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.

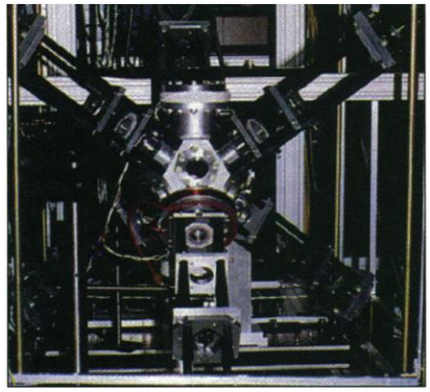
But scientists were heartened by the level of consensus achieved at the workshop among experts of varied backgrounds. "The science is ready for this kind of activity," says James Baker, administrator of NOAA. "The scientists are there; they know what to do; they just need the technology."

–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

the actual pull of gravity changes. So Kasevich and his colleagues stacked one atom interferometer on top of another, a meter apart.

In their initial tests of the approach, the researchers gauged gradients between the devices as small as one part in 10,000,000. They have since improved the sensitivity of the setup 100-fold. Made over a broad area, such measurements can generate a map of gravitational gradients, useful for everything from prospecting for oil to warning a submarine navigator when his ship is nearing the sea floor.

CATHALEEN CURTISS

The new device "is a very impressive first step" toward measuring gravitational gradients with atom interferometers, says Dave Pritchard, an atom interferometry pioneer at the Massachusetts Institute of Technology. For now, the mechanical gradiometers traditionally used to look for oil and gas deposits still beat the atom-based device in sensitivity. Part of the trouble, says Yale team member Jeff McGuirk, is that some vibrations can cause unwanted movements in the instrument's laser-directing mirrors, affecting the paths of the laser pulses through the interferometers. But McGuirk adds that the group has already tested a scheme for compensating for the vibrations, which should improve the sensitivity by another factor of 10 to 100, good enough to beat the competition, he says. **–ROBERT F. SERVICE**

PROTEIN CHEMISTRY

A Two-Piece Protein Assembles Itself

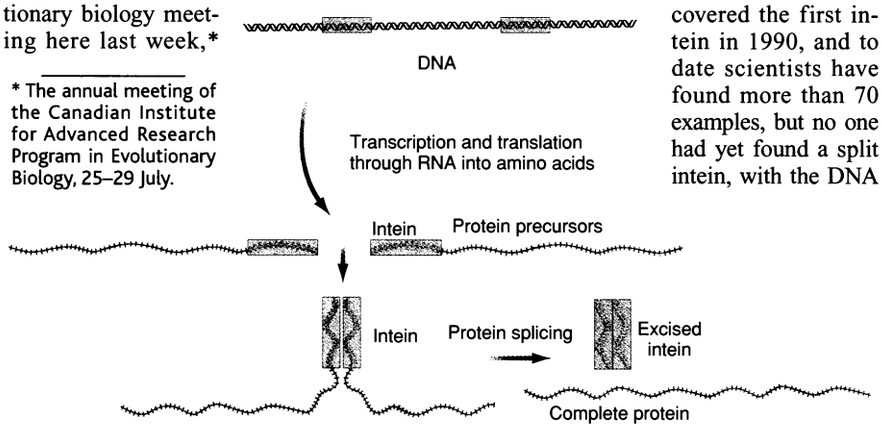
MONT-ROLLAND, QUEBEC—Proteins do many of the trickiest jobs in living cells, catalyzing reactions, passing signals, and providing basic structure. Now scientists have discovered a bacterial protein with yet another talent: seamlessly splicing together two other protein pieces. At an evolutionary biology meeting here last week,* molecular biologist Xiang-Qin Liu reported that he and his colleagues have identified a molecular matchmaker, a protein-within-a-protein called a split intein, which brings together two pieces of protein encoded on very different parts of the chromosome, knits the pieces together, and then neatly cuts itself out.

Scientists had theorized that a bit of protein with such clever action might exist, and several protein engineers had made artificial versions in the lab, but "it is gratifying and very exciting" to have an example in nature, says molecular biologist Henry Paulus of the Boston Biomedical Research Institute. Although many proteins are made from several subunits that clump together, this is the first time anyone has found a natural mechanism that actually splices two disparate protein fragments together into an unbroken amino acid chain. Researchers predict that other split inteins will surface from newly sequenced genomes, and they hope the find will lead to new ways to manipulate proteins in biotechnology.

The finding, published in the current issue of the *Proceedings of the National Academy of Sciences*, may also offer clues to the origin of more run-of-the-mill inteins—stretches of extraneous amino acids that interrupt proteins. Inteins are similar to the better known introns, sequences of extra DNA that commonly interrupt genes. Introns, however, are cut out of the RNA code for making a protein before the code is translated into an amino acid sequence. Inteins, on the other hand, are encoded in both RNA and DNA; only after they are translated into proteins do they remove themselves and splice the interrupted protein back together. In a process similar to some intron splicing mechanisms, the intein forms a loop, bringing the protein fragments together, and then catalyzes the formation of a normal peptide bond between them.

Researchers discovered the first intein in 1990, and to date scientists have found more than 70 examples, but no one had yet found a split intein, with the DNA

* The annual meeting of the Canadian Institute for Advanced Research Program in Evolutionary Biology, 25–29 July.



Some assembly required. A bacterial DNA polymerase protein is made in two pieces and then spliced together by a bit of protein called an intein.

ScienceScope

LANE, RICHARDSON GET GREEN LIGHT

While Congress and much of Washington head out of town this week on vacation, Bill Richardson and Neal Lane will start work in their new positions as, respectively, energy secretary and director of the White House Office of Science and Technology Policy (OSTP). The Senate confirmed both nominations by President Bill Clinton hours before leaving for a monthlong recess.

Richardson's confirmation came after Clinton assured Senator Larry Craig (R–ID) that the new secretary would have full authority over nuclear waste issues at the Department of Energy (*Science*, 31 July, p. 623). Craig had threatened to hold up the nomination because of his concerns about undue White House influence on DOE's approach to nuclear cleanup. Lane's nomination, in contrast, was not controversial, but was held up for months because of the Republican-controlled Senate's tardiness in approving Clinton nominees. Lane's confirmation clears the way for Rita Colwell to succeed him as National Science Foundation director.

... BUT VISA FIGHT ON HOLD

Congress left town, however, before resolving a controversy over how many software-savvy foreigners should be allowed to work in the United States. U.S. high-tech companies, citing a booming economy and tight job market, are lobbying lawmakers to increase the number of visas granted to skilled overseas workers—such as computer programmers, engineers, and scientists—from 65,000 this year to 115,000 in 2001. The visas, which can be extended for up to 6 years, can be an important step for workers looking to settle permanently in the United States.

Last May the Senate approved legislation to boost the visa ceiling, but the House was still struggling to pass its own version as *Science* went to press. If the bill is approved, it won't be until September that both chambers can come up with a single bill to send to President Bill Clinton for his signature. The White House has threatened to veto the legislation, saying that its provisions so far—including one designed to ensure that an employer tried and failed to find an American for the job and that no Americans were fired in order to hire a foreigner—don't go far enough to protect jobs for U.S. citizens.

Contributors: Andrew Lawler, Erik Stokstad, and Luis Campos.