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Numerical simulation of the solar wind-Moon interaction using 3D Particle-in-Cell (PIC) simulations.

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We present results of three-dimensional Particle-in-Cell (PIC) simulations of quiet solar wind-Moon interaction using full-particle electromagnetic implicit code iPIC3D. The Moon is taken as a passive absorber of the inflowing particles, without intrinsic magnetic fields or resistivity. We show that (similar to past 1D, 2D PIC and 3D hybrid studies) the large-scale Lunar wake with nearly zero density is formed, which is bounded by strong rarefaction and compression waves attached to the Moon.

We investigate in detail velocity distribution functions (VDFs) and ion and electron moments in the wake, including regions with very small macroparticle count. In order to reconstruct the distributions in low-density wake, we sample VDFs using a backward Liouville method by tracing particles back in time in quasisteady electric and magnetic fields taken from original 3D PIC simulation. Obtained VDFs display large degree of anisotropy and nongyrotropy and reveal fine-scale features which can be interpreted as the Moon's shadow in velocity domain.