Astronomers discover two dust belts surrounded by a large dust halo around young star HD 95086

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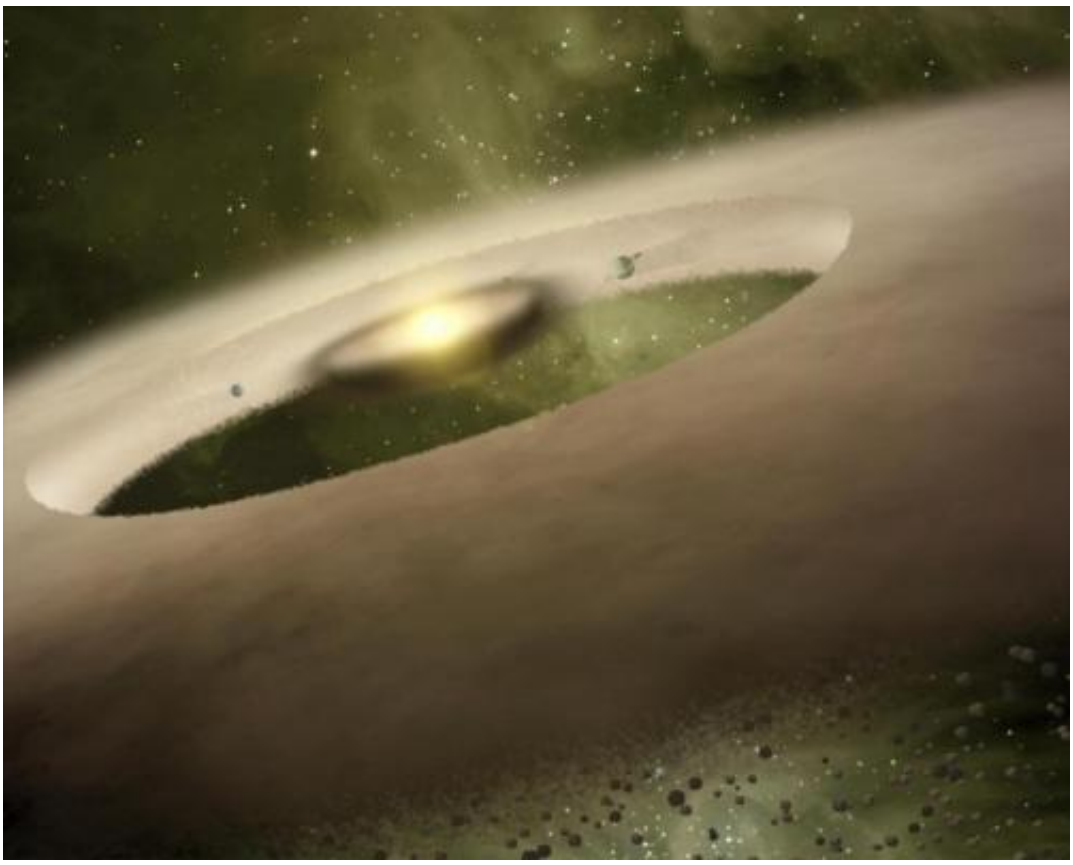


An artist's impression of a young star surrounded by debris rings and a vast dust halo. Credit: NASA/JPL-Caltech

