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Interplanetary dust physical properties deduced from scattered and emitted light simulations

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In situ studies as well as interplanetary dust particles collections in the earth stratosphere provide important but spatially limited information about the interplanetary dust properties. It is therefore of major importance to complement these studies through remote observations of scattered and emitted light, interpreted through numerical simulations. Physical properties of the interplanetary dust in the near-ecliptic symmetry surface, such as the local polarization, the temperature and its composition, together with their heliocentric variations, may be derived from such observations [1], giving clues to the respective contribution of the particles sources. The size distribution, as well as the shape and the composition of the particles constituting the interplanetary dust cloud are tentatively derived from scattered and emitted light observations through a model of light scattering by a cloud of solid particles constituted by spheroidal grains and aggregates thereof [2]. Considering the same particles cloud, this model allows us to simultaneously interpret the heliocentric variation of the temperature, which is different from the black body one.

A good fit of the local polarization phase curve, $P(\alpha)$, near 1.5 AU from the Sun is obtained for a mixture of both silicates and more absorbing organics material ($\sim$40% in mass) and for a realistic particles size distribution, typical of the interplanetary dust (power law a^{-3} for particles with an equivalent diameter in the 0.2 μm to 20 μm size range and $a^{-4.4}$ for larger particles). The contribution of un-fragmented dust particles aggregates of cometary origin is at least 20% in mass around 1.5 AU. This size distribution can also explain the variation of temperature with the solar distance. The decrease of $P(\alpha=90^\circ)$ with the solar distance between 1.5 and 0.5 AU is interpreted as a progressive disappearance of solid organics (such as HCN polymers [3] or amorphous carbon) towards the Sun, probably linked with the presence of an extended zone of thermal degradation [4]. The drastic change of $P(\alpha=90^\circ)$ closer to the Sun, below 0.5 AU, could be the result of other minerals (e.g. silicates) degradations in this zone.

[1] Levasseur-Regourd et al., In: *Interplanetary dust*, Grün, Gustafson, Dermott, Fechtig (eds), pp. 57 (2001)

[2] Lasue and Levasseur-Regourd, *J. Quant. Spectros. Radiat. Transfer* **100**, 220 (2006)

[3] Fray et al., *Meteoritics and Planetary Science* **39**, 581, (2004)

[4] Lasue et al., *Astron. Astrophys.* (submitted)