

R008-14
C 会場 : 11/27 AM1 (9:15-10:45)
9:45~10:00:00

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Computer Simulation of Dust Impact signals Detected by Electric Field Instruments Onboard Satellites

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High-speed collisions between spacecraft and interplanetary or interstellar dust generate plasma clouds that cause dramatic changes in the spacecraft's potential. While these "dust impact" signals are observed by electric field instruments onboard scientific satellites like STEREO and ARTEMIS, a comprehensive theoretical model explaining the physics is still lacking. Existing simple models can explain the data acquired by the STEREO satellites, but often fail when applied to the ARTEMIS observation, indicating a lack of our understanding of the physical mechanisms of dust impact-generated signals.

This study utilizes EMSES, a particle-in-cell (PIC) simulation tool, to reproduce the entire process of a dust impact. By simulating the electron and ion dynamics, we aim to clarify how the spacecraft's potential responds to these events. As a first step, we implement a simplified dust impact current model, where the collected electron current is assumed to be a Gaussian function of time, to establish a baseline simulation.

Ultimately, a better understanding of these dynamics has two future applications. First, using the spacecraft itself as a detector to determine the properties of interplanetary and interstellar dust. Second, developing methods to eliminate unwanted dust impact signals from electric field data on future space missions, thereby improving the precision of scientific measurements.