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The efficiency of electrostatic dust transport in shaping the surfaces of airless planetary bodies

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Recent laboratory experiments, along with the newly developed "patched charge model", have shown a strong support for electrostatic dust mobilization and transport to occur on the surfaces of airless planetary bodies due to direct exposure to solar wind plasma and solar ultraviolet (UV) radiation. These new studies laid a foundation for ultimately explaining a number of unusual planetary observations, such as the lunar horizon glow, the dust ponds on asteroid Eros and comet 67P, as well as the radial spokes in Saturn's rings. More importantly, this electrostatic dust transport process may have a significant role in the surface evolution of airless planetary bodies, in addition to all other already recognized surface processes. We report on new laboratory experiments to show the changes of the surface properties, such as surface morphology and porosity, under exposure to photons or energetic electrons. To estimate the efficiency of this process in shaping the surface, we recorded the dust lofting rate over a long exposure time as a function of the incoming flux of photons or energetic electrons that mimic space condition at 1 AU. Our preliminary results indicate that the dynamics of dust mobilization depend on both the surface compactness and the dust size distribution. It is also shown that this process slows down as time elapses. It may be because the porosity varies with the depth of the regolith surface. These effects are currently examined in detail to accurately estimate the characteristic timescale of this process in space.