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Three APS Fellows Share 1997 Nobel Prize in Physics

In October, the Swedish Academy of Sciences selected three APS Fellows as recipients of the 1997 Nobel Prize in Physics: Steven Chu of Stanford University, William Phillips of National Institute of Standards and Technology (NIST) and Claude Cohen-Tannoudji of the Ecole Normale Supérieure in France. The scientists were recognized for their development of methods to cool and trap atoms with laser light. The award will be officially presented in Stockholm, Sweden, on December 10th, 1997. The three newest Nobelists are expected to give invited talks at the APS Spring Meeting in April.

William Phillips is congratulated by APS Treasurer Thomas McIlrath.

Laser cooling techniques, in conjunction with magnetic trapping and cooling techniques, have allowed physicists to cool atoms closer to absolute zero than ever before. Cooling atoms to millionths or even billionths of a degree above absolute zero allows the creation and study of such new states of matter as Bose-Einstein condensates and promises even further improvements in already ultraprecise atomic clocks.

Published articles on the Nobel Prize-winning work of these three scientists have appeared in *Physical Review Letters* over the years. In a 1985 paper, Chu reported his discovery that "the motion of atoms in the intersection region is similar to the movement in a hypothetical viscous medium," and coined the term "optical molasses." In an early 1988 paper, Phillips reported that the atoms had a temperature of about 40 Microkelvins, much below the predicted Doppler limit of 240 Microkelvins. They also found that the lowest temperatures were reached under conditions that contradicted those of the theoretical Doppler limit. Finally, Cohen-Tannoudji demonstrated how the Doppler effect can be used to ensure that only the coldest atoms end up in the dark state. His so-called velocity selective coherent population trapping (VSCPT) method was first applied, and reported on in PRL: in 1988 in one dimension in 1994 in two dimensions, and in 1995 in three dimensions.

In these experiments, an array of laser beams converges on a gas of atoms.

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APS and Scientific Societies Endorse United Statement on Research

The APS, the Acoustical Society of America, the American Association of Physics Teachers, the American Crystallographic Association, the American Astronomical Society, the American Association of Physicists in Medicine, the American Vacuum Society and the American Geophysical Union joined the American Institute of Physics and 97 other scientific organizations in issuing a "Unified Statement on Research." The statement calls for a doubling of the federal budget for research by the year 2009, and was released on October 22 at a U.S. Capitol press conference.

Legislation which supports much of the coalition's goal — the "National Research Investment Act of 1998 (S.1305)" — was recently introduced by Senator Phil Gramm (R-TX) and Senator Joe Lieberman (D-CT). The bill calls for a doubling of federal funding for basic scientific, medical and pre-competitive engineering research over the next decade. Pete Domenici (R-NM), the powerful chair of the Budget Committee, threw his support behind the bill; he was joined by Jeff Bingaman (D-NM). Domenici vowed to make the bill a priority. Gramm and Lieberman are confident they can round up the 51 co-sponsors needed to ensure passage. In the House, George Brown (D-CA) is offering his "Investment Budget" that would increase R&D 5 percent a year, which is not incompatible with doubling research in 10 years.

Dr. Ronald Breslow, Immediate Past President of the American Chemical Society; Dr. D. Allan Bromley, former science advisor to President Bush and APS President; Dr. Winfred Phillips, President Nominee of the American Society of Mechanical Engineers; and representatives of the more than 100 professional societies were present at the press conference to discuss the economic, public health, environmental and historical significance of research funding and the coalition's goals.

The full text of the joint statement is below. A complete list of the endorsing organizations can be accessed at the following web site: http://www.chemcenter.org/decade.html.

Unified Statement on Research: "A Decade of Investment"

To secure the economic health and prosperity of the United States as the next century approaches, our national investment in research must be strengthened. The increased competitiveness of the global economy makes such an investment even more important now than in the past. To that end, we call upon the U.S. Congress and the Administration to double the current level of federal investment in research within the next 10 years, starting with fiscal year 1999.

The United States has a critical and long-standing interest in advancing engineering, mathematics, and scientific research and education. The reasons for this are well accepted by industry leaders and public policymakers alike.

- Research provides the basis for the nation's productivity and economic growth, sustains its high standard of living and quality of health, and ensures its security.
- Research conducted today generates the knowledge from which the future is built and helps develop researchers for the future.

Our nation has developed a dynamic, comprehensive, interdependent research system that has enabled the United States to assume global leadership and enjoy a high standard of living. The research efforts of the Departments of Agriculture, Commerce, Defense, Energy, Interior, and Transportation; the National Aeronautics and Space Administration; the National Institutes of Health; the National Science Foundation and others have provided countless scientific and technological innovations that have formed the foundation for our nation's prosperity.

Even during this time of extraordinary economic growth, it must not be forgotten that tomorrow's health, economic, environmental, and national security needs depend on the choices that are made today. As leaders of the science, engineering and mathematics communities, we maintain that doubling the nation's research budget during a 10-year period strikes a responsible balance between near-term fiscal goals and long-term economic growth and productivity.

Inside...

APS Fellow Reception held in New York City

On September 30th, more than 100 APS Fellows located in the Northeast convened at the Yale Club of New York City for a Fellows Reception. Such receptions employ a regional approach and are intended to provide a vehicle for recognizing APS Fellows and informing them about the Society's activities. APS President D. Allan Bromley (Yale University) chaired the New York reception, which featured presentations on APS public policy issues, an October planning meeting on international collaboration [see "International Desk," page 5], plans for the upcoming APS Centenary, and the success of the APS Campaign for Physics, followed by a question and answer session. Receptions held prior to the NY Fellows Reception included Cambridge, MA and Stanford and Berkeley, CA. Another Fellows reception was held on November 12 at the American Center for Physics and was chaired by APS Vice President, Jerome Friedman of MIT (more details to come to come in a future edition of *APS News*. In addition, receptions are planned for Los Angeles, CA and Chicago, IL early in 1998

Jim Wynne, IBM, makes an illuminating point to the assembly of NY area Fellows.

APS Executive Officer Judy Franz greets James Anderson, Stevens Institute of Technology.

Interferometric Lithography, High-Density Plasma Sources Featured at GEC'97

Interferometric lithography, high density plasma sources for flat panel displays and environmental applications of plasmas were among the highlights of the 50th Annual Gaseous Electronics Conference, a topical conference of the APS, held October 6-9 in Madison, Wisconsin. In addition to the regular scientific program, there was a town meeting on Monday night to discuss the future organization of the GEC, including the possibility of forming a Topical Group on Gaseous Electronics within the APS. A new feature this year was the "Foundation Talk," a review paper aimed at educating students and individuals working outside the immediate field and given by Allan Gallagher, who spoke on gas-phase processes in low-pressure silicon deposition plasmas.

This year's program also included a special plenary session to recognize the 50th anniversary of the GEC's founding, with presentations on electric discharge light source R&D over the last 40 years, electron collisions in astrophysical plasmas, a historic perspective of gas phase lasers and the kinetics of swarms and discharges. There was also an historical exhibit on the achievements of Irving Langmuir, who first coined the word "plasma" to describe the bulk region of certain laboratory discharges and who essentially started the science of surface reaction processes and catalysis. His efforts resulted in such significant technological advances as the mercury diffusion vacuum pump, the gas-filled incandescent lamp, the thoriated electrode and the high-vacuum electron tube diode and amplifier.

Interferometric Lithography

The silicon industry continues to accelerate the historical rate of decrease in the critical dimension (CD), or smallest printed feature size, of ULSI circuits. Current estimates call for the introduction of 180-nm features in manufacturing by the year 2000, with succeeding generations of 130 nm and 100 nm to follow at three-year intervals. According to S.R.J. Brueck of the University of New Mexico, this rapid pace of change has implications not only for lithography, but for all related manufacturing processes, including etching and deposition. In particular, the limits in depth-of-field and photoresist mechanical properties are likely to lead to thinner resist layers, requiring increased selectivity during etching.

