

CHORUS: Searching for faint AGNs at $z=4.9$ with dual narrow-band excess selection

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Abstract

We search for high redshift type-2 Active Galactic Nuclei (AGNs) as well as type-1 in a wide field ($\sim 1.6 \text{ deg}^2$ in the COSMOS field) based on the dual narrow-band excess selection under the CHORUS project. By combining Subaru/HSC NB718 and NB921 data, we have selected 4 reliable NB718-NB921 dual-excess objects, that should be Ly α -Civ dual emitters at $z\sim 4.9$. If all their redshifts are really 4.9, the number density will be $8 \times 10^{-6} \text{ Mpc}^{-3}$ at $M_{1450} \sim -21.0$, which is comparable to that of faint AGNs at $z\sim 5$ selected by X-ray observations and “little red dots” recently found from observations with the JWST. Therefore, our faint AGN candidates, which were missing so far, may also play an important role in keeping the intergalactic medium highly ionized in the $z \sim 5$ Universe.

Background

Number density of high- z AGNs

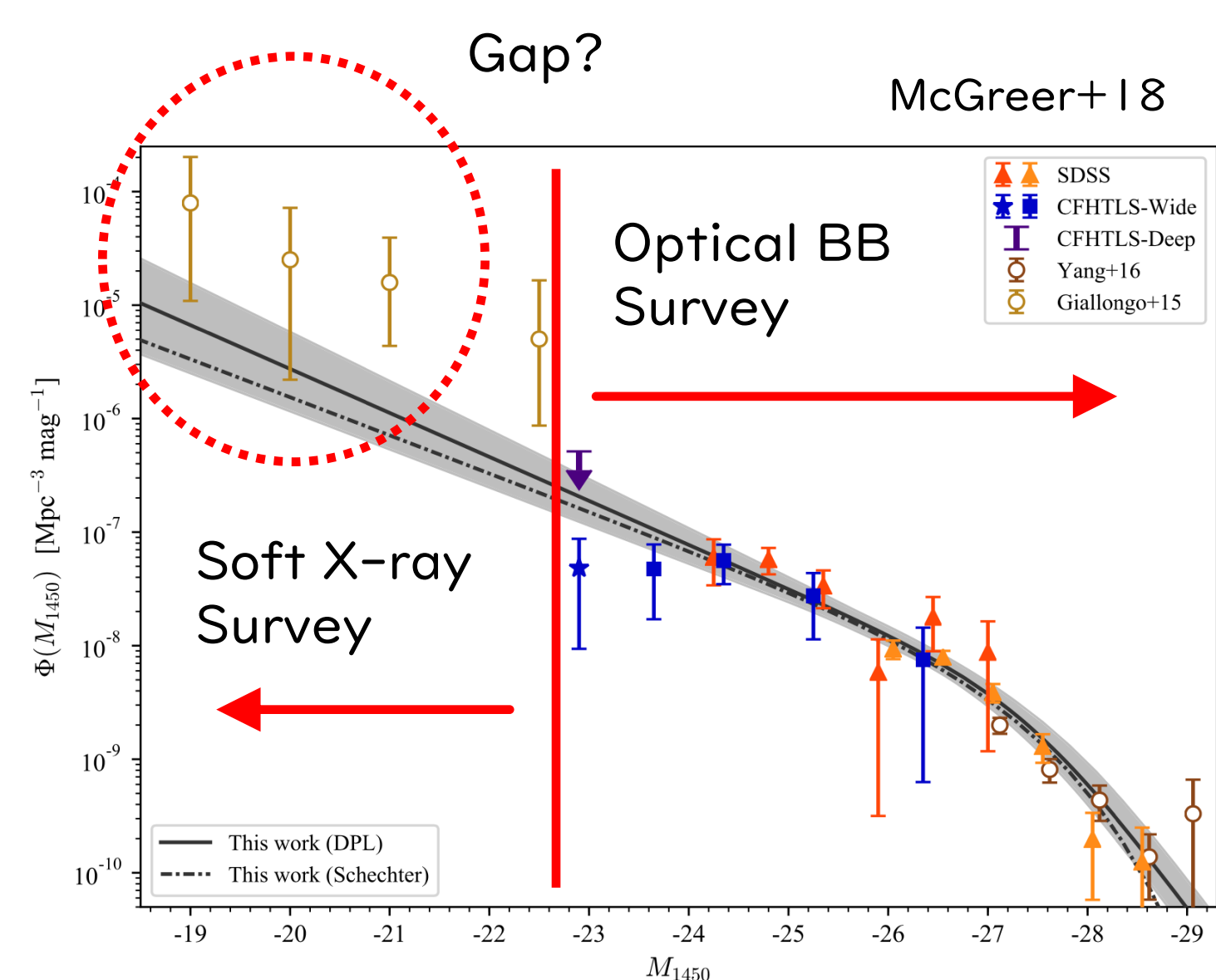
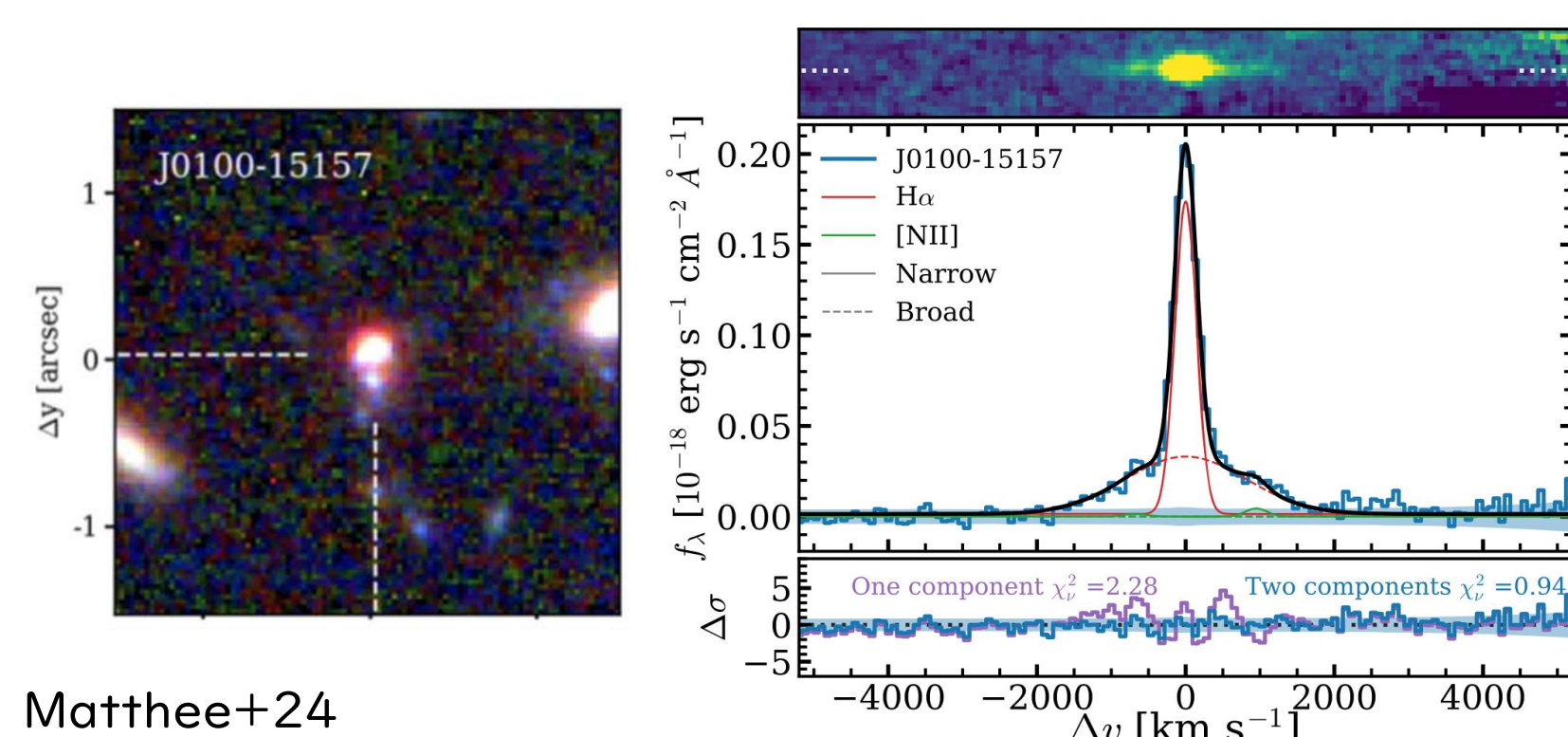


Fig.1 Number density of AGNs

- Optical Broad-Band surveys are insensitive to type-2 AGNs.
- Soft X-ray surveys are close to the sensitivity limit.
- There is a gap between the number density of faint AGNs and the extrapolation from bright quasars.

