Bright End of the UV Luminosity Functions at z=4-7 Derived with the 200 deg^2 Data of the Subaru HSC Survey

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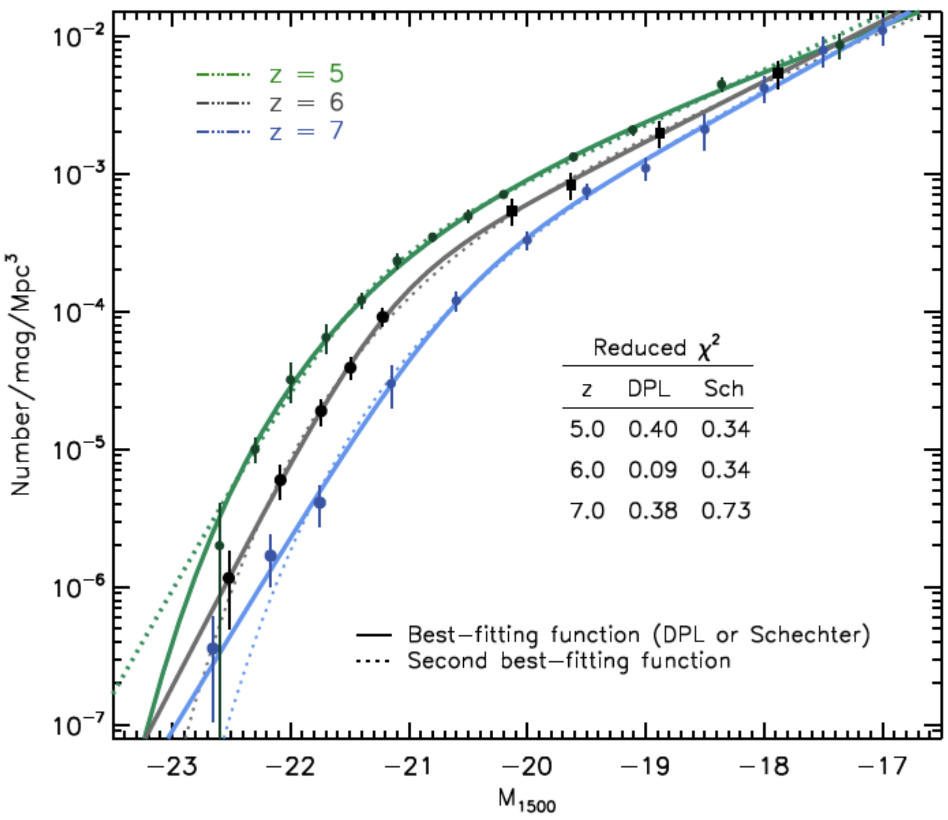
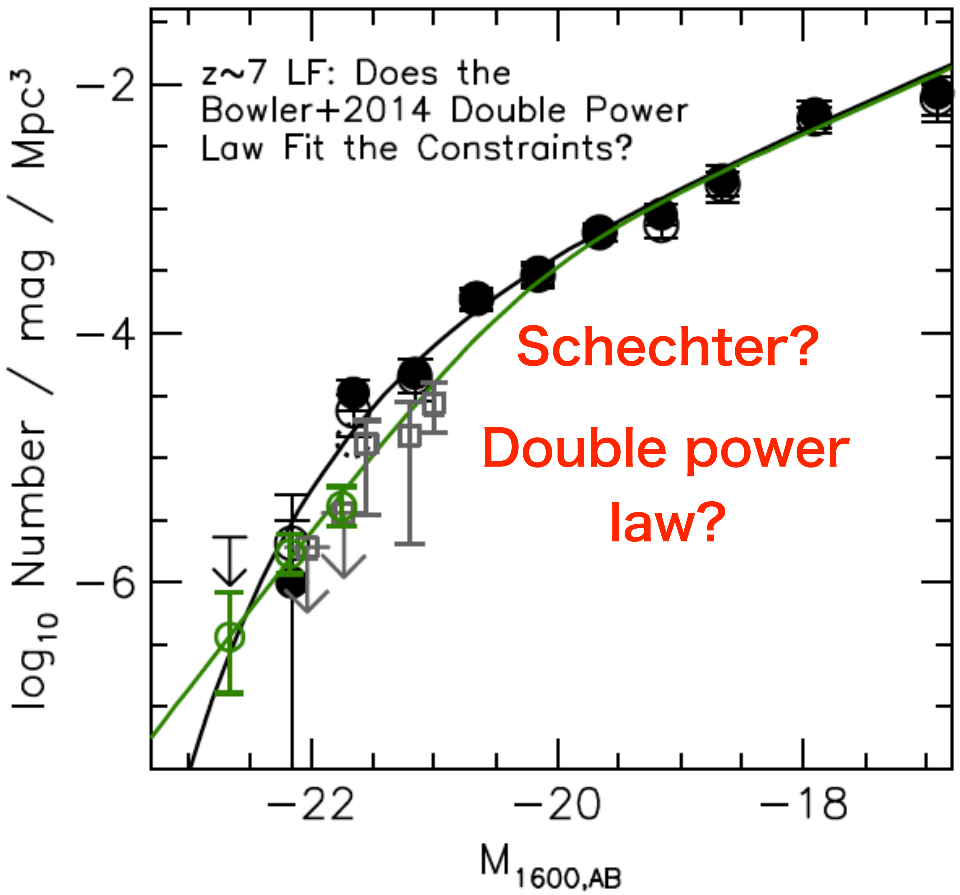
Introduction



(Bowler et al. 2015)

