# PHYSICISTS DISMAYED BY NSF'S MANY CUTS IN CONGRESS'S HARD-TIMES 1988 BUDGET

This is the winter of discontent for physicists who depend on Federal money. Although expectations had been optimistic when President Reagan first presented the fiscal 1988 budget in January 1987, many physicists grew worried as Congress and the Administration diverged in a chronic impasse over deficits and priorities. Congress's self-imposed deadlines for adopting various budget bills came and went, producing frustrations all around. Then came the Wall Street debacle on 19 October, "Black Monday," and at both ends of Pennsylvania Avenue, everyone began thinking the unthinkable: Washington needed to let Americans and the rest of the world know that it could control its insatiable urge to spend. Even so, what the 100th Congress finally did on 22 December, almost three months after the start of the government's fiscal year on 1 October, came as a shock.

It seems that Congress played the Grinch in a Christmas pantomime when it came to appropriating money for scientific research in 1988. Just three days before Christmas, it passed two documents, a $604 billion omnibus continuing resolution (P. L. 100-202), which funds those government agencies dependent on annual spending authority for day-to-day operations, and a deficit reduction act (P. L. 100-203), which seeks to reduce the government deficit through a package of tax increases, sales of Federal assets and cuts in such entitlement programs as Medicaid, Medicare and farm subsidies. Thus, for the second year in a row, Congress packaged all its 13 appropriations bills into one massive resolution after failing to adopt any separately.

However disquieted the lawmakers may feel about the money they finally gave NASA and the National Science Foundation—which is locked into the same appropriations bill with such politically sensitive accounts as housing programs and Veterans Administration medical care—most of them believe that scientists ought to be content with their lot. The collapse on Wall Street brought a new reality: The US needs to deal with the huge government debt, which has more than doubled to $2.5 trillion since 1981 and requires paying more than $150 billion per year in interest. This double whammy and the budget deadlock led Reagan to convene a bipartisan summit meeting of Congressional leaders and Administration officials. On 20 November, after a month of negotiations, they hit on a solution: Reduce the Federal deficit by $30.2 billion in fiscal 1988 and $45.9 billion in fiscal 1989, and limit spending in fiscal 1989 to 2% above the level in 1988. As it turned out, Congress's 1988 budget scales down the projected $180 billion Federal deficit by some $33 billion, though it's not clear whether asset sales and entitlement cuts will yield the expected revenues.

## Pork and paper

Together, the two bills consist of almost 3300 pages of spending authorities, directions and restrictions, pet "pork barrel" projects and other bumf. The documents went to the President on 22 December, when, apparently without reading them, he signed both.

The contents of both acts give scientists a clear message: little gain and lots of pain. Congress approved a total of $61.1 billion in R&D funds, compared with $67.1 billion requested by the Administration. The $6 billion decrease resulted from reductions for DOD (down $6.8 billion), NASA (down $450 million) and NSF (down $202 million), offset by increases to other, nondefense R&D programs (at the Departments of Health and Human Services, Agriculture, Commerce, Education, Energy and Interior). In terms of constant dollars, based on a 1987 inflation rate of 3.6%, total spending for R&D in 1988 represents a real decline in purchasing power of about 0.3% overall. Spending for basic research went up 6% to a total of $9.8 billion, compared with $9.2 billion in fiscal 1987. Real growth, discounting inflation, is just under 3% for all agencies combined. Some agencies, notably the National Institutes of Health, Agriculture and Interior, got hefty hikes in their research budgets, while DOD, NASA and NSF took the deepest cuts. Indeed, considering the Administration's promises about raising budget levels for basic research in physical sciences, many physicists feel betrayed by the outcome of the 1988 budget process.