Is the number density of faint AGNs high?

“Little Red Dots” found by JWST



Matthee+24

Fig.2 False-color image and Ha line profile

- Compact morphology
- Blue UV and Red optical colors
- Broad component in Ha emission line

Faint AGN candidates?

Data & Sample selection

CHORUS+HSC-SSP imaging data

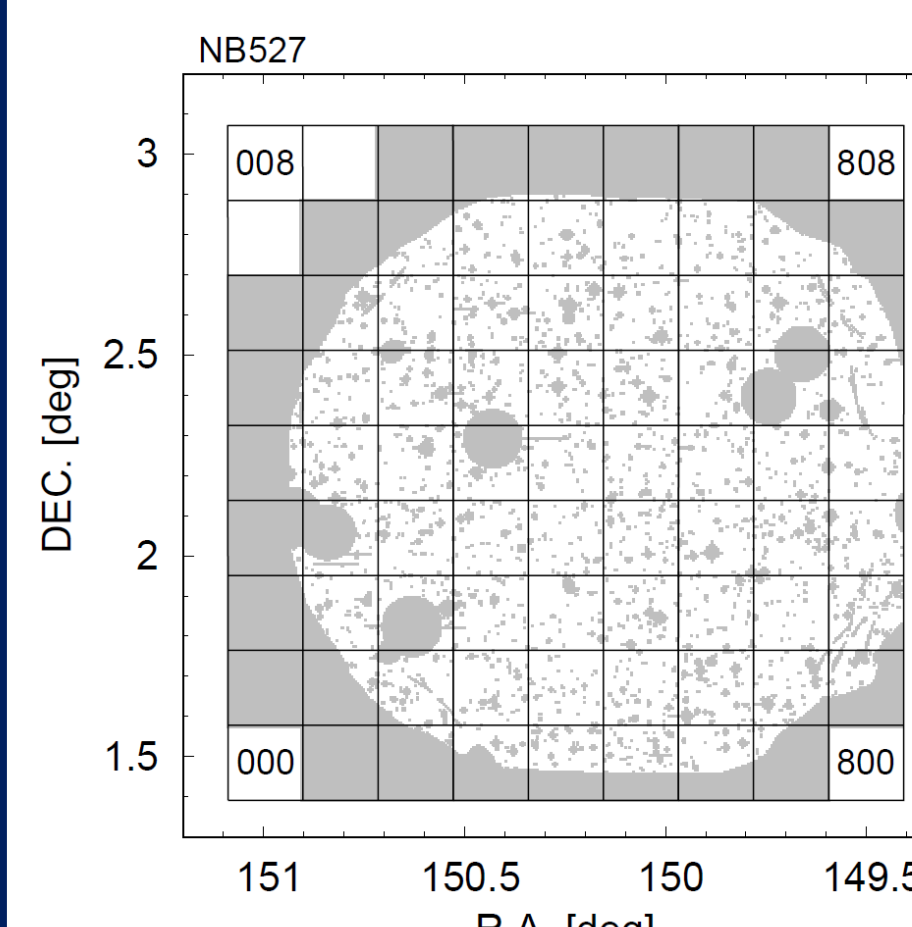


Fig.3 Field-of-view of CHORUS NB527 image (left) response curves of filters (right)

CHORUS(Inoue+20)

- 4NBs and 1IB
(NB387, NB527, NB718, NB921, and NB945)

HSC-SSP(Aihara+18)

- 5BBs and 2NBs
(grizy, NB816, NB921)

