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Dust properties modeled from light scattering and thermal emission observations

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The light scattered by cometary and interplanetary dust corresponds to smooth phase curves, typical of the interaction of light with irregular particles of size larger than the wavelength [1].

We present results of a versatile numerical model for dust clouds consisting of a mixture of silicates, organics - or possibly silicates core/organics mantle - compact (spheroids) and fluffy (fractal aggregates of up to 256 spheroids) particles. Comparison with observations gives insights into the physical properties of interplanetary and cometary dust clouds. Thermal properties of particles are also investigated.

The interplanetary polarization phase curve (at 1 AU in the ecliptic plane [2]) is best approached for a size distribution following a -3.1 power law between about 0.1 up to 100 μm sizes with a 45-70% silicates and 30-55% organics mixture in mass. The variation of polarization at 90° with the solar distance can be interpreted from the above model as a change in both composition and size distribution of the cloud.

The cometary polarization phase curves together with the quasi-linear dependence of the polarization with the wavelength in the visible are best approached with a size distribution following a -3 power law between about 0.1 up to 40 μm sizes of 40-67% silicates and 33-60% organics mixture in mass [3]. These results give hints on the physical properties of cometary comae which will be useful to optimize the rendezvous strategy of the Rosetta mission at 67P/Churyumov-Gerasimenko.

[1] Levasseur-Regourd et al., JQSRT 79-80, 903-10, 2003. [2] Levasseur-Regourd et al., In Interplanetary dust (Grün et al., Eds.), p. 57-94, 2001. [3] Lasue et al., JQSRT, 2005, in press.