Dust-grain fragmentation envisaged at comet 67P/Churyumov-Gerasimenko in view of potential ROSETTA COSIMA observations

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Dust grains lifted off the comet nucleus are subject to fragmentation processes. Observations and models on fragmentation are based on data collected several hundred kilometers off the comet nucleus. Rosetta will be the first spacecraft operated in near vicinity of a comet nucleus during its passage through the inner solar system, and will, on a few occasions, even pass through the dust acceleration region. In the forthcoming 2 years, the instrument COSIMA onboard ROSETTA will collect cometary grains at various distances off the nucleus and analyze cometary grains with a microscope and a secondary ion mass spectrometer. The instrument determines the organic and mineral composition as revealed on dust-grain surfaces. While break-up of dust grains on the collecting metal target foams are part of the COSIMA instrument function, fragmentation of grains prior to collection by COSIMA is part of the inner-coma physics to be studied with Rosetta. Grain collection and detection efficiencies of COSIMA are a function of grain size, shape, and optical and mechanical properties, and have been studied with the COSIMA reference laboratory model. Dust fragmentation prior to collection is due to interaction of grains with the coma, solar radiation and solar-wind plasma as well as the grain composition. Fragmentation might include the continuous seeding of tiny attogram dust grains as well as breaking up of grains into pieces of comparable sizes. We will discuss the potential fragmentation processes in view of the optimum COSIMA operation strategy and the impact of the inner-coma dust fragmentation on COSIMA mass-spectrometer data interpretation.