Joining RAMSES simulations and LGRB afterglow spectroscopic observations to study high-redshift galaxies

The afterglow spectroscopy of Long Gamma Rays Bursts (LGRBs) is a major tool to study the chemical properties of their host galaxies even at very high redshift. When the afterglow illuminates the galaxy as a background source, it reveals non-radiating elements present in the gas, along the line of sight, through absorption lines in the spectra. This offers unique information on the gas in, and surrounding, the GRB star forming region, as well as of the warm gas in the interstellar medium of the galaxy. Combined with typical observations integrated over the entire galaxy, from photometry or emission line spectroscopy, LGRBs bring a broad view of the physical property of its host. That makes LGRBs unique tools to better understand galaxy evolution.

I will present ongoing work comparing results of the observations of LGRB host galaxies and zoom-in hydrodynamical simulation of a representative LGRB host at redshift z=3, focusing in particular on neutral hydrogen, metals, and escape of lyman-alpha and ionizing photons. The goals of my work is to physically interpret LGRB spectra, to investigate the impact of LGRBs on the progenitor environment, and test galaxy simulations. I will discuss the results of the exploration related to the absorption of neutral hydrogen and escape of lyman-alpha and ionizing photons, and I will also present some preliminary results I obtained on metal absorption lines.