APS NEWS

FEBRUARY 1996 | THE AMERICAN PHYSICAL SOCIETY | VOLUME 5, NO 2

Special Programming Planned for 1996 March and Spring Meetings

1996 March General Meeting — St. Louis, MO

Job Market, Science Policy Featured

On 1 December 1995, the deadline for the 1996 March Meeting arrived, and along with it, some 4,400 contributed papers. Together with the over 500 invited presentations that had previously been decided on, this turnout promises to make the 1996 March Meeting one of the largest ever. The meeting will take place at the Cervantes Convention Center in St. Louis, which, fortunately, can house the entire program under one roof. (This has not always been the case).

Over 86 percent of the contributed abstracts came in via the new electronic abstract submission process, demonstrating clearly that such a method of submitting papers to meetings was long overdue. For a look at the complete program, go to the APS Home Page (http://aps.org), under Meeting Programs.

Along with the traditional technical programs made up of the contributed papers and invited symposia, there will be a number of sessions devoted to non-technical topics, and less formal presentations. On Monday morning, 18 March, the Forum on Physics and Society and the Forum on Education will be presenting a panel and open forum on "Science Policy in an Era of Political Change", which will feature speakers from the political arena. Along similar lines, the Forum on International Physics has a session entitled "The Changing International Environment for Science" on Tuesday morning, 19 March.

There will be several sessions concerning the current job market in physics. On Sunday evening, 17 March, the Forum on Physics and Society will be jointly sponsoring a session with the Forum on Education and the Forum on Industrial and Applied Physics, entitled, "Jobs and Education: A Progress Report and Open Forum." On Monday, 18 March, the Forum on Education (FED) will be sponsoring a symposium entitled "Beating Today's Job Market." As always, the APS will be running a career placement service at the registration desk, with the assistance of the American Institute of Physics' Career Services Division. APS has also arranged a free career workshop run by AIP on Sunday, 17 March.

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1996 May APS/AAPT Meeting — Indianapolis, IN

High Level Unified Physics Featured in Indianapolis

The Joint Meeting of the APS and the American Association of Physics Teachers will be held in Indianapolis, 2-5 May 1996. Planners anticipate the highest attendance at this meeting in many years, due not only to its central location and weekend schedule, but to changes in the program structure and a list of very impressive speakers.

Martin Perl (1995 Nobel Prize winner) will be speaking at the meeting. Kip Thorne, the 1995 Julius E. Lilienfeld Prize recipient will be delivering a talk at the Unity of Physics session on Friday, 3 May, as will Carl Wieman, who will be talking about recent results in Bose-Einstein condensation.

Part of the mission of the meeting is to emphasize the unity of the discipline of physics. Toward that end, on Thursday evening, there will be a special tri-divisional colloquium, organized by the Divisions of Nuclear Physics (DNP), Astrophysics (DAP), and Particles and Fields (DPF), entitled "Shadows of Creation: Dark Matter in the Universe" (see IN BRIEF). On Friday, the Unity of Physics session will also feature the retiring APS Presidential address of C. Kumar N. Patel. The DNP and DAP have organized a special memorial session on William A. ("Willie") Fowler for Friday evening.

The unity of physics is further emphasized by the annual meetings of three APS divisions coming together in Indianapolis: the DAP, Physics of Beams (DPB), Computational Physics (DCOMP) and the new Topical Group on Gravitation. Each division has its own specialized symposia, as well as sessions cosponsored and organized by other units of the APS. Some of those sessions are: Precision Experiments in Gravitation; Measuring Fundamental Properties of Complex Materials; Futures of Renewable Energy: Efficiency, Fission, and Fusion; and Particle Beam Processing of Materials.

Other joint sessions include Computations in Beam Physics; Synchrotron Radiation; High Energy Accelerators - Present and Near Term Future; Intense Beams; Beam

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APS 1995 President, C. Kumar N. Patel (right), and AAPT Past President, Howard G. Voss (left), share a moment of congratulations during the November 18 launch of The Campaign for Physics, a joint science education reform initiative which has raised $3.5 million to date.

Council Takes Stand on Helium Conservation

At its November 1995 meeting, the APS Council adopted a strongly worded statement calling for measures to conserve and enhance the nation's helium reserves. Drafted by the APS Panel on Public Affairs, the action was prompted by pending legislation that would require the nation's helium reserves to be sold off by 2015.

"In the rush to downsize government, the helium program has become a metaphor for 'boondoggle' among politicians who associate it with blimps and party balloons," said Robert L. Park, APS director of public affairs, in the December 8 issue of "What's New," the Society's weekly electronic opinion newsletter. "There is scant awareness of helium's growing cryogenic uses, or of its rapid depletion."

Helium is a constituent of natural gas from a few "helium-rich" fields in the U.S. Only about half of the helium in the gas pumped from these wells is extracted to supply current demand. The rest is irretrievably lost to the atmosphere when the methane is burned. Thus, the exhaustion of our helium is determined less by helium usage than by natural gas demand, which is very high. These helium-rich fields are being rapidly depleted.

The federal government does maintain a helium reserve that could supply the current market demand for about ten years, but demand is growing at about 10% per year. Unfortunately, current legislation aimed at balancing the budget, calls for selling off even this meager reserve by the year 2015 — about the time the helium rich fields will be exhausted.

The text of the APS statement follows.

The American Physical Society is profoundly concerned about the potential loss of the nation's accumulated helium reserves. Helium is essential for achieving the extremely cold temperatures required by many current and emerging technologies, as well as for advanced scientific research. The overall demand for helium has been steadily increasing, and there is every reason to believe that this trend will continue.

Although the United States is fortunate in having a greater abundance of this critical element than any other nation, the supply has severe natural limits. Helium is economically extracted from natural gas. If not extracted, the helium is irretrievably lost to the atmosphere when the gas is burned. For this reason, the federal government prudently established a storage program for helium, but legislation now being considered would dispose of virtually this entire helium store within two decades.

In view of the importance of this unique and irreplaceable natural resource to modern science and technology, The American Physical Society urges that measures be adopted that will both conserve and enhance the nation's helium reserves. Failure to do so would not only be wasteful, but would be economically and technologically short-sighted.

IN THIS ISSUE

Novel Plasma Applications Highlight 1995 DPP Meeting

More than 1,200 plasma scientists gathered in Louisville, Kentucky to hear about the latest in plasma applications, as well as plasma transport, laser plasmas, fusion and the magnetohydrodynamic (MHD) process, during the 37th annual meeting of the APS Division of Plasma Physics (DPP), held 6-10 November. Over 1,450 papers were presented, including five review and prize addresses and 58 invited talks. There were three special evening symposia featured a panel discussion on challenges to physics graduate education, future directions in plasma physics and fusion research, and short-pulse lasers and wakefields.

In addition, the DPP program included sessions on: career/employment issues, including one focusing on mid-career changes; science education; public outreach; government science policy; women in plasma physics; and human rights, among others.

Plasma Applications. Researchers at the Princeton Plasma Physics Laboratory, in conjunction with the Charged Injection Corporation (CIC), have been working on electrostatic atomization and its applications to fuel injection, paint spray, and agriculture, among other areas. The team analyzed charged droplet sprays generated by a simple capillary source — using a quadrupole mass spectrometer and a charge detector — and found that the droplet distribution shows complex mono- and multimodal distributions for a given charge-to-mass ratio. In addition to the atomization experiment, an extensive numerical modeling effort was made to help develop electrostatic sprays at unlimited flow rates with arbitrary droplet sizes.

Improvements in plasma processing — in which a partially ionized gas is used for semiconductor etching reactions — continue to increase the technique's applicability to the industry. Scientists at the University of Wisconsin, Madison carried out a series of etching experiments in three types of electrodeless high-density, low-pressure etch tools plasma sources: electron cyclotron resonance, inductively coupled and helicon etching tools.

