



Potential observations of attogram dust at 67P/Churyumov-Gerasimenko

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Abstract

In 2014 the ROSETTA spacecraft will approach comet 67P/Churyumov-Gerasimenko. The potential dust grain observations, ie the dust observations during the approach of the spacecraft towards the comet nucleus in summer and autumn 2014 are of interest for planning the observational instrument modes of the secondary ion mass spectrometer COSIMA onboard ROSETTA.

About a quarter of a century ago, the particle-impact ion mass spectrometers (PIA and PUMA) carried onboard GIOTTO and two VEGA spacecraft missions to Comet Halley in 1986 produced unexpected signals almost one million kilometers from Halley which could be attributed to high number densities of dust particles with masses of order 10^{-18} g. The data implied that up to several percent of the total mass lost during the entire apparition was present as such dust within a half-million kilometer radius if radial symmetry was assumed. The total volume mass density of particles observed varied with r^{-5} at large distance, and the mass of the largest individual particles observed varied with r^{-3} , while the number density varied as r^{-1} . The mass distribution implied strong fragmentation processes [1].

While attogram dust is not observable by optical means such as ground-based telescopes or the microscope of the COSIMA instrument onboard ROSETTA, the method of secondary mass spectrometry could be well suited to observe the composition of nano sized particles collected on the surface of the metal targets of COSIMA [2].

We will discuss the potential observation of attogram dust with COSIMA during the approach of ROSETTA towards the comet nucleus in 2014.

References

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- [2] Kissel, J et al, Cosima High Resolution Time-of-Flight Secondary Ion Mass Spectrometer for the Analysis of Cometary Dust Particles onboard Rosetta, Space Science Reviews, Vol 128, pp. 823, 2007