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Solar wind interaction with a lunar magnetic anomaly: Hybrid modelling results

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New in situ plasma, neutral atom and magnetic field observations done by recent lunar missions have revealed that the solar wind interaction with the Moon is more complex and scientifically more interesting than anticipated before. Especially, an unexpectedly high fraction of the incident solar wind protons is reflected from the surface, and an even larger fraction by the lunar magnetic anomalies. Such reflection has been observed both by measuring deviated solar wind ion flow near the magnetic anomalies and by observing decreased flux of energetic neutral hydrogen atoms, H-ENAs, from the surface region of strong magnetic anomalies. These processes affect the properties of plasma near the lunar surface.

In this work we study the solar wind interaction with a lunar magnetic anomaly by a 3D hybrid model (HYB-Anomaly). In the hybrid model, ions are modelled as particles while electrons form a charge neutralizing massless fluid. The HYB-Anomaly model can also simulate H-ENA productions when the solar wind protons hit against the surface. The magnetic anomaly has a surface strength of the order of 100nT, producing an interaction region with length scales at or below proton inertial length scales. We find an upward electric field responsible for the deceleration of precipitating protons, which is consistent with observed H-ENA features. In this presentation, we further discuss the dependence of H-ENA emissions on the direction of the interplanetary magnetic field.