Although the physical processes resulting in ionization and electron heating in the three sources are quite different, the results showed that the etch rate process is identical for the three tools when viewed from the wafer sheath boundary. "In a real sense, the etch rate does not depend on the plasma source when high density-low pressure sources are employed," said group leader Noah Hershkowitz. "Major differences in tool etch characteristics are more likely determined by tool wall material, chemistry, and geometry."

Francis Chen of the University of California, Los Angeles, receipient of the 1995 APS Maxwell Prize, reported that new high-density RF plasma sources are needed for the fabrication of the next generation of computer chips, which will be faster and smaller, requiring more exacting processing techniques. The newest of these is the helicon source, based on low-frequency whistler waves.

The pulsed laser ablation technique for deposition of thin films has proven extremely successful at growing high-quality films of very complex and novel materials, such as high-temperature superconducting compounds and diamond-like carbon. Modeling this can be difficult because of the complex physics involved, including laser-solid interactions at the target, plasma formation off the target, vapor/plasma plume transport towards the deposition substrate, and plume-solid interactions at the substrate. Scientists at Oak Ridge National Laboratory (ORNL) have developed a global physics and computational approach to the laser ablation process.

While the team concentrated on silicon to experimentally confirm their models, ORNL's Jean-Noel Leboeuf said, "the application of our physics results go beyond silicon, given the universality of many experimental observations, such as plume splitting, for a wide variety of laser-ablated materials, including carbon, copper, or yttrium."

Transport and Self-Organization. Chaotic radial transport plays a central role in the formation and evolution of energetic particle populations trapped in planetary magnetospheres. A recent experiment at Columbia University used electron-cyclotron resonance heating to create a localized population of magnetically trapped, energetic electrons which periodically became unstable. The observed instabilities drove electrostatic fluctuations, which in turn resonated with the precessional drift motion of energetic electronics. They found that increases in the flux of energized electrons to the detector occurred only when fluctuations which met the conditions for global chaos were present, according to Columbia's Harry Warren. Furthermore, transport simulations indicated that the particle motion is strongly chaotic. Quasilinear models do not reproduce several important features of the experimental measurements.

Scientists at Oak Ridge National Laboratory have developed a model for transport based on the concept of self-organized criticality (SOC). The model seeks to describe the dynamics of the transport without relying on the underlying local fluctuation mechanisms, according to ORNL's D.E. Newman. The dominant scales are system sizes rather than the underlying local fluctuation scales.

Reverse Shear Discharges. A promising operating scenario for the next generation of high-performance non-inductively driven tokamaks is the use of plasma discharges with reverse central magnetic shear. This allows access to the second stability regime, which has produced high values of beta in previous experiments. Recently, Princeton Plasma Physics Laboratory (TFTR) and General Atomic (DIII-D) tokamak researchers performed experimental investigations in this regime in an attempt to improve tokamak plasma confinement and stability at high beta. The effects are dramatic. The particle confinement is enhanced, the thermal losses are reduced by a factor of over 40, and the central density increases by a factor of 3 in the shear-reversed region in TFTR. Future emphasis, say fusion scientists, will be to extend the volume of the reversed-shear regime.

Inertial Fusion. Understanding drive symmetry in gas-filled hohlraums is currently of interest because the baseline design of the indirect drive ignition target for the planned National Ignition Facility (NIF) uses such a device. Scientists at the Nova laser facility at Lawrence Livermore National Laboratory conducted a series of symmetry measurement experiments using thin wall gold hohlraums filled with methane or propane gas, in which the gas serves to tamp the motion of the gold ablating from the hohlraum walls, reducing spot motion and swings in drive symmetry. The results showed that the gas is effective in impeding the motion of the wall blowoff material, and that the resulting implosion performance of the capsule is not significantly degraded from vacuum result. The LLNL team also obtained data on neutron yield, implosion time, and spectroscopy of argon emission from the imploded core.

Laser Plasma. Researchers at the University of Maryland have successfully demonstrated the channeling of intense laser pulses over distances much greater than a Rayleigh length. They used a two-pulse technique in which the first pulse prepares a shock driven, axially-extended radial electron density profile which guides the second pulse, injected after an adjustable delay, according to group leader H.M. Milchberg.

Livermore's L.B. Da Silva has found that the reliability and characteristics of collisionally pumped soft x-ray lasers make them ideal for a wide variety of plasma diagnostics. His team has used x-ray lasers to probe high-density, laser-produced plasmas by taking advantage of recently developed multilayer beamsplitters to construct an interferometer operating at 255 angstroms. They have also combined x-ray lasers with a multilayer imaging system to study hydrodynamic imprinting of

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Editor: **Barrett H. Ripin**
Newswriter: **Jennifer Ouellette**
Production: **Elizabeth Buchan-Higgins**
Coordinator: **Amy Halsted**

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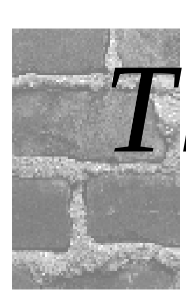

Thank you!

Thank you to all the members who participated in our 1995 Member-Get-A-Member Campaign. The campaign was a success with 244 members each recruiting a colleague and a total of 300 new members recruited. There were 38 members who recruited two or more colleagues. APS will announce the winners of the Member-Get-A-Member grand prizes in the March issue of *APS News*.

The following members participated in the Member-Get-A-Member Campaign by recruiting one or more new members. This list includes entries from November 25 through December 31, 1995.

Roslan Abd Shukor*	Gary D. Doolen	Nancy M. Haegel	Vittorio Pellegrini
E. Antonoyiannakis	Victor D. Elvira	W.H. Harless, Jr.	Karsten Pohl
Jose M. Barandiaran	Andreas Fledderjohann	Edson L.B.Justiniano	Daniel Prober
Ravindra Nautam Bhatt*	W. Matthew Foulkes	Anzor A. Khelashvili	Denis L. Rousseau
Charles D. Bloch	R. Garfagnini	Darmadi Kusno*	Siddharth S. Saxena
Juan L. Cabrera	Ross Garrett	Jeng-Mei Liu*	Michael H. Shaevitz
Francisco J. Chinea*	Nevin D. Gibson	Gloria B. Lubkin	Gerald J. Smith
Janet M. Conrad	Steven M. Girvin	Nestor E. Massa	Jared P. Squire
James P. Crawford	John L. Gland	Jon M. Meese	David Tomanek
Beth Anne Cunningham	Javier Guevara*	Yasuhide Minonishi*	Jesse L. Weil
Cosmin Deciu*	Gonzalo J.Gutierrez*	Shyamal Nath	Bogdan Wojtsekhowski
Manhar Ramji Dhanak	Peter A. Hackett	Ji-Yong Park*	

* These individuals recruited more than one new member.

Council Approves Mass Media Fellowship Program

In November, the APS Council approved a proposal from the Forum on Education (FED) to establish an APS Mass Media Fellowship program to enable advanced physics students to spend up to three months working in the mass media. Its purpose is to improve communication and mutual understanding between physicists and the media, thus leading to better coverage and more accurate reporting of scientific topics and increased scientific literacy of the general public. The program will be administratively coordinated with a similar existing program of the American Association for the Advancement of Science (AAAS).

Initially, the fellowships will be for two physicists in early stages of their careers, according to David Bodansky, chair of the APS Panel on Public Affairs, which endorsed the proposal. The cost of the program was estimated at $16,000 per year; following a three-year trial period, Council will re-evaluate the program and determine whether it should be continued.

"Physicists generally agree that the public doesn't understand or appreciate physics research," said FED Chair Ruth Howes (Ball State University). "Frequently we contrast inadequate media coverage of physics research with high quality coverage of astronomy or medical research." A forum subcommittee charged with exploring the possibility of media fellowships concluded that the best course of action for the APS would be to follow a model similar to that used for its Congressional Fellowship program.

