Research Highlight

A 'hot Jupiter' with unusual winds

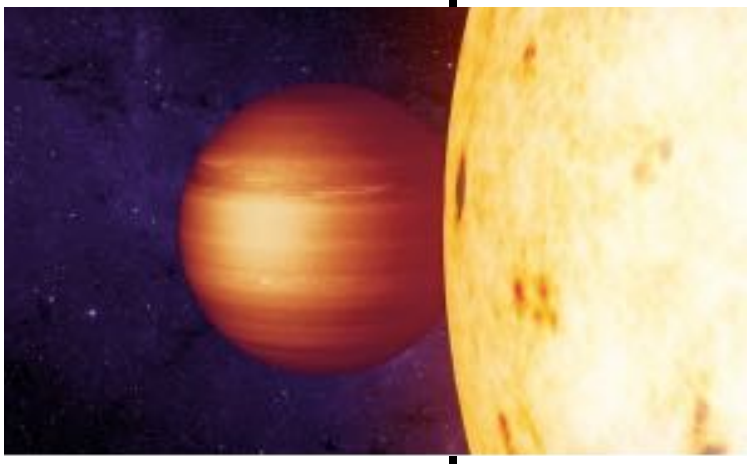
Lisa Dang *is a Ph.D. student in Prof. Nicolas Cowan's research group. Her research is focused on the characterization of Hot Jupiter's atmospheres*

Why this is important

The westward hotspot offset on a hot Jupiter is the first of its kind. All plausible explanations call into question our current understanding of exoplanet science. CoRoT-2b presents an ideal opportunity to improve our understanding through further observation and modelling.

Dang, L., Cowan, N.B., Shwartz, J.C., et al (2018) Detection of a westward hotspot offset in the atmosphere of hot gas giant CoRoT-2b, Nature Astronomy, 2(3), 220.

Below: Artist's rendition of gaseous exoplanet CoRoT-2b with a westward hot spot in orbit around its host star. Credit: NASA/JPL-Caltech/T. Pyle (IPAC)



The hottest point on a gaseous planet near a distant star isn't where astrophysicists expected it to be – a discovery that challenges scientists' understanding of the many planets of this type found in solar systems outside our own.

Unlike our familiar planet Jupiter, so-called hot Jupiters circle astonishingly close to their host star, so close that it typically takes under three days to complete an orbit. And one hemisphere of these planets always faces its host star, while the other faces permanently out into the dark.

Not surprisingly, the "day" side of the planets gets vastly hotter than the night side, and the hottest point tends to be the spot closest to the star. Astrophysicists theorized and observed that these planets also experience strong winds blowing eastward near their equators, which can sometimes displace the hot spot toward the east. All hot Jupiters observed so far have had winds blowing to the east, as theory would predict, until now.

In the mysterious case of exoplanet CoRoT-2b, however, the hot spot turns out to lie in the opposite direction: west of center. Research led by MSI student Lisa Dang made the discovery using NASA's Spitzer Space Telescope. CoRoT-2b, discovered a decade ago by a French-led space observatory mission, is 930 light years from Earth. With an inflated radius and a remarkably featureless spectrum, this target is not a typical hot Jupiter. Now, a westward offset can be added to the list of unusual characteristics, and this may not be coincidental.

The researchers offer three possible explanations for the unexpected discovery, each of which raises new questions:

- The planet could be spinning so slowly that one rotation takes longer than a full orbit of its star; this could create winds blowing west rather than east, but it would also undercut theories about planet-star gravitational inter-action in such tight orbits.
- The planet's atmosphere could be interacting with the planet's magnetic field to modify its wind pattern; this could provide a rare opportunity to study an exoplanet's magnetic field.
- Large clouds covering the eastern side of the planet could make it appear darker than it would otherwise – but this would undercut current models of atmospheric circulation on such planets.

"We'll need better data to shed light on the questions raised by our finding," Dang says. "Fortunately, the James Webb Space Telescope, scheduled to launch next year, should be capable of tackling this problem. Armed with a mirror that has 100 times the collecting power of Spitzer's, it should provide us with exquisite data like never before."

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