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3D implicit PIC simulations of solar wind - moon interactions

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We present three-dimensional Particle-in-Cell simulations of an unmagnetized insulating Moon-sized body immersed in the solar wind. The simulations are performed using the implicit electromagnetic Particle-in-Cell code iPIC3D [Markidis, 2009]. Multiscale kinetic physics is resolved for all plasma components (heavy ions, protons and electrons) in the code, recently updated with a set of open boundary conditions designed for solar wind - body interaction studies. Particles are injected at the inflow side of the computational domain and absorbed at all others. A bow shock is not formed upstream of the body, but the obstacle generates faint dispersive waves propagating parallel to the magnetic field lines, in agreement with numerical simulations done in MHD approach. Polarization electric field is generated in the wake. In addition, plasma flows filling the wake tend to excite streaming instabilities, which lead to bipolar signatures in the parallel electric field. Our future work includes updating the physical model to include photoionization and re-emission at the object's surface.