

PHYSICS NEWS IN 1995

Physics News in 1995 is a summary of the year's research highlights. It appears for the third year as a special section in this issue of *APS News*. The booklet covers the most important research results of 1995. Highlights in physics and government, physics history, and physics education are also covered.

Edited by Phillip Schewe and Ben Stein of the American Institute of

Physics (AIP) Public Information Division, the report had previously been published annually by *Physics Today*, until 1989. In 1992, the APS decided to publish *Physics News* as a trial service to its members, and elected to continue publication based on the positive response.

Articles are selected and prepared by members of the APS and other AIP member societies.

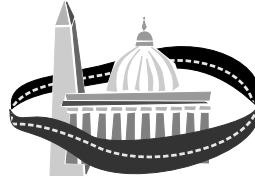
Beller International Lecture at DAMOP Meeting

The second Beller International Lecture will be given by Serge Haroche in the opening Plenary Session of the DAMOP meeting in Ann Arbor, MI on May 15. The subject of Haroche's talk is "Quantum Measurements and Decoherence Studies with Single Atomic in Cavities." Dr. Haroche is a fellow of the APS and is at the Lab de Physics de l'Ens, Paris, France.

The Beller International Lectureship Fund was endowed by the estate of Esther Hoffman Beller in 1993. Earnings from the fund are used to pay for honoraria and stipends for distinguished foreign scientists to speak at APS meetings. It is assumed that, in turn, societies abroad will ask U.S. physicists to lecture at their meetings. The first Beller Lecturer was presented by Joachim Trümper at Unity Day of the April 1994 APS/AAPT Joint meeting.

IN THIS ISSUE

Physics News In 1995 Inside	1
INSIDE THE BELTWAY	1
International News	1
Physicists To Be Honored at 1996 May Meeting	2
IN BRIEF	3
Opinion	4
CAREER CORNER	6
Physics Success Stories Provide Tool for Scientists	6
Announcements	7
The Back Page	8
APS Meeting News	Insert
Physics News in 1995 Supplement	1-24



INSIDE THE BELTWAY

Shifting Political Winds Open a Window of Opportunity for Science

by Michael S. Lubell, APS Director of Public Affairs

It may seem absurd to suggest that Pat Buchanan's win in New Hampshire or Steve Forbes' victories in Delaware and Arizona could have anything to do with science policy in Washington, particularly since Bob Dole has practically wrapped up the Republican nomination for president. But Buchanan and Forbes' rejection of the balanced budget imperative, the centerpiece of 1995 GOP spending plan, and their emphasis on tax reform could have serious implications for future federal support of science. Let's take a closer look at the still unfolding story.

For more than a year, from November of 1994 until January of 1996, Washington was awash with the rhetoric of the Contract with America. That 10-point document, which the Republicans had ridden to victory in the last election, framed most of the legislative debate during the first session of the 104th Congress. Although three items ultimately passed both Houses and received the president's signature, the others did not. And when the session finally ended in December, the nation was left with much of its government shut down, largely as a result of the balanced-budget impasse between President Clinton and the Republican House freshmen. Throughout the year, that ardent group of representatives, elected on a tide of promised reform, had been the most unabashed supporters of the Contract with America.

By the time the second session opened at the beginning of January, however, with their confrontational approach suffering a battering in public opinion polls, the House freshmen, under great pressure from their more seasoned leadership, finally capitulated. Although the president had given considerable ground in agreeing to a seven-year balanced budget plan scored by the conservative economists in the Congressional Budget Office, Washington observers generally agreed that the White House had achieved a significant political victory. Privately, many Republicans acknowledged as much, as well.

Therefore, it was no accident that shortly after the president's State of the Union Address, with the government once again functioning, the GOP leadership decided on a month-long break in the congressional schedule to give House and Senate members time at home to repair the political damage they had suffered. Of course, Senate Majority Leader Dole also badly needed the recess to concentrate on his campaign for the presidential nomination.

By the time Punxsutawney Phil saw his shadow in early February and withdrew to his burrow for six more weeks of winter, the Contract with American had vanished from the Washington scene,

(continued on page 3)

INTERNATIONAL NEWS



Workshops Explore Future of Telecommunications, E-Publications

UNESCO Electronic Publishing in Science — Representatives from the APS, libraries, academia, and scientific publishers gathered at UNESCO headquarters in Paris, France, on 19 February for an expert conference on electronic publishing in science. Organized by UNESCO and ICSU Press, the conference was intended to explore the current tools and standards, as well as legal and ethical issues associated with the revolution in information technology.

"Electronic publishing has radically altered scientific transactions in the physical sciences," said Irving Lerch, APS director of international scientific affairs, adding that growing numbers of scientists exchange frontier information in freely distributed non-refereed preprints, while journal publishers are rapidly moving to restricted-access online archival journals.

In fact, a new regime of electronic or "gray" media, characterized by hypertext and linked graphical displays, is subsuming many aspects of traditional print exchanges. Questions remain as to whether this will further impede the availability of scientific literature in developing and "redeveloping" countries, or will facilitate access to it. Another issue, according to Lerch, is whether electronic publishing will unite colleagues or dissipate much-needed — and increasingly limited — resources. This was the focus of a workshop organized by the UNESCO Physics Action Council working group on telecommunications networks for science and APS on the first day of the conference.

(continued on page 2)

Physicists To Be Honored at 1996 DAMOP Meeting

The APS will honor three physicists in May for their contributions to the fields of atomic, molecular and optical physics and particle physics. The 1996 Will Allis Prize, Davisson-Germer Prize, and Dannie Heineman Prize will be presented during the annual spring meeting of the APS Division of Atomic, Molecular and Optical Physics (DAMOP), 15-18 May, in Ann Arbor, Michigan. Recipients, citations, and brief biographical information are provided below.

1996 WILL ALLIS PRIZE

Endowed in 1989 by AT&T, GE, GT&E, IBM, and Xerox Corporation to recognize and encourage outstanding research into the behavior of ionized gases.

Chun C. Lin
University of Wisconsin

Citation: "For advancing the understanding of the microscopic behavior of ionized gases through his innovative and pioneering studies of excitation in electron and ion collisions with atomic and molecular targets."

Lin received his BS degree from the University of California-Berkeley in 1951 and Ph.D. from Harvard University in 1955. His thesis advisor was J.H. Van Vleck. Lin was on the faculty at the University of Oklahoma during 1955 to 1968. In 1968 he moved to the University of Wisconsin-Madison where he is now the John and Abigail Van Vleck Professor of Physics.

Lin began his career in the field of microwave spectroscopy. While at the University of Oklahoma he initiated a program on electron excitation of atoms in collaboration with Robert M. St. John. Much of his research in this field is directed toward understanding the basic nature of the atomic and molecular processes in ionized gases. For many years, Lin also worked on the theory of the electronic structure of crystals and impurity atoms in solids. Lin served as the Chairman of the Gaseous Electronics Conference in 1990-1992 and the Chair DAMOP in 1994-1995.

1996 DAVISSON-GERMER PRIZE

Established in 1965 by a donation from AT&T Bell Laboratories, the Davisson-

Germer Prize is intended to recognize and encourage outstanding work in atomic physics or surface physics.

Thomas Francis Gallagher
University of Virginia

Citation: "For his elucidation of the characteristics and collisional behavior of highly excited states of atoms."

Gallagher was born in Bronxville, New York in 1944. He received a BA in physics from Williams College in 1966 and an MA and a Ph.D., both in physics from Harvard University in 1968 and 1971, respectively. After a year as a research associate at the University of Utah, he spent the next 12 years at SRI International (formerly Stanford Research Institute). In 1984 he moved to the University of Virginia, where he is now the Jesse W. Beams Professor of Physics. Much of Gallagher's research has been focused on Rydberg Atoms, understanding their intrinsic properties and using their exaggerated properties to explore unusual physical situations. He has written the monograph, *Rydberg Atoms*, on this topic.

