Astronomers reveal new insights into physical properties of the young star system ROXs 12

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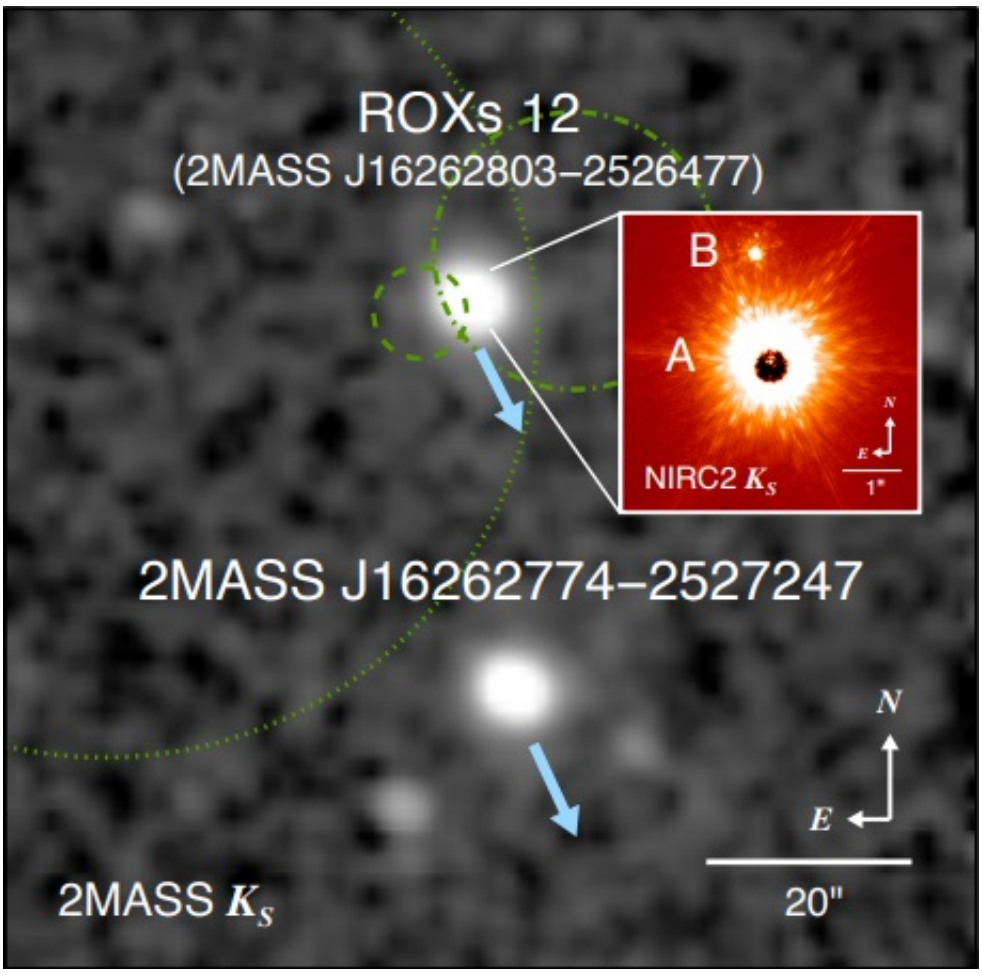

Overview of the ROXs 12 triple system. Image credit: Bowler et al., 2017.

Astronomers have disclosed new information about the young star system ROXs 12 as a result of near-infrared spectroscopic observations of one of the system's components. The findings, presented Aug. 25 in a paper published on arXiv.org, provide new insights into physical properties of ROXs 12 and reveal the existence of an additional companion to this system.

Located about 400 light years away from the Earth, ROXs 12 is a young system, known to be composed of two 6-million-year-old objects. The larger component, designated ROXs 12 A, is a star of spectral type M0, with a radius of 1.14 solar radii but about 35 percent less massive than the sun. ROXs 12 B is a much smaller substellar companion of ROXs 12 A, but very little is known about its physical parameters.

Given that ROXs 12 B is separated from ROXs 12 A by more than 100 AU, it makes it one of only a handful of young, very low-mass companions at wide orbital distances from their hosts. Therefore, ROXs 12 B offers a valuable opportunity to study the atmosphere of a young substellar object that occupies the mass range between the heaviest gas giant planets and the lightest stars.

In order to get more details about ROXs 12 and its mysterious companion, a team of researchers led by Brendan Bowler of the University of Texas at Austin has conducted moderate-resolution near-infrared spectroscopic observations of ROXs 12 B. For their observational campaign, the astronomers used several spectrographs, including the Near-Infrared Integral Field Spectrometer (NIFS) at Gemini-North 8.1 m telescope in Hawaii, and the OH-Suppressing InfraRed Imaging Spectrograph (OSIRIS) at the Keck I telescope, also in Hawaii.

These observations allowed the team to carry out a comprehensive analysis of ROXs 12, revealing more insights about this system.

"Here we present near-infrared integral-field spectroscopy of the substellar companion to ROXs 12 (2MASS J16262803-2526477), an M0-type pre-main sequence star near the boundary between the Ophiuchus and Upper Scorpius star-forming regions," the paper reads.

Bowler's team found that ROXs 12 B shows signatures of low surface gravity including weak alkali absorption lines and a triangular H-band pseudo-continuum shape. The observations revealed that the star has a spectral type of L0, has a mass of approximately 17.5 Jupiter masses, and an effective temperature of 3100 K.

According to the study, the orbit of ROXs 12 B is likely misaligned with the spin axis of its host star. Thus, it makes ROXs 12 B the lowest-mass imaged companion with evidence of spin-orbit misalignment. Such misalignment suggests that this star formed akin to fragmenting binary stars or in an equatorial disk that was torqued by the wide stellar tertiary.

Furthermore, the astronomers found that the ROXs 12 system has one more component, designated MASS J16262774-2527247, which is heavily accreting and exhibits stochastic variability in its light curve. With a spectral type of M1, this star has a mass about the half of our sun and a radius of approximately 0.96 solar radii. The researchers estimate that MASS J16262774-2527247 is about 8 million years old, has an effective temperature of 3700 K and is located some 5100 AU from ROXs 12 A.

More information: arxiv.org/pdf/1708.07611.pdf

https://phys.org/news/2017-08-astronomers-reveal-insights-physical-properties.html