Detectability of magnetic star-planet interactions in compact exosystems

Antoine Strugarek*[1], Rim Fares , Vincent Bourrier , Allan Sacha Brun , Jean-Francois Donati , and Claire Moutou

[1]Département d'Astrophysique-AIM, CEA/IRFU, CNRS/INSU, Université Paris-Saclay, Université Paris Diderot, Université de Paris, 91191 Gif-sur-Yvette, France – AIM, CEA, IRFU, DAp – France

Résumé

Close-in planets are thought to generally orbit in a sub-alfvénic stellar wind. The perturbations they excite in the stellar corona are able to travel upwind down to the stellar surface, and potentially induce observable phenomena. The effective connection between the planet and its host takes the form of two Alfvén wings. The stellar global magnetic field is at the heart of star-planet magnetic interaction: its strength sets the magnetic energy available for the interaction, its shape determines the connection path between the star and the planet, and its temporal modulation (e.g. magnetic cycles) is at the source of an on/off behavior of the magnetic interaction. I will briefly give an overview of our understanding of star-planet magnetic interactions and propose scaling laws for their amplitude. I will then present specific studies of the 3D star-planet magnetic interactions, in the Kepler-78 system and in HD 189733. I will show how stellar rotation, planetary orbit, and stellar magnetic topology come all in play to modulate the signal from star-planet magnetic interactions. By analysing such signal based on 3D numerical simulations, I will show that we can explain the difficulty to detect them with existing observational campaigns of HD 189733 (e.g. Cauley et al. 2018). Our results warrant dense spectroscopic observational campaigns, coupled to spectro-polarimetric campaigns to firmly detect star-planet magnetic interactions. Such firm detections would open up the possibilities to characterise the magnetic field of distant exoplanets on short orbit.

*Intervenant