

# Where water comes from: A new clue from alien worlds

**Water is essential for life on Earth — but where did it come from in the first place?**

By Kim Baptista, ASU News  
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For decades, scientists believed that Earth's water originated far from the sun. In the cold outer reaches of the solar system, water-rich bodies formed and later migrated inward, delivering water to our planet.

A new study, however, challenges this long-held view. Researchers led by Harrison Horn, who earned his PhD from Arizona State University's [School of Earth and Space Exploration](#) in 2022, and ASU Professor [Dan Shim](#), in collaboration with Allona Vazan of the Open University of Israel, have found that planets may not need to begin with water at all to become water-rich worlds. Their findings were [published Wednesday in Nature](#).

"Planets can make one of the key ingredients for life — water — even in hot environments close to stars," said Shim, a professor in the School of Earth and Space Exploration. "It changes how we think about which planets are capable of becoming water-rich."

[NASA's Kepler mission](#) and other planet-hunting telescopes have revealed thousands of exoplanets — planets orbiting stars beyond our sun. Among them are two intriguing common classes: rocky "super-Earths" and larger "sub-Neptunes," which have thick hydrogen atmospheres. These types of planets don't exist in our solar system, and many orbit extremely close to their stars, where temperatures should be too high for water to form or survive.

Yet observations show that while some sub-Neptunes are dry rocky planets, others are covered in water. This contradiction has puzzled scientists, raising questions about how such planets could acquire water in such hostile environments.

To test a new idea, Horn and Shim re-created the intense conditions found inside sub-Neptune planets. Using high-powered lasers, diamond anvils and the Advanced Photon Source at the University of Chicago, the team compressed and heated hydrogen gas with rocky materials to extreme pressures and temperatures. Their experiments revealed a surprising process: Hydrogen from the atmosphere reacts with oxygen in the rocks to form water. This means that even planets born dry, with only rock and hydrogen, could generate water deep within their interiors.

This discovery suggests that water-rich planets may not require delivery from distant icy bodies. Instead, many could manufacture their own water from the inside out.

“These new findings call for a reevaluation of the theory and modeling of exoplanets formed with hydrogen envelopes,” Vazan said.

The results also blur traditional boundaries between planet types. Dry, hydrogen-rich worlds and water-covered planets may actually represent different stages of the same evolutionary pathway.

While extreme heat near stars may still prevent life as we know it, the research suggests that water could be much more common in the universe than previously believed.

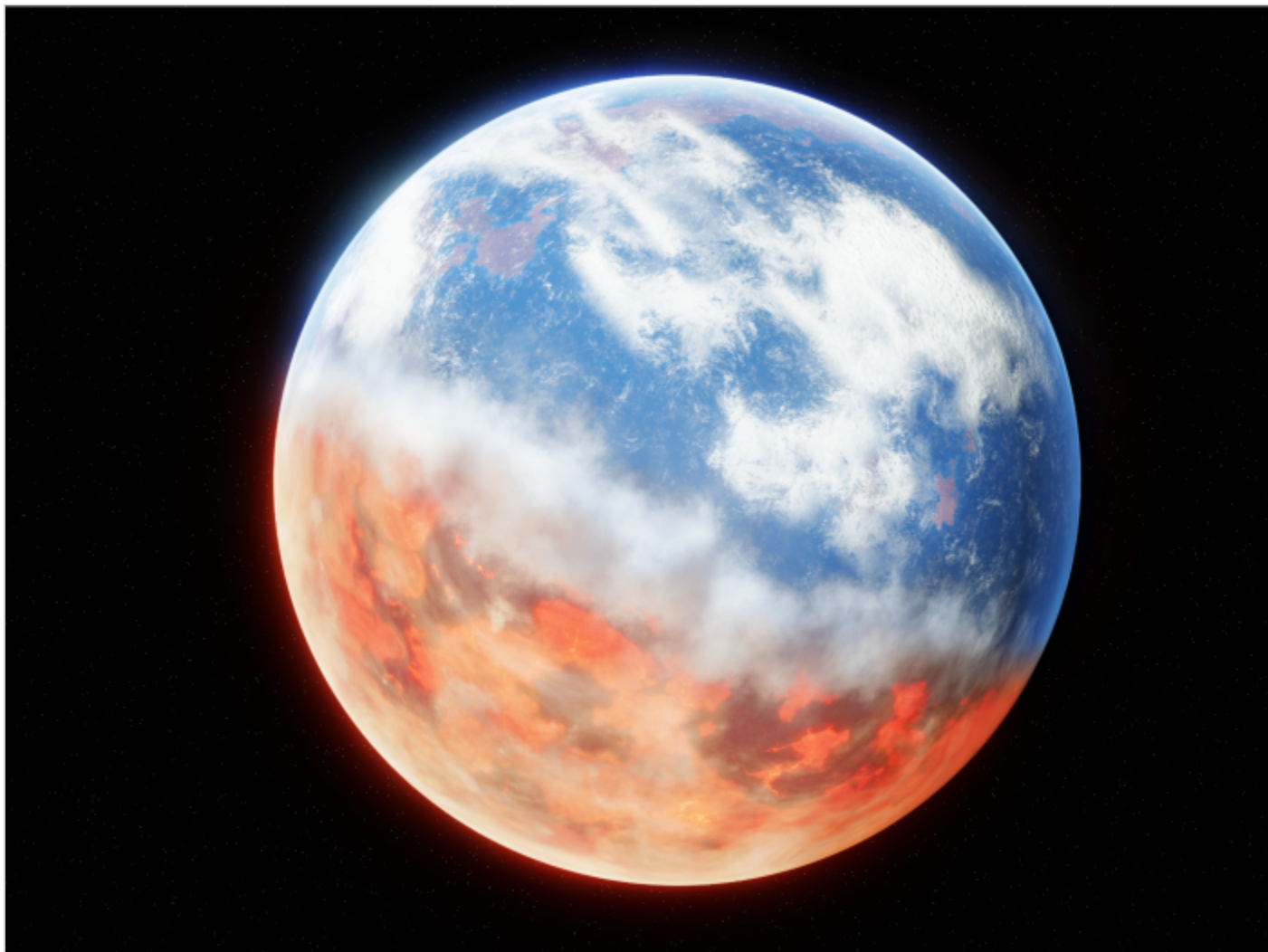
“Although we cannot visit these exotic worlds, we can probe their interiors by re-creating their conditions in state-of-the-art laboratories,” Horn said.

By overturning long-standing assumptions, the study opens the door to a new understanding of how planets — and potentially habitable environments — form throughout the cosmos.

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*This story originally appeared on [ASU News](#).*

## **Main image**



An image depicting the transformation of a sub-Neptune exoplanet from a hydrogen-rich world into a water world. Image courtesy of ASU/illustration by Jenny Horn