Insider

NEWS


How to Use a Surplus: Squeeze and Double

by Michael S. Lubell, APS Director of Public Affairs

It seems only yesterday that the federal budget was drowning in a sea of red ink. Less than two years ago the White House projected that the annual deficit would run $200 billion or more, but into the future as analysts could peer. As little as a year ago, forecasts of even-keel for the current fiscal year seemed to be little more than wishful thinking. And just December, when Director Raines vehemently denied rumors that his office was projecting a surplus for this year.

Yet within two months, the Office of Management and Budget reversed its public stance, and by the time President Clinton delivered his State of the Union Address,OMB was forecasting a small surplus—under $13 billion a small number. By April, the figure had grown to $39 billion, and by the sultry summer days enveloped the nation’s capital, OMB once again moved its estimate upward, this time to $63 billion. Some analysts believe that by the close of the fiscal year on September 30, the surplus could reach $75 billion, driven by an incredibly vibrant economy that is fueled by technology.

With all this cash piling up in the Treasury, you might wonder why Congress is considering billions of dollars in tax cuts. In its State of the Union Address, the President proposed to cut $100 billion in the current spending plans. The answer is simple: It’s 25 percent ideology and 75 percent politics—as most things are in Washington. Here’s the inside dope.

First the ideology. Congress, including a large majority of Republicans, and a band of about 20 Blue Dog Democrats, want to shrink the federal government in order to adhere to their popular credo. They regard the federal government, at worst, as the enemy of the people and, at best, as a well-meaning but inept legion of bureaucrats.

But there is a crisis, of course, is still a matter of debate. Control of the House of Representatives to the Democrats. This simple fact is well known by every Beltway denizen, establishes the backdrop for almost all current decision making in Washington. To position the Democratic party for the November shoot-out, the White House last January decided to try to deprecate the GOP of its ammunition of choice—tax cuts. In its State of the Union Address, the President forecasted any budget surplus until the Social Security "crisis" is solved. Whether there is a crisis, of course, is still a matter of debate.

(continues on page 7)
The American Physical Society selected the APS 1998-99 Congressional Fellow at its annual spring meeting in Columbus, OH in April. Antonia Herzog, currently a consultant with the American Association for the Advancement of Science (AAAS), will serve one year as a special legislative assistant in a congressional office of her choice, following an intensive, ten-day orientation period and interview process.

Herzog received a BA in physics from Vassar College in 1987 and a BE in general engineering from Dartmouth College the following year. After completing her MS in applied physics at Columbia University in 1989, where she studied the stresses and strains in doped silicon membranes using Raman spectroscopy, she went on to earn a PhD in physics from the University of California, San Diego. There she studied the transport properties of disordered metallic and superconducting one-dimensional wires. Herzog also gained an appreciation for the political climate with a summer internship at Xerox Corporation in Webster, New York, in 1988, while working in the Business Products & Supplies/Marketing Group. Before joining the AAAS, Herzog explored other research options, working as a postdoctoral researcher at The Salk Institute for Biological Studies, studying the organization of neuronal circuits for visual information processing. Although she used intracellular electrophysiological recordings in brain slices to elucidate the functional connectivity of cortical neurons in the visual cortex, “There is an expanding interaction between biology and physics, especially in the computational modeling of neurobiological systems,” she said, adding that while the two fields are very different, “The techniques that I used in my neuroscience lab were related to experimental techniques that I used in my physics lab.”

While positive, the experience convinced Herzog that her true interests lay elsewhere, and in 1997 she moved to Washington, DC, to pursue a career in science policy. At AAAS, she has been exploring various issues related to the ethical, legal and policy implications of science and technology. Past congressional service includes working for the San Diego chapter of the Sierra Club to preserve the remaining coastal wetlands in San Diego County through lobbying efforts and public education. “It made me realize that this is a very complex process and you need to know what you’re doing if you want to get anything accomplished,” she said of the experience. She also participated in Habitat for Humanity, a non-profit group that provides housing for low-income families at reduced costs.

Applying for the APS Congressional Fellowship was a logical next step for Herzog’s budding career in science policy. “I felt that to really understand how things are accomplished, you have to know how Congress works,” she said. “I felt this would be an incredible first-hand experience that would make me more effective at whatever I was guarding whatever issues concerned me.” While she has yet to decide where she will spend her fellowship year, Herzog is looking forward to working personally with a member of Congress: “Congress is all about the home state and constituency concerns and if you don’t understand that, you’ve missed the boat.” She is specifically interested in working on issues regarding energy use and conservation, global climate change, and other environmental concerns, and ultimately sees herself working for a nonprofit science policy organization.

The APS Congressional Fellowship program is intended to provide a public service by making available individuals with scientific knowledge and skills to members of Congress, few of whom have a technical background. In turn, the program enables scientists to broaden their experience through direct involvement with the legislative and political processes. “Fellows gain a perspective which, ideally, will enhance not only their own career but also the physics community’s ability to more effectively communicate with its representatives in Congress,” said APS Associate Executive Officer Barrett Ripin.

Recent studies on Coulomb interactions of hydrogen atoms and ions have induced interest in the relative masses of protons and antiprotons, as well as the possibility of transistors made using xenium of atomic dots, which would be ideal for producing miniaturized components. At this year’s annual meeting of the APS Division of Atomic, Molecular, and Optical Physics (DAOM), Holger Ruben, chairman of the division of the Canadian Association of Physicists, the conference took place from 27-30 May 1998 in Santa Fe, New Mexico.