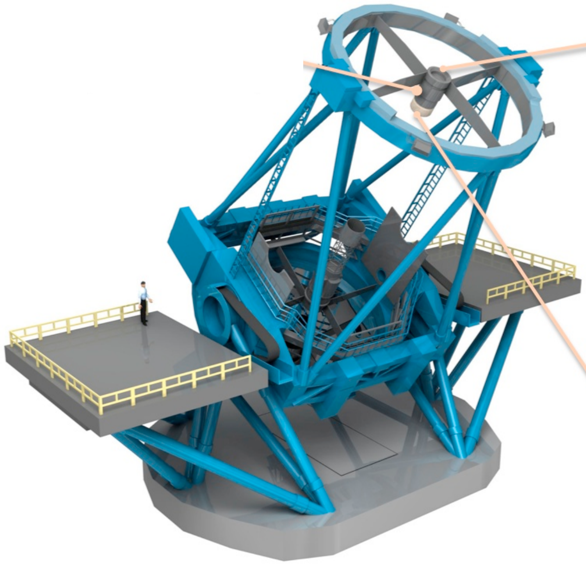


(Bouwens et al. 2015)

- Bright end of the UV luminosity function at high redshift
  - power law or exponential?
  - inefficient quenching at high redshift?

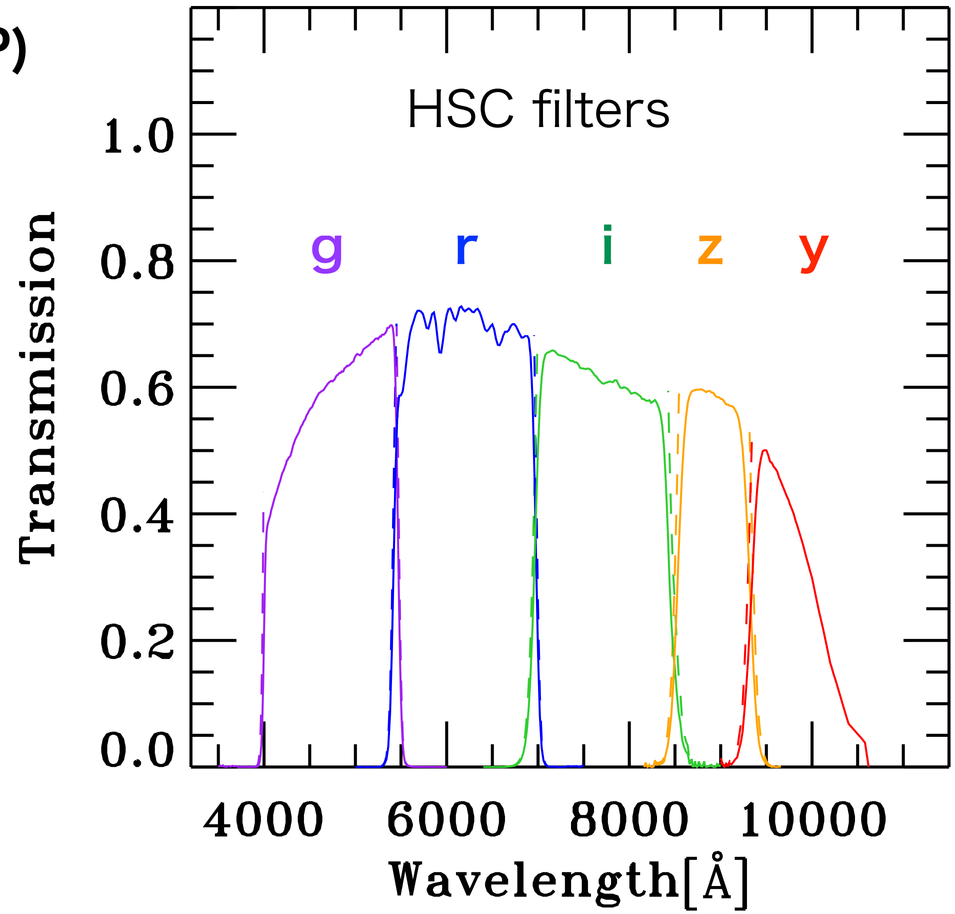
Data

- **Subaru Strategic Program with Hyper Suprime-Cam (HSC SSP)**



Subaru Telescope

Hyper Suprime-Cam (HSC)



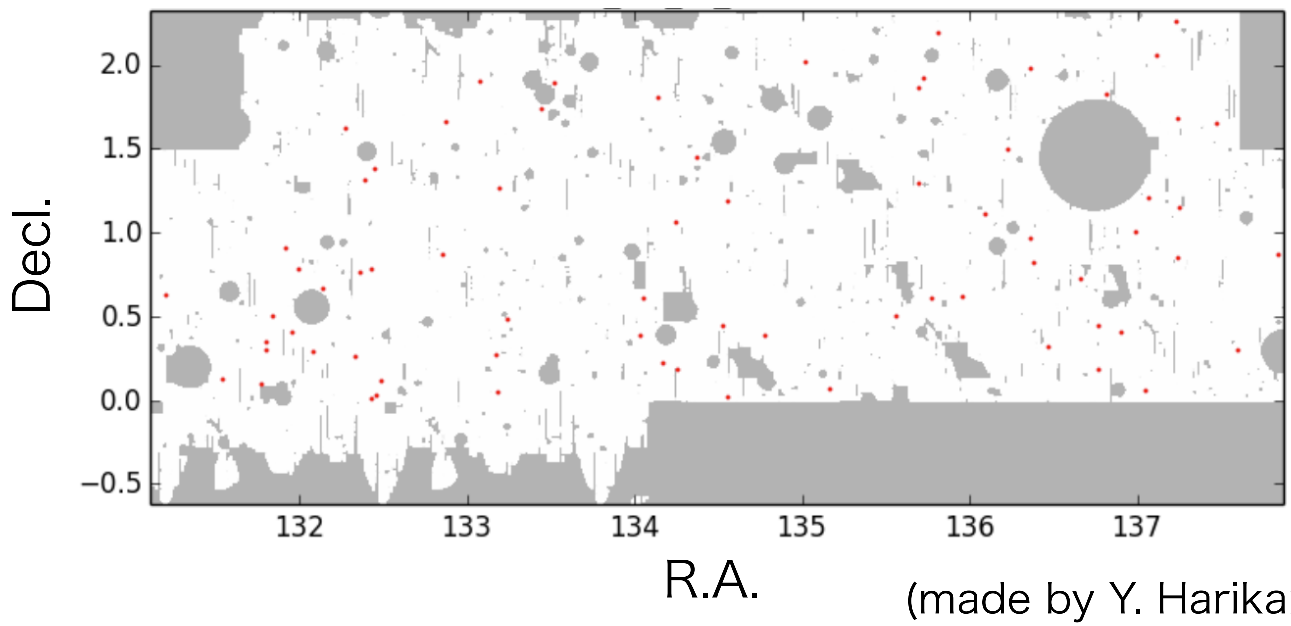
(http://subarutelescope.org/Topics/2013/07/30/fig4j.jpg) (http://subarutelescope.org/Observing/Instruments/HSC/sensitivity.html)

