Contribution ID: **79** Type: **Poster**

Dust and gas properties in nearby galaxies

Monday 11 June 2018 17:06 (1 minute)

The amount of dust in the interstellar medium (ISM) is directly linked to physical quantities that trace the evolution of galaxies. The emission from dust has been proposed as a probe of the amount of star formation within a galaxy and the physical properties of the dust are related to those of the ISM where it is located. Therefore, understanding better how the dust physical properties change under different conditions of the ISM will help us to get a better picture on how the dust traces the star formation rate and how galaxies evolve with time.

The infrared/submillimetre spectral energy distribution (SED) of galaxies provides a unique set of data to study how the dust is processed in galaxies and in the ISM in general. In this talk we present an analysis of the dust properties across the disc of M 33 performed by fitting the observed infrared SED at small galactic scales of $\sim$170 pc with the classical dust model from Desert et al. (1990). Our new analysis provides relative dust grain abundance of the different species and shows how they change with the ISM physical conditions in the disc of M 33. The dust grains are modified inside the star-forming regions, in agreement with a theoretical framework of dust evolution under different physical conditions. At each spatial location in the disc, we investigate how the gas-to-dust mass ratio is correlated with other physical properties of the galaxy: metallicity, dust and gas mass surface density and strength of the interstellar radiation field heating the dust.

The submillimetre excess, defined as the fraction of emission in the submillimetre range that is above a dust model having an emissivity coefficient β=2, is analysed at each spatial location. We produce a map of submillimetre excess in the 500μm SPIRE band for the disc of M 33. The excess can be as high as 50% and increases at large galactocentric distances. We further study the relation of the excess with other physical properties of the galaxy and find that the excess is prominent in zones of diffuse ISM outside the main star-forming regions, where the molecular gas and dust surface density are low.

We have applied the same methodology for M 33 to a set of nearby star-forming galaxies and we will present the first results of this analysis.

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Session Classification: Poster Presentations

Track Classification: Dust as a tool