

A View on Dust Evolution with Metallicity and ISM physical conditions, from *Herschel* Observations of the Nearby Universe

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The observational approach to dust evolution consists usually in relating measured dust properties to parameters quantifying the physical conditions of a given region. Nearby galaxies constitute, in that sense, unique targets, due to the wide range of heavy element abundances (metallicity) and irradiation conditions they exhibit. Modeling the infrared (IR) spectral energy distributions (SED) of nearby galaxies observed with *Herschel* & *Spitzer*, nowadays, does not allow us to isolate individual grain processes. However, it is a powerful mean to scrutinize the variations of average grain properties with environmental conditions, providing crucial benchmarks for dust evolution models.

In particular, the evolution of the gas-to-dust mass ratio (G/D) with metallicity is one of the keys to understanding cosmic dust evolution. Individual galaxies, at different metallicities can be considered as snapshots of galaxy evolution, at different stages of their elemental enrichment, despite the possible differences in star formation history. I will first discuss a recent study (Rémy-Ruyer *et al.* 2013), presenting such a relation in a sample of 126 nearby galaxies observed with *Herschel* & *Spitzer*, covering 2 dex metallicity range. This work shows that the dust-to-gas mass ratio is roughly proportional to metallicity above $12+\log(\text{O}/\text{H})\approx 8.0$, and becomes non-linear below.

Then, I will discuss the methodological problems encountered when modeling dust properties and deriving correlations. Extending the work of Kelly *et al.* (2011) to complete dust models, I will show that hierarchical Bayesian modeling is the best way to unbiased correlations obtained with SED modeling. I will demonstrate it on *Herschel* observations of a resolved star-forming region.