Probing the atmospheric dynamics, clouds and chemistry of brown dwarfs and young giant exoplanets

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Brown dwarfs and young giant exoplanet are subject to variability and colour changes, known as the L/T transition, fundamental for their thermal evolution. Clouds are expected to be the main driver of the L/T [1,2]. Using a three-dimensional Global Climate Model, we show that clouds play a major role in shaping the atmospheric properties of brown dwarfs, in agreement with the observed variability and L/T transition [3]. A major consequence of our 3D simulations is the preferential cloud formation in the equatorial region, leading to a latitudinal thermal gradient which could impact the atmospheric chemistry. We show that observations at high spectral resolution can be used to test the scenario of an equatorial cloud band by probing latitudinal chemical and cloud variations. We apply this technic to CRIRES+ observations of the late L-dwarf DENIS J0255-4700 [4]. Finally, we discuss the great potential of this method for current instruments (i.e. VLT-Hirise, CFHT-SPIRou) and future instruments on the ELT (i.e. ANDES, METIS, PCS).

References

- [1] Marley et al., ApJ 2010
- [2] Charnay et al., ApJ, 2018
- [3] Teinturier et al., in revision
- [4] Charnay et al. in prep