PRESS RELEASE

Astronomers discover distant cousins of the Pleiades; dusty interlopers masquerade as young planetary systems
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By Robert Sanders, Media Relations

Washington, D.C. - Astronomers searching for dusty disks around nearby stars instead have discovered relatives of the Seven Sisters.

In a paper presented today (Tuesday, Jan. 8) at the American Astronomical Society meeting in Washington, D.C., a team headed by assistant research astronomer Paul Kalas at the University of California, Berkeley, reports an unexpected result from its search for dusty disks. Hoping to image for the first time extrasolar analogs to the Kuiper Belt, a ring of comets encircling the sun beyond the orbit of Neptune, the scientists found that the dust surrounding five stars out of 100 surveyed is actually a cloud of interstellar dust on a collision course with each star.

These cosmic collisions produce giant reflection nebulosities, a brilliant phenomenon best known around the Seven Sisters, the brightest stars in the Pleiades cluster in the constellation Taurus.

The results show that solid matter detected around stars could be foreign to the system rather than indigenous material related to the formation of extrasolar planetary systems.

"We knew that each star in our sample was heating dust because of the far-infrared emission observed, a phenomenon first associated with the star Vega, and thought to indicate the existence of cometary and asteroidal dust around other stars," Kalas explained. "But what we discovered instead was five stars sweeping through the galactic dirt and producing beautiful nebulosities like the ones you see in the Pleiades."

In their paper, the astronomers call this effect the "Pleiades Phenomenon." When a star and a cloud of galactic dust approach each other, pressure from stellar radiation splits the cloud and dust travels in streams around the star. The result is a reflection nebulosity dominated by many linear features crossing the star in roughly the same direction.

In the images presented today, the length of nebulous filaments corresponds to several tens of thousands of astronomical units, or over a trillion kilometers. An astronomical unit is the average distance between the Earth and the sun - equal to 93 million miles.

The astronomers made their observations at the University of

Hawaii 2.2-meter telescope on Mauna Kea, Hawaii, and with a powerful University of California adaptive optics system on the 3-meter telescope at Lick Observatory. Since most of the stars in their survey are very bright, a coronagraph was used to artificially eclipse each star, uncovering the much fainter dust surrounding it in optical and near-infrared reflected light.

New distance measurements from the Hipparcos satellite reveal that the stars are significantly farther than originally thought - over 400 light years from the Sun. The team concluded that the Pleiades Phenomenon is more likely to explain the dust surrounding distant stars because the stars lie outside the Local Bubble.

Astronomers have long known that the sun resides in a relatively dust-free bubble approximately 300 light years in radius, possibly due to an ancient supernova that cleared material from the solar vicinity. Stars within the bubble are unlikely to encounter galactic dust clouds, but may have circumstellar dust as a consequence of the formation and erosion of asteroid and comet-like bodies orbiting the star. Beyond the Local Bubble, the dust found in close proximity to stars is more likely to have an interstellar origin.

The research team cautions that, in some cases, a star could have a circumstellar debris disk and interact with interstellar dust simultaneously.

"High-resolution observations are what you really need to see the origin of far-infrared emission from these stars, to distinguish between disks and other dusty structures," remarked UC Berkeley astronomer Ray Jayawardhana, an expert on dust disks. "These pictures show that, in some cases, much of the emission comes from wispy clouds, but do not rule out disks very close to the stars."

The results will be published in the March 2002 issue of The Astrophysical Journal. The authors are Paul Kalas and James Graham of UC Berkeley; Steven Beckwith of the Space Telescope Science Institute; David Jewitt of the University of Hawaii; and James Lloyd of UC Berkeley. This work was supported by the National Science Foundation's Center for Adaptive Optics and the NASA Astronomical Search for Origins program.

Images of the five stars embedded in giant dust complexes are on the Web at http://astron.berkeley.edu/~kalas/press/pleiades.html.

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