Brueck reviewed the current status of several potential future lithographic techniques, focusing on interferometric lithography, a newly developed optical technique that allows fabrication of the next several CD generations with currently available sources and photoresist systems, enabling immediate development of the necessary etch and deposition tools. "Imaging interferometric lithography is…providing a true integration of imaging optical and interfermometric techniques that offers the potential of extending optical lithography beyond 70 nm," he said.

Environmental Applications

According to Louis Rosocha of Los Alamos National Laboratory, who spoke on Monday morning, electrical discharges in gases can be used to create nonthermal (or nonequilibrium) plasmas with energetic electrons at near-ambient background gas temperature. These low-temperature plasmas are an excellent source of free radicals and other active species useful for chemical conversion and synthesis. In particular, when reacted with volatile organic compounds, (VOC), these active species exhibited high reaction-rate constants for decomposition of the VOCs, making them very useful for pollution control.

David Green of NIST, who spoke at the same session, said he believes that better databases and models are required to evaluate the applicability of non-thermal plasma-based methods — such as electron beam irradiation or electrical discharge techniques —for the abatement of VOCs in contaminated humid gas streams. "Much of the existing information on the energy efficiency of VOC destruction and the nature of byproducts is empirical, and the processes are so complicated that it is essential that predictive models and simulations be improved," he said. The general data types needed include transport, thermodynamic, kinetic and electron interactions, and the nature of the data is dependent to a large extent on the concentration, pressure, temperature and degree of ionization.

High-Density Plasma Sources for FPDs

According to John Holland of Lam Research, the current trend in flat panel display (FPD) manufacturing is towards producing larger and higher quality displays, resulting in the increase of the size of the glass substrates used as the basis for displays as well as a need for improvements in the processing steps used to deposit and etch films on the glass. Typically either wet chemistry or low density, reactive ion etch (RIE) plasma sources have been used for these process steps, which are adequate for small display sizes. However, as the dimensions of the glass substrates are increased, these methods can be limited by their low processing rates and poorer process uniformities.

Holland maintains that a promising alternative, until recently unavailable commercially, is the use of a high-density plasma source for plasma processing of the large area panels. While these have become commonplace for wafer-based manufacturing, not all have been scalable for large area applications. A notable exception is the planar, inductively coupled plasma source, which has recently been demonstrated on a 600-mm substrate. In this way, issues with processing rates can be overcome, and process uniformities can be much lower than those achieved with either wet chemistry or RIE etching.

Planar Laser Induced Fluorescence

Low-pressure radio frequency (rf) fluorocarbon plasmas are extensively used for etching and chamber cleaning during microelectronics device fabrication. However, the models which are necessary to the understanding of these complex plasma processes require experimental input and must be rigorously verified by comparison to experimental measurements, according to Kristen Steffens of NIST, who spoke on Wednesday morning. She has found that planar laser-induced fluorescence (PLIF) is one of the most useful optical techniques for 2-D measurements of gas-phase species, relative densities and distributions. "Because the entire 2-D map of the species density is obtained simultaneously, the need for multiple point measurements is eliminated," she said, adding that PLIF is also highly sensitive to free radical intermediates, which play crucial roles in plasma chemistry.

Enhancements to APS Online Journals

Free *JETP-online*

In an effort to promote the online version of the *Journal of Experimental and Theoretical Physics (JETP)*, the American Institute of Physics (AIP) is offering free access to current subscribers of *Physical Review Letters-online* from October 15, 1997, through December 31, 1998. One of the most important physics journals published in Russia, JETP presents timely and topical short papers, emphasizing fundamental theoretical and experimental research in all fields of physics — from solid state to elementary particles. Its first-hand reports of the current state of research in the former Soviet Union place it among the most consulted journals serving physics, chemistry and engineering departments and laboratories around the world.

The online edition provides access to *JETP* articles beginning with January 1996 issues, and includes the following features: reference linking to connect to a referenced article's abstract; new download options to enable users to print full-text PostScript or PDF files for each published article; and "See also" links providing access to such related information as errata, multi-part papers, reader comments and author responses to comments. Subscribers to *PRL-o* may gain immediate access to *JETP Letters Online* at http://www.aip.org/jetpo, using their current username and password. They may also link from one letters journal to the other without re-validation. There is no need to complete another subscriber agreement for access. For technical questions, contact AIP at 516-576-2262, or via e-mail: ojshelp@aip.org.

APS Link Manager Now Available

The APS announces a new "link manager" to facilitate linking to our online journals by providing a simple URL scheme based upon the information found in a typical journal citation. In particular, issue numbers are not needed even though some of our online offerings use URLs that require the issue number. The APS has promulgated a policy of keeping all abstracts in our online offerings freely available, making them a natural target for outside links into our journals. By using the APS link manager, researchers, publishers, and libraries can link easily to *Physical Review* without worrying about future changes in the location of our online services, changes in the URLs that are used internally within these services, or broken links because of subscription limitations. Information on the APS link manager can be found at http://publish.aps.org/linkfaq.html.

PINET-Plus and SPIN Abstracts

An online subscription to *Physical Review Letters* allows access to both the AIP SPIN and Advance SPIN Abstracts bibliographic database. SPIN contains the abstracts of over 80 physics journals since 1975, a total of over 700,000 entries. PINET-Plus, an information service of the AIP, is also accessible without charge to *Physical Review Letters online* subscribers. Both PINET-Plus and SPIN can be accessed through the entry page of your online subscription under "Access to SPIN Abstracts."

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Joseph Henry, for more information see: [www.albany.edu/physics/jhenry.html].

INSIDE THE BELTWAY

Getting Priorities Right

by Michael S. Lubell, APS Director of Public Affairs

Imagine American politics without partisan wrangling. It seems preposterous. Yet, for much of the first session of the 105th Congress, that's how the House and Senate functioned. Well, almost, anyway.

A principal fault line eventually developed over campaign finance reform, with Democrats—who are consistently outspent by Republicans—arguing for spending limits, and Republicans—who were especially targeted by organized labor in 1996—arguing for restrictions on how union dues may be spent. Legislative action in the Senate came to a grinding halt several times in the fall, as both sides filibustered and Democrats threatened repeatedly to attach campaign reform legislation to extraneous bills.

But with neither party willing to risk public ire over a government shutdown, the appropriations bills for the most part escaped unscathed. And those bills generally carried good news for science.

After four years of cuts, Congress seemed genuinely persuaded by the logic behind "The 7 Percent Solution" and provided research programs in many federal agencies with increases that ranged between 3 and 8 percent. One of the few exceptions was the Defense Department's 6.1 Program, which came under the scalpel when Appropriations Committee conferees tilted toward the House version of the bill and left DOD basic research frozen at fiscal year 1997 levels to accomodate B2 bombers and personnel infrastructure. By contrast, they gave the DOD applied research 6.2 Program a hefty 8.9 percent increase.

But the big news on Capitol Hill this fall was the bipartisan Senate Bill S. 1305, "The National Research Investment Act of 1998." The original version of that legislation, which Senator Phil Gramm (R-TX) drafted last January, had only Republican co-sponsors, leading some critics to argue that it represented nothing more than a grandstanding play.

Gramm, who holds a Ph.D. in economics and a bachelor's degree in physics, vehemently denied the accusation and promised to withdraw his bill and submit a substitute that had bipartisan co-sponsorship.

For much of the summer, his staff worked closely with Senator Joseph Lieberman's (D-CT) office to develop language that was acceptable to both senators. With the assistance of some members of the scientific community, including APS President D. Allan Bromley, they achieved a breakthrough in early September.

The result was an authorization bill that would double the federal investment in civilian basic scientific, medical and precompetitive engineering research over the next decade. In its thrust, the bill was consistent with the general goals of the "Unified Statement—A Decade of Investment" that the leaders of 106 science, engineering and mathematics societies had just endorsed, on behalf of more than 3 million researchers and educators.

On Wednesday, October 22, Gramm and Lieberman, accompanied by more than 35 society leaders, held a joint press conference in the Mansfield Room of the Capitol to unveil the bill and the statement.

But Washington is a town that leaks like a sieve. So, for the cognoscente, neither the bill nor the statement contained any surprises.

