University of Colorado at Boulder

AEROSPACE ENGINEERING SCIENCES

Seminar

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Science enabled by the dust accelerator operated at CU-Boulder

The dust accelerator facility at the University of Colorado was commissioned in 2011. It employs a 3 MV electrostatic generator and can produce micron and submicron sized dust particles with up to 100 km/s velocities. This new capability enabled the development and calibration of space instruments and a number of unique science investigation. In this talk I will present results from the laboratory simulation of (a) micrometeoroid ablation and (b) effects of dust impacts on spacecraft.

Many tons of extraterrestrial material fall into Earth's atmosphere every day in the form of micrometeoroids of cometary and asteroidal origin. These particles completely or partially ablate in the upper atmosphere and the ablation products play a role in a number of phenomena, including the observed neutral metal layers, or the formation of noctilucent clouds. However, the understanding of the microphysics of the ablation process is incomplete and significant uncertainties remain. The interpretation of meteor radar measurements, for example, has been called into question, and is important for the understanding of the micrometeoroid complex in our solar system. An experimental setup is designed to simulate the ablation process in well-defined laboratory conditions. The ablation takes place in a gas cell over a short distance and allows determining important (and unknown) parameters, such as the ionization efficiency, and test the validity of existing ablation models.

Electric field and plasma instruments are known to be sensitive to dust impacts occurring on the spacecraft body. This is both a nuisance, as the dust impact signals can outclass other useful data sets, and a welcomed capability that turns the spacecraft into a rudimentary dust detector. We have performed laboratory simulation measurements that showed that there are three different mechanisms that can lead to the generation of impact signals. The data show the way to enhance the qualitative and quantitative interpretation of dust impact signals that is relevant to a number of ongoing and future missions.

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2:00 PM
DLC Bechtel Collaboratory

Refreshments!