

Experimental measurements of highly negatively charged dust particles from electron-emitting dusty surfaces

J. Schwan^{1,2}, X. Wang^{1,2}, H. -W. Hsu^{1,2}, E. Grün^{1,2}, and M. Horányi^{1,2}

¹Laboratory for Atmospheric and Space Physics, University of Colorado-Boulder, Boulder, Colorado 80303

²NASA/SSERVI's Institute for Modeling Plasma, Atmospheres and Cosmic Dust, Boulder, Colorado, 80303

Highly negatively charged dust particles are measured as a result of dusty surfaces being exposed to ultraviolet radiation or energetic electrons causing the surface to emit photoelectrons or secondary electrons. This negative charge polarity is contrary to the generally expected positive charge on dust particles due to photoemission. Magnitudes of these negative charges are several orders larger than those predicted by previous charge models. These contrary charge measurement results are in agreement with our recently developed “patched charge model”. This new model shows that dust particles that form microcavities in a dusty surface can attain large negative charges from the collection of photoelectrons or secondary electrons emitted by their neighboring particles. These unexpectedly large charges on dust particles and the resulting repulsive forces between them are responsible for dust mobilization and transport on the surfaces of airless planetary bodies. Our charge measurement results provide the critical initial conditions for dust dynamics studies, which until this point were undefined.