The bright end of the galaxy luminosity function at z ≈ 7

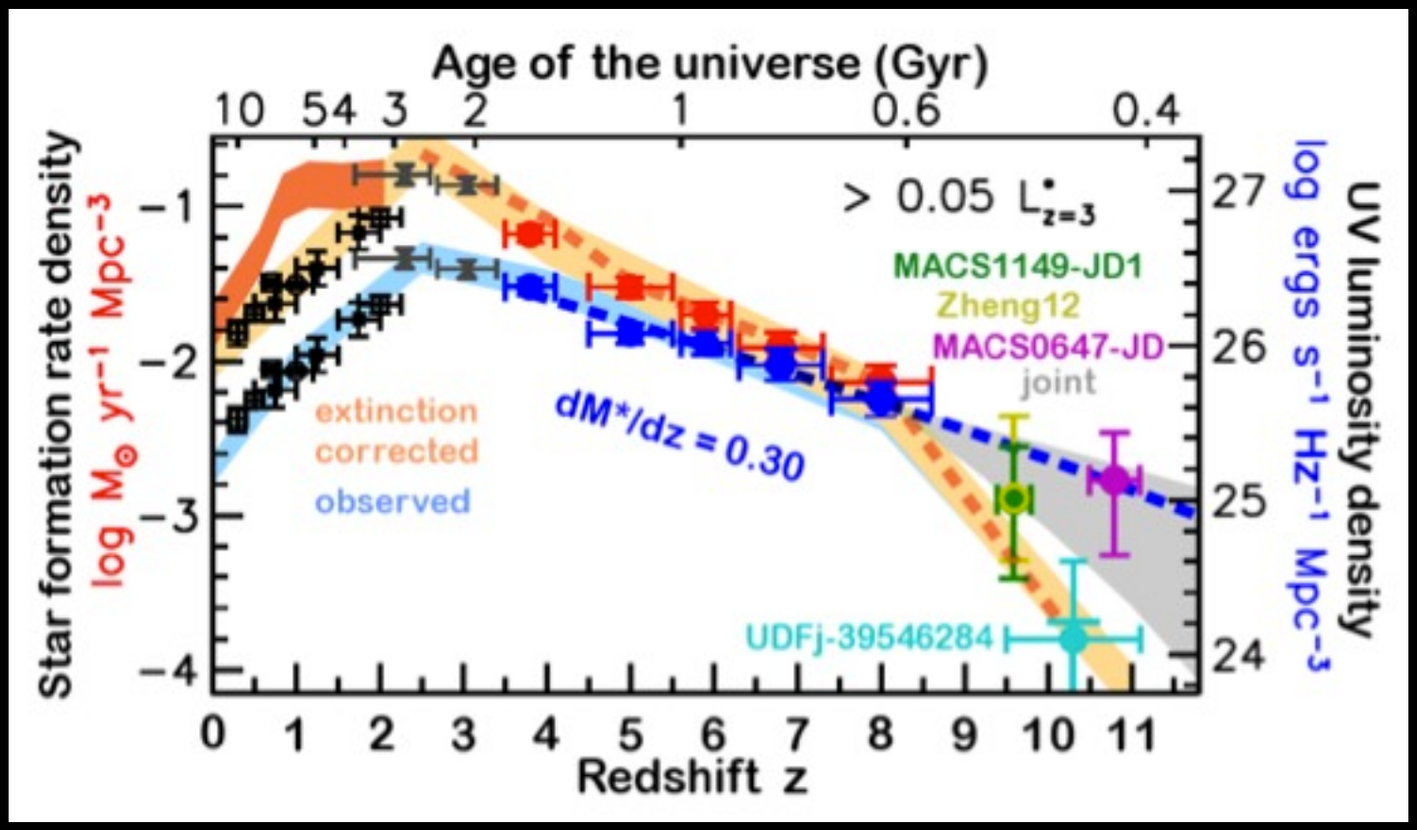
- before the onset of mass quenching?

Rebecca Bowler

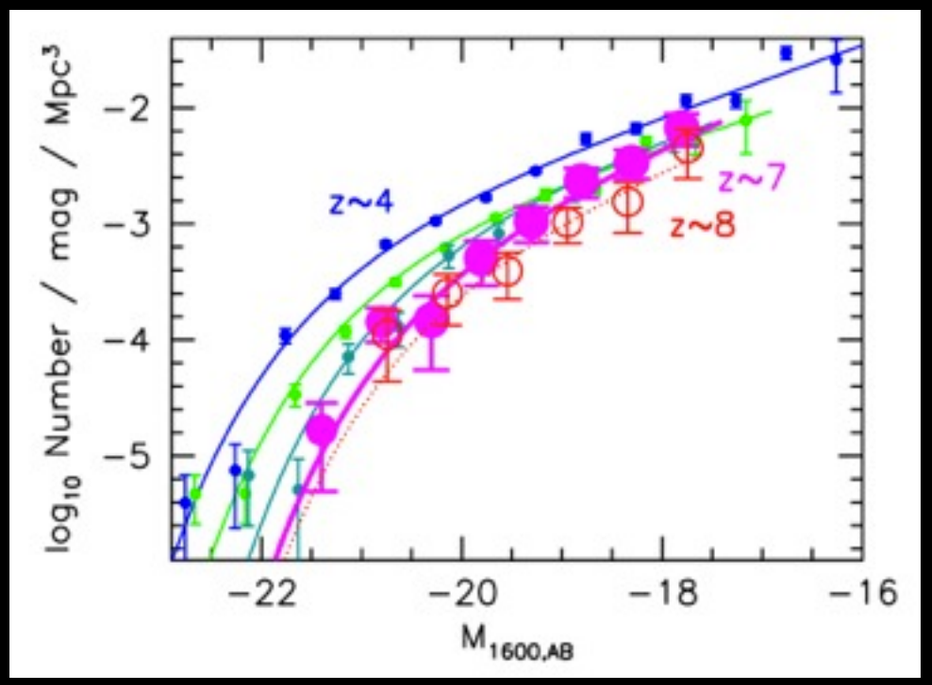
arXiv: 1312.5643

with Jim Dunlop, Ross McLure, Sandy Rogers + others

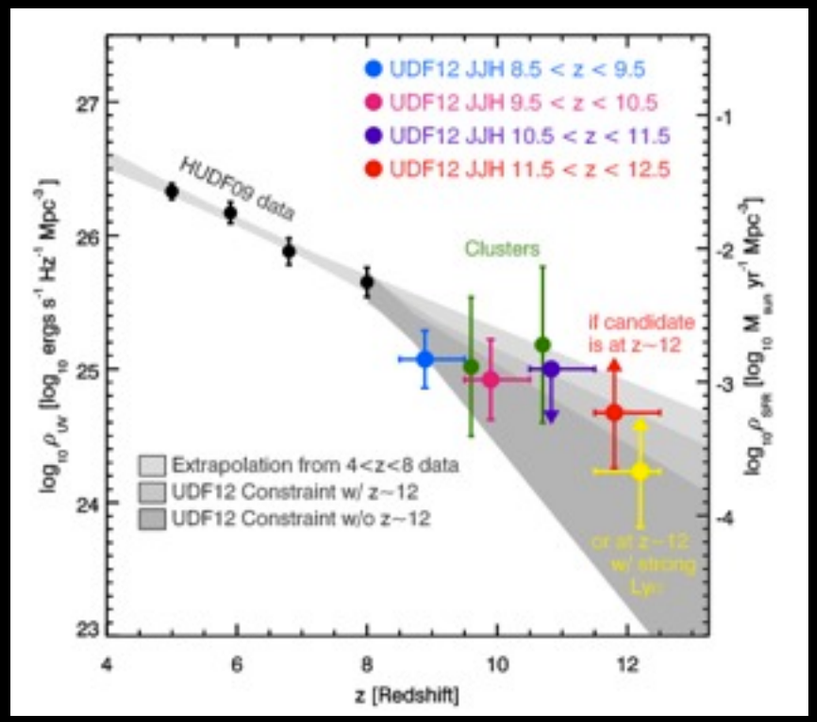
Context - the Madau plot at high redshift