"The AAAS fellowship program has proven itself effective in strengthening the connections between scientists and the mass media," said Howes of the reasons for operating within the AAAS' existing infrastructure. Now in its 20th year, the AAAS Mass Media Science and Engineering Fellowship Program supports 15-20 advanced science and engineering students for 10 weeks during the summer as reporters, researchers and production assistants in print and broadcast mass media organizations nationwide. The fellows are provided with an intensive orientation and assigned to participating media organizations through a network of AAAS contacts.

It is estimated that about half of the AAAS program participants have found employment in the media following their fellowships, while the others pursued careers in science and engineering. The program also provides a model for internships in which physics graduate students are encouraged to broadcast their training, and could serve as a model for other types of programs, such as industrial fellowships.

MEMBER IN THE Spotlight

Ugo Fano To Receive Presidential Fermi Award

President Clinton announced in December that Ugo Fano is one of two recipients of the 1995 Enrico Fermi Award. A long-standing APS fellow and Associate Editor of *Reviews of Modern Physics*, Fano is professor emeritus of physics at the University of Chicago. The other recipient, Martin Kamen, a chemist, is professor emeritus at the University of California at San Diego and at the University of Southern California. Each recipient will receive a $100,000 honorarium and a gold medal.

The Fermi Award, which dates to 1956, honors the memory of Enrico Fermi. The honor is the government's oldest science and technology award and is granted for a lifetime of achievement in the field of nuclear energy.

Fano, 83, will receive the award for pioneering contributions to the theory of atomic and radiation physics, work that has had great implications for the field of nuclear medicine. Kamen, 82, will receive the award for his discovery of Carbon-14 and his development of its use as a tracer atom.

Fano is one of the last living students of Enrico Fermi. Fano's research has been important to the development of both the gas laser — now used in virtually all the physical and biological sciences — and radiation diagnostic and therapeutic medical applications. These developments were aided by Fano's work to achieve a deeper understanding of the structure of atoms and molecules and the ways they interact with light, electrons and each other.

Born in Torino, Italy, Fano earned his doctorate in mathematics at the University of Torino. His postdoctoral work with Fermi was at the University of Rome and with Werner Heisenberg at the University of Leipzig. After emigrating to the United States in 1939, he was employed at the Washington Biophysical Institute, the Carnegie Institution and the National Bureau of Standards. He has been at the University of Chicago since 1966.

President Clinton approved the Fermi awards upon the recommendation of Secretary of Energy Hazel R. O'Leary. The Department of Energy administers the Fermi Award for the White House. Secretary O'Leary will present the awards in a ceremony in Washington, D.C. at a date to be announced.

CIFS to Petition China

At the March and May meetings the Society's Committee on the International Freedom of Scientists (CIFS) will be co-sponsoring a petition signing station with the New York-based Committee of Concerned Scientists. The petition will be on behalf of imprisoned physicists and scientists in the People's Republic of China and will be sent to China's President Jiang Zemin and Premier Li Peng. A reception to kick off the signature drive will be held at 6 o'clock on the evening of Sunday March 17, 1996. All March meeting participants are invited to attend. CIFS encourages those attending the March or May meeting to look for and sign the petition. It will be accessible in the registration area. Your support is greatly appreciated!

IN BRIEF

- At its November meeting, the APS Council approved a proposal for the APS to join The Science Coalition, a Washington, DC based organization working to identify and demonstrate support for basic research to Members of Congress, the Administration, the media, and the general public. The APS joins some 200 leaders, companies, associations and universities committed to sustaining the federal government's historic commitment to U.S. world leadership in basic science research. There is no membership fee, and participation in Coalition activities is strictly voluntary. Activities include meeting with Congressional representatives in Washington and in local district offices, as well as participation in letter-writing campaigns, and local or national media activities. Although the APS, like many organizations, is already engaged in stressing the importance of basic research, The Science Coalition is intended to create an additional support network to help the many diverse interested parties to coordinate their efforts.

- Three APS divisions — Astrophysics, Nuclear Physics, and Particles and Fields — will jointly sponsor a special colloquim for general audiences on the evening of May 2, in conjunction with the 1996 APS/AAPT Joint Meeting in Indianapolis. The talks are intended to provide an introduction to three important issues in nuclear and particle astrophysics: big bang nucleosynthesis and the dark matter problem, the solar neutrino puzzle, and the microwave background as a probe of cosmological models. David Schramm (University of Chicago) will address key problems in physical cosmology today, including the nature of dark matter. Hamish Robertson (University of Washington) will describe recent experimental results indicating a pattern of solar neutrino fluxes that is inconsistent with predictions. Paul Steinhardt (University of Pennsylvania) will explain how measurements of the cosmic background radiation can be used to test cosmological models.

- The APS Division of Biological Physics (DBP) has compiled a directory of graduate opportunities in biological physics, available electronically on its home page on the World Wide Web. According to DBP Past Chair Stuart Lindsay (Arizona State University), the division has been ruminating on the production of a brochure explaining biological physics for some years, with the goal of attracting students to the field. However, producing something for such a very diverse group proved too difficult, and the division decided to circumvent the problems of printing costs and obsolescence by posting a directory of graduate opportunities on the World Wide Web. Frank Moss (University of Missouri), a DBP Executive Committee member, compiled the listing from entries in AIP publications, and Lindsay formatted the resulting text. "We hope that it will be a dynamic listing, kept up to date by email from the users, and that it will play a role in introducing students to the exciting research areas in biophysics," said Lindsay.

- The APS Laser Science Topical Group has become the Division of Laser Science, after maintaining a membership exceeding 3 percent of the total APS membership for two consecutive years and approval by the APS Council. A special election will be held this year to elect the new divisions first councillor. According to Chair Patricia Dehmer (U.S. Department of Energy), the unit has developed into a focal point for laser science within the Society, and is unique among the APS units in that it is both broadly multidisciplinary and interactive with other professional societies. Its annual joint meeting with the Optical Society of America includes invited and contributed papers in chemistry, physics, biosciences, medicine, nonlinear optics, ultrafast phenomena, and instrumentation, with attendees from all research sectors: academia, industry, and government laboratories.

- The newly-approved APS Division of Laser Science has selected its traveling lecturers for 1996-1997. The program's purpose is to bring distinguished scientists to predominantly undergraduate colleges and universities in order to convey the excitement of laser science to undergraduate students. The lecturers will visit selected academic institutions for two days, during which time they will give a public lecture open to the entire academic community, and meet informally with students and faculty. They may also give guest lectures in classes related to laser science. A selection committee decides on host institutions, giving priority to those not located in major metropolitan areas and lacking extensive resources for similar programs. The 1996-1997 lecturers and their topics are Geraldine Richmond (University of Oregon), surface nonlinear optics; Jagdeep Shah (AT&T Bell Laboratories), quantum optics; Stephen Leone (JILA/ University of Colorado), chemical physics; Philip Bucksbaum (University of Michigan), high-field laser physics; and Bill Phillips (NIST), atom cooling and trapping.

- In December, APS Past President C. Kumar N. Patel (University of California, Los Angeles) forwarded a letter to the president of the Chinese Physical Society expressing the APS Council's concern that the Memorandum of Understanding (MOU) between the two societies is not being satisfactorily implemented, particularly with respect to the enrollment of Chinese institutional and university libraries in the Library Outreach Program. The Council resolved that if substantial progress is not made within the coming year, it will abrogate the agreement, acting on the appropriate recommendation from the APS Committee on the International Freedom of Scientists and the Committee on International Scientific Affairs.

OPINION

APS VIEWS

The Not-So-Silent Physicists

by Robert Park, APS Director of Public Information

A story in this issue of *APS News* discusses the statement on "Conservation of Helium" adopted by the APS Council at its meeting on November 19, 1995. It was a bold action, calling for conservation and enhancement of the nation's helium reserves at a time when pending legislation calls for abolishing the reserve. Faced with the prospect of severe cuts in science spending over the next seven years, most scientific groups have been reluctant to speak out on issues that might offend powerful members of Congress. But silence carries its own risk.