Gallagher is a fellow of both The American Physical Society and the Optical Society of America. He has been a divisional associate editor for *Physical Review Letters*, an associate editor for *Optics Letters*, a topical editor for the *Journal of the Optical Society of America*, and chair of the DAMOP.

1996 DANNIE HEINEMAN PRIZE

Established by the Heineman Foundation for Research, Educational, Charitable, and Scientific Purposes, Inc. in 1959 to recognize outstanding publications in the field of mathematical physics.

Roy J. Glauber
Harvard University

Citation: "For important contributions to the mathematical physics of quantum optics and short-wavelength scattering."

Glauber has been the Mallinckrodt Professor of Physics at Harvard University since 1976. He received his Ph.D. in 1949 from Harvard University. He worked as a staff member on the Man-

hattan Project and did postdoctoral work for the Institute for Advanced Study at Princeton and at the Swiss Federal Polytechnic Institute in Zurich, and has served on the editorial boards of several technical journals, including *Nuclear Physics B* and the *Journal of Mathematical Physics*. Glauber has been a member of the Advisory Board for the Program for Science and Technology for International Security at MIT since 1983.

International News (continued from page 1)

The morning session featured nine plenary lectures covering trends of electronic publishing in industrialized countries; the role of electronic technologies in relieving the shortage of scientific literature in developing countries; programs and proposals for promoting the availability of scientific literature; and collaborations between industrial and developing countries, as well as regional collaborations. In the afternoon, two panel discussions focused on the impact of electronic publishing on literature availability, and how to find the right mix of technologies to meet the needs of developing countries.

APS Treasurer Harry Lustig outlined some of the major new challenges facing scientific societies with the advent of electronic publishing, including the problem of archiving, the complications of maintaining copyright protection for authors and publishers, and the economic complexities associated with publishing refereed and edited journals electronically. The APS has committed to having all its journals available electronically within five years, according to Lustig, and the current online version of *Physical Review Letters* is a first step in that direction.

Several speakers addressed the issue of how the copyright system should evolve to protect the interests of publishers. Thomas Dreier of the Max Planck Institute for Foreign and International Patent, Copyright and Competition Law in Munich, provided the historical context for the issue, maintaining that the copyright system has successfully adapted to new distribution techniques such as phonograms, radio, television and video. However, he believes that the transition of copyright into the digital era will not happen as smoothly. "Digitization affects the whole body of protected works, and networking fundamentally alters the traditional means of creating, distributing and using subject matter protected by copyright," he said. "Furthermore, in a networking context, any user may himself easily become a distributor."

The remaining speakers covered other related topics, including the economics and organization of present and future scientific publishing, electronic data archiving and access, and research policies currently affecting the development of digital libraries in science and technology, with many offering examples of proposed models and initiatives aimed at overcoming these obstacles.

For instance, Paul Ginsparg of Los Alamos National Laboratory, who heads a project for automated electronic archiving of research information in many fields of physics, believes the current model of funding publishing companies through research libraries — in turn funded by overhead on research grants — is unlikely to survive in the electronic realm. "It is premised on a paper medium that was difficult to produce, distribute, archive, and duplicate, hence requiring numerous local redistribution points," he said. "The electronic medium shares none of these features and thus naturally facilitates large-scale disintermediation of research information."

NATO Networking Workshop Plans — On 5-6 February, senior academic, research and telecommunications experts from various regions of the Russian Federation and other Western and Eastern European nations gathered in St. Petersburg, Russia, to determine the content, schedule, participation, administration, funding and implementation of one or more NATO Advanced Networking workshops to be held in 1996 and beyond.

The ultimate objective of these workshops is to develop a program for training users, administrators, managers and technical support staff within the academic and research communities. Funding will be sought from NATO and a consortium of national and international foundations and agencies. Co-sponsored by UNESCO's Physics Action Council, NATO, The Euro-Asian Physical Society, and St. Petersburg State University with APS participation, the program opened with a summary of academic and research telecommunications needs and descriptions of several existing programs. Participants also engaged in panel discussions on training needs and facilities, organizational roles and collaborations, and coordination of national and international programs.

A training workshop will be convened in St. Peterburg in October with a follow-up workshop in Novosibirsk, and other workshops will be organized as needed. An international coordinating committee — formed within the UNESCO/PAC Working Group on Telecommunications Networks — will be responsible for implementing the program, with local and regional organizing committees handling planning and other arrangements.

Training will focus on technical and management issues designed to support sustainable network access. User training will be the responsibility of each organizing committee. The upcoming October workshop will also include a short orientation for senior administrators to include university, institute and government officials, and representatives of the commercial sector.

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INSIDE THE BELTWAY *(continued from page 1)*

disappearing almost as rapidly as it had appeared a little more than a year earlier. And with it went almost all talk about a balanced budget agreement, although leaders of both political parties continue to pay it lip service when pressed.

Bob Dole did not get to be majority leader of the Senate without being extraordinarily sensitive to shifts in the political wind. So it is not surprising that he dropped all references to the Contract from his stump speech once he hit the hustings. It was an easy change for him to make, since he reportedly had not been much enamored of it from the time Newt Gingrich first unveiled it in 1994. But Dole has not been alone in ignoring the Contract. Every one of his primary rivals has too.

And what about balancing the budget? While Bob Dole continues to pledge his support for pursuing it, his two principal opponents, Pat Buchanan and Steve Forbes, have shown little taste for it, and for good reason. Much of Buchanan's success in New Hampshire is directly traceable to his populist campaign theme of keeping jobs in at home, whatever the cost. With corporate America still shedding thousands of jobs each month, his message has hit a resonant chord with many workers throughout the country who feel continually threatened. For them, the existence of a federal deficit is not a defining issue.

For Steve Forbes, an unapologetic supporter of supply-side economics, balancing the budget simply is not a major factor either. Growing the economy is his prime focus. The federal deficit, he believes, will take care of itself in the long term. But on tax cuts Buchanan and Forbes come down on

the same side as Dole. All three believe in large ones.

Lawmakers on Capitol Hill will pay close attention to the results of the primary voting. And while Bob Dole almost unquestionably will be the GOP presidential nominee, the size of the Buchanan and Forbes voting blocs will force many Republicans to accommodate their positions. Therefore, on economic issues look for tax cutting to remain high on the Republican agenda. And look for balancing the federal budget to take a back seat, at least by comparison with where it was in 1995. Also look for President Clinton's priorities to differ only marginally from those of the GOP in this regard.

Where does this leave science? First, while the Republican Congress will continue to stress reduced federal spending, it will do so with much less balanced budget fervor that it did in 1995. Second, in this election year, Republicans and Democrats alike will reflect to former House Speaker Tip O'Neill's maxim, "All politics is local." In the last analysis, their votes will be dictated by the volume of the voices raised by their constituents. If federal programs will help the folks back home, members of Congress will support them. President Clinton's FY 1997 budget proposal has given science a good start.

With the political window of opportunity having been opened a bit, it is now up to the science community to carry the debate forward. As the recent experience with the NSF budget demonstrates, when scientists in large numbers raise their voices, Congress is prepared to listen. If they remain silent, as has been their general custom in the past, scientists will have no one to blame for the consequences but themselves.

FY 1997 R&D Budget Request Announced

On March 19, John Gibbons, assistant to the president for science and technology, introduced the Clinton Administration's FY 1997 budget request for science and technology programs. Overall research funding would increase by 2 percent, or \$1,229 million, to \$72,679 million under the administration's budget request. (Note: Since final appropriations have not yet been signed for some R&D agencies, the FY 1996 basis represents the administration's best approximation.)

