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## Cometary dust: structure at the nanometre scale

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The Rosetta orbiter carried three dedicated dust analysis instruments to investigate the properties of the comet and its dust at smallest scales. The images with the highest resolutions were obtained by the MIDAS (Micro-Imaging Dust Analysis System) atomic force microscope [1,2]. It collected dust particles of one to tens of micrometres in size and imaged their surface in 3D. Nominal images had approximately hundreds of nanometres resolution and were used to study the particle morphology at the micrometre scale. It was shown that the majority of collected particles were fragile agglomerates [3] with a moderate packing density of subunits at the surface [4]. Exceptions were one extremely porous particle with a fractal structure that is suggested to be pristinely preserved from early agglomeration processes in our Solar System [4], and the particles of about one micrometre size that show less fragility. To study these smallest detected particles a special scanning mode, called ‘reverse imaging mode’, was developed that reached resolutions down to eight nanometres [5]. In the reverse imaging mode dust particles were picked up with the tip and imaged with the help of a sharp spike on a calibration sample. The resulting images opened the possibility to identify the agglomerate structure of the dust down to the nanometre scale and to determine smallest features with mean sizes of about 100 nanometres. Whether these smallest features are surface related or true subunits comprising the dust will be discussed on the basis of comparisons to smallest subunit sizes identified by indirect Rosetta measurements and by investigations of other cometary material.

### References:

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