The End of the Reionoization Epoch Probed by Lyman Alpha Emitters at z = 6.5 in the Subaru Deep Field

by Kashikawa et al.

presented by: Jason Young

Background:

Page et al. 2006: WMAP temperature polarization implies reionization at: $z = 10.9^{+2.3}_{-2.7}$

Gunn-Peters Trough in SDSS QSOs suggested reionization ended at z ~ 6

Willott et al. 2005: QSOs alone are not enough to reionizate the universe.

We expect the number of LAEs to drop at high z because the neutral IGM density is much higher - and the LAE luminosity function can constrain the epoch of reionization.

58 Photometric Candidates selected photometrically from Subaru Deep Field (34' x 27')

Criteria: For all: $NB921 \leq 26.0(5\sigma)$

For $i' \leq 27.87(2\sigma)$

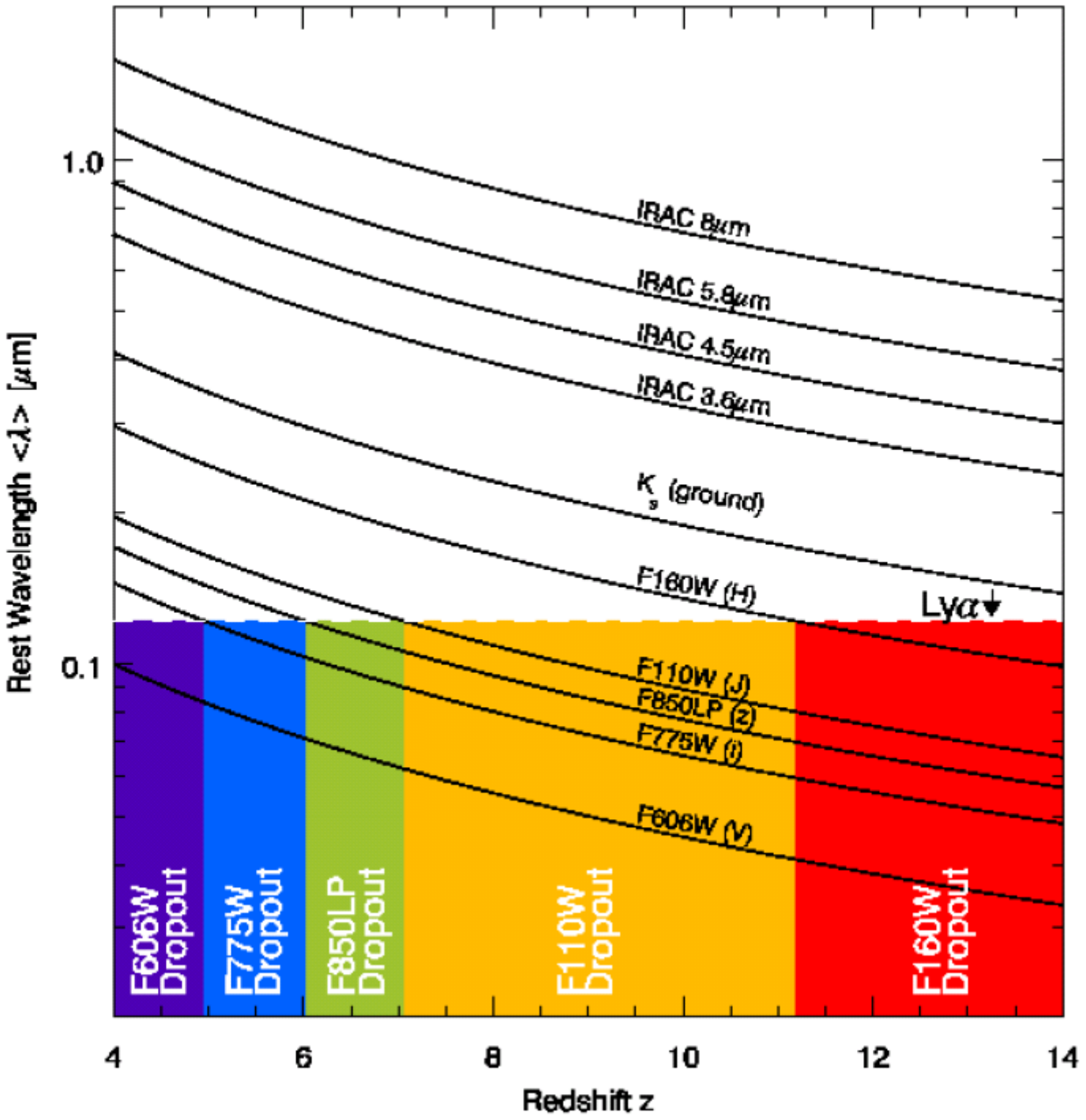
$z' - NB921 > 1$

$z' - NB921 > 3\sigma$

$i' - z' > 1.3$

For $i' > 27.87(2\sigma)$

$z' - NB921 > 1$


Rest Wavelength <λ> [μm]
1.0
0.1
IRAC 8μm
IRAC 5.8μm
IRAC 4.5μm
IRAC 3.6μm
K_s (ground)
F160W (H)
Lyα
F110W (J)
F850LP (z)
F775W (i)
F606W (V)
F606W Dropout
F775W Dropout
F850LP Dropout
F110W Dropout
F160W Dropout
4
6
8
10
12
14
Redshift z

Follow up Spectroscopy with Keck II DEIMOS or Subaru Focus to confirm redshift.

2 Data Sets:

2005 paper: 9 objects
This paper (2006): 8 objects

Skewness:

