ship as a separate program rather than a percentage of the large block grant. The conferees then authorized funding for the Department of Education partnership at $450 million.

Money vanishes

But when the education bill went before the joint appropriations committee, the $450 million all but went away. "As many people forget, an authorization isn't an appropriation," Holt said. "There was no one in the [appropriations] conference committee looking out for science education. I wouldn't call anyone an enemy of the partnership, but there was no one who felt responsibility for the partnership."

The appropriators, Holt said, looked at the partnership as a new program because the final education bill structured it that way. "When appropriators see a new program, they are reluctant to put too much money into it, and because nobody was there to explain what the history was, the partnership only got a small fraction of what was authorized." That fraction amounted to $12.5 million.

With the guaranteed money for the partnership reduced far below the level needed to run state-based programs, Holt and Ehlers had to use their colloquy on the House floor to try to fund math and science teacher training from the $2.85 billion education block grant. Whether that will happen is not clear.

"While the block grant is there for professional development, it is also available for 13 other uses, including class-size reduction, hiring, merit pay, and teacher testing," said Jodi Peterson, the legislative director of the National Science Teachers Association. "The teachers are already standing at the back of the line and if it comes down to a school district using the money for hiring a new body or training a teacher in math and science, we're afraid training won't be a priority."

Instead of trying to create new partnerships with its $12.5 million, the Department of Education has indicated it will co-fund some of the NSF math and science partnership programs. "The NSF program was supposed to be the developmental project, the laboratory, for the larger Department of Education program," an education specialist on Capitol Hill said. "It didn't turn out that way."

The funding situation doesn't change much under the administration's 2003 budget proposal, which calls for the NSF partnership to be funded at $200 million and the Department of Education partnership to receive $13 million. Ehlers and Holt indicated they will try to restore guaranteed math and science teacher training money that goes directly to school districts. In the meantime, they hope that their colloquy fills the void. **JIM DAWSON**

Powerful NMR Machines Debut in US

US laboratories are installing the first batch of 900-megahertz (21-tesla) nuclear magnetic resonance (NMR) machines months ahead of their European and Japanese competitors. With a 12% increase in resolution over their 800-MHz (18-T) predecessors, the new machines can resolve previously inaccessible protein structures. "NMR is probably the most versatile if not unique tool to study such complex structures," says Andrey Geim, a leading expert in high magnetic fields from the University of Manchester in the UK, "and these new machines are incredibly technologically complex." Ten 900-MHz systems are either deployed or currently in production worldwide; and the only two wide-bore models, which accommodate larger-than-usual samples, will both be in the US.

OXFORD INSTRUMENTS

A 900-MHZ NUCLEAR MAGNETIC resonance device.

At the heart of the new machines are superconducting coils, cooled with liquid helium, that create a 21-T magnetic field uniform to one part in a billion. Any slight instability in the magnetic field can create a millikelvin temperature change in the system, which in turn can destroy the superconducting state and crack the magnet. To combat these effects, engineers have developed new ways to contain the immense stresses on the magnets.

NMR machines work by sending a series of radio-frequency pulses through a magnetically polarized sample (see PHYSICS TODAY, September 2000, page 19). When the frequency of the pulses matches the Larmor frequency of a particular type of nucleus in the sample, those nuclei absorb and emit energy. The resonant frequencies identify the isotope—for example, 900 MHz is the resonant frequency of hydrogen in a 21-T field. NMR can also indicate what chemical bonds are in the sample. "This chemical shift is usually small, which makes the resolution so important," says Geim.

"Even an incremental improvement in magnetic field strength can often lead to dramatic advantages for the spectroscopy or imaging of specific molecular systems," says Timothy Cross, NMR spectroscopy and imaging program director at the National High Magnetic Field Laboratory (NHMFL) at Florida State University in Tallahassee. Many peaks hidden in previous NMR spectra can now be detected with the increased resolution. And experiments that used to take a month can be done in days.

Building these multimillion dollar machines can take years and, because of the high cost, most of these new systems are being sold to national or international research centers. Last June, the nonprofit Scripps Research Institute in La Jolla, California, took delivery of the first narrow-bore (55-mm diameter) 900-MHz NMR system from Bruker Instruments in Germany. "It's fantastic," says Peter Wright, chairman of the department of molecular biology at Scripps. "The capabilities of this instrument take us to a new level."

Scientists are even more excited about trying out new wide-bore machines. "Mice are commonly used animal models for a variety of biological studies," says Cross, "and adult laboratory mice cannot be accommodated in a narrow-bore system." The extra room provided by a wider bore also allows research into solid-state materials, catalysts, and large membrane proteins. One of the wide-bore systems (65 mm), developed by UK-based Oxford Instruments, will be at the William R. Wiley Environmental Molecular Sciences Laboratory at the Department of Energy's Pacific Northwest National Laboratory. The

second instrument (105 mm) is built on a different design with help from Intermagnetics General Corp in Latham, New York, and is based at the NHMFL.

"Physically, they [wide-bore machines] are two to three times the size of a narrow-bore magnet because of the stresses involved, and it's too expensive to make these systems commercially," says Alan Street, technical director at Oxford Instruments.

