Thesis subject

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Subject's title: Star Formation and its history in nearby galaxies at low and high surface brightness

Subject description:

It was discovered about 10 years ago that 30% of galaxies present an eXtended Ultra-Violet disk (XUV), showing unexpected star formation at very large distance of the center of galaxies, at low density (Gil de Paz et al. 2005, Thilker et al. 2007, Boissier et al. 2007). With the progresses of detectors, it is now possible to make deep photometric and spectroscopic measurements down to very low surface brightness (SB). We are currently re-discovering the outskirts of nearby large spiral galaxies such as M83; We are finding new galaxies at low SB and densities (e.g. ultra-diffuse galaxies -UDG- of Koda et al. 2015, low SB disk of Hagen et al. 2016). We also have the opportunity to study the class of giant low SB galaxies like Malin 1 (Boissier et al. 2016), with a disk diameter above 200 kpc. It is now important to understand how star formation proceed in such regions, and how it compares to the more usual "high" surface brightness galaxies.

In an on-going collaboration involving J. Koda (New York), A. Gil de Paz (Madrid), B. Madore (Pasadena), we have in hands several sets of photometric and spectroscopic data to achieve this goal:
- Spectroscopy of Malin 1 and in the outer disks of NGC6946 (we also have an on-going MUSE proposal for Malin 1). Spectroscopy will allow us to better know the star formation rate, attenuation, metallicity in these very low surface density regions.
- Very deep photometry of a set of XUV galaxies and of UDGs in several clusters, including Subaru Hyper-Suprime Cam. This will allow us especially to study the structure (size, SB) of galaxies and study their formation history.
- We also have in hands multi-wavelength data in M83 (including ALMA, spectroscopy, HI and UV archival data) in which we will re-investigate especially the "star formation law" on different spatial scales.

Finally, we have access to different type of models that can be used to interpret the empirical results coming from these studies, or to make predictions concerning the high redshift universe.

The PhD candidate will participate in these projects and will lead as a priority the study of our spectroscopic data (and potentially some of the studies based on the photometry). The work will take place in the GECO team at LAM, offering a lively and active environment, with interactions with our international partners.

Bibliography:

Some references related to the project:

- Boissier et al. 2007, “Radial Variation of Attenuation and Star Formation in the Largest Late-Type Disks Observed with GALEX”, ApJS 173, 524
- Boissier et al. 2008, « GALEX Observations of Low Surface Brightness Galaxies: UV Color and Star Formation Efficiency », ApJ 681, 244
- Boissier et al. 2013 “Star formation in galaxies”, Planets, Stars and Stellar Systems Vol. 6, by Oswalt, Terry D.; Keel, William C., ISBN 978-94-007-5608-3. Springer Science+Business Media Dordrecht, 2013, p. 141
- Boissier et al. 2013B, “A method for quantifying the gamma-ray burst bias. Application in the redshift range of 0-1.1”, A&A 557, 34
- Boissier et al. 2016 “The properties of the Malin 1 galaxy giant disk. A panchromatic view from the NGVS and GUViCS surveys”, A&A 593, 126
- Koda et al. 2015, « Approximately a Thousand Ultra-diffuse Galaxies in the Coma Cluster”, ApJ, 807L, 2
- Thilker et al. 2007, “A Search for Extended Ultraviolet Disk (XUV-Disk) Galaxies in the Local Universe”, ApJS, 173, 538