make the best parents. "It doesn't take two great varieties to produce a great progeny," says Meredith. Or as Luby puts it, "Even a scruffy bull can sire good offspring."

–MICHAEL HAGMANN

ASTRONOMY

Stellar Small Fry, or Runaway Planet?

Dark objects each the size of a dozen Jupiters could lurk in nearby space, a new discovery suggests. Maria Zapatero Osorio of the Canaries' Institute of Astrophysics in La Laguna, Tenerife, along with colleagues there and at the University of California, Berkeley, has found a mysterious object, dubbed S Ori 47, which defies easy classification: It may be too light to be a brown dwarf, the smallest kind of star, and could even be a giant planet drifting alone through space.

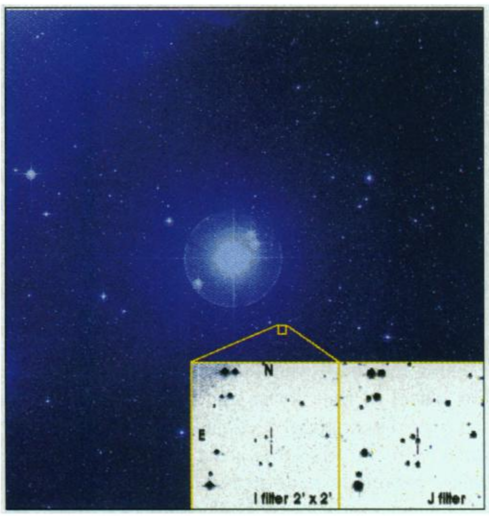
"This is the lowest mass object [beyond our solar system] ever imaged by astronomers," says Zapatero Osorio, who descibes the finding with her colleagues in a paper to appear in *Astrophysical Journal Letters*. S Ori 47 may be just 1.5% of the mass of the sun, or 15 times the mass of our own giant planet Jupiter. Whatever it is, it could be only one of many, as it is visible only because it is still glowing after its fiery birth. "There may be tens of them within 30 light-years from the sun," says Zapatero Osorio. "It's a very important discovery," says Kevin Luhman of the Harvard-Smithsonian Center for Astrophysics, who himself is hot on the trail of extremely low-mass objects. "It's discoveries like this that are developing an empirical picture of substellar objects." But he doubts that the objects are plentiful enough to account for the galaxy's "dark matter," the mysterious missing mass that seems to pull on the visible stars and gas.

Zapatero Osorio and her colleagues found S Ori 47 when they were observing a young star cluster in the constellation Orion. The stars in the cluster, 1100 light-years away, all formed just a few million years ago, so S Ori 47 is still glowing with the heat generated as interstellar gas collapsed to form it. The team studied it in detail using an infrared camera mounted on a 1.5-meter telescope at Teide Observatory on Tenerife in the Canary Islands, measuring its luminosity (0.2% of that of the sun) and surface temperature (some 1700 degrees Celsius). They estimated its mass by plugging these measurements into theoretical models of how quickly objects of different masses should cool and fade after their formation. The models are uncertain, says Zapatero Osorio, so the mystery object could be anything from 10 to 20 Jupiter masses.

That mass range straddles the dividing line between brown dwarfs and giant planets, which many astronomers put at about 13 Jupiter masses. Objects just above that mass—brown dwarfs—are not massive enough to ignite the hydrogen fusion furnace in their cores, but at some point during their lifetime they do burn deuterium (heavy hydrogen). However, anything less than 13 Jupiter masses is thought to be incapable of burning even deuterium and is considered a planet. Planets are also generally thought to form in the disk of material around a star, while stars can form directly out of a collapsing gas cloud. S Ori 47 may have formed as a solitary object, but it is equally likely to be an ejected planet.

Last year, Susan Terebey of the Extrasolar Research Corp. in Pasadena, California, claimed to have discovered an ejected planet on a Hubble Space Telescope photo. Although "there has been much skepticism about this particular claim, there's no reason why it couldn't happen," says James Liebert of the University of Arizona, Tucson. According to Liebert, the highly elliptical orbits that some extrasolar planets seem to follow around their parent stars can only be explained through the gravitational interactions of a third body in the system. "This can easily result in the ejection of a Jupiter-mass planet from the solar system altogether," he says.

Regardless of its true origins and nature—



Miniature mystery. Is S Ori 47 a star too small to ever burn or an ejected planet?

