Electric Titan: A world molded by electrostatics

Joshua Méndez Harper, George McDonald, Josef Dufek, Mike Malaska, Devon Burr
Georgia Tech, U.S.A.
e-mail: ub313@gatech.edu

***Abstract*—Triboelectric, or frictional, charging is a ubiquitous, yet poorly understood, phenomenon in granular flows. Recognized in terrestrial volcanic plumes and sand storms, such electrification mechanisms are likely present on Titan. There, dunes and plains of low-density, organic particles blanket extensive regions of the surface. Unlike Earth, Titan hosts granular reservoirs whose physical and chemical properties likely enhance the effects of charging on particle motion. Here, we demonstrate in laboratory tumbler experiments under atmospheric conditions and using organic materials analogous to Titan that Titan sands can readily charge triboelectrically. We suggest that the resulting electrostatic forces are strong enough to promote aggregation of granular materials and affect sediment transport on Titan. Indeed, our experiments show that electrostatic forces may increase the saltation threshold for grains by up to! an order of magnitude. Efficient electrification may explain puzzling observations on Titan such as the mismatch between dune orientations and inferred wind fields. We conclude that, unlike other Solar System bodies, nanometer-scale electrostatic processes may shape the geomorphological features of Titan across the moon's surface.**