- 300 night Subaru HSC time in 5 years.
- will cover 1400 deg^2 with broadband filters grizy.

HSC SSP Early Survey Products

■ Effective area for our study
- Ultradeep (UD) ～ 2.4 deg^2 (COSMOS+SXDS)
- Deep (D) ～ 13 deg^2.
- Wide (W) ～ 60 deg^2.

Example:
W_GAMA09H



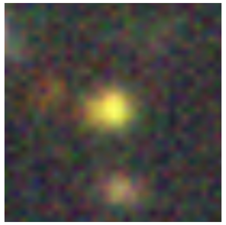
(made by Y. Harikane)

■ Limiting magnitude (5-sigma ABmag)
- UD: g～27, r～27, i～26.5, z～26, y～25
- D: g～26.5, r～26, i～26, z～25, y～24.5
- W: g～26, r～26, i～26, z～25, y～24

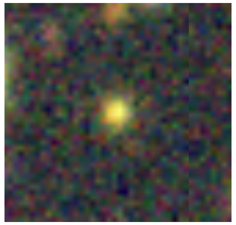
→ select high-z galaxy candidates by using the Lyman break technique.

Dropout Sample

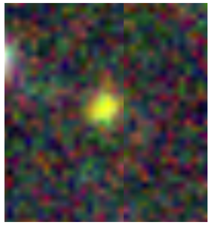
z=4



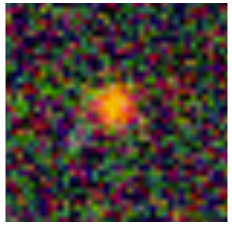
z=5



z=6



z=7

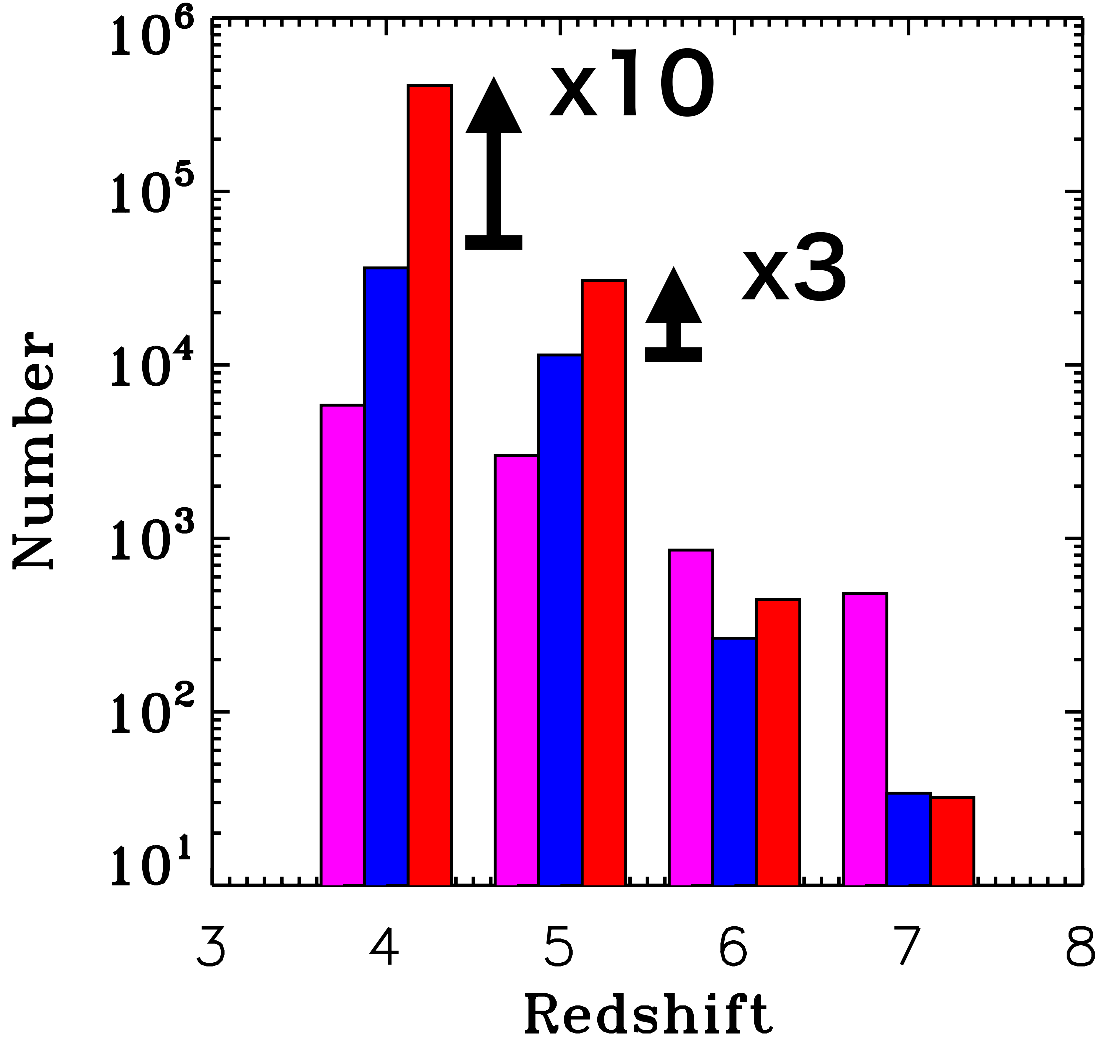


Field	# of g-drops	# of r-drops	# of i-drops	# of z-drops
D_COSMOS	43693	5997	67	4
D_DEEP2_3	31523	1306	48	5
D_ELAIS_N1	5405	188	4	1
D_XMM_LSS	3316	335	3	0
UD_COSMOS	10644	1990	50	12
UD_SXDS	9916	1209	36	10