CREDIT: ZAPATERO OSORIO ET AL., AP. J. LETTERS, IN PRESS; BEJAR ET AL., AP. J. 521, 671 (1999)

low-mass brown dwarf or rogue planet—S Ori 47 appears to be no astronomical oddity. "Currently, we're observing much fainter candidates in the same cluster," says Zapatero Osorio. Because all cluster members are roughly the same age, the fainter ones are probably even less massive. If the cluster is typical for the galaxy at large, space could be heavily populated with such objects. But their

ScienceScope

Steamed About Stem Cells A prominent biomedical advocacy group is taking some heat for failing to support controversial human stem cell research. In a letter last month to John Seffrin, CEO of the American Cancer Society, Stanford biochemist Paul Berg expressed "deep disappointment" over ACS's "recent action withdrawing its support for human embryonic stem cell research," which uses cells derived from embryos and fetuses.

The 26 August letter from Berg, head of the American Society for Cell Biology's public policy committee, was prompted by a 29 July *New York Times* report that influential Catholics had pressured ACS into withdrawing its endorsement of Patients' Cure, a group advocating stem cell research. It was "shocking," Berg wrote, that ACS had failed to join with other groups calling for federal funding of such work.

But Berg has it wrong, says Greg Donaldson, ACS vice president of public relations in Atlanta. Although ACS isn't backing Patients' Cure, he says "nothing could be farther from the truth" than the claim that ACS withdrew its support for stem cell research. "How could we, when we haven't formulated a policy yet?" he asks. Though ACS joined other groups in May to urge Congress not to ban stem cell research, he says staff are still "engaged in a deliberate internal dialogue" on its policy.

Whose Mummy? Researchers and Native Americans are at odds over the fate of Spirit Cave man, a 9400-year-old mummy. Found in 1940 about 90 km east of Carson City, Nevada, the mummy is the oldest documented North American yet. First presumed to be less than 3000 years old, the remains were carbon-dated after being rediscovered in storage at the Nevada State Museum in Carson City in 1994. The new date sparked a flurry of research, as well as demands from the Fallon Paiute-Shoshone tribe, which wants to bury its alleged ancestor.

Scientists are keen to do a DNA probe on the Spirit Cave bones, but the government has forbidden any invasive procedures pending a custody decision. Both sides are pleading their case to the federal Bureau of Land Management (BLM), which will make the decision. In the meantime, scientists eager to see whether Spirit Cave man sheds light on the peopling of the Americas are on tenterhooks. Says University of Nevada archaeologist Eugene Hattori: "Everyone is waiting for BLM."

Contributors: David Malakoff, Eliot Marshall, Constance Holden

true numbers may never be known, because most are expected to have faded to blackness.

–GOVERT SCHILLING

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

NEUROSCIENCE

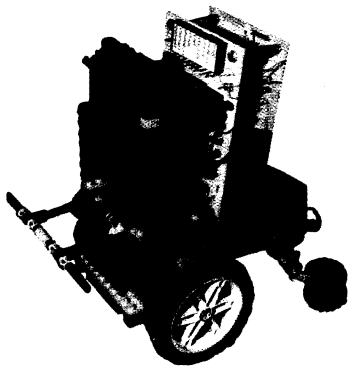
A Machine With a Fly's-Eye View

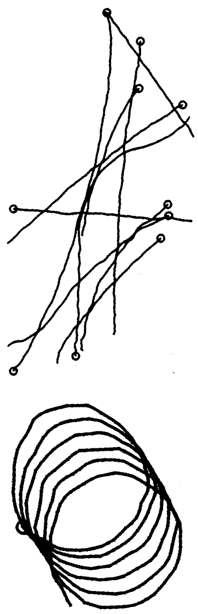
Watch a house fly dart through a kitchen, navigating around obstacles at top speed, and you may not be surprised to learn that this blight of homemakers is a favorite of neurobiologists. For more than 30 years, they have measured brain activity and movement in tethered living flies to learn how the tiny fly brain processes fast-changing visual information and turns it into flight commands. More recently, they have used computer simulations to try out their theories on how these processes work. Now, scientists have a new tool that may help them unravel the secrets of a fly's agility: an analog electronic circuit that models a key part of the fly's visual system and is built into a rudimentary robot so that it can interact with the real world.

