Thesis subject

Name of the laboratory: Laboratoire d'Astrophysique de Marseille (LAM)

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Subject's title: **Cosmic Reionization: The Privileged View of MUSE and the Gravitational Telescope**

Subject description:

The goal of this thesis project is to understand the galaxy formation process, based on the identification and study of the **first galaxies formed in the early universe**, and their relative **contribution to cosmic reionization.** The student will take advantage from a privileged access to one of the best facilities currently available to achieve this goal, namely the MUSE/VLT(1) Guaranteed Time Observations of lensing clusters already performed by the collaboration. The student will participate to the scientific activities of the MUSE collaboration on this domain, in particular the international collaboration team working on this topic.

MUSE observations for this project are focused on the Lyman-alpha emitters (LAEs) identified at $2.9 < z < 6.7$ behind lensing clusters, without any photometric pre-selection. This is an original aspect of this project because a significant fraction of LAEs are not detected on the deepest photometric surveys or display extended Lyman-alpha emission (see e.g. Wisotzki+ 2016). By construction, the sample of lensed galaxies explore the faintest limits in luminosity, and encompasses the end of the re-ionization at $z\sim6$. The feasibility of the concept has been demonstrated by two pioneer studies conducted by our group on a sub-sample of four lensing clusters, which made it possible, for the first time, to constrain the shape of Luminosity Function for the faintest LAEs (Bina+2016, de la Vieuville+ 2019), and to evaluate the interrelation between the populations of Lyman Break Galaxies and LAE within the same volume of the universe (de la Vieuville et al. 2020). The final goal is to quantify the contribution of the different populations of star-forming galaxies to the re-ionization process.

There are presently 12 lensing clusters observed by MUSE, with reduced data cubes and catalogues already available, containing a few hundreds of lensed LAEs (Richard et al. 2020). Three additional clusters will be available in the coming months. Also accurate lensing models are available for all these clusters. Most of the tools needed to investigate the global properties of these population are already available from previous pioneer studies conducted by our group. In this thesis we expect to include all the possible cluster fields observed by MUSE in order to reach unprecedented accuracy in the measurement of the Luminosity Function of LAEs towards the faintest limits in luminosity, knowing that this faint population is susceptible to make a major contribution to the re-ionization process. Depending on the availability of multi-wavelength observations on these fields, a close up look at some of these galaxies based on SED-fitting procedures would allow us the better characterize the physical properties of (at least) a sub-sample of these galaxies, such as the star-formation rates or the stellar masses.

The exploitation of the MUSE blind survey of magnified high-redshift galaxies represents a unique opportunity for a student to explore galaxy formation when large projects such as JWST, EUCLID and the ELTs will start operations.

Bibliography:

(1) http://muse-vlt.eu/science/
- Bina, D.; Pelló, R.; Richard, J.; et al. Astronomy & Astrophysics, Volume 590, id.A14, pp.
- de La Vieuville, G.; Bina, D.; Pello, R.; et al., 2019, A & A, Volume 628, id.A3, 30 pp.
- de La Vieuville, G.; Pello, R.; et al., 2020, A & A, Volume 644, id.A39, 10 pp.
- Richard, J., Claeyssens, A.; Lagattuta, David J.; Guaita, L.; Bauer, F. E.; Pello, R.; et al. 2020, A&A submitted, eprint arXiv:2009.09784
- Wisotzki, L., Bacon, R., Blaizot, J., et al. 2016, A&A, 587, A98