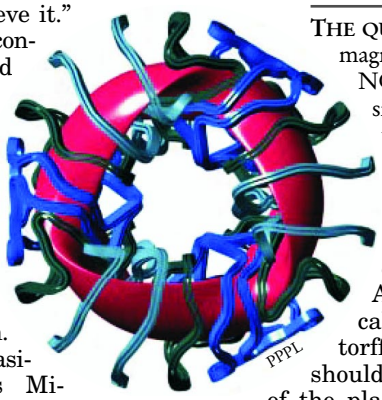
the magnets to achieve it." Research on plasma confinement at HSX and on stability of current-carrying plasmas at another small stellarator, the Compact Toroidal Hybrid under construction at Auburn University in Alabama, will feed into NCSX's research.



THE QUASI-AXISYMMETRIC magnetic field confining NCSX's plasma (red in this simulation) will be created using 18 modular coils (blue), plus some other weaker magnets.

NCSX will be quasi-axisymmetric, says Michael Zarnstorff, who heads the experiment's physics group. "We are trying to make it so that the magnitude of the field doesn't change as you go around the torus. If you do that, the particles don't know if they are in a tokamak or a stellarator. The lack of symmetry [in traditional stellarators] means that the orbits of the particles in the magnetic field are not necessarily bounded. They can leave the device."

Hand in hand with quasi-axisymmetry come other tokamak features. The shape can be chubbier—more like a truck tire than a bicycle tube—which lowers the cost for a given plasma volume. And a plasma current creeps in. But where plasma current alone creates the confining poloidal field in a tokamak, in NCSX, the current will contribute about a quarter of that field, with the rest coming from external magnets. According to theoretical calculations, says Zarnstorff, having some current should drive up β—the ratio of the plasma pressure to magnetic field pressure and a measure of plasma confinement—without introducing disruptions. NCSX is designed for a steady β of 4–6%—in line with projected reactor requirements. For comparison, stellarators recently topped β values of 3%, and tokamaks have typically achieved 11%, but only transiently. "The big challenge at the moment is how to sustain sufficient β to make fusion attractive in terms of reactor cost and power output," says Zarnstorff. And the big advance in stellarators, he adds, is the use of computers to sift through the infinity of possible three-dimensional shapes. "That, and the realization that you don't have to make the coils helical."

The bulk of NCSX's magnetic field will come from 18 contorted coil modules, with another 28 weaker coils for tweaking. The plasma, consisting of hydrogen, deuterium, or perhaps helium isotopes, will have a major radius of 1.4 meters and a periodically varying cross-sectional shape.

BALCKE-DÜRR

THE PLASMA VESSEL will be adapted to match the plasma shape in Wendelstein 7-X, a quasi-poloidally symmetric stellarator under construction in Greifswald, Germany. This prototype is to scale.

Stellarator renaissance

In going ahead with NCSX, the US is rejoining the stellarator fold. First proposed in 1951 by Lyman Spitzer of Princeton University, stellarators were later largely abandoned by the US fusion community in favor of tokamaks. Stellarator research continued elsewhere, however—notably in Japan, where a record-size stellarator has come close to matching tokamak results, and Germany, where the numerical computations used to design HSX and NCSX were developed. Germany's stellarator in Garching will be shut down on 31 July. A successor, Wendelstein 7-X, is slated to start up in 2007 in Greifswald, in the former East German state of Mecklenburg–West Pomerania. Wendelstein 7-X will have quasi-poloidal symmetry and zero toroidal plasma current.

The international stellarator community must form a consensus as to the most promising stellarator concept for fusion energy, says Friedrich Wagner, director of Wendelstein 7-X. There won't be the time or the will, he says, to build a stellarator comparable to the International Thermonuclear Experimental Reactor, a hoped-for tokamak intended to show the feasibility of fusion energy. "The decision between the ITER tokamak line and the stellarator line may come in the definition of DEMO [a post-ITER prototype commercial fusion power plant]," Wagner says.

