HYPERDUST: ADVANCED INSTRUMENT FOR THE IN-SITU DETECTION AND CHEMICAL ANALYSIS OF COSMIC DUST PARTICLES. Z. Sternovsky,[1,2] E. Gruen,[1] M. Horanyi,[1] K. Kempf,[1] K. Maute,[2] F. Postberg,[3] and R. Srama[3], [1]LASP, University of Colorado, Boulder, CO 80303, [2]Aerospace Engineering Sciences, University of Colorado, Boulder, CO 80309, [3]IRS, Stuttgart University, Stuttgart, Germany (Zoltan.Sternovsky@colorado.edu).

Introduction: Cosmic dust particles originating from planetary surfaces, or remote sites and times are treasures of information. By determining the dust particles' source and their elemental and chemical composition, we can learn about the environments, where they were formed and processed. Interplanetary dust that originates from comets and asteroids may be in different stages of Solar System evolution. Atmosphereless planetary bodies, e.g., planetary satellites, asteroids, or Kuiper belt objects are enshrouded in clouds of dust released by meteoroid impacts or by volcanism. The ejecta grains are samples from the surface of these objects and their analysis can be performed from orbit or flyby to determine the surface composition, interior structure and ongoing geochemical processes. The goal of dust astronomy is to uncover the information contained in tiny cosmic dust grain.

A long series of previous dust instruments lead to novel in-situ instrumentation suitable for implementing the goals of **dust astronomy**: *determining the origin of dust particles and their elemental composition by the Hyperdust instruments*. Early dust mass spectrometers on the Halley missions had sufficient mass resolution in order to provide important cosmochemical information in the near-comet high dust flux environment. A decade later the Ulysses dust detector discovered interstellar grains within the planetary system (Gruen et al. A&A, 1994) and its twin detector on Galileo discovered the tenuous dust clouds around the Galilean satellites (Krueger et al., Icarus, 2003). It was the combination of a large-area dust instrument with highly sensitivity electronics that provided the reliable detection of these unexpected dusty phenomena. The similar-sized Cosmic Dust Analyzer onboard the Cassini mission combined a highly sensitive dust detector with a low-mass resolution mass spectrometer. Compositional dust measurements from this instrument probed the deep interior of Saturn's Enceladus satellite (Postberg et al., Nature, 2009). Based on this experience new instrumentation was developed that combined the best attributes of all these predecessors and exceeded their capabilities in accurate trajectory determination.

The Hyperdust instrument is a combination of a Dust Trajectory Sensor (DTS) together with an analyzer for the chemical composition of dust particles in space. Dust particles' trajectories are determined by the measurement of induced electric signals, when a charged grain flies through a position sensitive electrode system. A modern DTS can measure dust particles as small as 0.3 μm in radius and dust speeds up to 100 km/s. Large area chemical analyzers of 0.1 m^2 sensitive area have been tested at a dust accelerator and it was demonstrated that they have sufficient mass resolution to resolve ions with atomic mass number >100. The Hyperdust instrument is capable of distinguishing interstellar and interplanetary grains based on their trajectory composition information. In orbit or flyby near airless planetary bodies the instrument can map the surface compositional down to a spatial resolution of ~10 km. The Hyperdust instrument is currently being developed to TRL 6 funded by NASA's MatISSE program to be a low-mass, high performance instrument for future in-situ exploration.

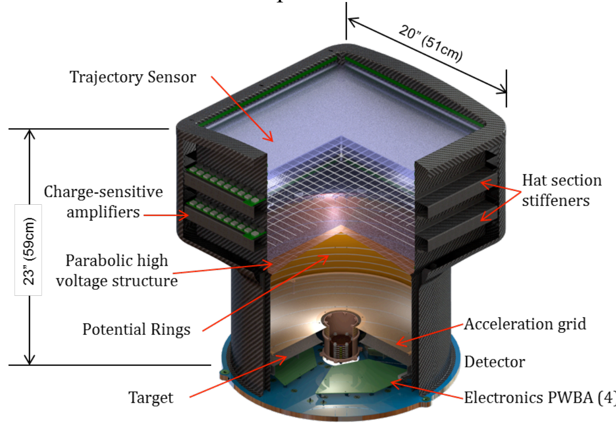

Figure: The Hyperdust instrument is desingned for high performenace, high sensitivity and low mass using advanced composite materials.

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