A breakdown of the budget request as it relates to science and technology is as follows. Basic research funding would increase by 2 percent, or \$268 million, to \$14,327 million. Applied research funding would increase by 4 percent, or \$622 million, to \$14,872 million.

Overall civilian R&D would increase by 3 percent, or \$1,057 million, to \$34,404 million. Overall defense R&D would increase 0.005 percent, or \$172 million, to \$38,275 million. Gibbons noted that the ratio between civilian and defense R&D has not changed much in this budget request. R&D support to universities would increase by 1 percent, or \$155 million, to \$12,728 million. Merit or peer reviewed R&D program

funding would increase by 6 percent, or \$1,246 million, to \$22,406 million.

Finally, overall spending on facilities would increase by 45 percent under this budget request. Gibbons explained that this is because of a change in the way that facilities would be financed, with the requested \$1,742 million being used to provide more up-front funding for facilities such as the DOE's RHIC and B-Factory. Aircraft carriers are now funded this way, as was the replacement of a major radio antenna at the Green Bank, West Virginia, observatory.

"The FY 1997 budget marks the fourth consecutive year that President Clinton has called for increases in science, technology, and education investments — investments we need to carry us into the 21st century," said Gibbons. "This budget delivers on President Clinton's commitment to maintain critical science and technology investments as a priority while balancing the budget. [The President] is saying again that he will not back down in the face of myopic Congressional proposals to slash R&D." However, Robert Walker (R-PA), chair of the House Science Committee, called the budget "a blow to basic research and a boon to industrial policy masquerading as science."

IN BRIEF

- At its February meeting, the APS Executive Board issued a special commendation to Daniel Kleppner, Lester Wolfe Professor of Physics at the Massachusetts Institute of Technology, for his years of excellent service as chair of the APS Physics Planning Committee. Kleppner's APS service also includes terms on the APS Council and Executive Board, the Panel on Public Affairs, and the Division of Atomic, Molecular and Optical Physics, as well as the editorial board of *Physical Review A*. A past recipient of the APS Davisson-Germer Prize and Julius Lilienfeld Prize, his research interests are in experimental atomic physics, high precision measurements, and quantum optics, including studies of hydrogen at extremely low temperatures and in ultra precise laser spectroscopy. Dan Kleppner was also awarded MIT's James Killian, Jr. Faculty Achievement Award in March.

- The APS Forum on Industrial and Applied Physics (FIAP), in conjunction with the Committee on Applications in Physics and APS staff, has produced a compilation of over 115 physicists who are available to speak on industrial and applied physics topics at schools, universities, and in other public forums. More than 200 titles are listed in the booklet, which is called the Industrial and Applied Speakers List. According to Barrett Ripin, associate executive officer, "it is intended to help break down the cultural barriers that exist between academia and industry, students, faculty and industrial physicists, and demonstrate the interesting variety of work done by physicists." About half of the listed speakers are employed in industry, one-quarter in universities, and the remainder in government laboratories and other venues. A copy of the booklet was mailed to all physics and astronomy departments and to each of the approximately 600 Student Physics Society (SPS) chapters in the U.S. Those interested in obtaining a copy of the booklet — or in volunteering for next year's edition — should contact Arlene Modeste, APS, One Physics Ellipse, College Park, MD 20740-3844; email: modeste@aps.org.

The speakers list is also posted on the FIAP web page, which is accessible via the APS Home Page [<http://aps.org>]. The web posting of the speakers list will be updated periodically as additional speakers are added.

- The APS Ohio Section held its annual spring meeting 12-13 April at Ohio State University in Columbus, organized around the theme of Physics at the Nanoscale. Friday's technical program included talks on nanostructures in semiconductors and nanomachines and nanosensors, as well as lab tours and the annual banquet, featuring keynote speaker Lawrence Krauss (Case Western Reserve University). Saturday's plenary session covered complex dynamics of nanometer-scale magnets and the ultrafast dynamics of semiconductor nanostructures. The meeting also featured two lectures by Nobel Laureates prior to the regular program. On Thursday evening, F. Sherwood Rowland (University of California, Irvine), recipient of the 1995 Nobel Prize in Chemistry, spoke on the stratospheric ozone depletion by chlorofluorocarbons. Friday morning featured a talk on Bose-Einstein condensation of trapped atoms by SUNY-Stony Brook's Chen-Ning Yang, recipient of the 1957 Nobel Prize in Physics.

- Ph.D.s are up, but first-year students are down, suggesting a coming downturn in physics Ph.D.s at U.S. universities, according to a new report by the American Institute of Physics entitled, "Enrollments and Degrees Report." Released in January, the report shows that physics Ph.D. production continues to rise: 1481 were granted in 1994, compared to 1369 the year before. But the number of first-year graduate students is down 22 percent at Ph.D.-granting institutions and undergraduate junior level physics majors are down 13 percent since 1992. For more information contact the report authors, Patrick Mulvey and Elizabeth Dodge at (301) 209-3076.

- A recent study of a sampling of active male and female researchers reveals that while women scientists publish slightly fewer papers than their male colleagues, their citation rate per paper is significantly higher. Men published 2.8 papers per year on average, compared with 2.3 for women; but women's papers were cited 24.4 times on average, compared with 14.4 times for men. Gerald Holton (Harvard University), a former chair of the APS Forum on History of Physics, has been working with Harvard sociologist Gerhard Sonnert on Project Access, a study Holton began in 1988 that probes the attitudes of more than 800 scientists — about one-third of them women — who began their careers with prestigious postdoctoral fellowships between 1952 and 1987. Sonnert and Holton's report was summarized in an article in the January/February 1996 issue of *American Scientist*, pg. 63.

The higher citation rates for women's papers are indicative of "more noteworthy" contents, the report concluded. Based on their findings, the authors also concluded that women scientists are "inclined toward more comprehensive and synthetic work and more likely to try to find a scientific 'niche' rather than compete with colleagues in the same area of expertise." However, this is not due to "a feminine methodology or way of thinking," but that women may pay greater attention to detail and to the formalities of research. The study also found that while 70 percent of the men considered their own scientific ability as being above average, only half of the women did.

OPINION

APS VIEWS

APS Money: Where it Comes From, Where it Goes, and Why We Need You to Give Us More

by Harry Lustig, Treasurer

When The American Physical Society was founded in 1899, its budget was \$285. In 1995, the APS expended \$27,180,038. One of the reasons for the disparity — surprising as this may be to some readers — is that we did not publish the *Physical Review* for the first 20 years of its existence. Readers who helped us celebrate the centenary of that journal or who have read the wonderful book by Paul Hartman, will recall that the *Physical Review* was founded in 1893 at Cornell University and published by the Macmillan Company. It was not fully taken over by APS, as a non-profit service to the physics community, until 1913.

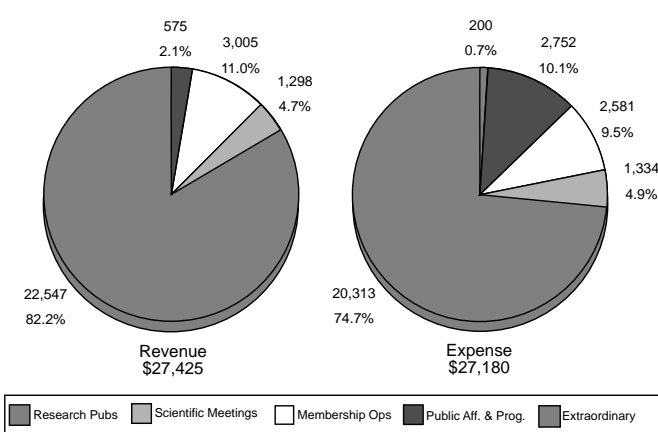
Another reason why our budgets have gone up is that in 1899 we only had 59 members; today the count is 41,670. Our expenses, and fortunately the revenues as well, have risen 135 times as fast as the membership. The explanation is not only that we live in an inflationary universe, but that the APS is now called on to do much more than the founders dreamt of. This is not because the Society's mission has changed. Remarkably enough, the APS Constitution says that it is exactly the same as it was in 1899: the advancement and diffusion of the knowledge of physics. (Some of our impetuous and radical presidents and Council members have suggested that it may be time to consider a change).