"Sociologically, stellarators and tokamaks represent two separate camps," adds Zarnstorff. "But not physics-wise—they have the same goals, with slightly different means." In any case, he says, "it's way too early to feel competitive." **TONI FEDER**

House Legislation Calls for Doubling NSF Budget

In the months since President Bush released his fiscal year 2003 budget calling for a 5% increase in the National Science Foundation budget while simultaneously proposing a 17% increase for the National Institutes of Health, many budget watchers in both Congress and the scientific community have been grumbling. The call for a "more balanced portfolio" between life sciences and basic research has become almost a mantra on Capitol Hill. NSF Director Rita Colwell has repeatedly found herself facing skeptical congressional questioners who note that, because of program money being transferred to NSF from other agencies, her budget request is closer to 3%, or about the rate of inflation.

In response to the increasing pressure to "fix" the NSF budget, several members of the House Science Committee, including Committee Chairman Sherwood Boehlert (R-N.Y.), introduced a bill in early May that would double the NSF budget within five years, beginning with a 15% increase in FY 2003. The bill, actually introduced by Representative Nick Smith (R-Mich.), chairman of the research subcommittee, was cosponsored by 16 representatives from both parties and is expected to give serious political momentum to reconfiguring the science budget to increase basic science funding.

At a crowded press conference in the committee's large hearing room on 7 May, Smith said that although he has "a philosophy of limited government," he wants to double the NSF budget because "continuing our support of basic research forms the building blocks for the applied research that keeps our security, health, and economy strong." Boehlert, who has been a strong supporter of increasing basic research funding throughout the federal government, said that "the thinking behind this bill is simple, but not simple-minded." NSF supports research that is of critical importance to the future of the nation's economy, security, health, and educational excellence, he said. "Those are all pretty solid arguments for rewarding NSF with more than praise," he continued. "Recognition is nice, but success requires real money. This bill will help NSF get the real money it needs."

The bill proposes to bump NSF's FY 2003 budget from the $5.03 billion requested by the administration to slightly more than $5.51 billion. The $5.51 billion would be a 15% increase over NSF's current budget of $4.79 billion. There would be another 15% increase in the FY 2004 budget, followed by yet another in FY 2005. The final goal, the committee members said, is to double the NSF budget by 2007.

In FY 2003, the bill would

▷ increase research and related activities by $540 million, or 15%; the bill designates specific increases for networking and information technology research, nanoscale science and engineering, mathematical sciences, and major research instrumentation

▷ increase science, math, and technology education by $131 million, or 15%, to fund existing programs as well as new ones the legislators hope to create

▷ authorize an increase of 9.8%, or $14 million, for major research equipment and facilities construction; the increases in this category would be much larger, 48% and 27% respectively in 2004 and 2005, and are intended to enable NSF to reduce its backlog of large facilities projects.

The bill also would require the National Science Board and Colwell to submit to Congress each year a priority list for proposed projects, along with explanations of how the rankings were determined. Congress has been trying unsuccessfully for several years to get such a list from NSF. David Stonner, head of NSF's Office of Legislative and Public Affairs, said the foundation was "thrilled with the confidence Congress has placed in us," but noted that adding more money to the NSF budget would mean taking it away from another agency to keep it within the limits of the administration's budget proposal.

Rep. Vern Ehlers (R-Mich.), a physicist-turned-legislator, said the bill has a good chance of passing the House, but getting it through the entire legislative process and getting the money appropriated remains "a big question."

JIM DAWSON

Watson Dumped from Climate Panel

The Bush administration, on the advice of the fossil fuel industry, surprised the international scientific community by refusing to renominate incumbent Robert Watson to chair the Geneva-based Intergovernmental Panel on Climate Change (IPCC), effectively killing his chances of retaining his position. Instead, at a 19 April meeting, the US delegate to the IPCC voted for Rajendra Pachauri, an Indian energy economist. Watson,