However, the press conference was anything but anti-climactic. As Allan Bromley, American Chemical Society Past-President Ron Breslow and American Society of Mechanical Engineers President-Elect Winfred Phillips all noted, the event was seminal. Never before had the leaders of professional societies representing the majority of the nation's scientists, engineers and mathematicians joined in such a public statement of concern for the future of the American science and technology.

And in their prepared remarks, Gramm and Lieberman both made it clear that they were dead serious about having Congress pass S. 1035, putting to rest all speculation that the legislation was merely a posturing exercise. Gramm pledged that they would have 51 co-sponsors signed on before the bill is taken up by the Labor and Human Resources Committee next spring.

But what really caused a buzz in the packed room was the unexpected presence of Senate Budget Committee Chairman Pete V. Domenici (R-NM). The powerful New Mexico legislator, who also chairs the Senate Energy and Water Development Appropriations Subcommittee, had decided to become an original co-sponsor of the bill only hours before. And his fellow New Mexican, Senator Jeff Bingaman (D-NM), also a strong supporter of science, joined as well.

Domenici, well known for his strong support of science, echoed Gramm's sentiments when he stated it was important for Congress to get its priorities right for the future. And those priorities, he asserted, were laid out in "The National Research Investment Act of 1998."

Unfortunately, reports received from the White House only a few days before the Capitol Hill press conference took place suggested that President Clinton was not fully comfortable with the legislation. As one senior official put it, "Those numbers are wildly out of line with our present thinking."

White House thinking, according to other sources, is a freeze at fiscal year 1998 levels for at least the next several years. Readers may recall, however, that last year the White House floated similar budget plans in October. But by February, when the President delivered his budget message to Congress, his proposals included modest increases for R&D investments.

The change in President Clinton's attitude occurred, at least in part, because the science community had taken the trouble to speak out. With a congressional initiative in the making and with more than 3 million scientists, engineers and mathematicians flexing their collective muscles, White House watchers are betting that the President once again will turn his positive rhetoric on science into budgetary action.

1997 Nobel Prize in Physics *(continued from page 1)*

In the simplest type of laser cooling, the wavelength of the light is tuned so that just the fastest atoms moving in a particular direction will absorb a photon head-on, thus slowing their motion in that direction. The atoms will eventually re-emit a photon but in random directions. The effect of the laser bombardment is a net slowing of the atoms. This "optical molasses" can slow millions of atoms to temperatures just millionths of a degree above absolute zero. Adding magnetic fields to the laser configuration enables the atoms to be trapped and cooled further.

As a result of these techniques, physicists can cool atoms closer to absolute zero than ever before, to temperatures of nanokelvins in some cases. Reducing the distracting presence of thermal motion permits the study of atomic properties with much greater precision. Furthermore, laser cooling serves as the first stage in reaching the exotic condition known as Bose-Einstein condensation, the new state of matter in which many atoms begin to "overlap," eventually assuming a single common quantum state.

Chu received his PhD in physics from the University of California at Berkeley in 1976 and remained there for two more years as a postdoctoral fellow before joining the technical staff at AT&T Bell Laboratories in 1978. He headed the Quantum Electronics Research Department in 1983, leaving the company in 1987 to join the faculty of Stanford University, where he is currently a professor of physics and applied physics. He received the APS Arthur L. Schawlow Prize in 1994 for his work in laser cooling and trapping of atoms. Chu has used his laser array to split ultracold atoms into separate waves and recombine them to form interference patterns that can provide detailed information on the atoms.

Phillips received his PhD in 1976 from the Massachusetts Institute of Technology and completed a postdoctoral stint there before joining NIST in 1978. Although his work was originally related to precision electrical measurements, he was allowed to perform experiments in laser cooling in his spare time, which eventually led to NIST's internationally recognized research program in this field. He was recently selected as the 1998 recipient of the APS Schawlow Prize, to be presented next fall. With his laser setup, Phillips can create "optical lattices," crystal-like arrays of atoms held in place by light waves. He and his team are continuing to study ultra-cold trapped atoms with spin-off applications for improved accuracy in atomic clocks and in the fabrication of nanostructures.

Born in Algeria and a citizen of France, Cohen-Tannoudji received his PhD in 1962 from the Ecole Normale Supérieure in Paris. He has been a professor at the College de France since 1973 and is a member of the Academie des Sciences. He shared the 1992 APS Lilienfeld Prize with Alan Guth. In a particularly sophisticated form of laser cooling, Cohen-Tannoudji has put helium atoms into a "dark state," whereby the coldest atoms become unable to absorb additional light and fall to temperatures even lower than previously imagined possible. The chilled atoms may also become the basis for extremely precise atomic clocks, accelerometers and gyroscopes.

Taking the Temperature of Dark-State Atoms

In the October 27, 1997 issue of *Physical Review Letters*, Claude Cohen-Tannoudji and his colleagues at the Ecole Normale Superieure in Paris present a new way to explore the coldest realm in the universe. One problem in this line of research is that traditional methods of thermometry have failed to measure how truly low the temperatures are for the large clumps of ultracold atoms in the "dark state." Traditionally, physicists have used "time-of-flight" methods: by allowing a cloud of ultracold atoms to expand freely and measuring how quickly the cloud expands, the researchers estimate the range of velocities in the gas atoms; a narrower range corresponds to a colder temperature. But for large clouds of ultracold atoms, including those in the dark state, the clouds expand too imperceptibly for researchers to make good temperature measurements.

To create the dark state, researchers first trap and cool helium atoms using a combination of laser beams and magnetic fields. Then, two laser beams traveling in opposite directions put each atom into a combination or "superposition" of two low-energy states that interfere with each other so as to prevent the atoms from absorbing or emitting laser light. This is important since a helium atom absorbing or emitting a single photon recoils by 9.2 cm/second, corresponding to a temperature of 4 microkelvins. Oblivious to photons, atoms in dark states can have temperatures well below this "single photon recoil limit." To determine these "subrecoil" temperatures more precisely, Cohen-Tannoudji's group probes the wavelike properties in the group of atoms. Each dark-state atom can be thought of as a superposition of two "wavepackets," corresponding to the two low-energy states which interfere to prevent light absorption.

Associated with the two wavepackets are two equal and opposite momentum states characterizing the movement of the atom as a whole; in effect the atom is moving in two opposite directions at the same time. As long as the dark state lasers are on, these two wavepackets are constantly superimposed. But when the researchers turn off the lasers in their experiment, the two wavepackets fly apart. A subsequent laser pulse applied after a certain time measures the various degrees of overlap in the wavepacket pairs that make up the cloud of atoms, allowing the researchers to measure the momentum (and therefore velocity) distribution of the atoms and thereby the temperature as well.

Applying this technique to subrecoil helium atoms, the researchers have measured a temperature (at least in the one dimension probed by their laser) of 5 nanokelvins, 1/800 of the recoil limit. This is the lowest fraction of the recoil temperature ever measured for an atom; the lowest absolute temperature, 3 nanokelvins for much heavier cesium atoms, was measured by the same group in 1995.

[Item courtesy of Philip F. Schewe and Ben Stein of AIP Public Information.]

OPINION

APS VIEWS

Senior Physicists Meet at ACP

Senior physicists from the Washington, D.C., area met in early October to begin planning activities that will keep retired physicists involved with science.

More than 50 senior physicists gathered at the American Center for Physics in College Park, Md., for an initial planning session. Many of the attendees expressed interest in working in physics education, from communicating the excitement of physics to students in primary grades to mentoring and discussing science careers with older students. Other physicists at the meeting suggested writing autobiographies to document the history of physics, conducting government studies, creating a lecture series for other physicists, lobbying government officials on behalf of the American Physical Society, providing material for physics Web sites and hosting social get-togethers.

Judy Franz, APS Executive Officer, welcomed the senior physicists and described some of the current APS programs for education. Trish Lettieri, manager of the APS membership department, facilitated the meeting.

Dick Strombotne, who served as the meeting moderator, was the first to propose that APS sponsor such a session. Efforts to organize the meeting began in mid-September, when the Society mailed about 900 letters to senior and retired members age 60 and older who live in Delaware, Maryland, Virginia and Washington, D.C.