The difference is that in 1899 the membership and the leadership of the Society were satisfied to carry out the mission by holding scientific meetings and publishing the *Bulletin of The American Physical Society*. As already noted, publishing the *Physical Review* came later. Today, we not only publish some 100,000 pages per year in seven journals, hold many large and smaller meetings, and provide a large range of services to members. More important for this report, and following a trend that began several years ago, we carry out many — we believe very cost effective — public information, public affairs, education, outreach and international programs.

The pie charts in Figure 1 depict APS' revenues and expenses for 1995, for our four operations centers: the research publications, the scientific meetings, membership operations and services, and public affairs programs. Figure 2 depicts the net revenues or deficits for each of these operations centers.

A glance at Figure 1 will show the financially dominant role of the journals: they contributed 82.2 percent of the income and accounted for 74.7 percent of the expenses of the Society. The difference constitutes net revenue. The "surplus" — about 10 percent of revenues over the last decade — has been achieved in spite of the fact that our journals are extraordinarily low priced, per unit of information conveyed, compared to those of commercial and many other society publishers. Reflecting this pricing policy, our surplus, as a percentage of revenues, has been much smaller than that of many other publishers.

FIGURE 1: Summary of Operating Revenue & Expense FY 1995
Thousand of Dollars



More than two-thirds of the Society's 175 employees are engaged in working with the journals and the number would be higher if we didn't farm out much of the production and distribution to AIP and to other vendors. These high numbers reflect, of course, the continued intellectual importance of the

journals and the contribution they make to the advancement and diffusion of physics.

Organizing and running the meetings account for about 5 percent and the Membership Operations for about 9.5 percent of the budget. Public Affairs and Programs contributes very different slices to the revenue and expense pies: 2.1 percent and 10.1 percent respectively.

The economics of the journals will be discussed in a coming issue of *APS News*. For now, let me only say that 75 percent of the revenues come from library subscriptions and 10 percent — a declining fraction — from page charges. The expenses are roughly equipartitioned between editorial, composition and production, and printing and distribution outlays. As the future article will make clear, several factors, including continued growth, the crisis in library funding, a decline in page charge income, large but essential expenditures to convert to electronic publishing, and uncertainty about obtaining revenue from online journals, cause us not only to discount future surpluses but to worry about the long run financial stability of the journals.

(continued on page 5)

LETTERS

Authorship Practices Need Review

How "scientific" is the process of assigning authorship on a scientific research paper that includes a postdoc? I decided to find out with a questionnaire. Three samples were taken of close to 100 postdocs each from: 1) a set semi-randomly approached at a conference, 2) from a national lab mailing list, and 3) a university postdoc mailing list, with an overall return rate of 57 percent. The core of the questionnaire was the APS ethics statement.

Let us first start with how many postdocs have ever seen the APS ethics statement? A low 23 percent.

Did postdocs think that obtaining grants and other funding for a project qualifies as a "substantial contribution" that warrants authorship? Forty-six percent of the postdocs answer affirmatively, while almost everybody else has the opposite opinion (a few say it depends).

Since postdocs apparently have different opinions about authorship a discussion about authorship criteria seems needed in order to properly assign authorship credit. Thus another question read: Has your supervisor ever discussed the criteria for authorship with you? Only 28 percent answer affirmatively.

Less Than Optimistic Views

I found Julian Simon's Back Page article an interesting exercise in misdirection. The concern of serious observers over the current exponential growth of population is not that food is going to vanish off our plates at some precisely determined date in the future, but rather that such growth seems unsustainable over the long term. Not being an economist, I would hesitate to insist on which of energy, water, disease, food, or whatever will come first as the major future challenge to mankind. Speculating on copper futures couldn't be more irrelevant.

Simon provides solace to those who do not need it; those already unwilling to admit that an exponential population growth cannot rationally be sustained indefinitely. Ironically, the implicit message is that technology can be counted on to ride (repeatedly!) to the rescue. Ironic because many of the apologists for unfettered population increase have little or no other interest in technology, if not downright antipathy. If memory serves, Professor Simon earlier gave a positive spin to this issue as "more geniuses" being born to solve our problems thanks (in both senses) to the ever-expanding population. How it is that economists, of all people, know that technology can be depended on to deliver in every case is not spelled out in the article. Another question that is not addressed is: why?

I then asked about the details of the authorship assignment of papers written (with the postdoc as an author) in the current postdoc position. I asked who were the authors and whether — according to the APS ethics statement — the authors of the papers made a "substantial contribution."

In 22 percent of papers with the supervisor as an author, the postdocs, guided by the APS ethics statement, feel that the supervisor should not be an author. Papers with additional authors other than the supervisor and the postdoc had in 37 percent of the cases one or more authors, other than the postdoc or the supervisor, who should not be there.

What were the reasons for inappropriate authorships? Implicit or explicit pressure from advisor; advisor's friend needs to be an author; tradition; advisor of a collaborator needs to be rewarded; the authors should appear as a team, etc.

It appears that the process of assigning authorship is not particularly scientific.

A full report can be obtained from the author [tarnow@netcom.com].

Eugen Tarnow
New Brunswick, New Jersey

What advantage does our present rapid population increase confer? If indeed we can always count on new solutions and substitutes coming along, fine. But why put ourselves in the position of facing disaster if any one of these falters? No Western government to my knowledge is actively trying to get its population to grow faster in order to "reap" all of these purported advantages.

The hydrologist comes back to report that the reservoir is almost dry and Professor Simon runs among the people shouting, "Wonderful, drink all you want because someone will then even sooner think up another solution to our need for water!" Sure. As for bets, I'll bet that half the (non-domestic) animals in current children's books will be extinct in 50 years; I'll bet that carbon dioxide continues to increase exponentially in the atmosphere as long as the population itself increases exponentially, I'll bet that the population will easily exceed the official UN "predictions" (which are consistently twice whatever the current population is: 10 billion a few years ago when the total was 5, now it's 12 given that the total is 6), barring of course massive die-offs of Malthusian proportions. Trouble with betting on the long term is you aren't around to collect.

F. Curtis Michel
Rice University

Has your mail bag been coming in light, or what? It's hard to resist responding to Julian L. Simon's "Resources and Population: A Wager" in your March 1996 issue. However, my paycheck is too insecure to wager, so a letter will have to do.

It is good to hear there really is some form for optimism about the future and

the possibility that technology will preserve the improved standard of living we enjoy and help spread it more uniformly to other lands, including those close to the equator. The same point is made by Jesse H. Ausubel ("Can Technology Spare the Earth?" in *American Scientist*, March-April 1996) He suggests ways evolving efficiencies can restore the environment even as popu-

OPINION

APS VIEWS *continued from page 4*

Meetings income derives predominantly from registration fees. At \$195 for "regular" members who preregister, the fees for the March and Spring meetings are still not high compared to those of many other professional societies. However, in consideration of the precarious state of research funding, the Executive Board has decided to keep the fees at their present level at least for next year. The Society wants its members to be able to participate in the meetings.

Dues represent the bulk of the income for funding membership operations and services. At \$90 for "regular" members and considerably less for seniors, juniors, and students, they are at about the median for U.S. physics and related societies and well below that of other professional associations.

