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The *in-situ* Large Area Mass Analyzer (LAMA) instrument for the measurement of elemental composition of cosmic dust

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One of the outcomes of the Stardust mission is that the concept of the protoplanetary nebula needs major revision. The current understanding is based on astronomical observations and the cosmochemical analysis of the collected meteorites and IDPs. However, laboratory sample analysis remains unable to provide a complete picture of the protoplanetary nebula and its eveolutionary stages because of the collection methods used strongly bias against micron and submicron sized particles. These become severely altered during the collection process. Astronomical observations of dust released by Deep Impact have painted a quite different picture of the composition of cometary dust than sample analysis from Stardust. A complimentary method is the in-situ analysis of the chemical and isotopic composition of cosmic dust particles. In-situ instruments are the Particle Impact Analyzers on the Halley missions, the Cosmic Dust Analyzer (CDA) and the Cometary and Interstellar Dust Analyzer (CIDA) onboard the Cassini and the Stardust spacecraft, respectively. These instruments utilize the impact plasmas generated upon hypervelocity dust impacts on solid target surfaces to make time-of-flight measurements of ions. There has been a recent significant progress in the instrumentation for in-situ measurements. The new generation of instruments has: a) larger collection areas (> 0.1 m^2) allowing the collection of statistically significant number of measurement even of low flux sources, and b) high mass resolution for

isotopic analysis.

The Large Area Mass Analyzer (LAMA) instrument has been recently developed and tested. The large target area ($0.25\ m^2$) makes this instrument well suited for detecting a statistically significant number of interstellar dust grains or other dust particles with a low flux. The mass resolution of the instrument is approximately $m/\Delta m \approx 200$. The device is a reflectron type time-of-flight mass spectrometer that measures the ions from the impact generated plasma due to hypervelocity dust impacts onto a solid target surface. The laboratory model of the instrument is tested and calibrated using the Heidelberg dust accelerator facility. The calibration is done using Fe and Ni projectiles of submicron sizes accelerated up to 40 km/s velocity and various target materials, including silver, brass, graphite and a small piece of the Allende meteorite. The experimental data show the characteristic mass spectra of the target and projectile materials.

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