Dual Narrow-band excess selection

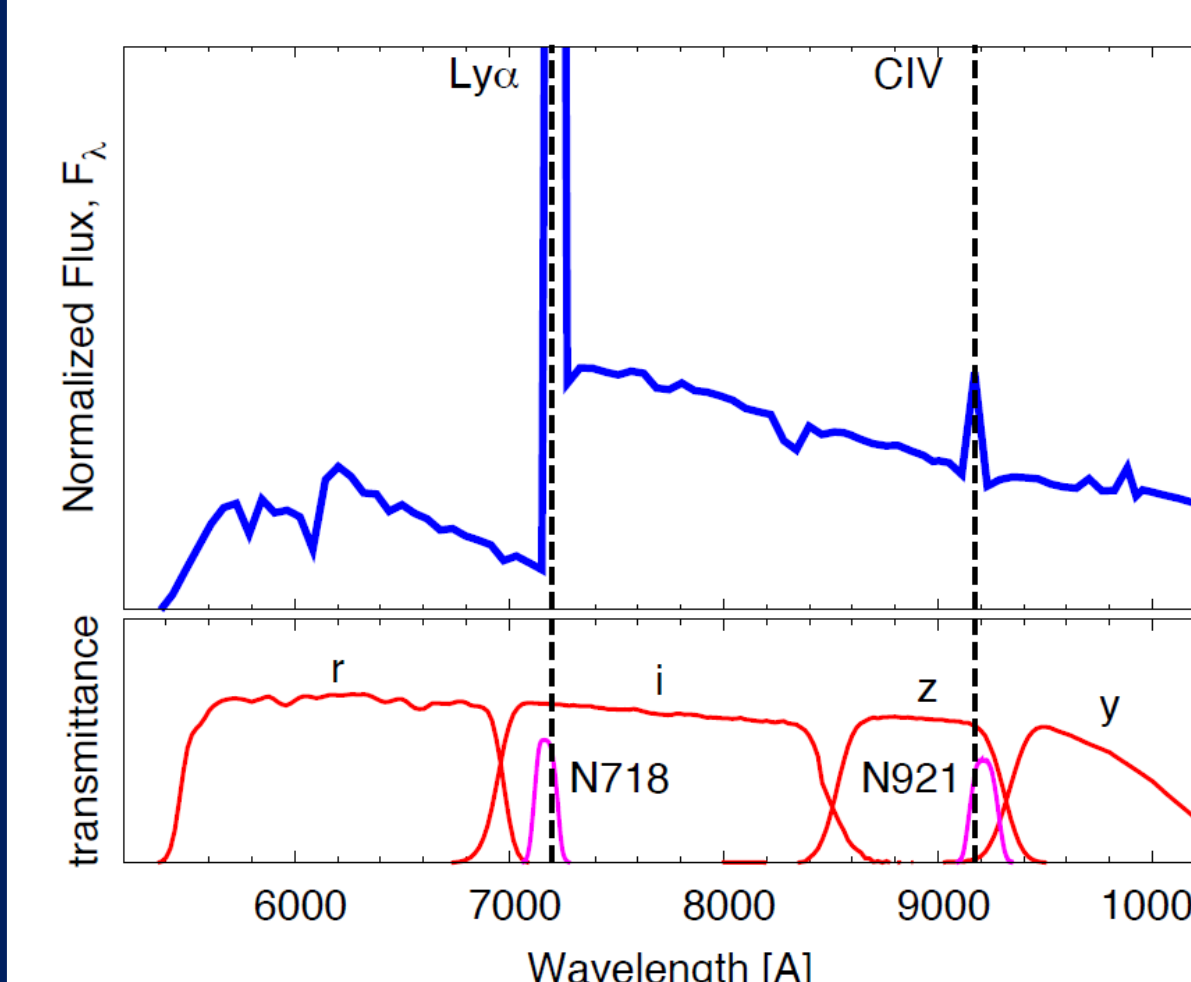


Fig.4 Example spectrum and filters

detection	color
$NB718 > 10\sigma$, $NB921 > 10\sigma$, $izy > 26.0 \text{ AB}$	$i - NB718 > 0.2 \text{ AB}$, $zy - NB921 > 0.2 \text{ AB}$, $r - i > 1.0 \text{ AB}$

Ly α and Civ emission line from galaxies at $z\sim 4.9$ is traced by NB718 and NB921, simultaneously.

