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# Spacecraft and Dust Charging at Enceladus

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## Abstract

The charging of the spacecraft in space is sensitive to the ambient plasma conditions and is of importance to the in–situ plasma measurements. It has been pointed out that, at the vicinity of Enceladus the modeled spacecraft potential is significantly more negative than the Cassini Langmuir probe measurements. To understand this potential difference and to gain insight into the complex dust–plasma environment at Enceladus' plume, we construct a simple charging model to simulate the spacecraft charging condition for Cassini Enceladus flybys. Due to the presence of abundant dust grains, in addition to conventional charging currents, we introduce two types of dust–related charging currents, the convective dust current and the impact plasma dust current. The convective dust current is simply the delivery of dust charges to the spacecraft, while the impact plasma dust currents are collection of ions and electrons from the impact plasma generated from high speed dust–spacecraft impacts. Adopting Cassini dust measurements, our model suggests that, the "dust currents" could contribute greatly to the spacecraft charging during the Cassini–Enceladus flybys. With these "dust currents", we are capable of reproducing the measured spacecraft potential. Our results show that, in a dust–rich environment, the spacecraft could be charged to more positive potential with higher spacecraft–dust speed, higher dust density, and lower ambient plasma density.