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# Modelling of the solar wind interaction with a lunar magnetic anomaly at macro and micro scales

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Recent lunar missions have shown that the solar wind interaction with the Moon is complex and scientifically more interesting than anticipated before, as shown by new in situ plasma, neutral atom and magnetic field observations. 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. This effect 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 ”macro scale” processes affect the properties of plasma near the lunar surface. Consequently, also physical processes at ”micro scales” within the Debye sheath layer, where the electric potential of the surface and near surface region are controlled by photoelectrons and solar wind particles, are affected.

In this work we study the solar wind interaction with a lunar magnetic anomaly by two numerical kinetic simulation models: (1) a 3D hybrid model (HYB-Anomaly) to study macro scale processes and (2) a full kinetic 1D and 2D Particle-in-cell (PIC) model to study micro scale processes. In the hybrid model ions are modelled as particles while electrons form a charge neutralizing massless fluid. The hybrid model also includes energetic neutral hydrogen atoms, H-ENAs, which are formed in charge exchange processes on the lunar surface when solar wind protons hit against it. In the PIC simulations both ions and electrons are modelled as particles. In the presentation we discuss, based on these models, properties of plasma near the lunar surface, its modification by a lunar magnetic anomaly and the reflected flux of ions and H-ENAs, which serves as messengers for the interaction processes at the surface.