

Leo Bellantoni, *Fermi National Accelerator Laboratory*

A Nobel Mistake

Several alert *APS News* readers rightly chastised us for the typographical error in the headline on page 5 of the July 1999 issue, referring to spin-polarized "Nobel" gases. Naturally, it should have read "noble" even though helium has certainly led to several Nobel prizes.

—Editor

Dyson's Skepticism Well-Founded

Brad Marston's reaction to Freeman Dyson's article is to label it misleading and ill-informed. However, Marston makes several misleading claims of his own. First, the deconvolution of borehole temperatures tells us only that temperature has increased worldwide during the past century—something that we know already from air temperature records. Several research groups have suggested that borehole temperatures show stable surface temperature prior to this recent increase. Yet I found a counter example that in typical circumstances borehole temperatures cannot resolve the Little Ice Age or the Late Middle Ages Optimum. If borehole temperature cannot resolve an event as significant as the Little Ice Age, then it has little to say one way or the other regarding the stability of past climate. In fact, borehole temperatures in glaciers, which, for technical reasons have better resolving power than other borehole measurements, do show wide variation of temperature over the past 10,000 years. Second, while the history of carbon dioxide concentration in our atmosphere is available

Continued on page 5

Researchers Find New Ways to Model Plate Tectonics, Soil Erosion

Thanks to a tub of molten wax, Cornell University's Eberhard Bodenschatz is able to witness 100 million years of tectonic evolution on the ocean floor — the creation of transform faults, rift valleys and spiral structures called "microplates" —in the course of a single hour. Bodenschatz believes the dynamics of the Earth's crust tell a large portion of the history of this planet, and his wax-tectonics modeling experiments shave away millions of years of field research by simulating portions of Earth's drama in the laboratory. Meanwhile, Daniel Rothman, a geophysicist at MIT, is combining physical reasoning, the analysis of digital elevation maps and computer simulation to predict and describe the mechanics of water-driven landscape erosion. Both researchers reported the latest results of their respective experiments at the APS Centennial meeting in Atlanta.

"Except for the occasional earthquake or volcano eruption, we typically witness few large scale changes in the Earth's crust; the earth's time scale dwarfs the life span of a human being millions of times over," says Bodenschatz. "But undeniably, the earth moves, shaping the land masses upon which we live. There is no reason to expect that in another hundred million years, the North American plate won't be oriented in a direction opposite to its current configuration." Unfortunately, he adds, "Humans lack the time to witness the full extent of this fascinating creation/demolition derby."

Clearly, an experimental system that allows the study of the dynamics of rift formation processes and its dependence on the material parameters of the solidifying crust was badly needed. Following some initial work in the mid 1970's, Bodenschatz and his collaborators developed a technique in which molten wax is frozen at the surface by a flow of cold air. The experimental apparatus is heated from below so that the wax melts and cools from above to create a crust, which represents the Earth's cold, hard lithosphere, while the molten wax below represents its plastic upper mantle. The solid layer is then pulled apart with constant velocity and the formation of the rift between the two solid plates is studied. While peering into the wax tank, one can observe and characterize the many phenomenon occurring on the planet. These in turn can be measured and analyzed to determine the factors contributing to their behavior. Most remarkably, says Bodenschatz, "These phenomena seem to scale to the Earth. That wax spreading patterns should form and be similar to the Earth is fascinating, and leads to deeper questions of dynamics in general."

For example, Bodenschatz found that at very slow spreading rates, the rift remains straight with a deep valley. At fast rates, the pattern is dominated by transform faults and fracture zones. But medium rates were, where Bodenschatz observed the most interesting phenomenon. Microplates, tiny chunks of solid wax that appear at the rift and begin rolling upwards much like a rolling snowball gathering snow, grow with constant velocity in the direction of the rift resulting in a spiral shape. Bodenschatz theorizes that microplates form in a similar fashion on the ocean floor.