Coe et al. 2013



Bouwens et al. 2011

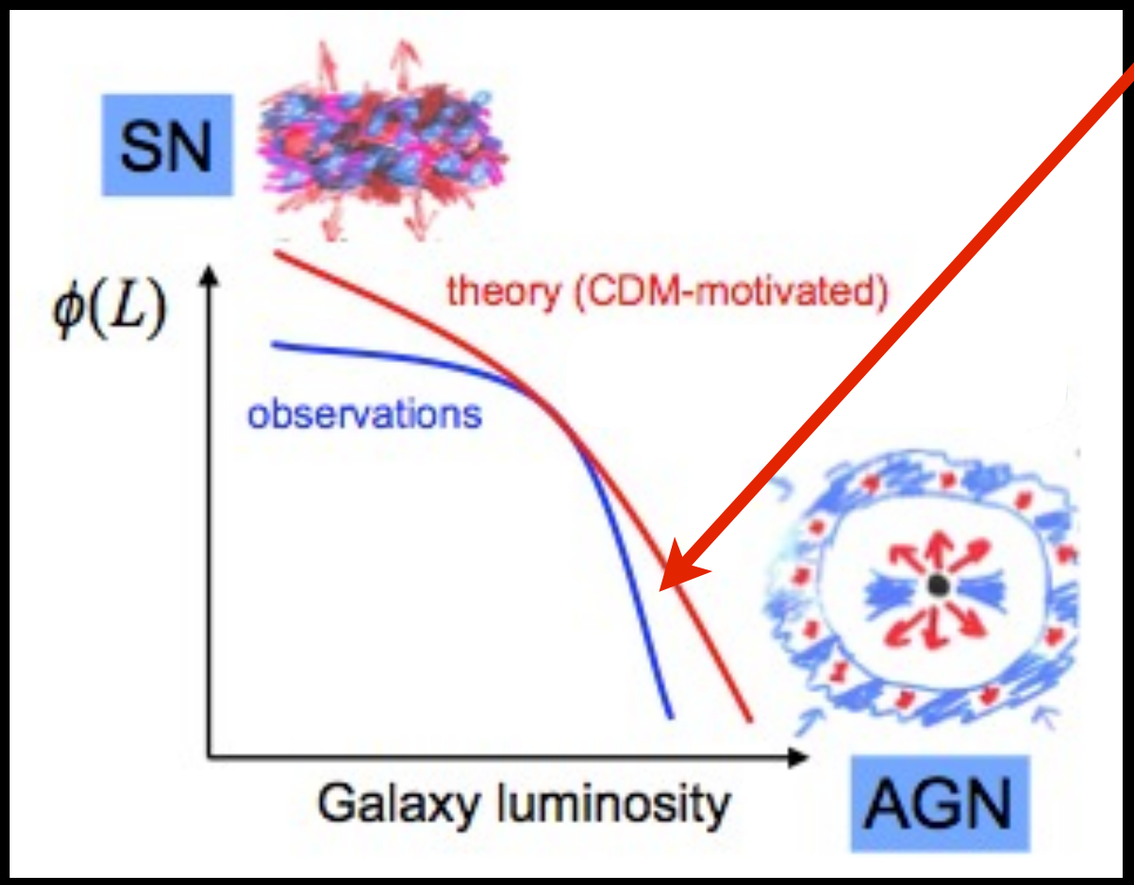


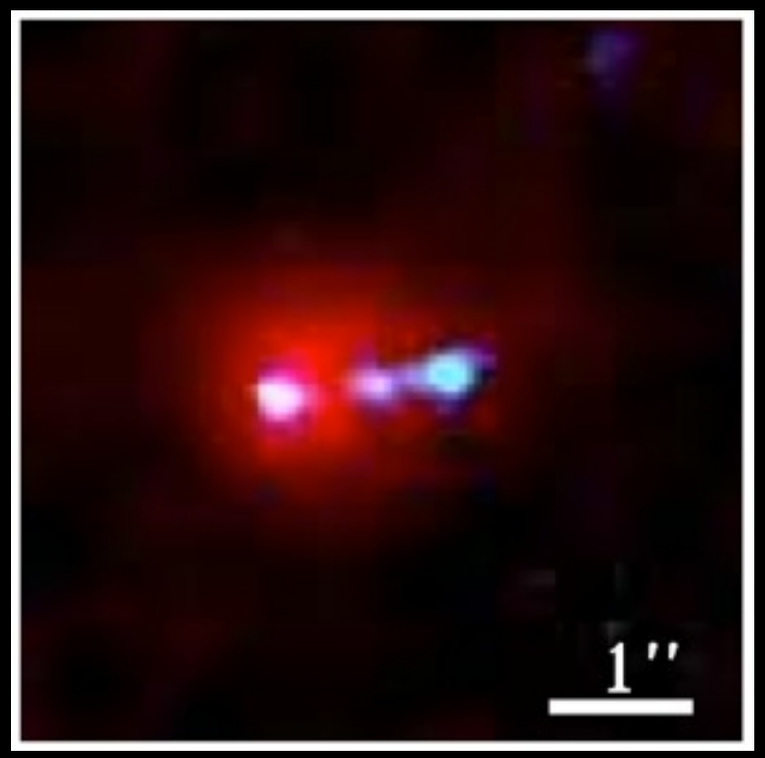
Ellis et al. 2013

Context - bright galaxies at high redshift

When is the onset of this suppression or quenching of SF?

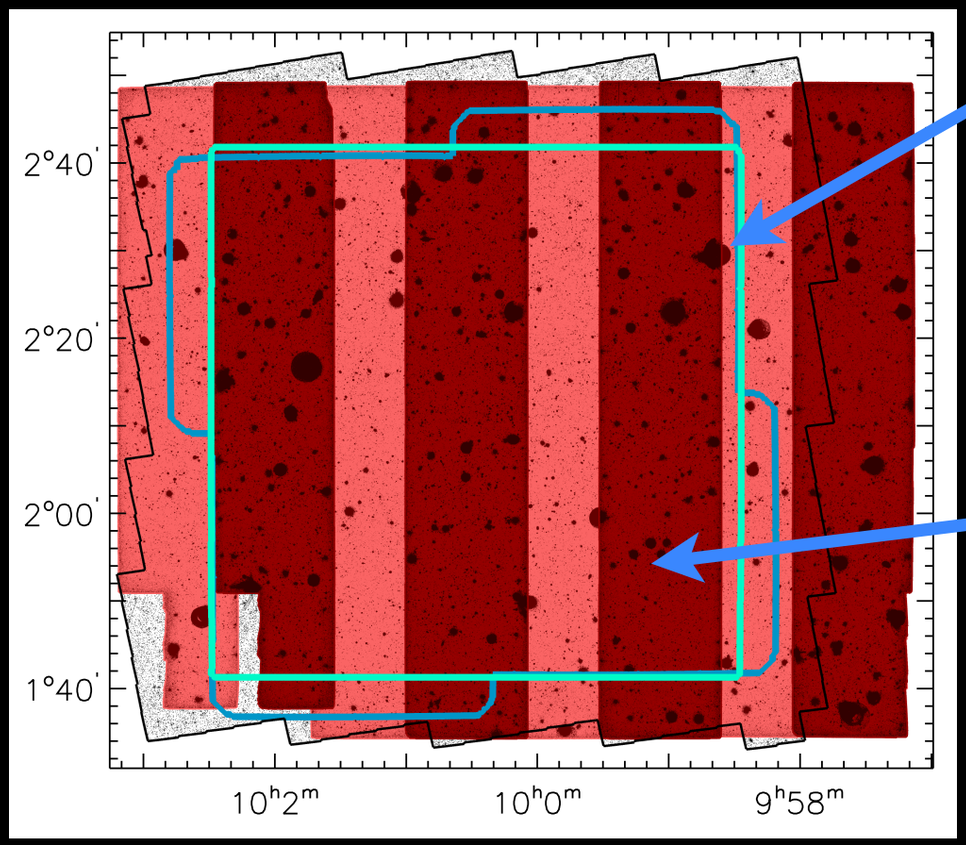
Silk & Mamon 2012





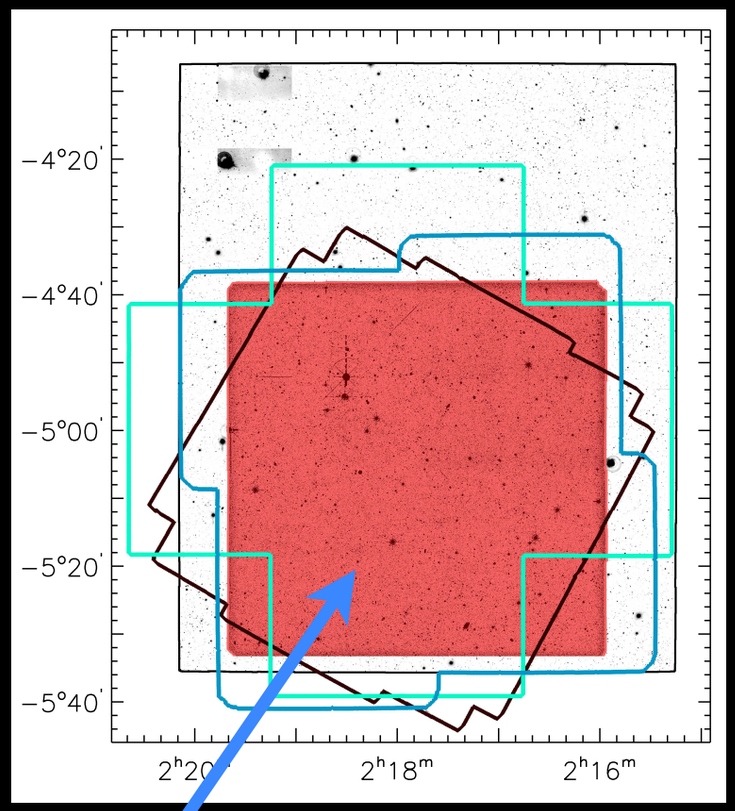
A triple merger system at z = 6.6 (m_AB ~ 25) discovered by Ouchi et al. 2013

