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Dust Detection in Space by Radio and Plasma Wave Instruments

Sheng-Yi Ye (1), Jakub Vaverka (2), Libor Nouzak (2), Zoltan Sternovsky (3), Arnaud Zaslavsky (4), Ingrid Mann (5), Sean Hsu (3), Terrance Averkamp (1), Ali Sulaiman (1), David Pisa (6), Jiri Pavlu (2), George Hospodarsky (1), William Kurth (1), and Mihaly Horanyi (3)

(1) University of Iowa, Physics & Astronomy, Iowa City, United States, (2) Charles University, Prague, Czechia, (3) LASP, University of Colorado at Boulder, CO, United States, (4) Observatoire de Paris, Meudon, France, (5) The Arctic University of Norway, Tromso, Norway, (6) Department of Space Physics, IAP CAS, Prague, Czechia

When spacecraft encounter dust at v > 1 km/s, the plasma clouds released by energetic dust impacts can induce potential perturbations of the spacecraft body or the electric field antennas. As a result, voltage pulses in waveforms and broadband noise in the spectra are recorded onboard by wave instruments, which are designed to detect radio and plasma waves in space. Such signals have been detected in the solar wind and different regions of planetary magnetospheres and simulated in the lab by shooting dust particles onto a spacecraft model with electric field antennas. Given the impact velocity and impact charge yield function, the size and density of the particles can be estimated from the measured signals. The results have been shown to be consistent with measurements by dedicated dust instruments, remote sensing observations, and modeling works. Recent spacecraft observations and laboratory measurements greatly improved our understanding of the generation mechanism of the impact signals, which would help us better constrain the properties of the dust particles detected in space. In this presentation, we will focus on the generation process of characteristic impact signals measured in space and laboratory simulations and the effect of changing background conditions on the shape of the signals.