# New planet-weighing technique found

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Although there have been about 800 extra-solar planets discovered so far in our galaxy, the precise masses of the majority of them are still unknown, as the most-common planet-finding technique provides only a general idea of an object's mass. Previously, the only way to determine a planet's exact mass was if it transits—has an orbit that periodically eclipses that of its host star. Former Carnegie scientist Mercedes López-Morales has, for the first time, determined the mass of a non-transiting planet. The work is published by *Astrophysical Journal Letters.*

Knowing a body's mass is essential first to confirm it is a planet and if so, to determine whether it is rocky and possibly habitable or large and gassy. Until now, only the masses of transiting planets have been measured. Transiting planets are also the only type of extra-solar objects on which atmospheres have been detected.

López-Morales, along with her colleagues Florian Rodler and Ignasi Ribas of the Institute of Space Sciences, ICE (CSIC-IEEC, in Barcelona, Spain) measured the exact mass of a non-transiting planet. They did this using a new method that involves studying the carbon monoxide signature of the planet's atmosphere—detecting, in the process, the atmosphere of this non-transiting planet.

The planet is called Tau Boo b, located in the constellation of Bootes, and it orbits a star about 50 light years from Earth that's bright enough to be visible to the naked eye. The planet is similar in size to Jupiter and is so close to its star (only 8 stellar radii), that a year for this planet asts only 3.3 Earth days. Furthermore, its surface temperature reaches 1,500 ° C, making it inhospitable to life.

Discovered in 1996, Tau Boo b was one of the first planets originally detected by the radial velocity method. This planet does not transit, but its presence and characteristics were initially determined by the wobble of its host star. This technique only provides a rough indication of a detected planet's mass.

In June 2011, López-Morales' team conducted five hours of observations at near infrared wavelength (2.3 microns). They obtained data from the high-resolution spectrograph CRIRES, an instrument mounted on one of the four 8.2m Very Large Telescopes (VLT) of the European Southern Observatory (ESO) in Chile.

The observations and subsequent data analysis revealed the presence of carbon monoxide in the planet's atmosphere. In addition, by studying the planet's orbital motion through the displacement of spectral lines of carbon monoxide, the team was able to calculate its exact mass—5.6 times Jupiter—a first using this particular method, and also a first for a non-transiting planet.

An independent study conducted by researchers at the University of Leiden in the Netherlands obtained a similar result for the same planetary system, confirming the potential of this technique.

"This method represents a strong advance in the field of exoplanets," said Lopez-Morales. "It opens a new path to determine masses of exoplanets and the composition of their atmospheres"

The research team expects many more planets will be weighted using this new technique. They are also convinced that in the future, they will be able to detect molecules that are associated with the presence of life in non-transiting distant planets."

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