Searching for the Missing Puzzle Pieces of the Early Universe with JWST in the COSMOS Field — 3μm Dropout Galaxies

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Abstract

The profound quest to understand the emergence of the first galaxies, focuses on identifying remote galaxies in projects like the Cosmic Evolution Survey (COSMOS), such as the "Search of 3μm Dropouts in JWST COSMOS field," aiming to push observational boundaries and analyze data for insights into the primitive conditions of the universe during the Epoch of Reionization, particularly studying Lyman break galaxies at redshift z~7.88 and their unique spectral features in various wavelength bands.

Intro

What are “Dropout Galaxies”?

The wavelengths of sources from high redshift galaxies (z>6) were to too long to be observed by certain filters for shorter wavelength.

Why we want to find the “Dropout Galaxies”?

To find the composition of early cosmos, that is, high redshift galaxies compositions.

Why do we choose COSMOS Field?

To find the wider field than the field we observed before.

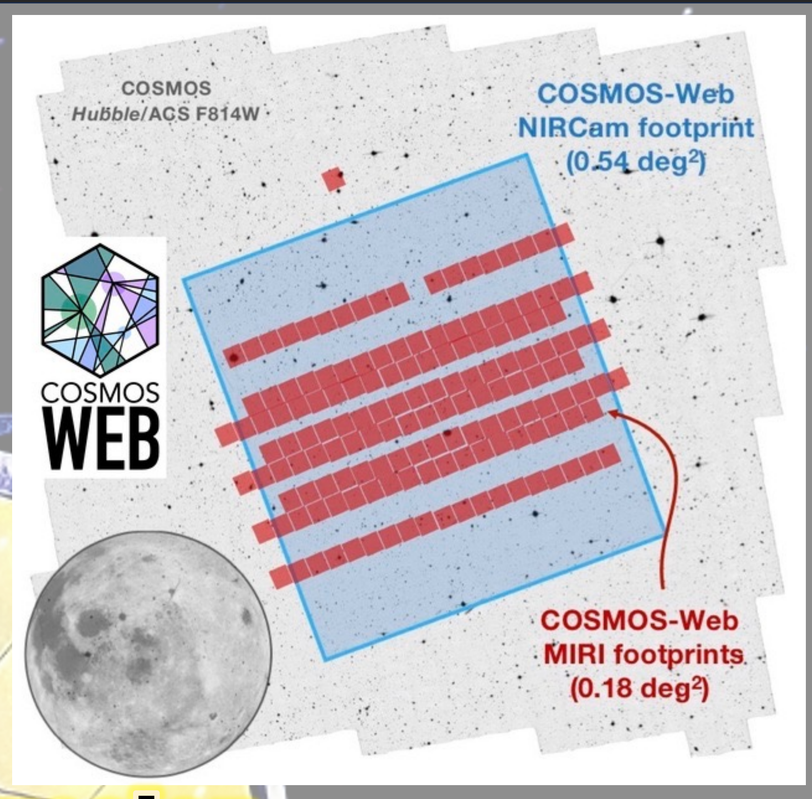

Figure 1. z > 7 redshift intervals and the corresponding wide-band JWST/NIRCam filter response curves
(Credit by COSMOS-Web)

Method

The 4 Filters of JWST

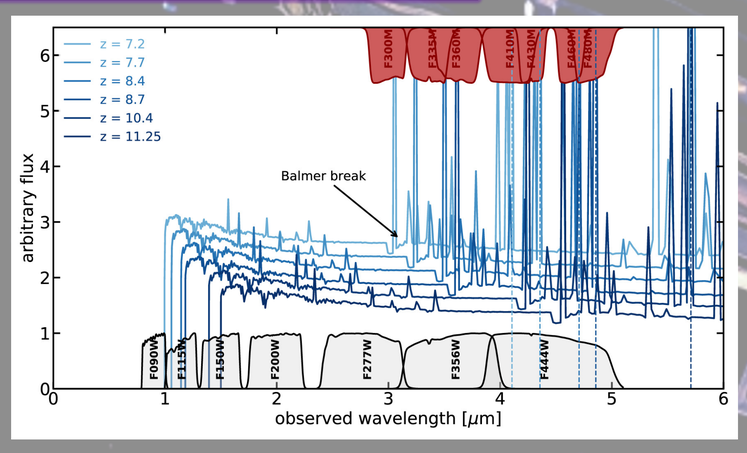

Figure 2. z > 7 redshift intervals and the corresponding wide-band JWST/NIRCam filter response curves (Credit by Guido Roberts-Borsani et al. 2021)

