Probing the impact of metallicity on the dust properties in galaxies

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As galaxies evolve, their Interstellar Medium (ISM) becomes continually enriched with metals, and this metal enrichment influences the subsequent star formation. Low-metallicity dwarf galaxies of the local Universe are ideal candidates to study the influence of this metal enrichment on the ISM properties of galaxies. Previous studies have shown that the ISM of dwarfs galaxies poses a number of interesting puzzles in terms of the abundance of dust grains, the dust composition and even the far-infrared (FIR) emission processes. Before the advent of Herschel, these studies were limited to the warmer dust emitting at wavelengths shorter than 200 microns and were done only on a small number of dwarf galaxies. Thanks to its increased sensitivity and resolution in FIR and submillimeter (submm) wavelengths, Herschel gives us a new view on the cold dust properties in galaxies and enables us to study the lowest metallicity galaxies in a systematic way.

To study the influence of metal enrichment on the ISM properties, we use two Herschel surveys spanning a wide variety of galactic properties in terms of metallicity, but also morphological type, stellar mass, star formation activity, etc. After discussing the motivations for my work, I will present these two samples. After collecting data over the full IR-to-submm wavelength range, realistic dust models are applied to analyse the dust properties (in terms of temperature, mass, luminosity and star formation activity) and their evolution with metallicity. Our study reveal different dust properties in low-metallicity environments compared to those observed in more metal-richs systems (e.g., an overall warmer dust component). An excess submm emission is often apparent near and/or beyond 500 microns rendering large uncertainties in the dust properties, even for something as fundamental as dust masses. We will thus discuss the appearance of this submm excess in our sample and test alternative dust composition, with more emissive grains, to explain this excess emission. Ideal tracer of the chemical evolutionary stage of a galaxy, the gas-to-dust mass ratios (G/D) is found to be much higher than what is expected by simple chemical evolution models. We will thus focus on the relation between G/D and metallicity and interpret it with the aid of different chemical evolution models to explain this unexpected trend. Finally perspectives to this work will be discussed.