

First water detected on potentially 'habitable' planet

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This artist's impression shows the planet K2-18b, its host star and an accompanying planet in this system. K2-18b is now the only super-Earth exoplanet known to host both water and temperatures that could support life. UCL researchers used archive data from 2016 and 2017 captured by the NASA/ESA Hubble Space Telescope and developed open-source algorithms to analyse the starlight filtered through K2-18b's atmosphere. The results revealed the molecular signature of water vapour, also indicating the presence of hydrogen and helium in the planet's atmosphere. Credit: Credit: ESA/Hubble, M. Kornmesser

K2-18b, which is eight times the mass of Earth, is now the only planet orbiting a star outside the Solar System, or 'exoplanet', known to have both water and temperatures that could support life.

The discovery, published today in *Nature Astronomy*, is the first successful atmospheric detection for an exoplanet orbiting in its star's '[habitable zone](#)', at a distance where water can exist in liquid form.

First author, Dr. Angelos Tsiaras (UCL Centre for Space Exochemistry Data (CSED)), said: "Finding water in a potentially habitable world other than Earth is incredibly exciting. K2-18b is not 'Earth 2.0' as it is significantly heavier and has a different atmospheric composition. However, it brings us closer to answering the fundamental question: Is the Earth unique?"

The team used archive data from 2016 and 2017 captured by the ESA/NASA Hubble Space Telescope and developed open-source algorithms to analyse the starlight filtered through K2-18b's atmosphere. The results revealed the molecular signature of water vapour, also indicating the presence of hydrogen and helium in the planet's atmosphere.

The authors believe that other molecules including nitrogen and methane may be present but, with current observations, they remain undetectable. Further studies are required to estimate cloud coverage and the percentage of atmospheric water present.

The planet orbits the cool dwarf star K2-18, which is about 110 [light years](#) from Earth in the Leo constellation. Given the high level of activity of its red dwarf star, K2-18b may be more hostile than Earth and is likely to be exposed to more radiation.

K2-18b was discovered in 2015 and is one of hundreds of super-

Earths—[planets](#) with a mass between Earth and Neptune—found by NASA's Kepler spacecraft. NASA's TESS mission is expected to detect hundreds more super-Earths in the coming years.

Co-author Dr. Ingo Waldmann (UCL CSED), said: "With so many new super-Earths expected to be found over the next couple of decades, it is likely that this is the first discovery of many potentially habitable planets. This is not only because super-Earths like K2-18b are the most common planets in our Galaxy, but also because red dwarfs—stars smaller than our Sun—are the most common stars."

The next generation of [space](#) telescopes, including the NASA/ESA/CSA James Webb Space Telescope and ESA's ARIEL mission, will be able to characterise atmospheres in more detail as they will carry more advanced instruments. ARIEL is expected to launch in 2028, and will observe 1,000 planets in detail to get a truly representative picture of what they are like.

Professor Giovanna Tinetti (UCL CSED), co-author and Principal Investigator for ARIEL, said: "Our discovery makes K2-18 b one of the most interesting targets for future study. Over 4,000 exoplanets have been detected but we don't know much about their composition and nature. By observing a large sample of planets, we hope to reveal secrets about their chemistry, formation and evolution."

"This study contributes to our understanding of habitable worlds beyond our Solar System and marks a new era in exoplanet research, crucial to ultimately place the Earth, our only home, into the greater picture of the Cosmos," said Dr. Tsaras.

Secretary of State Andrea Leadsom said: "Space exploration is one of the greatest adventures of our time, and for decades, scientists and astronomers have scoured the skies for planets capable of supporting

life. This discovery by UK researchers is a giant leap forward in this endeavour, opening a new world of possibilities. The secrets of our universe are out there, and I am enormously proud that our Government-backed researchers and councils are at the forefront of efforts to unlock answers to mysteries that have endured for centuries."

Chris Lee, the UK Space Agency's Chief Scientist, said: "This exciting discovery demonstrates the UK's leading strengths in the science of exoplanets. "We continue to build on this expertise, with UCL at the heart of a new mission—ARIEL—to study the atmosphere of worlds orbiting other stars in our Galaxy. This is one of a number of international space science missions involving leading roles for UK science and industry and forms part of our ongoing commitment to the European Space Agency."

Dr. Colin Vincent, Head of STFC's Astronomy Division, said: "Finding other planets that might have the capability to support life is one of the holy grails of astronomy research. This result based on data from the Hubble Space Telescope gives an exciting taste of what may be possible in the next few years as a number of new telescopes and space missions supported by STFC and the UK Space Agency come online."

More information: Angelos Tsiaras, Ingo P. Waldmann, Giovanna Tinetti, Jonathan Tennyson & Sergey N. Yurchenko, 'Water vapour in the atmosphere of the habitable-zone eight Earth-mass planet K2-18 b' *Nature Astronomy* (2019). [DOI: 10.1038/s41550-019-0878-9](https://doi.org/10.1038/s41550-019-0878-9)

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