W_GAMA09H	33742	4478	71	0
W_GAMA15H	79017	4882	53	0
W_HECTOMAP	22345	745	11	0
W_VVDS	17104	1009	14	0
W_WIDE12H	66697	3837	30	0
W_XMM	85085	4648	56	0
Total	408487	30624	443	32

 # in total

～400,000

Dropout Sample



This Study
Bouwens+15
van der Burg+10 (z=4,5)
Bowler+15,16 (z=6,7)

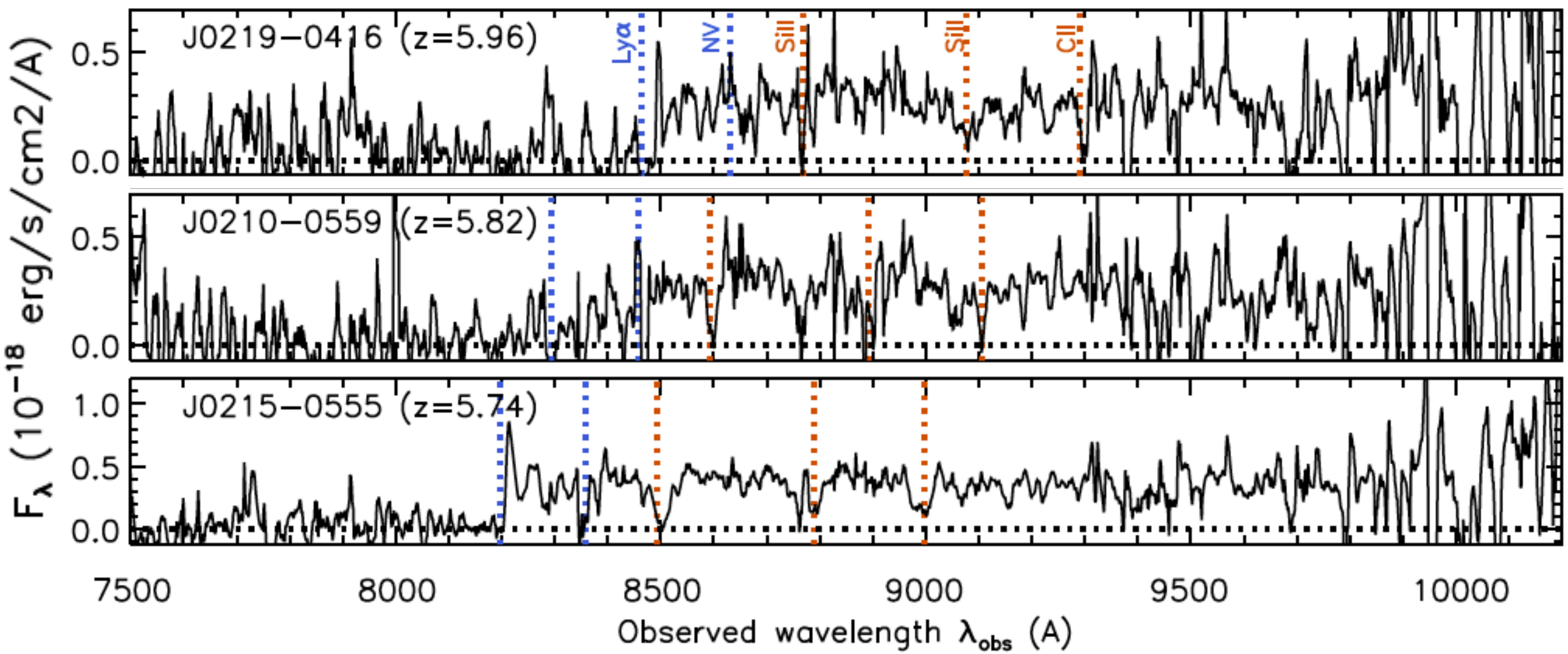
- z=4 and 5: larger than previous work
- z=6 and 7: comparable with previous ground-based survey

■ dropout galaxy studies

- clustering analysis: **Y. Harikane et al. → Yuichi's talk**
- protocluster study: **J. Toshikawa et al. → Jun's poster**
- UV luminosity function: **Y. Ono et al. → This talk**

and others …

Comparison with Spectroscopic Results



(Matsuoka et al. 2016)

- In the W layer, several candidates have been confirmed by Matsuoka+2016.
- In the UD layer (COSMOS+SXDS), many (>100) g-dropouts and r-dropouts have been spectroscopically identified by previous work.
- Contamination fractions = 10-20% based on previous spectroscopy results.