When Reagan delivered the 1988 budget to Congress, scientists had every reason to be gleeful. On paper the National Science Foundation was to receive a substantial 16.7% boost of $238 million above its 1987 appropriation, and NASA was marked for a 15% boost, worth $313 million. Nothing like that happened for either NSF or NASA. As for the Department of Energy, a funny thing happened to it on the way to the continuing resolution. DOE had asked for a modest 2.2% increase over last year in R&D spending authority. Instead, DOE's Office of Energy Research got $2.05 billion, a spending rise of 10%, and within that figure basic energy sciences went up 8%, to $564.6 million—though the increase of $85 million above the request is allocated to special earmarked projects. Such projects are customarily called pork—items that members of Congress insert into budgets, usually at the last minute and without open debate or regard for the scientific merits. While DOE is obligated to pay for the pork, agency officials say complying with some of the allocations will be difficult and cause cutbacks in research programs. Two of the new items are not on any list of facilities but are set aside for research in x-ray lithography and high-temperature superconductivity. Congress directed DOE to spend $10 million for each without adding any money for the work.

The Superconducting Super Collider, however, ran into trouble on

Capitol Hill. DOE had requested $35 million for the SSC in fiscal 1988—$25 million for continued R&D and $10 million for construction. The Senate Appropriations Committee went along with the request, designating the entire amount for R&D, site selection studies and other project activities, but ruling out any funds to start building the giant particle accelerator. The House committee also deleted the construction money, appropriating just $25 million for R&D. In conference, Congress went along with the House recommendation and encouraged DOE to explore building the machine with the collaboration of foreign governments.

Except for SSC construction, DOE's high-energy physics program was unscathed. Magnetic fusion, however, was whacked down from the requested $345.6 million to $335 million. Congress also authorized the Compact Ignition Tokamak as an $8 million line item construction project at Princeton. In addition, Congress added $40.5 million to the President's request for inertial confinement fusion, approving a total of $159 million, about $4 million above last year's figure.

## Space science spared

NASA's core space science programs were generally spared from deep cuts in the final legislation. This was due in part to reductions for the space station, which Congress finally approved for construction. The station, one of the President's favorite projects, is marked for $425 million—$342 million less than the funding request. Senate–House conferees also told NASA to submit a report by 29 February "rescoping and rescheduling" plans for the station in anticipation of the "significantly reduced funding" the agency should expect in fiscal 1989.

The space agency's R&D account came to $3.4 billion—$249 million under what was asked, but $220.5 million more than last year's appropriation. The conference report includes language that supports programs in NASA's Office of Space Science and Applications and states that it should receive not less than 20% of the agency's funds. Physics and astronomy programs received $577.1 million, which is $24.3 million more than last year and $10 million more than NASA had asked for. Congress agreed to cut spending on planetary exploration R&D by $26.1 million. Specific changes call for $18 million more for the Mars Observer program, $20 million more for the Global Geospace Science mission and $61 million for TOPEX, an oceanographic topography experiment that is scheduled to be launched by France's Ariane rocket in late 1991. But funding for the upper-atmosphere satellite will decrease by $18.8 million.

The Department of Defense budget, the big winner in Reagan Administration fiscal policy the past six years, was clobbered this time. Spending for research, development, testing and engineering was held to $37 billion, a mere 1% increase in the overall Defense outlays of $285.4 billion. That total represents a 3.5% net decline that nonetheless involves no cancellations of major weapons. Basic research is slated for $902 million, somewhat less than the $918 million requested, but DOD officials note that this sum includes $25 million for university instrumentation grants. DOD got $85 million for its University Research Initiative instead of the $92.8 million it asked for. This was allocated in one lump sum, rather than divvied up among the services as in the past, because Congress has been unhappy with the way the Army spent its funds at colleges and universities. What's more, the Pentagon is directed to fund URI actions in any state at no more than 14% of the total. This affects two of the nation's high-tech states—California, which got 22% of URI funds last year, and Massachusetts, which received 17%.

R&D for the Strategic Defense Initiative was cut to 3.7% below the 1987 level of $3.7 billion. But when DOE's roughly $350 million appropriation for SDI is added, "Star Wars" will receive a total of $3.9 billion this year—far below the Administration's request of $5.7 billion. Moreover, the continuing resolution prohibits funding either engineering development, the stage just prior to "bending metal," or actual deployment of space-based interceptors, those elements of the program known as "kinetic kill vehicles."

Separate from SDI, the National Aerospace Plane, which Reagan dubbed the "Orient Express" last year, received $183 million—$53 million below the requested allocation.