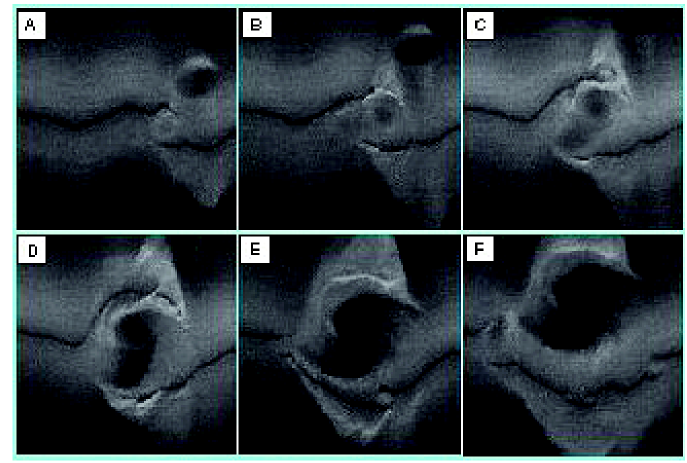

Image from http://milou.msc.cornell.edu/lay_wax.html

The evolution of wax-microplates is observed from above. A picture is taken every 15 seconds, each image size is 3.0mm across, and the pulling speed is 35 microns/sec. The dark line is the rift. An offsetted spreading center is formed in image (A). As time progresses (A to D), a microplate is formed and rotates counter clockwise and increases in size. In image E the microplate breaks off and is frozen into the newly formed crust (D). The spiral shape can be explained by a model that works both for wax and Earth.

Rothman's goal at MIT is to explain why a landscape exhibits its particular features, and why so many — whether it be the underwater continental slope off the coast of Oregon or the Amazon river basin — exhibit similar features. "Based on simple assumptions concerning the tendency of running water to run in the same direction, our model challenges existing theories of landscape evolution that assumes landscapes evolve to a form that minimizes the rate of energy dissipation," he says. On a more practical level, Rothman's work may make it easier for analysts to find oil, predict floods, or determine whether the topological features on the surface of Mars were sculpted by running water. "From the air, riverbed erosion might look like limbs branching off a tree trunk, crystals forming on an icy windowpane, or a nerve cell's axions," says Rothman, and he hopes to make mathematical sense of the dendritic patterns of the river's branches.

NRC Invites Member Input for Survey

The National Research Council is seeking the input of the physics community for a survey it is conducting under the auspices of its Board on Physics and Astronomy. The present survey is intended to provide a broad overview of the field of physics, as a complement to the volumes published thus far in the series, covering atomic, molecular and optical science; cosmology; plasma science; elementary particle physics; nuclear physics; condensed matter and materials physics; and gravitational physics.

Comments should be directed to bpa@nas.edu. The Overview Committee is particularly interested in such issues as the support of research in universities and laboratories, international trends in physics, and science education and training, as well as the impact of physics on biomedical sciences, environmental science, the economy, information science, and national security. More information about the project can be found online at: http://www.nas.edu/bpa/projects/physicssurvey/overview.

Letters, *continued from page 4*

through sampling in glacier boreholes, it is not easy to make estimates (simple or otherwise) of the carbon dioxide forcing function. There is dispute over whether changes in carbon dioxide concentration lead or lag the temperature variations, making even the assignment of cause and effect uncertain. Freeman Dyson's skepticism is hardly misplaced.

Kevin T. Kilty, *Washington State University*

Brad Marston's criticism of Freeman Dyson's article is off base. The crucial question certainly is whether greenhouse theory is quantitatively correct, *i.e.*, whether climate models can reproduce the observations. So far at least, they have not only failed to do that, but they differ among themselves by several hundred percent in their predictions. The major failings have to do with the modeling of clouds and aerosols, whose optical properties determine the radiative forcing along with that of greenhouse gases, but whose distribution in time and space is highly variable. None of the climate models encompass properly the most important of atmospheric greenhouse gases, water vapor, whose vertical distribution determines whether water vapor exercises a positive or negative feedback on warming. Until climate models are reasonably well validated, one cannot accept their predictions, nor base far-reaching and costly policies on such predictions. Respected economists have revisited the UN's climate report and now find that CO^2 increases and warming produce substantial economic benefits. Under the circumstances, one can only recommend policies like avoiding waste, cost-effective investments in energy conservation, and similar measures that make economic sense.

S. Fred Singer, president, *Science & Environment Policy Project, Fairfax, Virginia*

Sober Message

I am writing to you in frustration about the social message sent in the July 1999 issue of *APS News*. I am upset by the continuing college fraternity mentality of the physics community as represented by devoting half a page to an astronomer's drinking song ... and much of the rest of the page to articles about beer. The article *Foam: Food for Thought* might be appropriate, but the rest is, at best, in very poor taste. "Drinking" and "drinking songs" are clearly not about having a glass of wine with dinner. Drinking is a wide-spread problem on college campuses (the death of an MIT student at a fraternity beer party last year is an example of the worst possible consequence) and in professional communities and should not be the subject of jokes in the publication of a professional society.

Margaret Geller, *Harvard-Smithsonian Center for Astrophysics*

Remembering a Friend of Science

US Representative George E. Brown, Jr. (D-CA) died in July from an infection developed following heart valve replacement surgery in May, in the midst of his 18th term as California's longest-serving congressman. The ranking Minority Member of the House Science Committee, Brown was widely recognized as a strong advocate for federal R&D funding, as well as a champion of civil rights and the environment.