Selection Completeness

■ mock catalog of galaxies

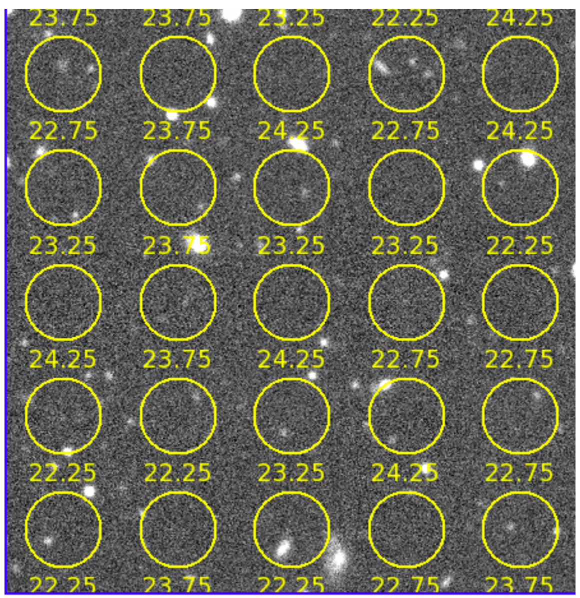
+ size distribution (Shibuya+15)
+ Sersic index n = 1.5
+ random ellipticity & position angle
+ Bruzual & Charlot (2003) SED
  - beta vs. redshift
  - beta vs. Muv

(Bouwens+14)

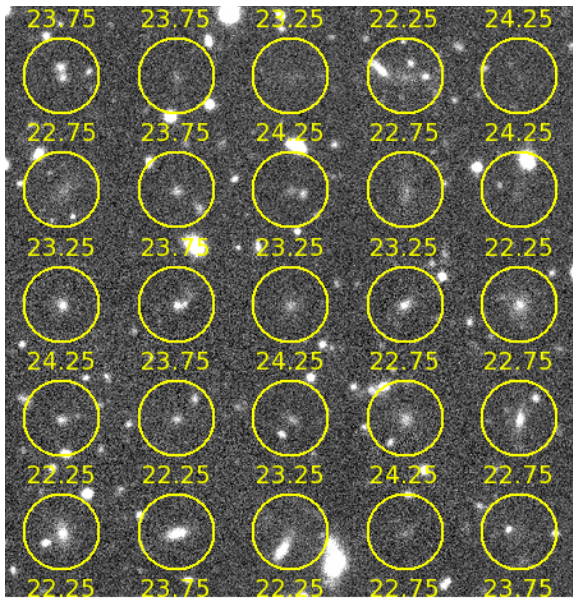
■ Monte Carlo simulations with SynPipe

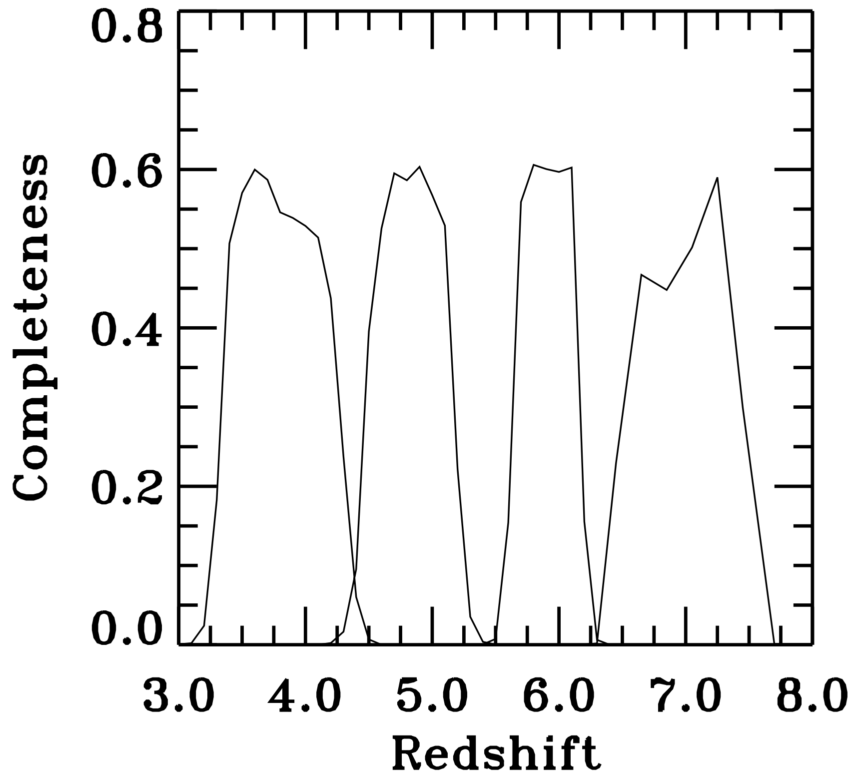
(S. Huang+ in prep.)

