to $16 million, and adds $4 million for plant genome studies and $5 million for animal genome studies. These efforts would have been part of the new foods initiative, but it's logical for NRI to fund them, says Sally Rockey, a deputy NRI administrator, because it is already supporting projects in these fields. But some things are lost in the trade-off, says Nipp. NRI-funded projects do not have the education and extension components that were to be part of the new initiative, and traditionally NRI awards are small, single-institution grants, he notes. "The NRI is not structured to do some of the things that the initiative was supposed to accomplish."

Although the bill's ultimate fate is uncertain—Clinton vetoed it in an attempt to win more emergency aid for farmers—most observers expected its provisions to be retained in a catch-all budget bill passed before Congress adjourned for the year. But supporters of the new initiative are not yet ready to throw in the towel. When Congress considers the agriculture budget next year, says Rockey, "we would hope we can resurrect it."

–ELIZABETH PENNISI

EVOLUTION

Male Mating Blocks New Cuckoo Species

The common cuckoo thrives by hoodwinking other birds, and it has mystified biologists as well. Cuckoos lay their eggs in the nests of many other bird species, but individual females specialize in nests of just a single species, leaving eggs that match those of the host bird to fool it into tending them. In spite of this specialization, the cuckoo itself remains a single species. Now, a study on page 471 reports that the reason lies not in the struggle between host and parasite, but in another ancient battle—between male and female.

Genetic analyses of cuckoos reveal that even as they specialize on different hosts, the different reproductive strategies of males and females prevent speciation. "They're at odds with each other," explains co-author Karen Marchetti, an evolutionary biologist at the University of California (UC), San Diego. Although it's in the interest of the female to mimic a particular host as closely as possible, Marchetti and her colleagues found that the male mates with females that parasitize many different hosts, spreading his genes around. "And that prevents the development of new species," says Marchetti.

"They've confirmed what we suspected but has been hard to show," says Bruce Lyon, an evolutionary biologist at UC Santa Cruz. "These are hard-won data," he says, noting that the secretive behavior of the cuckoo has hindered earlier efforts to study its reproductive patterns. But the jury is still out on some of the team's theories—for example, that cuckoos pass egg traits such as color, pattern, and size only from mother to daughter, enabling them to produce a variety of egg patterns in spite of the males' homogenizing effect. "It's tantalizing, but it raises more questions than it answers," says John Eadie, a behavioral ecologist at UC Davis.

To solve the mystery of how cuckoos specialize without speciating, Marchetti and her co-authors studied the mating patterns of the Japanese common cuckoo. This bird lays its eggs in the nests of three other species, then leaves, letting the hosts perform all the chick-rearing chores. There's always the risk that the host species will learn to recognize foreign eggs and push them out of the nest. "That puts selective pressure on the female cuckoos to lay eggs that match their host's," explains Marchetti. Such evolutionary pressure is beginning to lead to the formation of "host races," with eggs specialized for a particular host species—a process that is more advanced in the European cuckoo, in which females lay very distinct eggs for each host. These races would seem to be poised to develop into different species—but the cuckoos don't go that far. "That's the mystery," says Marchetti.

The Japanese cuckoo has been carefully studied in the field by one of the authors, ornithologist Hiroshi Nakamura of Shinshu University in Nishinagano, Japan. He noted that just 30 years ago, the cuckoo added the third host, the azure-winged magpie, to its surrogate parent list. To see how this new specialization affected the bird's genetics, Nakamura collected blood samples from 83 adult male and 79 female cuckoos. He also sampled 136 chicks, recording which of the three host nest types the chicks were found in.

Marchetti then used this material to determine each chick's parenthood. Family tree in hand, she could then see where each female's chicks grew up. It quickly became clear, as researchers had guessed from field observations but never shown, that females are typically faithful to their host species, laying eggs in the kind of nest in which they were born. If an egg gets laid in the wrong nest by mistake, as happens about 5% of the time, and if the naïve host rears the chick, the cuckoo can immediately be set on a new evolutionary path, leading to the formation of host races—and potentially a new species.

But when researchers looked at the chicks' paternity, they found that the males willingly mate with any female, regardless of which host she is attached to. That behavior should block the development of any new species. "It's a conflict between the sexes," says Marchetti. "The males want to maximize the number of their offspring … [while] the female is under pressure to produce the best matching egg, one the host won't reject."

