Unveiling the Demography of High-Redshift Galaxies through In-depth JWST Studies

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This work presents a thorough analysis of the data collected by the James Webb Space Telescope (JWST) during its first observation cycle, highlighting distant galaxies from the era of reionization ($z > 7$) [1]. By leveraging the PRIMER observation program, we observed the deep extragalactic fields COSMOS and UDS using the JWST's MIRI and NIRCam instruments, complementing pre-existing data from various instruments such as the HST, VLAT, and ALMA. Our main goal was to set new observational constraints on the formation and evolution of galaxies based on photometric data.

The process began with the calculation of photometric redshifts [2] using LePhare, a set of Fortran programs designed for fitting the spectral energy distribution. We tackled the challenges associated with confusion between stars and galaxies due to instrumental and physical limitations, notably by analyzing the spectra of sources with and without MIRI detection.

The advanced analysis included reproducing color-color diagrams for the selection of high-redshift galaxies and the potential detection of AGNs, based on criteria established in recent works [3]. Furthermore, we explored the selection of brown dwarfs by reproducing specific criteria from the literature.

Results include the selection of 57 objects whose spectral properties match those of distant galaxies with a redshift higher than 5, as well as the identification of 4 candidate massive high-redshift galaxies, potentially harboring an AGN. Statistical analyses, including histograms of optimal redshift (zbest) and dust extinction (EB-V), as well as the luminosity function by redshift bin [4], were performed using Python and the astropy libraries, highlighting the importance and complexity of studying the earliest galaxies.

This work opens new perspectives in understanding the young universe and underscores the potential of the JWST in revolutionizing our understanding of cosmology and galactic evolution

References

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