us in doing so, and they may in some limited way," Davies said.

Congress recessed last week until September without an agreement between the House and Senate on a final 1999 DOE spending bill. That will provide DOE officials with additional time to make the case for ITER to lawmakers. The project's fate may be riding on their powers of persuasion.

–ANDREW LAWLER

With reporting by Dennis Normile in Tokyo.

SUPERCOMPUTING

Computer Experts Urge New Federal Initiative

Last week, 200 experts from academia, industry, and government gathered in Washington, D.C., to help put together a potential major research initiative: an effort spread among several government agencies to build the next generation of U.S. supercomputers. The National Workshop on Advanced Scientific Computation—hastily convened by the Department of Energy (DOE) and the National Science Foundation (NSF), which are now preparing their fiscal year 2000 budget requests—reached broad agreement that the government should invest about $1 billion over the next 4 years to develop a national network of supercomputers for civilian use, together with supporting technology and cutting-edge software.

> **"The science is ready for this kind of activity. The scientists ... know what to do; they just need the technology."**
>
> **—James Baker**

The ultimate goal would be to construct two 40-teraflop machines by 2003, each of which would be 200 times more powerful than the best supercomputers in universities today. (A teraflop is 1 trillion operations per second.) To allow scientists across the country access to the new machines, workshop participants also agreed to urge the government to bankroll a network of scientific and support centers. The workshop's organizers—who include DOE Undersecretary Ernest Moniz and Larry Smarr, director of the Illinois-based National Center for Supercomputing Applications—have put together a 10-page draft proposal that they will pass along to DOE this week for consideration in its budget preparations.

If the proposal is approved, it would provide a civilian counterpart to the Accelerated Strategic Computing Initiative, a 2-year-old DOE project to develop a 100-teraflop machine in the next decade that would be used to model the behavior of nuclear weapons. Although some universities have constructed high-end computing systems, their machines cannot keep pace with the demands of scientists for faster number-crunching capabilities for tasks such as mapping climate change, simulating combustion systems, or studying a microbe's interaction with its environment. "This [supercomputer] initiative is the most cost-effective way of leveraging this new world of science and technology," says James Langer, a physicist at the University of California, Santa Barbara, and chair of the workshop.

DOE and NSF are not the only potential participants in the initiative. The National Institutes of Health, the National Oceanic and Atmospheric Administration, and NASA, among other agencies, are also interested in taking part and contributing funds, says Michael Knotek, program adviser for science and technology in Moniz's DOE office. "Everybody sees here a real opportunity," says Robert Eisenstein, assistant director of mathematics and the physical sciences at NSF.

"We've got to move fast to do it right," says Langer. But he and other participants acknowledge that the program's ambitious goals won't be easy to achieve. Even if the White House includes the initiative in its 2000 budget request and Congress endorses the plan, attracting the hundreds of experts needed to implement it from a relatively small pool of computer science graduates will pose a challenge. And "some of the development requires machines not available for 3 to 4 years," says Paul Messina, who directs the Center for Advanced Computing Research at the California Institute of Technology and helped organize the conference.

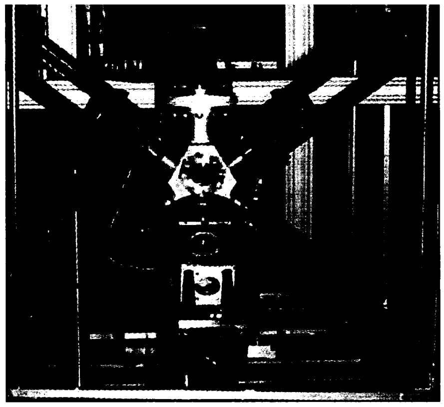
But scientists were heartened by the level of consensus achieved at the workshop among experts of varied backgrounds. "The science is ready for this kind of activity," says James Baker, administrator of NOAA. "The scientists are there; they know what to do; they just need the technology."

–JENNIFER COUZIN

PHYSICS

Gravity Measurements Ride the Atom Wave

Gravity may be the law of the land, but the force it applies varies slightly depending on the rocks beneath our feet. In the 3 August *Physical Review Letters*, researchers report that they have devised a sensitive new scheme for mapping these variations that relies on the quantum mechanical nature of atoms. The device could eventually be useful for searching out new oil and gas deposits, which reveal themselves in tiny gravity anomalies.



M. KASEVICH/YALE UNIV.

Interrogating atoms. Lasers firing into a vacuum chamber (center) manipulate atoms to create an atom interferometer.

Devised by Yale University physicist Mark Kasevich and his colleagues, the scheme builds on the bizarre dual nature of matter, which behaves—so says quantum mechanics—as solid particles at some times while resembling light waves at others. Since the late 1800s, instruments called interferometers have split light waves, allowed them to travel separately for a distance, and then recombined them. The result is a shadowy interference pattern, created because waves that converge in phase form light patches and those that cancel each other out form dark areas. In 1991, several research teams showed that "matter waves" of atoms can produce the same effect.

Typical atom interferometers work by dropping a collection of ultracold cesium atoms down a vacuum tube while hitting them with a series of laser pulses. The first of these pulses effectively places the atoms in two separate energy states at the same time, one moving faster than the other. These "atom waves"—two for each atom—split and move apart. Another pulse brings the two together again. In the meantime, however, the force of gravity has slightly different effects on the separated waves because they follow different trajectories. It alters the way they recombine, affecting the interference pattern, which a third laser pulse reads out.

One interferometer wouldn't be enough for measuring gravity in the field, says Kasevich. The problem is vibration, which can make gravity's tug appear weaker or stronger by moving the instrument closer to Earth's center or farther away. Using two instruments, one atop the other, gets around the problem. Both experience the same vibrations, but the difference in the two measurements—the gravitational gradient—stays constant. It varies only when