Wednesday’s opening plenary session featured lectures from this year’s recipients of the Davidson-Gemel Edward K. Plyler and William Allen Phillips (NSF) – were featured at Saturday’s closing plenary session. There was also a special session featuring papers presented by finalists for the DAMOP Thesis Award and for undergraduate research (see pages, 5).

Mass. Protons and antiprotons have the same mass to within one part in 10^10, according to Harvard physicists Gerald Gabrielse and Akin Hase Khabbaz. Along with their Boulder collaborators, they are able to make this comparison by loading a single antiproton and a single proton into a cell with two electrons, in order to make the proton into a negatively charged object and letting them orbit simultaneously around an ion trap under the influence of a strong magnetic field. This elegant new measurement constitutes the best test yet (by a factor of 10) of the CPT theo-

Coulomb Interactions of Hydrogen Ions. How three hydrogen ions share their energy and how they position themselves with respect to each other has been experimentally measured for the first time, shedding light on the so-called xenium dot. In a work by Harald Atto Doering and associates, a xenium dot has been used to study the alignment of a xenium ion.

Quantum dot cellular automata (QCA) might make possible a new type of transistorless computing. A quantum dot is essentially a zero-dimensional artificial atom, isolated on (or in) a semiconductor substrate. Using a pair of electrons within a cell of four closely spaced dots — the electrons can tunnel from dot to dot — creates a binary bit the configuration of the electrons establishes either a 1 or a 0. Put many of these cells together and you have a programmable cellular automata network. Wolfgang Poutz at Notre Dame reported on the recent publication of a QCA army, including a demonstration of the manipulation of a single electron by another nearby single electron.

In the United States the successful conclusion of World War II inspired a heady sense of optimism and social change which was repeatedly bolstered by the end of the Great Depression. Renewed prosperity, in turn, allowed America to contribute generously to the reconstruction of the world’s shattered economies. Yet it was the emerging Cold War, nor the sudden eruption of the Korean conflict in 1951, could dampen the good spirits. Physics, too, blossomed as young scientists returned to their universities and industrial labs, full of new ideas picked up in the course of their war work, and eager to get on with their careers. Far from closing down, laboratories developed into permanent national institutions devoted to both military and civilian research. For the first time, the federal government undertook the systematic support of basic science. One of the theoreticians who came down from Oppenheimer’s mountain-top in New Mexico was Richard Feynman (right), a native New Yorker just three years past his Ph.D. Brilliant, irreverent, and ambitious, he distrusted authority and insisted on figuring things out in his own way. His particular strength was his visual imagination. For example, he developed an elegant code for representing complex equations by simple diagrams that allowed him to make his point by drawing pictures instead of using mathematical calculations toward quick, accurate solutions.

Feynman brought this unorthodox technique to bear on what was at the time the principal problem of theoretical physics: the quantum mechanics of light. Photons have a great deal of information, but a detailed description of how they are emitted and absorbed by electrons was lacking. Together with American colleagues and Japanese physicists who had worked along similar lines while they were out of touch with the West during the War, Feynman solved the problem by creating Quantum Electrodynamics (QED). QED proved to be of such unprecedented precision and scope that it set a standard of excellence against which all future fundamental theories of elementary particles would come to be measured.

In contrast to QED, which applies to the outer shell of the atom where the electrons reside, theoretical descriptions of the atomic nucleus remained rudimentary. Even as the list of so-called elementary particles produced at accelerators grew, the quantum numbers proliferated, but none were mathematically satisfactory. Neither the aging giants, such as Werner Heisenberg, nor the young geniuses, such as Feynman, knew which way to turn. The tantalizing success of QED only added to their frustration.

In the October issue, APS News will feature the seventh introductory essay: 1955-1965: Connections.

Editor’s Note: A CENTURY OF PHYSICS, a dramatic illustrated timeline wallchart of over a hundred entities on eleven large posters is intended for high schools and colleges. Each poster covers a decade and is introduced by a thumbnail essay to provide a glimpse of the historical and scientific context of the time.

100 years: The International Dimension

The 23rd General Assembly of the International Union of Pure and Applied Physics will convene in Atlanta, Georgia (March 17-21, 1999), just one week before the beginning of the APS Centennial Meeting. Thus, at the outset, there will be a substantial international physics presence in Atlanta, with more than 150 leaders of the academic and industrial research communities meeting to chart the future course of the Union. The new Union President, former APS President Burton Richter, will assume the IUPAP Presidency at the conclusion of the General Assembly.

In addition to the 50 plenary sessions, physical societies have indicated that they will send delegates to represent their organizations. The Nobel luncheon and opening of the Nobel Exhibit on Saturday, March 20, will be held in honor of laureates from all over the world. It will be a fitting start to the 100 year celebration of physics as a global cultural, social and economic adventure—one that has transformed the 20th century and promises even greater contributions to our quality of life and understanding of nature in the new millennium.

In acknowledgment of the importance of the international dimensions of the physics enterprise, the opening plenary on March 20 is entitled, “International Cooperation in Physics,” and will feature presentations by Cyon Condeses de Silva (Brazil), Jan S. Nilsson (Sweden and IUPAP), Predamnan K. Kaw (India), Tadahiro Sekimoto (Japan) and Luciana Maiani (Italy and CERN). The session will be chaired by Jerry Friedman, incoming President of APS. After the conclusion of the plenary, a reception and dinner will be hosted by APS in honor of our sister societies around the world.