An industrial physicist by training — he earned a BS in industrial physics from the University of California, Los Angeles, in the late 1940s — Brown entered public service as a Monterey Park city councilman in 1954, 15 years after he helped integrate student housing at UCLA by taking a black student as his roommate. He was first elected to the US House of Representatives in 1962, representing Monterey Park, but gave up his seat after eight years to run (unsuccessfully) for the US Senate. He returned to the House in 1972, serving San Bernardino and surrounding communities, and remained in that position until his death.

During his years in Congress, Brown helped establish the Office of Science and Technology Policy and the now-defunct Office of Technology Assessment. He advocated peaceful space exploration and international scientific collaboration, and opposed earmarking of federal science funds, a practice known colloquially as "pork-barrel funding."

George E. Brown

He was also an outspoken critic of the Vietnam War in an era when it was politically unpopular to be so. Because of his science background, he became a fixture on the House Science Committee, twice serving as chairman.

One of Brown's major initiatives was a study of the health of the US research enterprise, and he was one of the first politicians to recognize and articulate the current prevailing national science policy: namely, that the path from scientific discovery to technological innovation to commercial product is complex and nonlinear and national policy should reflect this nature. "Always genial, he nevertheless fought tenaciously for civil rights, the environment and science," APS Director of Public Affairs Robert Park wrote of Brown's passing in the July 16 *What's New*. "With his passing , the world is darker."

APS Intern, *continued from page 1*

complex, resulting from security concerns earlier this year. Her research of specific issues included interviewing psychologists, FBI agents and other specialists about the reliability of the polygraph, in the wake of a Department of Energy proposal to require 5000 scientists engaged in defense-related research at the national weapons labs to submit to polygraph testing. She also contributed to "What's New," the frequently irreverent weekly electronic newsletter on public policy penned by APS Director of Public Affairs, Robert Park.

Grossman spent two previous summers as a research assistant at Yale, studying the use of magnetic mirrors to bounce ultra-cold atoms, which led to co-authorship of a paper in *Physical Review Letters*, as well as optical properties of highly distorted micro-cavities. In 1995, she spent the summer at the Weizmann Institute of Science in Israel, working with a young professor in the Department of Complex Systems on computer simulations of atoms propagating through an atomic lens. "It gave me the opportunity to see science at work in another country," she says, as well as refining her knowledge of computer simulations. And in 1997 she spent the summer as a research assistant at Lucent Technologies working on scanning capacitance microscopy, as part of the requirements of a grant she received from the company's *Graduate Research Program for Women* fellowship program.

DNP Meeting Features Second Annual Outreach Program for Undergrads

For the second year running, the fall meeting of the APS Division of Nuclear Physics (DNP) — to be held later this month in Asilomar California — will feature a special program of events designed specifically for undergraduates. The Conference Experience for Undergraduates (CEU) program is sponsored by the NSF and several DOE laboratories, including Los Alamos National Laboratory, Lawrence Berkeley National Laboratory, Argonne National Laboratory, and Oak Ridge National Laboratory. Its purpose is to provide a "capstone" conference experience for undergraduates who have conducted research in nuclear physics, by providing them with the opportunity to present their research to the larger professional community and to one another. CEU also enables the students to converse with faculty and senior scientists from graduate institutions about graduate school opportunities.

The program is the brainchild of Warren Rogers, associate professor of physics at Westmont College. An active DNP member, he noted the lack of undergraduates at DNP meetings and decided to do something about it: he wrote a grant proposal to the NSF outlining the project, and received enthusiastic approval. Qualified students for the CEU program are those with former participation in experimental or theoretical nuclear physics research. Travel and lodging awards are presented to the top qualifying applicants, based on their submission of a research abstract and brief summary of the student's individual contribution to a larger group effort. But thanks to donations from the national laboratories and individual schools, all 60 of last year's applicants were able to attend, and Rogers is confident that all 61 of this year's applicants will be able to attend as well.

The week's CEU-related events will kick off with a welcoming reception on Wednesday evening to allow the undergraduates to meet members of the DNP, followed by a keynote address by one of the luminaries in nuclear physics, outlining the current status of the field. This will be followed by a general DNP reception, and an hour-long undergraduate poster session, during which students will be able to share their research with the professional nuclear physicists in attendance. A special CEU seminar will be held Thursday afternoon, covering a more specific topic in nuclear physics.

On Friday, the students will attend a special luncheon, during which representatives from various graduate schools will present information about their respective programs, followed by a tour of the Monterey Bay aquarium. "Half of the reason for doing this is to create these sorts of ties," says Rogers. "There's a general lack of students going into these graduate programs, and this helps foster a pipeline." Students are also encouraged to participate in the regularly scheduled meeting events, particularly the plenary lectures.

