LUNAR DUST MOBILIZATION IN THE PRESENCE OF CRUSTAL MAGNETIC FIELDS. X. Wang[1], L. H. Yeo[2], and M. Horanyi[1,2] [1]LASP, University of Colorado, Boulder, CO 80303, [2]Department of Physics, University of Colorado, Boulder, CO 80309. (xu.wang@colorado.edu)

Introduction: The Moon has no global magnetic field rather crustal magnetic anomalies. It has been found that high-albedo lunar swirls are co-located with strong magnetic anomalies. It is suggested that the solar wind is deflected by the crustal magnetic fields to prevent the areas from space weathering. Additionally, charged dust may be re-sorted by surface electric fields created as a result of the solar wind interactions with the crustal magnetic fields [1]. Recent laboratory studies have demonstrated electrostatic dust lofting and mobilization with a Patched Charge Model [2]. This paper presents laboratory investigations of dust charging and mobilization in the presence of a magnetic field. The results have important implications for dust mitigation related to human exploration activities in lunar magnetic anomaly regions.

Experiment: A permanent dipole magnet was placed below a bed of dust with an orientation either perpendicular or parallel to the surface (Fig. 1). Dust was charged and mobilized by exposure to UV light (172 nm) and its activity was recorded by a video camera.

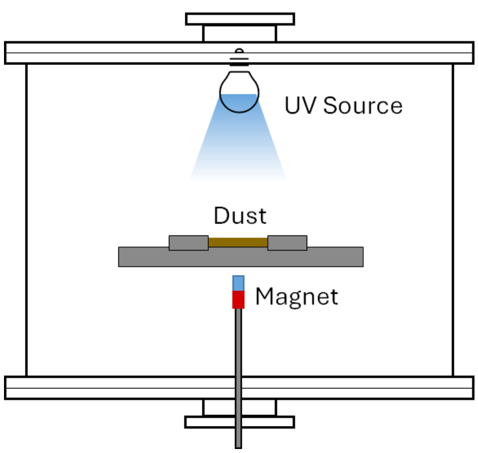

Fig. 1 Schematic of the experimental setup.

Results: Dust mobilization was observed to be correlated with the orientation of the magnet, and was inhibited in certain regions (Fig. 2). We introduce an expanded Patched Charge Model to explain the experimental results as follows: Dust particles within microcavities that photoemit are charged positively and will collect ambient electrons from neighboring areas, causing additional electrons to be emitted from them and collected by the surrounding dust particles. Subsequently, this results in the enhanced repulsive force between these negatively charged dust particles, causing their lofting. Conversely, photoemitting dust particles within microcavities that do not receive ambient electrons from neighboring areas are less charged and remain immobilized.

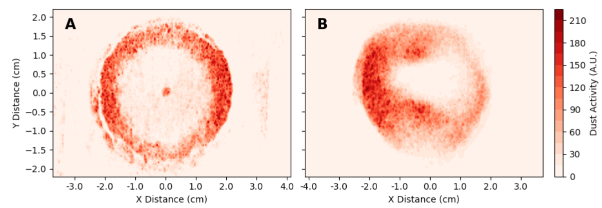

Fig. 2 Dust Activity Profiles. Dust activity levels extracted from recorded images when the dipole magnet is A) perpendicular and B) parallel to the dust surface. The center of the magnet is 7.5 mm and 10.5 mm away from the dust surface, respectively.

Test-particle simulations were performed to track the trajectories of electrons generated by photoemission at the dust surface and from the chamber wall. Results show that in regions where the mobility of ambient electrons is inhibited by the magnetic field, dust is inactive; contrarily, in regions where ambient electrons can reach, dust is active. The simulation results show agreement with the expanded Patched Charge Model.

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References: [1] I. Garrick-Bethell, J. W. Head III, and C. M. Pieters (2011), *Icarus, 212,* 480. [2] Wang, X., J. Schwan, H.-W. Hsu, E. Grün, and M. Horányi (2016), *GRL, 43*, 6103–6110.