

## Spacecraft surface charging environment in the medium earth orbit

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Analysis of spacecraft surface charging in the medium earth orbit (MEO) is important for spacecraft designs and operations, because the significant charging sometimes cause spacecraft anomalies due to discharging arcs. We study the surface charging environment using the Electric Field and Wave instruments (EFW) and the Helium Oxygen Proton Electron (HOPE) data of the Van Allen Probes. The charging events ( $< -50$  V) are located about 25000 km further away from the center of the Earth and in the mid-night to dawn region. Among them, the significant charging ( $< -1$  kV) events are only observed in eclipse. By using a charging analysis tool for the Van Allen Probes, we analyze the electron and ion energy flux spectrum observed in eclipse. The electrons usually have multi-temperature spectrum. For the onset of negative charging, the incoming hot electron ( $\sim$  keV) current overcomes the outgoing secondary electron current emitted by warm electron ( $\sim$  hundreds eV) impacts. The analysis shows that the combination of critical temperature and threshold density of the hot electrons give the criterion for the onset of negative charging in the MEO eclipse. We will discuss the charging events in sunlight and the relationship between the charging events and space weather conditions.

Keywords: Spacecraft surface charging, Medium earth orbit, Space weather