The robot fly was developed at the California Institute of Technology (Caltech) in Pasadena by Christof Koch and graduate student Reid Harrison, who says it may turn out to be a better probe of the fly visual system than experiments with live flies or computer simulations. "By building a model that interacts with the real world in real time, one can easily expose the model to complex stimuli that might be difficult to simulate," says Harrison. The robot fly's eye may also benefit robotics, because its analog design is fast, very stable, and uses little power. "[These experiments] show that much can be learned from biology for robotics," says fly vision expert Martin Egelhaaf of the University of Bielefeld in Germany.

Harrison and Koch, whose results will soon be published in *Neural Computation* and *Autonomous Robots*, based their visual system on three layers of structure in the fly's eye. The top layer of photoreceptors each send a signal to a cell called an elementary motion detector, which detects motion by working in concert with neighboring EMDs. When a photodetector picks up a signal, its EMD compares that signal with what its neighbors are seeing. If a neighbor detects an identical but delayed signal, then the EMD decides that they are coming from a single source moving in that direction and sends a message to the next layer of cells. These are the large "horizontal system" (HS) cells, which collect the outputs from all the EMDs and sum them to produce a signal that drives the fly's motor system to react to the detected motion.

The researchers duplicated this structure in a single integrated computer chip. Each electronic EMD consists of a light detector and a simple circuit to compare signals and generate an output signal—all covering an area 60 by 200 micrometers. The chip contains 144 such devices arranged in a 6-by-24 grid. Each EMD in the array sends its signals to another circuit—the equivalent of the HS cells—that sums the outputs to produce a response to the observed movement.





Seeing straight. This robot naturally wants to move in loops *(bottom right)*, but a fly-inspired vision chip keeps it in a straight line *(top)*.

To see if this vision system would successfully respond to real-world stimuli, the researchers mounted it on a wheeled Lego robot. The robot had two powered wheels with very different gear ratios, so it naturally ran in tight circles. The vision system would therefore see a lot of horizontal motion and produce a large signal. The team wanted to use the signal to get the robot to compensate for the motion and move in a straight line. So the Caltech team used the output from the vision system to boost the power driving the low-geared wheel and reduce the power driving the high-geared wheel. Hence the more the robot turned, the bigger the signal, causing the small wheel to run faster and the big wheel to run slower and hence slowing the turn. This optical feedback worked well, and, with the vision system installed, the robot moved in near-straight lines despite the huge asymmetry in its wheels.

Insect vision specialists told *Science* that the success of the robot is an important validation of current theories of fly vision. Alexander Borst of the University of California, Berkeley, believes the way the Caltech vision array feeds straight into the motor system, and hence gets automatic feedback, mirrors biology well. "The big advantage that I see is that the visual system is automatically in a closed loop, which neuroscientists usually forget when thinking of the computational tasks of the visual system," he says.

The nature of the circuits may also hold lessons for roboticists. The vision system contains no digital electronics, which would involve a complex computational recipe containing thousands of operations, but instead uses analog circuits, processing light signals by employing the innate physics of the device—a technique pioneered by Caltech's Carver Mead. This makes its power consumption extremely low—just 5 microwatts for the array. Harrison compares this with the charge-coupled device imagers on the Sojourner rover used in the recent Mars Pathfinder mission. These used 0.75 watt just to acquire images, and much more power to process the data.

The Caltech researchers are now continuing to refine their vision controller system, while at the same time giving their robot fly a smaller and more biologically inspired body that they hope might one day take flight. In particular, they are in the process of designing micromechanical "halteres": vestigial wings that assist a real fly with attitude control and stabilization.

–SUNNY BAINS

Sunny Bains is a scientist and journalist based in the San Francisco Bay area.

COMPUTER SCIENCE

Internet Security Code Is Cracked

A popular encryption tool for keeping credit card numbers and other information secret on the Internet has been cracked. Last week, scientists announced at a press conference in Amsterdam that, using a sophisticated mathematical algorithm and cleverly written software, they had broken the RSA-155 code, which protects credit card transactions and secure e-mail in Europe. The number-crunching legerdemain suggests that anyone trafficking in confidential information on the Internet may soon have to switch to more sophisticated encryption software.

Using RSA-155, one party can send a secure message to another by using the recipient's "public key"—a 155-digit product of two large prime numbers—to transform the original message into ciphertext. Decoding the message, however, requires the two prime numbers, known only to the recipient. For a long time this encryption was considered secure. Factoring a 155-digit number was thought to be beyond the scope of practical computations.

Two years ago, however, a group led by Herman te Riele of the Centre for Mathe-

CREDIT: REID HARRISON