Lightest exoplanet imaged so far?

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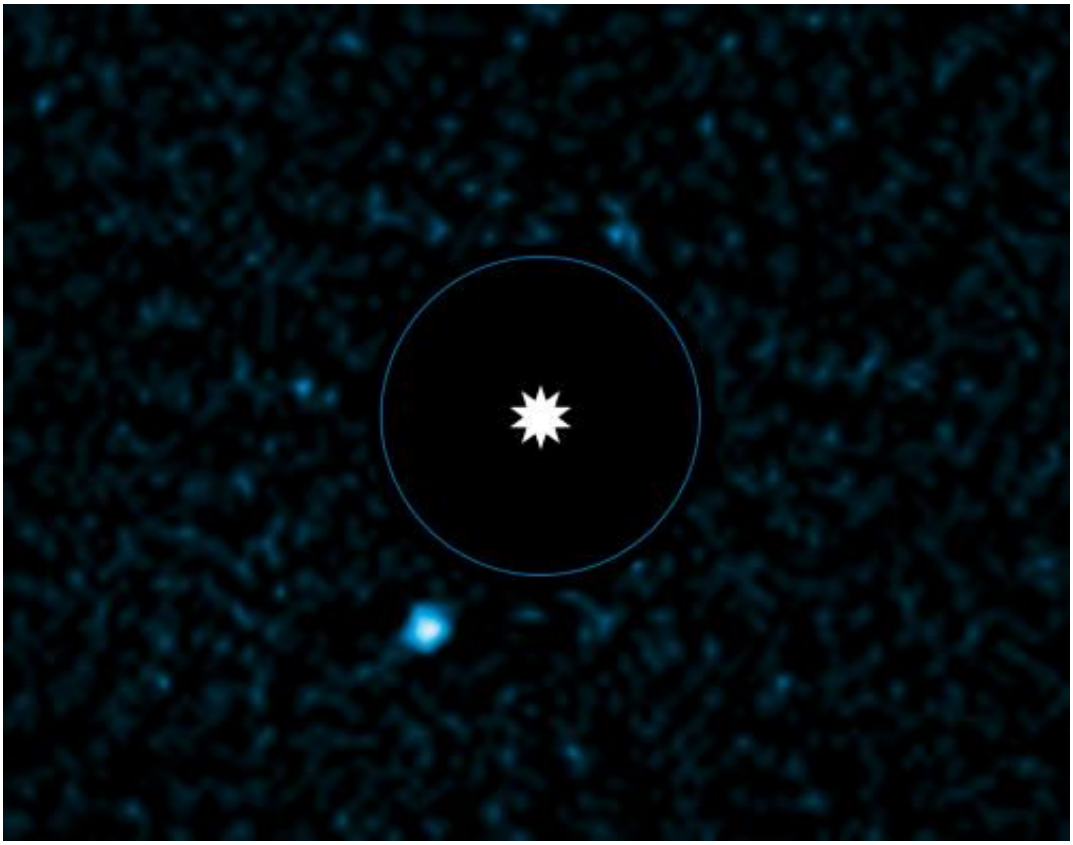

This image from ESO's Very Large Telescope (VLT) shows the newly discovered planet HD95086 b, next to its parent star. The observations were made using NACO, the adaptative optics instrument for the VLT in infrared light, and using a technique called differential imaging, which improves the contrast between the planet and its dazzling host star. The star itself has been removed from the picture during processing to enhance the view of the faint exoplanet and its position is marked. The exoplanet appears at the lower left. The blue circle is the size of the orbit of Neptune in the Solar System. The star HD 95086 has similar properties to Beta Pictoris and HR 8799 around which giant planets have previously been imaged at separations between 8 and 68

astronomical units. These stars are all young, more massive than the Sun, and surrounded by a debris disc. Credit: ESO/J. Rameau

(Phys.org) —A team of astronomers using ESO's Very Large Telescope has imaged a faint object moving near a bright star. With an estimated mass of four to five times that of Jupiter, it would be the least massive planet to be directly observed outside the Solar System. The discovery is an important contribution to our understanding of the formation and evolution of planetary systems.

Although nearly a thousand exoplanets have been detected indirectly—most using the radial velocity or transit methods—and many more candidates await confirmation, only a dozen exoplanets have been directly imaged. Nine years after ESO's Very Large Telescope captured the first image of an exoplanet, the planetary companion to the brown dwarf 2M1207, the same team has caught on camera what is probably the lightest of these objects so far.

"Direct imaging of planets is an extremely challenging technique that requires the most advanced instruments, whether ground-based or in space," says Julien Rameau (Institut de Planetologie et d'Astrophysique de Grenoble, France), first author of the paper announcing the discovery. "Only a few planets have been directly observed so far, making every single discovery an important milestone on the road to understanding giant planets and how they form."

In the new observations, the likely planet appears as a faint but clear dot close to the star HD 95086. A later observation also showed that it was slowly moving along with the star across the sky. This suggests that the object, which has been designated HD 95086 b, is in orbit around the star. Its brightness also indicates that it has a predicted mass of only four

to five times that of Jupiter.

The team used NACO, the adaptive optics instrument mounted on one of the 8.2-metre Unit Telescopes of ESO's Very Large Telescope (VLT). This instrument allows astronomers to remove most of the blurring effects of the atmosphere and obtain very sharp images. The observations were made using infrared light and a technique called differential imaging, which improves the contrast between the planet and dazzling host star.

This picture shows the sky around the young star HD 95086 in the southern constellation of Carina (The Keel). It was created from images from the Digitized Sky Survey 2. Credit: ESO/Digitized Sky Survey 2. Acknowledgement: Davide De Martin

The newly discovered planet orbits the young star HD 95086 at a distance of around 56 times the distance from the Earth to the Sun, twice the Sun–Neptune distance. The star itself is a little more massive than the Sun and is surrounded by a debris disc. These properties allowed astronomers to identify it as an ideal candidate to harbour young massive planets. The whole system lies some 300 light-years away from us.

The youth of this star, just 10 to 17 million years, leads astronomers to believe that this new planet probably formed within the gaseous and dusty disc that surrounds the star. "Its current location raises questions about its formation process. It either grew by assembling the rocks that form the solid core and then slowly accumulated gas from the environment to form the heavy atmosphere, or started forming from a gaseous clump that arose from gravitational instabilities in the disc." explains Anne-Marie Lagrange, another team member. "Interactions between the planet and the disc itself or with other planets may have also moved the planet from where it was born."

Another team member, Gaël Chauvin, concludes, "The brightness of the star gives HD 95086 b an estimated surface temperature of about 700 degrees Celsius. This is cool enough for water vapour and possibly methane to exist in its atmosphere. It will be a great object to study with the forthcoming SPHERE instrument on the VLT. Maybe it can also reveal inner planets in the system—if they exist."

This research was presented in a paper entitled, "Discovery of a probable

4-5 Jupiter-mass exoplanet to HD95086 by direct-imaging", to appear in the journal *Astrophysical Journal Letters*.

More information: Research paper

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