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UV emissions of Hot Jupiters

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In the solar system, the giant planets Jupiter and Saturn have bright aurorae due to particle precipitation in the upper atmospheres. The brightest optical auroral emissions are emitted by H and H_2 in the UV and by H_3^+ in the IR.

Due to the short distance to the parent stars, hot Jupiters are likely to be bombarded by intense stellar winds and UV fluxes and have strong emissions at the same wavelengths.

When detected, their UV emissions could bring helpful information to characterize the upper atmospheres of the exoplanets. The first question to address is : are these emissions bright enough to be observed from Earth and distinguished from the stellar UV emissions ? We focus on Jupiter-like atmospheres, composed of H, H_2 and He. Kinetic calculations allow to estimate the electron flux throughout the atmosphere and to calculate excitation rates of the upper levels of UV transitions of H and H_2. Radiative transfer calculations are then done to estimate the intensity of the emergent lines and the profile of the H Lyman alpha line.

Using the Yelle (2004) atmosphere model for HD209458b, we evaluate the H Lyman alpha dayglow of the planet. We also evaluate UV emissions of the planet caused by the precipitation of particles with and without an intrinsec magnetic field. We find that the Lyman alpha emission of the planet could reach 1/1000 of that of the star.

It has been shown that the profile of the H Lyman alpha line is very sensitive to the atmospheric model and to the energy of the precipitating electrons (Menager et al. 2010). We see here a way to constrain the upper atmosphere of exoplanets and their particle environment, that could be used by future UV telescopes.

References

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