Possibility of Developing A New Hybrid Dust Detector Using PZT as The Target of Impact Ionization Detector

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In-situ detection of interplanetary and interstellar dust have been conducted for about half a century by dust detectors onboard a large number of spacecrafts [1]. Impact velocity, mass, chemical compositions and so on of impacted dust particles are estimated from various measurements of physical phenomena accompanied with hypervelocity impact. Dust detectors estimates physical properties of dust mentioned above from own unique empirical law and have their own advantages and disadvantages in terms of measurement sensitivity and precision. In future dust measurements dust detectors made up of various types of detectors taking each advantage are required for more precise estimation of physical properties of dust particles.

PZT (lead zirconate titanate) which is a kind of piezoelectric element can measure the mass of dust particles with higher precision than impact ionization detector (IID) except impact velocity is faster than about 20 km/s [2]. On the other hand IID which has monocrystalline metal target can deduce the mass of dust particle even if the velocity above 20 km/s [e.g. 3]. In case of impact velocity measurement IID have relatively rough precision [3]. In contrast, PZT can deduce the velocity with higher precision above about 6km/s [2].

Therefore, it is expected that a hybrid dust detector consists of PZT and impact ionization measurement system provides more precise measurement of mass and impact velocity of dust particles. In this presentation, results from measurement experiment of depolarization charge and impact ionization plasma generated on PZT will be presented and the possibility of new hybrid detector will be discussed.

Keywords: hybrid dust detector; impact ionization; in-situ dust detection; piezoelectric element.

References

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