before

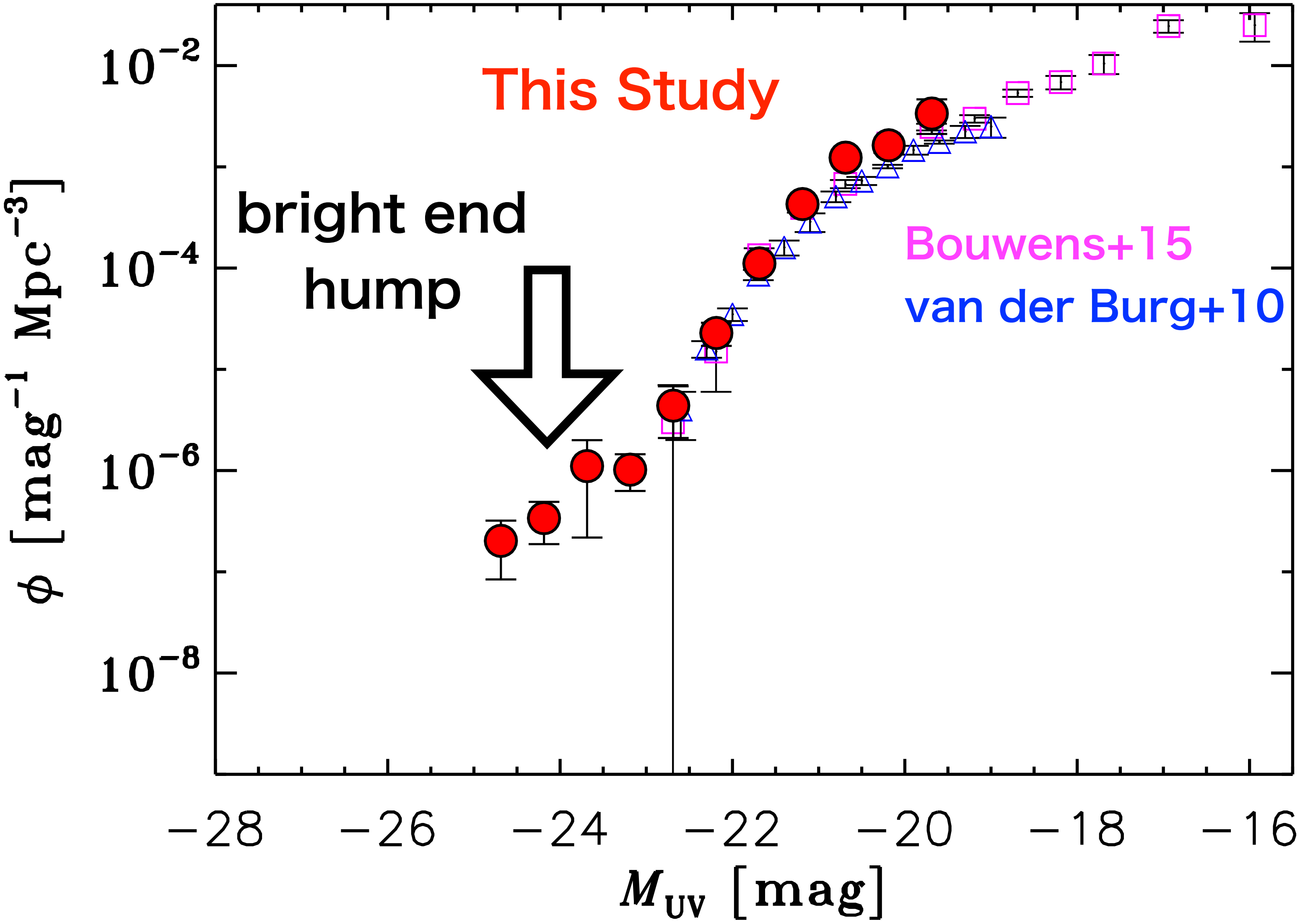


after





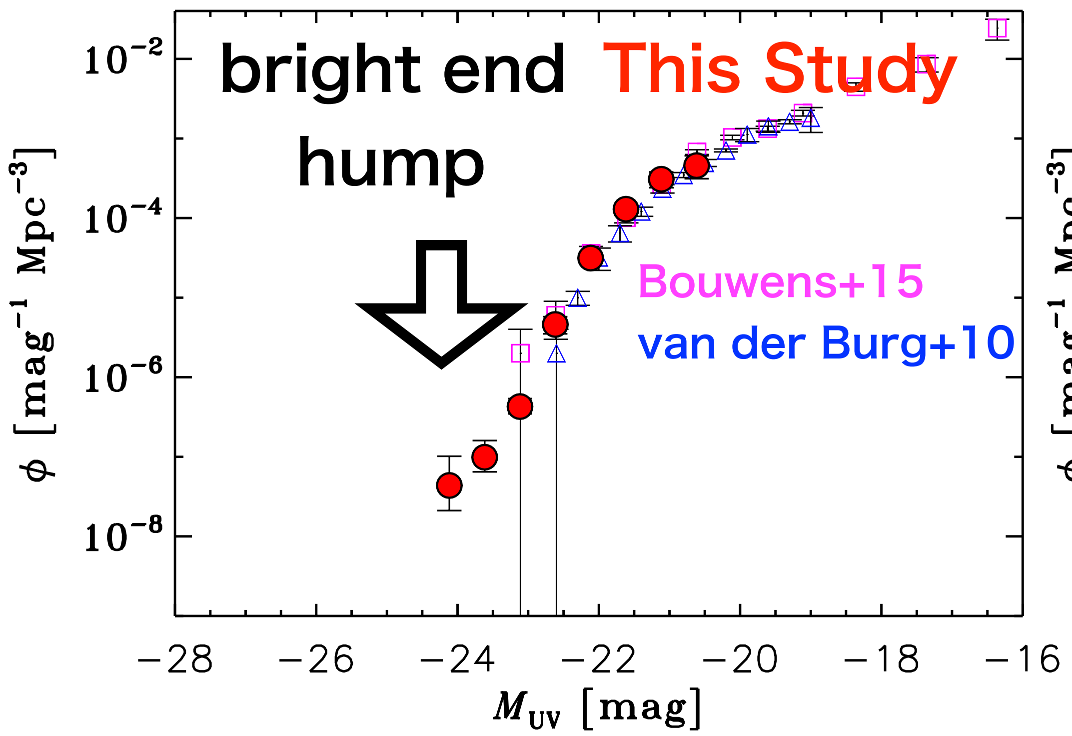
UV Luminosity Function at z=4