Most political leaders share in the general scientific illiteracy of the public. Their decisions on scientific and technical issues, therefore, should be informed by the views of the scientists. Alas, the scientific community has been notoriously timid about letting its views be known on controversial issues. This is particularly true in the case of what might be termed "politically motivated science projects," that is, projects that are funded primarily because they address particular political objectives, rather than because of their promise in advancing scientific understanding. The prevailing view seems to be that nothing is to be gained, and much might be lost, by speaking out on the scientific merits of such projects.

The "nothing-to-be-gained" argument contends that funds taken from these politically motivated projects will not go to more worthy science, but will be lost to science altogether. It's a seriously flawed argument. Funding is limited. In opposing politically motivated projects, scientists aren't looking for a transfusion, they're trying to stop the bleeding. The "much-might-be-lost" argument holds that opposition to politically popular programs risks alienating powerful members of Congress who may otherwise be friends of science. But taking a position based on the temporary occupants of political office is short sighted and foolish. Nevertheless, these arguments have intimidated much of the scientific community.

Not so the physicists. In 1991, ignoring veiled threats of retaliation, the Council adopted a position on the manned space station stating that, "Scientific justification is lacking for a manned space station in Earth orbit." The statements of the Society are reviewed each year by the Panel on Public Affairs to see if they should be retained, reaffirmed or discarded. The space station statement remains the position of the Society today.

Not all statements of the Council are politically sensitive of course, but they are generally controversial, otherwise there would be little point in issuing them. The Council has spoken out on scientific integrity, power line fields and public health, employment opportunities for physicists, the imprisonment of Chinese physicists, creationism, government censorship, billboards in space and a host of other issues of concern to physicists and to society. The Council takes its responsibility seriously, and the most controversial statements are frequently returned to committee for further study the first time they come up. To even be considered by Council, a statement must either deal with an issue of special importance to the physics community, such as freedom of scientific communication, or with an issue of importance to society about which physicists have special knowledge, such as nuclear energy.

But does issuing a statement do any good? It may. Often a statement coming from a respected scientific organization such as the APS is news in itself. The APS statement on power line fields and public health, for example, was covered by the New York Times. The story was reprinted in newspapers all across the country. Eventually it was picked up by dozens of trade journals and newsletters. It was the subject of talk-show debates and numerous media interviews. For weeks, the Washington Office of the APS was hard pressed to supply the huge demand for copies of the statement.

Did it change anything? Perhaps. It was the first time a major scientific society had weighed in on the issue, and it seems to have put the ill-informed fear mongers on the defensive for the first time. Interestingly, physicists were concerned that perhaps it would be more appropriate for the biological community to comment. But when biological societies were asked if they planned to issue similar statements, they responded that they couldn't because they didn't understand the physics.

Even when the statement itself is not news, it allows the APS President to speak with the full weight of the Society behind him. APS Presidents are frequently asked to testify before Congress, for example. It also provides clear guidance to the Washington Office in responding to the frequently asked question: "What do the physicists think about this?"

Correction

In the article on APS Presidents and the Nobel Prize (in the January issue of *APS News*) , we mistakenly identified Robert R. Wilson (APS President, 1985) as the winner of the Nobel Prize in 1978. The 1978 Nobel Prize went to Robert W. Wilson (along with Arno Penzias) for "work that made it possible to obtain information about cosmic processes that took place a very long time ago, at the time of the creation of the universe." R.W. Wilson did not serve as APS President — although it would have been nice if he had. We have also been informed that the first APS President would have preferred his name spelled Albert Michelson.

LETTERS

About: *What Has Happened to Research at Independent Laboratories?* (Back Page, *APS News*, December 1995)

I would like to applaud Alan Fowler's article, "What Has Happened to Research at Industrial Laboratories?" Fowler correctly points out that a successful economy cannot be sustained without continued investment in basic research. I share this view, but feel that it is becoming a minority viewpoint within the physics community.

It seems that physicists have been acquiescing to what I feel is a growing "political correctness" imposed upon (and increasingly accepted by) physicists. This political correctness brands basic research as a luxury that does not pay for itself, and glorifies applied research and incremental improvements in products and understanding. Fowler describes incremental improvements precisely when he states, "No matter how successful incremental improvements are in the short term, if pursued exclusively, they lead to disaster in the long term."

Basic research should be aggressively funded by the federal government because it is the raw material from which technologies are built. The laser and the transistor are just two examples of technologies which have transformed society, and which could not have been conceived of without the basic understanding of matter and energy which basic research provided. Product development and applied research are equally important and should be pursued just as aggressively.

However, applied research should be done in industry, since companies are eminently better prepared and motivated to do such work than universities or federal laboratories. Basic research, on the other hand, will always find a limited role in industry since the quarterly time scale upon which companies must operate makes the decades-long time scale of basic research untenable. Thus, the federal government is the only institution capable of funding the basic research effort which will provide the knowledge and understanding necessary for the development of new technologies.

The community of physicists seems to want funding for basic research. It is, however, reticent in stating its case forcefully. Rather, we tend to move along with the political winds even when we feel the direction is wrong. More and more, physicists are adopting the view that the pursuit of basic research is hedonistic. It is my hope that this trend will reverse itself and that physicists will cease to apologize for their success and demand funding for basic research — not because it is deserved, but because it is necessary.

Let us be clear: the transistor is not the last scientific discover which will transform the human race. Other profound and fundamental discoveries await. The important question is not whether these discoveries will occur, but where.

John R. Saylor
Naval Research Laboratory

Alan B. Fowler's thoughtful analysis of the changing research climate in our country with respect to industrial research labs has one startling omission from its considerations: research at the multi-disciplinary national laboratories. Although single-purpose labs might well be excluded as too narrowly focused, laboratories such as ours (Los Alamos, but there are at least half a dozen to which this applies) are extremely well suited "to dig into an innovation on the three-to-10 year span," as evidenced by many and recent successful product creations and transfers to industry. We are "particularly adept at the cross-disciplinary efforts required" that Fowler finds lacking at universities.

Fowler is correct that political considerations do not presently favor the application of government labs in this way. However, the industries that are abandoning long-term research due to unavoidable market pressures must also realize that the "worthless" basic patents need to come from somewhere nearby if they are to avoid the "disaster in the long term" to which Fowler refers. It therefore behooves Fowler, and our industrial leaders, to affirm publicly that when the multi-disciplinary laboratories volunteer for this work, that does indeed represent a valid concern for our country's future and not simply institutional self-interests.

Terry Goldman
Los Alamos National Laboratory

Alan Fowler's article entitled, "What Has Happened To Research at Industrial Laboratories?" raised fundamental questions concerning the short-term focus of industrial research and the deterioration of basic research at Bell Labs, IBM, and elsewhere. However, Mr. Fowler failed to articulate any solution, except to bemoan the poor support for patent rights and research funding in Congress. Oddly, physicists seem to enjoy a fatalistic attitude toward the possibility of positive change.

During the past year, as an APS Congressional Science Fellow, I have worked on legislation (H.R. 359) to establish a patent term of 17 years from grant, or 20 years from filing, whichever is longer. Such a formula would protect breakthrough innovations, which often take five to 10 years to be processed by the Patent Office and are therefore disadvantaged by the newly instituted 20-years-from-filing term.

Just as importantly, it would help to turn around the short-term mind set which has destroyed basic research efforts at large companies like IBM over the past few years. Those companies are being run by foolish corporatists who believe that there is no need or opportunity for fundamental research and new inventions. In fact, IBM has been one of the strongest opponents of H.R. 359. This

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OPINION

LETTERS

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is not surprising in light of their abandonment of basic research in recent years, as Dr. Fowler noted.

Universities and inventor groups have strongly supported H.R. 359 and opposed further weakening of American patent rights. The scientific community has been either silent or needlessly temporizing. It is clear that over dependence on government funding has blinded scientists to the possibilities for research funding in the private sector. The decimation of industrial laboratories proceeded while physicists and others wrung their hands on the sidelines, just as patent protections are being undermined today with our silent acquiescence.

