Dust evolution from the diffuse to the dense ISM

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Dust grains are ubiquitous in all astrophysical environments, from the Solar System and protoplanetary disks to interstellar and intergalatic clouds, and their influence on the radiative properties of all these very diverse media is always significant through the absorption, scattering, and (non-)thermal re-emission of starlight. They are also a major player in the determination of the ISM gas temperature and have a great influence on the chemical complexity in the ISM. The grain radiative properties and their catalytic efficiency are, at least, reliant on the grain size distribution, structure and chemical composition, which vary throughout the dust lifecycle.

Observations show that major changes in grain properties occur from the diffuse ISM to cold and dense regions. Grain growth arises in cold molecular clouds and cores as traced by an enhancement of the dust far-IR emissivity, a change in the far-IR SED spectral index and by the effects of cloud-/core-shine from the visible to the mid-IR. The grain surface properties also appear to be altered compared to those found in more diffuse and warmer ISM regions, most certainly through gas accretion in the form of ice layers and possibly through the accretion of the smallest carbonaceous grains onto larger silicate ones. Dust evolution impacts a priori as much on its size distribution as on its structure or chemical composition. The aim of this introductory talk will be to make a brief inventory of the observations that have allowed us to measure this evolution and to see to what extent we can understand it today in terms of grain property modelling.