JWST observes the COSMOS field using four filters: F115W, F150W, F277W, and F444W. In the quest to identify galaxies at redshift z ~7.88, our focus lies in detecting F150W dropouts.

COSMOS-Web has the ambitious goal of mapping the earliest structures in the universe, intending to conduct a comprehensive survey encompassing up to 1 million galaxies. This survey is anticipated to span 255 hours of observing time.

Result & Discussion

The Criteria

We can find the 3μm dropout galaxies candidates, being decided by the criteria (Harikane et al. 2021)

$$F150\ Dropout$$

$$\begin{cases} (F150W - F277W) > 1.0 \\ (F277W - F444W) < 1.0 \\ (F150W - F277W) > 1.5(F277W - F444W) + 1.0 \end{cases}$$

Figure 3. The equation of the dropout galaxies criteria.

Color-Color Diagram

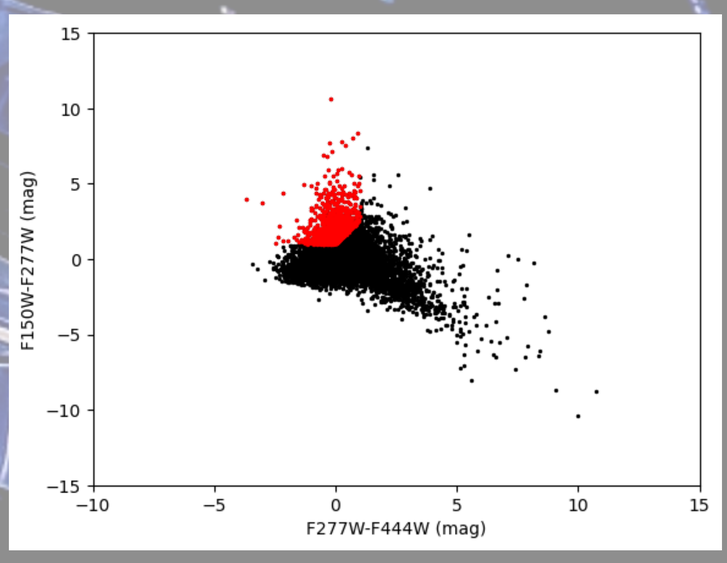

Figure 4. Color-Color Diagram of the galaxies. The red data points represent dropout galaxies candidates based on the equations in Fig.3.

Future work

Make the Cutout image

We will find the galaxies with the images of observing,i.e., the cutout images for different places of galaxies, in order to confirm if the candidates are truly dropout.

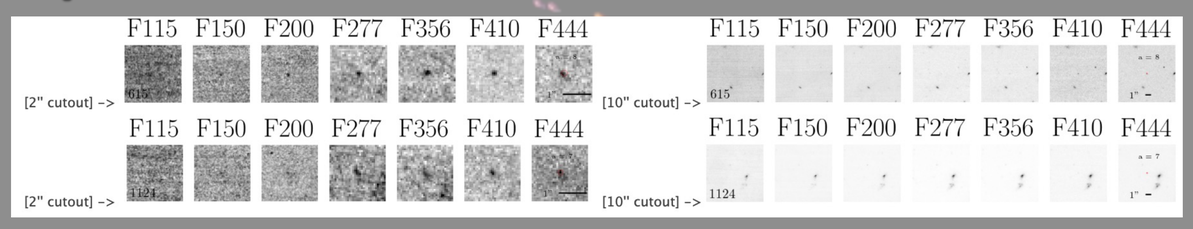

Figure 5. Cutout images of the dropout sources of CEERS fields (Credit by Jacob Cheng-Yu Yen)

COSMOS