

Celebrating 20 years of Swift Discoveries



Contribution ID: 71

Type: **Contributed talk**

GRBs as probes of the high- z Universe

Tuesday 25 March 2025 16:30 (15 minutes)

The characterization of galaxies at the highest redshifts remains one of the central goals in contemporary astrophysics. For the last two decades, GRBs have been heralded as effective diagnostic to probe the interstellar medium (ISM) of high-redshift faint star-forming galaxies and their metal content. An opportunity to fulfill this promise was provided by the bright GRB 210905A at redshift $z=6.3$ and by the recent blast of GRB 240218A at redshift $z=6.8$, both discovered by Neil Gehrels Swift Observatory.

VLT/X-shooter optical spectroscopy of GRB 210905A afterglow allowed to detect and characterize in detail neutral-hydrogen, low-ionization, high- ionization and fine-structure absorption lines, as well as a tentative Lyman- α emission. Metallicity, kinematics, chemical abundance pattern, dust depletion and dust-to-metal mass ratio could be determined for the ISM and CGM of the GRB host galaxy. Additionally, late-time HST and VLT/MUSE observations of the GRB field revealed a complex picture of the GRB host galaxy and its surroundings. Another possibility to study the neutral gas in such galaxies at the end of the reionization era has been recently provided thanks to the VLT/X- shooter spectrum of GRB 240218A. The results that I will present in this talk provide unique information on the metal enrichment history of the Universe, rivaling and complementing JWST surveys. Furthermore, they motivate pursuing GRBs dedicated space missions to fully exploit the possibility to use GRBs to explore the high-redshift Universe.

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Session Classification: GRB as probes