Rogers is optimistic that student reactions to this year's event will match the enthusiastic response of those who participated last year. "They really enjoyed meeting each other and comparing their research experiences," he said. "I think many found it very inspiring to learn of the research being done by their peers around the country."

Shocking Snowbird Meeting Explores Materials at High Pressures

Researchers keen on hearing the latest advances in shock compression science flocked to the 11th biennial International Conference of the APS Topical Group on Shock Compression of Condensed Matter (SCCM), held June 27 through July 2 in Snowbird, Utah, a year-round resort located in the Wasatch mountains, about 30 miles from Salt Lake City.

The meeting kicked off with two special keynote sessions on Monday morning focusing on issues related to the U.S. Department of Energy. DOE Deputy Assistant Secretary, Gilbert Weingard, summarized current progress on the Accelerated Simulation Initiative (ASCI), a mission-based program that seeks to enable the use of computer simulation to move from a test-based to a science-based assessment of the nuclear weapons stockpile. "Such simulations are extremely complex and will require computers that are orders of magnitude more powerful than the largest systems in place today," he said, adding that software environments must also be expanded in order to use such large systems effectively. Later that morning, Hans Mark, director of the DOE's Defense Research and Engineering division, outlined the financial outlook and potential results of defense technology R&D.

The technical focus of this year's SCCM meeting was the physics of materials at elevated pressure or stress. Tuesday morning featured a lecture by this year's recipient of the Shock Compression Award, Lynn Barker, of Valyn International. He discussed the development of the VISAR technique in 1972, which first made laser interferometry applicable to a wide range of shock experiments, such as a plate impact study of phase transitions in iron. Since then several subsequent improvements have been made to the device, most recently Valyn International's "multi-beam" VISAR, capable of measuring several points on a specimen simultaneously. He was followed by a plenary address on bridging length scales in dynamic plasticity simulations by Rodney Clifton of Brown University, who reviewed recent computer simulation methodology ranging from atomistic to macroscopic scales.

On Wednesday morning, Mel Baer, of Sandia National Laboratories, described new three-dimensional simulations of shock impact on a realistic ensemble of crystalline grains, which demonstrated that rapid material distortion occurs at crystal boundaries. Such advanced simulations are now possible because of the vastly improved new parallel computing machines able to provide improved resolution of shock processes at the mesoscale. In a third plenary session later that morning, Brad Holian, of Los Alamos National Laboratories, discussed recent advances in simulations of shock waves and related phenomena, including plastic deformation, high-speed interfacial sliding, and fragmentation. "As experimental observations become more and more refined, and molecular dynamics simulations become larger, even approaching the mesoscale, fruitful overlap is achievable in the near future," he concluded.

The topical group also organized several special events to balance out the technical aspects of the program. Tuesday afternoon featured an outdoor picnic on the deck of the Snowbird Center, complete with a complimentary ride on the 125-passenger tramcars to the top of the 11,000-foot mountain. On Wednesday, participants were given the option of choosing between two tours. The first began at Bear Hollow, Utah's state-of-the-art winter sports park and one of the venues for the 2002 Winter Olympics, and proceeded on to the Deer Valley Resort and Park City's Historic Main Street, a former mining town that now houses specialty shops, art and history museums, and restaurants The second tour focused on Salt Lake City's most famous sites, beginning with the Kennecott Copper Mine, from which 5 billion tons of ore have been extracted since operations began in 1905. [The mine is so enormous it is actually visible from space.] The tour then proceeded to the Great Salt Lake, the largest saltwater body of its kind in the world, where participants were given a summary of the lake's history from the Ice Age to the present.

zero gravity

Problem: To Catch a Lion in the Sahara Desert

Hunting lions in Africa was originally published as "A contribution to the mathematical theory of big game hunting" in the *American Mathematical Monthly* in 1938 by "H. Petard, of Princeton, NJ" [actually the late Ralph Boas].

Theoretical Physics Methods

The Dirac method
We assert that wild lions can *ipso facto* not be observed in the Sahara desert. Therefore, if there are any lions at all in the desert, they are tame. We leave catching a tame lion as an exercise to the reader.

The Schroedinger method
At every instant there is a non-zero probability of the lion being in the cage. Sit and wait.

The quantum measurement method
We assume that the sex of the lion is *ab initio* indeterminate. The wave function for the lion is hence a superposition of the gender eigenstate for a lion and that for a lioness. We lay these eigenstates out flat on the ground and orthogonal to each other. Since the (male) lion has a distinctive mane, the measurement of sex can safely be made from a distance, using binoculars. The lion then collapses into one of the eigenstates, which is rolled up and placed inside the cage.