$$S = \frac{1}{I\sigma^3} \sum_i^n (x_i - \bar{x})^3 f_i$$

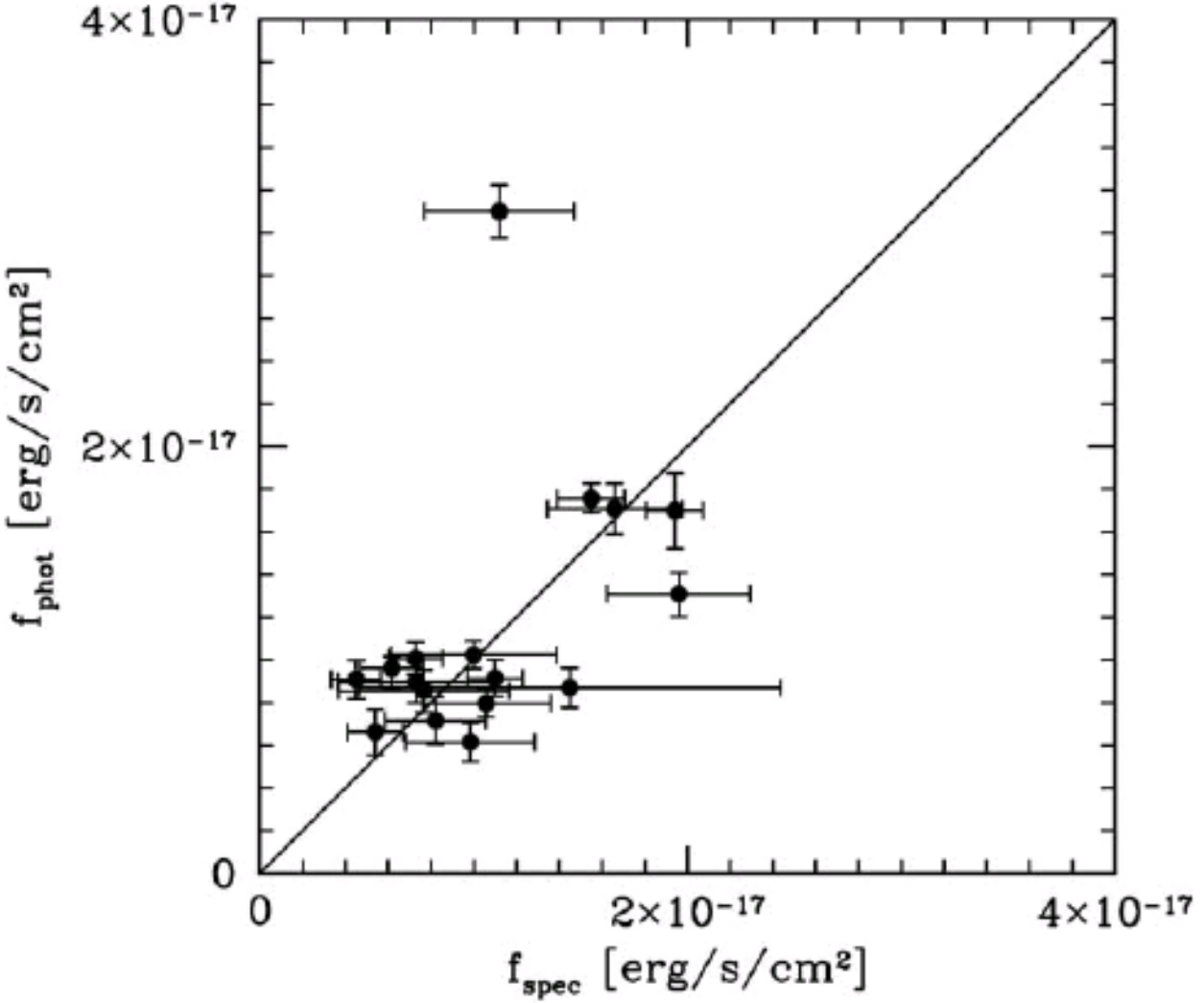
$$I = \sum_i^n f_i$$

