Tracing Atmospheric Energy Balance in Ultra-Hot Jupiters: A Second OH Detection with IRD/Subaru

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Ultra-hot Jupiters (UHJs) are highly irradiated gas giants with dayside temperatures above 2200 K, making them useful laboratories for studying planetary atmospheres under extreme conditions. One important question is how their atmospheric energy balance is controlled and how thermal inversions are produced. Optical absorbers such as TiO/VO and atomic species have been proposed as sources of upper-atmosphere heating. However, while atomic species are commonly detected on the daysides of UHJs, TiO/VO has only been detected in a small number of systems. Another possibility is that the thermal dissociation of H_2O reduces infrared cooling, which may help produce or maintain thermal inversions.

Using IRD/Subaru, we previously detected OH emission from WASP-33b, providing direct evidence for H_2O thermal dissociation in an exoplanet atmosphere. In this talk, we present new IRD/Subaru observations of another UHJ. Using high-resolution cross-correlation spectroscopy, we detect an emission signal from the planet's dayside at >7σ, revealing the presence of a thermal inversion. Further investigation shows that this signal mainly arises from Fe I and OH emission, detected at 5.2σ and 5σ, respectively. This is the second OH detection with IRD/Subaru. Since this planet is cooler and has lower gravity than WASP-33b, the result extends OH detections to a different region of UHJ parameter space and brings us closer to understanding the energy balance of UHJ atmospheres.