Scientists at the University of Arizona have discovered what might be

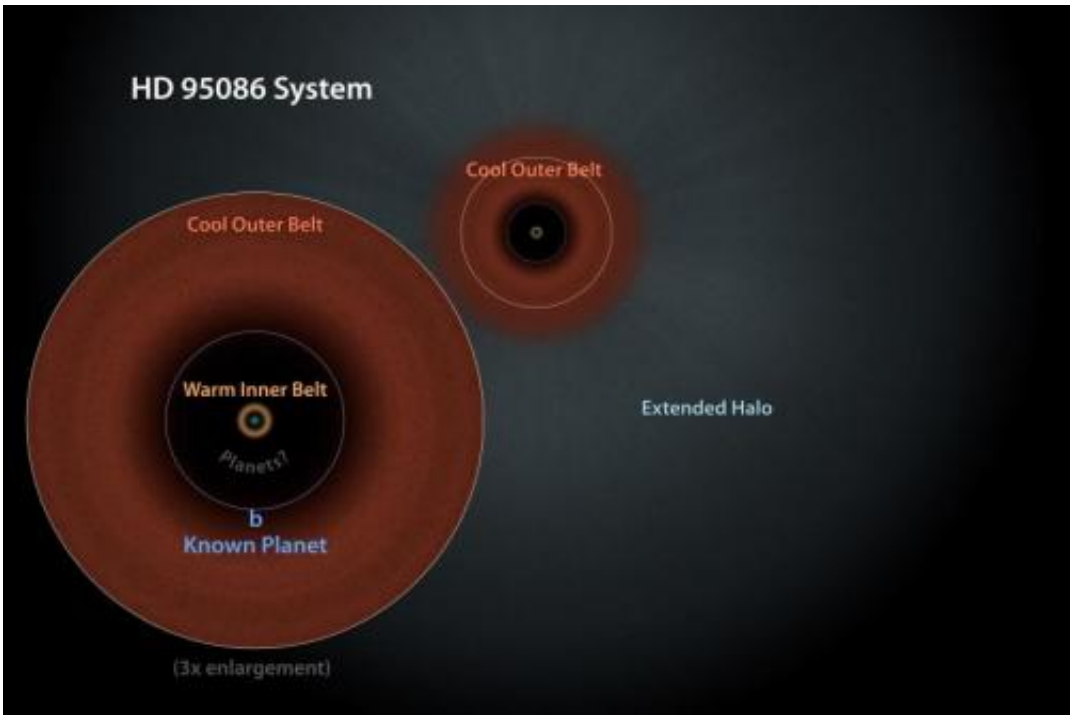
the closest thing to "baby photos" of our solar system. A young star called HD 95086 is found to have two dust belts, analogous to the asteroid and Kuiper belts in the Solar System, surrounded by a large dust halo that only young planetary systems have.

Similar dust structures are also found around another, slightly older star called HR 8799, where four massive planets occupy the large gap between the two belts. HR 8799, the first star found to host four directly imaged planets, is often referred to as a younger and scaled-up version of our Solar System. Finding another star similar to HR 8799 suggests a common model for how stars form planets and how their planetary systems evolve.

The ages of these systems span an interesting period, about 10 to 90 million years, when terrestrial planets form and giant planets settle down to their final configuration in our own Solar System, the team reports.

"We think HD 95086 is a snapshot of what our solar system might have looked like when it was only 10 to 20 million years old," said Kate Su, an associate astronomer in the UA's Department of Astronomy and Steward Observatory and lead author of the paper (URL to publication here).

Using data from NASA's Spitzer Space Telescope and ESA's Herschel Space Observatory combined with detailed simulations, the researchers found HD 95086 and HR 8799 each have a vast disk halo of fine dust, suggesting enhanced collisional activities in their Kuiper-belt-like belts. This is an expected behavior for systems that are experiencing dynamical settling of gas giants and possibly late formation of giant ice planets.



A schematic view of the HD 95086 system. Credit: NASA/JPL-Caltech

The large gap between the warm and cold belts in HD 95086, HR 8799 and some other nearby older systems like debris disk twins Vega and Fomalhaut is an excellent signpost for multiple, yet-to-be-discovered planets, according to the research team.