Weighted Skewness:

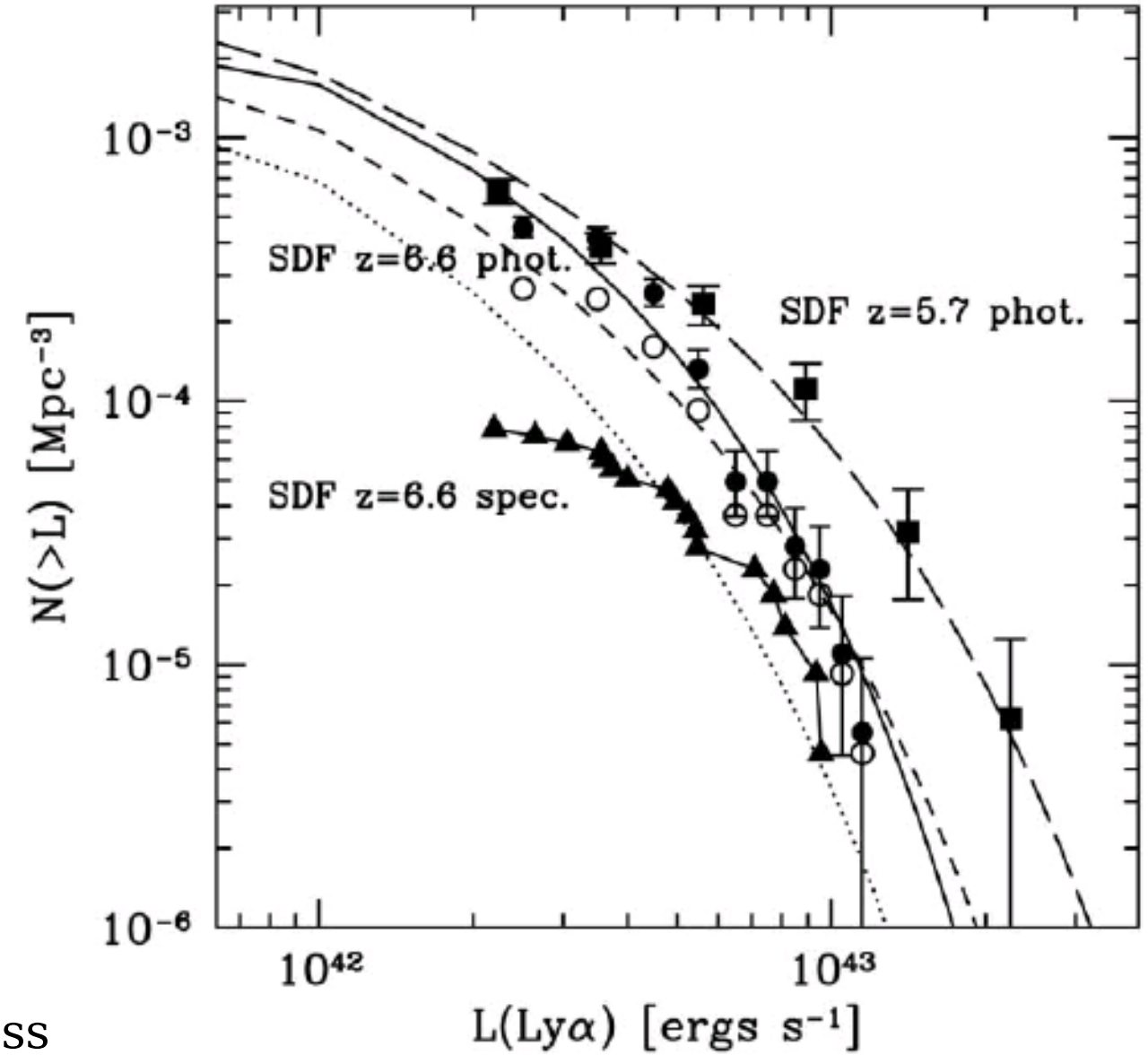
$$S_w = S(\lambda_{10,r} - \lambda_{10,b})$$

