**Particle-in-Cell Simulations of the Lunar Dusty Plasma Environment**

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The lunar surface represents a complex plasma environment due to electron photoemission via solar-UV radiation, the incoming solar wind flux and the presence of micron-sized dust particles. Several observations indicate that dust grains on the surface of the Moon undergo charging, levitation, lofting and transport due to interactions with this plasma environment. These observations include Surveyor images of Horizon Glow (HG), astronaut sketches of dust streamers and in-situ measurements made by the Lunar Ejecta and Meteorite (LEAM) experiment. Recent laboratory experiments have confirmed the ability to levitate and transport dust grains in a tenuous electron sheath. In order to understand the evolution and characteristics of this dusty plasma and the required conditions for dust launching, levitation and transport, the lunar plasma environment has been modeled via 1- and 2-dimensional particle-in-cell (PIC) codes. In order to validate this code, the results are compared with analytical solutions of the electron density, electric field and sheath thickness for three standard electron velocity distributions: mono-kinetic, mono-energetic and Maxwellian. Initial simulations have focused on the dependence of the lunar photoelectric sheath on solar radiation, non-standard electron velocity distributions and non-trivial surface topography. The data are analyzed in an effort to find non-monotonic potential distributions in the sheath, which are thought to be a key component in the levitation and transport of lunar dust. Further additions to the model will include the temporal evolution of the solar UV flux and the presence of dust particles, especially their role as sources and sinks of plasma. The dynamics of levitated and transported dust grains will be studied and compared to laboratory and in-situ measurements.