A journey to the interior of ultra short period planets

Mathilde Kervazo*[1] and Vincent Bourrier[1]

[1]Observatoire Astronomique de lÚniversité de Genève – Suisse

Résumé

Half of known exoplanets orbit close to their star, featuring a desert of hot Neptunes whose origins remain uncertain. The lower border of the desert ends in a population of small rocky planets ($\leq$ 2 R$\oplus$) on ultra-short periods ($\leq$ 1 day) called USPs. These USPs are central to study planetary evolution around the desert, as they might be the exposed rocky cores of evaporated gaseous planets. Due to their proximity to the star, the surface temperature of USPs are expected to be higher than the melting point of most rock-forming minerals. Their likely molten unstable surface, which could lead to significant outgassing from magma oceans or active volcanoes, and the formation of a dust- and metal-rich envelope, would significantly affect the composition of the outer enveloppe. There is thus a need in characterising the internal structure of planets subjected to such extreme conditions.
Most studies concerned with interior characterization have generally concentrated on computing mass-radius relations based on terrestrial-type interior structures and compositions. Such "forward" approaches, however, allow for different core sizes and mantle compositions, affecting the mass-radius relationship, and do not quantify the inherent degeneracy of interior structure models. In the light of this inherent ambiguity, some studies propose a complete Bayesian inverse analysis by employing a Markov chain Monte Carlo method to provide full probability distributions for the model parameters of interest.
In this context, the goal of our study is to develop a coherent internal structure model for the specific USP population and to derive samples of properties on their internal structure, by performing a statistical method which allows to characterize an exoplanet's interior given its mass and radius. For that purpose, we use the simulation code call the Bayesian Interior Characterisation of ExoPlanetS (BICEPS) model, and adapt it to USPs in order to better understand the formation and orbital evolution of short-period planets.

*Intervenant