

AN MHD MODELING APPROACH TO UNDERSTAND THE DYNAMIC LUNAR ENVIRONMENT IN THE GEOTAIL. Souvik Roy¹, Srikar P Tadepalli², Ranadeep G Dastidar³, Arnab Basak¹, Arghya Mukherjee¹, Shyama Narendranath², Dibyendu Nandy^{1,4}; ¹Center of Excellence in Space Sciences India, Indian Institute of Science Education and Research Kolkata; Mohanpur 741246, India, email: sr18rs037@iiserkol.ac.in ²Space Astronomy Group, U R Rao Satellite Centre, ISRO; Bengaluru 560017, India, ³Department of Physics and Astronomy, Purdue University; West Lafayette 47907, USA, ⁴Department of Physical Sciences, Indian Institute of Science Education and Research Kolkata; Mohanpur 741246, India.

Introduction: The moon spends most of its time exposed to the solar wind acting as a passive absorber of the impinging solar wind particles, akin to a non-magnetized obstacle in high-Mach plasma. However, in each lunation, during its six days transit through the Earth's magnetotail, the moon is apparently shielded from solar transients. How is this environment like? Observations from Chandrayaan-2 Large Area Soft X-ray Spectrometer (CLASS) on board the Chandrayaan-2 indicate the moon experiences a flux of energetic particles in the geotail, pointing out it is a dynamic environment. We have developed a solar wind-driven, three-dimensional magnetohydrodynamic (MHD) star-planet-moon interaction module to study the lunar environment under the forcing of the solar wind and the dynamic magnetotail. In our simulations, we find that the moon's presence modifies the magnetic structure around its vicinity when in the geotail region. Based on our analysis of the in-situ spacecraft data as well as the simulated data from our model, we propose that non-neutral current sheets form around the Moon, which accelerate electrons to higher energies. Our results are relevant for understanding the lunar space environment and (exo)planetary systems and their interactions with (exo)moons.

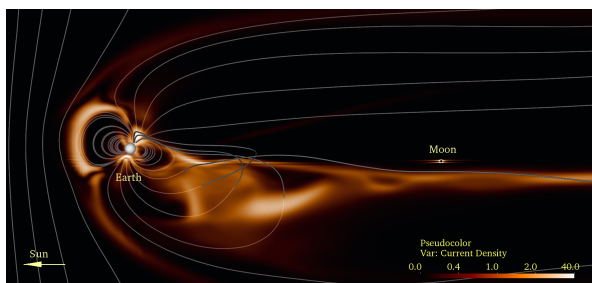


Figure Caption: An xz plane slice of the steady state of the simulated Earth-Moon system shaped by the solar wind. The background colour-map shows the total current density in units of nA/m^2 . The colour palette has been saturated at the maximum to show weaker currents. Grey lines represent projections of 3D magnetic field streamlines on the plane. The geotail current sheet extends from the night side of the Earth and passes below the Moon.