Contribution ID: **21** Type: **not specified**

Modelling the Effects of Stellar Magnetic Fields on (Exo)Planetary Magnetosphere - Atmosphere systems with Implications for Habitability

Tuesday 25 April 2023 14:05 (15 minutes)

The long-term evolution of stellar magnetic activity governs the environment of the orbiting planets impacting their habitability. We perform three-dimensional magnetohydrodynamic simulations followed by a detailed parameter space study to understand the effect of variation in stellar wind magnetic field and intrinsic magnetosphere on the planetary magnetic field topology and atmospheric mass loss rate. We find that the relative strength of the planetary magnetic field with respect to that of stellar wind plays a critical role in determining the steady-state magnetospheric configuration and atmospheric erosion. Either strengthening the stellar wind magnetic field or weakening the planetary magnetospheric strength results in stellar field accumulation in front of the planet, similar to that of an imposed magnetosphere. We explore the formation of Alfvén wings on the planetary night-side wake region at different magnetic activity levels. We identify reconnection processes and wind conditions that lead to the bifurcation of the current sheet in the magnetotail. With increasing stellar wind magnetic field strength, the day-side reconnection point approaches the planet, thereby increasing the mass-loss rate. Our model results demonstrate the existence of an analytical relationship between atmospheric mass loss rate and ratio of planetary to stellar wind magnetic field strengths. Our study has far-reaching implications in the context of star-planet interaction and (exo)planetary habitability.

Author: Ms GUPTA, Sakshi (Indian Institute of Science Education and Research Kolkata, Near Haringhata farm, Nadia, West Bengal, India)

Presenter: Ms GUPTA, Sakshi (Indian Institute of Science Education and Research Kolkata, Near Haringhata farm, Nadia, West Bengal, India)

Session Classification: Solar System & extrasolar planets