To capitalize on the success of the brainstorming session, a small planning group of senior physicist has met twice since to sort through and organize the ideas. This planning group will continue to meet as they work to generate practical ways for implementing the many suggestions. Because many of the attendees of the original meeting were interested in contributing to physics education, the group is organizing a workshop/forum where Washington, D.C.-area where senior physicists can learn about current programs as well as discuss problems in education and ways they can help.

For more information about activities for senior physicists, contact Dick Strombotne c/o Judy Franz at APS, franz@aps.org, or by phone or fax at 301-540-9597.

APS Task Force on Physics Today Begins Work

The newly appointed APS Task Force on *Physics Today* as an APS Member Benefit will begin its work to evaluate the content and style of *Physics Today*, with the main goal of suggesting ways in which the magazine could better serve the diverse interests of the Society's membership. The majority of APS members see *Physics Today* as one of the most important member benefits, and it is important for the APS that the magazine serves its members well.

The task force will meet at least once with the editor of *Physics Today* and other key people at the American Institute of Physics involved in producing the magazine. As background material, results from a three-year-old survey of members of AIP societies concerning *Physics Today* will be consulted. A new AIP survey is underway and as results become available they will be shared with the task force.

The task force will remain in existence for up to one year, but it is expected that most of the work will be completed by the April 17, 1998 Council meeting. Members wishing to express their views about *Physics Today* are invited to forward them to the task force chairman, Burton Richter of Stanford Linear Accelerator Center [e-mail: brichter@slac.stanford.edu]. Other members of the task force are Julia Phillips, Sandia National Laboratories; Ray Baughman, Allied Signal; Jon Pribram, Bates College; Ron Walsworth, Smithsonian Astronomical Observatory; and John Wilkins, Ohio State University.

LETTERS

Misuse of Einstein's Relativity Theory

The Committee on the International Freedom of Scientists (CIFS) of the American Physical Society found it very inappropriate for President Jiang of the People's Republic of China to use Einstein's theory of relativity to justify his Government's intolerance of different opinions and violation of human rights. President Jiang did this in an interview by the *Washington Post* prior to his visit to the United States (published in the *Washington Post* on October 19, 1997) and again at the joint Press Conference with President Clinton on Wednesday, October 29, 1997. That statement reads: "The theory of relativity worked out by Mr. (Albert) Einstein, which is in the domain of natural science, I believe can also be applied to the political field. Both democracy and human rights are relative concepts and not absolute and general."

Meanwhile, Prof. Xu Liangying, the translator of Einstein's three volumes of scientific work into the Chinese language, has been under virtual house arrest in Beijing for the last few years.

Einstein's theory of relativity is based on the assumption that physical laws are invariant under relative motion. An appropriate analogy would be the inviolability of human rights under all conditions. Here we note that the Declaration of Human Rights signed by China and other United Nations member countries is universal, not relative. It is wrong to use the theory of relativity to illustrate moral relativism.

Einstein was an eminent scientist who was concerned about human affairs. His work not only influenced the career choice of Prof. Xu Liangying, the translator of Einstein's work, but also his political beliefs. In Oct. 1992, Prof. Xu Liangying wrote an article titled: "Without Democracy There Will be No Reform" for the Chinese magazine *Future and Development.* After the article was published, all copies of that issue were seized. In March, 1994, he appealed to the Chinese authorities to release all political prisoners. In May, 1995, together with 45 prominent intellectuals in China, he wrote a petition letter to the Chinese Government titled "Tolerance is Essential to Modernization" asking the Chinese Government to show tolerance towards political thoughts and religious beliefs, and to reassess the tragic events that occurred at Tiananmen Square on June 4, 1989. Both the 1994 and 1995 letters were published in the *New York Times* or reported in the *Washington Post.* In response, the Chinese Government placed guards outside Prof. Xu's residence to monitor his movements, took measures to prevent American physicists from visiting him, and harassed and sometimes detained his Chinese visitors.

To respect Einstein, we call on President Jiang to respect Prof. Xu Liangying's rights to freedom of speech guaranteed under the Chinese Constitution. We also ask the Chinese Government to stop harassing Prof. Xu Liangying and his friends and to release Wang Dan and other intellectuals who were detained and imprisoned after signing the 1995 petition letter.

Ke Chiang Hsieh
CIFS Chair

Letters to the editor are welcomed from the membership. Letters must be signed and should include an address and daytime telephone number. The APS reserves the right to select and to edit for length or clarity. All correspondence regarding *APS News* should be directed to: **Editor, *APS News*, One Physics Ellipse, College Park, MD 20740-3844, e-mail: letters@aps.org.**

zero gravity

Improbable Researchers Gather for 1997 Ig Nobel Prize Ceremony

A new crop of Ig Nobel Prizewinners was honored on October 9, 1997, at the Seventh First Annual Ig Nobel Prize Ceremony, held before a paper-airplane-throwing sellout crowd of 1200 in Harvard University's Sanders Theatre. The event was produced by the science humor magazine "Annals of Improbable Research" (AIR), and co-sponsored by the Harvard-Radcliffe Science Fiction Association and the Harvard Computer Society and by the new book "The Best of Annals of Improbable Research."

The prizes were presented to the winners by several genuine Nobel Laureates, including Dudley Herschbach, William Lipscomb, Richard Roberts and Robert Wilson. A worldwide audience watched via a live Internet telecast. (The event was also recorded, and will be broadcast on National Public Radio's "Talk of the Nation Science Friday" program on the day after American Thanksgiving.)

The Nobel Laureates were active throughout the evening. Lipscomb was given away in a Win-a-Date-With-a-Nobel-Laureate Contest. Plaster casts of the left feet of Lipscomb and Herschbach, and fellow Nobel Laureate Walter Gilbert were auctioned off for the benefit of the Cambridge public schools science programs. All the laureates joined soprano Margot Button and Baritone Benjamin Sears in the world premiere of a new mini-opera ("Il Kaboom Grosso") about the Big Bang.

BIOLOGY: T. Yagyu and his colleagues from the University Hospital of Zurich, Switzerland, from Kansai Medical University in Osaka, Japan, and from Neuroscience Technology Research in Prague, Czech Republic, for measuring people's brainwave patterns while they chewed different flavors of gum.

ENTOMOLOGY: Mark Hostetler of the University of Florida, for his scholarly book, "That Gunk on Your Car," which identifies the insect splats that appear on automobile windows.

ASTRONOMY: Richard Hoagland of New Jersey, for identifying artificial features on the moon and on Mars, including a human face on Mars and ten-mile-high buildings on the far side of the moon.

COMMUNICATIONS: Sanford Wallace, president of Cyber Promotions of Philadelphia — neither rain nor sleet nor dark of night have stayed this self-appointed courier from delivering electronic junk mail to all the world.

PHYSICS: John Bockris of Texas A&M University for his wide-ranging achievements in cold fusion, in the transmutation of base elements into gold, and in the electrochemical incineration of domestic rubbish. [Note: Bockris is a chemist by profession.]

LITERATURE: Doron Witztum, Eliyahu Rips and Yoav Rosenberg of Israel, and Michael Drosnin of the United States, for their hairsplitting statistical discovery that the bible contains a secret, hidden code. [Drosnin's popular book, "The Bible Code," was published by Simon & Schuster.]

MEDICINE: Carl J. Charnetski and Francis X. Brennan, Jr. of Wilkes University, and James F. Harrison of Muzak Ltd. in Seattle, Washington, for their discovery that listening to elevator Muzak stimulates immunoblobulin A (IgA) production, and thus may help prevent the common cold.

ECONOMICS: Akihiro Yokoi of Wiz Company in Chiba, Japan, and Aki Maita of Bandai Company in Tokyo, the father and mother of Tamagotchi, for diverting millions of person-hours of work into the husbandry of virtual pets.

PEACE: Harold Hillman of the University of Surrey, England, for his lovingly rendered and ultimately peaceful report "The Possible Pain Experienced During Execution by Different Methods."

METEOROLOGY: Bernard Vonnegut of the State University of Albany, for his revealing report, "Chicken Plucking as Measure of Tornado Wind Speed."