Datasets - UltraVISTA and the UDS



UltraVISTA DR1
area = 1 sq. deg
Y + J ~ 25
(Bowler et al. 2012)

UltraVISTA DR2
area = 0.62 sq. deg
Y ~ 25.8 (AB)
0.5-1 mag deeper



UKIDSS UDS
area = 0.74 sq. deg

filters	telescope	AB depth
u*, g, r, i, z	CFHT	~ 27
i (814)	HST/ACS	~ 27
z’	Subaru	~ 26.5
Y, J, H, Ks	UltraVISTA	~ 24-25 /25-26
3.6μm, 4.5μm	Spitzer	~ 24

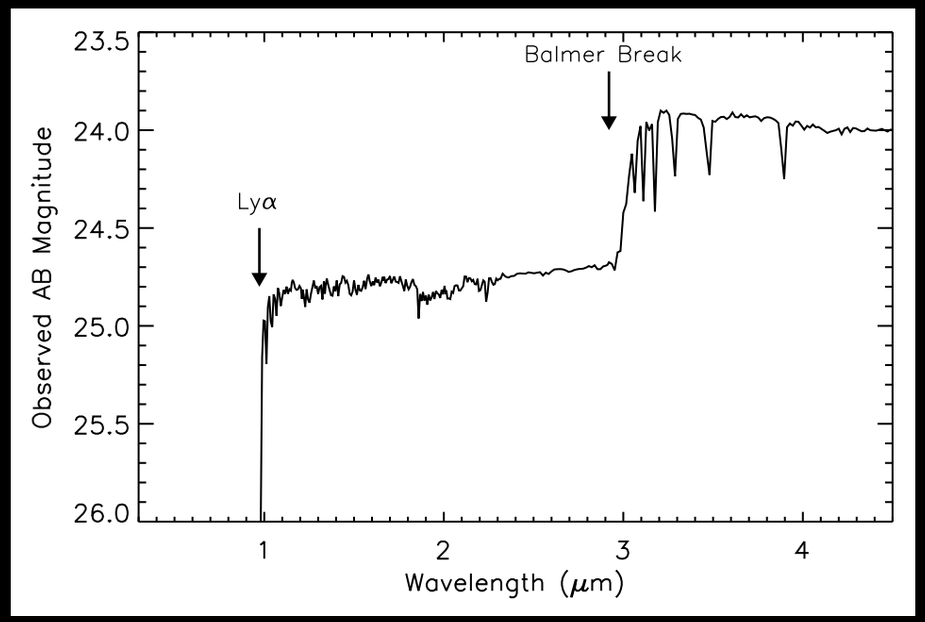
filters	telescope	AB depth
B, V, R, i	Subaru	~ 27
z’	Subaru	~ 26.5
Y	VISTA VIDEO	~ 25
J, H, K	UKIRT	~ 25-26
3.6μm, 4.5μm	Spitzer	~ 24

Galaxy Selection - LBGs, photo-z fitting

multiwavelength images

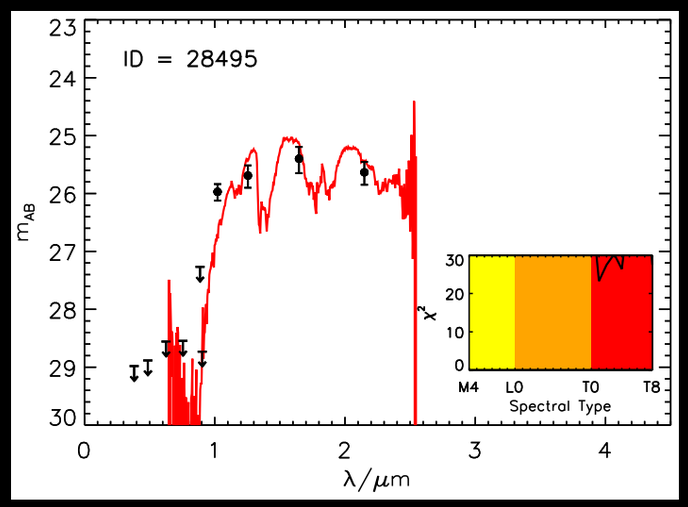
multiwavelength catalogues

SED fitting

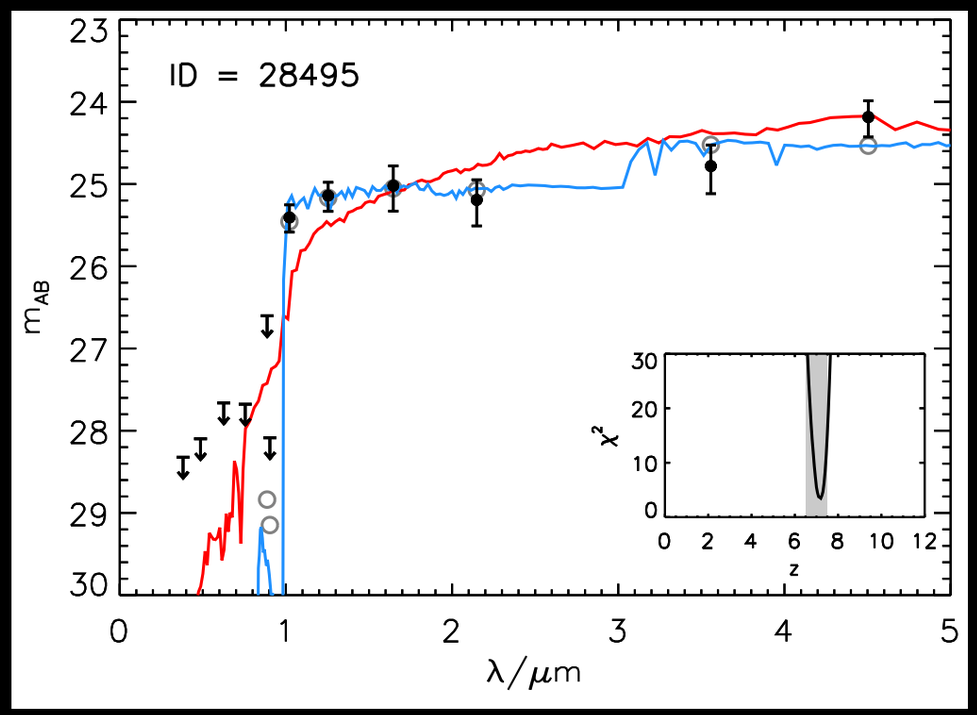


z > 6 galaxy

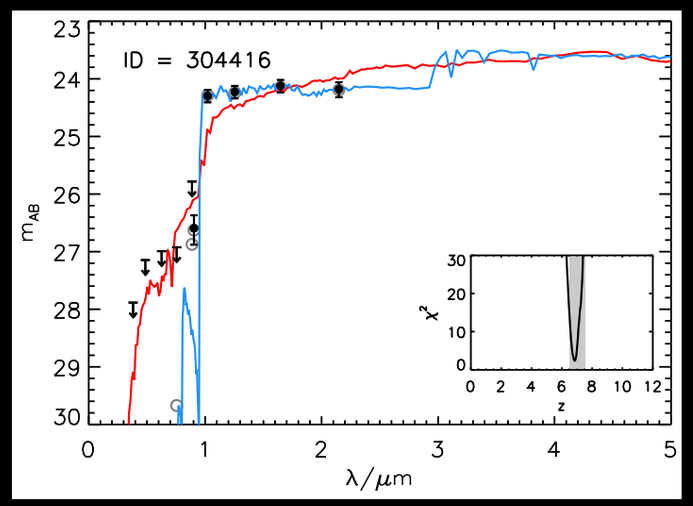
galactic
dwarf star



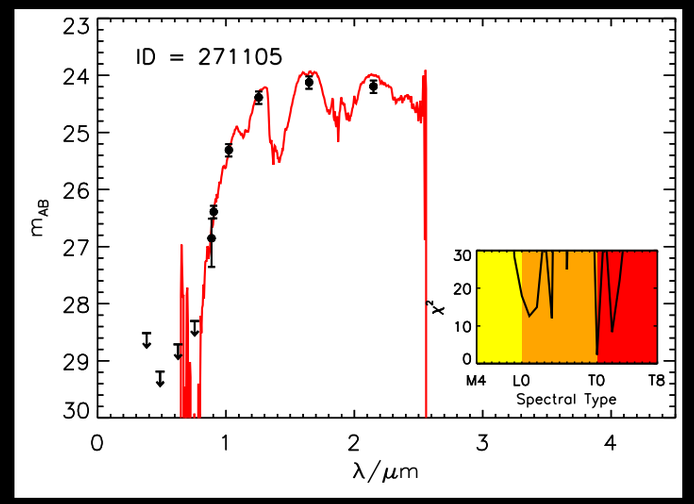
dusty low-z
galaxy



Galaxy Sample - results, stellar masses, SFRs +



- 34 star-forming galaxies with 6.5 < z < 7.5 from 1.65 sq. degrees of imaging
- 9/10 candidates found in Bowler et al. 2012 are reconfirmed as z > 6 galaxies with the new data
- final object is likely a star



