Extracts

Astronomers Find Seven New Planet-Forming Disks

A mammoth sky survey led by University of Florida astronomers has uncovered seven planet-forming disks in clusters of young stars, doubling the number of such disks discovered and expanding the territory that might yield new planets.

The disks, composed of giant clouds of gas and dust that surround infant stars, are about 1,000 light-years away — about four times farther away than most disks seen previously. They also are by far the biggest yet observed — which suggests that planets, known to coalesce in such disks as they rotate, may exist at much greater distances from stars than any yet discovered. This observation could lead astronomers to expand the areas in which they search for new planets — a search that has so far been confined to stars' immediate vicinities.

"You might be able to look much farther out than people have been looking and find planets," said Richard Elston, a UF professor of astronomy who conducted the survey with his colleague and wife, UF astronomy Professor Elizabeth Lada.

Elston and Lada presented their findings at the American Astronomical Society meeting in May.

Lada also presented research showing that planets may come together and form in the disks in far less time than currently believed. Her findings suggest planets may form in the first 3 million years of a star's life, much earlier than the 10 to 12 million years thought previously. Although 3 million years may seem like a long time, it is actually brief for stars, which can live tens of billions of years. "If you think of our Sun as a middle-age star and that middle-age people are about 36, it would seem planet formation occurs within 1 week of stellar birth," Lada said.

As a cloud of molecular gas collapses under the pull of gravity to form a star, it rotates and the dust, gas and debris gradually gel in the shape of a two-dimensional disk. The material in these disks both feeds into the forming star and steadily coagulates into bigger and bigger chunks, which eventually form planets. The remnants of this process are visible in our own solar system, where all the planets line up, more or less, along the same two-dimensional plane.

Elston and Lada found seven such disks as part of a major survey for newborn celestial objects in "giant molecular clouds" in the constellations Orion and Perseus. These clouds, which contain the raw material for stars and planets, are the largest features of our galaxy, stretching hundreds of light-years across.

The astronomers worked at the National Science Foundation's 2.1-meter, or 88-inch, telescope at the Kitt Peak National Observatory in Arizona, using a UF-developed near-infrared spectrometer and imager. The Florida Multi-object Imaging Grism Spectrometer, or FLAMINGOS, can image tens of thousands of stars in a cloud in the near-infrared each night — many more than could have been examined without the instrument. Such observations must be made in the near-infrared because visible light from young stars is nearly completely absorbed by dust in the molecular clouds, rendering the forming stars invisible to the human eye.

Computers can encode the infrared light in optical wavelengths, creating visible images. Most of these "snapshots" reveal only mature stars, and the resulting images appear similar to the sky on a clear night. However, the survey also revealed in several positions, in Elston's words, "wild places" — startling clusters of infant stars in varied stages of formation. These stars appear in the image as colorful balls of light, with each of the seven disks resembling a dark swath surrounding each star.

Astronomers used to think stars formed in relative isolation. But over the past two decades, research by Lada and others has shown that stars usually form in clusters — celestial birthing grounds. Lada and her colleagues have shown that the majority of stars in such clusters are formed with circumstellar disks. So while it wasn't unusual to find the disks, the surprise was that they ranged in size from 10 to 100 times larger than any of the handful of similar disks yet seen and imaged — with each disk stretching thousands of astronomical units in diameter.

One astronomical unit, the distance from the sun to Earth, measures 93 million miles. The diameter of our solar system is approximately 60 astronomical units. The fact that these disks extend many times farther than that suggests that planets, too, could extend well beyond the relatively close proximity observed in our solar system and elsewhere. That would be good news for astronomers because the further planets are from stars, the easier they are to detect, Elston said.

This cluster of infant stars in the constellation Perseus is home to several hundred young and forming stars and seven planet-forming disks. The image was obtained with a University of Florida-built near-infrared camera and multi-object spectrometer at the National Science Foundation's Kitt Peak National Observatory near Tucson.

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