Can we really trust photometric redshifts?

perhaps, since the scatter appears random



Z = 6.5 Luminosity Function

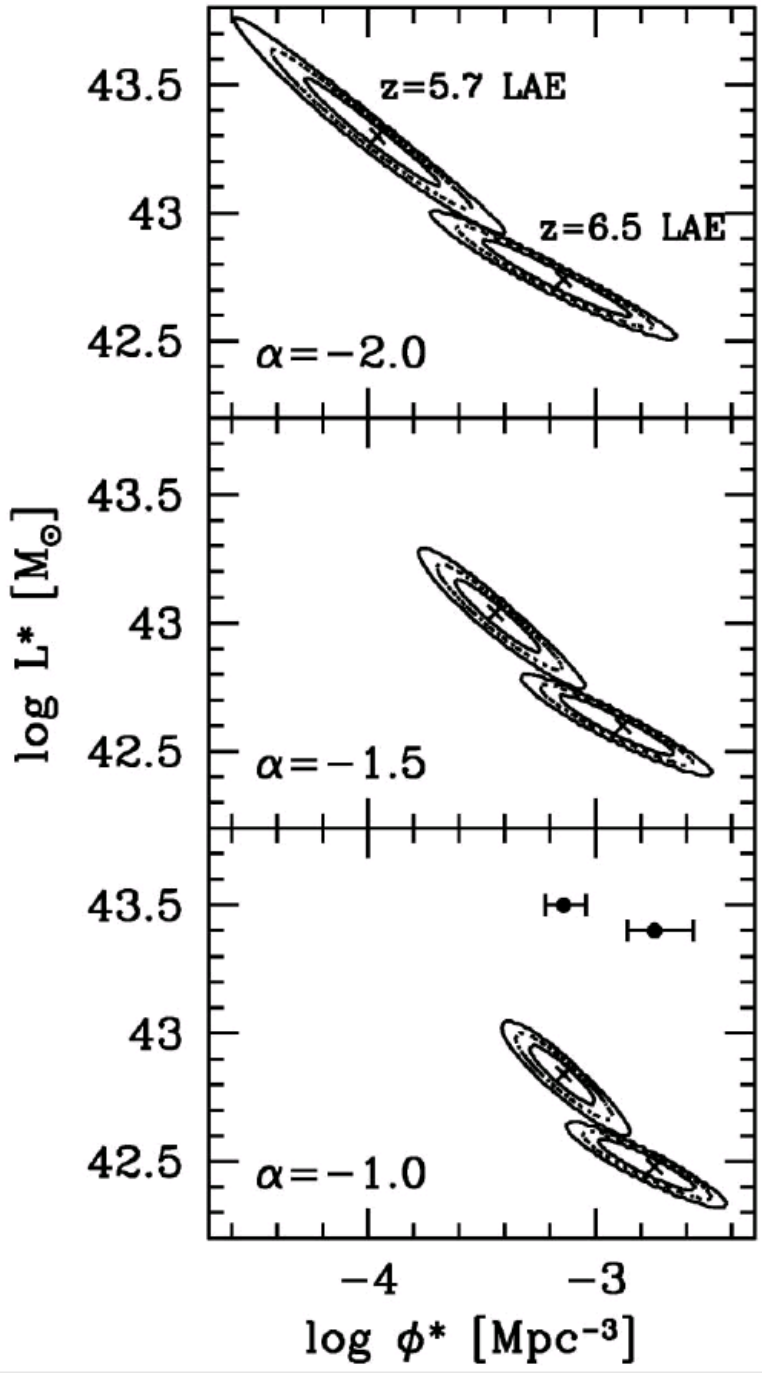


Filled circles are corrected for completeness (upper bound).

