MODELING POLARIZATION PROPERTIES OF STRUCTURE ANALOGS OF COMETARY DUST PARTICLES

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Introduction: Cometary dust atmosphere is believed to include grain aggregates that can be considered in some approximation as pre-fractal clusters. This is confirmed with investigations of interplanetary dust particles [1] and results of *in situ* measurements by the Halley comet missions, e.g., [2]. We study scattering properties of such pre-fractal clusters.

Used model of aerosol aggregates: To construct pre-fractal clusters, we use the Whitten – Sander model, generalizing it for the 3-D case. In a finite cubic lattice we randomly put a grain in a cell. Then new grains are randomly added into empty cells. Each new grain randomly moves with the Monte-Carlo method. The movement of the grain in the lattice volume proceeds till it finds the initial grain. Then it stops and a next grain repeats the process of random moving. In such a way a pre-fractal cluster grows (see fig. 1). We use the discrete dipole approximation (DDA) method to study the polarization properties of the pre-fractal clusters with size parameter x = 8, 10, 12. Each cluster contains from 10000 to 70000 grains (dipoles).

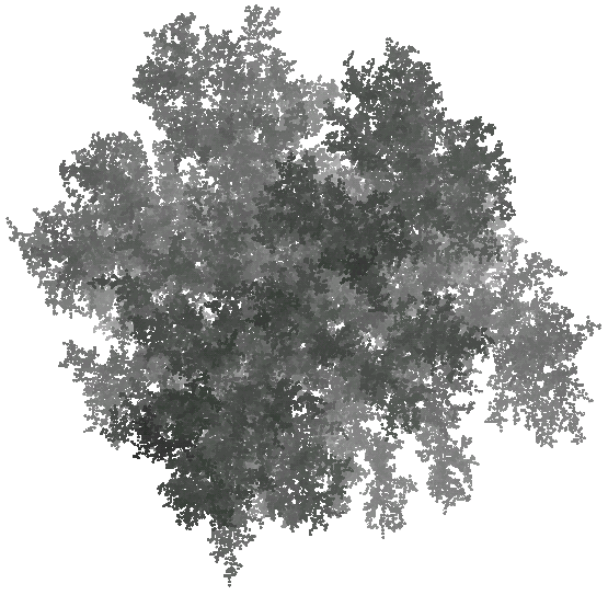

Fig. 1

Results and discussion: We have made calculations for various refractive indices of grains and different packing densities of clusters. We find that the clusters produce significant negative polarization branches at small phase angles, when packing density is large enough. The branches qualitatively consist with the observational data for cometary dust atmospheres. Increasing the packing density and the refractive index makes the negative polarization more prominent.

References: [1] Bradley, J.P., Sandford, S.A., Walker, R.M., 1988. Interplanetary dust particles. In: Kerridge, J.F. and Matthews, M.S. (Eds.), *Meteorites and the Early Solar System.* Univ. of Arizona Press, Tucson, pp. 861–895. [2] Fulle, M., Levasseur-Regourd A.-C., McBride, N., Hadamcik, E., 2000. In situ dust measurements from within the coma of 1P/Halley: first-order approximation with a dust dynamical model. *Astronomical Journal* 119, 1968-1977.