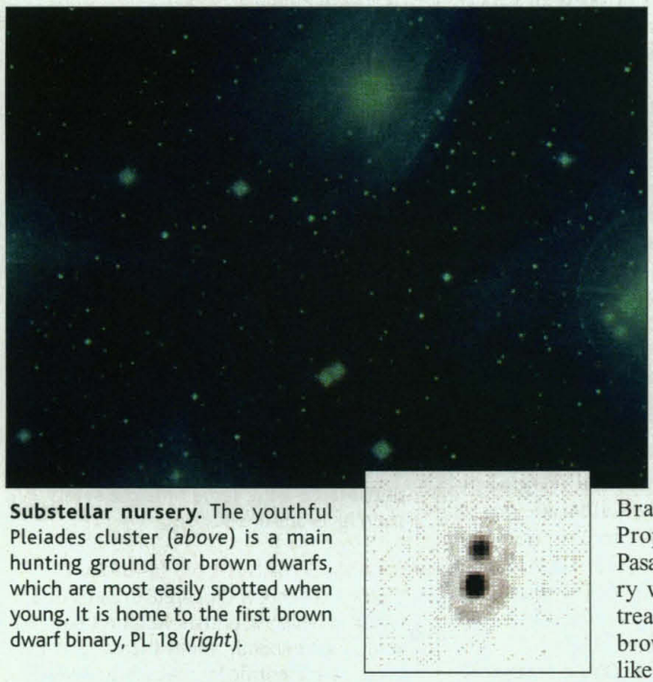
ASTRONOMY

Binaries Answer Riddle Of Brown Dwarf Origins

A brown dwarf is a poor excuse for a star. Too small for gravity to ignite its nuclear furnace, a brown dwarf is heated primarily by the energy released as it contracts, although some deuterium fusion may take place. As a result, its surface at its hottest barely reaches 2000 degrees—our sun's surface is 5800 degrees—and it glows more like a hot coal than a star, emitting most of its energy in the infrared. But in one respect a brown dwarf is undeniably a star, as is shown by two recent studies of brown dwarfs, one of them in this issue of *Science*. Unlike planets, which take shape from debris that remains after the formation of their parent sun, a brown dwarf can form on its own out of interstellar gas and dust, like any respectable star.



Substellar nursery. The youthful Pleiades cluster (*above*) is a main hunting ground for brown dwarfs, which are most easily spotted when young. It is home to the first brown dwarf binary, PL 18 (*right*).

Astronomers discovered the first brown dwarfs only 3 years ago, and only a dozen or so of these dim, barely visible objects have been documented, some near other stars and some on their own. The question of how they originate has not been settled, however, because an isolated brown dwarf could have formed like a planet, around a star, and then been flung into interstellar space by gravitational interactions. But astronomers have now imaged brown dwarfs with companions—in one case another brown dwarf, in the other a star too young to have planets—that show the brown dwarfs must have formed from interstellar clouds.

Because brown dwarfs are at their brightest when they are young and still contracting, young star clusters such as the Pleiades—just 100 million years old—have become the main hunting grounds for these objects. A team led by Eduardo Martin of the University of California, Berkeley, used the NICMOS infrared camera on the Hubble Space Telescope to scour the Pleiades for a kind of object that might settle the origins question: a binary brown dwarf. If brown dwarfs form from collapsing gas clouds, as stars do, then you should see binaries made up of two brown dwarfs, just as ordinary stars are often found in binary pairs. And as the team will report in *Astrophysical Journal Letters*, they found such a pair: a system, dubbed PL 18, made up of two brown dwarfs with masses just above and just below 50 Jupiter masses, orbiting each other every 1000 years at a distance 42 times the Earth-sun distance.

Although an isolated brown dwarf could have formed like an oversized planet and then been flung into space, says team member Wolfgang Brandner of NASA's Jet Propulsion Laboratory in Pasadena, California, a binary would not survive that treatment. "It follows that brown dwarfs must form like stars, from clouds that collapse and then fragment."

Support for this view of brown dwarf formation comes from another find by Rafael Rebolo of the Astrophysical Institute of the Canaries in Tenerife, Spain, and his colleagues. The group—two members of which also worked with Martin on the brown dwarf binary—reports on page 1309 that it has found a tiny brown dwarf circling a star using ground-based telescopes in the Canaries. "We have imaged what is the lowest mass substellar object so far found orbiting a star," says Rebolo.

To find this system, "we chose stars that are much younger than the sun," says team member Maria Rosa Zapatero Osorio. They identified 52 of these young stars—the ones most likely to have detectable brown dwarf companions—by looking for lithium, an element that is formed during the big bang but is gradually burned up in the nuclear furnace of stars and is only visible early in a star's lifetime. Close to one of the stars, they saw a second dim, lithium-containing body—a brown dwarf, which they call G 196-3B.

They estimate that the two components are separated by roughly 100 times the Earth-sun distance, and that the brown dwarf's mass may be as low as 15 Jupiter masses. The team believes that the binary system is about 100 million years old—too young, says Ralph Neuhäuser of the Max Planck Institute for Extraterrestrial Physics in Garching, Germany, for the dwarf to have formed from an accretion disk, like a planet. He adds, "Because the brown dwarf is so far away from the star, fragmentation of a molecular cloud is the most likely scenario for its formation."

The evidence that brown dwarfs are just like other stars, at least by birth, is likely to get stronger, although formation in accretion disks is not ruled out by the astronomers in some cases. Zapatero Osorio says that since the *Astrophysical Journal Letters* paper was submitted, the team has identified another 20 brown dwarf candidates in the Pleiades and imaged a second binary brown dwarf system. Brandner believes that the number of brown dwarf discoveries will increase fast. The Pleiades, for example, contain about 600 known stars, and "it looks like there are as many brown dwarfs as there are stars," says Brandner. **–ALEXANDER HELLEMANS**

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GRADUATE EDUCATION

Cold Spring Harbor to Offer Own Degrees

While some scientific leaders are trying to persuade universities to reduce the number of Ph.D.s they award in the life sciences, Cold Spring Harbor Laboratory (CSH) in New York announced last week that it is going in the opposite direction. It's creating a new grad school that will offer Ph.D. candidates a shorter, more student-oriented graduate experience.

The biology lab won state accreditation in September to open a School of Biological Sciences, and it will enroll five candidates in its inaugural class next fall, says CSH director Bruce Stillman. The school, which will be headed by CSH assistant director Winship Herr, eventually will expand to 10 students per year. Stillman says CSH hopes to raise an endowment of about $1 million per student, enough to free them from some of the pressures of obtaining outside funding.

CSH has been educating people "since its inception" as a research field station a century ago, says Stillman. It currently has more than 50 Ph.D. candidates from the State University of New York, Stony Brook, on campus and thousands more taking short courses tailored to everyone from world-class scientists to high school novices. Still-

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