Abstract SF2A

Title: The coupling of interieur and atmosphere exoplanetary models to determine the thermal evolution of exoplanets.

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As planets age, they evacuate internal energy as such their thermal profile changes as well as the effective entropy. This temporal evolution will lead to changes in observed luminosity and radius of a planet. The modeling of the thermal evolution requires a planetary model with rigorous equations of state for the composition. The equations of state with a hydrostatic equilibrium model help give the radius of a planet for a given thermodynamic configuration. Work on this by Marley & al. (2006) or Fortnay & al. (2009) showed that one can estimate the evolution of the radius of a Jupiter like planet over time given an initial starting entropy and with the H/He equation of state by Saumon et al. (1995). However, these models uniquely evaluate the radii without considering the complex atmosphere equilibrium essential from an observational point of view. Subsequent models such as by Marley et al. (2021) couple atmosphere models with more rigorous interieur equations of state which act as a boundary condition. By doing this, one has access to the temporal evolution of the spectra as well as the radius. We propose a similar approach where we seek to link the 1D self-consistent radiative convective atmosphere model, Exorem (Blain et al.), with a planetary interieur model, Exoris (Mazevet et al.). By linking the thermal profiles of these two models we can have a complete model considering the high pressure and temperature conditions of the interieur and the complex radiative and chemical properties of the atmosphere. Exorem gives us the added possibility of exploring the impact of parameters such as clouds and stellar irradiation on the evolution of the spectrum and radius. Exorem also disposes of a disequilibrium chemistry model, rendering the atmospheric modeling more precise. Exoris allows us to create more complex interiors combining radial shells with different compositions. By linking precisely, the thermal profiles we can get an insight into the planetary interior. We shall first explore how the atmosphere and interior models function before showing how they can be linked. Finally, we will look at the type of results that we can obtain from this combined model. We will notably explore how these results fit into the type of observations we can hope to obtain with JWST for Jupiter and sub-Jupiter like planets