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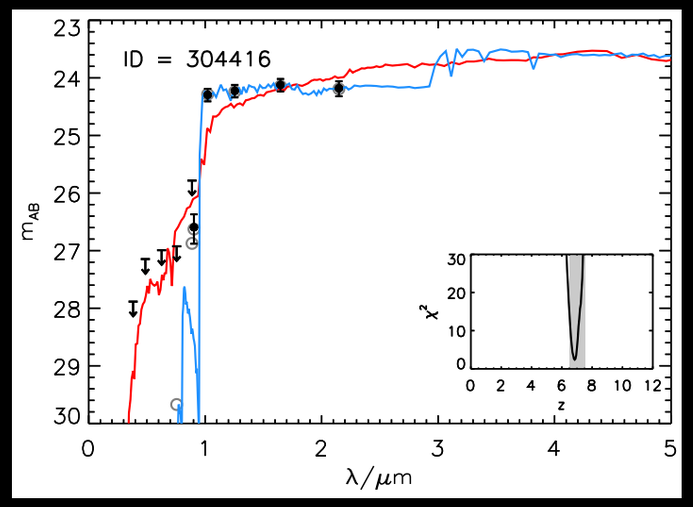

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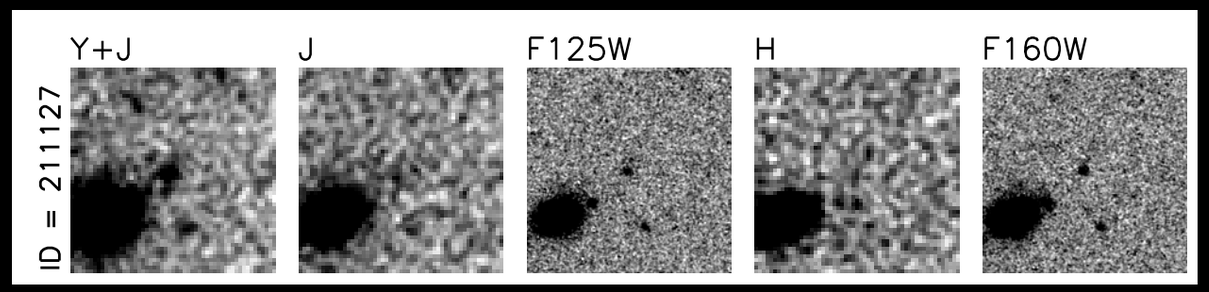
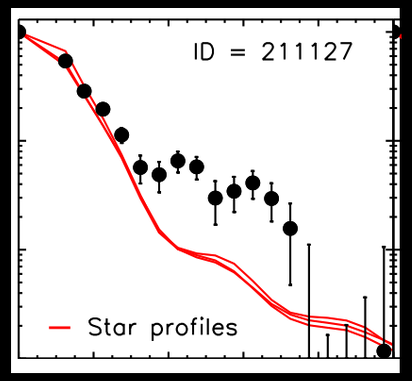
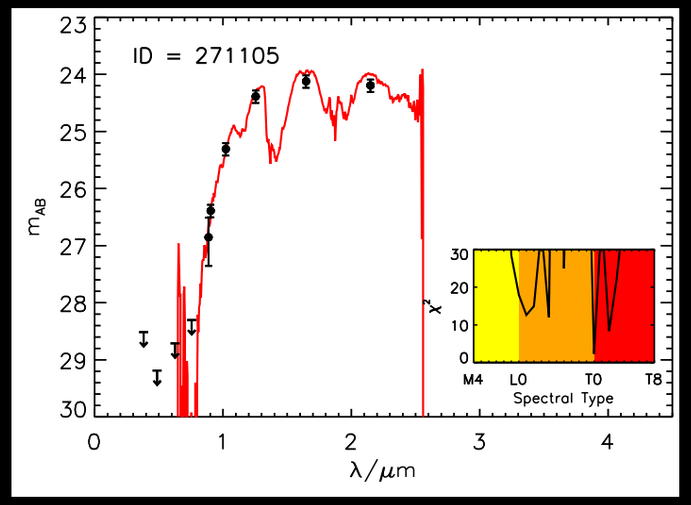






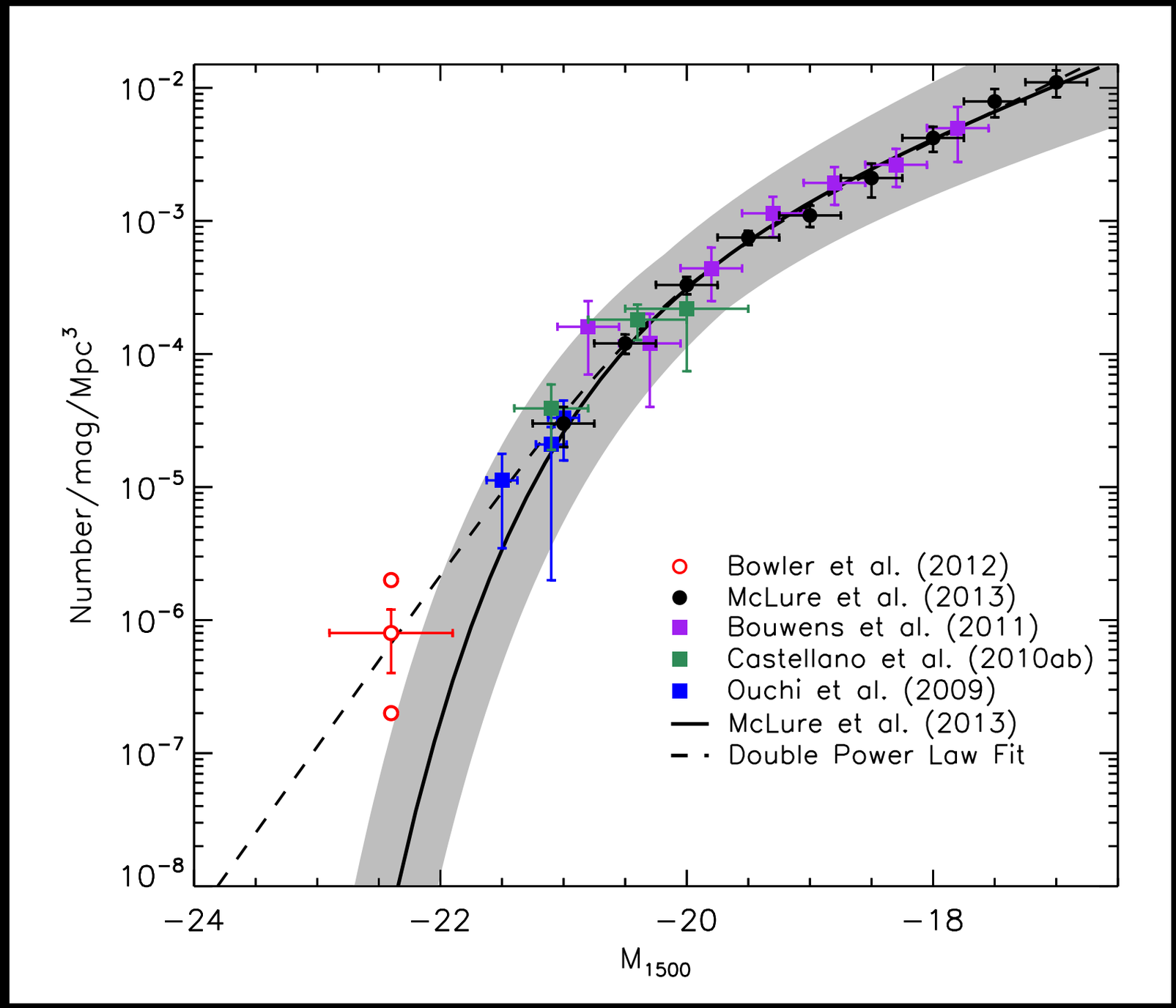
- sample includes the most massive z = 7 galaxies with 10^10.5 Msun
- 10 < SFR < 40 Msun/yr , sSFR < 2 /Gyr (less efficient star formation?)
- absolute magnitudes of: -22.7 < Muv < -21.2
- median rest-frame UV slope β = -2.0, no evidence for redder values
- FWHM consistent with r_1/2 ~ 1.5 kpc, with extended profiles in HST data