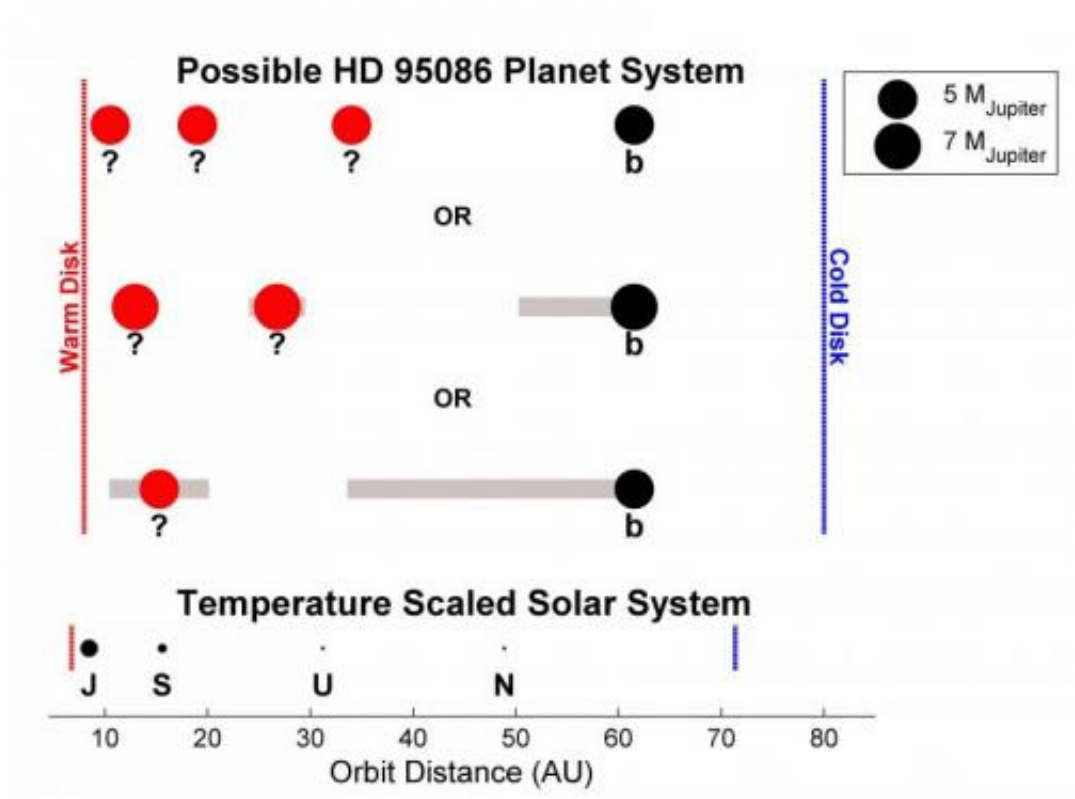
HD 95086 and HR 8799 are located 295 and 129 light years from Earth in the constellations of Carina and Pegasus, respectively.

"The HD 95086 system with its a young star hosting at least one planet of about five Jupiter masses along with massive asteroid and Kuiper-like debris belts is a promising target for planet hunting," Su said. "Both systems are very similar, except the HD 95086 has more dust, which is in line with theories of planet formation and leads us to believe it is the younger of the two. By looking at other systems like these we can piece

out how our solar system came to be."

"There have to be more planets than have been discovered to make a gap that is this big," said Sarah Morrison, a co-author of the paper and a PhD student in the UA's Department of Planetary Sciences who ran computer models to constrain the possibilities of how many planets are likely to inhabit the system, what their masses could be like and where their orbits could be. "We think that the system is a prime candidate for direct imaging campaigns to find those planets."

Knowing where additional planets could be and how massive they are in HD 95086 is of great advantage for scientists who are looking for the dim signatures of planets near a bright star.



Possible planet masses and locations along with debris belts in HD 95086 compared to a scaled-up version of our outer solar system. Black points indicate

known planets; red points show where additional planets are likely to be if they have a certain mass (the unit 'M Jupiter' equals the mass of Jupiter); and gray regions show the possible locations the planets can inhabit. One AU is the average Earth-sun distance. Credit: Sarah Morrison

"By knowing where the debris is plus the properties of the known planet in the system, we can get an idea of what other kinds of planets can be there," Morrison added. "We know that we should be looking for multiple planets instead of a single giant planet"

"These two stars are at a stage in their evolution when we think many interesting events happened in our Solar System, such as the formation of our Moon and initial trigger of the late heavy bombardment," said Renu Malhotra, professor in the UA Department of Planetary Sciences and one of the study's co-authors. "The processes we see going on in these other systems can be correlated to observations made in our Solar System and provide a look-back at our own history."

"One of the outstanding questions about our solar system has been, 'why is the space between the planets so empty?'" she added. "We know that over long periods of time, the planets' gravity can clear the debris. Systems like HR 8799 and HD 95086 offer the opportunity to observe dynamical processes that occurred very long ago in our own solar system."

The researchers presented the findings at the Division for Planetary Science Meeting of the American Astronomical Society held in Tucson, Arizona from Nov. 8-15.

Provided by University of Arizona