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Detection of OH at the evening terminator of the ultra-hot Jupiter WASP-76b

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Ultra-hot Jupiters have dayside temperatures similar to those of M-dwarfs. While molecular absorption from the hydroxyl radical (OH) is easily observed in near-infrared spectra of M-dwarfs, it is often not considered when studying the atmospheres of (ultra-)hot Jupiters. We use high-resolution spectroscopic near-infrared observations of a transit of WASP-76b obtained using CARMENES to assess the presence of OH. After validating the OH line list, we generate model transit spectra of WASP-76b with petitRADTRANS. The data are corrected for telluric contamination and cross-correlated with the model spectra. After combining all cross-correlation functions from the transit, a detection map is constructed. OH is detected in the atmosphere of WASP-76b with a signal-to-noise ratio of 6.1. From a Markov Chain Monte Carlo retrieval we obtain Kp=234 km/s and a blueshift of 13.9 km/s. Considering the fast spin-rotation of the planet, the OH signal is best explained with the signal mainly originating from the evening terminator and the presence of a strong day- to nightside wind. The signal appears to be broad, with a full width at half maximum of 16.2 km/s. The retrieval results in a weak constraint on the temperature of 2420-3150 K at the pressure of the OH signal. Our results demonstrate that OH is readily observable in the transit spectra of ultra-hot Jupiters. Studying this molecule can give new insights in the molecular dissociation processes in the atmospheres of such planets.