Luminosity Function - previous results

Bowler et al. 2012

10 galaxies

1 sq. degree



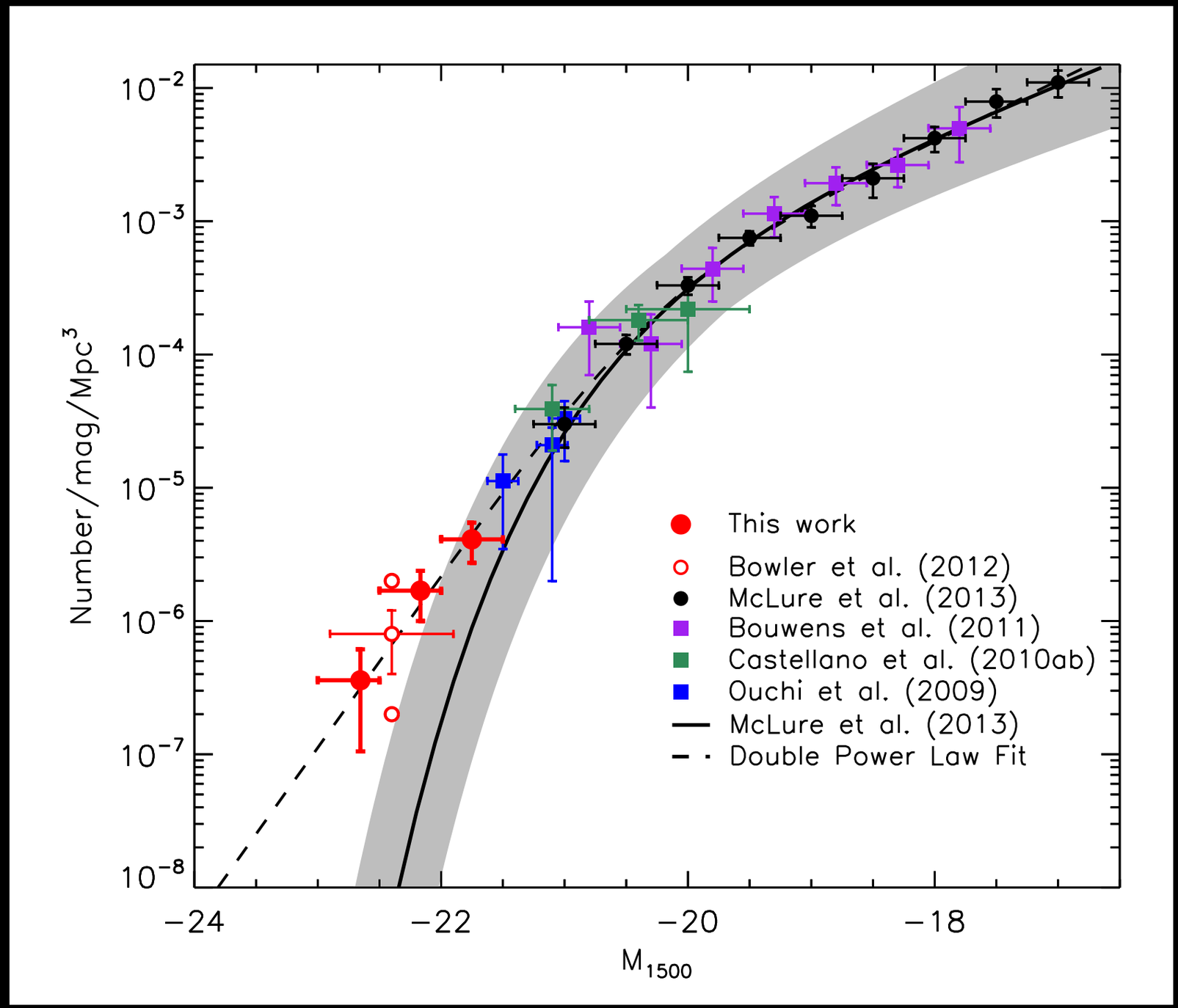
Luminosity Function - new results

Bowler et al. 2013

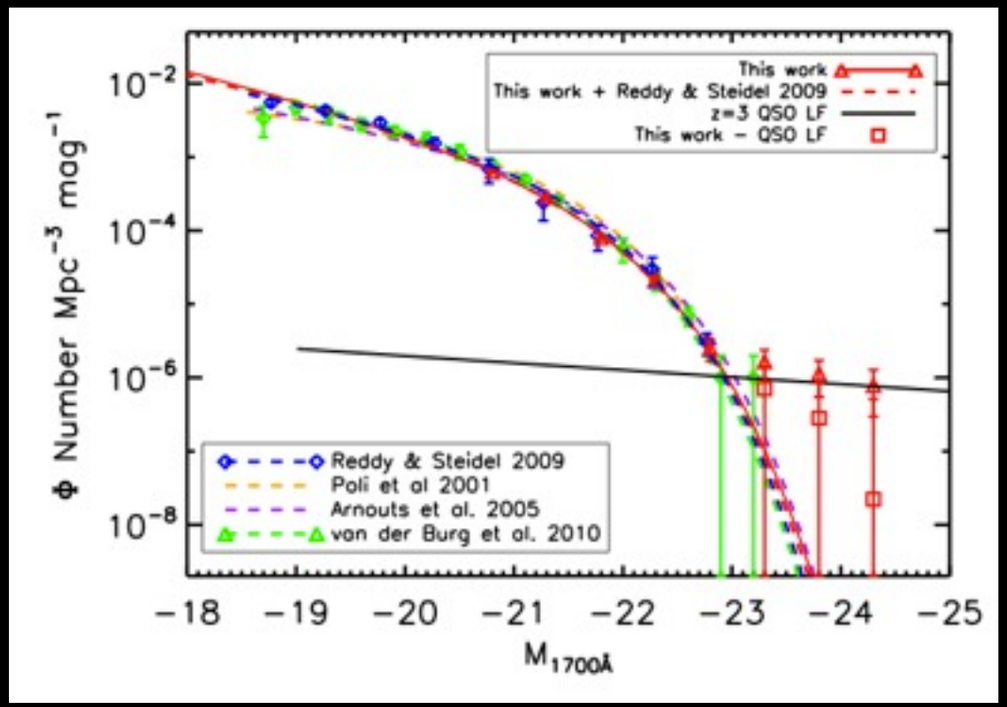
34 galaxies

1.65 sq. degree

0.5-1 mag deeper near-IR data



Luminosity Function - quasars



z = 3 LF from
Bian et al. 2013

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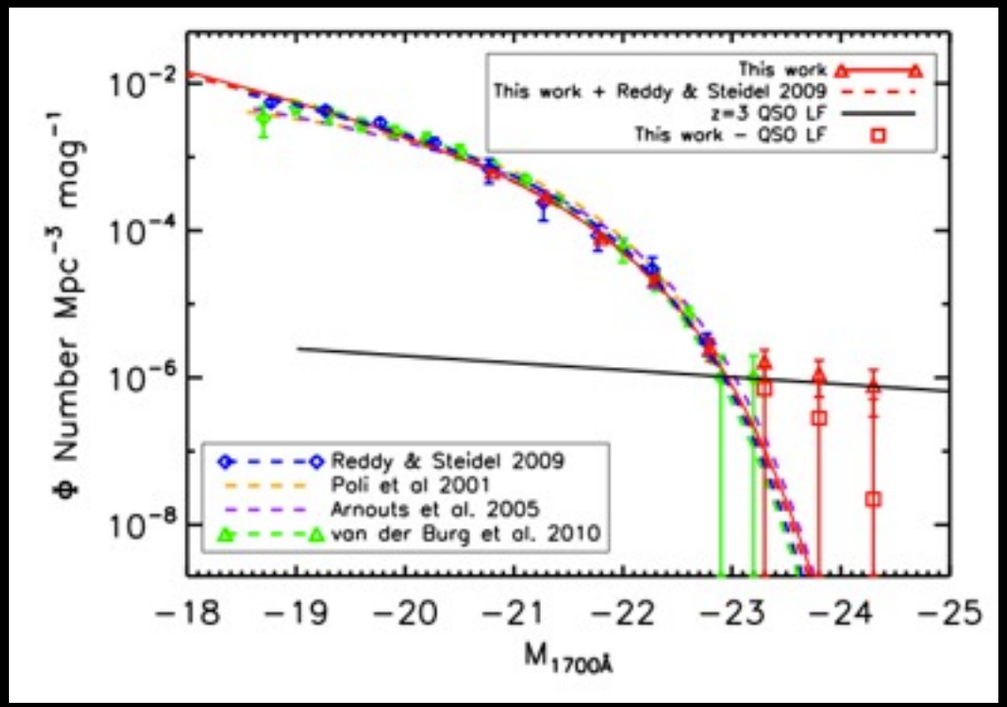

