The new policy, if adopted, would mark a significant step in an ongoing campaign to increase the level of accountability at Japan's universities and research institutes. Until fairly recently, universities and professors operated free of almost any type of oversight. Faculty members arrived on campus with jobs for life and received guaranteed, although modest, funding for research even if they never published a paper or submitted a patent application. Infrastructure funds for the 98 national universities were split depending on enrollment and tradition and rarely varied.

That system has started to crumble in the past decade as the amount of research money made available to scientists through competitive, peer-reviewed grant schemes has nearly tripled, to $1.9 billion, while the base funding has grown more slowly, to $1.3 billion. "Individual researchers are now largely subjected to peer review of their work," says Masayuki Shibata, director of Monbusho's Office of Science Policy.

Progress has been less dramatic on the institutional level, however. Although some departments invite blue-ribbon panels from around the world to review their research and education programs, most universities have opted for committees drawn from within. "These self-assessments just don't go far enough in an era when science and technology have become borderless," says Hiroyuki Abe, president of Tohoku University in Sendai and chair of the science council's working group on research evaluation. The council's report recommends "third party," or external, evaluations to remedy that problem.

Although the use of outside evaluations to shape government funding decisions for institutions has broad support, some scientists are worried about the details. Nakai, who also served on the evaluation working group, fears a centralized evaluation would tend to apply the same evaluation criteria across disciplines and between fields. The criteria for groups working in accelerator physics should be different from other areas of physics, not to mention engineering, he says, noting the variations between large and small science and the differing attitudes among disciplines toward the importance of publication. He also worries that a centralized system will seek a common denominator and penalize universities that cater to local needs. "Everyone recognizes that Japanese primary and secondary education is overly focused on the single objective of doing well on university entrance exams," he says. "There is a possibility of making the same sort of mistake on this."

Abe, who also serves on a new committee that will advise Monbusho on the envisioned evaluation body, says that policymakers and advisers share these concerns. The report, which is intended to "advance the nation's scientific research," also recommends that Monbusho create a mechanism that allows universities to collect overhead on government-sponsored research and improve ties between universities and the private sector. The report also asks Monbusho to revise rules that restrict the hiring of research assistants and technicians.

–DENNIS NORMILE

ASTRONOMY

The Coolest Brown Dwarfs Proliferate

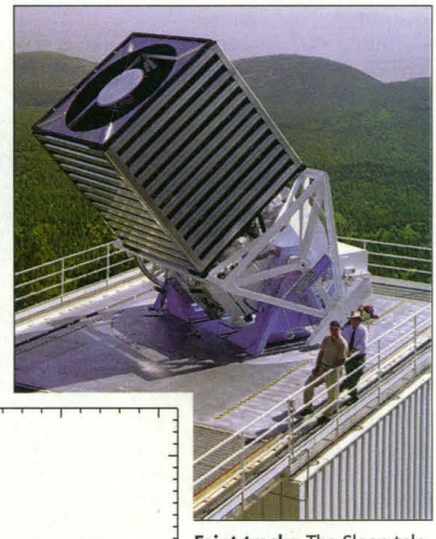
CHICAGO—By collecting and cataloging hundreds of millions of celestial objects, the Sloan Digital Sky Survey may turn a rare oddball into a common denizen of the heavens. The $80 million project is designed to create a three-dimensional map of galaxies extending to hundreds of millions of light-years. But the Sloan, which is still in a shakedown phase, has demonstrated that its census-taking power extends to our cosmic neighborhood as well. At an American Astronomical Society meeting here on Monday, survey members announced that it has turned up two of the coolest, dimmest stars called brown dwarfs ever seen, lurking by themselves in the equatorial sky.

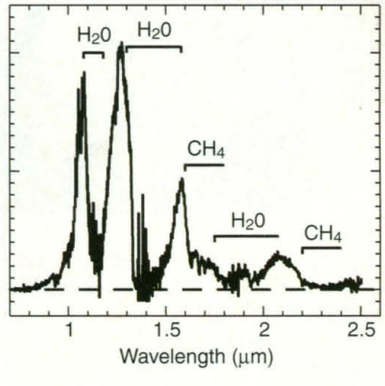
Probably located within 30 or 40 light-years of Earth, the brown dwarfs are so small that their surface temperature is no more than 1000 Kelvin, cool enough for methane and water—compounds normally associated with planets—to survive. Until now these molecules had been seen in only one other brown dwarf (*Science*, 1 December 1995, p. 1435), which was tethered to a brighter and more massive companion. "They're the first methane brown dwarfs found floating out there in isolation," says David Golimowski of Johns Hopkins University and the Sloan team—and a hint that, as theorists have predicted, large numbers of such stars are waiting to be found. "Given that the sky survey was built for other purposes, that's a really handsome payoff," says Alan Boss, an astrophysicist at the Carnegie Institution of Washington.

The Sloan's special wide-field telescope on Apache Peak, New Mexico, is combing wide swaths of sky to compile a "field guide" of hundreds of millions of objects, from which the million brightest galaxies can be selected for detailed mapping. Like a trawl of the heavens, the effort also nets objects ranging from nearby stars to the most distant quasars—brilliant beacons in the early universe (*Science*, 11 December 1998, p. 1969).

Sloan astronomers stumbled across the brown dwarfs while searching for new quasars in data from a test period. Because quasars are so distant that their light is shifted toward the red end of the spectrum, they glimmer in the Sloan's long-wavelength, infrared channels but vanish in optical bands. So do brown dwarfs, as Michael Strauss and Xiaohui Fan of Princeton University and Zlatan Tsvetanov and Wei Zheng of Johns Hopkins found when detailed studies of the objects' spectra revealed that they were cool, dim, and close by.

Defined as stars with less than about 8% of the mass of the sun (or 80 Jupiter masses), brown dwarfs never ignite much fusion burning in their cores and gradually dim after they form. Dozens of garden-variety brown dwarfs, called L dwarfs, slightly too massive and warm to host water and methane, have turned up over the last couple of years, many of them in the infrared 2-Micron All-Sky Survey at the University of Massachusetts, Amherst. But theorists expected that the smaller methane dwarfs would be common as well, because a cloud of gas as small as 10 Jupiter masses can, in principle, collapse into a star. "It's nice to see some confirmation of that theoretical prejudice" from the Sloan results, says Boss.





Faint tracks. The Sloan telescope in New Mexico captured evidence of water and methane in a brown dwarf.

As the Sloan expands its view to cover much of the northern sky, the smallest dwarfs could become a tribe. "They're oddballs at the moment," says Golimowski, "but I'm confident they'll be pretty boring objects within a few months."

–JAMES GLANZ

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