Almost every politician wants to be perceived as being "pro-science" and in favor of progress in research and development. Instead of complaining at afternoon tea about how bad things have become, physicists should get into the habit of letting their elected representatives know about what it important to the scientific community. That implies support for basic research, strong patent protections, and incentives for the rebuilding of the nation's industrial laboratory infrastructure.

John Morgan
Washington, DC

Morgan was an APS Congressional Fellow in 1995 in Rep. Dana Rohrabacher's Office

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Alan Fowler has aptly described the apparently dwindling prospects for American industrial — and academic — physics. I would like to suggest at least a rosier light at the end of the tunnel.

The "pure" versus "applied" dichotomy is surely delusory (even though these are convenient categories for politicians). For example the canonical exhibit, the transistor, evolved from 1949 into today's "silicon empire" by a long, intimate interplay of physics, chemistry and engineering lore. Today's outpouring of discovery and invention is, clearly, owing to the powerful synergy of a like variety of disciplines and efforts. Our problem is not downsizing in itself, but the threatened decline of this broad and deep scientific culture, in which the diversity of research institutions, including industrial, and the ready movement of scientists and ideas between them, is a notable aspect.

The "bottom line now" spirit in industry, that Fowler describes, seems an instance of game theory's Prisoner's Dilemma. Any one enterprise, by dropping out of contributing to the science culture, can still to an extent benefit from its existence; but only so long as the others stay the course. Otherwise, all may elect to be impoverished in concert. The challenge is for government to contrive a dispensation where the prosperous alternative, with industry broadly participating together with academia and the public laboratories, prevails — though such interventions may not be possible during a reign of economic fundamentalists in Congress.

There is indeed "a dance in the old girl yet." The sciences today are enjoying a remarkable innovative vitality and speed of advance. My choice of exemplar is the technology and uses of atomic-scale observation and atomic manipulation at solid surfaces. In a few years since the first STMs, we have a growing capability to "see" via probe force and sensed electron density and "near field" light, elaborated by spectroscopy, and to interfere with individual chemical bonds and push atoms around. The steep learning curve apparently is continuing. Applications in materials science and chemistry (and possibly in electronics) are naturally following. Biology is reported on in *Physics Today*, December 1995. Practical consequences of the field could indeed come to be more than we are prepared for (such as the ethics of gamete surgery). But no one can say — as was memorably suggested in 1960 — that our science is about to run out of steam.

Peter J. Price
IBM/T.J. Watson Research Center

Alan Fowler Responds...

Morgan complains that I did not propose solutions. I was asked to say what has happened, not to solve problems. His comments on IBM are ill-taken given that IBM still discloses the most patents in the world. The canonical time for impact of revolutionary invention is strangely close to the life of patents. Cause, effect or coincidence?

Goldman feels that I have shortchanged public labs. Maybe so. I feel that if they are to be effective they will need coupling to industry. Is that a possibility given the direction of what passes for political thought?

I agree with Saylor on the importance of basic research. I do not believe that industry is obligated to support it when it is irrelevant to its needs. I do feel that industry should support mid-term research that is relevant. I continue to shudder when the transistor is described as the product of basic research. It was in fact the product of top-directed, applied and product motivated research. The basic physics was an outgrowth of the fertile minds of very applied physicists.

I agree with most of Peter Price's comments. Where I disagree I respect his opinion.

I had expected a spate of letters protesting my trashing of universities. I especially regret the use of the phrase "Byzantine politics." It was unfair both to the generally successful Byzantines, who were no worse than their contemporaries, and to universities. Seldom or never has a posse of professors plucked out the eyes of a deposed dean. "Feudal" was the word I wanted. Yet there is much good evidence that cooperative efforts can be achieved not only between disciplines but also surprisingly within departments. To be applauded are increasing efforts of universities and industry to cooperate.

Finally I should like to apologize to some of my more literate readers for improving upon T.S. Eliot and for my abominable French.

Alan Fowler
IBM, Yorktown Heights, NY

Basic Research Should Not Depend on Bureaucracy

In the November 1995 issue of *APS News*, Crystal Barker asked that science not be turned into a partisan issue. The comments were referring to an earlier commentary by Jeff Bingaman. I do not wish to sound like I am criticizing her letter, but I believe she is in error stating that "the majority of the population does not support basic research."

What America is voicing is its disgust with the inappropriate use of government bureaucracy. What America can no longer support is its best trained scientists spending their lives being paid to produce nothing but high quality research proposals for large government grants at the tax-payers' expense. There are plenty of us who want to see basic research receive funding, but do not condone the use of central planning through government bureaucracies as an economically valid means.

Physicists must not complain that we can not do science without cushy government jobs. Reduction in federal spending simply means that physicists must prove the value of basic research dollars to private industry.

Of course that may mean change, and that is what really frightens people. Even physicists.

W.T. Buller
Bethesda, Maryland

Cold Water Thrown on Dowsing...

In reference to the letter by L.W. Frederick et al., (*APS News*, November 1995), supporting the use of dowsing to find water, we are sorry to pour cold water on their beliefs. They cite work by H-D Betz as evidence of the reality of dowsing. The two Betz papers referred to were examined in an excellent article, "Dowsing Expectations," by J. Raloff in *Science News*, 148, 90-91 (1995). The APS reader is urged to read Raloff's article, which is epitomized by a photograph of one of Betz's blindfolded dowsers, wearing an obviously incompetent blindfold. Betz is no doubt sincere, but his study is woefully lacking in the sort of controls that are the sine qua non of modern research. Nor must one rely solely on the study by Randi. Almost a quarter of a century ago, a beautifully done study by R.A. Foukes was published in *Nature*, 229, 163-168 (1971) — that's no older than the car one of us drives, so it must still be relevant. Foukes' results were in complete agreement with Randi's.

In most regions, dowsing is no big deal; water is ubiquitous. Pick a spot at random and you'll probably find water. In fact, however, it may be even easier in thinly-populated desert regions, since the population tends to be strung out along the aquifers. Want to find the water? Find the people. As desert enthusiasts, we volunteer for any expeditions to check this out.

Hydrologically yours,
Leonard Finegold, *Drexel University*
and
Robert Park, *University of Maryland*

Upon closer examination, the highly-publicized Betz endorsement of the dowsing phenomenon seems rather less than well-founded. Betz and his colleague Koenig have steadfastly refused to identify the one dowser who produced most of the data reported, even to the Gesellschaft zur wissenschaftlichen Untersuchung von Parawissenschaften (GWUP), a reputable organization of skeptical scientists in Germany that wished to look into the claims. Furthermore, the press release that preceded the Betz paper referred to it as the result of "a 10- year study." That would imply that 10 years ago, an experiment was launched to gather and assess data on this phenomenon, when in actuality the paper was a summary of 10 years of reports made by the dowsers themselves.

Dowsing still is, not to the surprise of most scientists, an unfounded claim. My present challenge, now amounting to U.S. $507,000 for the performance of ONE successful series of experiments establishing the existence of a dowsing facility, remains unclaimed, even by the Quadro Corporation, who manufacture and sell a $955 high-tech version of the popular bent-coat-hanger version of dowsing stick, offered for sale to boards of education to detect arms and drugs in school lockers.

James Randi
Plantation, Florida

Fluid Researchers Gather for 1995 DFD Meeting

New studies of various aspects of turbulence and the behavior of single strands of DNA in aqueous suspensions were among the highlights of the 1995 fall meeting of the APS Division of Fluid Dynamics, held 19-21 November in Irvine, California. More than 850 contributed papers were presented, in addition to several invited lectures. The meeting also featured the 13th Annual Gallery of Fluid Motion, an exhibit of contributed photographs and videos of experimental fluid dynamics. Outstanding entries, selected for originality and their ability to convey and exchange information, will appear in the September 1996 issue of Physics of Fluids.

