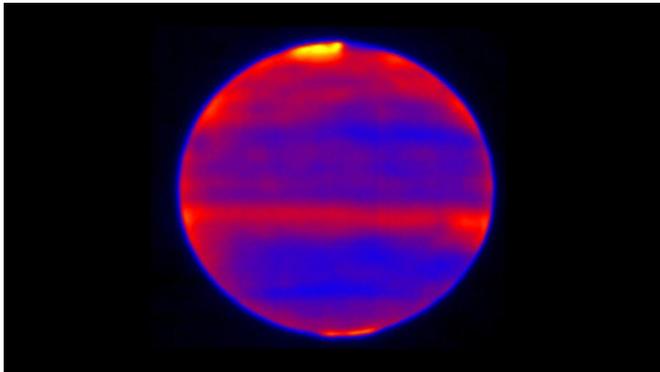


Jupiter's atmosphere heats up under solar wind

9 April 2019



Sensitive to Jupiter's stratospheric temperatures, these infrared images were recorded by the Cooled Mid-Infrared Camera and Spectrograph (COMICS) at the Subaru Telescope on the summit of Mauna Kea, Hawaii. Scientists used red, blue and yellow to infuse this infrared image; regions of the atmosphere that are more yellow and red indicate the hotter areas. This highlights the auroral heating that occurs at Jupiter's poles, where energy from the solar wind and magnetosphere are deposited. This image was captured on Jan. 12, 2017. Credit: NAOJ/NASA/JPL-Caltech

New Earth-based telescope observations show that auroras at Jupiter's poles are heating the planet's atmosphere to a greater depth than previously thought—and that it is a rapid response to the solar wind.

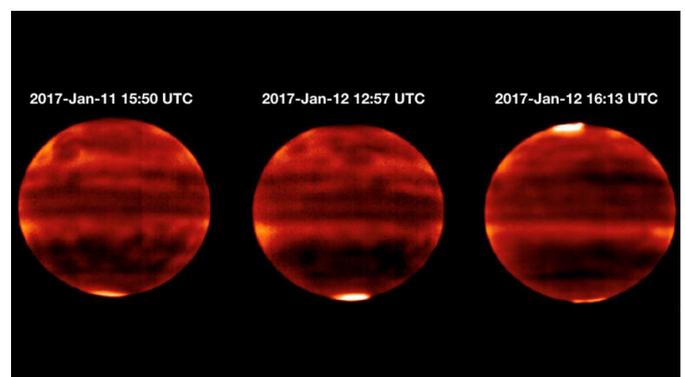
"The solar wind impact at Jupiter is an extreme example of space weather," said James Sinclair of NASA's Jet Propulsion Laboratory in Pasadena, California, who led new research published April 8 in *Nature Astronomy*. "We're seeing the solar wind having an effect deeper than is normally seen."

Auroras at Earth's poles (known as the [aurora borealis](#) at the North Pole and [aurora australis](#) at the South Pole) occur when the energetic particles blown out from the sun (the solar wind) interact

with and heat up the gases in the upper atmosphere. The same thing happens at Jupiter, but the new observations show the heating goes two or three times deeper down into its atmosphere than on Earth, into the lower level of Jupiter's upper atmosphere, or stratosphere.

Understanding how the sun's constant outpouring of solar wind interacts with planetary environments is key to better understanding the very nature of how planets and their atmospheres evolve.

"What is startling about the results is that we were able to associate for the first time the variations in solar wind and the response in the stratosphere—and that the response to these variations is so quick for such a large area," said JPL's Glenn Orton, co-author and part of the observing team.



Sensitive to Jupiter's stratospheric temperatures, these infrared images were recorded by the Cooled Mid-Infrared Camera and Spectrograph (COMICS) at the Subaru Telescope on the summit of Mauna Kea, Hawaii. Areas of the atmosphere that are more yellow and red indicate the hotter regions. Auroras produce enhanced and variable heating at Jupiter's poles. The heating occurs when the magnetosphere and the solar wind interact and deposit energy into Jupiter's atmosphere. Images were captured less than a day apart, from Jan. 11-12, 2017, and illustrate how quickly the atmosphere

varied in response to the solar wind. Credit:
NAOJ/NASA/JPL-Caltech

Within a day of the [solar wind](#) hitting Jupiter, the chemistry in its atmosphere changed and its temperature rose, the team found. An infrared image captured during their observing campaign in January, February and May of 2017 clearly shows hot spots near the poles, where Jupiter's auroras are. The scientists based their findings on observations by the Subaru Telescope, atop the summit of Mauna Kea in Hawaii, which is operated by the National Astronomical Observatory of Japan.

The telescope's Cooled Mid-Infrared Camera and Spectrograph (COMICS) recorded thermal images—which capture areas of higher or lower temperatures—of Jupiter's stratosphere.

"Such heating and [chemical reactions](#) may tell us something about other planets with harsh environments, and even early Earth," said Yasumasa Kasaba of Tohoku University, who also worked on the observing team.

More information: J. A. Sinclair et al. A brightening of Jupiter's auroral 7.8- μ m CH₄ emission during a solar-wind compression, *Nature Astronomy* (2019). [DOI: 10.1038/s41550-019-0743-x](#)

Provided by NASA

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