'Hot Jupiter' detected around nearby variable star

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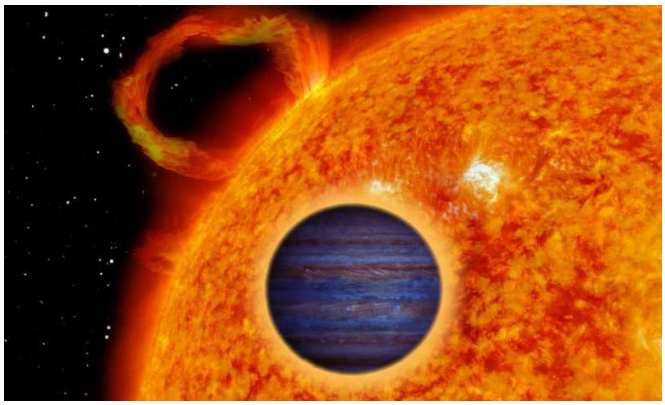

Artist's impression of a "hot Jupiter". Credit: Ricardo Cardoso Reis (CAUP)

(Phys.org)—Astronomers have detected a new "hot Jupiter" exoplanet orbiting a nearby T Tauri star known as TAP 26. The newly detected alien world, designated TAP 26 b, is about 66 percent more massive than Jupiter and is orbiting its parent star approximately every 10 days. The findings were presented in a paper published Jan. 6 on arXiv.org.

Located some 480 light years away, TAP 26 belongs to the T Tauri class of variable pre-main-sequence stars. With a mass similar to that of the sun, TAP 26 has a radius of 1.17 solar radii and is about 17 million years old. Such young forming T Tauri stars could provide important information about the formation and early evolution of planetary systems. Therefore, detecting "hot Jupiters" around these objects and determining their orbital properties could help astronomers to understand how they form and migrate, offering crucial insights on physical processes responsible for generating such planets.

With this aim in mind, a team of astronomers led by Louise Yu of the Toulouse University in France, has observed TAP 26 between November 2015 and January 2016 using the the 3.6-meter Canada-France-Hawaii Telescope (CFHT) in Hawaii. The observational campaign, which utilized CFHT's Echelle SpectroPolarimetric Device for the Observation of Stars (ESPaDOnS), was carried out under the Magnetic Topologies of Young Stars and the Survival of close-in massive Exoplanets (MaTYSSE) program.

By implementing three different methods, the researchers managed to detect a planet radial velocity signal in TAP 26's spectrum. The discovery is based on the analysis of 29 unpolarised and circularly polarised spectra collected over a timespan of 72 days.

"We report the detection of a hot Jupiter around TAP 26 using three different methods, two using Zeeman-Doppler Imaging (ZDI) and one Gaussian-Process Regression (GPR), with a false-alarm probability smaller than 6 10?4," the paper reads.

According to the research, the newly detected planet has a mass of 1.66 Jupiter masses and is circling its parent star at a distance of nearly 0.1 AU. With its short orbital period, huge mass and proximity to its host star, TAP 26 b was classified as a "hot Jupiter." The so-called "hot Jupiters" are gas giant planets, similar in characteristics to the solar system's biggest planet, with orbital periods not longer than 10 days. They have high surface temperatures, as they orbit their parent stars very closely.

More detailed characteristics of TAP 26 b are expected to be determined by further observations, in particular including more regular temporal sampling.

Besides deriving fundamental parameters of the newly detected planet, the researchers also revealed some important insights on the nature of the host star. According to the paper, the team created surface brightness and magnetic maps of

TAP 26, revealing the presence of cool spots and warm plages totaling up to 12 percent of the stellar surface. They found that the star's photospheric temperature is about 4,620 K and its maximum V magnitude is equal to 12.16. Moreover, based on the observational data, the scientists assume that TAP 26 dissipated its accretion disc very early and its magnetic field started to evolve into a complex topology.

More information: A hot Jupiter around the very active weak-line T Tauri star TAP 26, arXiv:1701.01512 [astro-ph.SR]
arxiv.org/abs/1701.01512

Abstract
We report the results of an extended spectropolarimetric and photometric monitoring of the weak-line T Tauri star TAP 26, carried out within the MaTYSSE programme with the ESPaDOnS spectropolarimeter at the 3.6 m Canada-France-Hawaii Telescope. Applying Zeeman-Doppler Imaging to our observations, concentrating in 2015 November and 2016 January and spanning 72 d in total, 16 d in 2015 November and 13 d in 2016 January, we reconstruct surface brightness and magnetic field maps for both epochs and demonstrate that both distributions exhibit temporal evolution not explained by differential rotation alone. We report the detection of a hot Jupiter (hJ) around TAP 26 using three different methods, two using Zeeman-Doppler Imaging (ZDI) and one Gaussian-Process Regression (GPR), with a false-alarm probability smaller than 6.10^-4. However, as a result of the aliasing related to the observing window, the orbital period cannot be uniquely determined; the orbital period with highest likelihood is 10.79 +/- 0.14 d followed by 8.99 +/- 0.09 d. Assuming the most likely period, and that the planet orbits in the stellar equatorial plane, we obtain that the planet has a minimum mass M.sin(i) of 1.66 +/- 0.31 M_Jup and orbits at 0.0968 +/- 0.0032 au from its host star. This new detection suggests that disc type II migration is efficient at generating newborn hJs, and that hJs may be more frequent around young T Tauri stars than around mature stars (or that the MaTYSSE sample is biased towards hJ-hosting stars).