From Herschel to ALMA and NOEMA: FIR fine-structure lines as tracers of gas reservoir and star-formation rate at high-redshift

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Résumé

While Herschel has unveiled a rich treasure trove of high-redshift galaxies, quantifying the gas reservoir and star formation activities of these galaxies is the next major challenge that ALMA and NOEMA will pursue. Convenient laboratories to explore the gas and dust properties in conditions that may be representative of early universe environments are the local universe dwarf galaxies which provide a broad variety of conditions to study star formation and feedback on the interstellar medium over a wide range of low metallicity environments. The Herschel Dwarf Galaxy Survey has targeted 50 low metallicity galaxies in photometry and spectroscopy divulging the unusual dust and gas properties in dwarf galaxies. Their low metallicity has a striking impact on the physical processes that take place to shape the structure of the ISM. While CO is a formidable challenge to detect in dwarf galaxies, the FIR fine structure lines are relatively bright. Unusually high [CII]/CO ratios are observed - higher than the [CII]/CO observed in the dustier starburst galaxies, suggesting a very clumpy environment and the presence of a substantial reservoir of CO-dark molecular gas which is not traced by CO, but which may be residing in the photodissociated envelopes. Results of the survey and the tools we have at hand to measure star-formation rates using FIR fines structure lines, will be presented. These newly-calibrated star-formation rate tracers, can now be applied to the high-redshift galaxies using ALMA and NOEMA.

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