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Numerical simulation of ion reflection by lunar crustal magnetic fields

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We investigate the dynamics of solar wind - Moon interaction by means of large-scale Particle-in-Cell (PIC) simulations in this study. Implicit moment PIC method and open boundaries are implemented in the code (iPIC3D) allowing to use large-scale domains in three dimensions. Even though the Moon has no global dipolar magnetic field, satellite magnetic field measurements at low-altitude (8-80 km) orbits discovered the presence of patches of intense remanent magnetization of the lunar crust. In order to simulate the scattering effect of the lunar remanent magnetic field we implemented an empirical proton reflection model based on low-attitude survey by the Chandrayaan-1 spacecraft [Lue, 2011]. In this study we focus on the day side effects only and thus do not resolve wake and limb effects. Reflected ions are found to create an energized population of particles in the solar wind and are responsible for sub-ion scale instabilities over the strongest anomalies with non-Maxwellian ion distribution functions.