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Evidence for strong C/O gradients in the atmosphere of WASP-76 b?

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Extreme temperature contrasts between the day and nightside of ultra-hot Jupiters result in significantly asymmetric atmospheres, with a large expansion occurring over a small range of longitude around the terminator. Over the course of a transit, WASP-76 b rotates by about 30°, changing the observable part of the atmosphere and invoking variations in the appearance of its constituents. Specifically, during the latter part of the transit, the planet's trailing limb probes an increasing portion of its inflated dayside, which has a higher atmospheric detectability in transmission. As recently reported, this results in time-variable effects in the neutral iron signal, amplified by its possible condensation on the nightside. Here, we will show the detection of molecular signals during a transit of WASP-76 b and compare the contributions from the morning and evening terminators. The results are somewhat puzzling, with simultaneous detections of H_2O and HCN but at significantly different positions in the K_P-V_{sys} map, with a blueshift of -14.3±2.6 km s^{-1} and a redshift of $+20.8^{+7.8}_{-3.9}$ km s^{-1} respectively, and a higher K_P than expected. The H_2O signal also appears stronger towards the second half of the transit, in contrast to that of HCN, which seems stronger early on. We tentatively explain this by silicate clouds forming and raining out on the nightside of the planet, partially removing oxygen from the upper atmosphere. For atmospheric C/O values between 0.7 and 1 this leads to the formation of HCN at the planet's morning limb (flowing away from the observer). At the evening terminator, with the sequestered oxygen being returned to the gas phase due to evaporation, these C/O values lead to formation of H2O (flowing towards the observer), instead of HCN. Overall, if confirmed, these results indicate that individual molecules trace different parts of this exoplanet's atmosphere, as well as nightside condensation, allowing spatial characterization.