In fact, in his State of the Union message on 25 January the President neglected to mention any of the big scientific ventures that appeared to excite him in 1987—the Aerospace Plane, Star Wars, the Superconducting Super Collider and even high-temperature superconductivity, a discovery that resulted in Nobel Prizes and led Reagan to deliver a rousing pep talk last July to scientists and businessmen on stepping up government support for the field. He had been expected to announce a new National Space Policy calling for privatization of certain programs, but he failed to mention space at all. Neither did he say anything about the proposal the Office of Management and Budget put forward to transform the laboratories of the National Institutes of Health into a private research center financed by government, industry and foundations. He also overlooked NSF, the agency he once said would have its research budget doubled by 1992.

Erich Bloch: Bashed by physicists.

## NSF in the cold

The situation at NSF turned out substantially worse than anyone had a right to expect. Until the budget summit the House and Senate had agreed on funding research in the agency at close to the Administration's request. But with NASA and NSF in the same budget category and, worse yet, squeezed into the same appropriations bill with the Department of Housing and Urban Development and the Veterans Administration, the competition for funds is fierce. In Senate–House conferences, Pete Domenici, an influential Republican from New Mexico and the senior minority member on the Senate Budget Committee, argued the case for retaining NSF's full request. However, William Proxmire, the Wisconsin Democrat who heads the committee, spoke up for VA and housing programs. Most members considered both programs to be politically untouchable. On top of that, a fervent plea for NASA by Jake Garn, a Utah Republican who had flown on the space shuttle, won over members of the Senate–House conference committee, so that in the end the space agency received a total of $8.9 billion,

a figure $653 million below Reagan's original request and $717 less than committees of Congress had authorized earlier in the year. Despite NASA's cuts, NSF's budget request had to be hobbled.

The bruising of NSF's budget came as a personal blow to the agency's director, Erich Bloch. He had fought all year to win friends on Capitol Hill, only to see his efforts scuttled. NSF's research budget came out at $1.45 billion, an increase of only 3% over last year, through a cut of 11%, or $182 million, from the request. The 1988 budget essentially reduced the NSF research program to doing only what's necessary, not what it could or should be doing. Congress leaves the agency free to make specific allocations within the research appropriation, so what happened is that the Directorate for Mathematical and Physical Sciences gets an increase of more than $8.2 million above the 1987 budget, for a total still $41 million less than the 1988 request. This is somewhat more of a jump than the other research directorates—engineering, computer science, geosciences and biological, behavioral and social sciences each showing increases of $6 million to $7.5 million. While the whole physics division receives only $2.2 million more than last year, elementary particles and atomic, molecular and plasma disciplines get somewhat less than they had before, while theoretical, nuclear and gravitational physics make small gains.

In materials research, both solid-state physics and condensed matter theory will get just about the same amounts each received in 1987, while ceramics and electronic materials and materials research groups show boosts of more than $1.2 million each, reflecting NSF's increased support for superconductivity.

The roller coaster that NSF rode throughout the protracted and disorderly budget process in Congress and the ups and downs within the agency's own allocations operation unsettled many in the physics community. Some complained that cuts and uncertainties in their funding have caused disruptions in the number of graduate students they could support and disapprovals of items of equipment for research projects. Materials research laboratories at Cornell and Illinois suffered 8% to 10% declines, while MIT's materials lab took a 15% cut. Principal investigators in solid-state and condensed matter physics complained of cutbacks ranging as high as 12% to 15%. One physicist, who prefers to be nameless, compares NSF's funding actions with the French battlefield practice of triage. NSF, he says, "is deciding which researchers can survive virtually on their own, which need more help and which ones should be left to die."

## NSF's physics problems

The centerpiece of the furor is money, of course. Most scientists supported by NSF feared that Bloch's plan to start a new program of multidisciplinary science and technology centers this year would come at the expense of individual researchers. After NSF's 1988 budget request called for $30 million to create 10 to 20 new centers, it was not surprising that 322 proposals were received from some 130 universities by the deadline of 15 January. In the circumstances of NSF's actual budget for 1988, it also was not surprising that Bloch announced he was delaying the program until fiscal 1989.