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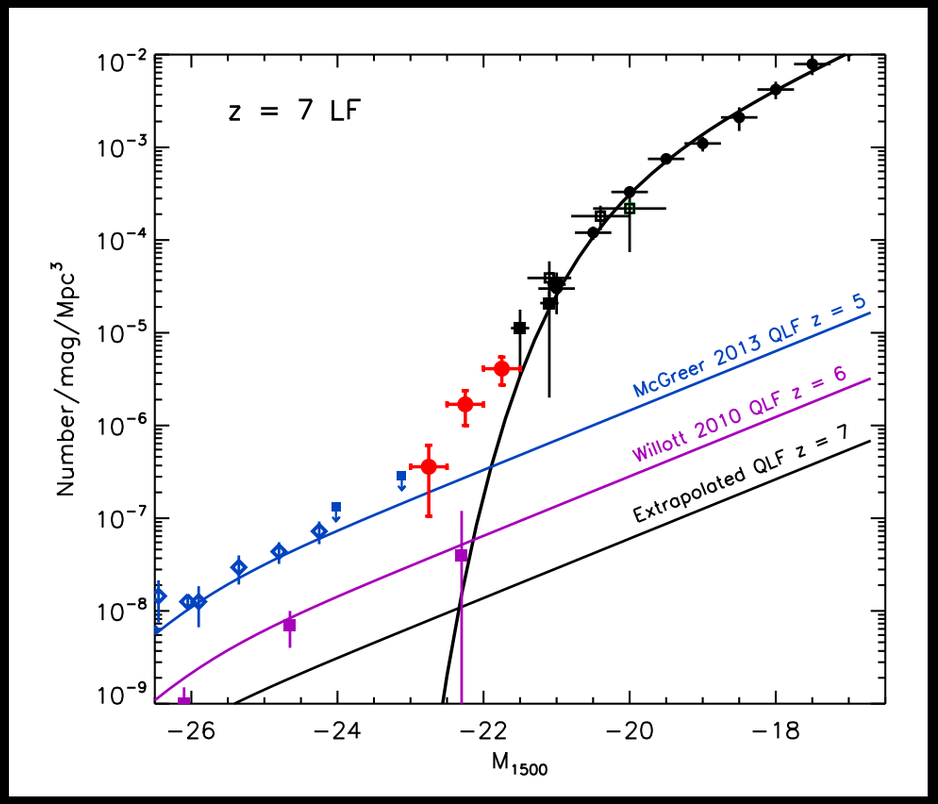
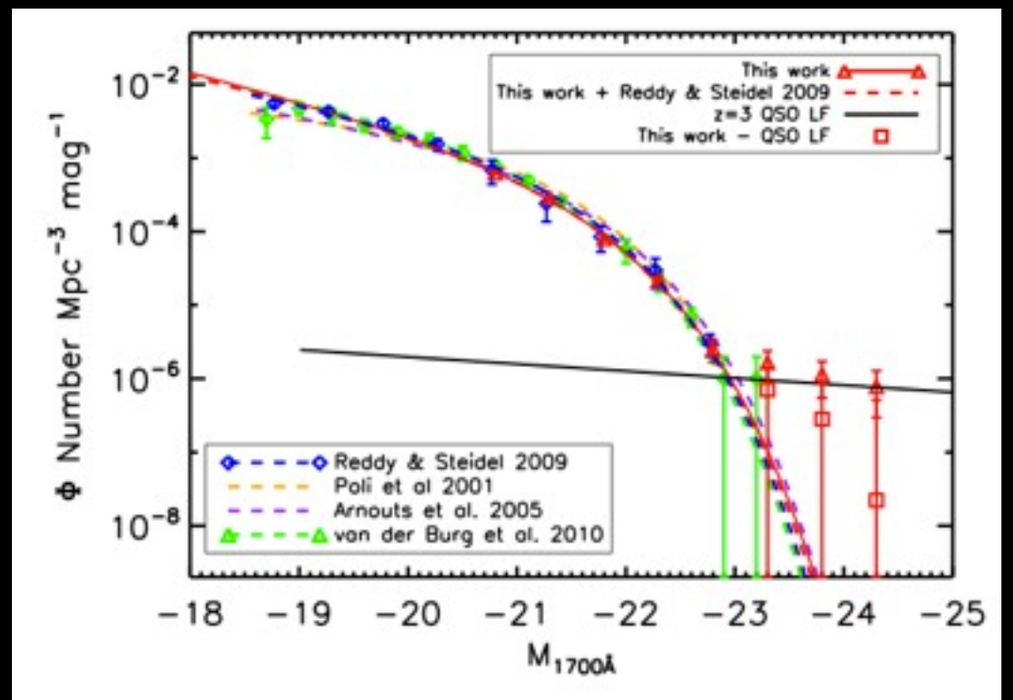
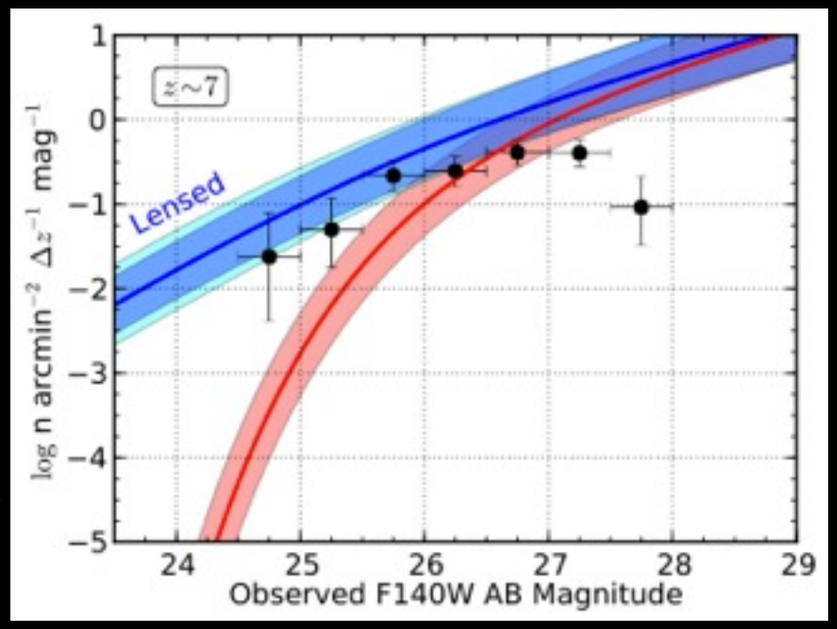


- Quasar contamination negligible

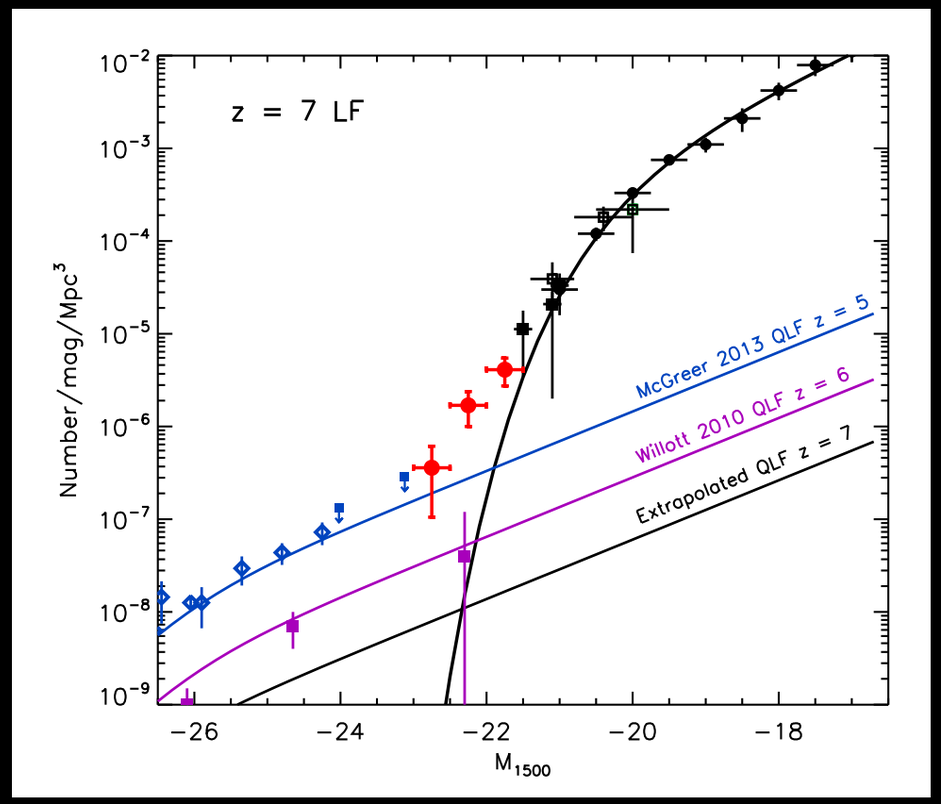
Luminosity Function - quasars, gravitational lensing