Breakdown Into Turbulence of Propagating Internal Waves. Internal waves are ubiquitous phenomena in the stably-stratified regions of the atmosphere and oceans, and it is thought that much of the turbulence in these regions is due to the breakdown into turbulence of these waves, according to James Riley of the University of Washington. As examples, he offered internal wave breakdown as playing a major role in the overall mixing and resultant diapycnal heat and mass transfer in oceans. Atmospheric wave breakdown is considered a source of clear air turbulence and provides a potentially important mechanism for the exchange of tropospheric and stratospheric air mass.

He has concluded from stability analysis that internal waves are unstable, even at small amplitudes, due to a parametric resonance. Riley's observations revealed that wave breakdown often occurs through wave intensification and steepening caused, for example, by interaction with ambient currents, or by reflection off sloping terrain.

Viscoelastic DNA Suspensions. Recent experiments at AT&T Bell Laboratories on the behavior of single DNA strands in aqueous suspensions have shown that the molecular relaxation can often endow such fluids with a viscoelastic time of seconds, with a viscosity similar to that of water. According to AT&T's Paul Kolodner, this has opened the way to experimental observation of oscillatory convective states resulting from viscoelasticity. Performed in a long, narrow, annular convection cell, the experiments revealed that the traveling waves (which represented the flow patterns) are much slower than expected: the oscillation periods are hours, while the relaxation times are typically 30 seconds.

Turbulence Stress Tensors. Turbulence subgrid-scale stresses — defined as the difference between spatially filtered momentum fluxes and momentum fluxes of large scales — are random variables that must be parametrized in terms of large-scale quantities. C. Meneveau of Johns Hopkins University discussed how hyperviscosity and non-local eddy-viscosity models can be motivated by more general constraints than the specific correlation functions usually associated with the function.

Meneveau studied the response of subgrid-scale stresses to a rapidly applied, irrotational straining field through a series of experiments in a water-tank, in which quasi-isotropic turbulence was subjected to rapid axisymmetric expansion.

Optical Studies of Wall Turbulence. According to the University of Illinois' R.J. Adrian, techniques based on particle image velocimetry for the measurement of velocity fields make is possible to observe spatial scales over more than two decades, a sufficient range in which to observe the large and small scales of turbulence simultaneously. Adrian reported on a number of different experiments on wall flows, such as pipe flow and channel flow, which afforded direct observation of the form of various fundamental structural elements at elevated Reynolds numbers, often for the first time.

New Prospects for Lagrangian Methods. A. Leonard of the California Institute of Technology reviewed recent efforts to develop a robust vortex particle method for two- and three-dimensional, incompressible flows. His scheme includes a novel treatment of viscous effects to allow for the accurate representation of boundary layer mechanics, including unsteady separation.

Prize and Award Lectures. In addition to the regular technical program, three APS prize recipients gave lectures at the meeting. Harry Swinney (University of Texas at Austin), recipient of the 1995 APS Fluid Dynamics Prize, spoke on anomalous diffusion and Levy flights in quaigeostrophic flow. The 1995 Otto LaPorte Award recipient, Katepalli Sreenivasan of Yale University, spoke on multifractals and turbulence. Joseph A. Johnson III, recipient of the 1995 Boucher Award (formerly the Minority Lectureship Award) spoke on natural turbulence closure in a supersonic free shear layer.

March Meeting Programs

(continued from page 1)

The Committee on the Status of Women in Physics and the Committee on Minorities in Physics has joined FPS in putting together a session entitled "Minorities and Women in Physics: Current Status and Issues," on Tuesday, 19 March. The centennial of Becquerel's discovery of radioactivity occurs in 1996, and in that vein, the Forum on History of Physics will be presenting a session on the history of radioactivity.

There will be the usual trappings of the largest physics meeting in the world. The opening reception will be held Monday evening, after the ceremonial session. A number of APS prizes and awards will be presented at the meeting. There will be two evening poster sessions, with some food and beverage supplied. The exhibit will open on Tuesday, with over 125 exhibitors of equipment and books. Over 5,000 physicists are expected to attend. For more information, please consult the APS Home Page, or the *APS Meeting News* insert in this issue.

Spring Meeting Programs

(continued from page 1)

Measurement and Accelerator Instrumentation; New Accelerator Facilities for Nuclear Physics: Opportunities and Challenges; High Energy Accelerators — Long-Term Future; Neutron Stars; The Physics of Novae and Supernovae; Plasma Astrophysics; Electron Beam Dynamics and Acceleration; New Developments in Few-Body Physics ; Lattice Gauge Theory; Structure of the Nucleon and Implications for RHIC; Topics in Particle Astrophysics; Progress in Fundamental Constants and Time Standards.

As always, there will be a number of social events. The Banquet, featuring physics demonstrations after dinner, is scheduled for Saturday evening following a no-host reception. There will be a special reception for graduate student members Thursday evening. A poster session is also planned in conjunction with the exhibit on Friday evening. All in all, this promises to be one of the most exciting Spring meetings in many years.

Harry Lustig to Retire as APS Treasurer

Harry Lustig, the APS Treasurer for over 10 years, announced his intention to retire at the end of June 1996. He joined the APS as Treasurer-elect in July 1985, overlapping a few months with outgoing Treasurer Joe Burton, before becoming Treasurer.

During his tenure, Lustig has helped guide the APS with great skill and affection through a period in which the Society has undergone many changes, including the relocation of APS headquarters to College Park, Maryland. Since 1985, the operating budget of the APS have grown from $10 million to more than $30 million, and the Society has operated in the black every year. As treasurer, he is one of the three operating officers of the APS.

Born in Vienna, Lustig did not initially plan to become a physicist. Following high school, he enrolled in the City College of New York with the intention of earning a degree in engineering. After a two-year interruption in his studies for military service, he switched to a physics major and went on to graduate school, earning his Ph.D. in physics in 1953. He returned to CCNY as a faculty member, where he later chaired the physics department and eventually became provost. Lustig's research primarily centered on the theory of nuclear reactions and on the Mossbauer effect.

Lustig's professional career has been divided between research and teaching at a university and APS administration, with additional interests in public service, such as international development and science education. In addition to his duties as treasurer, Lustig acts as administrator of the APS Leroy Apker Award, established in 1978 to recognize outstanding achievement in physics by undergraduate students.

Although Lustig and his wife, Rosalind, will move to their new home in Santa Fe, New Mexico, after his retirement, he said that he intends to remain active in APS affairs.

An announcement seeking candidates for a new APS Treasurer can be found on page 7. An extensive profile and interview with Lustig was featured in the December 1992 *APS News.*

1995 DPP Meeting Highlight *(continued from page 2)*

laser speckle pattern on directly driven thin foils, and used x-ray laser moire deflectometry to measure the electron density profile in ICF hohlraums.

Fluctuations and Transport in Toroidal Systems. Herbert L. Berk of the University of Texas at Austin's Institute for Fusion Studies has developed a basic nonlinear theory for a kinetic system driven by a source of energetic particles, which he believes is directly applicable to such problems as the bump-on-tail instability and fishbone oscillations, as well as the alpha particle interaction with Alfven waves in a fusion reactor.

Recent measurements of magnetic fluctuation-induced electron thermal transport confirm key aspects of the theory that accounts for clumping of electrons that stream along the magnetic field, according to the University of Wisconsin, Madison's P.W. Terry.

Explosive Instabilities and Detonation in MHD. According to UCLA's Steven Cowley, many plasma systems exhibit large scale explosive events, such as solar flares, magnetic substorms, and tokamak disruptions, which almost always require nonlinear destabilization to achieve their fast time scales. He has developed a new mechanism for explosive behavior using a nonlinear MHD model of the instability, in which the system crosses the instability threshold in a small region of space. The model demonstrates that the nonlinearity causes the linear instability to broaden into the linearly stable region, forming shocks.

