Geophysical Research Abstracts
Vol. 13, EGU2011-695, 2011
EGU General Assembly 2011
© Author(s) 2010

Modeling the solar wind proton velocity space distribution function in the near lunar wake

Shahab Fatemi, Mats Holmström, and Yoshifumi Futaana
Swedish Institute of Space Physics (IRF), Kiruna, Sweden (shahab@irf.se)

Solar wind proton fluxes have been observed close to the Moon in the lunar wake. In this study, we investigate how these solar wind protons can access the lunar wake by using a 3D hybrid model of plasma (particle ions and fluid electrons). However, since the protons density at the lunar night side is several order of magnitudes less than that of the solar wind, the number of particles in a hybrid model is too small to examine the proton kinetics there. To improve the statistics, a Backward Liouville method is used, where the electric and magnetic fields of the interaction region are obtained from the hybrid simulation results, and ion trajectories are computed backward in time from the location of interest using these fields. This allows us to study the proton velocity space distribution function at the lunar night side in detail, and to compare our modeling results with the observations performed with the SARA (Sub-keV Atom Reflection Analyzer) instrument on-board Chandrayaan-1, which observed proton fluxes in the lunar wake, $\sim 50^{\circ}$ behind the terminator in the equatorial plane of the Moon, and at a height of 100 km [Futaana Y. et al., 2010, Journal of Geophysical Research, Vol. 115, A10248]. It is shown that our model can explain the reported observation of higher energy and lower density than predicted by 1-D gas-dynamic theory, if we assume an anisotropic solar wind velocity space distribution function. In addition, the absorption effect of the lunar surface on the solar wind proton energy, density and velocity space distribution function in the lunar wake are discussed.