Nano-to-micro dust environment monitored by GIADA during the entire ROSETTA scientific phase

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The Micro Balance System (MBS) [1] is the GIADA [2,3,4] subsystem devoted to the flux and fluence of nano-to-micro dust particles measurement. The cumulative flux of particles/grains with diameters <10 μm is measured by a net of five Quartz Crystal Microbalances (QCMs) pointing towards different directions in order to characterize the dust flux within a solid angle of 180 deg.
Each QCM has an acceptance angle of about 40 deg, a collection area of about 12 mm^2 and consists of a matched pair of quartz crystals resonating at ~15MHz. Each QCM is equipped with a heating device to: (1) check the frequency vs. temperature dependence, (2) perform thermo-gravimetric measurements on the accumulated dust, at temperatures < 100 °C, and (3) remove volatile materials from the sensitive surface. Starting from the July 2014, i.e. during the Rosetta/ESA space probe approach to comet 67P/Churyumov-Gerasimenko, the MBS was continuously operating to monitor the dust coma environment. The QCMs' high sensitivity (0.2 [Hz ng^{-1}]) allowed to detect nano-micron-sized dust dust flux variation events well constrained in time. Otherwise, the nano-to-micron-sized particle flux was constant over the entire Rosetta mission scientific phase. The MBS data analysis allowed us to characterize the nano-to-micron sized dust particles flux identifying: (1) the preferred dust flux directions; (2) the flux time variation for particles with sizes smaller than 10 microns; 3) the presence of fine dust in dust "outbursts".

References

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