RÉPUBLIQUE FRANÇAISE
Liberté
Égalité
Fraternité

Université de Toulouse

PRESS RELEASE

Toulouse, 27 October 2026

Hint of a magnetic field in the atmosphere of an exoplanet

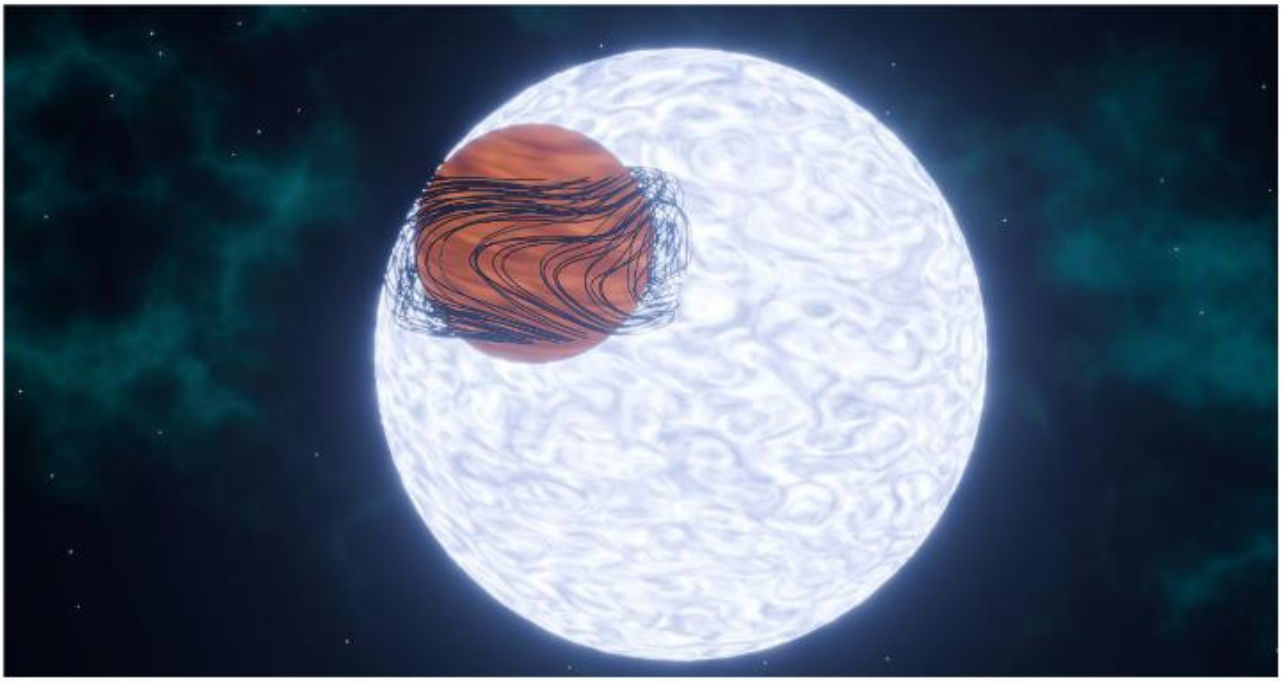
An international team led by scientists based in Toulouse has attempted, for the first time, to directly detect the magnetic field of an exoplanet. Between September 2025 and July 2026, the SPIRou spectropolarimeter, installed at the Canada-France-Hawaii Telescope, observed three transits of KELT-9b, the hottest known exoplanet, in front of its star. A polarization signal appears to have been detected during the first transit but was absent during the other two. The study, published on 22 October in Astronomy & Astrophysics, considers this hint tentative, but it opens the way to a new method for probing the magnetism of distant worlds.

A planet's magnetic field is one of its most fundamental properties. Without it, a planet would be exposed to the winds of its star, and in some cases its atmosphere would gradually disappear. For the planets of the Solar System, space probes have measured magnetic fields in situ. For the roughly 6,000 known exoplanets, only indirect clues are available, such as radio emissions.

"*Yet there is a way to detect it*," explains Alexis Lavail, a postdoctoral researcher at the University of Toulouse, at the Institut de recherche en astrophysique et planétologie (IRAP-OMP, CNES/CNRS/UT), and lead author of the study. A spectropolarimeter spreads a star's light out into its colours, like a rainbow. This spread of light is called a spectrum. "*Each type of atom absorbs light at very specific colours, which draws thin dark lines in the spectrum, like the atom's barcode. This is where the Zeeman effect comes in: a magnetic field changes the light absorbed by atoms and leaves its imprint on each line. The barcode changes. All you have to do is spot that imprint*."

This method has been used for decades to detect and map the magnetism of stars, notably with instruments developed by IRAP such as ESPaDOnS and SPIRou, installed at the Canada-France-Hawaii Telescope, as well as Neo-Narval and SPIP at the Bernard Lyot Telescope at the Pic du Midi. "*The drawback is that with an exoplanet, the task is much harder: as it passes in front of its star, the light thatcrosses the planet's atmosphere is tiny. The signal we are looking for is therefore very faint,*" the researcher adds.

The team chose the most favourable target: KELT-9b, a gas giant of nearly three times the mass of Jupiter. Located 680 light-years away, it completes its orbit around its star in 36 hours. The exoplanet's dayside approaches 4,000 degrees Celsius. At such a temperature, molecules are broken apart and iron and titanium atoms are ionized: the atmosphere conducts electricity, and the winds of more than ten kilometres per second that sweep across it could induce a magnetic field.



Artist's rendering of the gas giant KELT-9b, the hottest known exoplanet, passing in front of its star. The dark lines represent the planet's possible magnetic field. The SPIRou spectropolarimeter at the Canada-France-Hawaii Telescope may have detected the signature of this field during a transit of the exoplanet in 2025, but did not detect it again in 2026. Credit: Jean Guislain (IRAP - University of Toulouse).

The Canada-France-Hawaii Telescope was pointed at KELT-9b's star, and SPIRou was able to analyse the small fraction of light that passed through the exoplanet's atmosphere. The planet's infrared spectrum and circular polarization were recorded during three transits, on 7 September 2025 and on 3 and 6 July 2026.

The September 2025 transit appears to show a polarization signal at the planet's expected velocity. In a simple model, its amplitude corresponds to a large-scale field of about 2,000 gauss, thousands of times the Earth's field and hundreds of times that of Jupiter. However, no signal was measured during the July 2026 transits.

"*This signal is what we call a candidate. It has withstood several checks, but on its own it is not sufficiently robust proof*," says Alexis Lavail. The scientists are considering two hypotheses. Either the 2025 signal is a noise fluctuation, a false positive, or the magnetic field varies. "*In theory, a field induced in such an atmosphere would be unstable and could change within a few months*."

"*Part of me would like to be able to explain this signal as noise; it would make our lives much easier. But it withstood all our checks, then refused to show up during the other two transits. It's a situation that is both intriguing and incredibly frustrating*," adds Nicholas Borsato, a postdoctoral researcher at the University of Toulouse – IRAP and co-author of the study.

Observations of new transits will make it possible to confirm or rule out this signal. Whatever the outcome, the method is now in place and opens a direct window onto exoplanet magnetism that no other technique has offered until now.

Press contact
Alexis Lavail
astro@lavail.net
+33 6 86 66 45 58