UV instruments to explore the gas processes governing galaxy evolution at z<2

The ultraviolet (UV) wavelength range offers a unique window into the universe. In particular, UV provides direct access to the star formation rate (SFR) across all redshifts as well as gas processes mapping through Lyman alpha (Lyα) emission before cosmic noon (z<2).
When coupled with observations from the U-band to NIR from ground-based telescopes, SFR estimates can be corrected for dust extinction and provide insights into the evolving star formation rates since cosmic noon (Picouet 2023).
However, the mechanisms governing star formation, such as accretion and outflows, remain elusive in current surveys. Without direct observations of these underlying gas processes, understanding the decline in star formation rates over cosmic time will remain challenging.
The circumgalactic medium (CGM), situated at the interface between galaxies and the intergalactic medium (IGM), is the crucial interface where the gas and energy exchanges happen, influencing star formation in galaxies. In recent years, new generation of integral field spectrographs like MUSE and KCRM were able to address this gap by imaging the gas around galaxies at z>2.
Because of the inherent difficulties of vacuum UV observations, we currently don't have CGM observations after cosmic noon. The FIREBall-2 pathfinder, a multi-object slit UV spectrograph, was specifically designed to fill this gap by imaging Lyman alpha emission from the CGM at z~0.7 and is scheduled for a new launch in 2025.
Despite its potential, observing the CGM in the UV spectrum poses significant challenges due to its faint nature and the requirements for photon starved astronomy: long integration time, large collecting area and photon-counting detectors. Therefore, in parallel to FIREBall-2, conceptual studies are underway to explore the feasibility of developing a lower-mass version of the instrument for deployment on super-pressure balloons, enabling extended observations up to a hundred of nights.
In addition to stratospheric UV projects, recent advancements in UV technology have led to the selection of the MIDEX ultraviolet Explorer (UVEX) for phase B: a NUV & FUV imager equipped with an enhanced resolution spectroscopic channel (R~2500). Scheduled for launch in 2030, UVEX will have the capability to map the surrounding of galaxies and enhance our understanding of the CGM and its role in galaxy evolution.
In this presentation, I will discuss the status of these different projects, as well as their capabilities in mapping the gas processes driving galaxy evolution at low redshift.