The nuclear physics method
Insert a tame lion into the cage and apply a Majorana exchange operator on it and a wild lion. As a variant let us assume that we would like to catch (for argument's sake) a male lion. We insert a tame female lion into the cage and apply the Heisenberg exchange operator, exchanging spins.

The Newton method
Cage and lion attract each other with the gravitation force. We neglect the friction. This way the lion will arrive sooner or later in the cage.

The special relativistic method
One moves over the desert with light velocity. The relativistic length contraction makes the lion flat as paper. One takes it, rolls it up and puts a rubber band around the lion.

The general relativistic method
All over the desert we distribute lion bait containing large amounts of the companion star of Sirius. After enough of the bait has been eaten, we send a beam of light through the desert. This will curl around the lion so it gets all confused and can be approached without danger.

The Heisenberg method
Position and velocity from a moving lion cannot be measured at the same time. As moving lions have no physical meaningful position in the desert, one cannot catch them. The lion hunt can therefore be limited to resting lions. The catching of a resting, not moving, lion is left as an exercise for the reader.

Experimental Physics Methods

The thermodynamics method
We construct a semi-permeable membrane which lets everything but lions pass through. This we drag across the desert.

The atomic fission method
We irradiate the desert with slow neutrons. The lion becomes radioactive and starts to disintegrate. Once the disintegration process has progressed far enough, the lion will be unable to resist.

The magneto-optical method
We plant a large, lense-shaped field with cat mint (*nepeta cataria*) such that its axis is parallel to the direction of the horizontal component of the earth's magnetic field. We put the cage in one of the field's foci. Throughout the desert we distribute large amounts of magnetized spinach (*spinacia oleracea*) which has, as everybody knows, a high iron content. The spinach is eaten by vegetarian desert inhabitants which in turn are eaten by the lions. Afterwards the lions are oriented parallel to the earth's magnetic field and the resulting lion beam is focused on the cage by the cat mint lense.

AT LAST! ANOTHER CONTEST!

It seems like ages since *APS NEWS* held a contest for its readers. With that in mind, we're soliciting submissions for amusing tales, puzzles, or other tools that teach physics concepts while entertaining the student. [As an example, see "How To Catch a Lion in the Desert" above.] Those who submit the winning entries will receive our usual fabulously silly prizes and have their entry published in *APS News*. Send submissions to the attention of the Editor, *APS News*, One Physics Ellipse, College Park, MD 20740, letters@aps.org. The deadline is any time when we feel we have enough entries to make a selection.

Announcements

OUTSTANDING DOCTORAL THESIS RESEARCH IN ATOMIC, MOLECULAR, OR OPTICAL PHYSICS

Sponsored by members and friends of the Division of Atomic, Molecular and Optical Physics.

Purpose: To recognize doctoral thesis research of outstanding quality and achievement in atomic, molecular, or optical physics and to encourage effective written and oral presentation of research results.

Nature: The award to be given annually consists of $1,000 and a certificate citing the contribution made by the recipient. All finalists will receive a travel stipend of $500.

Rules and Eligibility: Doctoral students at any university in the U.S. or abroad who passed their thesis defense for the PhD in the disciplines of atomic, molecular or optical physics after December 6, 1997 are eligible for the award, except for those whose thesis advisors serve on the current selection committee. Any APS member may submit a nomination for this award.

Deadline: The deadline for submission of nominations is **DECEMBER 6, 1999.**

Send the name of candidate, biographical information and supporting letters to Eric Cornell, JILA, Campus Box 440, Boulder, CO 80309-0440, Phone: (303) 492-4763, Fax: (303) 492-5235, email: cornell@jila.colorado.edu. Also visit: http://www.aps.org/praw/dissdamo/descrip.html for more detail.

AWARD DEADLINE UPDATE

The deadline for submission of nominations for the 2000 NICHOLAS METROPOLIS AWARD FOR OUTSTANDING DOCTORAL THESIS WORK IN COMPUTATIONAL PHYSICS has been extended to NOVEMBER 1, 1999.

Nominations should be sent to the Chair of the Selection Committee: Edmund Bertschinger; Dept of Phys 6-207 / MIT; 77 Massachusetts Ave; Cambridge MA 02139; Phone (617) 253-5083; Email edbert@mit.edu

Discounted Auto Insurance Added to Member Benefits

The APS has entered into an agreement with GEICO, a leading auto insurer, to provide members with a preferred rate. With a current or new GEICO Preferred auto insurance policy, mention your APS membership number (listed on the first line of your *APS News* mailing label) and, in most states, GEICO will give you an extra 8% discount.* The savings will cover the cost of annual APS dues in most cases. In addition to savings, GEICO offers convenient 24-hour service from a professional representative for rate quotes, claims, or questions. When you qualify, you'll get coverage tailored to your personal needs and a choice of payment plans.