INTERNATIONAL NEWS

Representatives from six large and five regional physical societies around the world attended a planning meeting on international collaboration, held October 8-10 in Washington, D.C. Participants separated into four break-out groups to discuss issues of international collaboration in the areas of electronic publishing, science policy and funding, physics education and public education and capacity building in developing countries.

Electronic Publishing

Chaired by APS Executive Officer Judy Franz, this group concluded that considerable evidence points to the persistence of paper journals and books, despite the advent of electronic publishing. Hence, there will be a continuing market for both electronic and paper products, and marketing policies must be developed to satisfy this mix. It is expected that new models of publishing will emerge to exploit the flexibility and power of the electronic media, including hyper-referencing and cross-linking, multimedia and communications capabilities.

Most society publishers are providing access to electronic journals free for to institutional subscribers to their paper journals. Nevertheless, they recognize the need to make the electronic product the principal publication, with paper versions sent as a subsidiary benefit. This is the direction adopted by the APS several years ago with the Bulletin of the APS (BAPS); other societies followed suit. However, since the bulk of publishing costs reside in editorial operations, little savings is expected to accrue as a result of electronic distribution. In fact, publishers will be obliged to provide for both paper and electronic distribution, thus increasing costs in the near term. The question of who pays — authors through page charges or other fees, or institutions through rising subscription costs — remains unresolved.

International access to electronic journals and e-print servers is dependent upon the status of Internet connectivity. Existing capacity is insufficient to maintain good trans-Atlantic or trans-Pacific connections, extending download times from remote hosts. Most developing countries lack any reliable connectivity. The group discussed three obvious solutions: mirrored servers, dedicated pipelines and a proprietary academic and research network with sufficient reserve capacity.

Mirrored servers are the costliest alternative for complex publishing operations, restricting their use to large, well-funded communities. But the APS will undertake a study of dedicated pipelines whereby a "virtual" server in Hawaii is directly connected to communications networks in Europe, Eurasia, South America and Asia. Preliminary evidence indicates that download times will be decreased by 3 to 4 orders of magnitude at relatively modest cost, although the specifics of how these approaches can be engineered to facilitate the use of hyperlinks and other enhancements is not yet known. IUPAP was encouraged to seek ways to improve internal connectivity world-wide.

Dinner table of workshop attendees. From back to camera-left: Kimitoshi Kono, Executive Secretary of International Affairs, The Physical Society of Japan; Yang Guozhen, Vice President and Secretary General, The Chinese Physical Society; Xu Rongsheng, Institute of High Energy Physics, Beijing; Yuki Kiyota, Secretary General, The Physical Society of Japan; Brian Bonnar, APS International Programs Administrator; Thomas McIlrath, APS Treasurer; and Denis Weaire (back to camera-right), President, European Physical Society.

Science Policy

With Denis Weaire of the European Physical Society serving as chair, this group explored the role of physical societies in influencing national programs, apparent trends in policy and consequences to the scientific enterprise. Specifically, today's policy makers are more inclined to address defined societal needs, which tend to favor interdisciplinary research. Physics is no longer perceived as the leading science, particularly for the coming century. In terms of R&D, many major corporations have reduced their level of investment in corporate research, while central research laboratories have been scaled down. However, the outsourcing of R&D has led to the growth of new small and medium enterprises (SMEs), which are attracting the attention of physicists in many countries. Finally, the retreat of corporations from long-term research leaves a gap that must be filled by public investment, which to date has not occurred.

The participants concluded that the natural role of professional societies in this area is to promote the subjects which they represent, avoiding potentially divisive decisions about which sectors might be more important. They made four primary recommendations: (1) National and continental societies should find common cause with other scientific disciplines, including engineering, through flexible and informal alliances. (2) The OECD's Megascience Forum, developed to foster cooperation in "big science" projects requiring investment beyond the means of individual countries, is commendable but insufficiently known at present, and its workings should be more transparent to the physics community. (3) The European Union's record in fostering international collaboration provides an admirable model which can be generalized to other contexts. (4) Experience in bringing industry and the academic physics community closer together should be pursued and shared more widely.

Physics Education

Chaired by Eric Svensson of the Canadian Association of Physicists (CAP), this group identified the apparent decreasing interest of students in physics as a major concern for the physics community. In Germany and the U.S., the numbers of physics majors are decreasing, while in the U.K., Japan, and China, the numbers remain constant. However, a lack of interest at the high school level implies that the quality of secondary physics education may be going down. The solution to these problems, participants concluded, is to implement innovative teaching techniques and curricula, an approach currently pursued aggressively in the U.K. with a new age 16-19 curriculum.

Another fundamental concern is the need to enhance the quality and significance of physics degrees. In Canada and the U.S., this is driven by the competition between physicists and engineers for jobs. In Russia and the U.S., the quality of university education is uneven. One proposed solution would be the establishment of national standards for physics departments. The Institute of Physics, for example, certifies physics departments in the U.K. with site visit teams who evaluate programs. The IOP also certifies physicists with undergraduate degrees plus five years of experience as professionals, and the Canadian physics community is pursuing the right to declare professional titles for physicists.

There was a general agreement of the need to improve public awareness and appreciation of physics world-wide. Participants described a number of successful public information programs in their countries.

Developing Countries

This group concluded that the international exchange of scholars is an important and effective means for building capacity in developing countries while still benefitting host countries. The role of the International Centre for Theoretical Physics (ICTP) in Trieste, Italy, in promoting such exchanges is particularly important. Many aid programs currently administered by developed industrial nations and intergovernmental agencies fail to recognize the importance of science and technology to national development. Instead, the focus is most often on agronomy, health, housing and other basic needs. Since the fundamental sciences are not viewed as essential elements to the development of long-term capacity, one objective of the physics community must be to influence the political leadership of both developed and developing countries to make appropriate levels of investment in science and technology.

In addition, the new information technologies available should be exploited and developed to enlarge, enliven and deepen physics education in developing countries. The group participants noted the advent of the "megauniversities," institutions which service as many as 500,000 students at 10 to 50 percent of the cost per student in traditional universities. These technologies hold the promise not only for wider student access, but for access to more resources, with the promise of extended collaborations and long-range consultations and exchanges.

Kennedy is APS Centennial Director

Franmarie Kennedy

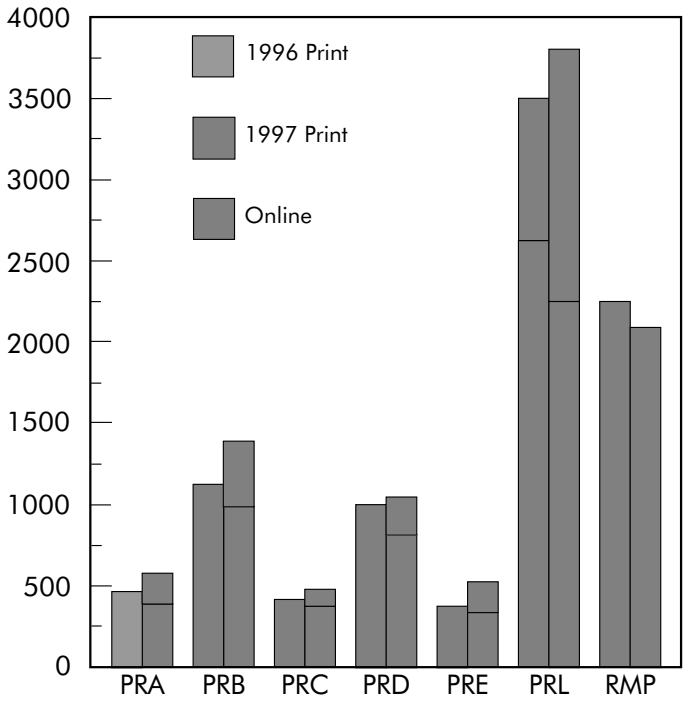
Franmarie Kennedy was appointed APS Centennial Director in October. She is charged with planning and organizing the upcoming APS Centennial meeting in 1999.

Kennedy received her PhD in educational administration from American University. In 1996 she founded the Prospect Foundation, a non-profit organization dedicated to producing and distributing educational programs for television. In addition, Kennedy offers advice to corporations and foundations on how to make their charitable contributions more strategic and focused. Before founding the Prospect Foundation, she established her own consulting firm and worked with the Clarendon Foundation to produce a documentary titled, "George Bush: The Making of a Leader," which aired in November on the A&E History Channel.