It was another of Bloch's announcements, however, that resulted in a ruckus. He deliberately chose a joint meeting of The American Physical Society and the American Association of Physics Teachers on 28 January to drop something of a blockbuster. In the first minute of his speech he suggested that high-energy physicists might be better served if other government agencies took over NSF's funding obligations. NSF, said Bloch, "provides only marginal support for high-energy physics, yet the amount [about $42 million] is a major share of the NSF funds available for physics research [$118.2 million]. Perhaps it is time we consider concentrating resources in those areas of physics research where alternative sources of funding do not exist, where NSF could have the greatest impact. Trying to do everything is to accomplish nothing. And priority setting is part of our responsibility."

The implication, which he admitted he offered "with some trepidation," is to transfer high-energy physics elsewhere, possibly to DOE, which spends $550 million on the field—though only about $75 million of that amount will go to university experimenters and theorists this year. Then there is DOD, says Bloch. It spends only 2% of its $41 billion R&D budget for basic research. Bloch believes the Pentagon should—and could—support much more basic science, which he insists is the "underpinning of the complex systems the military develops to meet its needs." Even at NSF, not all funding in elementary particles goes to individual investigators. Last year, nearly $11 million went to upgrading the Cornell Electron Storage Ring and another $8 million went to CESR operations.

Reaction to Bloch's talk was immediate—and explosive. The day after he spoke, a High Energy Physics Advisory Panel subgroup meeting at Fermilab went critical over Bloch's idea. A protest, written principally by Sam Treiman of Princeton and James Cronin of the University of Chicago and signed by 11 subpanel members, was sent to Bloch, arguing that NSF "is an essential, not a marginal, force in the nation's program in elementary-particle physics. . . . Fully one-third of all university scientists engaged in particle physics, including many of the most talented, are supported by NSF."

The situation resembled trench warfare as other physicists, shell-shocked by the agency's budget actions, took to their word processors, telephones and facsimile machines. Bloch and members of Congress were sent a letter from condensed matter physicists who had met in late January at the Aspen Center for Physics. It noted that "increased interest and enthusiasm" in high-temperature superconductivity "is being met with decreased funding from NSF." It continued: "In particular, individual university researchers have almost all suffered funding cuts of between 6% and 12% for the current fiscal year. For lack of funds promising young students must be turned away and creative young faculty are frustrated at the beginning of their research careers. In the longer term the pool of scientific and technical talent needed if this country is to be competitive in the increasingly technological international arena will be significantly diminished. . . . Steps must be taken now to reverse the increasing shortfall in Federal funding for condensed matter physics in universities."

On 9 February an article by Philip W. Anderson of Princeton appeared on the op-ed page of *The New York Times*. It declared that "a round dozen or so of the leading practitioners [in superconductivity theory], myself included, have received apologetic phone calls from our various contract officers in NSF and other agencies, explaining that our funding for fiscal 1988 is to be cut by some figure between 12% and 20%. There was no apparent favoritism: No one who has been contributing anything useful to the field was spared. . . . This is a scientific disaster of the greatest magnitude—and not only for superconductivity research. It is the latest move in the erosion of the funding system on which working scientists

depend."

He went on to express his sorrow for graduate students and postdoctoral associates in his field. "It is precisely the funding for this future leadership that is being cut most severely. Worse, the budget cuts mean that the entry level into our ranks, thin as it has been, is essentially to be wiped out for at least a year and that funding for new young people entering the universities from industry, government or postdoctoral positions is nonexistent." The last third of his editorial dealt with the struggles of "small science" to withstand the support of "super" projects by government agencies.

"The reasons for this trend are a bewildering variety of understandable factors," wrote Anderson, "including the desire of bureaucrats both for neat packages that they can micromanage and for tangible reports in great quantities, the pork barreling tendencies of Congress and, to be sure, empire building among scientists.... The great democratic, individualistic system of peer-reviewed contract research that has been the source of American eminence in science (the field where, most of all, America has 'stood tall' in the eyes of the world) has been allowed to collapse by simple default. Science in the United States is dying of giantism."

Anderson had sent a copy of his editorial to Bloch earlier with a letter that explained his angry declaration: "It represents my response to what seems to me a nearly total breakdown of communication between NSF and the research community.... From my viewpoint it seems as though NSF is attempting to destroy my science as an academic specialty."

