Dust Impact Ionization Charge Yields from Gold and Silver Targets

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The in-situ detection and analysis of cosmic dust particles in space reveal the characteristics of their parent bodies and the environment where they underwent processing, including comets, asteroids, moons, or the interstellar medium. Advanced instruments have been recently developed which enable the measurement of the elemental or chemical composition of dust particles. The measurement principle is based on impact ionization, where the particle becomes an ionized plasma following a high-velocity impact with a target surface. The impact charge yield is described by a scaling law which relates the particle's mass and velocity to the total charge generated upon the impact. This charge yield is known to vary primarily on the material of the target surface, which in turn drives the dynamic range and other important parameters of the dust analyzer instrument. This presentation reports on an experimental study conducted using the dust accelerator facility at the University of Colorado. The impact charge yields have been measured for five target materials over impact speeds from 1 – 70 km/s. The target materials tested were Au, Ag, polished Ag, Ag with 10nm Au coating, and polished Ag with 1 micron Au coating, and the dust material was Fe as with the calibration of many previous dust instruments flown in space. The target samples were placed in a dust impact detector which used a grid biased to +100V or -100V to separate the ions and electrons from the impact plasma. Contrary to earlier published results, the data from this study shows there is no substantial difference in the charge yields or scattering of the investigated target materials.