

Compositional Mapping of Europa's Surface with a Dust Mass Spectrometer

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The SURface Dust Analyser (SUDA) is a new generation dust mass spectrometer developed at the Laboratory for Atmospheric and Space Physics (LASP) at the University of Colorado. It was selected in May 2015 by NASA for a flyby mission investigating Jupiter's moon Europa. SUDA can measure from orbit the composition of ballistic, micron-sized dust particles populating the thin dust exospheres as they were detected around the Galilean satellites [Krüger et al., 1999], and recently also around Earth's Moon [Horányi et al., 2015]. Because these grains are samples from the moon's icy surface, unique information can be obtained about the surface composition, constraining geological activity on and below the surface. The instrument addresses main scientific questions of NASA's Europa Flyby Mission (former provisional name Europa Clipper Mission), in particular about surface composition, habitability, and exchange processes with the deeper interior of Europa. SUDA is a time-of-flight, reflectron-type impact mass spectrometer (<5.6 kg, sensitive area 220 cm²) with mass resolution $m/\Delta m$ of 150-250 in the mass range of interest $m=1-300$. The ejecta particles recorded by SUDA move on ballistic trajectories. From the location of the detection, the measurement by SUDA of dust velocity components in the moment of detection, and the statistics of particle motion, one can constrain their location of origin on the surface. Thus, from their composition one can conclude, with given probability, on the composition of a certain part of the surface. In this way, recording a large sample of dust grains with an orbiter, it will be possible to resolve compositional variations on the surface and relate them to topological features [Postberg et al., 2011].

[Horányi et al., 2015] Horányi, M., Szalay, J. R., Kempf, S., Schmidt, J., Grün, E., and Sternovsky, Z. (2015). A permanent, asymmetric dust cloud around the Moon. *Nature*, 522(7556):324–326.

[Krüger et al., 1999] Krüger, H., Krivov, A. V., Hamilton, D. P., and Grün, E. (1999). Detection of an impact-generated dust cloud around Ganymede. *Nature*, 399(6):558–560.

[Postberg et al., 2011] Postberg, F., Grün, E., Horányi, M., Kempf, S., Krüger, H., Schmidt, J., Spahn, F., Srama, R., Sternovsky, Z., and Trieloff, M. (2011). Compositional mapping of planetary moons by mass spectrometry of dust ejecta. *Planetary and Space Science*, 59(1):1815–1825.