Astronomy

Brown dwarfs: A second Pleiades candidate

If only it had more mass, a brown dwarf could be a star.

A star forms when a cloud of gas and dust undergoes gravitational collapse, becoming hotter and denser at its core. Eventually, that core grows hot enough to ignite and sustain a powerful energy source—the fusion of light nuclei into heavier ones.

A brown dwarf arises from the same raw material, but its lower mass and weaker gravitational contraction prevent it from attaining a high enough core temperature to burn nuclear fuel steadily. Thus, when gravitational contraction comes to a halt, a dwarf is doomed to slowly cool and fade into oblivion.

That's exactly why the Pleiades star cluster has recently proved a fruitful hunting ground for such objects. The cluster's relative youth—about 100 million years—means that any brown dwarfs that formed there haven't lived long enough to have faded. Now, for the second time in 3 months, researchers report compelling evidence of a brown dwarf candidate that almost certainly resides in the cluster.

Raphael Rebolo and his colleagues at the Instituto de Astrofisica de Canarias in La Laguna, Spain, discovered the candidate while analyzing images of the Pleiades taken with a telescope at Teide Observatory in the Canary Islands. Using several telescopes to reexamine the object, now named Teide 1, the researchers conclude in the Sept. 14 NATURE that it lies in the cluster and probably has a mass equal to 2 percent of the sun's.

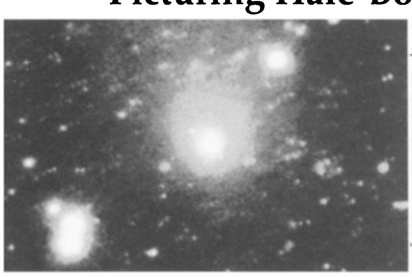
That estimate places Teide 1, unlike previous candidates, well below 8 percent of the sun's mass—the maximum a brown dwarf can have, comments Lorne A. Nelson of Bishop's University in Lennoxville, Quebec. Because of uncertainties in calibrating the surface temperature of Teide 1, astronomers can't entirely rule out the possibility that the body may have a mass as large as 7 percent of the sun's, Nelson adds. But he notes that this still puts Teide 1 below the required mass limit.

Another group of astronomers reported recently that PPL 15, a Pleiades resident estimated to have a mass just under the dwarf limit, has retained most of its primordial allotment of lithium. The presence of lithium indicates that the body never had an opportunity to destroy the gas through nuclear burning and is either a brown dwarf or an object right at the transition between a star and a dwarf (SN: 6/24/95, p.389).

Nelson argues that if PPL 15 qualifies as a brown dwarf, then the seemingly less massive Teide 1 should certainly make the grade. He and other researchers agree, however, that the ultimate test—finding the fingerprints of lithium in Teide 1—still lies ahead.

Astronomers may not have long to wait, notes Gibor S. Basri of the University of California, Berkeley, a member of the team that detected the lithium content of PPL 15. He says that he and his collaborators, including Rebolo, plan to examine the abundance of lithium in Teide 1 with the same telescope, the W.M. Keck atop Hawaii's Mauna Kea, this November.

Picturing Hale-Bopp in the infrared


European Southern Observatory

Infrared image of Hale-Bopp shows apparent dust tail.

Last month, astronomers obtained one of the first near-infrared images of Comet Hale-Bopp, an object that may put on a dazzling light show when it nears the sun in 1997 (SN: 8/12/95, p.103). The image appears to show the beginnings of a dust tail or jet produced by the pressure of sunlight striking the comet's dusty shroud, or coma.

Biology

DNA interruptions made a late entrance

Until 1977, geneticists had always thought of a gene as one long stretch of DNA that describes how to build a protein. That year, two research groups showed that the DNA instructions for a single protein may frequently be interrupted by introns, fragments of DNA that serve no apparent purpose.

Almost immediately, a group of researchers, dubbed the introns-early crowd and led by Walter Gilbert of Harvard University, proposed that the DNA segments were of ancient origin and vital to the creation of modern genes. They argued that the genes describing today's complex proteins derived from small pieces of DNA called exons. Each exon, the theory went, describes a primitive protein. As time passed, exons linked up in different combinations to encode more complex proteins. Gilbert argued that introns facilitated this "shuffling" of exons.

The introns-early crowd appeared to have won a major victory 2 years ago when investigators discovered a new intron in a gene for an enzyme called TPI. Before 1993, researchers had found only 11 different introns in *TPI* genes from various species. To fit his model of how exons created the *TPI* gene, Gilbert argued that a seemingly uninterrupted portion of the gene had once been broken into two exons by an intron. He even predicted where that intron should be—and that's exactly where researchers found one in 1993.

Now, two new studies indicate that the celebration of the intron-early supporters may be short-lived. There are at least seven other novel introns in various *TPI* genes, reports a group led by Jeffrey D. Palmer of Indiana University in Bloomington and Virginia K. Walker of Queen's University in Kingston, Ontario, in the Aug. 29 PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES (PNAS). Gilbert's exon-shuffling model for the *TPI* gene can't account for these new introns, argues Palmer, who says the data favor the idea that introns have been inserted randomly, and recently, into genes.

A second study in the same issue of PNAS, by a group headed by Francisco J. Ayala of University of California, Irvine, launches a similar attack on the introns-early theory, noting that the *TPI* intron found in 1993 appears in two closely related species of insects but not in 19 other, diverse species. They argue that the insertion of that intron occurred relatively recently in the common ancestor of just a few species of insects.

Gilbert, who says his group will soon present new evidence, retorts that "the last word hasn't been said yet."

Why do hamsters stay on the wagon?

Naturally derived from kudzu vines and part of a Chinese herbal treatment reputed to prevent alcoholism, the chemical daidzin may prove a potent drug to combat alcohol abuse. In 1993, Bert L. Vallee and Wing-Ming Keung of Harvard Medical School in Boston reported that injections of daidzin reduce alcohol consumption in hamsters that naturally guzzle the intoxicating beverage (SN: 11/13/93, p.319).

Vallee and Keung also showed that daidzin inhibits an enzyme that breaks down acetaldehyde, a natural metabolite of ingested alcohol. As a result, many researchers thought the chemical worked like disulfiram (sold as Antabuse), one of only two drugs approved in the United States to treat alcohol abuse. Disulfiram inhibits the same enzyme as daidzin: When someone taking disulfiram drinks alcohol, he or she becomes nauseous as acetaldehyde builds up in the body.

But Vallee, Keung, and two other colleagues at Harvard now observe that daidzin must work by a different pathway than disulfiram. At doses that curb alcohol drinking by hamsters, daidzin does not affect the metabolism of acetaldehyde, they report in the Sept. 12 PNAS. "It has been assumed, without further proof, that this would be the mechanism of the drug. But you don't get any accumulation [of acetaldehyde]," says Vallee.