From 1991 to January 1993, Kennedy served as director of the National Institute for Literacy. Prior to this appointment she was a special advisor to the Secretary of Education on the GOALS 2000 educational reforms. She also served as President Reagan's Deputy Assistant for Domestic Policy, directing the first White House Conference on Educational Choice and coordinating the White House Conference on Global Change in 1990. In the late 1980s, she held several positions in the Department of Education, including Chief of Staff to the Deputy Secretary and the Under-Secretary.

Factal

Member Print & Online Subscriptions 9/96 vs. 9/97



A resurgence of member subscriptions to all sections of *Physical Review* is occurring through the availability of online versions, even as paper subscriptions continue to decline.

APS Group Insurance has Affordable Options

For almost 30 years, members of the APS and other participating organizations have relied on the APS Insurance Trust program to provide affordable life insurance provisions for a broad range of member needs. Other associations that participate in the trust include the American Association of Physics Teachers, the American Astronomical Society, the American Geophysical Society, the Acoustical Society of America, the American Vacuum Society, the Optical Society of America, Sigma Pi Sigma and the Society of Physics Students.

According to Kenneth Friedman of Herbert V. Friedman Inc. (HFI), which administers the program, the APS Insurance Trust was established in 1969 and first offered to the membership in February 1970. At that time, only term life insurance was included. One of the continued benefits of the program, says Friedman, is that unlike most private life insurance programs, which require a physical exam, the APS Term Life program does not require a medical exam unless the non-medical questionnaire reveals a problem that can only be addressed by a physical examination.

The program serves younger members of the APS particularly well. For example, the term life program provided insurance for younger members at a cost far below the market price of early 1970s, when many were having difficulty finding work in physics research. Similarly, during the job market crunch of the early 1990s, a substantial number of physicists were unable to find employment or lost their jobs, thus losing group insurance benefits. "The cost of our insurance was so small as to provide a wonderful substitute for their loss at a price even unemployed physicists could afford," Friedman said.

In addition, as the cost of term insurance went down with private companies, the APS program kept pace. "Today, except for ages over 60, our prices are most competitive with any private insurance plans," Friedman said. There is a provision, at no additional cost, that the premiums will be waived if the insured become disabled. And to adapt to the changing needs of APS members over the years, HFI has added long-term disability, hospital indemnity, accidental death and dismemberment and long-term care to its provisions, and continues to examine new programs which may prove beneficial for APS members. For example, this year the APS added a Living Benefit Option to the Life Program, a provision that allows for 50 percent — up to a maximum of $100,000 — of an insured's principal sum to be paid out to the insured, if he or she is certified by a physician as being terminally ill.

Members interested in obtaining complete information on any of the plans offered by the APS Insurance Trust should contact Herbert V. Friedman, Inc., 119 North Park Avenue, Rockville Centre, New York, 11570-4179; phone: 516-764-0050; toll free: 1- 800-272-1637; e-mail: hvfinc@aol.com.

Who is this Well-known American Physicist?

He was born 200 years ago on December 17th, 1797, in Albany, NY. Our bi-centurion studied meteorology at the Albany Academy, established a national system of observation stations across the U.S., and persuaded Congress to establish a Department of Meteorology. However, he is most remembered for his discoveries in magnetism. He was Professor of Natural Philosophy at the College of New Jersey (now know as Princeton University), and was elected as the First Secretary of the Smithsonian Institution, President of the AAAS, the National Academy of Sciences and the Philosophical Society of Washington, D.C., among other positions.

Family photo

Photos courtesy of the Smithsonian Institution

Give up? His name is printed below the staff box on page 2.

Do you have interesting historic photographs of physicists or meetings? Please send them to: Editor, *APS News*, One Physics Ellipse, College Park, MD 20740. We will see that they get to the Emilio Segrè Visual Archives of the Center for History of Physics Niels Bohr Library.

CAUGHT IN THE WEB

Notable additions to the APS Web Server. The APS Web Server can be found at http://www.aps.org

APS News Online latest edition

APS Committees and Governance
- APS Unified Statement on Research
- National Research Investment Act of 1998 (S.1305)

Journals
- Link Manager for Physical Review

Meetings
- March & April 1998 meetings information
- Meeting Calendar updates

Units
- DCOMP, TG on Magnetism pages updated
- FIAP Fall Newsletter & March Focus Sessions
- FHP Newsletter & March Focus Sessions
- FIP Elections page
- Online updates for unit directory added

Lettieri Promoted to APS Membership Department Manager

Patricia (Trish) Lettieri was promoted to APS Membership Department Manager in October. Trish replaced Mary Pat Paris, who joined TMA/Resources after four years with the APS. Trish has a Bachelor's Degree in Business Administration and has been working with professional associations since 1989. In 1993 Lettieri was hired as the APS Membership Marketing Coordinator and then promoted to Membership Supervisor the following year. One of her goals now as head of the Membership Department is to improve and expand APS membership benefits. She is working closely with the APS Committee on Membership to develop more services for members.

Lettieri hired a new Membership Supervisor, Donna Greene, to fill the position she vacated. Together they will be working to ensure the best possible customer service for APS members.

"I have a great membership staff and hope to accomplish a lot with them. The new anniversary billing system is working well and memberships continue to be processed throughout the year," Lettieri said. "I expect our membership to show growth over the next year as we lead into the Centennial celebration."

Physical/Biological Interface Science Awards Available

The Burroughs-Wellcome Fund is continuing its initiative to encourage the interdisciplinary training of promising graduate and postdoctoral students from the physical, chemical, and computational sciences so that they can better apply their unique knowledge and talents to biological problems. Grants of $350,000 to $500,000 per year for five years will be made to four to six institutions. The program is not intended to introduce more graduate and postdoctoral students into the research system, but rather to promote a different kind of training and a change in institutional behavior. Emphasis will be placed on supporting new programs or existing programs that will change graduate and postdoctoral training in a meaningful way, as opposed to programs seeking more funding for conventional activities already under way. Degree-granting institutions in the United States and Canada are invited to propose graduate or postdoctoral training programs, or a combination of both. Several affiliate organizations within an institution may join together to submit an application. Consortia representing several institutions also may submit applications, as long as one academic institution is prepared to oversee the program and administer the grant. Ancillary activities — such as undergraduate student research programs, faculty seed grants or invited lectures — may be included as part of the proposal. However, the program's primary emphasis is on promoting the training and research activities of graduate and postdoctoral students, rather than on supporting faculty research projects. Additional information about the Burroughs-Wellcome Awards can be found at [http://www.bwfund.org]. The deadline for submission is February 2, 1998. For application information contact: tburroughs@bwfund.org.

Seven Years of Physics at your Fingertips

Physics News Updates are free weekly synopses of exciting new advances in physics distributed via an e-mail subscription list. They are produced by Phil Schewe and Ben Stein of the AIP Public Information Division. Subscriptions to AIP's Physics News Updates e-mail distribution may be obtained by following these steps—send a message to listserv@aip.org, leave the "subject" blank, and in the letter itself specify 'add physnews.'

The entire run of *Physics News Updates* is now available in searchable form on the AIP Web site at this address: [http://www.aip.org/physnews/update]. Just type in a term or expression and up come references to items in past Updates. For example: searching for "leptoquark" hauls up two items; "steven chu" finds three hits; "DNA" results in 13. All past Updates can be viewed by going to the archives. See also Physics News Graphics [http://www.aip.org/physnews/graphics], our growing archive of physics figures, most of which accompany Update items.

