An analysis of interstellar medium and star-formation scaling relations in nearby galaxies

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We present a detailed analysis of dust, star-formation and interstellar medium (ISM) scaling relations - pivotal when trying to understand the ISM evolution or the star-formation and the lifecycle of dust and gas - done on a representative sample of nearby galaxies, as a proof-of-concept study for a new alternative method to derive more accurate, dust-corrected star-formation rates (SFR) and related dust/ISM and star-formation quantities. Hα images are analysed in order to derive the integrated galaxy luminosity, known as a more instantaneous and accurate star formation rate tracer, and the required photometric and structural parameters. Dust- and inclination-corrected Hα luminosities, SFRs, and related quantities are determined for the analysis of the scaling relations, using a self-consistent method based on previous work prescriptions. The main advantages of the method are: a) only Hα fluxes / luminosities are needed; b) easy to use based on a few equations and numerical corrections; c) no Balmer decrements (or other hydrogen recombination lines) needed or the assumption of a certain attenuation curve; d) other dust models can be easily considered in the equations; e) dust masses, opacities and dust temperatures are determined along the way; f) more instantaneous dust-free SFRs can be derived; f) it can be applied for normal low- to intermediate redshift spiral, elliptical, and lenticular galaxies and used in larger scale studies of galaxy and ISM evolution.

To investigate which star-formation or ISM related quantity best traces dust temperature, we analyse relations between the dust temperature and surface densities of SFR, dust and other related quantities.

We also show how the diffuse dust distribution in the stellar disc compares with the extent of star-formation distribution and the stellar continuum emission one, and their evolution with stellar mass.