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The morphology of cometary dust: Subunit size distributions down to tens of nanometres

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The Rosetta orbiter carried a dedicated analysis suite for cometary dust. One of the key instruments was MIDAS (Micro-Imaging Dust Analysis System), an atomic force microscope that scanned the surfaces of hundreds of (sub-)micrometre particles in 3D with resolutions down to nanometres. This provided the opportunity to study the morphology of the smallest cometary dust; initial investigation revealed that the particles are agglomerates of smaller subunits [1] with different structural properties [2]. To understand the (surface-) structure of the dust particles and the origin of their smallest building blocks, a number of particles were investigated in detail and the size distribution of their subunits determined [3].

Here we discuss the subunit size distributions ranging from tens of nanometres to a few micrometres. The differences between the subunit size distributions for particles collected pre-perihelion, close to perihelion, and during a huge outburst are examined, as well as the dependence of subunit size on particle size. A case where a particle was fragmented in consecutive scans allows a direct comparison of fragment and subunit size distributions. Finally, the small end of the subunit size distribution is investigated: the smallest determined sizes will be reviewed in the context of other cometary missions, interplanetary dust particles believed to originate from comets, and remote observations. It will be discussed if the smallest subunits can be interpreted as fundamental building blocks of our early Solar System and if their origin was in our protoplanetary disc or the interstellar material.

References:
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