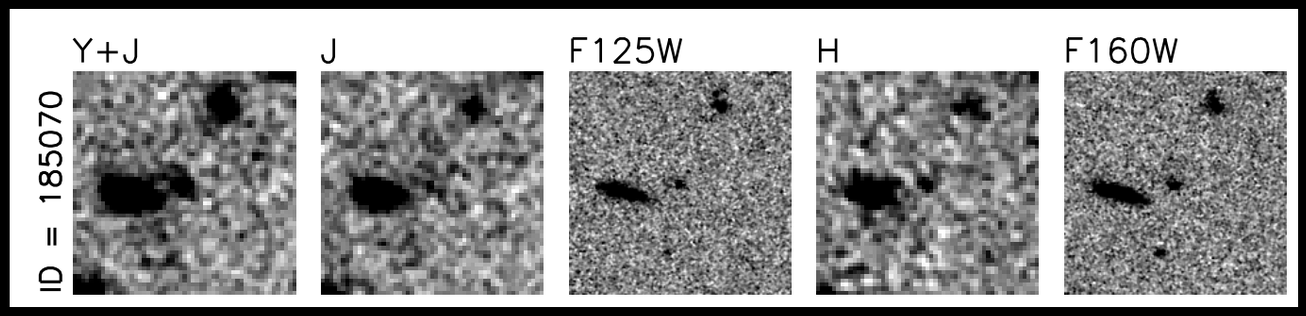


z = 3 LF from
Bian et al. 2013



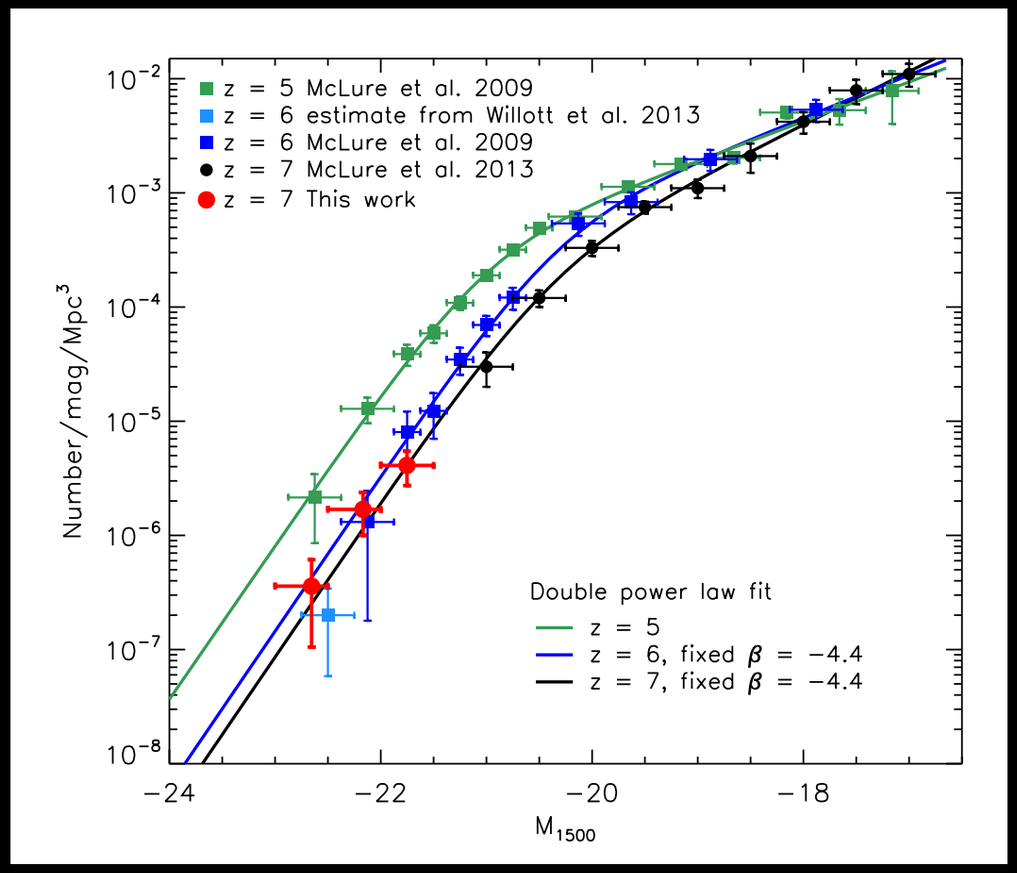
Effect of strong lensing
from a galaxy cluster
Bradley et al. 2013

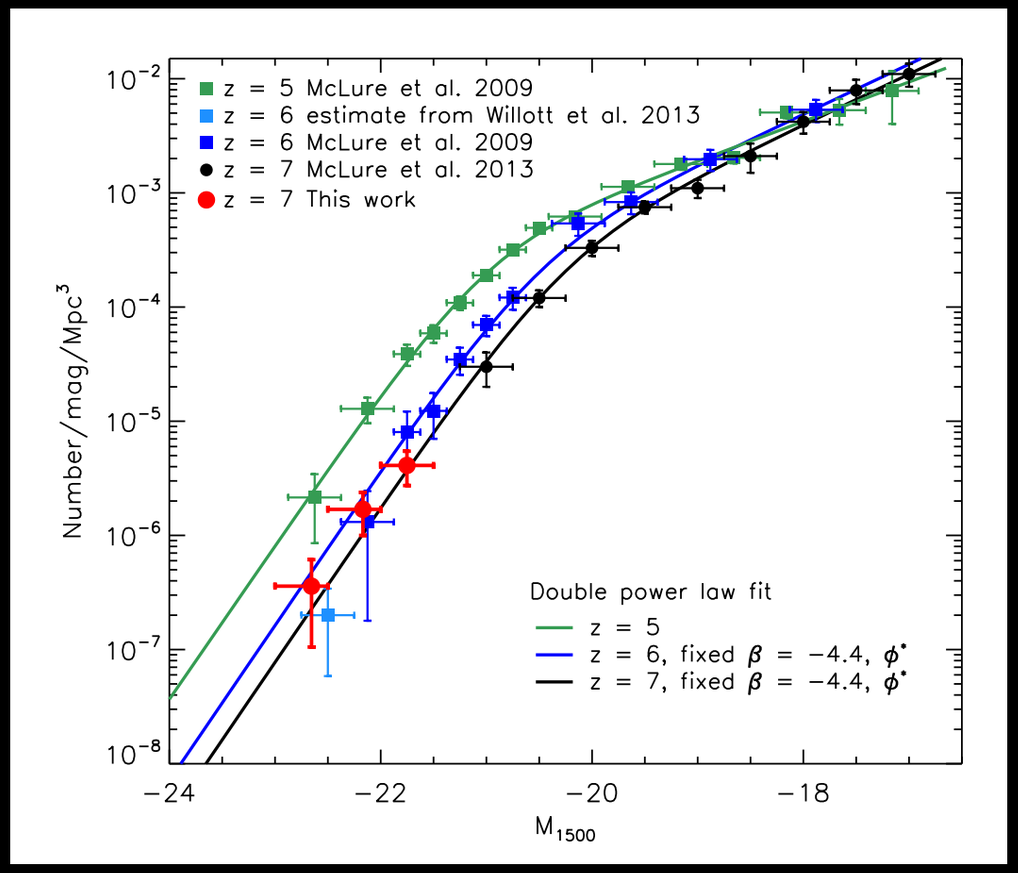




- Quasar contamination negligible
- Moderate gravitational lensing by foreground objects of ~ 0.1 mag is common (0.3 mag maximum)

