ICED: IAS/CEA Evolution of Dust in Nearby Galaxies

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Interstellar dust grains are solid particles made of heavy elements vailable in the ISM, with sizes 0.3 nm<d<0.3 µm, rather uniformly mixed with the gas. Although accounting just for 1% of the ISM mass, they have a radical impact on galaxy emission, since they scatter and absorb starlight, and re-radiate at longer wavelengths a large amount of the total stellar power, up to 99% in ultraluminous IR galaxies [1]. Dust grains are also catalysts of numerous chemical reactions, including the formation of H_2 [2], and they are responsible for the heating of the gas in PDR [3]. A detailed knowledge of grain properties is crucial to study the ISM lifecycle and the evolution of galaxies, as it is needed to, e.g., unredden UV-visible observations; study deeply embedded regions; build reliable diagnostics of the physical conditions and of the evolutionary stage of a galaxy or a star forming region; provide accurate prescriptions in photoionization and photodissociation models.

Most of our knowledge of dust grains comes from studies of the Milky Way. However, the latter are limited by a narrow range of environmental conditions (e.g. no massive star forming regions, narrow radial metallicity gradient, passive central BH) and by confusion along the sightline [4]. Instead, nearby galaxies allow us to study dust grains in extreme conditions, since they harbor a wider diversity of metallicities, star forming regions, etc. They also constitute a necessary intermediate step towards understanding distant galaxies. Finally, high latitude observations of face-on galaxies can provide cleaner sightlines than the ones available for the MW.

This provides the scientific motivation for our project ICED. In this talk, I will present the major and latest results of our ongoing project, applied on a selection of nearby galaxies in the multi-wavelength DustPedia Archive [5], that have been recently observed at 1 and 2 mm by NIKA2 (IRAM 30-m telescope) as a part of the European consortium of NIKA2 Guaranteed Time program, IMEGIN (PI Madden). Interstellar dust grain properties, such as composition, size, geometry, temperature, mass, etc., are derived by the spatially-resolved modelling of the optical-to-cm galaxy Spectral Energy Distribution (SED), that is performed with the THEMIS dust evolution model [6], implemented within the hierarchical Bayesian SED fitting code HerBIE [7].

Références

[1] Clements DL et al. 1996. MNRAS 279:477-497 [2] Gould RJ, Salpeter EE. 1963. ApJ 138:393 [3] Draine BT. 1978. ApJS 36:595–619 [4] Galliano et al. 2018. ARA&A 56:673-713 [5] http://dustpedia.astro.noa.gr/ [6] Jones et al. 2017. A&A 602, A46 [7] Galliano 2018. MNRAS 476, 1445–1469