

it would be possible to cut CERN's budget further and still build the LHC [Large Hadron Collider] on schedule." (See PHYSICS TODAY, February, page 58.) JET is scheduled to be shut down at the end of 1999, so it is of somewhat less concern than CERN and ESA, to which Sweden's contributions are also much larger.

A broad scope

At the national level, the polar, environmental, space and fusion research programs would be hit the hardest, if the commission's recommendations are followed.

"We are still licking our wounds" from the 14% already cut this year, says Kerstin Fredga, director of the Swedish National Space Board, whose agency's national research budget could be slashed by another 26% (SEK 10 million) as of next year. "I can't say now how we would distribute these cuts. I still hope they won't occur." Fredga worries most about the impact on Sweden's instrument building and satellite program. And since some instruments are built for ESA satellites, cuts in Sweden's national program could also affect international space research.

Fusion research could lose 20% of its budget, in addition to any reduction in Sweden's contribution to JET. That "would drastically affect research within universities in Sweden, and Swedish activity at JET and for ITER [the planned International Thermonuclear Experimental Reactor]," says James Drake, who heads the Swedish fusion research program. The commission was "very specific in saying that only the applied part [of fusion research] should go," says commission secretary Fagerström, adding that this recommendation was made because "the government has to make up its mind" about what type of energy to pursue. "We cannot be a jack-of-all-trades in a decreasing economy."

Backup funding?

Fagerström also says that in many cases the proposed cuts seem worse than they are. "Most areas have backup sources of funding," he says. This backup would come mainly from several private foundations recently established by the government to fund strategic research "that has a clear connection with stimulation of the economy and industry in Sweden," says Skeppstedt. That's why many worry that basic research stands to suffer most.

"I would not rule the foundations out at all, but I would not pin my hopes on them, either," says the space board's Fredga. The foundations made up for about half of this year's cuts in research. And they will probably spend

about SEK 1.5 billion annually on research in the coming years, says Björn Brandt, the ministry of science and education's deputy head of science policy. But Ingvar Lindgren, director of the Foundation for Strategic Research, the largest of the new foundations, says, "The foundations have done much of what they can do. We will be able to cover very little [of the additional proposed cuts]." And since fees for membership in international organizations are the government's responsibility, the foundations can't pick up the slack there, either.

"You cannot save this amount of money without hurting and harming," says Fagerström. In fact, the commission came up SEK 10 million short of

its target. "From the very beginning it was obvious that this is not a rational way to save money," says Fagerström. "The internationally oriented research is always high quality. If the task had been to save SEK 150 million from the Swedish research system in general, our recommendations would have been different."

Now the commission's recommendations, along with comments from Swedish universities and scientific agencies, are being considered by the government, which will announce its decisions in September. Says Gunnar Leman, head of planning for the Swedish Natural Science Research Council, "I still think there will be deviations from the recommendations."

TONI FEDER

US Policy toward Cuba Undermines Scientific Exchanges

The freedom of scientists to associate and travel is considered essential to the conduct of science. Science organizations such as the International Union of Pure and Applied Physics (IUPAP) uphold the free circulation of scientists by sponsoring meetings only in countries where the participation of all scientists is assured.

And so in February, when a group of Cuban scientists was denied US visas to participate in scientific meetings here, those involved hoped that the matter was merely a bureaucratic oversight. It wasn't.

As inquiries from the American Physical Society revealed, the Cuban quantum chemists—who included the University of Havana's Luis Montero Cabrera and four members of his research group—were denied entry to the US because, as university faculty, they are also employees of the Cuban government—a qualification that applies to most, if not all, of the scientists in that country. As such, they can be granted visas only by exception, if the US State Department deems it in the national interest to do so.

Reversion of policy

APS leaders and other physicists moved quickly to protest the decision. "The visa denials are not only disappointing to meeting organizers and applicants alike, but also are detrimental to American science," wrote APS president Allan Bromley in a letter to Secretary of State Madeleine Albright. "Free exchange of information is essential to the health and vitality of our domestic and international scientific enterprise."

Seeking clarification, members of

By barring the entry of Cuban scientists, the US government is jeopardizing American institutions' bids to host international science meetings in the states—a grim prospect for scientists here and abroad.

several scientific groups, including APS, the New York Academy of Sciences (NYAS), the American Association for the Advancement of Science and the American Chemical Society, met with State Department officials in May. According to Irving Lerch, international affairs director of APS, what they learned is that the visa policy is a holdover from the Reagan Administration, and that an executive order issued by President Clinton in October 1995, which sought to ease academic exchanges between the US and Cuba, had been "nullified" amidst the political furor that followed Cuba's February 1996 shootdown of two American planes (see PHYSICS TODAY, April 1996, page 53).

Exceptions to the visa rule are made by the State Department on a case-by-case basis. "Certain types of researchers are considered nonthreatening—medical doctors, AIDS researchers," Lerch says. Physical scientists, on the other hand, are thought to pose a greater national security risk and therefore more likely to have their visa applications rejected. "From our perspective, no one in the State Department is qualified to make such a judgment," says Lerch. Another criterion used by the State Department is that of "bragging rights"—whether an applicant's visit is likely to advance the foreign policy of Fidel Castro's regime.

"Despite extensive questioning, we did not get a clarification as to how [the policy] is being interpreted," says Joseph Birman, Distinguished Professor of Physics at City College of New York and chair of the NYAS Committee on Human Rights of Scientists. "For example, while 'quantum chemists' was a deniable category, 'physical chemists' or 'environmental chemists' may not be." He points out that during the cold war, Soviet physicists routinely were granted visas by the US. "Basically, what I think we achieved was revealing the arbitrariness of our government's actions in this area."

