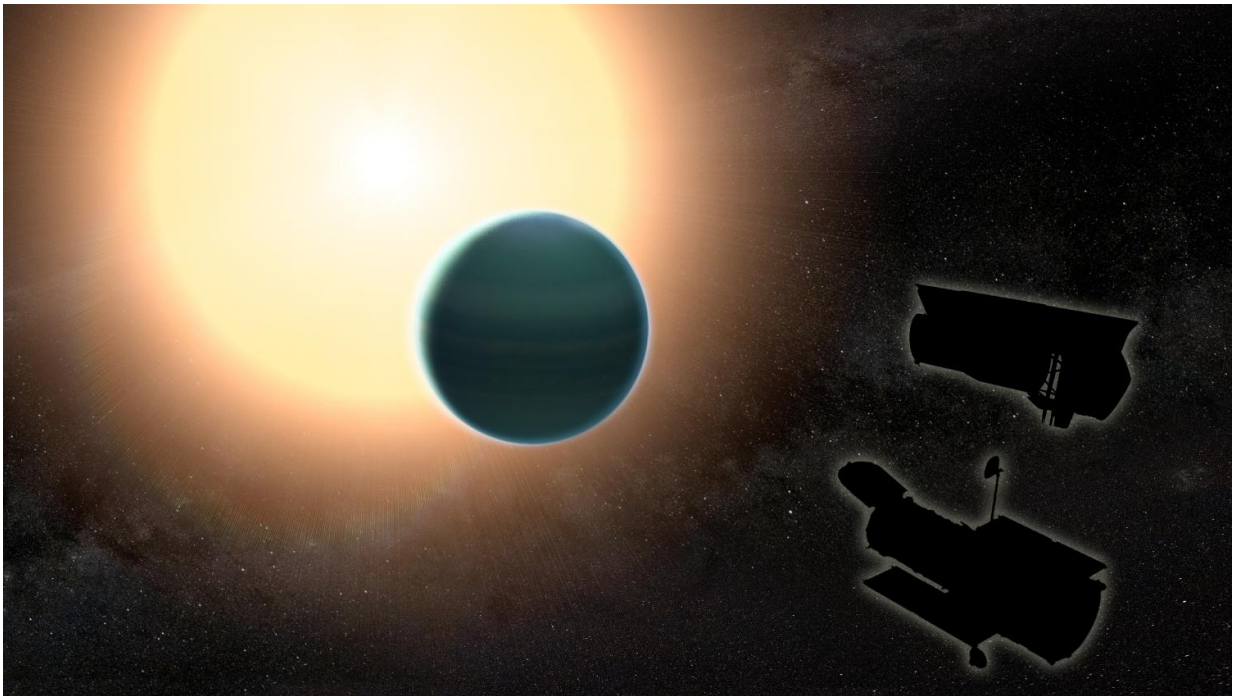


Primitive atmosphere discovered around 'Warm Neptune'

May 11 2017



The atmosphere of the distant 'warm Neptune' HAT-P-26b, illustrated here, is unexpectedly primitive, composed primarily of hydrogen and helium. By combining observations from NASA's Hubble and Spitzer space telescopes, researchers determined that, unlike Neptune and Uranus, the exoplanet has relatively low metallicity, an indication of the how rich the planet is in all elements heavier than hydrogen and helium. Credit: NASA/GSFC

A pioneering new study uncovering the 'primitive atmosphere'

surrounding a distant world could provide a pivotal breakthrough in the search to how planets form and develop in far-flung galaxies.

A team of international researchers, co-lead by Hannah Wakeford from NASA and Professor David Sing from the University of Exeter, has carried out one of the most detailed studies to date of a 'Warm Neptune' - a planet that is similar in size to our own Neptune, but which orbits its sun more closely.

The study revealed that the exoplanet - found around 430 light years from Earth - has an [atmosphere](#) that composed almost entirely of hydrogen and helium, with a relatively cloudless sky.

This primitive atmosphere suggests the planet most likely formed closer to its [host star](#) or later in its solar system development, or both, compared to the Ice Giants Neptune or Uranus.

Crucially, the discovery could also have wide implications for how scientists think about the birth and development of planetary systems in distant galaxies.

The research is published in leading journal, *Science*, on May 11 2017.

Professor Sing, from the University of Exeter's Astrophysics department said: "This exciting new discovery shows that there is a lot more diversity in the atmospheres of these exoplanets than we have previously thought.

"This 'Warm Neptune' is a much smaller planet than those we have been able to characterize in depth, so this new discovery about its atmosphere feels like a big breakthrough in our pursuit to learn more about how solar systems are formed, and how it compares to our own."

In order to study the atmosphere of the planet - named HAT-P-26b - the researchers used data collected when the planet passed in front of its host star, events known as transits.

During a transit, a fraction of the starlight gets filtered through the planet's atmosphere, which absorbs some wavelengths of light but not others. By looking at how the signatures of the starlight change as a result of this filtering, researchers can work backward to figure out the chemical composition of the atmosphere.

In this case, the team pooled data from four separate transits measured by NASA's Hubble Space Telescope, and two seen by NASA's Spitzer Space Telescope.

The analysis provided enough detail to determine the planet's atmosphere is relatively clear of clouds and has a strong water signature - also the best measurement of water to date on an exoplanet of this size.

The researchers used the water signature to estimate the metallicity, an indication of how rich the planet is in all elements heavier than hydrogen and helium. Astronomers calculate the metallicity because it gives them clues about how a planet formed.

To compare [planets](#) by their metallicities, scientists use the sun as a point of reference - similar to describing how much caffeine different drinks have by comparing them to a standard cup of coffee.

In our solar system, the metallicity in Jupiter (5 times greater than the sun) and Saturn (10 times) suggest these 'Gas Giants' are made almost entirely of hydrogen and helium. Neptune and Uranus, however, are richer in the heavier elements, with metallicities of about 100 times that of the sun.

Scientists think this happened because, as the solar system was taking shape, Neptune and Uranus formed in a region toward the outskirts of the enormous disk of dust, gas and debris that swirled around the immature sun.

As a result, they would have been bombarded with a lot of icy debris that was rich in [heavier elements](#). Jupiter and Saturn, in contrast, formed in a warmer part of the disk and would therefore have encountered less of the icy debris.

This new study However, this new study discovered that HAT-P-26b bucks the trend. The research team believes its metallicity is only about 4.8 times that of the sun - much closer to the value for Jupiter than for Neptune.

Hannah Wakeford, who previously studied at the University of Exeter and is now a postdoctoral researcher at NASA's Goddard Space Flight Center in Greenbelt, Maryland, led the study.

Hannah said: "Astronomers have just begun to investigate the atmospheres of these distant Neptune-mass planets, and almost right away, we found an example that goes against the trend in our solar system. This kind of unexpected result is why I really love exploring the atmospheres of alien planets."

Co-author Tiffany Kataria of the Jet Propulsion Laboratory in Pasadena, California added: "To have so much information about a warm Neptune is still rare, so analyzing these data sets simultaneously is an achievement in and of itself."

More information: H.R. Wakeford et al., "HAT-P-26b: A Neptune-mass exoplanet with a well-constrained heavy element abundance," *Science* (2017). [science.sciencemag.org/cgi/doi ... 1126/science.aah4668](https://doi.org/10.1126/science.aah4668)

Provided by University of Exeter

Citation: Primitive atmosphere discovered around 'Warm Neptune' (2017, May 11) retrieved 26 April 2024 from <https://phys.org/news/2017-05-primitive-atmosphere-neptune.html>

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.