The Society will also host round-tables on a variety of international topics the following day, Sunday, March 21, prior to the opening of technical and scientific sessions. It will constitute the beginning of a global dialogue in physics in the 21st century.
Status Report on Physics: Trends, Opportunities and Threats

by Roman Czujko, AIP Employment and Education Statistics Division

Over the last few years, the US economy has been very strong. The unemployment rate has been driven by technological innovation, and the career opportunities for individuals with physics training have improved markedly. The following report is an overview of some of the trends and statistical data that are worth noting. The report contains both positive and negative aspects to each stage of both the education and employment systems.

Precollege Physics Education. Over the past decade, the number of students who take a physics course have increased from 20% to 27%. This is due to the large number of high school graduates who have taken physics classes in recent years. There are approximately 760,000 students in 1991. During the late 1980s, bachelor production hovered around 4900-5000 per year, with about half of these students taking the calculus-based course, 37% the algebra-based course, and 40% of these students taking the calculus-based course.

There is talk about some engineering departments taking over physics teaching. At the same time, the percentage of female high school physics students who are taking an introductory physics course that requires no college math is 40%. The major reason for this is that physics is offered at about 1,100 different campuses, and that physics is offered at the college level. We published a report in 1997, about 380,000 girls took physics in US high schools.

Bachelors Plus Five

The number of students admitted into physics graduate programs has been declining since 1992. First-year graduate student enrollment in 1993 was 1,480, while in 1997, it was 1,350. We anticipate that the total will drop below 1,100 new physics PhDs by 2002, and for the first time, the majority of those PhDs will be earned by foreign citizens.

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Initial Employment. About half of all physics bachelors enter the work force, 30% study physics at the graduate level, and the remaining 20% go on to advanced education in a broad variety of fields. Of the physics bachelors who enter the work force, about 60% are employed in the private sector. The average starting salary for physics bachelors is $31,000. We expect that the physics graduates of 1997 and 1998 entering industrial employment will earn significantly higher salaries than those of the class of 1996.

Over the last few years, there have been significant changes in the initial employment of physics bachelors. Until the late 1980s on and early 1990s, about 60% of new physics PhDs took a postdoctoral appointment. This trend changed for the classes of 1995 and 1996, dropping to about 40%. Preliminary analysis of the employment of the class of 1997 indicates that this trend has bounced back somewhat, and about half of all new physics PhDs took a postdoctoral appointment. Part of this may be due to salaries. Preliminary results indicate that postdoc salaries for physicists in universities have increased to about $32,500 for the class of 1997. For the PhD classes of 1996 and 1997, there is also a major shift towards industrial employment outside the field of physics. The dominant employment areas in the latter case are engineering, software development, and modeling within finance and business.

Career Issues. One of the strengths and weaknesses of physics is that people with a physics education work throughout the economy in a broad range of common careers. On the positive side, this reflects the value of a physics education as a foundation for responding to changes in the demand for technically trained workers. However, during recessions and difficult job markets, physics degree recipients are often at a disadvantage, in part because so few jobs are specifically labeled as physicist.

The retirement patterns of physics faculty is an important but not well understood issue. The change in the law has certainly added to the complexity of this phenomenon. Up until 1990, it was possible to project academic retirements with considerable accuracy. However, this is no longer true, given the increase in deferred retirements, early retirements, and concern about whether institutions will allow physics departments to replace retired faculty. The age structure of physics faculty in research departments has become increasingly distorted and there are now more faculty who are over the age of 60 than under the age of 40. Within the next six months, the AIP Statistics Division will publish a report describing the complexities and parameters of academic retirements.

Based on a study of a sample of Sigma Pi Sigma members carried out in 1994, it is clear that the majority of physics graduates at all degree levels believe that their physics training was a solid foundation for their current careers, regardless of whether those positions were primarily in physics or in other fields. With support from the NSF, the AIP Statistics Division has recently initiated a new study entitled Bachelors Plus Five, which will develop detailed data on the subsequent educational and employment experiences of the physics bachelor classes of 1991, 1992 and 1993. It will provide students with information about the rich diversity of careers commonly pursued by physics alumni, and will provide faculty with information that they can use to assess the effectiveness of their undergraduate curriculum.

Postdocs continue to be an attractive option for physicists. We estimate that there are about 1700-1800 physicists holding postdocs in PhD-granting departments and university-affiliated research institutes. More than one quarter of them earned their PhDs abroad. We estimate that there are another 900 postdocs in other sectors, mostly at 30 hospitals and medical centers. The Funded Postdoc Website (FundedPostdoc.com & Development) shows that about 60% of postdocs are (1) What proportion of postdocs eventually get faculty positions in research universities, and (2) Of postdocs who do not (the majority), where do they go jobs and was their postdoc experience valuable to them in their subsequent careers?

Unfortunately, we do not know the precise answers to these questions. What is more, the system is presently so volatile that whatever may have been true two years ago may not be true two years from now. The AIP Statistics Division will develop a grant proposal to look at the early careers of PhD physicists during the 1990s, both those who began in postdocs and those who entered permanent positions.

