Evolution of optical properties of organic materials when approaching the Sun: laboratory simulations

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Carbonaceous compounds are found in numerous clouds of solid particles in the Solar System (e.g. cometary comae, interplanetary dust). When particles containing organics approach the Sun their physical properties may change (size, structure, refractive index). The variation of the linear polarization and albedo measured by remote observations is a diagnostic to this evolution [1, 2].
The PROGRA2 experiment offers the capability to study clouds of solid particles [3,4]. The technique allows the use of large size distributions and a large variety of materials. We study organic particles (mainly Cx Hy Nz) that have been exposed to high temperatures up to 675 K. In a first part, we present some variations in the samples characteristics such as the color and albedo. The mass decreases as the temperature increases for some C-bearing compounds [5]. It may be related to distributed sources in cometary comae [6]. Changes in morphology produce changes in the scattered light. Variation in the linear polarization of the scattered light and in its spectral gradient, are diagnostics of these evolutions.
In a second part, we present polarization results on interplanetary dust analogs composed of different mixtures of silicates and organics. The samples were tentatively built using the results of a numerical model of evolution of particles as a function of solar distance [7]. We compare the linear polarization and its spectral gradient to results deduced from observations at different solar distances in the symmetry surface of the interplanetary dust cloud at a phase angle of 90° [1].

Keywords: Organics; interplanetary dust: comets; polarization; simulations

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