Dues pay for our share of *Physics Today*, for *APS News*, for a portion of unit expenses and newsletters, for governance operations and for the maintenance and improvement of the membership database. Again, probably as a consequence of the pressures on the physics community, after about 100 years of essentially monotonic growth, the last few years have seen small declines in the numbers of members — just at a time when we need more resources to help preserve and improve the health of physics. We are therefore reluctant to raise the dues.

It is not difficult to see why public affairs and programs are fated to operate at a substantial deficit. Income comes primarily from grants and contracts (which, of course, must be expended dollar-for-dollar for the activities contracted for) and from members' contributions.

Where does the money go? Into dozens of programs, large and small, — but all, we believe, important, cost-effective, and member driven — in the areas of public information, public affairs and governmental relations, education, outreach, and international activities. Table 1 is a short, representative *sample* list of these programs and their 1995 costs. We will be happy to provide anyone with details, on request.

TABLE 1

ACTIVITIES
PUBLIC AFFAIRS & INFORMATION Panel on Public Affairs Congressional Fellows PG Net Science Media Relations Physics Planning Committee Industry - Academic Government Roundtables
EDUCATION AND OUTREACH High School Teachers Days Physics Olympiad Physics Teachers/Scientists Alliance Industrial Summer Intern Program Minorities Committee, Scholarships & Speaker Grants Women's Committee, Roster, Speaker Grants
INTERNATIONAL AFFAIRS Matching Membership Former Soviet Union Programs (grant funded) Committee on International Scientific Affairs Committee on International Freedom of Scientists
CAREER SERVICES Graduate Student Packet, CareerPlus Industrial Speakers List Employment/Career Workshops

Even though much of the work is done by volunteers, we need to pay for staff and office expenses to help run the programs. Anyone who knows what these people accomplish and compares that with the staffing pattern in similar organizations will agree that our staffing is gratifyingly lean, about 11 FTEs for these departments. This is consistent with the fact that physicists (and the Society that represents them) are very frugal. (Some would say "cheap", but that is no more true than the observation that physicists are arrogant.)

So where are we and where do we go from here? Look again at Figure 2. A simple way to interpret the graphs is to say that in 1995 the surplus from the journals paid for the public affairs

Letters *(continued from page 4)*

programs of the Society. A simple and sobering conclusion is that with the surplus threatened, APS must now wean itself away from reliance on it and must find other sources to finance the increasingly necessary public affairs programs.

lution grows, but also notes how increasing levels of consumption make the problem appear more formidable. Guarded optimism appears appropriate because of the way destructive unrest can accompany population growth. Savage events in Rwanda and in what was Yugoslavia are examples of this apparent correlation. The incredible destruction of human life in Europe during this century has been linked to population pressure by historians such as Friedrich Meinecke and Jacques Bainville. Surely other factors are also involved, but all deserve to be considered and weighed if we hope to prevent such misfortunes from visiting us in our own communities. The economic value of personal security may

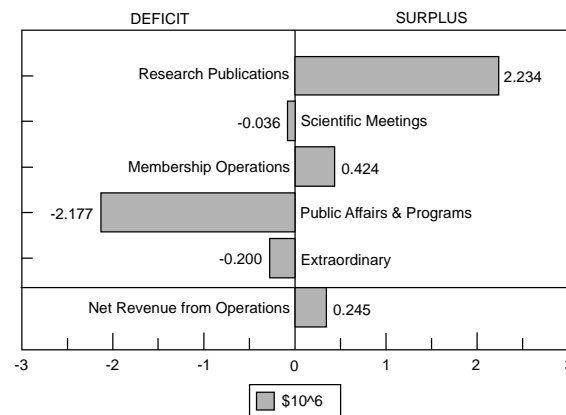
be difficult to estimate, but its subjective value is enormous when it is our own or that of those close to us.

It is an oversimplification to state flatly that better living started only 200 years ago. More than two centuries ago, Adam Smith remarked (in print) on the sensible improvement in the human condition compared to earlier times. Charles Van Doren points out (in "A History of Knowledge") that the growth of knowledge needed for this improvement was accelerated by a general increase in prosperity subsequent to the black death four centuries earlier. And this paradox shows population growth is not a negligible factor in Professor Simon's wager, in which I wish him every success.

Fortunately, the situation is not as bleak as the graph would seem to indicate. Over the last decades, the Society has built up a "reserve fund" which is now equal to about one year's expenditures. The original motivation was to enable APS to continue to operate for one year, in the absence of income or as a result of other dire events. Fortunately this fund has been well invested and now produces, in a good year, significant income. With the goal of keeping the reserve fund at one year's expenses requiring only modest annual additions and assuming that the journals must be able to pay for themselves and for part of the investments in electronic publishing, we can and will use some of the income to help fund the public affairs and outreach programs of the Society.

However, investment earnings are not enough and increased income from other sources is clearly needed. We will seek more grants, but these will generally finance only new programs that are of interest to the granting agency and not programs that the Society and its members want to continue or expand. The Campaign for Physics, launched in cooperation with the American Association of Physics Teachers, is an important new initiative, mainly designed to enhance pre-college science education (See *APS News*, December 1995). Corporate and individual donations are being sought to achieve the Campaign's goal of \$5 million. Please contact the Campaign Director, Darlene Logan, at logan@aps.org or at (301) 209-3224, for more details.

FIGURE 2: Net Revenues (Expenses) of Operations Fiscal Year 1995



The mainstay of support for many APS programs, such as those illustrated in Table 1, will need to come from more annual contributions from you, the members. This support has been habitually solicited with the renewal invoice, in the form of suggested voluntary contributions. In 1995 the contributions totaled \$323,612. For several years the level suggested has been \$25 for members and \$50 for fellows. We are suggesting the same amounts on the invoices this year. The explanations that go with the invoice state that "if you would like to contribute at a level other than this amount, please adjust the suggested amount...." Needless to say, we would very much prefer the substitution of a higher rather than a lower amount. In fact, we hope to double the 1995 total. This can be achieved only by a rise in the number of members who honor the voluntary contribution and/or an increase in the size of the contributions. For the first 200 members who contribute \$100 or more, we have an actual gift: a copy of the Hartman *Memoir of the Physical Review*. It is really a delightful and informative book, and at 212 pages, can be read in one evening.

We recognize that among the public affairs programs that APS carries out, members have their favorites and, in some cases, their antifavorites. You may designate on the invoice which group of activities your contribution will be used for.

For those who would like to consider becoming big-time donors, we have other suggestions, such as planned giving programs and bequests in the donors' wills. Please contact me or Darlene Logan if you would like to discuss any of these possibilities further. (If you just want to send in your \$5,000 check, don't hesitate to do so.) I wish I could say it's only the spirit that counts, but it isn't. Every contribution will help the Society (with a capital 'S') in its efforts to enhance the welfare of physics and of society (with a lower case 's').

For further information contact Harry Lustig at: lustig@aps.org or 301-209-3220.

Both Professor Simon and Jesse Ausubel present the same valuable message: those of us who hope for a better future should be on guard that

pessimism does not paralyze our capacity for positive action.

Robert R. Turtle

Simon Article Legitimizes Foolish Notions

I usually enjoy reading the well-considered comments on The Back Page, although I do not always agree with them. However, I do not think the recent illogical article by Julian Simon was worth printing. It wastes paper and your readers' time as well as lending legitimacy to some foolish idea. The author

has an extremely narrow point of view concerning the success of progress without any concern for the environment. Now I assume there will be many letters to the editor with further discussions of what most of us understand.

Janet Machol
NOAA

Editor's Note:

Indeed the Back Page article by Julian Simon stimulated many more members to respond than we can accommodate. The gist of these letters are represented by these printed here. We apologize to those whose letters were not printed.