There are then the so-called ‘hidden physicists.’ Only about one in seven physics bachelors go on to earn a PhD in physics, and only about 55% of those report that their primary field of employment is physics. The question is, what can and should the APS do to promote the careers of hidden physicists?
Christopher Wood Received 1998 DAMOP Thesis Award

At the recent meeting of the APS Division of Atomic, Molecular and Optical Physics (DAMOP) in Boulder, Colorado, Wood was chosen from among five finalists who presented their papers at a special Thursday morning session. Born and raised in Wyoming, Wood attended the University of Wyoming in Laramie from 1985 to 1989 for his undergraduate studies. During that time, he worked as an undergraduate on balloon-borne measurements of the ozone hole (PNC) in Antarctica. He also participated in the Summer Science Undergraduate program at the National Laboratory, Accelerator Center. He opted to attend the University of Colorado (JILA) for graduate study, where he worked on the cesium parity non-conservation measurement with Carl Wieman, for which work the DAMOP thesis award was given. He is presently engaged in 1-, 2-, and 3-ion experiments (using Be+ ions) for quantum logic and quantum optics at NIST.

DAMOP has held an annual graduate student competition, the best undergraduate AMO research being performed for the last four years. All DAMOP advisors are asked to encourage their outstanding undergraduates to apply. Candidates submit an abstract of their research project. An international committee of DAMOP researchers select the best candidates for presentation at the DAMOP meeting. Undergraduate recipients are awarded $500 and an invited talk at the DAMOP meeting.

DAMOP outstanding undergraduate researchers. From left to right: David Griggs, Chris Maloney, Don Chen, Brooks Hitt and Robert Komara.

Statement on the Advancement of Women in Science, Engineering and Technology

Professional organizations, universities, private industry, and government research laboratories have made modest progress in attracting women to careers in science and engineering. Yet, the numbers remain disturbingly low. In physics, for example, women account for only 4.5% of the labor force and only 13 percent of new PhDs. For a number of years, The American Physical Society has championed programs that encourage more women to enter the science and engineering fields. In accordance with these policies, the Executive Board of The American Physical Society endorses the establishment of a Commission on the Advancement of Women in Science, Engineering and Technology proposed in the bill H.R. 3007, which will seek to identify barriers that might deter women from entering these fields.

Executive Board Endorses Proposed Commission on Women in Science

Outstanding Atomic, Molecular and Optical Undergraduate Researchers

DAMOP awarded 1998 DAMOP Thesis Award to Christopher Wood, a University of Wyoming graduate student for his research on quantum logic and quantum optics at NIST.

Editor's Note: Given the past popularity of physics limericks, APS News announces a new contest: brain teaser puzzles, presented in limerick form. Some examples, using rudimentary mathematical concepts, are below. We are looking for original and challenging puzzles on more advanced physical and mathematical concepts, as a challenge to readers and would-be limerickists alike. Winning entries will receive the usual fabulous prizes, plus publication in a future issue of APS News. The deadline for receipt of submissions is November 30, 1998.

1. Kindly old Grandfather Lunn
   in limerick form.
   How many hits did Nero make:
   Plus weight squared, minus eight,
   Squared his number of hits, the big hero!

2. A truly remarkable hive.
   Were as nineteen to one,
   How many sons (drones) were in the hive?
   Plus weight squared, minus eight,
   Twenty-five years ago

3. There was a young fellow named Clave
   Who's number ten power five
   The daughters to each son
   Were as nineteen to one,
   Plus weight squared, minus eight

4. A team's opening batter named Nero
   Squared his number of hits, the big hero!
   And subtracting his score
   Twice its weight
   Plus weight squared, minus eight

5. Some freshman from Trinity Hall
   Played hockey with a wonderful ball;
   Twice its weight
   Two times its weight
   Plus weight squared, minus eight

6. The representation of African Americans is low among all the physical sciences, and physics is no exception. We estimate that fewer than 200 African Americans earned physics PhDs between 1973 and 1996, representing less than 1% of the total pool of physics PhDs conferred over that time. About 4% of new physics bachelors degrees are earned by African Americans. This is up slightly over the past decade. However, about 60% of African Americans who earn physics bachelors degrees come from the 30 Historically Black Colleges and Universities that have physics degree granting departments. It is estimated that about 60 African Americans earn bachelors degrees each year from the 730 majority institutions with physics departments. Hispanic Americans account for only 2% of physics bachelors and physics PhD recipients.

More detailed information on employment and education in physics can be found online at http://www.aip.org/statistics.

APS Views (continued from page 4)

do for the vast majority of physics bachelor degree recipients, i.e., those who use their availability among recent PhDs (12%). Women also represent 12% of all physics graduates, a fact that may have implications for a variety of physics research. About 4% of new physics bachelors degrees are earned by African Americans. This is up slightly over the past decade. However, about 60% of African Americans who earn physics bachelors degrees come from the 30 Historically Black Colleges and Universities that have physics degree granting departments. It is estimated that about 60 African Americans earn bachelors degrees each year from the 730 majority institutions with physics departments. Hispanic Americans account for only 2% of physics bachelors and physics PhD recipients.

