Webb telescope finds brown dwarf with dust clouds in its atmosphere

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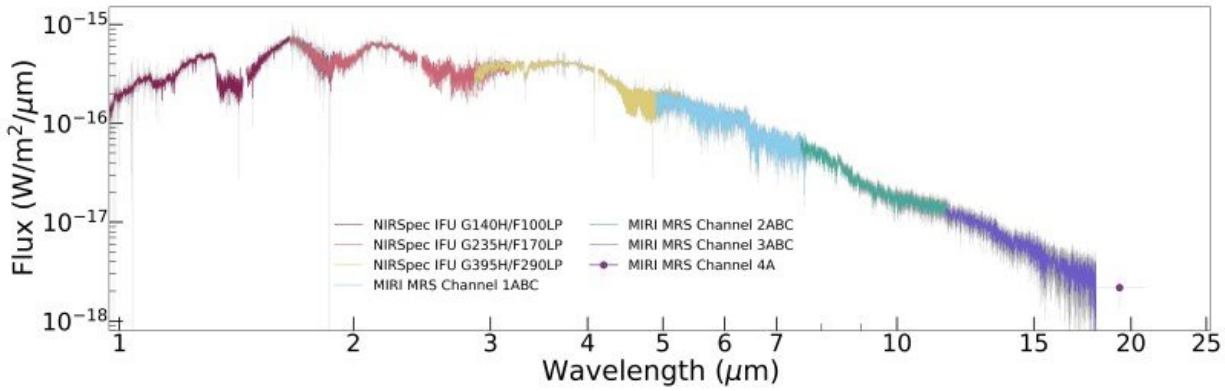

The full spectrum of VHS 1256 b using JWST's NIRSpec IFU and MIRI MRS observation modes. Bandpasses are highlighted with different colors and error bar are displayed in gray. A single photometric point for MIRI MRS Channel 4A is shown because there is little to no signal in the MIRI MRS 4B, and 4C channels. Error bars are plotted in a light gray. Credit: Brittany E. Miles et al (2022), https://arxiv.org/abs/2209.00620

The James Webb Space Telescope (JWST) captured images of a brown dwarf with silicate particles in its atmosphere. In their paper posted on the arXiv preprint server, astronomers describe their analysis of the brown dwarf and its unique atmosphere.

Brown dwarfs are space objects that some have dubbed failed stars. They begin their existence in much the same way as other stars but fail

to build up enough hydrogen to instigate a fusion reaction. Because of that, they do not grow to the size of stars; hence, their name. Brown dwarfs are able to fuse deuterium, though the temperature and pressure are much lower than hydrogen in stars. They also emit heat and light, which is why space scientists are able to see them, generally by studying infrared wavelengths. And it just so happens that studying objects in the infrared spectrum is what the JWST was designed to do.

The brown dwarf observed by the researchers is approximately 72 light years away—it was first observed in 2015 and is named VHS 1256-1257 b. Its size is roughly 19 times that of Jupiter and previous research has shown that it is still young. Prior images of the dwarf have shown that it has a reddish hue to its atmosphere, which is what caught the attention of the researchers.

The researchers found that the atmosphere of the brown dwarf was similar to most other brown dwarfs, though it was clearer. They found methane, sodium, water, potassium and carbon dioxide. And they also found clouds, which they believe are made of silicate particles. The clouds, they noted, formed in thick layers. They suggest that they are probably made of some type of mineral, such as enstatite, quartz or forsterite.

The researchers note that their observations confirm theories that brown dwarfs can be encircled by dusty clouds, which, they further note, can have an impact on their brightness. They conclude that the JWST represents a big step toward more detailed study of objects such as exoplanets and brown dwarfs.

More information: Brittany E. Miles et al, The JWST Early Release Science Program for Direct Observations of Exoplanetary Systems II: A 1 to 20 Micron Spectrum of the Planetary-Mass Companion VHS

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