CAREER CORNER

This is a regular feature describing diverse employment opportunities and career advice for physicists, appearing as space permits. If you are a physicist employed in a nontraditional career and would like to contribute to future columns, send a letter describing your background, how and why you changed careers, and any advice you might have for physicists seeking to do the same to APS News, One Physics Ellipse, College Park, MD 20740-3844; fax: (301) 209-0865; email: letters@aps.org.

Jeffrey Marque Beckman Instruments

Jeffrey Marque is a staff physicist with Beckman Instruments in Palo Alto, California, where he works primarily on problems that require both experimental and computational fluid dynamics and structural dynamics analysis. While much of his present work is in engineering, over the past 25 years he has worked in areas ranging from physics, cell biology, cardiology, anesthesiology, and biophysical chemistry.

Marque received a B.S. in biology and physics from the University of California, Berkeley in 1971, then worked for a year as a hospital technician in a cardiac catheterization laboratory and also as the first violinist in a professional string quartet. Since he had a strong interest in neuroscience, he subsequently took a position as a staff research associate at the University of California, San Francisco's School of Medicine's Cardiovascular Research Institute, where he worked on a study of anesthetic effect on cerebral blood flow, ischemia and edema. He was also able to combine his interest in mountaineering with his research director's interest in high altitude physiology by offering a course in medicine for mountaineers, coordinated with the San Francisco Bay Chapter of the Sierra Club.

In 1975, Marque was awarded a scholarship to study chamber music at the San Francisco Conservatory of Music,

and he concurrently entered the M.S. program in physics at San Francisco State University. Upon completion of the master's program, he moved to the University of Illinois. He received his Ph.D. in experimental physics there in 1983, with a dissertation on thermodynamic and kinetic studies of the bacterial protein bacteriorhodopsin. His first post-doctoral position was at RIKEN in Japan, where he worked on steady-state and time-resolved fluorescence anisotropy decay studies of tagged bacteriorhodopsin. He also collaborated with a colleague at Ochanomizu University in Tokyo on a dynamic light scattering study of membranes formed from a mutant of the protein.

Marque accepted another post-doctoral position with Cornell University in 1985, where he developed an instrument for the study of the kinetics of a receptor protein in nerve cell membranes. Although he received offers for two assistant professor positions while at Cornell, he was unable to accept because the salary was insufficient to support his family.

In 1988 Marque was hired as a physicist in the Engineering Department of Beckman Instrument's Spinco Division, where he has worked ever since. Although the engineer who hired him was looking for a "hot shot theoretical physicist" to help engineers with concepts and calculations, Marque convinced the en-



Jeffrey Marque (right)

gineer that his broad background in instrumentation and physical chemistry would also be useful to the department and company. Within six months of joining Beckman, he invented algorithms for automating the optimization of certain kinds of centrifugal separations, and for using physical chemical theory to enable local solute concentration control during centrifugation, resulting in two U.S. patents and several pending international patents. He began work in mechanical engineering in 1990, when two mechanical engineers with expertise in structural dynamics left Beckman.

Marque challenges the assumption that academic research is somehow more sophisticated and demanding than industrial research, claiming that he has found much more satisfaction solving problems connected to useful products

than he did in deriving scientific information of either remote, indirect, or no utility, although the work in both areas was comparable in quality and difficulty. "With the exception of the most brilliant scientists who can truly exploit open-ended research to make great break-

throughs, I think that the idea that satisfying scientific work can only be had in academia is wrong," he said. "I think that many young scientists are misguided and made unnecessarily miserable because of this serious error in outlook."

The breadth of his background and knowledge has unquestionably been a valuable asset in his work with Beckman. He believes that a physics background allows job seekers entrance to interesting and challenging work in technical field both in and outside of physics, and urges young Ph.D.s planning their careers to exploit the fact that their physics training gives them flexibility. He is currently a participant in an APS/AAPT program in which industrial physicists give career advice to community college students who are interested in physics and engineering.

Physics Success Stories Provide Tool for Scientists

The American Institute of Physics' Public Information Division has prepared a series of one-page brochures aimed at illustrating the practical benefits of physics, entitled *Physics Success Stories*. Each brochure summarizes a single research area from among the physical sciences. According to Philip F. Schewe, AIP's director of public information, the primary aim of the brochures, at least initially, is to help scientists effectively discuss the prominent benefits of physics when visiting their elected representatives.

To be considered, the subject matter had to meet the following criteria: (1) the research must benefit society; (2) it must represent noteworthy physics; (3) the topic must lend itself to an attractive graphical layout; (4) federal funding has been prominent; and (5) the research has resulted in billion-dollar-per-year industrial markets. The brochures, demonstrate that physics plays a vital role in our daily lives.

"Many leaders in Congress and the executive branch have suggested that the scientific community has not been sufficiently involved in the debate over the future of federal science funding," said Schewe of the rationale behind the brochure, pointing out that NSF Director Neal Lane has criticized the overall "resounding silence" of scientists on the subject. "In some cases, Congress has heard from scientific society officers. But some Washington insiders have observed that an individual makes a greater impression when he or she actually visits a Congressional office, and does so as a constituent."

Work on the project began in October 1995, and has involved the work of several AIP Public Information staffers ever since. The first five stories cover medical imaging, lasers, the Global Positioning System, the environment, and new materials. The APS was the first to use the brochures, including them in information packets sent to physicists scheduling congressional visits in April.

Many worthy topics were suggested by APS members and others, from which a tentative list of five more stories were chosen: telecommunications (capitalizing on the recently-passed Telecommunications Bill); electronics (the nation's largest single industry); physics in the home (mostly consumer goods); national defense; and transportation. The next five are expected to be completed by June 1. Other topics under consideration include magnets, superconductors, and friction (or coatings).

Individuals on Capitol Hill and in other government offices have so far been enthusiastic about the *Success Stories*. The first five will be posted on the AIP Home Page (<http://www.aip.org>) in the next few weeks. In addition, the stories may be supplied to schools, museums, libraries, and elsewhere. For further information, contact Michal Freedhoff at 301-209-3084, or mfreedho@aip.acp.org.

Physics Designs the Future

New Materials

From Air Force to Air Jordan[®], federally funded materials physics, often inspired by national defense needs, has led to a wide variety of consumer products that have changed our lives and added billions of dollars to the economy. For instance, Teflon, found in everything from frying pans and fashion to medical transplant materials, was first used by the military to make O-ring seals during World War II. Lighter than aluminum but stronger than steel, composite materials are used to minimize earthquake damage and to build planes, sports equipment, and musical instruments. And that is just the beginning of the materials revolution. "Smart" materials will one day be taught to "think" and respond on their own, changing everything from building design to television as we enter the 21st century.



W.L. Gore & Associates

POLYMERS AS BREATHABLE INSULATING CLOTHING

- GORE-TEX[®] is made by stretching Teflon, a polymer, and is insulating, fire-resistant, and durable.
- Worn by the U.S. Army for strenuous activities in cold climates.
- Has been used for 3.5 million medical procedures, including synthetic blood vessels, sutures and tissue reconstruction.
- Initial research: 1930s-40s: DOD
- Applied research: 1950s-90s

Another in a series of Physics Success Stories



NSM, Ted Furowitz, 1996

MATERIALS FOR MEDICINE

- Polymer physics results in the development of artificial joints, skin, bone, heart valves and cartilage.
- There are more than 5000 medical devices and diagnostic products that utilize biomaterials.
- Health care costs are reduced through new glasses and coatings for smaller, cheaper surgical instruments, leading to less invasive surgery and shorter hospital stays.
- Initial research: 1960s-70s: NSF, NIH
- Applied research: 1980s-90s: NSF, NIH

PLASMA THERMAL SPRAY COATINGS

- Military and commercial aircraft engines are coated with new materials that resist wear and extreme heat.
- The global spray coatings market is \$1-2 billion.
- Thermal spray coatings are used in baby bottles, bicycle rims and toys.
- Initial research: 1960s-70s: DOE, DOD
- Applied research: 1980s-90s: DOE, DOD, NASA, NSF



NASA

ANNOUNCEMENTS

PRL-o Renewal Time is Here

To members who now subscribe to *PRL-online* and to members who would like to begin a subscription — the time to act is now. Simply indicate the addition on the dues invoice that you recently received in the mail. Subscription prices are the same as last year's: U.S. \$75 for U.S. subscriptions; U.S. \$80 for all others. Renew by July 1 to keep your licensing agreement active and avoid losing access to your copy of *PRL-online*.