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DFD Establishes New Acrivos Dissertation Award

In April, the APS Council approved a resolution to establish a new dissertation award to honor the many outstanding contributions to fluidics by Andreas Acrivos, particularly his years of distinguished editorialship of Physics of Fluids. The Acrivos Dissertation Award is endowed by donations from members and friends of the APS Division of Fluid Dynamics. The division expects to make the first award in 2000.

Consisting of $1,000 and a certificate citing the accomplishments of the recipient, the award is intended to provide recognition to exceptional young scientists who have performed original doctoral thesis work in outstanding scientific areas of fluidics, and to increase the area of fluidic research. As with most APS prizes and awards, up to $500 is available for travel to enable the recipient to attend the annual meeting of the Division of Fluid Dynamics at which the award will be presented. Any doctoral student studying at a college or university in the U.S. is eligible to apply. The work to be considered must have been accomplished as part of the requirements for a doctoral degree.

Born in Athens, Greece, Acrivos earned his PhD in 1954 from the University of Minnesota, and promptly joined the faculty of the University of California, Berkeley’s Department of Chemical Engineering. A member of the faculty of Stanford University in 1962, where he has been professor emeritus since 1988. He is presently the Albert Einstein Professor of Science and Engineering at the City College of New York, as well as director of the Benjamin Levich Institute for Physicochemical Hydromechanics. His research interests include fundamental problems in fluid mechanics, the effective properties of two-phase systems, and particulate and fluid sedimentation. A two-time Guggenheim Fellow and long-standing editor of Physics of Fluids, Acrivos received the 1995 APS Fluid Dynamics Prize for his work in fluid mechanics.

Physics Today magazine continues to receive high marks from APS members, who rate the publication the most valuable of the Society’s membership benefits. An APS task force concluded in its final report, which was accepted by the APS Executive Board in June, that there is room for improvement. Most notably in expanding the breadth of technical coverage and shortening many magazine articles. The monthly magazine, which recently celebrated its 50th anniversary, is published by the American Institute of Physics (AIP) and distributed to APS members, as well as to members of other AIP societies.

Chaired by APS Past President Burton Richter (Stanford Linear Accelerator Center), the task force was charged with evaluating the content and style of Physics Today and suggesting ways in which it could better serve the diverse interests and needs of APS members. The special role of Physics Today as a unifying force in physics is widely appreciated within the APS, the report stated in its introduction. “However, as the physics community grows ever larger and more diverse in personnel and practice, the ability of the magazine to serve the American industry has been forced to shorten its research time horizons and to adopt risk-averse R&D strategies. The result is that the federal government has the scientific leadership and high-risk research, which is now performed by universities and national laboratories. Scientists in the underpinning of technological progress. Indeed, basic research, according to economists such as Stanford’s Michael Boskin and the late Edwin Mansfield of the University of Pennsylvania, provide extraordinary social returns on the federal investment. Estimates run between 200 and 600 percent.”

“Tomorrow’s technology is based upon today’s research. Although some efficiencies in research have shortened the time to market, many time horizons still run one, two or more decades from research proposal to marketable product. Much of the extraordinary technological growth we have witnessed in recent years over the last ten years is based upon research ideas first explored 20 or 30 years ago. While the federal investment in research has been declining by most relevant measures. For FY1997, only 1.9% of the federal budget was allocated to non-defense R&D, compared to more than 5.7% about 30 years ago. As a fraction of the GDP, the federal investment in research is less than half of what it was 30 years ago. Scientific disciplines have become thoroughly intertwined and completely interdependent. Progress in one area invariably requires support from work in other areas. Examples abound. HIV protease inhibitors were synthesized by pharmaceutical companies, while the structure of HIV protease determined by biologists, using physicists’ x-ray diffraction techniques; neural network computing algorithms find their origin in brain studies performed by neurobiologists; and MRI, the least invasive and most precise medical imaging diagnostic tool, comes from research carried out by physicists, chemists and mathematicians.

The task force also felt that until recently, some articles had become too technical for readers to gain an acquaintance with the subject area being reviewed. The recent addition of the “Physics News Update” section makes a good complement to the “Search and Discovery” section. Many articles in the latter were considered too long, and a lack of some subjects, such as biophysics, was noted. The task force suggested recruiting “stringers” or contributing editors to help broaden the range of expertise. The “Reference Frame” column has received high marks from the task force members. Among the non-science features, the task force deems the “Washington Reports,” “Physics Community” and “Letters” sections most valuable to the magazine’s readers.

The editorial board retains the primary limiting factor in terms of broader coverage, the task force felt that the focus of existing staff should be shifted from producing lower price articles to higher quality articles; and be directed more to book reviews and obituaries, which the task force deemed overlooking. One recommendation was that the APS consider funding a Science Writing Fellowship to increase the physics workload staff available to work on the science portion of the magazine.

The task force also briefly examined the relationship of Physics Today with its sister publication, the Industrial Physics Today (IPT), and concluded that both publications successfully satisfy complementary needs for the physics community. Surprisingly, a large portion of TIP’s 50,000 readers are members of AIP societies, making the publication a useful vehicle to attract new members to AIP organizations. To that end, the task force recommended establishing a cut-rate introductory membership offer for AIP societies to TIP subscribers.

Overall, despite the need for improvements in organization and efficiency, “Physics Today is doing a good job of serving the interests of the APS,” the task force concluded in its report, noting that the magazine’s Advisory Committee is in agreement with its findings and plans an ongoing study to address the areas of concern.

