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Dusty Plasmas in the Solar System

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In most space environments dust particles are exposed to plasmas and UV radiation and, consequently, carry electrostatic charges. Their motion is influenced by electric and magnetic fields in addition to gravity, drag and radiation pressure. On the surface of the Moon, in planetary rings or at comets, for example, electromagnetic forces can shape the spatial and size distribution of charged dust particles. The dynamics of small charged dust particles can be surprisingly complex leading to levitation, rapid transport, energization and ejection, capture and the formation of new planetary rings.

Extensive numerical modeling of the charging and dynamics of charged dust particles over the past several years have now reached the stage where useful comparisons between simulations and observations can be made. The success of these models allows for testing the validity of our plasma models, as well as the relative importance of the various sources of dust in the system.

This talk will focus on recent Cassini measurements at Saturn. In addition we will also discuss the outstanding challenges dusty plasma processes represent for the human exploration of the Moon and Mars.