

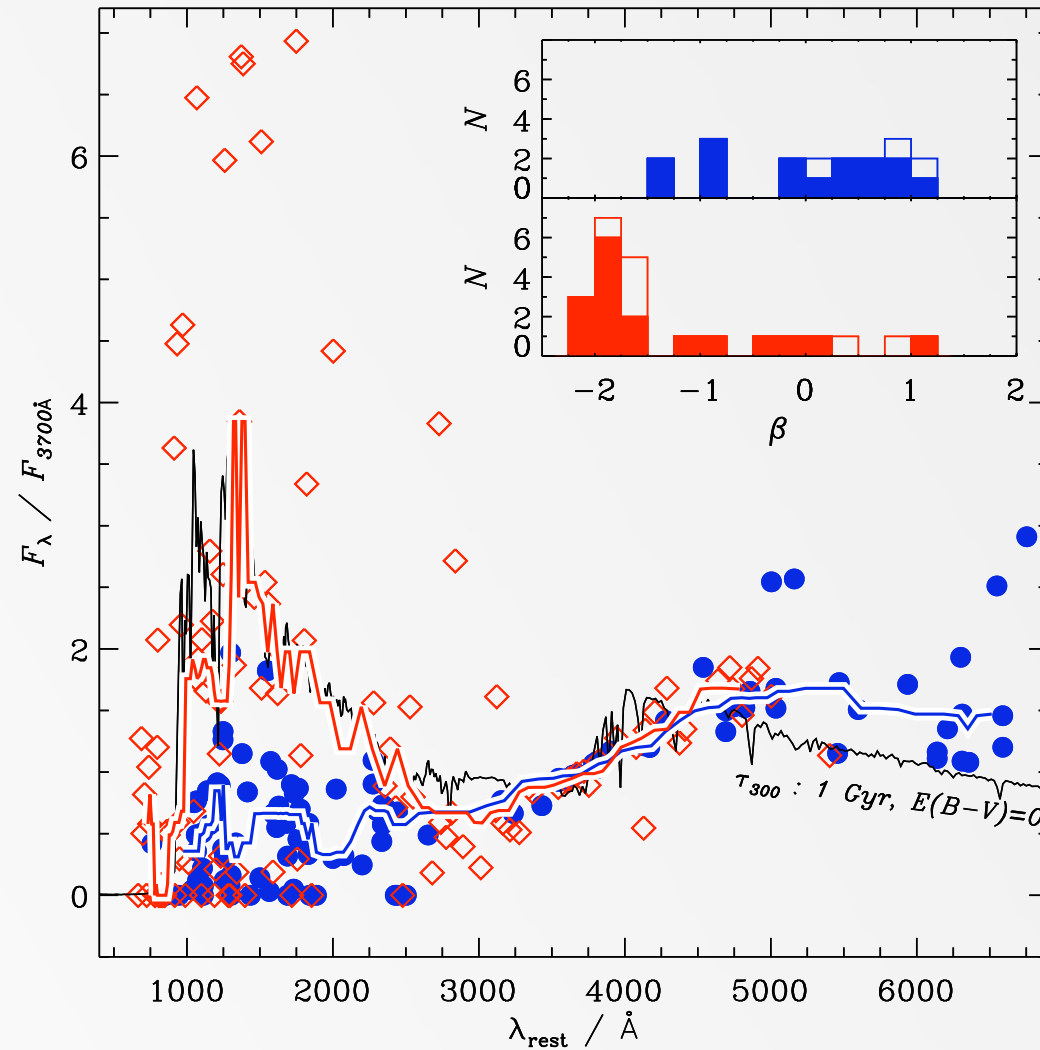
Science with the deep layer

Mariska Kriek
for Princeton University

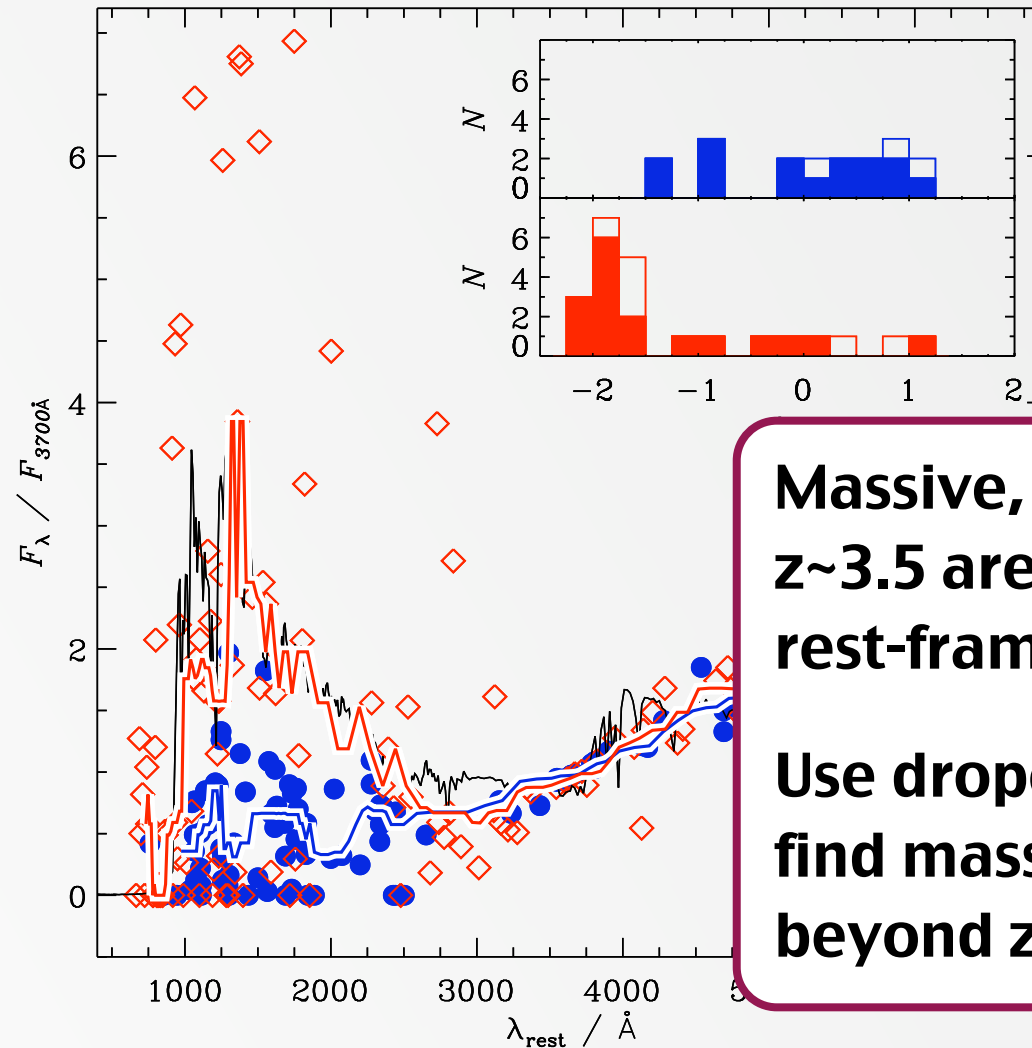
The deep layer

- ❖ **Depth: $g=29.8, r=29.3, i=28.9, z=28.2, y=27.4$**
- ❖ **Area: 5 deg^2**
- ❖ **4 Narrow bands at $z \sim 4, 5, 6, 7$**
- ❖ **Main science goals:**
 - ◆ **Dropouts / Lyman break galaxies (LBGs) at $3.5 \lesssim z \lesssim 6.0$**
 - ◆ **Lyman Alpha emitters (LAEs) at $z = [4,5,6,7]$**

