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The ultra-cold night sides of the hot and super-hot Jupiters WASP-43b and WASP-18b, arising with deep wind flow

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Abstract

We have shown that the hot Jupiter WASP-43b may develop strong westward winds at the equatorial day side, that is, anti-rotation - if deep wind flow ($p > 10$ bar) is taking into account [1]. Because equatorial anti-rotation prevents efficient horizontal heat transport, we also predict that the night side of WASP-43b will emit very little thermal flux (≤ 1000 ppm) for wavelengths 5 - 12 micron.

Here, we compare our 3D climate results for the hot Jupiter WASP-43b (Teff=1400 K) with new results for the super-hot Jupiter WASP-18b (Teff=2400 K) that was recently shown to also have inefficient horizontal heat distribution [2]. In the work of [2], the observational signals were explained by imposing magnetic drag throughout the atmosphere, which suppresses zonally banded jets and leads to direct or radial day-to-night-side flow. We will show an alternative climate scenario for WASP-18b with (partially) banded wind flow in our 3D GCM with deep wind flow.

We predict that, JWST/MIRI observations of the thermal emission at the night side of WASP-43b and WASP-18b will unambiguously distinguish between a climate scenario with wind flow at depth and ultra-cool night sides and other scenarios (fully superrotating jet with clouds [3] and drag-induced climate without jets [2]).

References

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