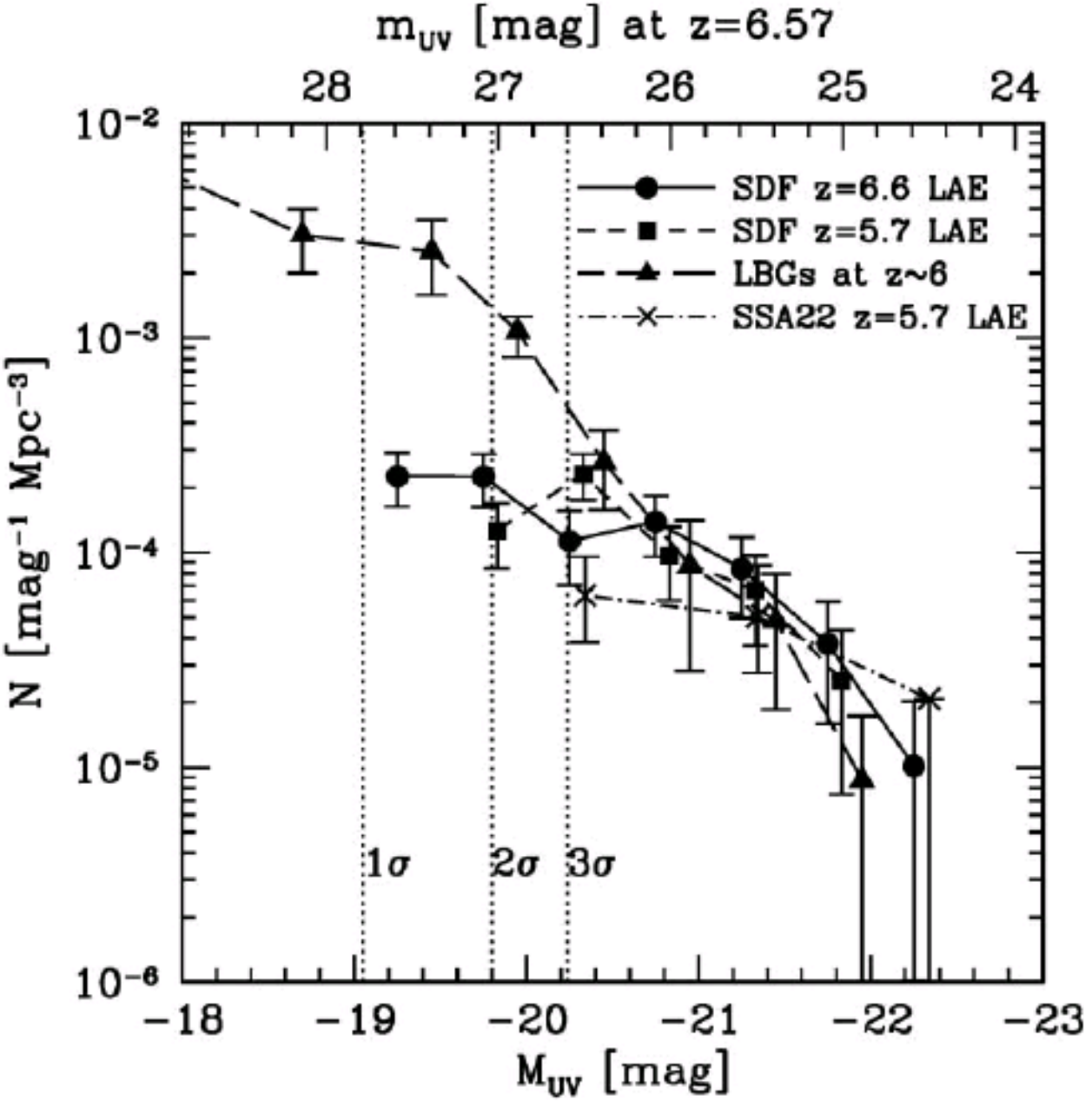
Triangles are raw counts (lower bound).

