James Webb Discovers his First Exoplanet

The James Webb Space Telescope (JWST) has characterized several previously known exoplanets since its commissioning in 2022. Thanks to work led by a CNRS researcher from the Paris-PSL Observatory, in association with the University of Grenoble Alpes, it has just captured a direct image of a previously unknown exoplanet. This discovery, to be published on June 25, 2025, in the journal Nature, is a first for the telescope. It was made possible by a French-made coronagraph installed on JWST's MIRI instrument.

Exoplanets are prime targets for astronomical observations because they allow us to better understand how planetary systems form, including our own. While several thousands have been detected indirectly, obtaining images of exoplanets represents a real challenge. They are indeed faint and, when seen from Earth, are located very close to their star. Their signal is drowned out by that of the star, without detaching itself sufficiently to be visible. To overcome this problem, the CNRS, in collaboration with the CEA, developed a device for the MIRI instrument at JWST: a coronagraph. It reproduces the effect observed during an eclipse; masking the star makes it easier to observe the objects surrounding it without them being obscured by its light. It is this technique that enabled a research team led by a CNRS researcher to discover a new exoplanet, the first to be discovered by JWST. It is located in a disk of rocky debris and dust.

Rings in Debris Disks

Scientists focused on the most promising observational targets: systems a few million years old, viewed from Earth through the pole of their star, a configuration that allows the disks to be seen almost face-on. Newly formed planets in these disks are still hot, making them brighter than their older counterparts. Low-mass planets are generally more easily detectable in the mid-thermal infrared, for which JWST has opened a unique observation window. Among all the disks viewed face-on, two particularly caught the researchers' attention, as previous observations had revealed concentric ring structures within them.

Scientists previously suspected these structures to be the result of gravitational interactions between unidentified planets and planetesimals. Called TWA 7, one of the two systems has three distinct rings, one of which is particularly thin, surrounded by two empty regions with almost no material. The JWST image revealed a source at the very heart of this thin ring. After eliminating the hypotheses of a potential observational bias, the scientists concluded that it is most likely an exoplanet. Detailed simulations have indeed confirmed the formation of a thin ring and a "hole" at the exact position of the planet, in perfect agreement with the observations made by the JWST.

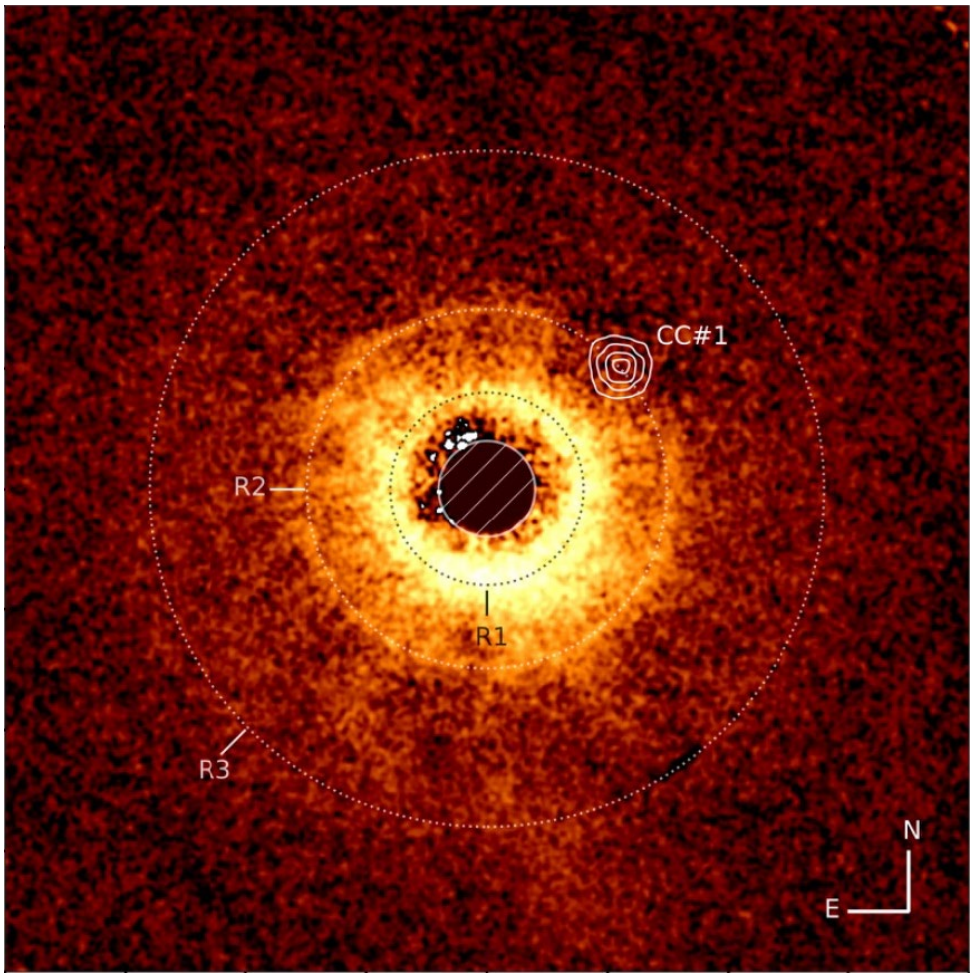

Image of the disk around TWA 7 realised with the instrument SPHERE of the Very Large Telescope (VLT). The image captured by the instrument MIRI of JWST is overlaid. The empty region around TWA 7b is clearly visible (CC #1) within the ring R2. ©A.-M. Lagrange et al. / ESO / JWST

What are the prospects for future exoplanet discoveries?

Named TWA 7 b, this new exoplanet is ten times lighter than those imaged to date! Its mass is comparable to that of Saturn, or about 30% that of Jupiter, the most massive planet in the Solar System. This result marks a new milestone in the search for and direct imaging of increasingly lighter exoplanets. JWST has the potential to go even further in the future. Scientists hope to be able to image planets as small as 10% of Jupiter's mass. This discovery paves the way for imaging Earth-like exoplanets. These will be the target of future generations of space and ground-based telescopes, some of which will also use more sophisticated coronagraphs. The most promising candidate systems are already being identified for these future observations.

Reference : ***Evidence for a sub-jovian planet in the young TWA7 disk****,* A.-M. Lagrange, C. Wilkinson, M. Mâlin, A. Boccaletti, C. Perrot, L. Matrà, F. Combes, D. Rouan, H. Beust, A. Chomez, B. Charnay, S. Mazevet, O. Flasseur, J. Olofsson, A. Bayo, Q. Kral, G. Chauvin, P. Thebault, P. Rubini, J. Milli, F. Kiefer, A. Carter, K, Crotts, A. Radcliffe, J. Mazoyer, T. Bodrito, S. Stasevic, P. Delorme, M. Langlois, 25 juin 2025, *Nature*, https://doi.org/10.1038/s41586-025-09150-4