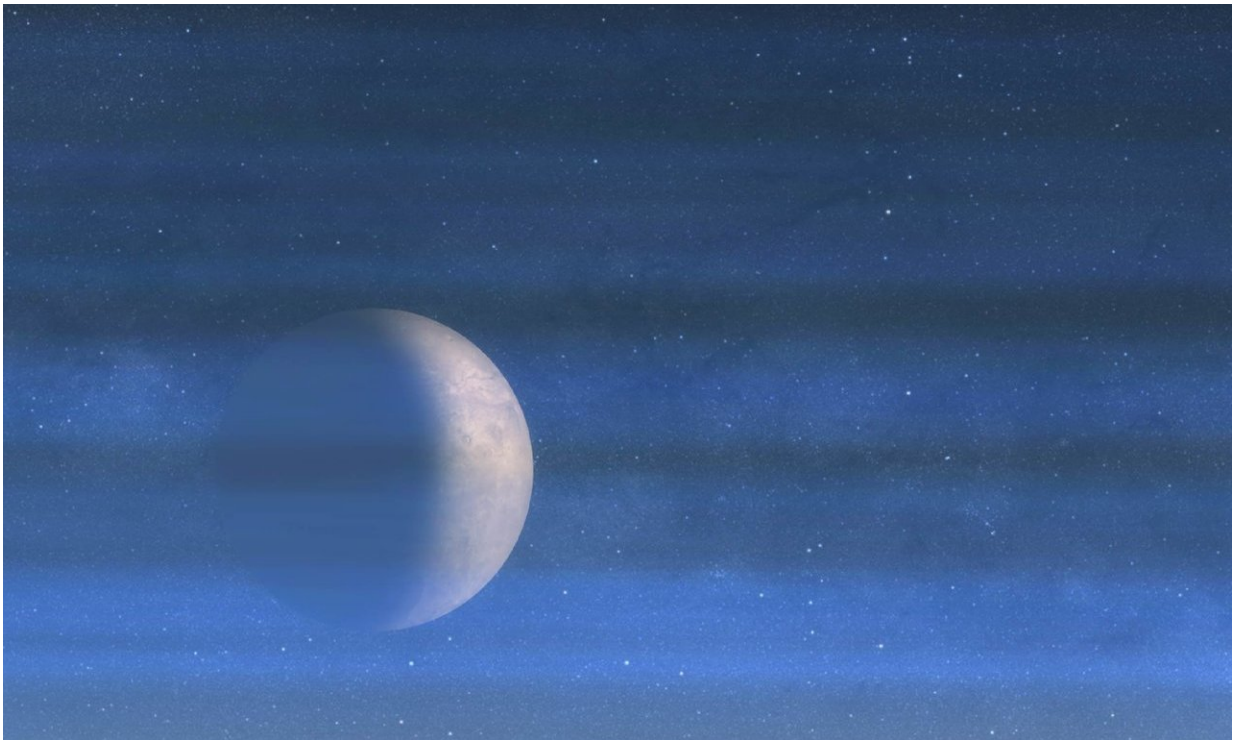


# Pluto's hydrocarbon haze keeps dwarf planet colder than expected

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An artist's impression of the view of the moon Charon through Pluto's atmospheric haze layers above the mountain landscape of bedrock water ice covered partially with deposition of dark, reddish haze particles. Credit: X. Liu

The gas composition of a planet's atmosphere generally determines how much heat gets trapped in the atmosphere. For the dwarf planet Pluto, however, the predicted temperature based on the composition of its

atmosphere was much higher than actual measurements taken by NASA's New Horizons spacecraft in 2015.

A new study published November 16 in *Nature* proposes a novel cooling mechanism controlled by haze [particles](#) to account for Pluto's frigid atmosphere.

"It's been a mystery since we first got the temperature data from New Horizons," said first author Xi Zhang, assistant professor of Earth and planetary sciences at UC Santa Cruz. "Pluto is the first planetary body we know of where the atmospheric energy budget is dominated by solid-phase haze particles instead of by gases."

The cooling mechanism involves the absorption of heat by the haze particles, which then emit infrared radiation, cooling the atmosphere by radiating energy into space. The result is an atmospheric temperature of about 70 Kelvin (minus 203 degrees Celsius, or minus 333 degrees Fahrenheit), instead of the predicted 100 Kelvin (minus 173 Celsius, or minus 280 degrees Fahrenheit).

According to Zhang, the excess infrared radiation from haze particles in Pluto's atmosphere should be detectable by the James Webb Space Telescope, allowing confirmation of his team's hypothesis after the telescope's planned launch in 2019.



Pluto's haze layers are visible in this image taken by the New Horizons Ralph/Multispectral Visible Imaging Camera and computer generated to replicate true color. Haze is produced by sunlight-initiated chemical reactions of nitrogen and methane, leading to small particles that grow and settle toward the surface. Credit: NASA/JHUAPL/SwRI

Extensive layers of atmospheric haze can be seen in images of Pluto taken by New Horizons. The haze results from chemical reactions in the upper atmosphere, where ultraviolet radiation from the sun ionizes nitrogen and methane, which react to form tiny hydrocarbon particles tens of nanometers in diameter. As these [tiny particles](#) sink down through the [atmosphere](#), they stick together to form aggregates that grow larger as they descend, eventually settling onto the surface.

"We believe these hydrocarbon particles are related to the reddish and brownish stuff seen in images of Pluto's surface," Zhang said.

The researchers are interested in studying the effects of haze particles on the atmospheric energy balance of other planetary bodies, such as Neptune's moon Triton and Saturn's moon Titan. Their findings may also be relevant to investigations of exoplanets with hazy atmospheres.

Zhang's coauthors are Darrell Strobel, a planetary scientist at Johns Hopkins University and co-investigator on the New Horizons mission, and Hiroshi Imanaka, a scientist at NASA Ames Research Center in Mountain View, who studies the chemistry of [haze](#) particles in planetary atmospheres. This research was funded by NASA.

**More information:** Xi Zhang et al, Haze heats Pluto's atmosphere yet

explains its cold temperature, *Nature* (2017). [DOI: 10.1038/nature24465](https://doi.org/10.1038/nature24465)

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