CAUGHT IN THE WEB

Notable additions to the APS Web Server for the month of December. The APS Web Server can be found at http://aps.org

New/Updated Links:

APS News Online

APS Press Releases

Education/Outreach
- Lecture Topics by Minorities, Women, and Industrial and Applied Physicists

Careers
- *Realities of the Physics Job Market* by Roman Czujko

Governance
- 1996 Operating and Bylaws Committees

Meetings
- Online Housing Board for May Meeting
- Online Ride Board for March Meeting
- 1996 DAMOP Annual Meeting
- 1996 Joint APS/AAPT Meeting

Physics Related
- "Physics Around the World" project

Units
- New York State Section Update
- FIAP November Newsletter

Journals
- *Reviews of Modern Physics* Information

ANNOUNCEMENTS

NOMINATIONS FOR PRIZES AND AWARDS

The following award is among those which will be bestowed at APS meetings in 1996. Members are invited to nominate candidates. A brief description is given below, along with the addresses of the selection committee chair to whom nominations should be sent. Please refer to the *1996-1997 APS Membership Directory*, pages xxiii-xxxix or the APS Home Page (http://aps.org) under the Prizes and Awards button, for complete information regarding rules and eligibility requirements for individual prize and awards.

1996 APKER AWARD

Endowed by Jean Dickey Apker, in memory of LeRoy Apker.

Purpose: To recognize outstanding achievement in physics by undergraduate students, and thereby provide encouragement to young physicists who have demonstrated great potential for future scientific accomplishment.

Description: In 1996, two awards may be made, one to an undergraduate student from an institution which does not have a Ph.D. program in physics, the other to a student from an institution which does have such a program. Each Award consists of $3,000, an allowance for travel to the meeting of the Society at which the Award is presented and a certificate citing the work and school of the recipient. Finalists in this annual competition (from whom the recipients are chosen) will each receive an honorarium of $1,000 and a certificate as an Apker Award Finalist. Certificates will also be presented to the home institutions of the winners and of the finalists. Beginning in 1996, the Physics Departments whose nominees become finalists or recipients will also receive awards, for the purpose of supporting undergraduate research. Each departmental award will be half of the stipend for the student, i.e. $1,500 for recipients and $500 for finalists.

Qualifications of Applicants: Nominations are open on behalf of students at colleges and universities in the United States who were enrolled as undergraduates during at least a part of the 12 months period preceding the 14 June 1996 deadline. Only one candidate may be nominated by an institution. The candidate should have completed or be completing the requirements for an undergraduate degree with an excellent academic record and should have demonstrated exceptional potential for scientific research by an original contribution to physics.

Application Procedure: The nomination should include: **1)** a letter of nomination from the head of the physics department, **2)** an official copy of the student's academic transcript, **3)** a description of the original contribution, written by the student, such as a manuscript or reprint of a research publication or senior thesis (unbound) and a 1,000-word summary thereof, **4)** two letters of recommendation from physicists who know the candidate's individual contribution to the work submitted. **5)** the nominee's address and telephone number during the summer. The deadline for completed applications is 14 June 1996. Each nominee will be granted a free APS Student Membership for one year upon receipt of the completed application.

Send name of proposed candidate and supporting information before 15 June 1996 to: Administrator, Apker Award Selection Committee, The American Physical Society, One Physics Ellipse, College Park, MD 20740-3844; telephone: (301) 209-3220; email: lustig@aps.org.

APS Seeks New Treasurer

The American Physical Society is seeking a successor to the current Treasurer who is retiring. The position is that of the chief financial officer and the Treasurer is one of three operating officers of the Society. She/he is expected to participate in all aspects of the governance, policy formation, and administration of the Society. The incumbent has been responsible for the preparation and administration of the budget, for the investments of the Society, for business interactions with the American Institute of Physics, for some of the non-editorial aspects of APS' publications, for the Society's legal affairs, and for personnel policies and administration. Together with the Executive Officer and the Editor-in-Chief the Treasurer has the responsibility for supervising the Society's staff.

Applicants or nominees should be physicists with significant reputations and demonstrated organizational, financial management, and managerial skills. The initial appointment is for five years with renewal possible after review. Salary is negotiable. The desired starting date is July 1, 1996 or earlier. The APS is an equal employment opportunity employer and specially encourages applications from or nominations of women and minorities. Inquiries, nominations, and applications should be sent by February 28, 1996 to:

Professor Donald Langenberg
Chair, Search Committee
The American Physical Society
One Physics Ellipse
College Park, MD 20740-3844

INTERNATIONAL NEWS

The U.S. Civilian Research and Development Foundation (CRDF) announced a call for proposals for its new Cooperative Grants Program. This program will support teams of former Soviet and U.S. scientists and engineers for cooperative projects. Proposals must be submitted to the CRDF's office in Arlington, Virginia by March 1, 1996. For more information on the CRDF Cooperative Grants Program, please contact the U.S. Civilian Research and Development Foundation, 1800 North Kent Street, Suite 1106, Arlington, Virginia, 22209; Phone: (703) 526-9720; Fax: (703) 526-9721; email: information@crdf.org; web: http://www.internext.com/crdf.

1996 OPERATING AND BYLAWS COMMITTEES

COMMITTEE ON APPLICATIONS OF PHYSICS: Fred Dylla (Chair), Arthur Bienenstock, Cynthia Carter, Robert Doering, David Fraser, Steve Garrett, Robert Kwasnick, Mara Prentiss, Roy Richter, Peter Rosenthal, John Rowell, Andrew Tam.

AUDIT COMMITTEE: Arthur Bienenstock (Chair), Virginia Brown, Gordon Dunn.

COMMITTEE ON COMMITTEES: Barbara Levi (Chair), Martin Blume, Joseph Dehmer, Laura H. Greene, Ernest Henley, Anthony Johnson, Zachary Levine, James Wynne.

COMMITTEE ON CONSTITUTION AND BYLAWS: Miriam Forman (Chair), Charles Falco, Frank Jones, Peter Levy, Michael Lubell, Ivan Sellin.

COMMITTEE ON EDUCATION: Leroy Cook (Chair), Bunny Clark, Don Correll, Lori Goldner, Kenneth Krane, Eric Mazur, Lyle Roelofs, Alan van Heuvelen, Clifford Will.

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COMMITTEE ON INTERNATIONAL SCIENTIFIC AFFAIRS: Fred L. Wilson (Chair), Nora Berrah-Mansour, Lynn Boatner, Nee-Pong Chang, Efim Gluskin, Horst Meyer, Ivan Schuller, James Vary, Lawrence Wilets.

INVESTMENT COMMITTEE: Harry Lustig (Chair), Andrew Sessler, Judy Franz, Robin Shakeshaft, Anthony Starace, Watt Webb.

COMMITTEE ON MEETINGS: Ernest Henley (Chair), Edward Berger, Judy Franz, Harry Lustig, Anthony Nero, Joe Thompson, Virginia Trimble, John Wilkerson.

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COMMITTEE ON MINORITIES: Richard Saenz (Chair), Fred Begay, James Gates, Carlos Handy, Wendell Hill, Alex de Lozanne, Harry Morrison, Robert Perry, Julia Thompson.

NOMINATING COMMITTEE: Martin Blume (Chair), Lowell Brown, Jolie Cizewski, Jan Herbst, Paul Horn, Boris Kayser, Kate Kirby, James Langer, C. Kumar N. Patel.

PANEL ON PUBLIC AFFAIRS: David Hafemeister (Chair), William Appleton, Sam Austin, David Bodansky, Aviva Brecher, Paul Craig, Anthony Fainberg, William Frazer, Edward Gerjuoy, Phillip Hammer, Carolyn Herzenberg, Ruth Howes, Duncan Moore, Thomas Picraux, Mark Sakitt, Nicholas Samios, Andrew Sessler, Steven Smith, Robert H. Socolow, Ellen Stechel, Jeremiah Sullivan, Robert M. White.

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COMMITTEE ON THE STATUS OF WOMEN IN PHYSICS: Katherine Gebbie (Chair), Peggy Cebe, Gerard Crawley, Elsa Garmire, Howard Georgi, Ruth Howes, Donna Hurley, Laurie McNeil, Linda Vahala.

