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DE GENÈVE

PRESS RELEASE

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AN EXOPLANET WITH AN INFERNAL ATMOSPHERE

As part of the PlanetS National Centre of Competence in Research (NCCR), astronomers from the Universities of Geneva (UNIGE) and Bern, Switzerland, have come to measure the temperature of the atmosphere of an exoplanet with unequalled precision, by crossing two approaches. The first approach is based on the HARPS spectrometer and the second consists of a new way of interpreting sodium lines. From these two additional analyses, researchers have been able to conclude that the HD189733b exoplanet is showing infernal atmospheric conditions: wind speeds of more than 1000 kilometres per hour, and the temperature being 3000 degrees. These results open up perspectives to approach the study of exoplanet atmospheres. They were published in two journals, namely *Astronomy & Astrophysics* and *Astrophysical Journal Letters*.

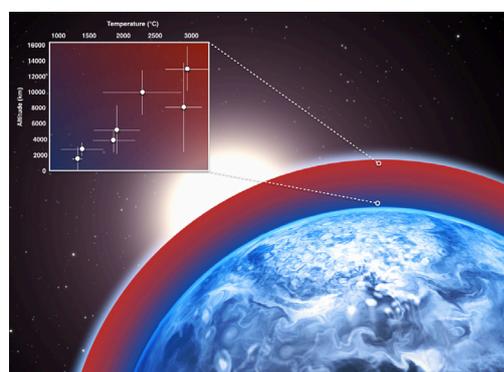
With a temperature of 3000 degrees and such winds blowing at several thousand kilometres per hour, the HD189733b exoplanet's atmosphere is truly turbulent. Measurements taken by a team of astronomers from the Universities of Geneva and Bern are given in the framework of the PlanetS NCCR; the figures come from observations made over sodium spectral lines. This element is contained in the exoplanet's atmosphere, and has been measured by the HARPS spectrometer, an instrument designed at the UNIGE Observatory, and installed on a telescope of the European Star Observatory (ESO) in Chile.

Following the sodium lines

When there is an atmosphere, sodium is the source of a clearly recognisable signal, whose intensity varies at the time when the planet passes before its star, an event called transit. This effect had been predicted in 2000, and highlighted two years later through Hubble space telescope observations. But, it had only been able to be detected since then from Earth, from giant telescopes, 8 to 10 metres in diameter.

At UNIGE, astronomers have had the idea of using observations already made by the HARPS spectrometer, to study sodium lines. By attentively scrutinising the data collected over many years, Aurélien Wyttenbach, a researcher at the UNIGE Faculty of Science, has been able to detect variations in sodium lines during several transits of HD189733b. Surprisingly, the analysis of HARPS data on Earth produces an equivalent detection, in terms of sensitivity, to that of the Hubble space telescope, but much better in terms of spectral resolution. It is this last aspect which has enabled an analysis to be achieved, which is a lot finer than previously, and this despite a telescope whose diameter remains modest.

Alongside this, and in another study, Professor Kevin Heng, at Bern University, has developed a new technique of interpreting variations in sodium lines. Instead of using a sophisticated computer model, he



HD189733b atmosphere and its temperature measurements

Crédit: NASA, ESA

PlanetS

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resorts to a set of simple formulae, which enable variations in temperature, density and pressure to be expressed within an atmosphere.

Two noteworthy studies

These two studies consequently open up the path of exploring exoplanet atmospheres with tools that are more accessible than giant or space telescopes. The study which was led by UNIGE is published in the latest edition of the *Astronomy & Astrophysics Journal*, together with the study carried out by Bern University, appearing in the current edition of *Astrophysical Journal Letters*.

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