Because the father's genetic contribution cannot foster specialized eggs, the team speculates that egg-mimicry traits are passed only from mother to daughter. That would increase the chances of the females laying well-matched eggs—even though the male

Birds of different feathers. Unwitting warbler feeds cuckoo chick.

mating habits are working against them. But Eadie and others note that this is still a theory, and the team has yet to muster evidence on how egg mimicry comes about and is maintained. "That's still a big, black box," says Eadie. "This paper has opened the door," says Paul Harvey, an evolutionary biologist at Oxford University. "We're going to see a lot more" now that genetic techniques can be applied to the cuckoo's sneaky reproductive habits.

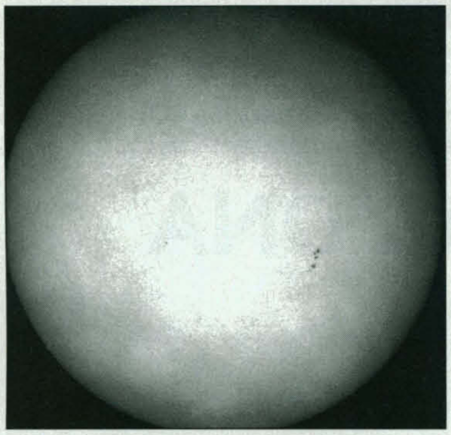
–VIRGINIA MORELL

SOLAR ASTRONOMY

Recovered SOHO Passes Health Check

Solar astronomers are breathing a sigh of relief this week. After a couple of months out of contact with Earth, spinning out of control, and exposed to extremes of temperature, the hugely successful Solar and Heliospheric Observatory (SOHO) appears to have come through its ordeal unscathed. As *Science* went to press, seven of the 12 instruments on board had been switched on successfully and recommissioning is complete for four of them, reports Bernhard Fleck, the European Space Agency (ESA) Project Scientist for SOHO at NASA's Goddard Space Flight Center in Greenbelt, Maryland. (SOHO is a joint project between NASA and ESA.) "We haven't observed any adverse effects due to the thermal stress so far," Fleck says. He is still surprised at how well the recovery has gone. "It is a miracle," he says.

When SOHO spun out of control in June, following a series of ground control errors (*Science*, 11 September, p. 1585), astronomers feared they would lose a unique vantage point in space to watch the sun as it reaches its 11-year maximum in solar activity around 2001. "The loss would have been a major setback," says Jørgen Christensen-



First light, again. An early image from SOHO's restored Michelson Doppler Imager.

Dalsgaard of Århus University in Denmark, a SOHO co-investigator.

Ground engineers reestablished contact with the spacecraft in August and painstakingly worked to slow its spin and recharge its batteries. On 25 September, they succeeded in taking the spacecraft out of its "safehold" mode—a safety position that keeps its arrays pointing toward the sun—and restored SOHO's high-precision pointing mode, in which its attitude is maintained by spinning reaction wheels and controlled by a fine-pointing sun sensor and a star tracker.

On 5 October, the first instrument was powered up—the Scanning Ultraviolet Spectrometer. The Variability of Irradiance and Luminosity Oscillations instrument was switched on the next day. "All the data we have seen up to now look very good," says principal investigator Claus Fröhlich of the Physical Meteorological Observatory of the Davos World Radiation Center in Switzerland.

The interruption of data taking was a setback for researchers studying the long-term oscillations of the sun, however. "We are still searching for the g-modes, the gravity modes, and the longer the time series, the better the signal-to-noise [ratio]," says Fröhlich. Although time has been lost, astronomers who spoke with *Science* are unanimous in praise for the Goddard recovery team, which has been toiling 7 days a week since June. "It is a major success ... following a major failure," says Christensen-Dalsgaard. –ALEXANDER HELLEMANS

Alexander Hellemans is a writer in Naples, Italy.