Interestingly, the last paragraph of the task force’s report reads: “In the long run, it would be best for the APS to take full responsibility for Physics Today, including its deficit. This is not likely to happen soon, but it is a possibility that should remain in our minds.”

The other members of the APS task force to evaluate Physics Today were Julia Phillips, Sandia National Laboratory; Fred Bingham, Allied Signal Inc.; John Pribble, Bates College; Ron Walsworth, Harvard-Smithsonian Center for Astrophysics; and John Wilkins, Ohio State University.

Physics Today August/September 1998

Task Force Suggests Physics Today Changes

An AIP task force is making recommendations about the content, style and organization of Physics Today in the April 20 meeting of the Society’s Board of Directors. According to AIP President Andrew Sessler, the task force was established to address recent APS efforts on behalf of science and technology and Space and Technology and Space and Technology and Space and Technology and Space and Technology and Space and Technology and Space of the bipartisan National Research and Development Council. Its April meeting, the APS Executive Board, is published by the American Institute of Physics (AIP).

APS Taskforce lettering for the physics

Science is the underpinning of technological progress. Indeed, basic research, according to economists such as Stanford’s Michael Boskin and the late Edwin Mansfield of the University of Pennsylvania, provide extraordinary social returns on the federal investment. Estimates run between 200 and 600 percent.

end of World War II, technology has accoun- cted for more than half of all economic growth in the U.S. Today, increased pro- ductivity, driven by technological innovation, remains a priority for sustaining the current expansion, which is characterized by low inflation and low unemployment. Federal investments in re- search and development are needed to keep the nation on the balanced budget path.

Federal investment in research sus- tains technological innovation. Almost 75 percent of basic research and 20 percent of U.S. in- dustrial patent applications reference publicly supported research. The cause is clear. American industry has been forced to shorten its research time horizons and to adopt risk-averse R&D strategies. The result is that the federal government has the scientific leadership and high-risk research, which is now performed by universities and national laboratories. Scientists in the underpinning of technological progress. Indeed, basic research, according to economists such as Stanford’s Michael Boskin and the late Edwin Mansfield of the University of Pennsylvania, provide extraordinary social returns on the federal investment. Estimates run between 200 and 600 percent.

• Tomorrow’s technology is based upon today’s research. Although some efficiencies in research have shortened the time to market, many time horizons still run one, two or more decades from research proposal to marketable product. Much of the extraordinary technological growth we have witnessed in recent years over the last ten years is based upon research ideas first explored 20 or 30 years ago. While the federal investment in research has been declining by most relevant measures. For FY1997, only 1.9% of the federal budget was allocated to non-defense R&D, compared to more than 5.7% about 30 years ago. As a fraction of the GDP, the federal investment in research is less than half of what it was 30 years ago. Scientific disciplines have become thoroughly intertwined and completely interdependent. Progress in one area invariably requires support from work in other areas. Examples abound. HIV protease inhibitors were synthesized by pharmaceutical companies, while the structure of HIV protease determined by biologists, using physicists’ x-ray diffraction techniques; neural network computing algorithms find their origin in brain studies performed by neurobiologists; and MRI, the least invasive and most precise medical imaging diagnostic tool, comes from research carried out by physicists, chemists and mathematicians.

• Revolutionary scientific discovery often originates from research that is noti- ther driven by strategic mission nor closely coupled to planned strategic outcomes. The lesson, which traces its genesis to the arcane study of optical pumping, is a prime example. Today’s corporate climate would make such research almost impos- sible. It could not be justified to stockholders and it would be inconsistent with the ruthlessness of global competition.

The main concern in terms of improv- ing service to APS members is that a larger fraction of editorial effort needs to be focused on the scientific cover- age. Specifically, more science articles should be published per issue, with more of an effort to cover all of physics over the course of a multi-year cycle. The

Answers to Zero Gravity Brain Teasers from page 5:

1. This year, he is 100; his son is 50.
2. 1. The answer is 100. Divide the clue (it was a 4;1 ratio) and you get a ratio of 25. Multiply by 400 to get 100. Subtract 10 and then 2 more and you get 0.
3. 4. Four. If you square it, you get 16. Subtract x number of two; it needs to go 12. Subtract 10 and then 2 and you get 0.
4. Two ounces. (Beach ball, or ping- pong ball?) 2x+4. 42 (2x+4). 8. 400.

A P S N e w s A ug u s t 5 g e t m e r 1998
Announcements

Free APS Membership Offered to Society of Physics Students

Starting in September, with the 1998-99 academic year, all undergraduate members of the Society of Physics Students (SPS) will be offered a free membership in the APS. Any member of the APS or one of the other nine APS Member Societies. This offer is meant to expose undergraduates to the benefits of professional society involvement. Promotional information will be sent to all SPS chapters in August.

If you would like more information, contact your local SPS chapter or visit the SPS web site at www.aps.org/education/spi/spi.htm. New SPS members will be able to join online starting this Fall.

All APS/SPS undergraduate members, with a renewal date after September 1, 1998, will be able to join SPS directly and choose APS at no charge. Questions about current APS student/SPS memberships should be directed to the APS Membership Department at (301) 209-3280 or membership@aps.org.

