

Electrostatic Lofting of Dust Aggregates Near the Terminator of Airless Bodies and its Implication in the Formation of Circumstellar Dust Rings

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Our current knowledge of launching dust grains from the surfaces of airless bodies appears to contradict in-situ observations of dust grains that are lofted off the surface of the Moon. We tackle the issue of high grain stickiness where cohesive forces estimated for compact spherical grains restrict the detachment of the grains from the surfaces of airless bodies. We show that electrostatic forces on irregular grains with rough surfaces, in particular, aggregates of the grains could overcome their cohesive forces, provide that their surfaces are hydroxylated. Our results suggest that levitation of lunar agglutinates takes place near the terminator of the Moon but that solar radiation pressure and organic refractory mantle prevent levitation of dust grains above the surfaces of asteroid 25143 Itokawa and short-period comets, respectively. The application of our results to extrasolar systems reveals a novel mechanism of forming tenuous dust rings in the vicinity of bright main-sequence stars by electrostatic lofting and subsequent radiative blown-out of dust grains from sub-km sized airless bodies.