How will this policy affect the US's eligibility to host international meetings? Meeting organizers seeking IUPAP sponsorship, for example, must be able to show that all qualified scientists will be welcome. The denial of visas to attend an IUPAP-sponsored meeting can result in the union's recommending that "no conferences be held in the country in question" until the offending policy is changed. As a precaution, IUPAP urges meeting attendees to apply for visas at least three months before they intend to travel.

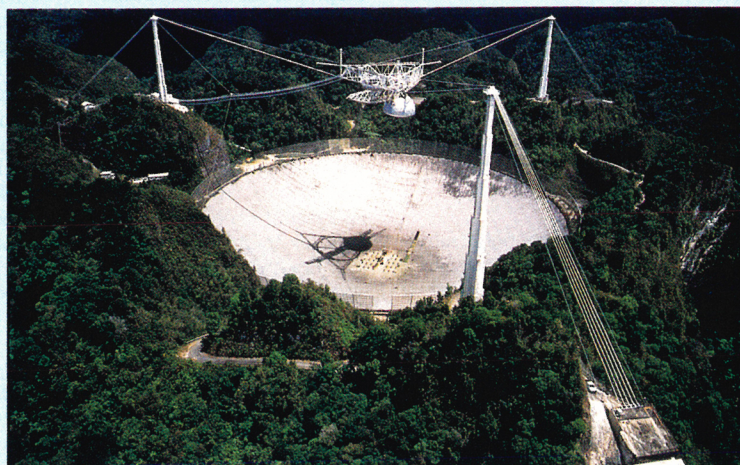
Birman and Lerch recommend that any US researcher who is inviting Cuban colleagues should forward as much information as possible to the State Department's Office of Cuban Affairs, to clarify that the visit is for bona fide scientific activity with no foreseeable military implications. "This is not saying it will help," Birman says. "But it might."

A cancelled trip

During their thwarted March trip, Montero and his colleagues had planned to attend the Sanibel Symposium on quantum chemistry in St. Augustine, Florida, and to meet with researchers in Georgia and New York. Montero has had "fruitful scientific exchanges" with researchers in Sweden, Spain and Germany, and he hopes to do the same in the US. The March visit, he says, was meant "to build bridges for future exchange, by showing who we are and what we are doing in science to an academic community which is fairly far from us, even though it is the nearest geographically."

Yngve Öhrn of the University of Florida, who was head organizer of the Sanibel Symposium, says that about 35 countries were represented at this year's meeting, with a number of participants from Latin America, as well as the former Soviet Union and China; only the Cubans were barred from attending. That is unfortunate, Öhrn says. "Quantum chemistry is a truly international field, and the total number of people in it is very small. So

Arecibo Telescope Is Upgraded



DAVID PARKER, 1997/SCIENCE PHOTO LIBRARY

The dome suspended above the telescope dish is 26 meters in diameter and weighs about 75 tons. Inside it, among other things, are 22- and 8-meter mirrors and electronics—the new Gregorian focusing system and cryogenically cooled receivers installed at the National Astronomy and Ionosphere Center's Arecibo Observatory in Puerto Rico. Hoisted 150 meters above the bottom of the 300-meter-diameter radio-radar dish in mid-May, the dome is part of a \$25 million upgrade, paid for by NASA and the National Science Foundation.

The fixed, spherical dish can be focused by positioning the dome along a suspended track. And focusing signals by using mirrors (rather than the line feeds previously used) has increased the telescope's sensitivity by about 3 to 20 times, according to Tor Hagfors, now at the Max Planck Institute for Aeronomy in Katlenburg-Lindau, Germany, who headed the upgrade design team, and Don Campbell, a planetary astronomer at Cornell University, who supervised the project. The new setup also extends the instrument's observable frequency range to 10 GHz; with the line feeds, 3 GHz was the maximum. To shield from thermal ground radiation, a 15-meter-high steel fence has been added around the telescope's perimeter, and a new 1 MW transmitter, housed in the dome, more than doubles the power that can be transmitted for radar astronomy experiments.

The world's largest single-dish telescope, Arecibo Observatory is used for radio pulsar research, planetary and asteroid astronomy and studies of the ionosphere, interstellar matter and distant galaxies.

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when you have a meeting like this, it's important to have as wide a representation as possible."

Montero and his colleagues had also planned to visit Clark Atlanta University's Center for Theoretical Studies of Physical Systems and Cornell University, where they'd been invited by Nobel laureate Roald Hoffmann, Paul Houston and Andreas Albrecht as a follow-up to trips the three Cornell professors had made to Montero's lab.

Like everyone else in Cuba, the University of Havana group must contend with the long-standing US trade embargo, which makes it difficult to get computer parts and other research equipment. Still, Albrecht says, their work is impressive: "They've adapted and optimized available quantum chemical codes to run on their PCs. They have their own approaches that are very interesting." That includes computational studies of hypersurfaces of solute-solvent supermolecules for

modeling environmental effects on calculated molecular properties; application of the Bardeen-Cooper-Schrieffer approach to correlation energy in molecules; and theoretical models of interactions between proteins and antibiotic enzyme inhibitors.

The cancellation of Montero's trip was "horribly disappointing," says Albrecht. "The message is that the US can do whatever it wants with respect to Cuba. But we wouldn't dare do the same thing with China, because of the economics."

JEAN KUMAGAI

Government Employs Physicists in Many Ways

A recent study of physicists in government finds that "government is not a homogeneous entity." Indeed, wide variations in age, education and work activities are seen among government physicists depending on where