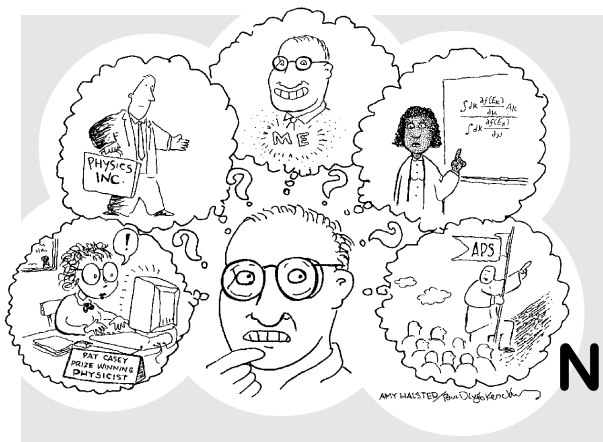
DISTINGUISHED TRAVELING LECTURER PROGRAM IN LASER SCIENCE

The APS Division of Laser Science is inviting applications from host schools for next year's awards for the Distinguished Traveling Lecturer Program. The DTL Program is intended to bring distinguished laser scientists to predominantly undergraduate colleges and universities for two-day visits, which generally include lectures and informal meetings with faculty and students.

Lecturers for the past academic year and their topics were Phil Bucksbaum (University of Michigan) on high-field laser physics, Steve Leone (JILA and University of Colorado) on chemical physics, Bill Phillips (NIST, and newly-minted Nobelist, see page 1) on atom cooling and trapping, Geraldine Richmond (University of Oregon) on surface nonlinear optics and Jagdeep Shah (AT&T Bell Labs) on quantum optics. The lecturers for the current academic year will be named soon.

Detailed and up-to-date information about the program and the application procedure is available on DLS Homepage on the World Wide Web at [http://www.physics.wm.edu/~cooke/dls/p_dtl.html].

Announcements



STOP!

THINK!

NOMINATE!

Which of your APS member colleagues do you admire most? Who shares your views and concerns? Who has the best combination of knowledge and experience to represent you and lead the APS in the right direction? Well, why not nominate the person (who could be you) to be a candidate for an elected position in the APS?

The Nominating Committee depends on APS members to propose candidates for positions elected by the membership: Vice President, Chair-Elect of the Nominating Committee and General Councillors as well as those elected by the Council: members of the Panel on Public Affairs and of the Nominating Committee.

For a nomination form contact: Amy Halsted, Administrator for Operating Committees, APS, One Physics Ellipse, College Park, MD 20740-3844, phone: (301) 209-3266; fax: (301) 209-0865; (e-mail: halsted@aps.org). Forms can also be found at http://www.aps.org/exec/nomform.html. Please provide biographical/supporting material on your nominees. The deadline is January 31.

APS/AIP CONGRESSIONAL SCIENCE FELLOWSHIPS: 1998-1999

The American Physical Society and The American Institute of Physics are currently accepting applications for their 1998-1999 Congressional Science Fellowship Programs. Fellows serve one year on the staff of a senator, representative, or congressional committee. They are afforded an opportunity to learn the legislative process and explore science policy issues from the lawmakers' perspective. In turn, Fellows may lend scientific and technical expertise to public policy issues.

QUALIFICATIONS include a Ph.D. in physics or a closely related field, a strong interest in science and technology policy and, ideally, some experience in applying scientific knowledge toward the solution of societal problems. Fellows are required to be U.S. citizens and, for the AIP Fellowship, a member of any of the AIP Member Societies at time of application. In exceptional cases, the Ph.D. requirement may be waived for applicants with compensating experience.

TERM OF APPOINTMENT for both fellowships is one year, beginning September 1, 1998, with participation in a two-week orientation in Washington, organized by the American Association for the Advancement of Science. Choice of congressional assignment is reserved to Fellows.

A STIPEND of up to $46,000 is offered, in addition to allowances for relocation, in-service travel, and health insurance premiums.

APPLICATIONS should consist of a letter of intent, a two-page resume, and three letters of reference, accompanied by a cover sheet indicating: name, address, phone, email, references, U.S. citizenship, Ph.D. status, society membership, and where you learned about the programs. All submissions should be on standard 8.5" x 11" paper, single-sided and unstapled, and should be sent directly to the address below. Candidates should state in the letter why they are applying and briefly describe their public service experience. Letters of reference should discuss not just the candidate's competence as a physicist, but also the education, experience, and attributes which would particularly qualify the candidate to serve as a Fellow. Unless otherwise specified in the letter, the applicant will be considered for both APS and AIP fellowships.

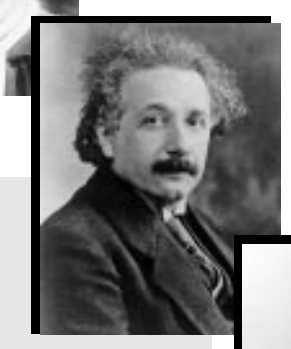
ALL APPLICATION MATERIALS MUST BE POSTMARKED BY JANUARY 15, 1998.

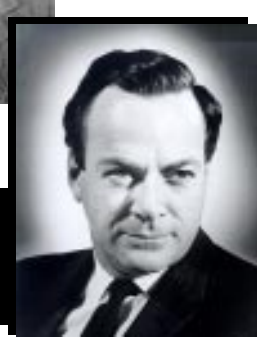
APS/AIP Congressional Science Fellowship Programs
529 14th Street, NW, Suite 1050
Washington, DC 20045
(202) 662-8700 • e-mail: opa@aps.org
APS and AIP home pages: [http://www.aps.org] and [http://www.aip.org].

Please note that other physics-related Congressional Science fellowship programs are run by The American Geophysical Union (202-462-6900) and The Optical Society of America/The Materials Research Society (contact: Gail Oare/412-367-3004). Please contact these societies directly for information on their Fellowships.

Physics Notecards Make A Unique Gift

Featuring four of the most admired physicists, these handsome notecards make a unique statement and an unusual holiday season gift





These photos come from the Emilio Segre Visual Archives, part of the world-renowned AIP Center for History of Physics. Proceeds from the sale of these cards benefit the Center and will be used to support the Center's mission *to preserve and make known the history of physics and allied sciences.*

To order, send your check (made out to the Center for History of Physics) for $10 per pack of 8 cards (2 of each photo) to: AIP Center for History of Physics
American Institute of Physics
One Physics Ellipse
College Park, MD 20740

For more information on the Center, contact us at chp@aip.org or [http://www.aip.org/history/]

APS Mass Media Fellowship Program - Summer 1998

Deadline: 15 January 1998

In affiliation with the popular AAAS program, APS will sponsor two 10-week fellowships for physics students to work full-time over the summer as reporters, researchers, and production assistants in mass media organizations nationwide.

▶ PURPOSE

The intent of the program is to improve public understanding and appreciation of science and technology and to sharpen the ability of the fellows to communicate complex technical issues to non-specialists.

▶ ELIGIBILITY

Priority will be given to graduate students in physics, or a closely related field, although applications also will be considered from outstanding undergraduate and postdoctoral researchers. Applicants should possess outstanding written and oral communication skills and a strong interest in learning about the media.

▶ STIPEND

Remuneration is $4,000, plus a travel allowance of approximately $1,000.

▶ TERM

Following an intensive three-day orientation in early June at the AAAS in Washington, winning candidates will work full-time through mid-August.

▶ SELECTION PROCESS

During February, a review committee will screen completed applications received by the January 15 deadline. Files of the four or five most qualified applicants will be submitted to host media organizations for final selection in April.

▶ TO APPLY

The following materials must be received at the address below by **JANUARY 15**:

- Completed application form (available from the program office, below, or at [http://www.aps.org/public_affairs.html])
- A copy of your résumé
- Brief sample(s) of your writing (3-5 pages on any subject, written in language understandable to the general public — no technical papers, please), on single-sided, 8 1/2" x 11" paper, unstapled
- Three letters of recommendation (to be mailed directly to the program). Two of these letters should be from faculty members; one should be a personal reference.
- Transcripts of your undergraduate and graduate work (to be mailed directly to the program)

▶ MAIL TO

APS Mass Media Fellowship Program
529 14th Street, NW, Suite 1050, Washington DC 20045
(202) 662-8700 • e-mail: opa@aps.org

THE BACK PAGE

Doctoral Education: Preparing for the Future

by Jules B. LaPidus

Virtually all discussions of graduate education involve the idea of preparing students for some kind of professional activity, that is, for jobs and careers in which they use the knowledge and skills that were the focus of their graduate education. For the most part, however, PhDs are prepared to do certain things, but not to work in any particular sector. Preparation for jobs or careers, in the sense of particular and specific training, rarely occurs. This is quite different for most master's programs, where the needs of the profession shape the majority of programs, and students are specifically prepared for professional practice.

