Decrease of magnetic field strength in the foremoon solar wind for parallel IMF

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Interaction between the lunar surface and incident solar wind is one of the unsolved problems of the lunar plasma sciences. The Kaguya (SELENE) measurements revealed that about 1 percent of incident solar wind protons are scattered at the lunar dayside surface and re-picked up by the motional electric field to affect the ambient solar wind as well as the lunar wake. However, few studies have been performed for the parallel IMF case, except for wave observations by ARTEMIS spacecraft. Here we show an event where strength of the IMF decreases at 100 km altitude on the lunar dayside when the IMF is almost parallel to the incident solar wind flow, comparing the upstream solar wind data from ACE and WIND with Kaguya magnetometer data. The lunar surface below the Kaguya orbit is not magnetised, and the upward-going protons show signatures of those scattered at the lunar surface. We find that the decrease in the magnetic pressure is compensated by the thermal pressure of the back-scattered protons. We note that the observed phenomena are to some extent similar to those of bow-shock reflected ions in the terrestrial foreshock and may generally take place as a result of interaction between solar wind and non-magnetised body.

Keywords: Solar wind - Moon interaction, Interplanetary magnetic field, Kaguya (SELENE), Proton scattering

