Thesis subject

Name of the laboratory: LAM/IRAM

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Subject's title: z-GAL: A redshift survey of the most brightest galaxies in the Universe

Subject description:
The discovery of a large population of bright sources at (sub-)millimeter wavelengths, the SubMillimeter Galaxies (SMGs), continues to have a profound impact on our understanding of galaxy formation and evolution. For these dusty galaxies, a large fraction of the light produced by the young stars is absorbed by dust and re-emitted in the far-infrared domain. They have the most extreme star formation rates (SFRs), and are likely to be the progenitors of massive elliptical galaxies (e.g. Casey, Narayanan & Cooray 2014). They have been found to reside up to z 6 - 7 and represent a key population for the understanding of galaxy formation and evolution.
The z-GAL project is an on-going Large Program using the NOEMA interferometer at IRAM, whose primary goal is a comprehensive redshift survey of a sample of the brightest SMGs from the main Herschel surveys. Together with the results of previous campaigns and other on-going projects, z-GAL will provide a sizeable and homogeneous sample of about 200 SMGs with reliable redshifts. It will increase very significantly the number of SMGs with known redshifts at the peak of the cosmic star-formation rate density, especially those either lensed or intrinsically hyper-luminous. It will also be possible to extract a lot of physical properties of this complete large sample of dusty luminous star-forming galaxies in the early universe.

The successful PhD candidate will be fully part of the z-GAL collaboration project, and will work in close collaboration with all its members. Within this project, the specific thesis objectives are (i) to study of the dust continuum properties of the z-GAL sources and their evolution with redshift, which is a crucial information for galaxy evolution models and (ii) to derive the properties of the interstellar medium, from which stars are formed, in high redshift starburst galaxies with mean stacked spectra of the z-GAL sample by identifying faint emission lines from the molecular and atomic gas. Both, dust continuum and emission lines, are key tracers of star formation activities and will help us understanding the physical conditions of star formation in these objects.

The PhD student will also participate to the follow-up observations of the z-GAL program, in particular at radio wavelength, and the high-angular resolution follow-up of the most interesting z-GAL sources. She/he will also contribute to the production of z-GAL sources catalogue including physical properties. Using already existing tools, she/he will perform source detection in data-cubes, and/or develop new optimal methods to robustly extract their spectra. These spectra will be combined to other datasets to build multi-wavelength spectral energy distribution used to extract physical properties as dust masses and star formation rate/history, using the "Code Investigating GALaxy Emission" (CIGALE) program developed at LAM.

This thesis is funded by the z-GAL ANR project, and offers the opportunity to participate to a pioneering observational project, within a dedicated team at LAM and many collaborators in France or over the globe.

Bibliography:

z-GAL:

http://www.iram.fr/~z-gal/Home.htm

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Berta, S. et al. 2019, in prep

Herschel Extragalactic surveys:

Oliver S. J. et al. 2012 MNRAS 424, 1614

Eales, S.A. et al. 2010, PASP 122, 499

Negrello, M. et al. 2017 MNRAS 465, 3568

Casey, Narayanan and Cooray 2014, Physics Reports, 541, 45

Related Studies:

CIGALE tool: Boquien et al. 2019, A&A 622, A103

Spilker, J.S. et al. 2014 ApJ 785 1469