37th COSPAR Scientific Assembly 2008

Space Studies of the Earth-Moon System, Planets, and Small Bodies of the Solar System (B)
The Moon: Science, New Results, Ongoing Missions, Future Robotic and Human Exploration (B01)

FULL PARTICLE SIMULATION OF THE ELECTRIC FIELD STRUCTURE AROUND THE MOON AND THE LUNAR WAKE

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The electric field structure around the moon is studied by using a 2-dimensional electromagnetic full particle simulation. By considering absorption of the plasma particles at the surface of the moon, we obtain an intense electric field at the terminator region where the electric field produced by the negatively charged lunar surface and the ambipolar electric field at the wake boundary are in the same direction. The intensity of the electric field is 2.2 E_0, where $E_0 = m_0 v_e \omega_p / q_0$, at the terminator. It corresponds to 3.5 [Vm^{-1}] in the solar wind. It has a large horizontal component due to the potential difference between the negatively charged, antisolarside surface of the moon and the electrically neutral, solar-side surface, even though the emission of photoelectrons are not taken into consideration in this study. The half width of the electric field structure is of the order of Debye shielding length. The electric field at the downstream wake boundary at x = 6.5 R_L is still as large as 0.1 $E_0 \sim 0.16[\mathrm{Vm}^{-1}]$, which is strong enough to cause the pitch angle diffusion of the solar-wind electron beam as expected in the generation mechanism of the wake-related whistler wave. The ion acceleration occurs in the close vicinity of the moon. It is explained by the acceleration by the electric field produced by the surface charging of the moon.