All it takes is a quick call to GEICO Preferred at: 1-800-368-2734 or a visit to their web site at: www.geico.com.

**Discount is 10% in CA, DC, and IL; 3% in NY; not available in all states. Discount is not available in GEICO Indemnity Company or GEICO Casualty Company. One group discount applicable per policy. Government Employees Insurance Co. GEICO General Insurance Co. GEICO Indemnity Co. GEICO Casualty Co. These shareholder-owned companies are not affiliated with the U.S. Government. GEICO Auto Insurance is not available in MA , NJ or outside the U.S.*

www.aps.org/apsnews/limericks.html www.aps.org/apsnews/limericks.html www.aps.org/apsnews/limericks.html
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Physics Limericks an Online Hit

The APS Physics Limericks site [www.aps.org/apsnews/limericks.html] is now a featured URL listing in the *Scout Report for Science and Engineering*, a biweekly collection of useful Internet sites for researchers, educators and students in the life sciences, physical sciences and engineering. The limericks were submitted by *APS News* readers from around the globe as part of a limerick contest held two years ago. "Besides showing that physics is fun, most of the physics limericks are focused on a specific concept and would work well in undergraduate physics courses," the annotation reads. Although the contest is long over, users may still submit limericks through an online form, just like Harry Meikle of Warrington, England, who recently submitted the amusing verse below.

After hours of scratching my bonce
I've come up with this simple response:
If our Father sublime
Hadn't invented Time,
Everything would have happened at once!

The *Scout Report for Science and Engineering* is a publication of the NSF-funded Internet Scout Project, based at the University of Wisconsin, Madison. Interested members can browse the selected listings at http://scout.cs.wisc.edu/report/sci-eng/current/index.html.

www.aps.org/apsnews/limericks.html www.aps.org/apsnews/limericks.html www.aps.org/apsnews/limericks.html
www.aps.org/apsnews/limericks.html www.aps.org/apsnews/limericks.html www.aps.org/apsnews/limericks.html

CAUGHT IN THE WEB

Notable information on the APS Web Server.

A Century of Physics timeline: timeline.aps.org
Playground Physics: www.aps.org/playground.html
Phys. Rev. Focus: focus.aps.org
Media Relations: www.aps.org/media
Physics Limericks: www.aps.org/apsnews/limericks.html
Amazon Books: www.aps.org/memb/amazon
100 Years of the APS - Exhibit & History: www.aps.org/apsnews/history.html

Now Appearing in RMP...

The articles in the October 1999 issue of *Reviews of Modern Physics* are listed below. For brief descriptions of each article, consult the RMP web site at <http://www.phys.washington.edu/~rmp/contents.future.html>. George Bertsch, Editor.

Nobel Lecture: Electronic structure of matter — wave functions and density functionals — *W. Kohn*

Nobel Lecture: Quantum chemical models — *John A. Pople*

HERA collider physics. Probing the structure of the proton. — *Halina Abramowicz and Allen C. Caldwell*

Light-meson spectroscopy. Mesons, glueballs, and multiquark excitations. — *Stephen Godfrey and Jim Napolitano*

Electroweak baryogenesis. On the origin of the asymmetry between matter and antimatter. — *Mark Trodden*

Suppression of bremsstrahlung and pair production due to environmental factors — *Spencer Klein*

The spatial behavior of nonclassical light — *Mikhail Kolobov*

Nonlinear optics of normal-mode-coupling semiconductor microcavities — *G. Khitrova, H. M. Gibbs, F. Jahnke, M. Kira, and S. W. Koch*

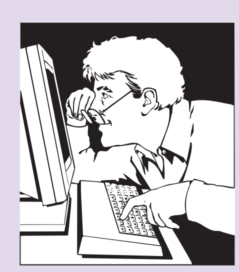
Studying conduction-electron/interface interactions using transverse electron focusing — *V. S. Tsoi, J. Bass, and P. Wyder*

Growth of nanostructures by cluster deposition — *Pablo Jensen*

History of the search for continuous melting (colloquium) — *J. G. Dash*

Molecular chirality and chiral parameters (colloquium) — *A. B. Harris, Randall D. Kamien, and T. C. Lubensky*

MAKE SURE WE HAVE IT RIGHT!

