



Science in School

The European journal for science teachers

ISSUE 51 – 15/01/2021

Topic Astronomy/space



Artist's impression of the night side of WASP-76b.
ESO/M. Kornmesser

ESO telescope observes exoplanet where it rains iron

Ever wondered what the weather is like on planets outside our solar system? Scientists have recently discovered an exoplanet where it rains iron!

Scientists have recently discovered an exoplanet where it rains iron.

“One could say that this planet gets rainy in the evening, except it rains iron,” says David Ehrenreich, a professor at the University of Geneva in Switzerland. He led a study, published today in the journal *Nature*, of this exotic [exoplanet](#). Known as WASP-76b, it is located some 640 light-years away in the constellation of Pisces.

This strange phenomenon happens because the ‘iron rain’ planet only ever shows one face, its day side, to its parent star, its cooler night side remaining in perpetual darkness. Like the Moon on its orbit around the Earth, WASP-76b is ‘[tidally locked](#)’: it takes as long to rotate around its axis as it does to go around the star.

On its day side, it receives thousands of times more radiation from its parent star than the Earth does from the Sun. It’s so



Artist's impression of the night side of WASP-76b.

Frederik Peeters (<https://frederikpeeters.tumblr.com/>)

hot that molecules separate into atoms, and metals like iron evaporate into the atmosphere. The extreme temperature difference between the day and night sides results in vigorous winds that bring the iron vapour from the ultra-hot day side to the cooler night side, where temperatures decrease to around 1500 degrees Celsius.

Not only does WASP-76b have different day-night temperatures, it also has distinct day-night chemistry, according to the new study. Using the new [ESPRESSO](#) instrument on [ESO's VLT](#) in the Chilean Atacama Desert, the astronomers identified for the first time chemical variations on an ultra-hot gas giant planet. They detected a strong signature of iron vapour at the evening border that separates the planet's day side from its night side. "Surprisingly, however, we do not see the iron vapour in the morning," says Ehrenreich. The reason, he says, is that "it is raining iron on the night side of this extreme exoplanet."

"The observations show that iron vapour is abundant in the atmosphere of the hot day side of WASP-76b," adds María Rosa Zapatero Osorio, an astrophysicist at the Centre for Astrobiology in Madrid, Spain, and the chair of the ESPRESSO

science team. "A fraction of this iron is injected into the night side owing to the planet's rotation and atmospheric winds. There, the iron encounters much cooler environments, condenses and rains down."

This result was obtained from the very first science observations done with ESPRESSO, in September 2018, by the scientific consortium who built the instrument: a team from Portugal, Italy, Switzerland, Spain and ESO.

ESPRESSO — the Echelle SPectrograph for Rocky Exoplanets and Stable Spectroscopic Observations — was originally designed to hunt for Earth-like planets around Sun-like stars. However, it has proven to be much more versatile. "We soon realised that the remarkable collecting power of the VLT and the extreme stability of ESPRESSO made it a prime machine to study exoplanet atmospheres," says Pedro Figueira, ESPRESSO instrument scientist at ESO in Chile.

"What we have now is a whole new way to trace the climate of the most extreme exoplanets," concludes Ehrenreich. <<

Acknowledgements

This article was originally published on [ESO News](#).

References

1. Ehrenreich D et al. (2020) [Nightside condensation of iron in an ultrahot giant exoplanet](#). *Nature* **580**: 597–601. doi: 10.1038/s41586-020-2107-1

Resources

- [Learn how to predict the weather](#) in this engaging classroom activity.
- [Use everyday ingredients](#) to explain meteorological phenomena.
- Read about how scientists are [discovering new exoplanets](#).

CC-BY