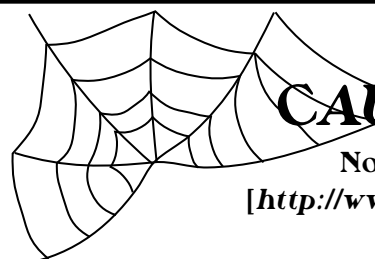
We look forward to welcoming you as a PRL-o subscriber!

Contact Maria Lebrón, associate publisher at assocpub@www.aps.org with questions, comments or suggestions.

PRL-online FACTOID

(1 July to 31 December 1995)

SUBSCRIBERS	MEMBERS	INSTITUTIONS
1 July 1995	87	236
1 December 1995	772	441
Total connect time = 186,115 minutes		
Total number of articles displayed = 21,247 articles		



CAUGHT IN THE WEB

Notable additions to the APS Home Page [<http://www.aps.org>] during the month of March.

APS News Online (latest edition)

Units

- New England Section Spring Newsletter

Meetings

- Joint APS/AAPT Meeting Program
- 1996 Joint Meeting Virtual Pressroom
- 1996 DAMOP Annual Meeting
- The 1996 Texas Spring Section Meeting

Miscellaneous

- Panel on Public Affairs Page
- The APS Centenary Celebration Page
- Redesigned Education and Outreach Page
- Advanced Listing of Accepted Papers in *Physical Review A,B,C,E*
- Advanced Listing of Accepted *Physical Review D* Papers with links to the HEP preprint database

Careers

- *CareerPlus*
- Additional links to career resources

NEW FACULTY CONFERENCE

The American Association of Physics Teachers (AAPT) is planning a conference aimed at helping new physics faculty understand how students learn physics and the implications of this information for their own teaching activities. Scheduled for 31 October through 3 November at the University of Maryland, the conference will cover new developments in physics curriculum and pedagogy. A follow-up session for the new faculty will be held at the AAPT Summer Meeting following the Conference.

Eligible participants should be physics faculty at colleges and universities in the first year or two of their initial tenure-track appointment, including senior faculty who have recently entered academia after careers in industry or in government laboratories.

For more information please contact the AAPT Programs, Conferences and Exhibits Department at (301) 209-3344 or fax to (301) 209-0845. You will also find more information by accessing AAPT's Home Page through the WWW at: <http://www.aapt.org>

NOMINATIONS FOR PRIZES AND AWARDS

The following prizes and awards will be bestowed at meetings of the Society in the coming year. Members are invited to nominate candidates to the respective committees charged with the privilege of recommending the recipient. A brief description of each prize and award is given below, along with the addresses of the selection committee chairs to whom nominations should be sent. Please refer to the APS Membership Directory, pages xxiii- xxxix, or the APS Home Page [<http://www.aps.org>] under the Prize, Award and Fellowship button, for complete information regarding rules and eligibility requirements for individual prizes and awards.

1997 FLUID DYNAMICS PRIZE

Sponsored by the Office of Naval Research.

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

Nature: The prize consists of \$5,000, a certificate citing the contributions made by the recipient, and a travel allowance to the meeting at which the prize is bestowed.

Send name of proposed candidate and supporting information before 1 September 1996 to: Stanley A. Berger, UC, Berkeley, Dept. of Mechanical Engineering, Berkeley, CA 94720, (510) 642-5950, fax: (510) 642-6163, email: saberger@me.berkeley.edu.

1997 OTTO LAPORTE AWARD

Sponsored by the friends of Otto LaPorte and the APS Division of Fluid Dynamics.

Purpose: To recognize outstanding accomplishments in research in fluid dynamics.

Nature: The award consists of \$1,000 and a certificate citing the contributions made by the recipient.

Send name of proposed candidate and supporting information before 1 September 1996 to: Sung Piau Lin, Box 5725, Clarkson University, Potsdam, NY 13699, (315) 268-6584, fax: (315) 268-6438, email: gw02@splin2.mie.clarkson.edu.

CORRECTIONS

The March and April issue of the *APS News* incorrectly indicated that the 1997 Davison-Germer Prize would be awarded for outstanding work in atomic physics. In 1997 it will instead be awarded for outstanding work in surface physics. A corrected call for nominations is listed below.

1997 DAVISSON-GERMER PRIZE

Sponsored by AT&T Bell Laboratories

Purpose: To recognize and encourage outstanding work in atomic physics or surface physics.

Nature: The prize consists of \$5,000 and a certificate citing the contributions made by the recipient. This annual prize will normally be awarded alternatively for outstanding work in atomic physics one year and for outstanding work in surface physics the following year. The 1997 prize will be awarded for outstanding work in surface physics.

Send the name of candidates, biographical information and supporting letters to Mark J. Cardillo, 1D-358, AT&T Bell Laboratories, 600 Mountain Ave., Murray Hill, NJ 07974, Ph. (908) 582-2418, Fax: (908) 582-3619, email: mjc@allwise.att.com. Nominations must be received no later than 14 June 1996.

Please note the following address and deadline changes to earlier announcements for the **1997 Tom W. Bonner Prize in Nuclear Physics:**

Send nominations to Prof. Michael J. Musolf, Institute for Nuclear Theory, Physics & Astronomy Bldg, Box 351550, University of Washington, Seattle, WA 98195. The deadline for submission of nominations is **1 July 1996**.

Impending APS Prize & Awards Deadlines

The following are impending deadlines of APS Prizes and Awards. For complete information regarding the description of each prize, previous recipients and the chair of prize selection committees, please see the Prize, Awards and Fellowship Page of the APS home page [<http://www.aps.org>]; consult the front of the APS Membership Directory, email your request to honors@aps.org, or call (301) 209-3268.

1997 Prize	Deadlines	Oliver E. Buckley Prize	06/14/96	George E. Pake Prize	06/14/96	Robert R. Wilson Prize	06/14/96
James Clerk Maxwell Prize	04/04/96	Davison-Germer Prize	06/14/96	W.K.H. Panofsky Prize	06/14/96	Tom W. Bonner Prize	07/01/96
Nicholson Medal	04/04/96	John H. Dillon Medal	06/14/96	Aneesur Rahman Prize	06/14/96	Fluid Dynamics Prize	09/01/96
Excellence in Plasma Physics Res.	04/04/96	Forum Award	06/14/96	I.I. Rabi Prize	06/14/96	Otto Laporte Award	09/01/96
Simon Ramo Award	04/04/96	Dannie Heineman Prize	06/14/96	Prize for Research in an Undergrad Inst.	06/14/96	Shock Compression Science Award	09/01/96
David Adler Lectureship Award	06/14/96	High Polymer Prize	06/14/96	Earl K. Plyler Prize	06/14/96	Dissertation in DAMOP	11/18/96
Apker Award	06/14/96	Irving Langmuir Prize	06/14/96	J.J. Sakurai Prize	06/14/96	Will Allis Prize	06/20/97
Dissertation in Beam Physics	06/14/96	Lilienfeld Prize	06/14/96	Arthur Schawlow Prize	06/14/96	Biological Physics Prize	06/20/97
Bouchet Award	06/14/96	Maria Goeppert-Mayer Award	06/14/96	Leo Szilard Award	06/14/96	Frank Isakson Prize	06/20/97
Herbert P. Broida Prize	06/14/96	Onsager Prize	06/14/96	John Wheatley Award	06/14/96	Dissert. in Nuclear Physics Award	06/20/97

THE BACK PAGE

Universities and Government — A Shared Commitment

Ernest J. Moniz, Associate Director for Science, Office of Science and Technology Policy

America's colleges and universities are unmatched in their capacity to provide advanced education in science and engineering and to enrich it through forefront research. The tight weave of research and education, fostered by Executive policy for half a century and supported through a robust bipartisan commitment, has served the nation exceptionally well. The nation's investment has been repaid many times over by a scientific enterprise without peer. The expression of scientific research in technological innovation has accounted for a major part of our economic growth, has underpinned our national security, and has promoted our ability to understand, prevent and treat disease. The promise of science and technology is far from exhausted, but will be realized only through continued strengthening of our world-class scientific enterprise. The bedrock of that enterprise is our system of research colleges and universities.

