

Development of Hyperdust: Advanced In-Situ Dust Telescope

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A functional prototype of an advanced dust analyzer instrument, Hyperdust, is developed for dust astronomy. Hyperdust combines the capabilities of measuring the velocity vector of individual dust particles with analyzing their chemical/elemental compositions. Hyperdust is derived from the Cassini Cosmic Dust Analyzer instrument and is a higher technology readiness version of previously-developed laboratory models. With its large effective target area of $> 600 \text{ cm}^2$, Hyperdust is suitable for a wide variety of science goals onboard planetary or heliophysics space missions, including the detection and analysis of interplanetary and interstellar dust particles, or ejecta clouds of airless bodies (e.g., moons, asteroids) from flybys. The Hyperdust development effort combines advanced analysis and optimization techniques with application of advanced materials to produce a low-mass instrument. The development effort also includes the design, fabrication and qualification of a high-dynamic-range and large active area ion detector (discrete dynode electron multiplier), and a low-noise Application Specific Integrated Circuit (ASIC) charge sensitive amplifier. The latter is needed to extend the trajectory measurement to particles < 1 micron in radius. This paper describes the current state of the Hyperdust instrument development.