We can efficiently search for high- z faint AGNs.

Results & Discussions

4 reliable candidates of high- z AGNs

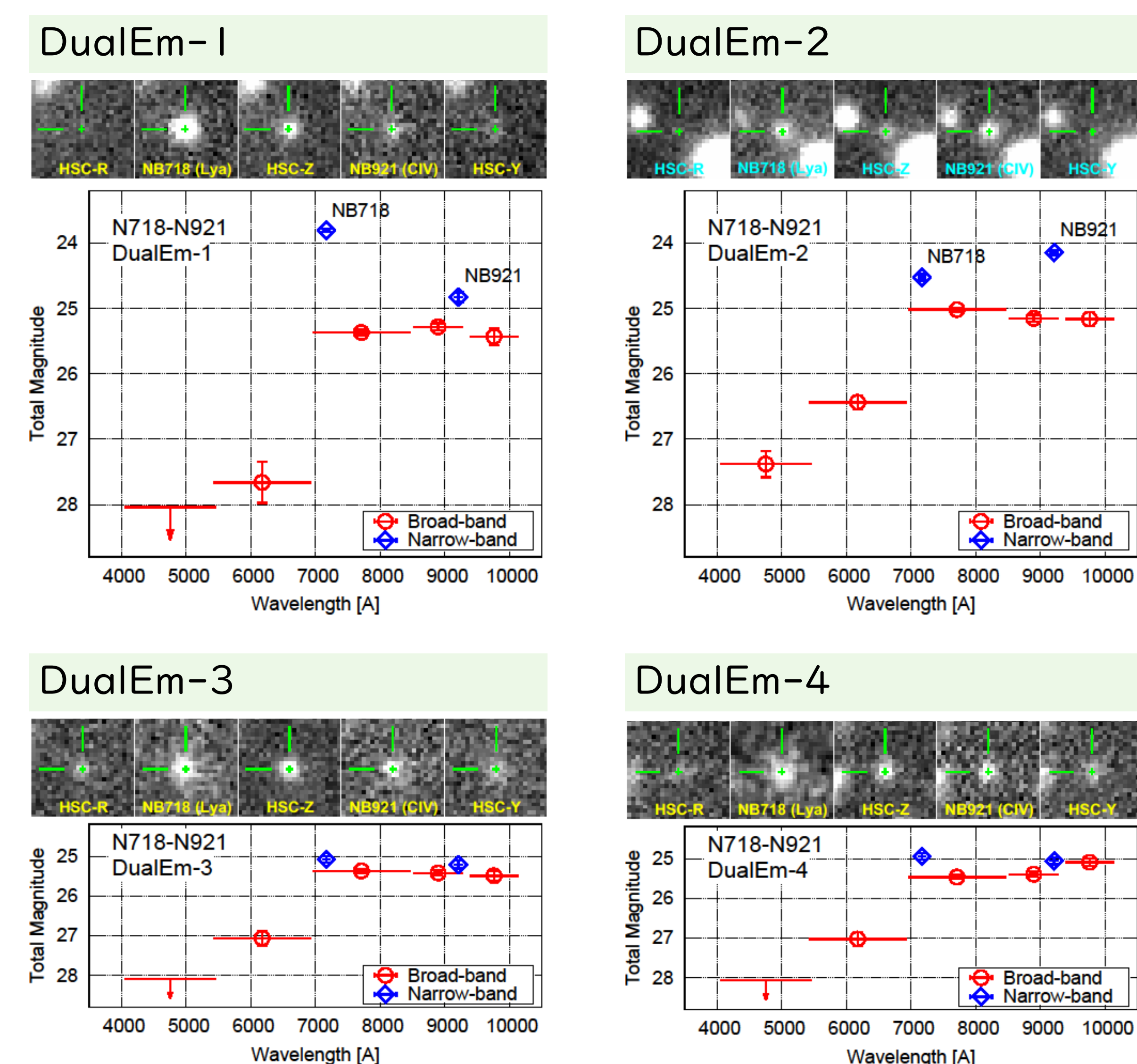


Fig.5 Thumbnail images and spectral energy distribution (SED)

Our dual emitter sample shows the following features;

- significant color excess in NB718 and NB921,
- clear Lyman break.

