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Surface charging of Saturn's plasma absorbing moons: theoretical estimations and comparisons with Cassini observations

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Abstract

Excluding Earth's moon, surface charging studies have been limited to very few solar system bodies. Here we assess the importance of surface charging for the Saturnian plasma absorbing moons. We focus mainly on the moons' trailing hemispheres and their variable charging pattern as a function of their magnetospheric local time. With only few exceptions, our results indicate negative potentials for all moons, with the most extreme values and profiles predicted for Rhea. When the leading hemisphere is partially sunlit the surface potential profile can be quite complex with many different transition regions. We also find that electrostatic acceleration of dust is at least equally (if not more) important as it is for Earth's moon for the sub-micron grains, but it is probably not sufficient to explain the detection of the larger micron-sized grains in the vicinity of the large moons of the outer planets. Regarding Saturn's asteroid-sized moons, we estimate that electrostatic forces can accelerate grains above the escape velocity and populate the Saturnian system and/or contribute to dust transport across those moons' surfaces [1]. We also discuss several methods that Cassini could directly observe the effects of surface charging and we apply them to recent Cassini observations of close moon flybys. We also present our first estimations of the moons' wakeside (leading hemisphere) potentials using different models for the plasma wake.

References

[1] Roussos, E., Krupp, N., Krueger, H., Jones, G.H..: Surface charging of Saturn's plasma absorbing moons, Journal of Geophysical Research (Space Physics), (in press).