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New Developments in in-situ Dust Experiments

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Impact ionization plasma detectors are commonly used for cosmic dust research onboard spacecraft. There seems to be no strong scientific background on their shape, area, and high voltages applied; they are determined rather empirically. To design a dust detector having large aperture and lightweight to collect dust effectively for the future missions, we are developing a new impact ionization type detector. Physical and chemical properties of dust particles are analyzed. As a first step, structure conditions of a simple cylindrical, parallel plane type dust detector are examined. Impact signals and velocity signals are obtained at various voltage-distance conditions with positive and negative applied voltage. From the rise-time of impact signals, the velocity of dust particles can be obtained by fitting empirical formula. Preliminary results show that plasma drift velocity is dependent on dust particle velocity. Several resent experimental results on curved potential TOF mass spectrometer are also discussed.

Keywords: Impact ionization dust detector; Impact signal rise-time; Plasma drift velocity; TOF-MS

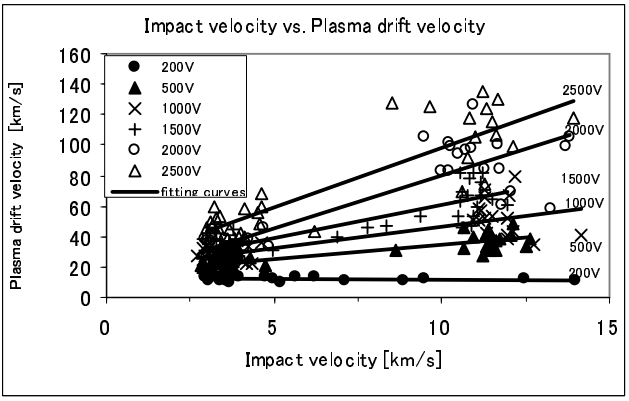

Figure 1. Impact velocity vs. plasma drift velocity. Target is positively biased.