Luminosity Function - double power law fits



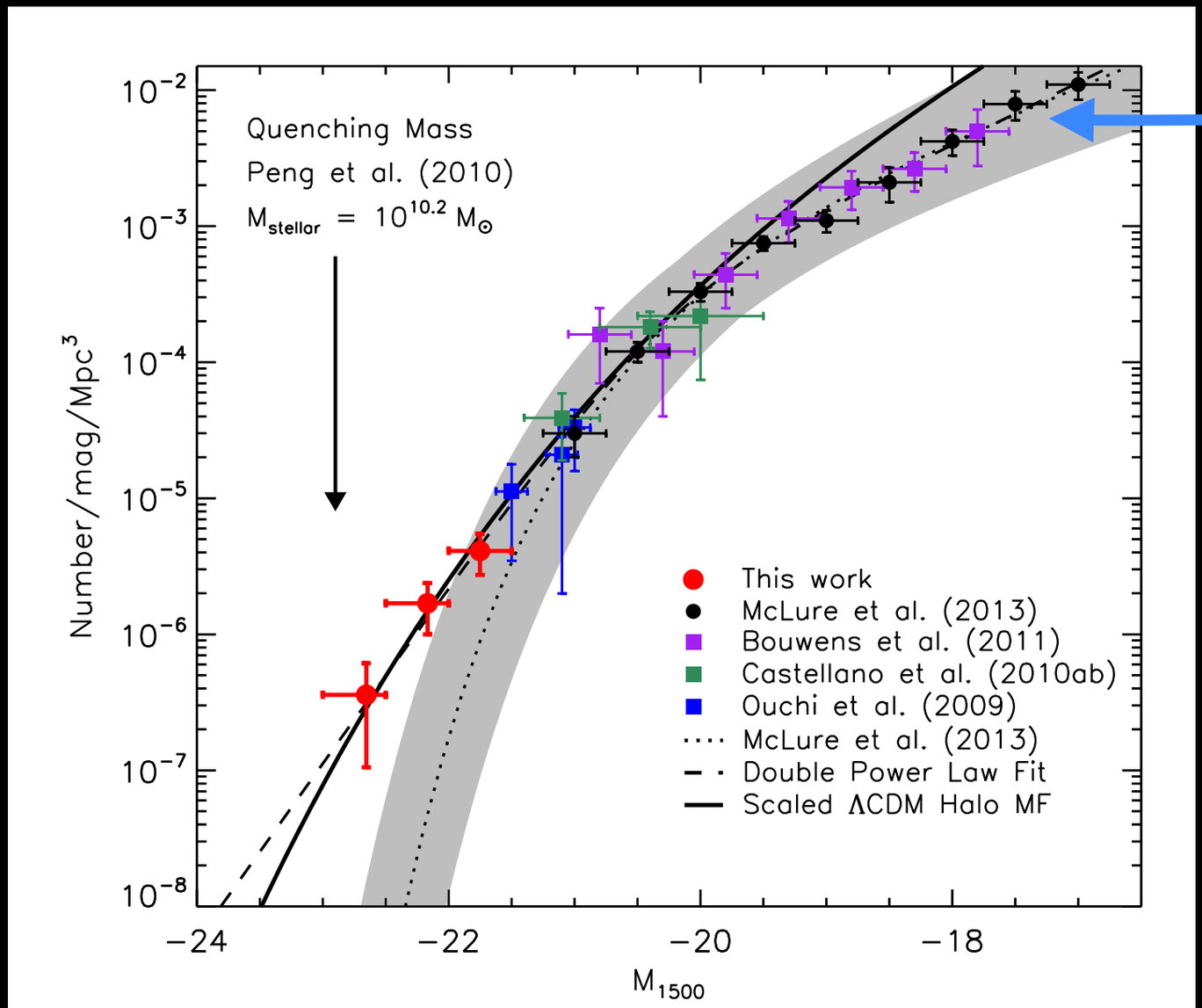


- a double power law provides a good fit to the data at z = 5, 6, 7
- little evolution at the bright end between z = 6 and z = 7
- M* evolution marginally preferred to Φ* evolution, supporting previous results of pure luminosity evolution from z = 5-7

Luminosity Function - astrophysical interpretation

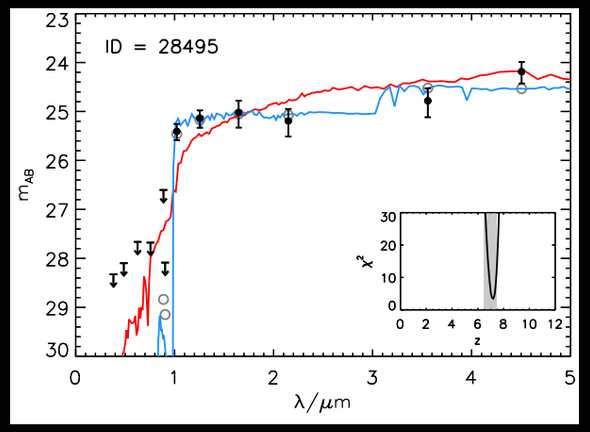
- ΛCDM dark matter halo mass function, scaled by a constant mass-to-light ratio

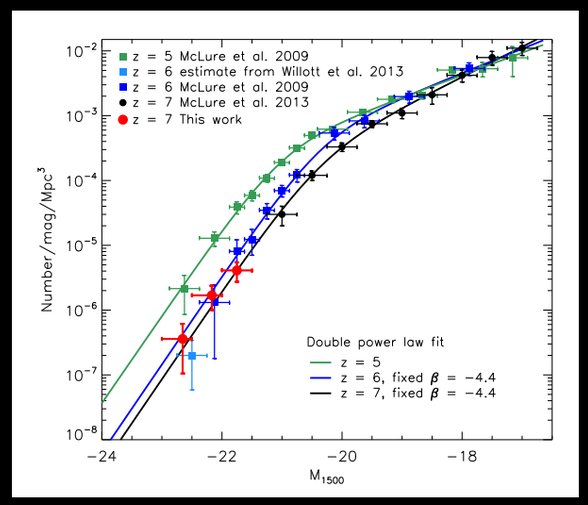
- Muv = -22.4 <-> 10^10 Msun
- Mstellar:Mdm = 1:30

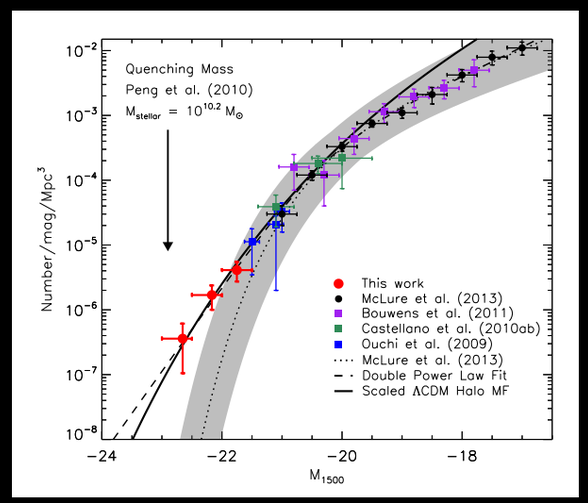


- feedback in faint galaxies appears to be active at early times
- feedback yet to become efficient in bright galaxies?
- Mstellar < Mcrit for mass quenching to be efficient (Peng et al. 2010)

Summary - (see arXiv:1312.5643 if interested)







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- 9/10 of the Bowler 2012 candidates confirmed
- the sample contains brightest and most massive z ~ 7 galaxies known (Muv ~ 22.5, M = 10^10.5)

- we find a shallower decline at the bright end of the z ~ 7 UV LF than predicted from the Schechter fit to fainter data
- a double power law fit well reproduces the observations
- quasar contamination is negligible

- are we seeing galaxies before the onset of mass quenching?

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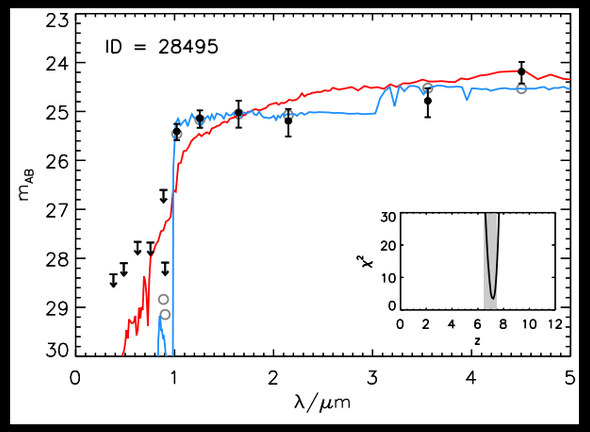

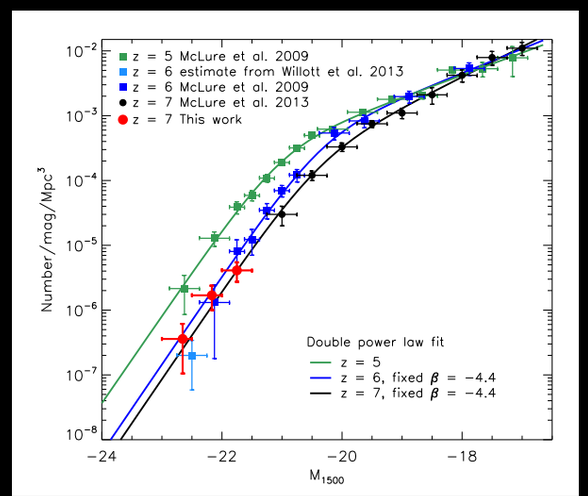

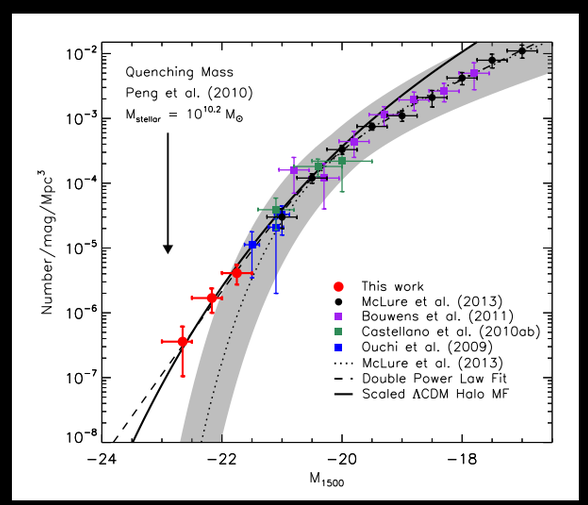

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Thanks for listening