Why then are the universities and the government-university partnership under considerable stress? Clearly, we are dealing with the uncertainty engendered by significant change. The uncertainties of research funding are driven by the need to eliminate the federal budget deficit, a deficit whose rapid growth in the previous decade constrains investment today. The proper scope and scale of government are, to many, uncertain with the end of the Cold War and with the emergence of highly competitive economies in Europe and Asia. The information revolution has many institutions uncertain about their future roles in society. The challenge of broadly expanding education beyond the "three R's" into science and technology confronts our schools. Unquestionably, reexamination and reestablishment of the 50-year-old government-university compact is called for.

The Clinton administration's posture, at a general level, is rather straightforward. First, the health and future of our research colleges and universities must be nurtured by government, with strong research programs revealing nature's secrets, stimulating innovation, and yielding world-class scientists and engineers. This policy has been supported eloquently in recent months by CEO's of major corporations and by many of the nation's governors. Second, the universities and their faculties must help define and then meet important new responsibilities and obligations to a society in change. These comprise the shared commitment.

The rationale for this position is not complicated. As President Clinton said in his 1996 State of the Union address:

We live in an age of possibility. A hundred years ago, we moved from farm to factory. Now we move to an age of technology, information and global competition. These changes have opened vast new opportunities for our people, but they have also presented them with stiff challenges."

That reality drives an investment agenda with a strong emphasis on research and

education, the two sides of the knowledge coin. Knowledge is the key resource of the information age. Thus, our knowledge institutions — schools, colleges and universities — will become increasingly central both to our society's collective prosperity and health and to each individuals' ability to prosper and grow within that societal structure. That is, knowledge inequities will correlate more and more directly with economic inequities and social inequities. Colleges and universities are not so much jewels in some mythical national crown, but rather an integral part of the crown itself.

Needless to say, this framework of values and policies must be translated into specifics. I will comment briefly on some of the research and education issues directly relevant to the government-academia partnership.

Research

The major part of the basic research portfolio, most especially research performed at universities, has traditionally been an area of bipartisan common ground. Federal support has grown steadily, but government plans for reducing overall domestic discretionary spending and the restructuring of many R&D-intensive industries have left universities extremely uncertain about future support. The most recent "hard data" are those in the administration's FY 1997 funding request. The figure reproduces the AAAS R&D highlights shown in the March 22, 1996 issue of *Science*. As is evident, priorities have been set in a highly constrained budget environment such that most programs which draw heavily upon and support academic researchers would increase. For example, the budgets of NSF and NIH, the bellwethers for university support, are proposed for 4.6 percent and 3.9 percent increases, respectively. Most of the mission agency basic science programs are supported fairly well. For example, the fusion program, which suffered a major reduction from 1995 levels, is proposed for restructuring, with a stronger emphasis on basic science and engineering. An obvious exception is the substantial drop in space science funding. However, this simply reflects the nearing completion of two large construction projects (AXAF and CASSINI). In fact, the space science budget sustains all the science missions and increases the funds for data analysis. All in all, the proposal clearly supports the high investment priority attached to basic research and its concomitant educational function in the universities.

The years beyond 1997 are very unclear for science budgets. Simple arithmetic highlights the issue. If total domestic discretionary spending, about \$250 billion, were frozen for five years, spending power would presumably decline by about 15-20 percent, or about \$40 billion, at the end of that period. Clearly, neither the overall balance between different parts of the budget nor

specific program choices are set. Many variables, including overall performance of the economy, will guide the prioritization process. Still, one cannot ignore the potential magnitude of the shortfall and thus the need for the research community to articulate clearly the long term value to society of the research and education investment. In addition, irrespective of the eventual outcome, spending projections will affect year-by-year decisions, such as the construction of major new facilities in balance with ongoing research. For example, the NIH budget proposal contains significant funding for a new clinical center, a vital facility for sustaining clinical research. The DOE will be faced shortly with decisions about world-class neutron sources and about participation in the Large Hadron Collider at CERN in the midst of considerable budget uncertainty. The necessity for these and other major facilities in advancing the scientific frontier will have to be evaluated against the size and scope of ongoing core programs. It is clear that scientific excellence will not be sustained long in any discipline without a focus on the most important scientific questions and the tools to address them. Only a dialog between government and the American science community will strike a scientifically and politically sustainable balance. A coalition of academic, industrial, and government leaders must speak for the future in emphasizing the need for stable investment in research and education.

Education

The information age will change both the process and the requirements of advanced education. With regard to process, it is easy to imagine radical departures in the cost-effective transmission of knowledge, simultaneously posing both leadership opportunity and threat for colleges and universities. With regard to requirements, a lively debate centers on K-12 education and the need for serious mathematics and science standards. Higher entrance and graduation standards may be the most direct route for colleges and universities to affect standards implementation. It may be time for the faculties of our colleges and universities to reexamine science "standards" in higher education. Thirty years ago, virtually all of the leading institutions had a serious science requirement. We would be hard-pressed to make that claim today, a time when science and technology will surely be of more importance in our children's lives.

These questions are clearly challenging ones for higher education. However, the critical shared responsibility in higher education is that of providing access. The importance of this collective responsibility follows directly from the central role of knowledge institutions in defining both societal and individual opportunity. While this is true for all fields of study, science and engineering careers have proved to be very



effective pathways for social mobility for significant numbers. The discussions of recent years about the job futures of scientists and engineers should not cloud the basic fact that such careers remain relatively very attractive for both combined prosperity and personal satisfaction. More of our young people deserve the opportunity. Recent data provided by the National Action Council for Minorities in Engineering indicate that only 12 percent of our high school graduates have the mathematics and science background to pursue a technical degree. The number is only half that for underrepresented minorities, groups that already provide almost one-third of the college age population. We need to develop and utilize fully our human capital. A growing education gap will eventually be even more damaging to the social fabric than the budget gap with which we struggle today.

The Clinton administration is actively supporting programs to improve access. The programs range from increased Pell grants to direct student loans to tax deductions for higher education. However, partnership among universities is essential. Continued cost containment by colleges and universities is a major responsibility to society at large. Further significant cost escalation or retrenchment from a commitment to our ethnically and economically diverse population will extract too high a societal price in the knowledge-based economy of the next century.

There are numerous other issues, such as accountability in the award and management of research funds, and the rethinking of university-national laboratory relationships, which deserve elaboration. Some of the partnership issues touched on are in productive dialog, while others await more creative investments in change. A shared commitment is part of the answer in all cases. A secure sense of the future is the needed backdrop to investments in research and education, investments whose return is typically many years off. Government and academia must articulate together the strong link between these investments and the bright future we can anticipate in the age of possibility.

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