

Optical Properties of Complex Dust Grains

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Dust particles in space may appear as clusters of individual grains. The morphology of these clusters could be of a fractal or more compact nature. To investigate how the cluster morphology influence the calculated extinction of different clusters in the wavelengthrange $0.1 - 100 \mu\text{m}$, we have preformed extinction calculations of three-dimensional clusters consisting of identical touching spherical particles arranged in three different geometries: fractal, simple cubic and face-centered cubic.

Optical properties of fractal clusters with fractal dimation $D < 2$ have earlier been predicted to be significantly different from those with $D > 2$. In our calculations, however, we find that the extinction of fractal and compact clusters are of the same order of magnitude.

For the calculations we have perfromed an in-depth comparison of the theoretical predictions of extinction coefficients of multi-sphere clusters derived by a rigorous solution, on the one hand, and popular discrete-dipole approximations, on the other hand. This comparison is essential if one is to assess the degree of reliability of model calculations made with the discrete-dipole approximations, which appear in the literature quite frequently without an adequate accounting of their validity.