Planet K2-18b may not host alien life, but it is home to a water-rich interior

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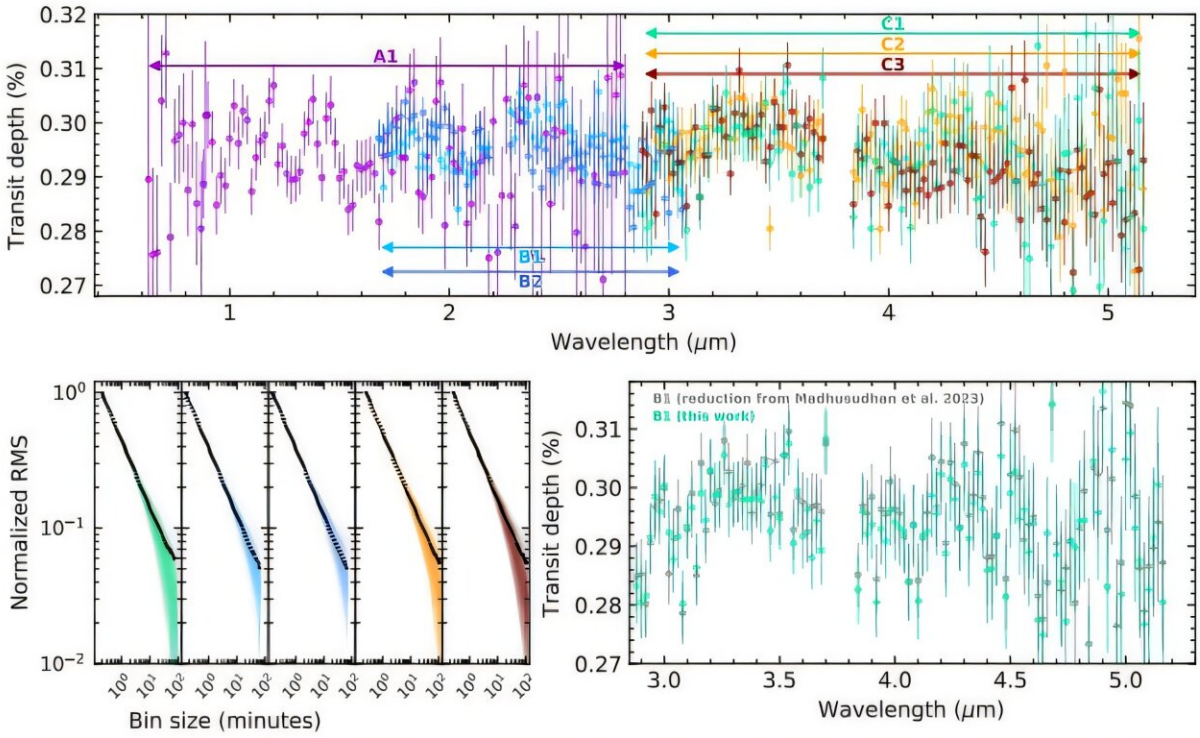

Top: JWST transmission spectra of K2-18 b. We show our reduction of the currently available NIRSpec and NIRISS data of K2-18 b. In this plot, the NIRISS data was binned down to the same resolution as the NIRSpec data ($\Delta\lambda$ = 0.02 μm). Bottom left: Normalized RMS versus bin size for all NIRSpec spectroscopic light curves (the color scheme follows that of the top plot). The black lines indicate the expected RMS for white noise. Bottom right: Comparison of our reduction of the G395H data from Program 2722 against the reduction by Madhusudhan et al. (2023) of the same data, binned to the same resolution. No offsets were applied to any spectra in this figure. Credit: *arXiv*

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A large sub-Neptune-sized planet revolving around a red dwarf star 124 light years away has been the topic of debate among several scientists in recent months.

According to models from a group of Cambridge scientists using data from the James Webb Space Telescope (JWST), there were signs of dimethyl sulfide (DMS) and dimethyl disulfide (DMDS) in the planet's atmosphere. These molecules are known to only be produced by living organisms on Earth. But shortly after the announcement, multiple other groups analyzing the same data claimed that their analyses did not back up these claims.

These early observations also gave some insight into the atmospheric composition of the planet, referred to as K2-18 b. It was found to have a hydrogen-rich atmosphere, containing methane and possibly carbon dioxide. There was limited evidence for the existence of ammonia and water vapor, but more observations were needed to get a clearer picture. The scientists involved in the debate over DMS and DMDS were also eager to clarify whether the possible signatures for these molecules would be present in future data.

Now, several of these scientists have gotten together and analyzed new data from four more recent JWST near-infrared transit observations and combined these with previous JWST and Hubble data. Their research was recently posted to the *arXiv* preprint server. The new results show no evidence for the DMS or DMDS signatures, but they do help to create a more solid picture of the planet's structure.

The biggest result to come out of the study is the certainty that K2-18 b

is a rather water-rich planet. The group found a robust detection of methane and carbon dioxide in K2-18 b's atmosphere, but no water vapor.

They explain, "The simultaneous presence of CH4 and CO_2 at the observed abundances can only be explained by either a massive atmosphere with roughly 100× solar metallicity and a bulk H_2O content of 10–25% by volume, or a small atmosphere overlaying a liquid-water ocean. Regardless of whether the planet hosts a liquid-water ocean, our results conclusively demonstrate that K2-18 b has a water-rich interior."

Ammonia and carbon monoxide were also absent in the planet's atmosphere. The study authors say that the lack of ammonia in the atmosphere is consistent with a liquid ocean, but it is not conclusive, and additional observations are needed to get useful information about the carbon dioxide to carbon monoxide ratio. The results also show that the absence of atmospheric water vapor might suggest a cold trap, likely due to water vapor condensation occurring before reaching the altitudes probed by their instruments.

As usual, more observations will help to refine the atmospheric models in these studies and give a clearer picture of whether the water on K2-18 b exists as a layer of gas, a liquid ocean or even part of an icy core. Whichever state it's in, the study indicates that there is no evidence of anything living in it. Still, this particular planet is a fascinating study for many scientists.

The study authors write,"K2-18 b—a cool, water-rich world—stands out as one of the most promising temperate sub-Neptunes for exploring the emergence of liquid-water environments in non-Earth-like planets, motivating further characterization of its atmosphere and interior."

More information: Renyu Hu et al, A water-rich interior in the

temperate sub-Neptune K2-18 b revealed by JWST, *arXiv* (2025). DOI: 10.48550/arxiv.2507.12622