

Dust impact detection by Faraday cup in space and laboratory

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Both antenna and Faraday cup instruments are serendipitously sensitive to the impact of cosmic dust particles. Despite the number of missions/instruments capable of detecting dust particles, the details of the detection mechanisms remain relatively poorly understood. While the antenna detection is widely studied, the use of Faraday cup is limited to fast devices only. Faraday cups excel with a simple geometry and the nearly homogeneous electric field. This paper presents laboratory investigations of the Faraday cup sensitivity to dust impacts. Iron dust particles, submicron in size and from a velocity range of 1–40 km/s, were generated by the dust accelerator facility operated at the University of Colorado. Faraday cup was represented by the engineering prototype similar to the BMSW (Bright Monitor of the Solar Wind onboard Spektr-R) instrument. The aim of this study is to clarify the physical processes of signal generation, to investigate instrumental effects, and to find possible consequences for dust signals detected by space-devices. The results indicate a principle role of the charge carried by the grain itself.