UNIVERSITÉ DE GENÈVE

PRESS RELEASE

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Helium leak on the exoplanet WASP-107b

An international team including UNIGE observed with the JWST huge clouds of helium escaping from the exoplanet Wasp-107b.

High resolution pictures

An international team, including astronomers from the University of Geneva (UNIGE) and the National Centre of Competence in Research PlanetS, has observed giant clouds of helium escaping from the exoplanet WASP-107b. Obtained with the James Webb Space Telescope, these observations were modeled using tools developed at UNIGE. Their analysis, published in the journal *Nature Astronomy*, provides valuable clues for understanding this atmospheric escape phenomenon, which influences the evolution of exoplanets and shapes some of their characteristics.

Sometimes a planet's atmosphere escapes into space. This is the case for Earth, which irreversibly loses a little over 3 kg of matter (mainly hydrogen) every second. This process, called "atmospheric escape", is of particular interest to astronomers for the study of exoplanets located very close to their star, which, heated to extreme temperatures, are precisely subject to this phenomenon. It plays a major role in their evolution.

Thanks to the James Webb Space Telescope, an international team including scientists from the Observatory of the University of Geneva (UNIGE) and McGill, Chicago, and Montreal universities has succeeded in observing large streams of helium gas escaping from WASP-107b. This exoplanet is located more than 210 light-years from our solar system. This is the first time this chemical element has been identified with the JWST on an exoplanet, allowing for a detailed description of the phenomenon.

Super-puff exoplanets

Discovered in 2017, WASP-107b is located seven times closer to its star than Mercury, the closest planet to our Sun. Its density is very low because it is the size of Jupiter but has only one-tenth of its mass, placing it among the so-called "super-puff planets", a category of exoplanets with extremely low densities.

The vast helium flow was detected in the extension of its atmosphere, called the "exosphere". This cloud partially blocks the star's light even before the planet passes in front of it. "Our atmospheric escape models confirm the presence of helium flows, both ahead and behind the planet, extending in the direction of its orbital motion to nearly ten times the planet's radius," explains Yann Carteret, a doctoral student in the Department of Astronomy at the Faculty of Science of the University of Geneva and co-author of the study.

Valuable clues

In addition to helium, astronomers were able to confirm the presence of water and traces of chemical mixtures (including carbon monoxide, carbon dioxide, and ammonia) in the planet's atmosphere, while noting the absence of methane, which the JWST is capable of detecting. These are valuable clues for reconstructing the history of WASP-107b's formation and migration: the planet formed far from its current orbit, then moved closer to its star, which would explain its bloated atmosphere and loss of gas.

The study on WASP-107b is a key reference for better understanding the evolution and dynamics of these distant worlds. "Observing and modeling atmospheric escape is a major research area at the UNIGE Department of Astronomy because it is thought to be responsible for some of the characteristics observed in the exoplanet population," explains Vincent Bourrier, senior lecturer and research fellow in the Department of Astronomy at the UNIGE Faculty of Science and co-author of the study.

"On Earth, atmospheric escape is too weak to drastically influence our planet. But it would be responsible for the absence of water on our close neighbor, Venus. It is therefore essential to fully understand the mechanisms at work in this phenomenon, which could erode the atmosphere of certain rocky exoplanets," he concludes.

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