energy and momentum transfer, which is one feature that gives scattering (whether neutrons or x-rays) a leg up over the traditional optical absorption or related techniques in mapping out dispersion curves and other excitation spectra, the ultimate aim of much of solid-state spectroscopy. The neutron's magnetic moment gives it the further ability to investigate the magnetic structure of materials.

With only six instruments at the start, the SNS will not be in a position to blanket the field. The ILL, by comparison, has 33 instruments and will soon be adding more. Of the six SNS instruments, whose average cost is about £600,000 each, three are elastic scattering instruments (diffractometers), two are inelastic spectrometers, and one is a quasi-elastic spectrometer. Quasi-elastic processes are low-energy dynamic effects such as molecular diffusion and rotation that have the effect of adding broad but lower intensity shoulders to the sharp peaks due to elastic scattering. Each instrument looks at a specific moderator, but the design of the shielding is such that any port can be arranged to look at any moderator. Moreover, the moderators can be tailored to provide neutrons optimized for different applications.

The prospects for additional instruments are mixed. Funding has been available for development work on three new instruments, which will be available for experiments when the techniques are worked out. But money to convert these into fully engineered instruments for university researchers, who will be the main class of SNS users, is lacking. The SERC has let it be known that spending on neutron scattering (mainly divided between the ILL and the SNS) will be reduced. The hope is that contributions from outside the United Kingdom in the form of instrument development and construction will take up some of the slack. In fact, one of the six instruments already in place, the high-resolution quasi-elastic spectrometer, actually comes from the Bhabha Atomic Research Center in Bombay.

Negotiations for a seventh instrument from an Italian group, though not concluded, are said to be promising. The biggest hope is that West German researchers, who have been among the most creative instrument developers, would join in. They are driving hard to get approval for their own pulsed source, the SNQ which would be built at Jülich and which would exceed the SNS in both neutron output and cost, and may well need a place to hone their experimental techniques pending construction or go to if the project fails to get the go ahead.

American and Japanese participation may also eventually come. In the United States, however, an upgrade project at the Los Alamos National Laboratory, scheduled for completion next year, has the potential for turning the present pulsed source there into one only a factor of 2 less powerful than the SNS, although target and instrumentation development has been slow, and a new experimental hall that neutron scatterers regard as essential to exploitation of the facility remains unfunded.

In sum, while Rutherford's SNS is a curious mixture of old and new, promise and peril, the overall facility is impressive, bodes well for European neutron scatterers, and gives their American colleagues a challenging target.

—ARTHUR L. ROBINSON

Additional Reading

1. *Current Status of Neutron-Scattering Research and Facilities in the United States*, available from National Academy Press, 2101 Constitution Avenue, NW, Washington, DC 20418.
2. *Physics Today*, January 1985 (special issue on neutron scattering).

Cosmic Cube Goes Commercial

Concurrent processing—the effort to create very fast computers by putting many processors to work in parallel—has finally begun to enter the marketplace: the Intel Corporation has announced a commercial version of the "Cosmic Cube," which has been under development for several years now at the California Institute of Technology and which has inspired quite a bit of enthusiasm among the researchers there. In its incarnation as Intel's "iPSC" line, the Cube will provide up to one third the power of a conventional supercomputer at roughly one tenth the cost.

While the Cube is only one of dozens of parallel designs now under development around the world, the theory and practice of concurrent processing is still very much in its infancy (*Science*, 10 August 1984, p. 608). Thus, Intel has explicitly tailored its machines for the research and development communities. "We want this to be the 'Access' machine," says Intel vice president Edward Slaughter, "the computer that people can get their hands on, where they can try things out and learn what can be done with parallel processing."

In fact, Caltech's original Cube has already established a remarkably good track record for that sort of thing. As developed by Charles L. Seitz, Geoffrey C. Fox, and their colleagues, it consists of 64 small computers, each of which is roughly equivalent to an IBM Personal Computer. These 64 processors are then linked together as if they were the corners of a six-dimensional "Boolean hypercube." Thus the name. (In two dimensions, four computers would simply be linked in a square; in three dimensions, eight computers would be linked as the corners of an ordinary cube; and so on.)

One of the first research applications of the Cube was a numerical calculation in quantum chromodynamics programmed by Caltech physicist Steven Otto. It ran for an accumulated total of 2500 hours, and showed for the first time both the short-range Coulombic forces and the long-range constant forces between quarks.

With that as an inspiration, other Caltech researchers have begun to develop concurrent algorithms for problems in high-energy physics, astrophysics, quantum chemistry, fluid mechanics, structural mechanics, seismology, and computer science. In fact, says Seitz, it is rather surprising to see just how many problems can be attacked with parallel algorithms once people start to think about it.

Intel, which donated processor chips to the Caltech team for the original Cube, has upgraded its commercial version to have as many as 128 processors, each somewhat more powerful than an IBM PC-AT. Provision has been made for the users to design and incorporate their own special-purpose boards. And the company is forming its own in-house group to work with the users in developing applications.

"It's a big risk for Intel," says Alvin Thaler, who is in charge of the National Science Foundation's program to put advanced computers in the hands of mathematicians, "but it's a very exciting development for the academic community."—M. MITCHELL WALDROP