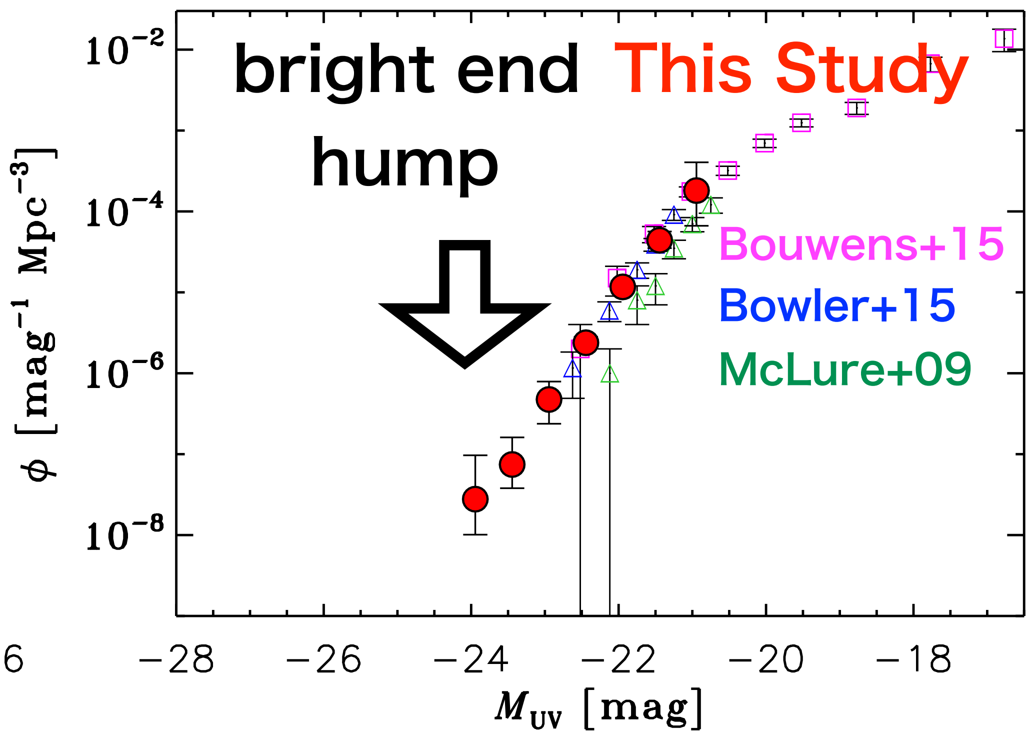
- broadly consistent with previous results at M_{UV} > −23 mag
- appear to have a hump at the bright end

