Dust modelling and confrontation to observations

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What are the properties of dust in the interstellar medium (ISM) and how do they change depending on local density? Since dust properties influence, for example, the formation and temperature of the major molecules in dense clouds and the grain dynamical behaviour when forming stars and protoplanetary disks, it is important to characterise the grain size, structure, shape, and material composition in all phases of the ISM.

Dust spectral energy distributions (SEDs) of dense ISM clouds show a decrease in colour temperature, and an increase in spectral index and opacity in the far-IR ad submm [e.g. 1, 2] when compared to diffuse ISM SEDs. Many dense clouds are also bright at visible to mid-IR wavelengths [3, 4, 5, 6]. These observations cannot be explained with environmental differences alone, but are assumed to occur due to changes in the dust properties. This finding seems to be also supported by Planck-HFI polarised data. Recently, Planck-HFI data revealed that dust properties do not only change in the transition from diffuse to dense ISM but also inside the diffuse ISM itself [7, 8], which was considered rather homogeneous until then. Observations by Planck-HFI for NH < 10^{21} H/cm² show variations in the dust temperature, submm opacity, and far-IR spectral index, at constant luminosity. This finding has a great impact on our understanding of the diffuse ISM since it implies that the dust properties vary.

In this talk, I will try to review the major advances that have been made by the PCMI community to model dust in the light of all the new observational constraints.

Références