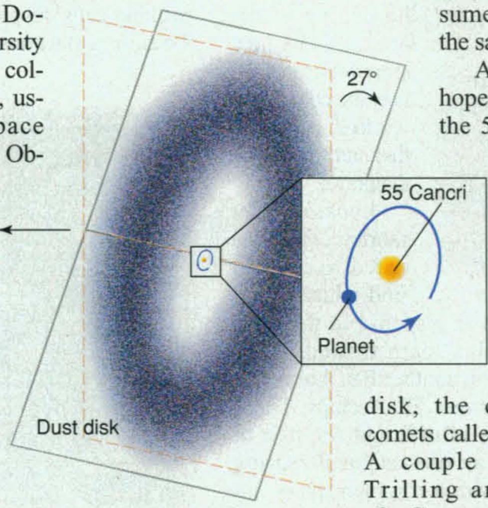
ASTRONOMY

Planet Hunters Become Weight Watchers

It's official: The invisible object tugging on a star in the constellation Cancer is a planet. Although it is 3 years since astronomers first detected the telltale wobble in a nearby star, indicating an unseen companion, they could not rule out the possibility that it is a dim star or brown dwarf instead of a planet. The same doubt has accompanied every one of the dozen or so planet candidates detected since then. But by imaging a flattened disk of dust particles surrounding one of those candidate planetary systems, two Arizona astronomers were able to deduce, for the first time, the mass of a suspected planet. The object is, they calculate, less than twice the mass of Jupiter—far too light to be a star or a brown dwarf.

Astronomers can detect invisible, low-mass companions around other stars by finding tiny periodic changes in the line-of-sight velocity of the parent star as the companion tugs it back and forth. But it is impossible to deduce the true mass of such objects from the stellar wobbles, because astronomers do not know the orientation of the companions' orbits with respect to the line of sight. The same radial-velocity variations in a star could be caused by a relatively low-mass planet in an edge-on orbit, or a heftier object—a brown dwarf, say—in an orbit at a steep angle to the line of sight.

Last year, Carsten Dominik of Leiden University in the Netherlands and colleagues announced that, using the European Space Agency's Infrared Space Observatory, they had detected an excess of far-infrared radiation from the star 55 Cancri, hinting at the existence of a disk of dust and debris orbiting it (*Science*, 5 December 1997, p. 1707). Hearing Dominik's announcement, David Trilling and Robert Brown of the University of Arizona, Tucson, realized they had a rare opportunity. The star was also known to have a possible exoplanet companion, discovered in 1996 by Geoff Marcy of San Francisco State University and Paul Butler of the Anglo-Australian Observatory in New South Wales. And Trilling and Brown had scheduled an observation of 55 Cancri the following week, using an instrument called CoCo (for cold coronagraph) at NASA's 3-meter Infrared Telescope Facility (IRTF) at Mauna Kea, Hawaii. CoCo is designed to observe cool objects such as clouds of dust. By imaging the disk around 55 Cancri, Trilling and Brown hoped to learn its orientation, and hence the orientation of the planet's orbit.



Telltale tilt. The inclination of 55 Cancri's disk reveals its planet's mass.

A week later, Trilling and Brown blocked out the star's own infrared glare to reveal a flattened disk of cool dust extending to at least 6 billion kilometers from the star. The infrared image implied that the disk is tilted 27 degrees from the plane of the sky. Assuming that the planet around 55 Cancri (which is much closer to the star) orbits in the same plane, its mass could be calculated from the wobbles Marcy and Butler originally measured. This week, Trilling and Brown announced their results, including an estimated mass of 1.9 Jupiters, at the American Astronomical Society's Division of Planetary Sciences meeting in Madison, Wisconsin; a paper is due to appear in *Nature* next week.

Trilling admits that he cannot prove the crucial assumption—that the disk and the planet orbit in the same plane. "But it would be a very strange dynamical system" if they were not in the same plane, he says. Dominik agrees. "All theories I know about the formation of planets around [sunlike] stars start with a disk around the star, and the planets are formed in that disk. I think it is very reasonable to assume that both are in the same plane."

Astronomers now hope to learn whether the 55 Cancri system is one of a kind, or whether other exoplanetary systems have disks that may betray their mass. Omens are good—after all, our sun has its own disk, the distant band of comets called the Kuiper belt. A couple of weeks ago, Trilling and Brown used CoCo again to observe a number of other stars thought to be accompanied by planets. Although he does not want to disclose any results yet, Trilling says that they found one or two more dust disks. "We expect that most systems with planets also have disks," he says.

Details of masses would tell us if other planetary systems are like our own; hence, other astronomers are on the lookout. Jane Greaves of the Joint Astronomy Center in Hawaii, who discovered a disk around the nearby star Epsilon Eridani (*Science*, 10 July, p. 152), says, "We haven't yet tried to image dust around [known exoplanet stars], but we're planning a project for early next year." It surely won't be long before other exoplanets are put on the dust-disk weighing scales. –GOVERT SCHILLING

Govert Schilling is an astronomy writer in Utrecht, the Netherlands.

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