CAUGHT IN THE WEB

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

APS News Online latest edition
APS Committees and Governance
• APS Governance page updated
• APS Bylaws updated
• APS Constitution updated

Membership
• Home page updated
• Recently Deceased Members List updated

Education
• Physics Alliances Newsletter for high school and college physics teachers

Prizes & Awards
• The Andrew Archer Award in Fluid Dynamics

Be sure to visit the CSWP-sponsored women physicists archive at http://www.physics.ucla.edu/~cwp

NOMINATIONS FOR PRIZES AND AWARDS

The following prizes and awards will be bestowed at the Fluid Dynamics Division meeting in 1999. 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 new 1998-1999 Centennial APS Membership Directory, pages A19-A37, or select the Prize and Award button on the APS homepage (www.aps.org) for complete information regarding rules and eligibility requirements for individual prizes and awards.

1999 FLUID DYNAMICS PRIZE

Sponsored by friends of the Division of Fluid Dynamics and the American Institute of Physics journal Physics of Fluids.

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 January 18, 1999 to: Elaine S Onas (Chair), 3516 Buff Dr., Falls Church, VA 22041; Phone (202) 767-2960; Fax (202) 767-4798; Email: ONAE@LCPR.LANL.MIL

1999 OTTO LAPORTE AWARD

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

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

Nature: The award consists of $2,000, and a certificate citing the contributions made by the recipient.

Send name of proposed candidate and supporting information before January 18, 1999 to: Izem J Wygvenski (Chair), School of Engineering, University of Tel Aviv, Tel Aviv 69978, ISRAEL; Fax 972-36425640; Email wygg@eng.tau.ac.il

Physical Review Focus

• Focus, the fully electronic journal featuring physics highlights, is available FREE through the APS Home Page (www.aps.org). under the research journal button, or directly at publishaps.org/FOCUS. To receive one-paragraph introductions to Focus stories each week by e-mail send the following message to majordomo@aps.org: subscribe focus [leave the subject line blank]

New Physics Teacher Newsletter Begins

The PhysicsAlliances Newsletter is a new online publication promoting alliances between high-school and college physics teachers. The aim is to help bring regional college and university personnel together with high school teachers for: meetings, visits, and sharing ideas, programs and possibly equipment. Sponsored by the APS Forum on Education, the newsletter is the reincarnation of the “CHIC Newsletter.” Editor Peter Lindenfeld of Rutgers University says the newsletter will feature interactive discussions on education issues, such as recent articles on: computer simulations in the lab and “Is the lecture dead?”

Inside the Beltway (continued from page 1)

But the President’s call resonated well with deficit hawks, such as Senate Budget Committee Chairman Domenici (R-NM), who note that without the current surplus in Social Security revenues, the rest of the federal budget would actually still be in the red, even if a year-end $75 billion surplus number for the total budget turns out to be true. Unlike the anti-Washington ideologists, the deficit hawks want to hold the line on spending.

So for now, the budget squeeze remains. Given the constraints, it’s amazing how the bill moved through the appropriations process. Sen. Domenici (R-NM), Rep. Lewis (R-CA), chairmen of the House and Senate appropriations process, respectively, boosted their appropriations bills by about 1.6 percent. But the President’s call resonated well with the deficit hawks, who want to hold the line on spending.

In June, WASHINGTON Post interviewed, he said, “Investing in our future ought to be our second highest priority after winning the war on drugs, and we should shape our appropriations bills accordingly.” Even House Appropriations Committee Chairman Livingston (R-LA), who always protects his right flank, was cautiously optimistic. “[A]n emphasis on science, at the request of the Speaker, means that science is going up,” he said.

Fortunately, science has the potential of remaining on the legislative agenda throughout the summer; thanks to a new bill, the "Federal Research Investment Act.” It was submitted on June 25 by Senators Frist (R-TN) and Rockefeller (D-WV), together with Senators Gramm (R-TX), Lieberman (D-CT), Domenici, and Bingaman (D-NM), the original co-sponsors of its S.1305 predecessor, the Senate Finance Committee approved the amendment on a voice vote, reflecting the popularity of environmental programs with American voters.

The real debate is in the appropriations bills. While the Big Three are boosting the appropriations bills, advocates for other federal priorities will try to strip away funds from the science accounts.

The first such assault took place in the Senate when the Energy and Water Resources Appropriations Bill hit the floor in the middle of June. Disagreement with the allocation for solar and renewable technologies, Senators Jeffords (R-VT) and Boxer (D-CA) offered an amendment to boost the funding for those programs by about $60 million. To help offset the allocation, they cut the DOE science account by about 1.6 percent, perhaps unwise that by so doing they would cut very some of the science upon which the solar and renewable technologies rely. Their Senate colleagues responded by approving the amendment on a voice vote, reflecting the popularity of environmental programs with American voters.

But for real debate starts in Round 3. Behind closed doors when Senate and House committees meet to iron out their differences. It is not unusual for the bills that finally emerge to be quite different from the ones that entered. During the August recess, members of Congress will listen closely to the voices of the constituents. And the budgets that emerge in September will mirror what they heard.
Science and technology have shaped our world in many ways...Yet, technology also surrounds us in millions of little ways we no longer even notice.

As a physician, I can envision a future in which science and technology will expand the current frontier of medical knowledge. Armed with this new knowledge, we will identify the causes, and eliminate most of the effects of the diseases that now plague mankind. As a Senator, I can envision the difference that science and technology will make in the life and health of our citizens.

