Thesis subject

Name of the laboratory: Laboratoire d'Astrophysique de Marseille

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Subject's title: High-redshift galaxies nebular emission lines

Subject description:

The goal of this PhD is to understand how the high-redshift galaxies evolution, from the epoch of reionization to nowadays, through their interstellar medium spectroscopic signatures. To go back in time and understand this evolution, we propose to model the emission spectra of atomic and molecular tracers from the X-rays to millimeter wavelength range for different galactic components: the HII region, the photodissociation region (PDR), the molecular region and a possible Active Galactic Nuclei (AGN).

The student will update the CLOUDY radiative transfer code chemical reactions network using recent astrochemical databases (UGAN, KIDA) to model chemical abundances and emission lines fluxes in HII regions, in PDRs, in the molecular regions and in AGN. The abundances and spectra of the different species will be calculated according to different parameters (metallicity, ionization rate, hydrogen density, dust abundance and size, star formation history, ...), their spectra will be included in the spectral energy distribution modeling and adjustment code, CIGALE, developed at LAM https://cigale.lam.fr). The spectral energy distributions can then be compared to existing observations (Herschel-FTS, ALMA, NOEMA, ...) or be used to predict next-coming observations (JWST, MOONS, PFS, MOSAIC, ATHENA, OST...). We will try to identify what are the robust tracers that provide reliable diagnostic of the evolution of galaxies.

Bibliography:

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- Constraints on the cosmic-ray ionization rate in the z~2.3 lensed galaxies SMM J2135-0102 and SDP 17B from observations of OH^+ and H_2O^+, Indriolo N. et al., arXiv:1808.04852v1
- HD and H_2 formation in low-metallicity dusty gas clouds at high redshift, S. Cazaux and M. Spaans, 2009, A&A, 496, 365