Thesis subject

Name of the laboratory: Laboratoire d'Astrophysique de Marseille

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Subject's title: A cosmic census of obscured star formation back to cosmic noon

Subject description:

The nature of stellar formation modes that a galaxy experiences along its lifetime is a key question of modern astrophysics. To address these questions from an observational side and put constraints on models aimed at explaining galaxy formation, data covering the entire electromagnetic spectrum are crucial to fully characterize galaxies.
For the first time we have the clues to perform a complete census of the star formation in the distant universe with an extremely large statistics. The Herschel observatory provided us with a huge harvest of far-infrared (IR) data (100-500 µm) in cosmological surveys covering more than 1000 square degrees: these data are mandatory to trace the obscured star formation. Combined with data at other wavelengths we have access to the non-obscured star formation and to other key parameters such as the stellar mass to define complete samples. The collation and the homogenization of data over the whole electromagnetic spectrum is available as the final product of the large European HELP project. With these exquisite data we can investigate few key topics, all identified as critical for our understanding of the evolution of galaxies: (i) large scale and statistical characteristics of dust attenuation in galaxies by providing recipes and attenuation curves and replacing them in the context of galaxy evolution, (ii) co-evolution between star formation and black hole growth by measuring correlations between star formation rate and the presence of an active nucleus (AGN) over samples of galaxies carefully selected, (iii) search for dusty, luminous and rare high redshift galaxies to put strong constraints on galaxy formation models. The studies will be investigated at any reachable redshift including the period when the star formation rate density in the universe is at its maximum.

The PhD student will have access to all the HELP data (delivered mid-2018), the analysis tools are already developped. She/he will first define the samples to be studied in relation with the scientific goals and perform the multiwavelength analyse (stacking, multiwavelength fits). She/he will also have access to early JWST data (Early Release Survey) both photometric and spectroscopic, and could join the NIKA2 and MOONS/VLT teams to address his/her scientific goals. She/he will also have the opportunity to work at extending our fitting tool to combine photometric and spectroscopic data to prepare the exploitation of these future data.
The PhD student will join the GECO (Galaxies, Etoiles et Cosmologie) team, and will work in a lively and pleasant context, with frequent scientific and social events.

Bibliographic references:

- Buat et al. 2015, A&A, 577, A141 : Dust attenuation up to z=2 in the AKARI North Ecliptic Pole Deep Field
- Ciesla et al. 2015, A&A, 576, A10 : Constraining the properties of AGN host galaxies with spectral energy distribution modelling
- Noll et al. 2009, A&A, 507, 1793 : Analysis of galaxies SED from far-UV to far-IR with CIGALE
- Pacifici et al. 2015, MNRAS, 447, 786 : On the importance of using appropriate spectral models to derive physical properties of galaxies at 0.7<z<2.8

Surveys :

Herschel/HELP: http://herschel.sussex.ac.uk/
JWST-ERS: https://jwst.stsci.edu/science-planning/calls-for-proposals-and-policy/early-release-science-program
MOONS : https://www.eso.org/sci/facilities/develop/instruments/MOONS.html
NIKA2: http://ipag.osug.fr/nika2/Welcome.html

Team
https://www.lam.fr/recherche-14/galaxies-etoiles-et-cosmologie-geco/