Three free parameters of the Schechter Function: L*, ϕ*, α

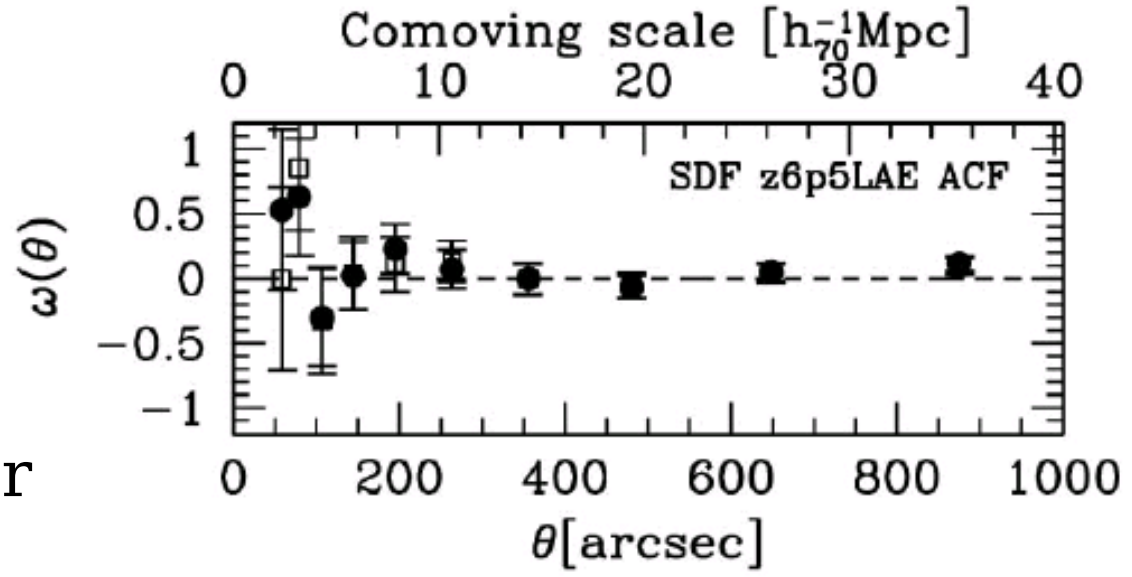
For all values of a, the error ellipses do not overlap - we can say with 3σ confidence that there has been evolution from z = 5.7 to z = 6.5.



UV Luminosity Function

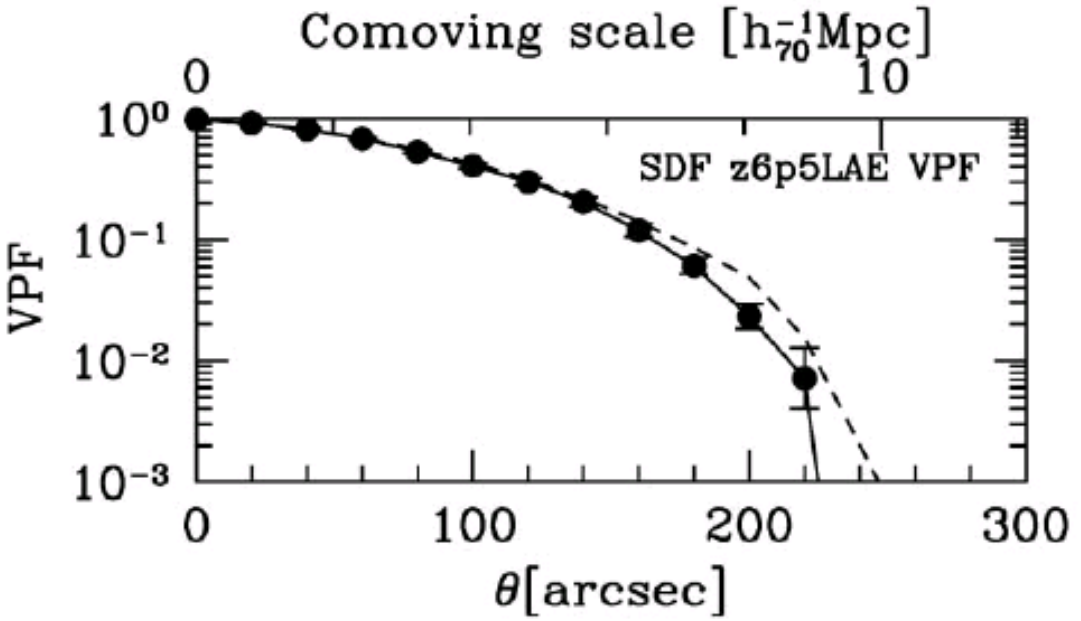


Clustering? None detected.



