

A Balmer lines view of the KELT-9 b atmosphere

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Abstract

KELT-9 b (the hottest known hot Jupiter) is the archetype of the new class of ultra hot Jupiter ($T_{\text{eq}} \gtrsim 2000\text{--}2500$ K). These planets are thought to be in chemical equilibrium and for the hottest one to have an atmosphere dominated by neutral and ionized atomic species, such as FeI, FeII, TiI, TiII, etc., some of which were recently detected in KELT-9 b. Recently, $H\alpha$ and $H\beta$ have also been detected in the KELT-9 b atmosphere. Particularly, the $H\alpha$ absorption hints that the hydrogen is filling the planetary Roche lobe and can escape from the planet, confirming that such object undergoes evaporation. In this work, we study the Balmer lines ($H\alpha$ to $H\zeta$) in the optical transmission spectrum of KELT-9 b obtained with the HARPS-N spectrograph. We found significant absorptions for $H\alpha$, $H\beta$ and $H\gamma$, and hint of absorption for $H\delta$. The absorptions level of those lines allowed us to put new constraints on the hydrogen population in the KELT-9 b atmosphere, on its temperature and its evaporation rate.