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

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Abstract

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 processes affect the properties of plasma near the lunar surface.

In this work we continue [1] to 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 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 presentation we analyse, based on the HYB model, 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.

References

[1] Kallio,E., R. Jarvinen, S. Dyadechkin, P. Wurz, S. Barabash, F. Alvarez, V. Fernandes, Y. Futaana, J. Heilimo, C. Lue, J. Makela, N. Porjo, W. Schmidt and T. Siili, Kinetic simulations of finite gyroradius effects in the lunar plasma environment on global, meso, and microscales, *Planetary and Space Science*, http://dx.doi.org/10.1016/j.pss.2012.09.012, 2012.