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Dust dynamical traceback problem for derivation the surface properties of 67P/Churyumov-Gerasimenko based on the GIADA measurements

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Abstract

One of the intriguing questions to be answered with Rosetta space probe dust data is to determine the locations on the nucleus from where the observed dust grains were ejected and consequently to investigate on the 67P/Churyumov-Gerasimenko (67P) nucleus properties. The solution of this traceback problem requires 3D+t dusty gas model able to reproduce the measurements performed by various instruments onboard Rosetta.

As a first step, we use the GIADA (Grain Impact Analyser and Dust Accumulator) [1] in-situ dust measurements to trace the grains back to the nucleus using an inverse computation of trajectories of single grains having physical properties as measured by the instrument. We adapted our nonspherical dust dynamical code [2] to compute the trajectory of single dust grain back to the nucleus first solving the direct problem of GIADA dust particle motion in a simplified gas coma as in [3].

The resulting map of all GIADA particles on the 67P nucleus surface will be discussed as a preparatory strategy to tackle the trace back problem. This strategy will be compared with a new one that can resolve the trace back with a statistical approach. The latter looks for the most probable location on the comet nucleus from where the dust particle is emitted, the solution being a probability map for one particular family of emitted grains.

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References

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