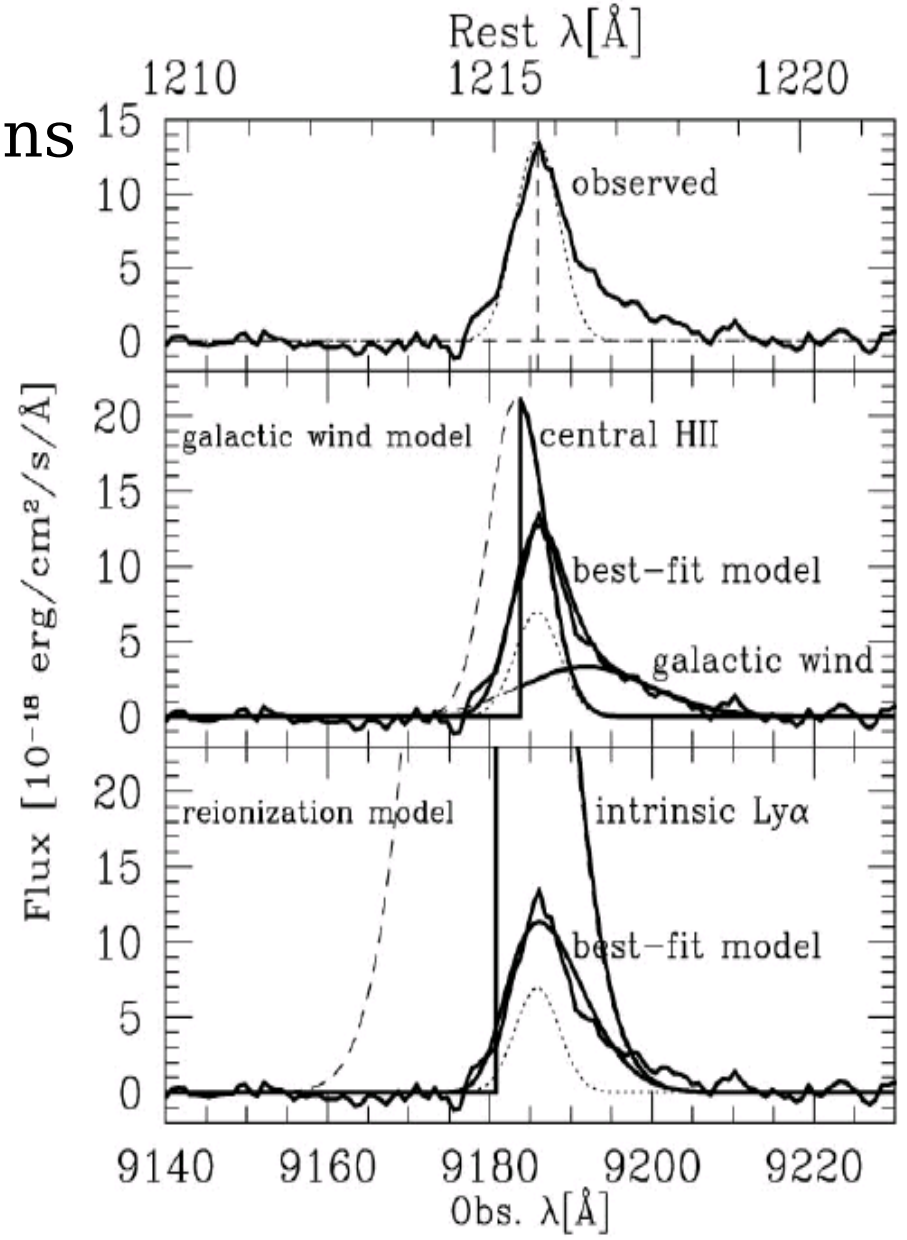
$\omega(\theta)$ = two point angular correlation at angular scale θ

Distribution is homogeneous in three clustering estimators.



Composite Spectrum (excluding 5 noisiest)

Asymmetric Line: two explanations
- backscatter off galactic wind
- red damping wing of the Gunn-Peterson trough



Results

Two Models:

Inside-Out: high density regions ionize first

Outside-In: low density regions ionize first

The bright end deficiency in these results is more consistent with Outside-In model.