Self-consistent modelling of dust growth from the diffuse to dense ISM

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Dust grains play a crucial role in many physical and chemical processes in the ISM. Their properties influence, for example, the formation and temperature of the major molecules in molecular clouds. It is therefore important to characterise the grain size, structure, shape and material composition in all phases of the ISM. Observations of the dust SED and extinction point towards variations in dust properties in the transition from the diffuse to denser ISM. The observed SEDs show a decrease in colour temperature, an increase in the spectral index and an increase in emissivity in the far-IR and sub-mm [1,2].

We explain these variations by accretion and coagulation processes. Our modelling is based on the diffuse-ISM dust model of [3] and [4], for which we allow for the accretion of carbonaceous and ice mantles as well as coagulation into aggregates. We use DDA [5] in order to derive the optical properties of these evolved grains and DustEM [6] in combination with the CRT radiative transfer code [7] to determine the SEDs which we compare to observations. The variations in the optical properties due to dust evolution are able to describe the observed changes in the SED from the diffuse to dense ISM with Av<10 [8].

Références

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