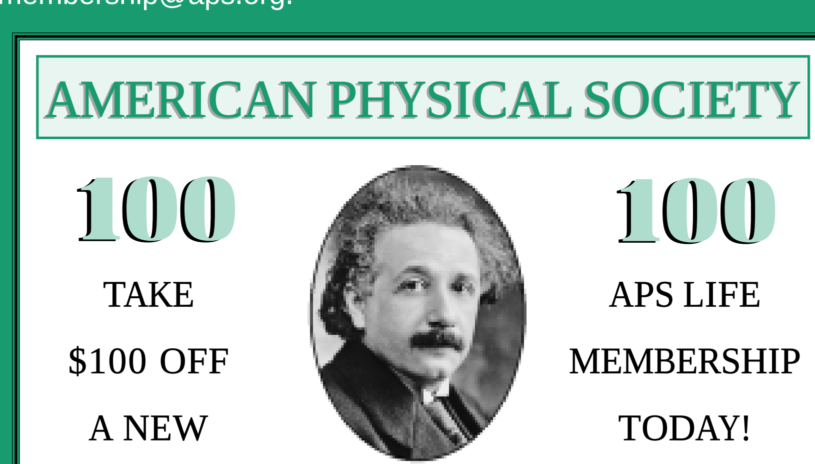


The *2000-2001 APS Member Directory* will be compiled in January 2000. Please check your directory listing online (www.aps.org/memb) or on your latest member invoice and forward any necessary changes to coa@aps.org. Updates may also be given to a Membership Representative at 301-209-3280 or faxed to 301-209-0867. All requests should be received no later than December 17, 1999.

Take $100 Off a New Life APS Membership

In celebration of the Centennial, the APS has initiated a $100 discount off new life memberships between March 1, 1999 and February 29, 2000. A life membership, which ordinarily costs 15 times the regular current annual dues rate, includes a free life membership in one dues-requiring unit.

To take advantage of this special offer, look for details in your next invoice renewal packet. The offer is not valid on an existing or previously purchased Life membership. Questions may be directed to the APS Membership Department at 301-209-3280 or membership@aps.org.



THE BACK PAGE

Views from a Physicist in Congress — *Washington — Where the Facts are Negotiable*

By Rush Holt

Why would a physicist serve in Congress? After spending many years teaching physics at Swarthmore College and many years as a leader at a major physics lab, why would I want to roll around in the dirt of politics? Actually, I grew up surrounded by politics. My father was a U.S. Senator from West Virginia. My mother was the Secretary of State of West Virginia — the first woman to hold that position. Although for most of my life I applied myself to physics as a career, I have developed an appreciation for the ways of politics. As an APS Congressional Fellow in the early '80s, I began thinking about how science and Congress can better work together.

Two Cultures – Science and Politics

Scientists and politicians often seem to come from two separate worlds. In politics it often seems that perceptions are facts, and facts are negotiable. Congress is not designed to arrive at the truth, but instead to find the best balance. Science is the pursuit of the facts, wherever they lead—politics is a balance of interests.

Congress is actually very effective at representing society at large. Members of Congress have the same hopes, fears, and prejudices as their constituents. Like most people, Members of Congress make decisions based on what they see and feel personally. It is up to scientists to help Congress and the public understand the importance of their research.

Members of Congress know that science is valuable, but to some extent they're not sure why. They appreciate the fruits of science, but there is not a good understanding of the role and process of science.

Public Access to Data

A misunderstanding of the scientific method by politicians can lead to problems like the one that has developed regarding public access to scientific data funded with government grants. Included in the huge Omnibus Appropriations bill passed at the end of 1998 were a few hidden lines which will require all organizations, including universities, to make public all data obtained under federal government grants upon request through the Freedom of Information Act.

Representative Rush Holt joins NIH Director Harold Varmus (center) and National Academy President Bruce Alberts (right) in testifying at a Congressional hearing on public access to scientific data. At another recent Senate hearing on this issue, Rep. Holt was joined by Don Langenberg, chancellor of the University of Maryland System and a past APS President, and American Chemical Society President Edel Wasserman.

This legislation is a direct result of a misunderstanding among legislators of the way that science is conducted. The openness of scientific exchange that exists in the research community is vital to maintaining scientific progress and vibrance. Instead of creating more openness, this legislation will make industries reluctant to continue or enter partnerships with federally-funded researchers. Once data are commingled in a partnership, it may be difficult to distinguish data produced with federal funds from those produced with other funds. The resulting reluctance of industry to enter partnerships will significantly hurt fast-paced hi-tech industries.

As another example, tobacco companies and the National Rifle Association have already used intimidation and "freedom of information" threats to stop research showing that their products are harmful. This legislation will open up researchers to further harassment.

