Particle simulations on charged dust dynamics in the lunar plasma environment

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The moon has no intrinsic magnetic field, and its surface interacts directly with the solar wind plasma, leading to the lunar surface charging. Due to the electrodynamic effect, some portion of micron and sub-micron sized grains on the lunar regolith layer are charging and levitated above the lunar surface, which are known as the Moon dust. It is of practical importance to assess such a distinctive environment, reminding that the dust grains will affect the Moon rover system in future landing missions.
In the present study, we apply our original particle-in-cell simulator EMSES, which have been used to study spacecraft-plasma interactions, to prediction of charged dust dynamics in the day-side lunar plasma environment. For this, we reproduce the near-surface electrostatic environment and develop a numerical model of dust charging in it by conducting the plasma particle simulations. We also consider an effect of characteristic lunar surface topography such as the lunar vertical holes, which are recently discovered by the Kaguya satellite. We will show preliminary simulation results on the charged dust environment near the moon surface.

Keywords: the Moon, dust grains, plasma, lunar surface charging, vertical hole, PIC simulation

