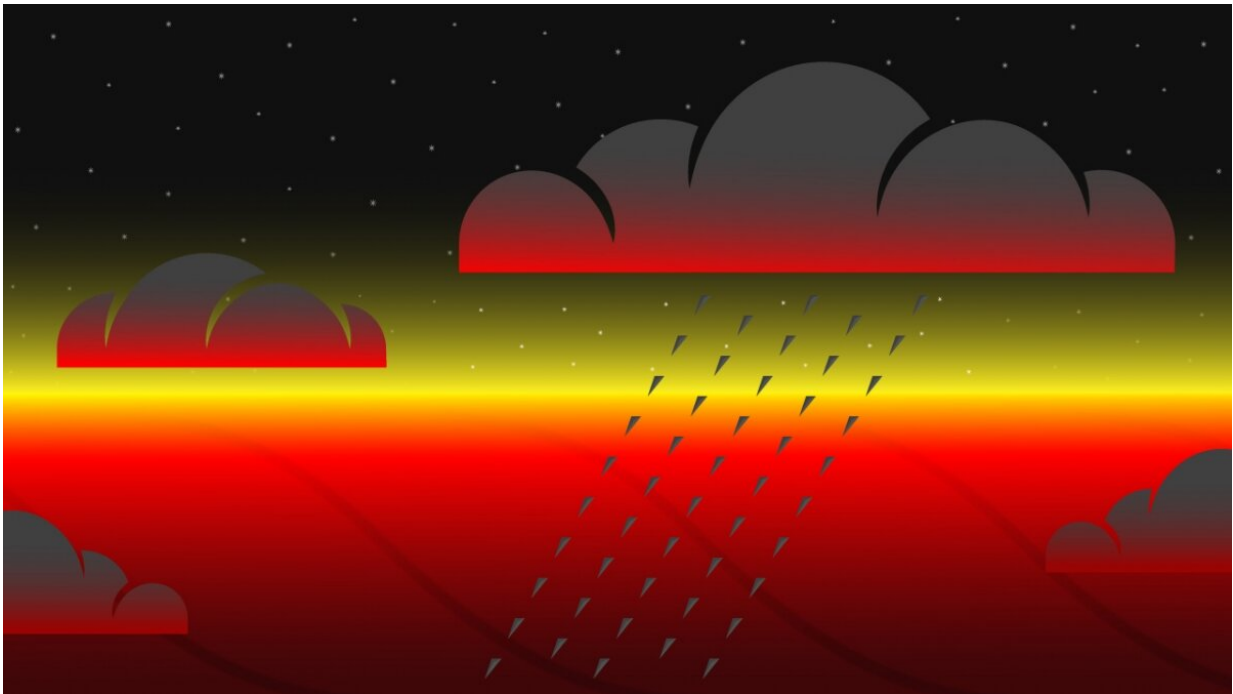


The dark sides of extrasolar planets share surprisingly similar temperatures

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Schematic of clouds on the night side of a hot Jupiter exoplanet. The underlying atmosphere is over 800 C, hot enough to vaporize rocks. Atmospheric motion from the deep atmosphere or from the hotter dayside bring the rock vapour to cooler regions, where it condenses into clouds, and possibly rains down into the atmosphere below. These clouds of condensed rock block outgoing thermal radiation, making the planet's nightside appear relatively cool from space.
Credit: McGill University

A new study by McGill University astronomers has found that the temperature on the nightsides of different hot Jupiters is surprisingly uniform, suggesting the dark side of these massive gaseous planets have clouds made of minerals and rocks.

Using data from the Spitzer Space and the Hubble Space telescopes, the researchers from the McGill Space Institute found that the nightside temperature of 12 hot Jupiters they studied was about 800°C.

Unlike our familiar planet Jupiter, so-called hot Jupiters circle very close to their [host star](#)—so close that it typically takes fewer than three days to complete an orbit. As a result, hot Jupiters have daysides that permanently face their host stars and nightsides that always face the darkness of [space](#), similarly to how the same side of the Moon always faces the Earth. The tight orbit also means these [planets](#) receive more sunlight from their star, which is what makes them extremely hot on the dayside. But scientists had previously measured significant amounts of heat on the nightside of hot Jupiters, as well, suggesting some kind of energy transfer from one side to the other.

"Atmospheric circulation models predicted that nightside temperatures should vary much more than they do," said Dylan Keating, a Physics Ph.D. student under the supervision of McGill professor Nicolas Cowan. "This is really surprising because the planets we studied all receive different amounts of irradiation from their host stars and the dayside temperatures among them varies by almost 1700°C."

Keating, the first author of a new *Nature Astronomy* study describing the findings, said the nightside temperatures are probably the result of condensation of vaporized rock in these very hot atmospheres.

"The uniformity of the nightside temperatures suggests that [clouds](#) on this side of the planets are likely very similar to one another in

composition. Our data suggest that these clouds are likely made of minerals such as manganese sulfide or silicates, or rocks," Keating explained.

According to Cowan, because the basic physics of cloud formation are universal, the study of the nightside clouds on hot Jupiters could give insight into cloud formation elsewhere in the Universe, including on Earth. Keating said that future space telescope missions—such as the James Webb Space Telescope and the European Space Agency's ARIEL mission—could be used to further characterize the dominant cloud composition on hot Jupiter nightsides, as well as to improve models of atmospheric circulation and cloud formation of these planets.

"Observing hot Jupiters at both shorter and [longer wavelengths](#) will help us determine what types of clouds are on the nightsides of these planets," Keating explained.

"Uniformly hot nightside temperatures on short-period gas giants," by Dylan Keating et al. was published in *Nature Astronomy*.

More information: Dylan Keating et al. Uniformly hot nightside temperatures on short-period gas giants, *Nature Astronomy* (2019). [DOI: 10.1038/s41550-019-0859-z](https://doi.org/10.1038/s41550-019-0859-z)

Provided by McGill University

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