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Cometary dust at the nanometre scale - the MIDAS view after perihelion

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Abstract

The MIDAS instrument on-board the Rosetta orbiter [1] is a unique combination of a dust collection and handling system and a high resolution Atomic Force Microscope (AFM). By building three-dimensional images of the dust particle topography with nano- to micrometre resolution, MIDAS addresses a range of fundamental questions in Solar System and cometary sciences. The greatest number of particles is expected to be collected around perihelion and the initial results of imaging these will be presented.

1. Predicting the dust flux at 67P

The number of dust grains to be collected by MIDAS during the mission was estimated prior to arrival at comet 67P using the GIADA dust environment model [2]. However, extrapolation of the dust size distribution observed from the ground to the size of interest to MIDAS (nanometre to micron sized) required assumptions about the power law index below the limit of such observations.

Because of this the range of expected particle counts was dependant on the model chosen and highly variable, but was always expected to be highest during the initial (bound) orbits and again at perihelion.

2. Dust collection at perihelion

Dust collection in the early months after arrival revealed very few small (sub-micron) particles but several particles much larger than expected (close to or beyond the limit observable with the instrument). This is believed to be partly due to the intrinsic dust distribution, but partly due to the spacecraft environment and charging effects [3].

It is expected that the exposure of the Southern hemisphere of the comet (last sunlit during the previous apparition) and the perihelion passage in August 2015 will together result in a significant increase in the number of particles collected.

The first results obtained from imaging these particles will be presented here and a comparison to pre-perihelion findings made.

References

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