THE BACK PAGE

Cold War Human Radiation Experiments: A Legacy of Distrust

by Mark Goodman

The April 1995 APS Meeting in Washington DC marked two significant anniversaries in the history of ionizing radiation and health. A special session celebrated the 100th anniversary of Roentgen's discovery of x rays. Since this discovery, ionizing radiation and radioactive tracer materials have become ubiquitous tools in medical research, diagnosis, and treatment. Another session, which I organized, marked the 50th anniversary of the first use of nuclear energy for military purposes and delved into the darker history of Cold War human radiation research.

In December 1993, Energy Secretary Hazel O'Leary learned of a newspaper article by an Albuquerque reporter about people who had plutonium injected into their bodies to study the resulting risks. O'Leary was shocked, and called for an outside investigation of these and other experiments that had come to light. She persuaded President Clinton to establish the Advisory Committee on Human Radiation Experiments, to report on human radiation experiments performed by the Department of Energy and other agencies implicated in similar activities. This committee of experts in medical science, biomedical ethics and related fields released its final report in October.

The Advisory Committee's report has been well-received in general, although some have expressed disappointment with its failure to condemn certain experiments and scientists. Reaching consensus on the ethical judgment of past actions proved quite difficult given the limits of available information. But the committee was widely praised for the way it carried out its two other main tasks, providing a public accounting of the events of the past and making recommendations for the future based on lessons from these events.

I was not a member of this committee, but served on its staff. The staff was responsible for most of the historical research, and drafted findings and recommendations for consideration by the committee. My work focused on experiments involving the deliberate release of radioactive materials into the environment.

More than most scientists, biomedical researchers face ethical questions of what means are legitimate for gathering experimental data, particularly when the experiments involve human beings as subjects of research. Biomedical ethics involves two basic principles. First, researchers must weigh the anticipated benefits of an experiment against the anticipated risks. Second, people who are subjects of research must knowingly agree to take part in that research, a requirement known as informed consent.

These principles seem fairly obvious, and served as the basis for the Nuremberg Code that provided the standard for judging Nazi doctors accused of crimes against humanity. Still, they were not widely observed as the standard of practice until decades later. Even in the 1960s, the physician was vested with great authority and informed consent was often honored in the breach. But the Cold War history of human experimentation raises more specific and serious concerns about secrecy and whether national security interests overrode respect for basic human dignity.

One of the first challenges of the Manhattan Project was the safe handling of radioactive material. Radium was the most hazardous radioactive material known at the time. Women who painted radium watch dials suffered high rates of cancer and necrosis of the bone caused by the radium they ingested when they licked their brushes. Yet the entire prewar stockpile of radium amounted to no more than 100 grams.

The Manhattan Project would produce tens of kilograms of plutonium and tons of radioactive waste. Like radium, plutonium is a strong emitter of alpha particles, but its biological hazard was unknown. Radiation safety therefore became an important part of the Manhattan Project, known by the code name of "health physics." The name stuck, and health physics is now a large and thriving specialty.

In the spring of 1945, urine samples suggested that those handling plutonium at Los Alamos were approaching the safety limits for plutonium within their bodies. These limits were based on animal studies, however, and health physicists therefore felt an urgent need for human experiments. Over the next few years, 18 patients at Oak Ridge, the Universities of California, Chicago, and Rochester were injected with plutonium to determine how it was metabolized.

Certainly the patients gained nothing from these experiments, but neither did they suffer any immediate harm. Choosing patients with short life expectancies would have limited any long-term health risk. This probably explains why many subjects were misleadingly described as "hopelessly sick" or "terminal." In fact, several survived for decades with body burdens well in excess of current occupational safety guidelines. Still, the Advisory Committee found no evidence of clinical harm to any of them.

The Advisory Committee found these experiments to be clearly deficient on the basis of informed consent. In most cases, it appears that the patients did not know that they were experimental subjects. Even where they may have known they were subjects, they could not be informed of the nature of the experiment because plutonium was a secret material and radioactivity in general was a sensitive subject.

Perhaps the most powerful evidence that officials were concerned about the ethical problems with these experiments lies in their subsequent secrecy. Researchers wanted to publish an article on these studies in an official history of the Manhattan Project, but their draft paper was classified solely because it might expose the government to lawsuits. After that, the Atomic Energy Commission's insurance branch assumed a formal role in declassification, not to protect national security but to shield the AEC and its officials from legal liability.

Nowhere was this secrecy more pervasive than with the intentional release experiments that the Advisory Committee was asked to review. For example, a series of tests of prototype radiological weapons undertaken from 1949-1952 was not made public until 1994. The Army's Chemical Corps tested these mechanisms to disperse radioactive materials at the Dugway Proving Ground in Utah, but kept them secret from nearby residents. The main reason for this secrecy was to avoid public alarm, and there is no indication of a national security motive.

The most controversial of the intentional release experiments I studied was known as the Green Run, in which large quantities of radioactive gas were deliberately released from the Hanford plutonium separation plant. Conducted in December 1949, less than three months after the discovery of debris from the first Soviet nuclear test, Green Run tested equipment and techniques that could be used to monitor Soviet nuclear production. The Green Run remained secret until 1986, its intelligence purposes acknowledged only in 1993.

The Green Run released roughly 8,000 curies (a curie is 3.7 x 10^{10} disintegrations per second, based on the radioactivity of a gram of radium) of iodine-131 into the atmosphere near Hanford. While dwarfed by the roughly 700,000 curies released during and soon after World War II, this was the largest one-day release ever from Hanford, more than 1,000 times the average daily emissions at the time. It was largely a matter of luck that the risk to nearby residents turned out to be small. Because the Green Run took place in the winter, dairy cows were not grazing on contaminated pastures, but this could not have been planned because the milk pathway was unknown at the time.

Nevertheless, the Green Run raises questions that remain relevant today. What benefits were anticipated or actually resulted? How can the government find an appropriate balance between disparate benefits to national security and risks to public health? The available documents provide no indication that anyone ever weighed the risks and benefits of the Green Run and concluded it was worth the risk. Furthermore, there is no evidence of a lasting benefit to U.S. intelligence from the Green Run; information that proved useful for that purpose came from other sources. More disturbingly, it remains unclear whether environmental risks undertaken as part of classified programs receive adequate review even today.

The story uncovered by the Advisory Committee, though it deals mainly with medical research, raises more general questions about the ethical obligations of scientists to society. What limits should be imposed on the means scientists use to obtain new knowledge? How do we weigh the costs of research, in dollars and in human health, against the benefits of the knowledge to be gained?

These questions underlie today's debate on public funding for research. To scientists it seems obvious that the benefits of their endeavor outweigh the costs, but the citizens who support research through their taxes are not so sure. While we have all come to rely on the technological and medical fruits of modern science, most citizens show little understanding of or interest in science.

Beyond a mere lack of interest, the public has grown increasingly skeptical of scientific experts and government officials (often one and the same), viewing them as special interests. Reassurances about the safety of nuclear testing, which often proved to be misleading, fed this skepticism, as did the exaggeration of risks by other "experts." As a result, our society is remarkably averse even to very small risks.

Most scientists do not involve themselves in such controversies, yet we all bear some responsibility for our poor image. Many of us interpret our obligations as scientists too narrowly. We prefer to avoid thinking about the value of our work, and when we do, we tend to rely on shopworn platitudes about the benefits of scientific progress. To restore our credibility, we will have to take seriously both the need to explain what we are doing to those who pay for it, and the obligation to understand how our work affects people.

Mark Goodman is a physical science officer at the Arms Control and Disarmament Agency. In 1994-1995 he was a research analyst with the Advisory Committee on Human Radiation Experiments in Washington, DC. The views expressed are his own and do not necessarily represent those of the Advisory Committee. An earlier version of this article appeared in the July 1995 issue of Physics and Society, *the Forum on Physics and Society newsletter.*