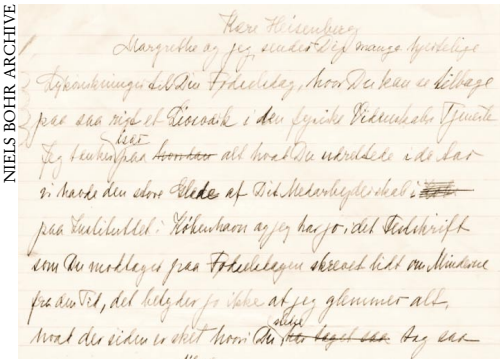
The US research lead in using 900-MHz devices may be shortlived. "Federal support for 900-MHz NMR systems pales in comparison to the support in Japan and Europe," says Cross. He adds that, without stronger federal support, magnet companies will be reluctant to push ahead with new research until their investments in 900-MHz systems are recouped. Still, says Street, "there's no doubt that the scientific community wants 1-gigahertz systems." **PAUL GUINNESSY**

Bohr Letters Clarify Mystery

The Niels Bohr Archive in Copenhagen has posted on the Web (at http://www.nba.nbi.dk) 11 short documents, never before made public, relating to the controversial visit of Werner Heisenberg to Bohr in German occupied Denmark in 1941. Most of them are drafts of letters Bohr wrote to Heisenberg in 1957 or later, but never actually sent. Since Gerald Holton (Harvard) announced the existence of one of these unsent letters two years ago, there has been much speculation as to what its contents might reveal about what was actually said during Heisenberg's enigmatic wartime visit to his former mentor. (See the articles by Holton and David Cassidy in PHYSICS TODAY, July 2000.)

The Bohr family had intended to withhold these personal documents until 2012, the 50th anniversary of Bohr's death. But as Finn Aaserud, director of the archive, puts it, the family has decided to release them now "to avoid possible misunderstandings regarding their contents." The documents (some in two or three different versions) are displayed as facsimile originals, Danish or German transcriptions, and English translations.

The immediate impetus for Bohr's first unsent letter, written soon after the 1957 publication of the Danish edition of Robert Jungk's *Brighter than a Thousand Suns*, was the reproduction in that edition of a letter from Heisenberg to Jungk, giving his version of the 1941 meeting. "I am greatly amazed," says Bohr's unsent draft, "to see how much your memory has deceived you. . . . I remember every word of our conversations, which took place against a background of extreme sorrow and tension for us here in Denmark."



NIELS BOHR ARCHIVE

DRAFT OF A LETTER FROM BOHR, congratulating Heisenberg on his 60th birthday in December 1961. The letter was never sent, though Bohr did send a congratulatory cable. Handwritten by Bohr's wife Margrethe, this draft is part of the collection of private documents recently released by the Niels Bohr Archive.

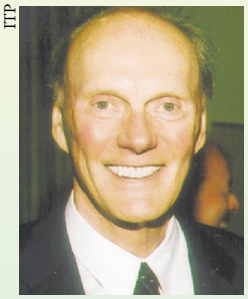
In several of the drafts, Bohr recalls that Heisenberg was quite confident of German victory, and that he therefore thought it foolish for Bohr and other Danes to rebuff "German offers of cooperation." Bohr also remembers Heisenberg saying that, under his leadership, "everything was being done in Germany to develop atomic weapons." If the war lasted long enough, Heisenberg told him, atomic weapons might be decisive. And if they were, "how fortunate

Kavli Endows ITP

The Kavli Institute for Theoretical Physics is how the Institute for Theoretical Physics at the University of California, Santa Barbara, will soon be known, thanks to a $7.5 million gift from local entrepreneur Fred Kavli. The ITP was founded in 1979 and its roughly $5 million annual running budget comes from NSF and UCSB. The Kavli money will help pay for expanding the ITP's building, doing research, and bringing scientists to the institute's celebrated workshops.

"Fred's gift will give us more flexibility to move in new directions," says ITP director David Gross. "Unexpected scientific breakthroughs cannot be easily accommodated by five-year funding cycles." For the next few years, Gross adds, biophysics will be among the topics "we'll keep looking at. There are a lot of exciting opportunities, and many physics departments are thinking about biology."

ITP



KAVLI

Kavli studied physics in his native Norway. He came to the US in 1956, and two years later founded Kavlico Corp in Moorpark, California, about 60 kilometers northeast of Los Angeles. The company has become one of the world's top suppliers of sensors for the automotive and aeronautic industries.

Kavli's gift to the ITP comes via his newly established Kavli Foundation, through which he plans to create endowed chairs at leading universities worldwide and give prizes to promote and recognize excellence in research. "Insights into fundamental reality form the basis for technological innovation," says Kavli. "The synergy that takes place among scholars who participate in the ITP's workshops, conferences, and residencies is astonishing. This gift, by helping the ITP to accommodate more participants in its programs and by supporting and inspiring its scientific discoveries, will make those programs even more valuable and productive for all involved." **TONI FEDER**

THE EXPANDED BUILDING will add 30% to the capacity of the Institute for Theoretical Physics. Construction begins next year on the new wing, which is on the left in this architect's rendering. (Courtesy of Michael Graves and Associates.)