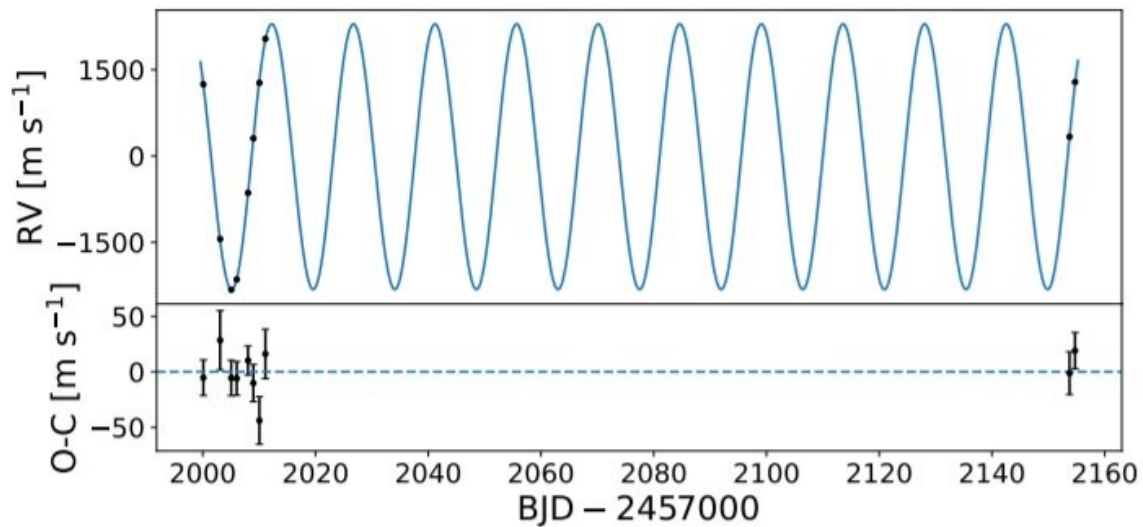


# Observations detect a brown dwarf orbiting the star TOI-1278

June 15 2021, by Tomasz Nowakowski



Radial velocity of TOI-1278 from SPIRou monitoring with an over plot of the best-fit orbital solution. Credit: Artigau et al., 2021.

An international team of astronomers reports the discovery of a companion to the M dwarf star known as TOI-1278. The newly found object turns out to be a brown dwarf nearly 20 times as massive as Jupiter. The finding is detailed in a paper published June 8 on the arXiv

pre-print server.

Brown dwarfs are intermediate objects between planets and stars, occupying the mass range between 13 and 80 Jupiter masses. Although many [brown dwarfs](#) have been detected to date, such objects orbiting other stars are a rare find.

Now, a group of astronomers led by Etienne Artigau of the University of Montreal, has detected a new rare brown dwarf in a [binary system](#). Using the Canada-France-Hawaii Telescope (CFHT), they found that the star TOI-1278 of spectral type M0V is orbited by a massive object.

"The system was first identified through a percent-deep transit in TESS photometry; further analysis showed it to be a grazing transit of a Jupiter-sized [object](#). Radial velocity (RV) follow-up with the SPIRou near-infrared high-resolution velocimeter and spectropolarimeter in the framework of the 300-night SPIRou Legacy Survey (SLS) carried out at the Canada-France-Hawaii Telescope (CFHT) led to the detection of a Keplerian RV signal with a semi-amplitude of  $2,306 \pm 10$  m/s in phase with the 14.5-day transit period," the astronomers explained.

The newly found brown dwarf received designation TOI-1278 B; therefore, the star was designated TOI-1278 A. The brown dwarf orbits the star every 14.5 days and its orbit has a slight but non-zero eccentricity.

According to the paper, TOI-1278 B has a radius of about 0.97 Jupiter radii and is 18.5 times more massive than our solar system's biggest planet. Thus, its density is at a level of approximately  $18 \text{ g/cm}^3$ .

The observations show that TOI-1278 B is separated from TOI-1278 A by about 0.095 AU. Given that TOI-1278 A is about 31 times more massive than its companion, such short separation makes TOI-1278

unique among known M-dwarf systems. The astronomers noted that systems with similar mass ratios exist with separations of tens to thousands of AUs.

"The number of known brown dwarf companions in close-in orbit around main-sequence stars is relatively small although they are easier to find in general than planetary companions. This is expected from a formation point of view, with close-in binaries having mass ratios tending toward unity. While most such companions orbit sun-like [stars](#), TOI-1278 combines relatively rare properties; there are few close-in (

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