The effect of asymmetric surface topography on dust dynamics on airless bodies

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Without a significant atmosphere or global magnetic field, the lunar surface is exposed to micrometeoroid bombardment, ultraviolet (UV) radiation, and the solar wind. Micrometeoroid bombardment grinds the surface into a regolith comprised of dust grains ranging in size from 10 nm to 1 mm (Grün et al., 2011). Incident UV radiation and solar wind particles electrically charge the surface forming a plasma sheath whose structure is dependent on the plasma and sur- face properties (Campanell, 2013; Guernsey and Fu, 1970; Poppe and Horányi, 2010; Nitter et al., 1998). Furthermore, dust grains that are liberated from the surface can collect additional charge and interact with the plasma sheath. These interactions have been suggested to explain a variety of phenomena observed on airless bodies including horizon glow and dust ponding (Colwell et al., 2005; Hughes et al., 2008; Poppe et al., 2012; Wang et al., 2009). The effect of surface topography on the plasma environment and ensuing dust dynamics is poorly understood and serves as the focus of this paper. We present the results of a three-dimensional particle-in-cell (PIC) code used to model the dayside near- surface lunar plasma environment at a variety of solar zenith angles (SZA) in the presence of two topographies. Using the results of the PIC code, we model the effects on dust dynamics and bulk transport.