

Physical properties of dust particles in different comets inferred from observations and experimental simulations

E. Hadamcik (1) and A.C. Levasseur-Regourd (2)

(1) Service d'aéronomie IPSL CNRS, UMR 7620, Route des Gâtines BP-3, Verrières-le-Buisson, F-91371 France, (2) Université Pierre et Marie Curie-Paris6, Service d'aéronomie UMR 7620, Verrières-le-Buisson, F-91371 France
(edith.hadamcik@aerov.jussieu.fr)

1. Introduction

Remote observations of solar light scattered by cometary dust particles provide information on the dust properties for a large variety of comets, in complement to the exceptional in-situ observations (with or without sample returns). The scattered light is partially linearly polarized, with a polarization degree depending on the geometry of observations (phase angle α) and on the physical properties of the particles. Differences in polarization have been found in cometary comae, pointing to different physical properties of the dust (e.g. sizes of the grains, of the aggregates, structures and porosities, complex refractive indices) [1, 2]. Such differences, as well as an observed polarimetric wavelength effect, tend to show that large aggregates made of submicron-sized grains could be present in some cometary comae regions [3, 4]. On the opposite, more compact particles seem to be present in other comae regions and/or comets [5, 6].

2. Results

We will present observations of different comets. The variations of the dust properties in the coma and their evolution will be discussed. The results will be compared to the results obtained by other observational techniques. On the images of comet 9P/Tempel 1 (at $\alpha=41^\circ$) some hours after Deep Impact, two kinds of dust particles are detected: more compact particles with small velocities and fluffy particles ejected by the impact

with larger velocities. On the images of comet 73P/Schwassmann-Wachmann 3, in the tail direction of fragment B, a disruption is observed. The dust coma around fragment C is more symmetric. For both A and B, important dust jets are ejected by the nucleus, which are visible on the intensity images in the solar and antisolar directions, and on the polarization maps.

3. Interpretation and conclusion

Numerical (7,8,9) and experimental simulations provide an interpretation of the observations in terms of the physical properties of the particles. Experimental simulations have been performed on numerous levitating samples (compact and fluffy) with the PROGRA² experiment, either in reduced gravity conditions (parabolic flights) [10,11], or lifted by an air-draught (laboratory conditions) [12,13]. The variations of the polarization are correlated to variations in the size of the grains and aggregates and are a function of the complex refractive index and its evolution. The correlation between the variations of the scattered intensity and the linear polarization maps allows us to disentangle different physical properties of the dust. The results are compared to results obtained from previous observations by the same methods.

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