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Improving planetary atmosphere characterization by 3D NLTE modeling of the stellar centre-to-limb effect

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The center-to-limb variation (CLV) of the stellar lines across the stellar disk is an important effect for planetary transit spectroscopy. Indeed the variation of spectral line profiles when the planet transits different part of the stellar disk can affect the determination of elemental abundances in the planetary atmospheres, as shown by Yan et al. (2017). Accurately modeling the CLV effect of planet-host stars is fundamental to better characterize the planetary transmission spectrum and to correctly detect and measure abundances of atmospheric species.

However, we know that the commonly used 1D plane-parallel LTE atmosphere models fail to reproduce spatially resolved observations of the solar disk. 3D hydrodynamic models and non-LTE line formation is required for an accurate modeling of the CLV effect.

So far, the best studied atomic lines in transit spectroscopy are the Na D lines and the NIR K resonance lines. In this talk I will present new results regarding the modeling of these lines in the Sun using 3D NLTE radiative transfer and discuss possible implications for transit spectroscopy.

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