



PhD Thesis

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PhD title: The cosmic census of the galaxies in the distant universe

Subject description (1 page max.):

The origin and evolution of galaxies and their major mode of stellar formation is a key question of modern astrophysics. Whereas the evolution of dark matter structure is described relatively satisfactorily, the evolution of the baryonic content of galaxies inside dark halos remains puzzling and is certainly a complex process involving radiative, hydrodynamic and gravitational processes highly non linear. The star formation rate (SFR) and the mass locked in stars (M_{\star}) at different ages for individual objects or integrated over the whole galaxy population have been recognized for a long time as key parameters to study this baryonic evolution.

The European FP7/HELP project (Herschel Extragalactic Legacy Project) is producing a state-of-the-art source extraction from the Herschel cosmological surveys, HerMES and H-ATLAS with all the available ancillary data processed in a homogeneous way on several hundreds square degrees distributed in several fields. This unique set of data is perfectly suited to build multi-wavelength datasets and measure physical quantities like SFR, M_{\star} , dust masses or luminosities up to redshifts 2-3.

Several topics will be investigated with these exquisite data like the evolution of dust content in relation with the star formation rate in the universe or the co-evolution of star formation and nucleus activity (AGN). The observations and the deduced quantities will be confronted to models. Numerical models, either semi-analytical, hydrodynamical or phenomenological will be used to simulate the observations and their predictions compared to the data.

A particular care will be put in the analysis of galaxies hosting an AGN: the role of the AGN in their star formation activity is still poorly known and the study of large samples of objects as complete as possible is needed to understand their contribution in the galaxy evolution. These objects will be identified in the Herschel fields and their star formation rate measured from their spectral energy distribution, accounting for all the available information, including X-ray and radio emission.

At the beginning of the thesis, the data will all be available and a first order analysis already performed for the HELP project. The first step of the work will consist in a careful definition and analysis of the samples. Then physical parameters will be measured by fitting the full spectral energy distribution, specific tools will have to be developed for the AGN contribution based on the analysis of the spectral energy distribution including X-ray data. Endly, the results will be confronted to models to constrain them and quantify the impact of an AGN on galaxy evolution, and according to the main properties of the galaxies

Bibliography :

HELP project : <https://herschellegacyproject.wordpress.com/>

Madau & Dickinson 2014 ARA&A 52, 415 for a general introduction to the field

Buat et al. 2012 A&A 545, A141 for an example of analysis of the data

Cousin et al. 2015 575, A32 for semi analytical models

Bethermin et al. 2012 , A&A 757, L23 for phenomenological models

Rosario et al. 2012 A&A 545, A45 for an example of AGN/SF analysis

Mehdipour et al. 2015, A&A 575, 22, for analysis including X-ray data