Probing dust grain properties in low-metallicity galaxies through the sub-mm excess with IRAM-30m/NIKA2

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Dust grain properties, including abundance and size distribution, evolve in response to local interstellar medium (ISM) conditions such as metal content, gas density, and radiation field intensity. How these properties vary across environments, however, remains difficult to constrain, as illustrated by the poorly understood sub-mm excess, which is frequently reported in low-metallicity galaxies, where observed flux densities at long wavelengths significantly exceed predictions from standard dust models. As the physical origin of this excess remains debated, characterising it is critical for accurate dust mass estimates and for constraining how grains evolve with environmental conditions.

In this talk, I will focus on the sub-mm excess in the low-metallicity subsample of the IMEGIN and SEINFELD surveys, which used the IRAM-30m/NIKA2 camera to observe more than 20 nearby galaxies at 1.15 mm and 2 mm. We modelled spatially resolved near-infrared-to-radio spectral energy distribution (SED) using the hierarchical Bayesian SED fitting code HerBIE (Galliano 2018), incorporating the laboratory-based THEMIS dust models (Jones et al. 2017; Ysard et al. 2024). By quantifying the strength of the sub-mm excess and its spatial variation within galaxies, we investigate its dependence on local metallicity, radiation field intensity, and ISM density. These results provide insights into dust grain evolution, specifically how millimetre-wavelength dust opacity and underlying grain properties vary across local ISM environments.