Follow-up observations for DualEm-1 shows $z_{\text{spec,Ly}\alpha} = 4.909$.

They should be reliable Ly α -Civ dual emitters at $z\sim 4.9$.

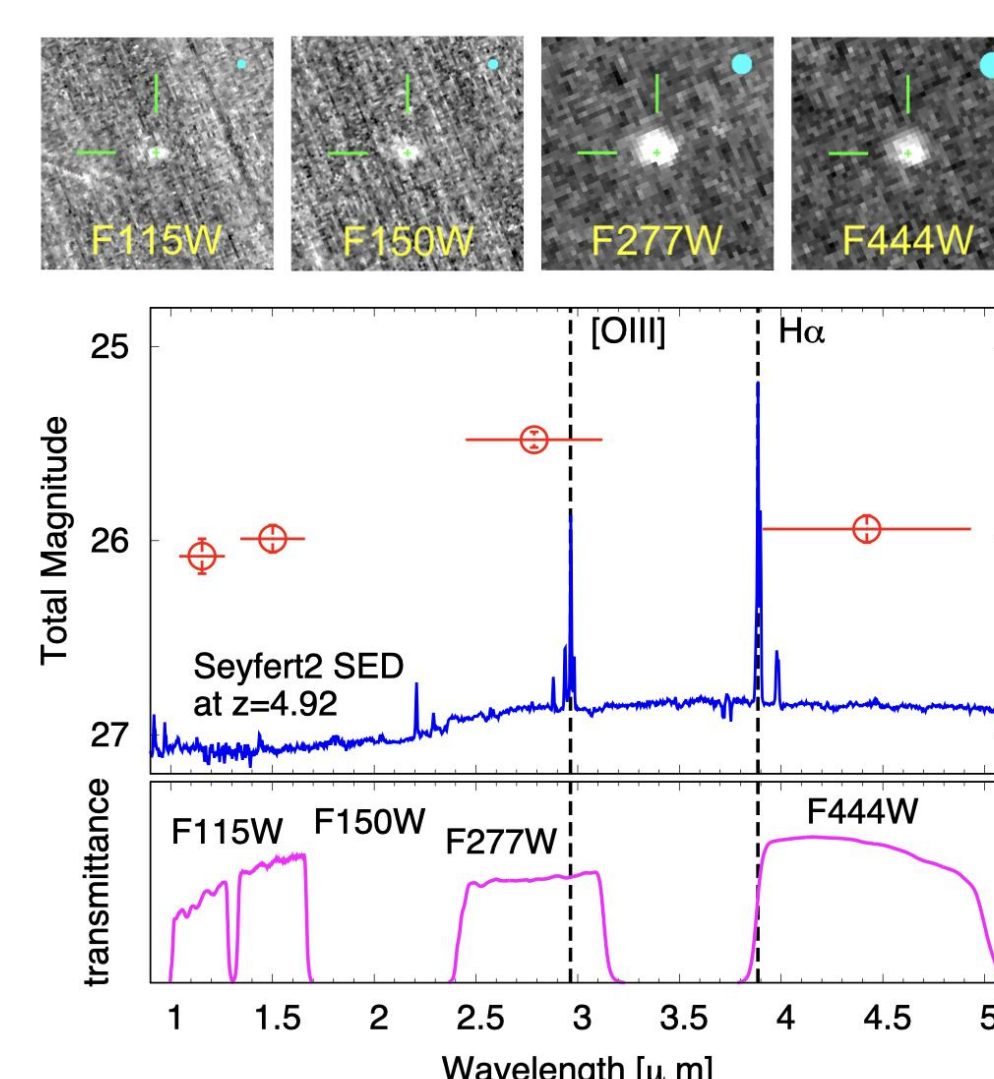


Fig.6 Thumbnail images and SED of JWST

- DualEm-3 is observed with JWST/NIRCAM
- JWST data shows the significant color excess in F277W
 - [OIII] $\lambda 4959,5007$?
 - H α $\lambda 6563$ is at the edge of F444W
- The redshift of DualEm-3 seems to be really 4.9.

