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Early Grain Detections in the Coma of Comet 67P/Churyumov-Gerasimenko

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Abstract

The GIADA (Grain Impact Analyser and Dust Accumulator) instrument aboard the Rosetta spacecraft at comet 67P/Churyumov–Gerasimenko (67P/C-G) measures dust grain number, mass, momentum and velocity [1,2]. GIADA is composed of three sub-systems: the Grain Detection System (GDS), detecting dust grains based on light scattering; an Impact Sensor (IS), providing momentum measurements from the impact on a plate connected to five piezoelectric sensors; and the MicroBalances System (MBS), made up of five Quartz Crystal Microbalances (QCMs), to yield cumulative deposited dust mass through the shift in resonance frequency.

1. Results

We will present preliminary results obtained since the beginning of the Rosetta scientific phase at the comet. We report early

detection by commencing at 815 km from the nucleus on August 1, 2014. Subsequent measurements allowed single grain dynamical properties to be determined. The final aim is to characterize the 67P/C-G dust environment at distances closer than 100 km from the nucleus for the first time for any comet. Accompanying the comet from 3.60 AU to 3.44 AU heliocentric distances, we obtained grain dynamical properties for the following mass bins: 10^{-10} – 10^{-9} kg; 10^{-9} – 10^{-8} kg; 10^{-8} – 10^{-7} kg.

Dust velocities measured by GDS+IS range from 2.6 m/s to 4.7 m/s, matching very well the predictions by Fulle et al. [3] for 67P/C-G at a heliocentric distance of 3.2 AU when a dust bulk density of 3×10^3 kg/m^3 is assumed.

The very preliminary GDS data analysis combined with the IS detections suggest a grain albedo ranging from 2% to 5% with densities ranging from 1×10^3 kg/m^3 to 3×10^3 kg/m^3. Initial observations indicate that the grains with lower albedo have higher densities.

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