Comparison massive galaxies at $z \sim 2.5$ and $z \sim 3.5$



Comparison massive galaxies at $z \sim 2.5$ and $z \sim 3.5$



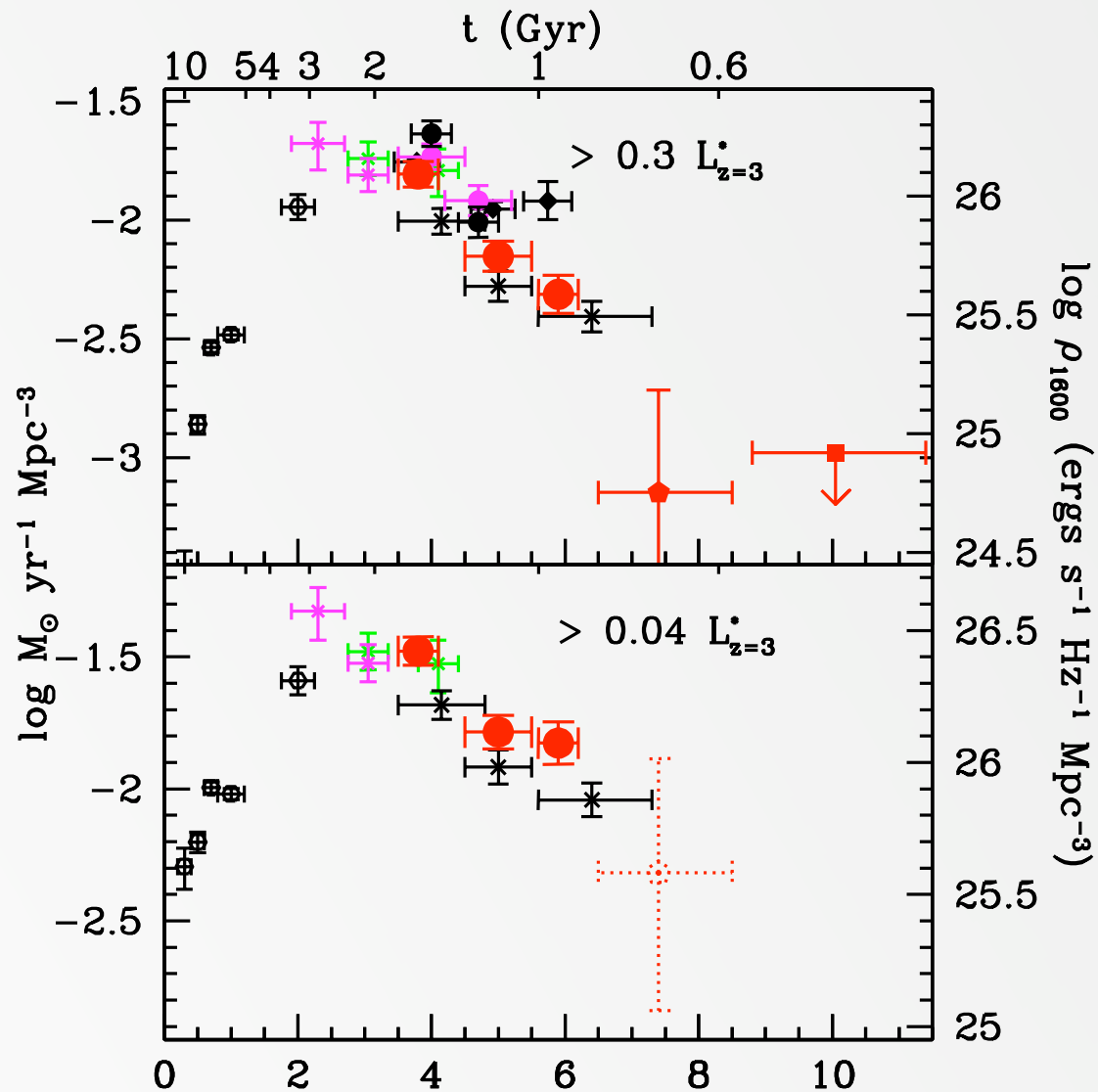
Massive, red galaxies at $z \sim 3.5$ are much bluer in the rest-frame UV than at $z \sim 2.5$:

