Title : 3D Modeling of the Hot Jupiter WASP-43 b using the LMDZ Global Climate Model

Understanding the atmospheric circulation, radiative transfer, and atmospheric chemistry of exoplanets is crucial to more accurately characterize these objects. In particular, Hot Jupiters are the most observed type of exoplanets. In the last decade, observing efforts have been made to begin the atmospheric characterization of these objects, in parallel to modeling efforts to understand these data.

We set out to use the LMD Generic model, a 3D Global Climate Model developed for paleo-climate and temperate exoplanets studies, to simulate the atmosphere of Hot Jupiters. As a case study, we chose to model WASP 43-b, a Hot Jupiter with an orbital period of 19.5 hours and an equilibrium temperature of 1400 K. This planet has been observed by HST and Spitzer, which makes it one of the most observed Hot Jupiters. It will supposedly be observed by the James Webb Space Telescope.

Our first simulations, using the LMDZ5 dynamical core, are able to replicate the already known atmospheric patterns of the atmospheres such as the equatorial super-rotating jet and the strong day/night temperature contrast, in a non cloudy case. Moreover, we study the effect of the depth of the lower boundary of the model, and the impact of the deep thermal structure on the atmospheric dynamic.

We also set out to use the new massively parallel dynamical core DYNAMICO, developed at LMD. It uses a quasi-uniform icosahedral C-grid instead of a traditional longitude/latitude grid, to solve the primitive hydrostatic equations assuming a shallow atmosphere.

We are currently working on including a generic scheme in the model which will take into account the condensation and sedimentation of any condensate clouds (Fe, Mg_2SiO_4, MnS,...). Confronting these simulations to phase curves will allow the characterizations of clouds condensates in the atmosphere of these hot irradiated planets.