

Dust Impact Monitor DIM onboard Rosetta/Philae: Laboratory Calibration with Impact Experiments

Harald Krüger¹, Thomas Ossowski¹, Klaus Seidensticker², Istvan Apathy³, Hans-Herbert Fischer⁴, Attila Hirn³, Manuel Jünemann¹, Alexander Loose¹, Attila Peter³, Matthias Sperl⁶

(1) Max-Planck-Institut für Sonnensystemforschung, Katlenburg-Lindau, Germany; (2) DLR, Institute for Planetary Research, Berlin, Germany; (3) MTA KFKI AEKI, Atomic Energy Research Institute, Budapest, Hungary; (4) DLR, Space Operations, MUSC, Köln, Germany; (5) DLR, Institut für Materialphysik im Weltraum, Köln, Germany;

1. Abstract

The Rosetta lander spacecraft Philae, which will land on the surface of comet 67P/Churyumov-Gerasimenko in late 2014, is equipped with the Dust Impact Monitor instrument (DIM). The DIM sensor, which is part of the SESAME instrument package [Seidensticker et al., 2007], consists of three piezoelectric detectors, each one mounted on the outer side of a cube facing in three orthogonal directions. The total sensor area is approximately 70 cm². DIM will measure impacts of sub-millimeter and millimeter sized ice and dust particles that are emitted from the nucleus and transported into the cometary coma by the escaping gas flow. A grain-size dependent fraction of the emitted grains is expected to fall back to the nucleus surface due to gravity. DIM will be able to detect both these components, the backfalling particles as well as the grains hitting the detector on direct trajectories from the surface. With DIM we will be able to measure fluxes, impact directions as well as the speed and size of the impacting cometary particles.

Two particle acceleration devices for impact calibration experiments are presently available at Max-Planck-Institut für Sonnensystemforschung (MPS), Katlenburg-Lindau: With (a) a dedicated dropping device and (b) a small air gun we can simulate impacts with particles of different materials (steel, glass, ruby, polyethylen, etc.), radii between 0.2 and 1 mm and impact speeds up to 2 m sec⁻¹. We have performed a large number of impact experiments with two flight spare units of the DIM sensor at MPS. We present the results from our impact experiments and discuss their implications for the calibration of the DIM flight instrument.

References

[Seidensticker et al., 2007] Seidensticker, K. J., Möhlmann, D., Apathy, I., Schmidt, W., Thiel, K., Arnold, W., Fischer, H.-H., Kretschmer, M., Madlener, D., Péter, A., Trautner, R., and Schieke, S. (2007). Sesame - An Experiment of the Rosetta Lander Philae: Objectives and General Design. *Space Science Reviews*, 128:301–337.