Spatial characterization of the trailing and leading limbs of WASP-76b: detection of H2O and HCN at high-resolution

Sánchez López, A.; Landman, R.; Casasayas Barris, N.; Kesseli, A.Y.; Snellen, I.A.G.

EPSC Abstracts
Vol. 15, EPSC2021-563, 2021, updated on 20 Jan 2022
https://doi.org/10.5194/epsc2021-563
Europlanet Science Congress 2021

Spatial characterization of the trailing and leading limbs of WASP-76b: Detection of H_2O and HCN at high-resolution

Alejandro Sánchez López, Rico Landman, Núria Casasayas Barris, Aurora Kesseli, and Ignas Snellen
Leiden Observatory - Leiden University

Extreme temperature contrasts between the day and nightside of ultra-hot Jupiters (UHJ) result in significantly asymmetric atmospheres, with a region of extreme atmospheric expansion appearing over a small range of latitudes around the terminator. Over the course of a transit, WASP-76 b rotates by about 30° and hence temporal variations of the observable atmosphere could significantly affect the detectability of its constituents. Specifically, the trailing limb of this planet allows us to probe a significant portion of the inflated dayside, resulting in a higher atmospheric detectability. This geometric effect could mimic the observed time-variability of absorption signals due to condensation in the nightside of these planets, which has been recently reported for neutral iron in WASP-76 b. By studying molecules that are not expected to condense in the nightside of UHJs (~1000K), we can isolate the possible effect of different day and nightside scale heights. Here, we will analyze a stronger water vapor signal during the egress of the planet than at ingress, which cannot be explained by condensation and suggests that the extreme geometry of UHJ manifests itself as time-dependent absorption signals. Additionally, we report a redshifted HCN signature arising from the leading limb (i.e., observable in the first half of the transit and absent from the second half) and a weak evidence of ammonia using high-resolution observations of WASP-76 b with CARMENES.