Number density of dual emitters

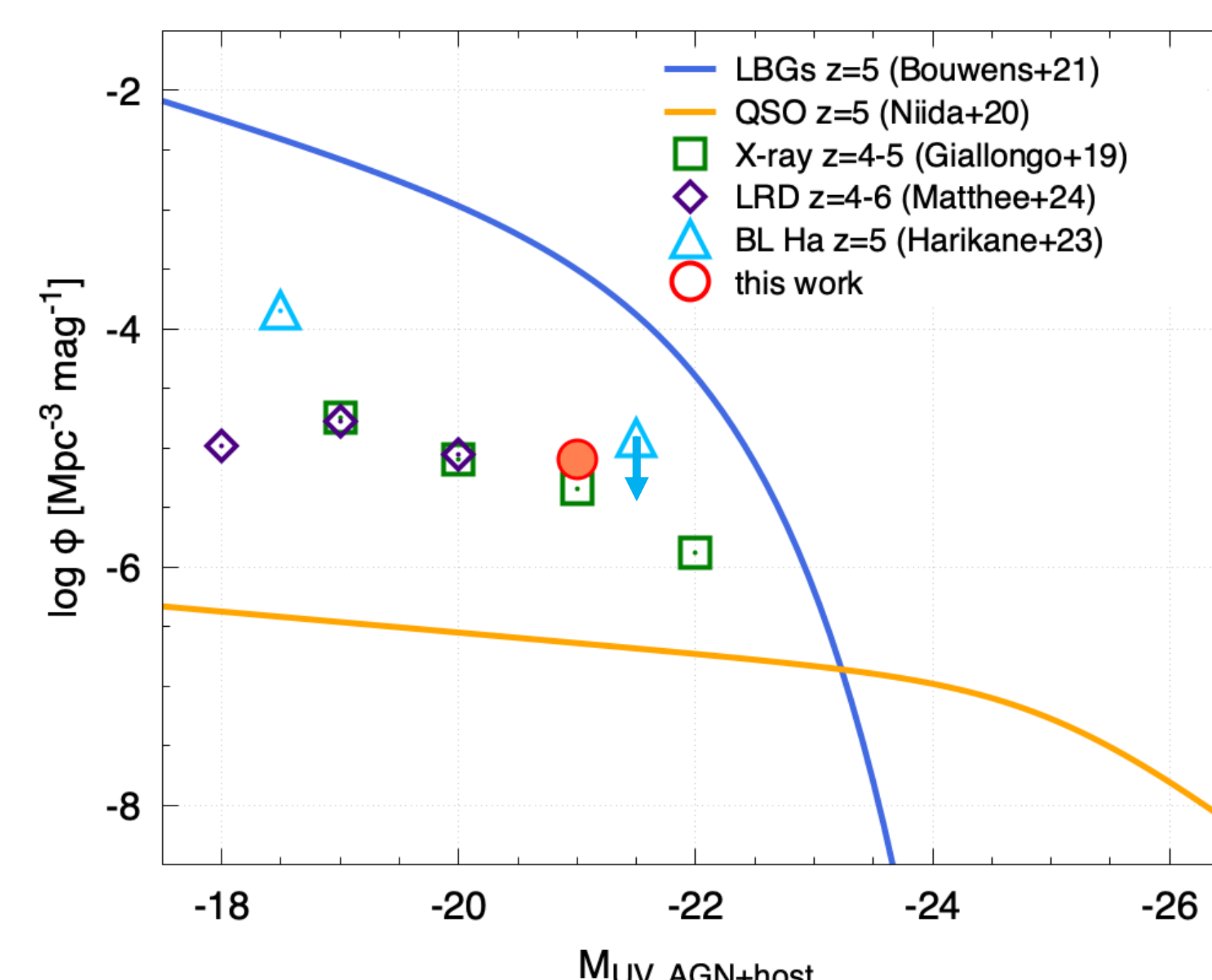


Fig.6 Number density of our result and previous works

Number density of N718-N921 dual emitters is $8 \times 10^{-6} \text{ Mpc}^{-3}$.

Our estimation is comparable to that of previous works.