I am taking an active role in discussing both the implications of this legislation and possible corrective measures with my colleagues in both the House and Senate. Representative George Brown, who had a clear grasp of the role and process of science, was the first to recognize the serious problems created by this legislation and worked to repeal it. It is a real loss that he is no longer here to provide leadership.

Final regulations will be in place at the beginning of October. Universities will now have to develop administrative ways of responding to requests for information as well as protecting their researchers. The Office of Management and Budget, which is implementing this regulation, has rightly tried to narrow the interpretation of this rule. However, it is unlikely that this narrow interpretation will stand up to a challenge in court.

Science Education

Improving science education for all children in our public schools is also critical to developing a broader appreciation for science and the scientific method in society. I believe that teachers are the most critical element in improving education. Nothing makes more of an impact on our children than a well-trained, caring, and dedicated teacher.

Public schools will have to hire more than two million new teachers over the next 10 years. Many of these new teachers will have to teach math and science in the elementary grades. Unfortunately, many of today's teachers, especially in elementary school, do not feel prepared to teach science. Over half of America's high school teachers of physical sciences (including chemistry and earth science) do not have a major or minor in any physical science. About a third of public high school math teachers do not have a teaching certificate in math.

As a member of the House Education Committee, I recently supported the Teacher Empowerment Act as it passed the House. I worked with both the Administration and the Education Committee leadership to increase the overall investment in professional development for math and science teachers. I also included language that requires school districts to ensure the professional development needs of all of their math and science teachers, including elementary school teachers, are met.

I am also serving on the National Commission for Math and Science Teaching that will meet over the next year. This Commission is chaired by John Glenn and includes academics, educators and business leaders from around the country. We will address the developing crisis that public schools are finding in recruiting and retaining qualified math and science teachers. Among the many aspects of this issue, we will focus on preparation of teachers in college and retraining for people who already have a technical background and want to become teachers.

I believe we need to work toward a science education system that teaches every student every science every year.

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Holt responds to questions from the APS News *Editor:*

Q: Many large-scale science and technology projects have become either too expensive for one nation to carry or duplicate capabilities elsewhere. Yet the US is viewed as an extremely unreliable international partner. What concrete measures should Congress undertake to reverse this?

A: There are two major problems for support of international research projects: cost estimates and location of the project. First, the science community needs to take responsibility for more accurate cost estimates. Reports to Congress have shown that Congress has cancelled projects most often when costs have more than tripled above original estimates. In Europe, projects must be re-approved by each country when the cost goes above 15 percent of the original estimates. This results in more accurate estimates the first time around.

Congress can do something to address the location issue. Since the political community in each country will look at a major research project as a jobs program, where it is sited is critical for support. Congress could encourage the White House to convene a discussion group at the G7 level to negotiate which projects will be built in each country.

Q: Funding for the physical sciences continues to decline in the US. What are you doing to convince your congressional colleagues of the importance of strong support for science?

A: Mostly I talk with them. In my position on the House Budget Committee, I have advocated measures to increase research funding. But politics is about relationships, and I think my most effective support for science is through my conversations with my colleagues.

Rush Holt

Most of my colleagues are aware of my background and like to consult with me from time to time. When we were recently in session late at night, I got a call about 9:30 from another member of Congress who wanted to talk about energy research. He knew that I would be the guy to call. Another member recently stopped me on the House floor to ask how fuel cells work.

My reputation among my colleagues extends from being able to discuss with them the needs of the research community to the fact that the daily paper on the Hill asked me to review the new "Star Wars" movie before it came out.

Q: What can "bench" scientists do to improve support for science?

A: First of all, become more informed about the political process. Get to know your Representative. I've said that politics is about relationships. Build a relationship with your Representative, and not just to demand funding increases. Invite them to your lab or to see how science education works in your local schools. Members of Congress like to know what is going on in their district. And in that way you become a resource.

Q: I guess you would say it's important to have scientists in Congress?

A: Absolutely. Since politics is about achieving the best balance of interests, the science community needs people at the table representing their views. The way the legislation requiring public access to data developed is a good case. It was pushed into a large bill when no one was looking, without any public debate and with no one representing the research community at the table when it happened.

A lot of conversation and negotiation happens between members of Congress on the House floor or in other venues. The science community is underrepresented in this body which makes so many decisions critical to its future.

Rush Holt is a US Congressman from central New Jersey who took office in January 1999, past Chair of the APS Forum on Education, and the former Assistant Director of Princeton University's Plasma Physics Laboratory.

The Back Page is intended as a forum to foster discussion on topics of interest to the scientific community. Opinions expressed are not necessarily those of the APS, its elected officers, or staff. 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.*