Science and technology have shaped our world in many ways. We've put men into space and looked into the farthest corners of the known universe. We've broken the code of the human genome and begun to dismantle previously incurable diseases. We've created a virtual world and a whole new realm called cyberspace. Yet, technology also surrounds us in millions of little ways we no longer even notice. From computers and cellular phones, to stop lights, grocery store checkouts, and microwaves: in a million ways technology makes our lives run smoother and faster.

Today's world runs on technology, and through its investment in research and development (R&D), the federal government has played a significant role in its expansion. In fact, more than 56 percent of all basic research is produced by federal agencies.

Much of our economy runs on technology as well. Half of all U.S. economic growth is the result of our technology and scientific achievements. Technology helps provide new goods and services, new jobs and new capital — even whole new industries.

Without a doubt, technology is the principal driving force behind our long-term economic growth and our rising standard of living. It is directly linked to the use of technology. As cited in a study conducted by the National Academy of Science, manufacturing businesses that used eight or more advanced technologies grew 14.4 percent more than those that did not.

Clearly, America's investment in science and technology must continue. The two central questions Congress must answer are: 1) will science and technology continue to be as great a congressional priority in the future as it has been in the past; and 2) will the kind of financial investment necessary to sustain future progress in science and technology continue in light of other growing financial commitments?

In 1965, mandatory federal spending on entitlements and interest on the debt accounted for 30 percent of the federal budget. Fully 70 percent went toward discretionary programs — research, education, roads, bridges, national parks, and national defense.

Today, just 30 years later, that ratio has been almost completely reversed: Sixty-seven percent of the budget is spent on mandatory programs and interest on the debt, leaving only 33 percent for everything else, including research. In fact, total R&D spending today as a percentage of GDP is just 0.75 percent — as compared to 2.2 percent in the mid-1960s when superpower rivalry and the race to space fueled a national commitment to science and technology. As the baby boom generation begins to retire and the discretionary portion of the budget shrinks even further, this situation will only grow worse.

Thus, we are faced with the long-term problem of addressing the ever-increasing level of mandatory spending and the near-term challenge of apportioning the ever-dwindling amount of discretionary funding.

This increased dependency on technology and decreased fiscal flexibility has created a problem too obvious to ignore. Not all deserving programs can be funded, and not all authorized programs can be fully implemented. In other words, the luxury of fully funding science and technology programs across the board has long since passed. We must set priorities.

I believe that Congress must reaffirm our national commitment to science and technology and double its efforts to ensure that funding is not only maintained but increased. I also believe that funding levels alone are not the answer. What we really need is a strategy for the future — a vision that not only provides adequate levels of funding, but ensures that funding is both responsible and sustainable over the long term.

We can do that by establishing a set of guiding principles that will enable Congress to consistently ask the right questions about both competing technology programs; focus on programs that program’s effectiveness and appropriateness for federal funding; and most importantly, make the hard choices about which programs deserve to be funded and which do not.

What are these guiding principles?

First, federal R&D programs must be good science. They must be focused, not duplicative, and peer-reviewed. Because there is strength in diversity, they must support both knowledge and edge-driven science and mission-driven science requirements. Second, programs must be fiscally accountable. Third, they should achieve their aims with measurable results. Finally, federal policy must be applied consistently across the entire spectrum of federal research agencies. High quality, productive research programs must be encouraged regardless of where they are located.

I believe it is time to get America refocused on the importance of science.

Accompanying the four first principles, are four corollaries: 1) government must create a flow of technology from research through commercialization, so that promising technology is not lost in a bureaucratic maze; 2) it must foster a close relationship between research and education and find ways to extend the opportunity for excellence of our university system to primary and secondary institutions; 3) we must encourage the revolutionary innovation taking place at the overlap by providing opportunities for interdisciplinary projects and fostering collaboration across fields of research; and 4) we must facilitate the creation of partnerships, in effect creating a whole that is greater than the sum of its parts.

These first principles and their four corollaries provide a framework that will guide the creation of new, federally funded research and development in the future — a vision that not only provides adequate levels of funding, but ensures that funding is both responsible and sustainable over the long term.

Taken together, they will create a powerful method for elevating the debate by increasing Congress’ ability to focus on the important issues, decreasing the likelihood that it will get sidetracked on politically-charged technicalities, and ensuring that federal R&D programs are consistent and effective. They will also help us establish a consistent set of national goals and a vision for the future.

On June 25th, Senator Rockefeller and I introduced the Federal Research Investment Act, a bipartisan bill which sets us on the path to accomplishing all of these goals.

The act elevates Congress’ commitment to federally-funded research and development by doubling the aggregate amount of civilian R&D spending over a 12-year period. It establishes the set of guiding principles outlined above. It requires the president to submit, as part of his annual budget, a detailed report on how the administration will meet congressional funding goals.

It also lays a solid foundation for evaluating both current and future programs by directing the Office of Science and Technology Policy to commission the National Academy of Sciences to develop methods for evaluating federally-funded research.

As a physician, a scientist and a Senator, I believe it is time to get America refocused on the importance of science. As a Congress and as a nation, we must reaffirm our national commitment to science and technology and double our efforts to increase funding as America moves into the next century. The economic future of our nation and our leadership position in the world depend on it.

Bill Frist is serving his first term as a Republican Senator from Tennessee. He is chairman of the Science, Technology and Space Subcommittee.