UV Luminosity Functions at z=5-6

z=5

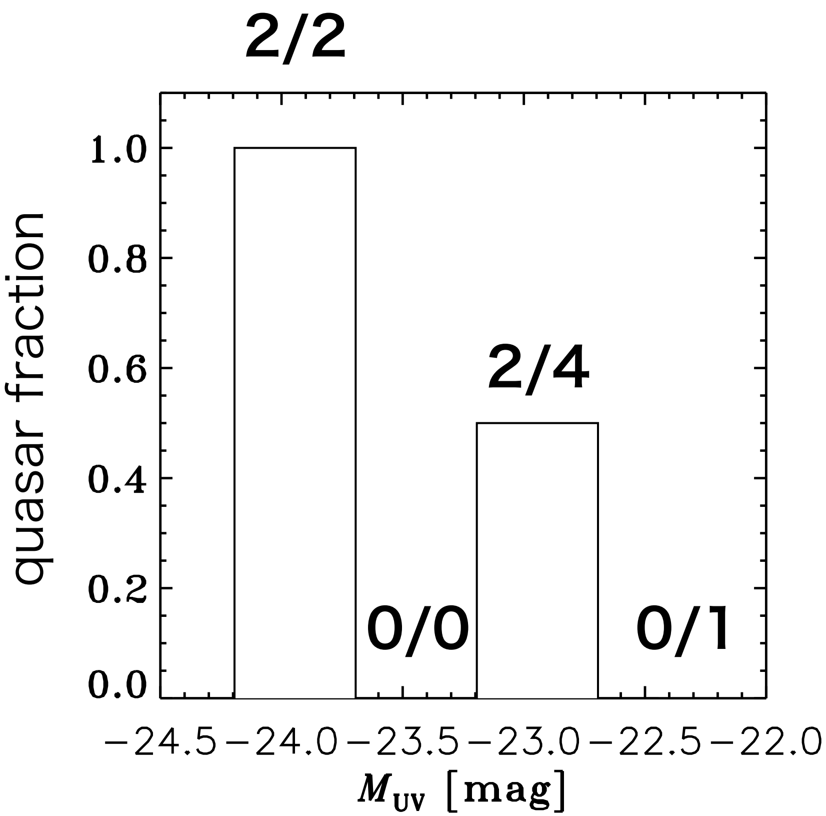


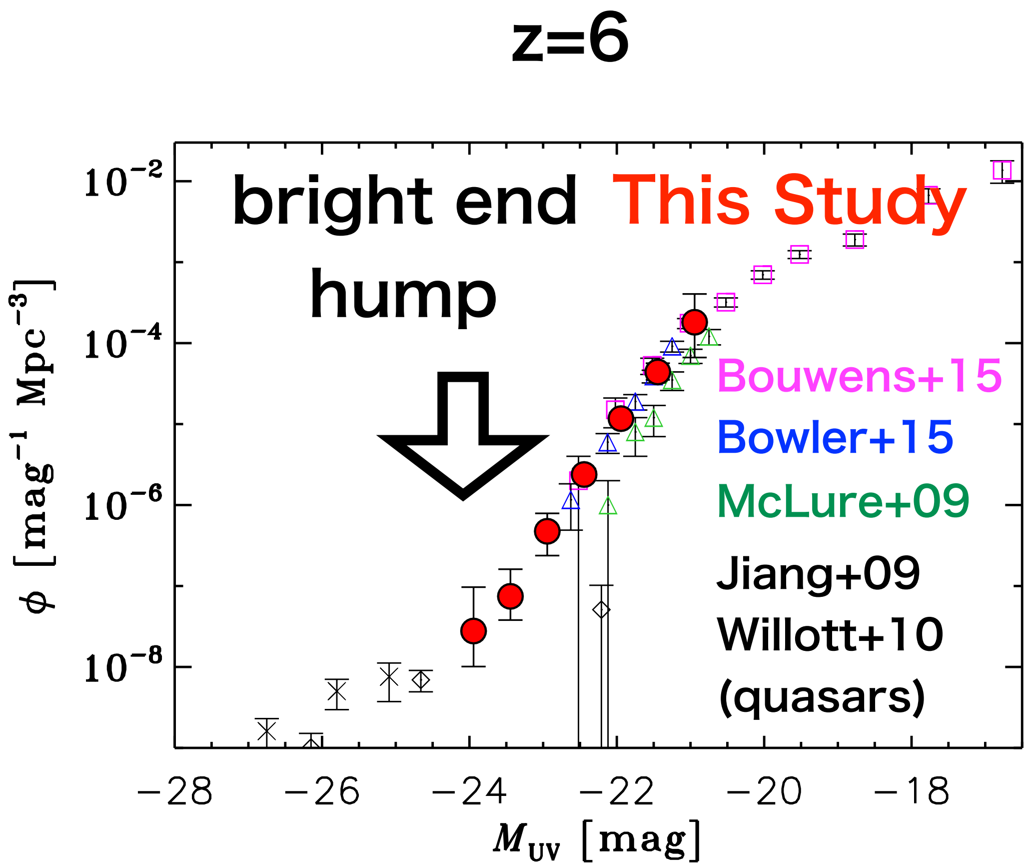
z=6



- broadly consistent with previous results at M_{UV} > −23 mag
- appear to have a hump at the bright end

Quasar Contamination





- the bright end hump can be partly due to quasar contamination.
- Spectroscopy results of Matsuoka et al. (2016) suggest that our bright end LF is affected by quasar contamination.

UV Luminosity Functions at z=4-7

z=4

z=5

z=6

z=7

UV Luminosity Function at z=4

This Study

Bouwens+15

van der Burg+10

- Based on the chi2 fitting results, double power law function gives a better fit, although the observed LF seems consistent with the Schechter function within 1-sigma

UV Luminosity Functions at z=4-7

z=4

z=5

z=6

z=7

UV Luminosity Functions at z=4-7

Little
Evolution?

Bouwens+15

This Study

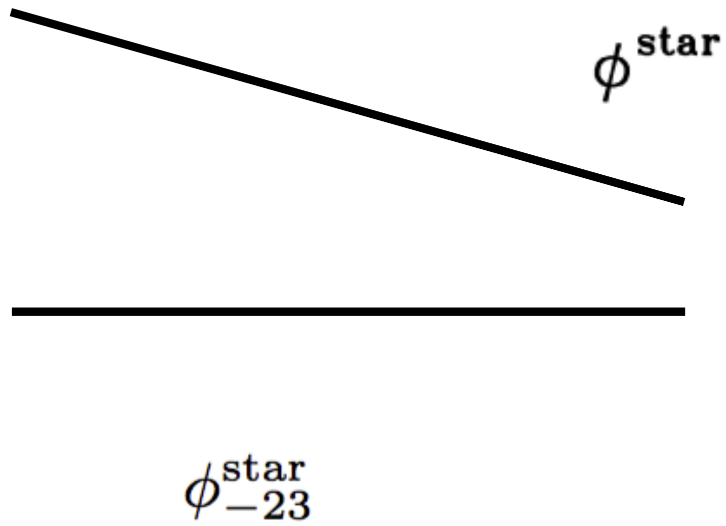
z=4
z=5
z=6
z=7

Evolution
(Bowler+15)

- At M_{UV} ∼−21 mag, the LF decrease with increasing redshift.
- At M_{UV} ∼−23 mag, the LF appear to show little evolution, although the errors are large.

Little Evolution at the Very Bright End?

$$\phi(M_{\rm UV}) = \frac{\phi^{\rm star}_{-23}}{10^{0.4(\beta+1)(M_{\rm UV}+23)}}$$



- fit single power law functions to the observed z=4-7 LFs in $-24 < M_{\rm UV} < -22$ mag.
- normalization $\phi^{\rm star}_{-23}$ seems to show no evolution
  → quenching feedback at the very bright end is less efficient at higher z?

Summary

- We construct a large sample of bright high-z galaxy candidates based on the HSC SSP data.

- The UV LFs of our dropouts show humps at the very bright end, which are partly caused by the contributions of quasars.

- After subtracting the quasar UV LFs, we fit Schechter functions and double power law functions with the observed results and find that double power laws are favored.

- We confirm that at $M_{UV} \sim -21$ mag, the UV LFs decrease with increasing redshift, We find that, at $M_{UV} \sim -23$ mag, the UV LFs seem to show little evolution.