It probably is true, particularly in the most prestigious departments, that there is a strong bias toward academic careers, specifically in research-intensive universities. But even in these cases, the only preparation for these careers will most likely be training in research. The ability to successfully carry out an independent research project has long been thought of as the primary, and perhaps the sole criterion, for obtaining a PhD With few exceptions, however, employers of PhDs assert that this is not the only thing they are looking for, and that opportunities to function as an independent investigator are increasingly limited.

The situation has all the elements of a classic mismatch, with the universities producing a highly specialized product that the employers don't want. That clearly is not the case. Academia and industry are still attracted to candidates with outstanding research credentials. Prospective employers still ask candidates to present research seminars describing their dissertation projects. But they are beginning to ask for more.

Increasingly, candidates for academic employment are being asked about their teaching experience and about their views on education, and some institutions may ask candidates to present a lecture rather than give a research seminar. Likewise, industrial employers may try to elicit a broader view of a candidate's research training, particularly as it relates to the interests of the company, than can be expressed by just examining the dissertation topic. These expectations of potential employers, coupled with constrictions in the traditional job market for PhDs, translate rather quickly into student interest in a broader approach to graduate education.

American graduate schools are very good at preparing students for research. We have prided ourselves on the ability to produce research and researchers as part of the same process. To do that, we have developed a system that involves coursework coupled with doing research under the supervision of an established researcher. Until recently, this has been a uniquely American idea. Several other countries are adopting or adapting this approach, and developing coursework components in what were formerly research-only programs.

Clearly, the research experience has to extend beyond mere technical training. Graduate education must be more than a simple apprenticeship, and research, in this context, must be more than a technical exercise for producing research results. It must be a vehicle for preparing scholars. Making students more aware of the implications of their work and how it fits into a bigger and more complex pattern, is much more difficult than teaching them how to carry out a procedure and interpret the results. It may be that if research is what you do, scholarship is the way you think about it. We know that people with graduate degrees find their way into a wide variety of jobs and careers, some by choice, some by chance, and some by default. The further away from their specific training, the greater the use of their general education, particularly the scholarly process. But this broader view is what distinguishes good graduate education from advanced training programs.

Preparing for Jobs and Careers

Graduate programs are less effective in preparing our students for jobs and/or careers. Good graduate programs produce people who are prepared to become faculty members or industrial researchers or practicing professionals in a host of fields. They have acquired knowledge and skills that make them well-suited for a variety of different positions, but they may need to be assisted in adapting to them. Regardless of the type of employment, the challenge is to make the transition smoother and more productive.

For example, preparing students for faculty positions encompasses much more than teaching. The new faculty member faces a daunting number of responsibilities: teaching advanced and undergraduate courses, doing research, getting financial support for research, directing graduate student research, advising and mentoring graduate students and assuming varied administrative and service roles. Historically there has been little preparation for any of these activities except research. Being a teaching assistant (TA) provides some exposure to teaching, but the experience is often confined to lower-level courses, and has not usually been thought of in terms of faculty preparation.

A number of universities have developed programs to introduce graduate students to the full range of faculty life. The Preparing Future Faculty (PFF) program, administered by the Council of Graduate Schools and Association of American Colleges and Universities is perhaps the most extensive. This program deals with the realities of being a faculty member in the variety of settings that constitute the academic job market.

Preparation for industrial careers has been even less structured. A number of institutions, in collaboration with industrial partners, have developed internships for doctoral and in some cases, postdoctoral candidates. In 1974, the Teaching Company Scheme was initiated in Great Britain. This has mainly involved engineering students but has been expanding to include other fields. In the U.S., a good example is the 'Externship' program in the MIT physics department. During the past few years, there has been increasing interest in reshaping the master's degree in the sciences to serve as a useful credential, particularly for industrial employment. This has been quite successful in Japan, and has been tried sporadically in the U.S.

Post-baccalaureate certificate programs are a rapidly growing but poorly defined area of graduate education. Certificates are offered by many kinds of organizations, including universities, companies and professional societies, for varying time periods and with different objectives. Sometimes these programs are designed to meet the needs of specific employers, or to satisfy continuing education requirements. Many deal primarily with professional updating, and provide information and technical training. They may be ideally suited for programming in electronic formats such as the Internet, compressed TV, or video cassette courseware.

Reforming Graduate Education

Several qualitatively different approaches are being suggested for improving the education of graduate students. Brief descriptions of a number of these appear on the website of the Association of Graduate Schools of the Association of American Universities [http://www-ags.ucsd.edu/ags.html]. Generally speaking, these approaches fall into several well defined categories.

A. Universities are trying to provide better information about jobs and the job market. Career services and career development offices usually have been geared to the needs of undergraduate students. Brown, Cal Tech, Princeton, and the University of Pennsylvania are among those that have developed specialized services of this type for graduate students.

B. Seminars or workshops on the relationship of graduate education to particular fields, and on how graduate education relates to work, are being offered at some universities, including Emory, Rutgers, Ohio State, University of California at Berkeley and Vanderbilt. The University of Alabama at Birmingham has developed a workshop on career development for the life sciences that addresses both academic and non-academic careers, as well as a monthly forum that brings in outside speakers to discuss unusual kinds of careers.

C. A number of universities are considering program modifications that will add more academic content. One method is to develop minors or collections of courses in closely related areas, e.g. molecular biology for organic chemists, economics for political scientists or computer science for physicists. The idea is to broaden the scope, but stay close to the student's major field of study. For example, Brown University has added an option for a second master's degree in a field related to the doctoral field, and Tulane is encouraging physics and astronomy students to take elective courses in computer science, engineering or finance.

Another option is to develop area studies options in very broad but related areas. The idea is to retain your expertise, but to relate it to a certain context or area of interest. The University of Colorado at Boulder has added interdisciplinary certificate programs in fields such as environmental policy and telecommunications.

Some institutions have developed courses, master's or certificate programs in presumably unrelated areas. In this case, the student is developing options that utilize the primary area as it applies to something else, for example, sales, writing or K-12 teaching. Penn State, Nebraska and Florida all offer combined or dual degree programs involving an MBA coupled with either a PhD or a master's degree. Cornell and others have developed 12-month MBA programs for scientists interested in business careers. Washington University and Wayne State have developed options whereby doctoral students can become certified to teach in the primary and secondary schools.

Other schools are developing programs similar to the Master of Research (MRes) degree recently initiated in the U.K. Students from different disciplines are brought together to discuss and dissect research in a number of fields. This kind of approach emphasizes multidisciplinary aspects of problem solving. A modification would be to have all graduate students participate in a research seminar that is multidisciplinary. Real world problems would be discussed, and students might work in groups and/or react to speakers. The emphasis would be on scholarly approaches to evaluating evidence, posing questions and suggesting ways to find answers.

Conclusion

All of the above suggestions are reasonable, and all suffer from the same drawback: they take time and increase the workload for students and faculty alike. But they hold out the promise of enhancing both the education and the career prospects of students. Graduate education, viewed in the broadest perspective, transcends departments and disciplines because the assumptions upon which it is based have more to do with the level of education than with the particular subject area in question. Whether it be physics or classics, the kinds of program modifications now being considered can be effective in improving the graduate educational experience of students and faculty alike.

Unfortunately, it is all too easy for departments or programs to become isolated to the point where they are not aware of good ideas from elsewhere that could be adapted to their own use, and are unable to share their good ideas with others. Graduate schools serve to create the linkages, to open the system and to focus the attention of the graduate faculty on the education of graduate students.

We have moved a long way from the one student, one professor, one research project concept of doctoral education, and are beginning to understand that graduate education should be designed to prepare students for a variety of roles and responsibilities. A broader and more realistic view of graduate education is emerging, one that is consistent not only with the size and scope of the current enterprise, but with the state of education, work, society and scholarship as we prepare to enter the 21st century.

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