On 11 February Bloch replied to Anderson. "Your letter and *New York Times* editorial attack the wrong targets!" Bloch began. "Scientists ought to be united in seeking public understanding and support for science and for increased funding of research. Instead, your editorial leaves the impression that a privileged group did not receive its entitlement. The impression, in a budget year that saw deep cuts in most discretionary Federal programs, will not win the scientific community any sympathies." He ended by stating, "Rather than castigating NSF and other parts of the Administration, you would serve science better by using your influence with your colleagues and with the media to help develop the public and Congressional support needed to turn these budget requests into appropriations."

In an interview, Bloch said physicists had been the only scientists griping about the cuts in grants this year. "I'm not against high-energy physics or any other branch of physics," he said. "I could have used organic chemistry or biology in making my point that some agencies are not paying their share in basic research at a time when NSF appears to be the only candy store. Our shelves are being rapidly depleted of candy."

Bloch defended his agency's actions. "We are guilty of being cockeyed optimists," he said. "We honestly believed we would get an increase of 15% to 17% on the way to doubling our budget in the next five years. We are just as disappointed and frustrated as our accusers."

—Irwin Goodwin

# US & USSR ACADEMIES EXTEND EXCHANGES AS INDICATION OF THAW IN RELATIONS

After all the euphoria of the Reagan–Gorbachev summit meeting in Washington last December, it would be disappointing if some high spirits didn't spread to US–Soviet scientific relations. Indeed, on the first morning of the summit, on 7 December, while the leaders of the two superpowers mulled over the final details of their arms control treaty at the White House, eight prominent members of the Academy of Sciences of the USSR spent more than three hours with about 37 US scientists, engineers and industrialists rounded up by the National Academy of Sciences. The American participants were somewhat surprised to hear Abel G. Aganbegyan, a leading economist who is credited as a chief architect of *perestroika*, admit to Soviet failings in agriculture, housing, ecology and manufacturing, observe that science is "seriously behind the demands of life" and suggest that research would become the engine of his country's economic and social growth. Such *glasnost* led NAS President Frank Press to describe the encounter as "perhaps the most candid, informed and good-natured" discussion ever conducted by the US and USSR on technical matters.

In the event, Yevgeniy P. Velikhov, a plasma physicist who is a vice president of the Soviet academy, and Roald Z. Sagdeev, also a plasma physicist and head of the Institute of Space Research, were the only two visitors with durable relationships in the West. The others were economists, planners and legal scholars, and, like Aganbegyan, all relatively unknown to their US counterparts. For its part, the US side consisted of corporate research managers and some scientists, economists, historians, foundation heads and government officials. Neither group, in effect, had the kinds of people likely to be involved in scientific research exchanges covered by the new five-year agreement that Press signed with his counterpart at the Soviet Academy, Gury Marchuk, in Moscow on 12 January.

## Suspended in protest

Though the signing ceremony made no news headlines or television spots, it was another conspicuous indication of the thaw in US–USSR relations. "It's a thrill to have our two governments talking about something besides missile throw weights," Senator Alan K. Simpson, a Wyoming Republican who champions a strong US defense capability, said recently at a Washington reception honoring a cultural agreement. The US had broken off most formal cultural and scholarly exchanges in 1980, after the Soviet invasion of Afghanistan. That same year the governing council of the US academy decided to suspend most scientific workshops with the Soviet Union as a protest against Andrei Sakharov's harassment by the KGB and his banishment to Gorky, a closed city 250 miles east of Moscow.

The first postwar exchanges of US and Soviet scientists took place in 1956, three years after Stalin's death. High-energy physicists from both countries described their experiments and their dreams at conferences in Moscow and at the University of Rochester. Washington's purpose in such events was stated in a recently declassified 1956 National Security Council directive that was printed by Yale Richmond, a veteran Foreign Service officer who specializes in East–West exchanges. As published in Richmond's book, *US–USSR Cultural Exchanges, 1958–1986: Who Wins?* (Westview Press, Boulder, Colorado), the NSC directive states: "To promote within Soviet Russia evolu-