Vega & Co.: What's Being Born Out There?

Astronomer Paul M. Harvey works at the University of Texas in Austin, but he was in northern California last week when he saw a newspaper article describing the dramatic results just announced about the star Vega (SN: 8/13/83, p. 100). The Infrared Astronomy Satellite (IRAS) had detected emissions from what its scientists now believe to be a vast concentration of solid particles around the star, forming a region apparently about twice the size of our solar system, and it was speculated that Vega could be the heart of another solar system in the process of formation. The report produced national headlines and television coverage, and Harvey just happened to be in the ideal position to confirm the IRAS data.

He was up north to make a series of astronomical observations from aboard the Kuiper Airborne Observatory (KAO), a telescope-equipped C-141 jet operated by the National Aeronautics and Space Administration's Ames Research Center in Mountain View, Calif. The KAO was the ideal tool to check on the Vega findings, because it is able to fly above most of earth's atmosphere, which keeps most of the long infrared wavelengths that IRAS sees from ever reaching the ground. The IRAS data indicated that Vega's emissions at a wavelength of 25 microns were about 1.3 times brighter than they should have been for an ordinary star of Vega's type and temperature (about 10,000 kelvin); at 60 microns, they were about 10 times brighter, and at 100 microns, about 20 times. They appeared to be coming from a region extending about 80 astronomical units (some 7.4 billion miles) out from the star. Harvey had only one KAO flight remaining, but the chance to check on the IRAS results at 60 and 100 microns was too great to pass up. Scrapping part of his previously planned observing program, Harvey turned the KAO's telescope at Vega and found that the excess brightness at the two wavelengths was indeed as the IRAS team had concluded. He also confirmed the source region's size, with the added confidence of a spatial resolution about three times as sharp.

The most dramatic extrapolation from the IRAS results — that there might be large, even planet-sized objects among the millimeter-or-smaller particles that can be directly inferred from the data — is so far a matter for theorists. No planets have yet been actually observed around a star other than the sun. Some researchers have measured the "wobble" in the motions of certain stars, indicating that there may be otherwise invisible "companion objects" in orbit around them, but the best-known report of such a companion small enough to be a planet — that of Barnard's Star — has been controversial for years.

Now, however, three astronomers from the U.S. Naval Observatory (USNO) report that precise measurements with the USNO 1.5-meter astrometric telescope in Flagstaff, Ariz., show two other stars to have relatively small, unseen companions. According to Robert Harrington, Varkey Kallarakal and Conard Dahn, a faint star known as VB10 (which is itself the companion of a brighter one named Wolf 1085) is being circled by an object that may be less than three times the mass of Jupiter. Another such dim star, VB8 (part of a complex triple system whose other two members — Wolf 629 and 630 — are both binary stars), also appears to have a companion of only a few Jupiter-masses. (The researchers, whose report appears in the July Astronomical Journal, use the term "milli-suns" — thousandths of the sun's mass — instead of Jupiter-masses. The two are about the same, but Harrington notes that milli-suns avoids the sometimes sensationalized implication of planets when no such striking conclusion is intended. Some scientists, for example, have said that Jupiter would have to be about 80 times more massive than it is for thermonuclear fusion to turn it into a star, yet VB10, a low-luminosity but visible object that is almost surely a dim star, has only about 40 times Jupiter's mass. Much remains to be learned.)

In 1977, Kaj Aa. Strand of the USNO reported that one of the two components of a binary star called Stein 2051 has a wobble, and that the implied companion is either a red dwarf star (like the one that is doing the wobbling) or some other kind of object with a mass of only 20 milli-suns.

As for the famed — or notorious — case of Barnard's Star, Harrington just this week completed analysis of USNO astrometric measurements that he believes are the strongest evidence yet against its having a giant planet. The saga began in 1962, when Peter van de Kamp of the Sproul Observatory in Swarthmore, Pa., reported that his study of Barnard's Star since 1937 indicated a wobble representing the presence of a planet larger than Jupiter. Several years later, however, George Gatewood of the Allegheny Observatory in Pittsburgh reported that a study of other Barnard's Star observations showed no such wobble. Both sides have modified their interpretations somewhat since then, but there have continued to be two sides, with some researchers perceiving a need to drop the other shoe (whichever "the other" might be). Measurements from USNO's Flagstaff facility, according to Harrington, seem to have done the job. "The Barnard's Star stuff as reported by van de Kamp," Harrington says, "clearly does not show in our data. I'm almost certain that Barnard's Star has nothing Jupiter-sized around it."

The IRAS satellite's Vega findings, however, involve not the detection of individual planets but rather the possibility of a whole solar system, possibly at a different stage of cosmological evolution. In May, for example, Masaki Morimoto of Nobeyama Observatory in Tokyo told a Japanese astronomy meeting of radioastronomy data indicating the presence, in the Orion nebula, of a rotating disk of gas and dust about 80,000 astronomical units across, centered around a newly forming star. This is about the size of our solar system, notes Carl Sagan of Cornell University, if one includes the "Oort cloud" region proposed as the source of many comets. Might the disk in Orion represent a system that, after a few billion years of evolution, will come to resemble our own?

—J. Eberhart

New test for birth defects

Among the four million pregnant women in the United States last year, some 30,000 underwent amniocentesis to determine whether or not their babies would be born with genetic defects. For the procedure to work, each of these women had to wait until at least her sixteenth week of pregnancy to have it done and another several weeks for the results. Now, a medical team at Michael Reese Hospital, in Chicago, has announced its preliminary success in using an alternative experimental procedure that can be used on a woman during the first trimester of her pregnancy and whose results can be evaluated overnight.

The procedure, called chorionic villi sampling (CVS), was originally developed in China during the early 1970s. Team leader Eugene Pergament told Science News that CVS involves inserting a catheter through a pregnant woman's cervix to collect a sample of the chorionic villi, a tissue surrounding the fetal sac. The tissue is then analyzed by a cytogeneticist for chromosomal abnormalities, including those associated with genetic diseases such as Tay-Sachs and sickle cell anemia. During the past six months, Pergament and his colleagues have successfully used CVS on five of six women. It failed on one woman because the structure of her cervix did not allow insertion of the catheter. Although CVS appears to be as safe a procedure as amniocentesis, Pergament said, four or five years of testing are required to establish its safety. □