Use dropout technique to find massive galaxies beyond $z \sim 3.5$

Science with dropouts / LBGs

- ❖ **UV Luminosity functions: star formation history (SFH) of the early universe** (e.g., Shimasaku et al. 2005, Yoshida et al. 2006, Tresse et al. 2007, Bouwens et al. 2007)
- ❖ **Clustering: importance of the environment for the SFH of galaxies**

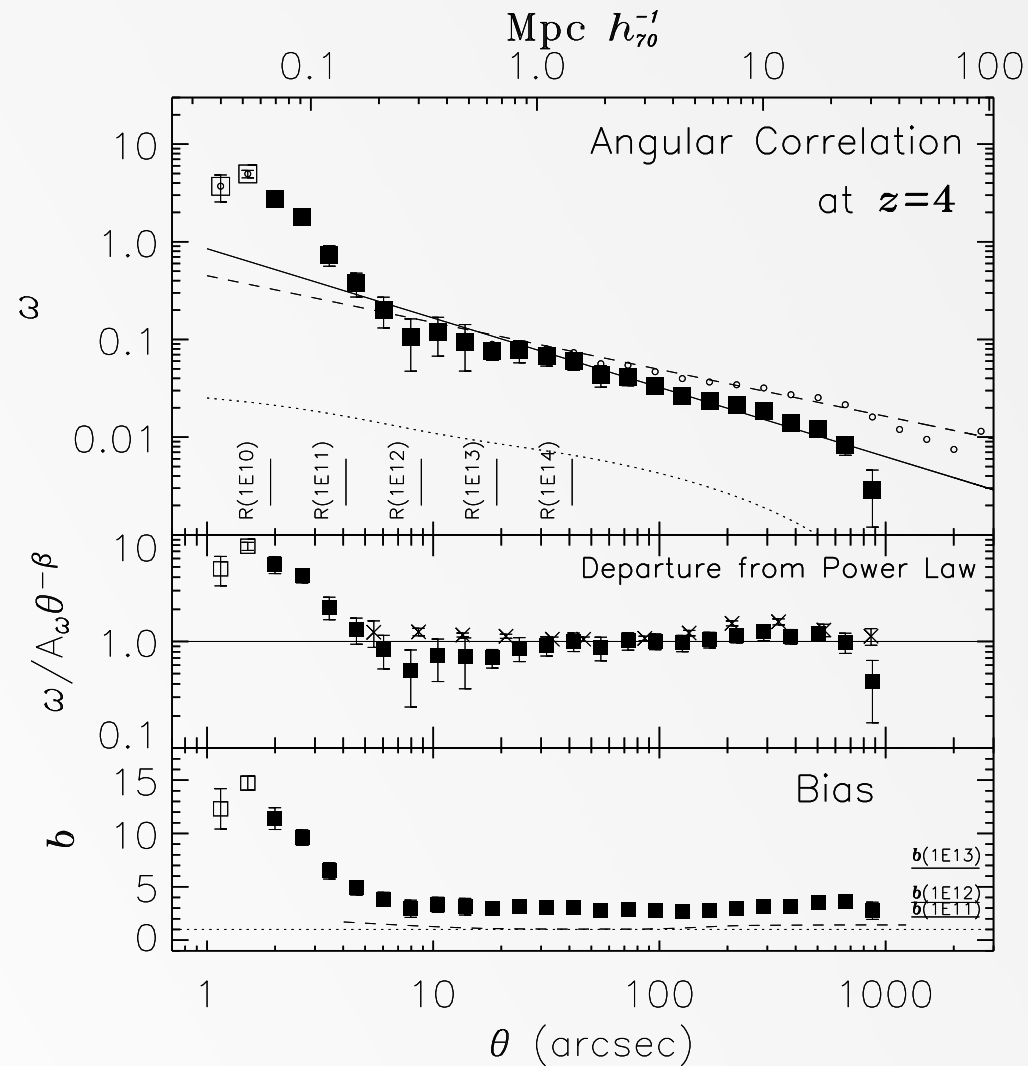
SFR density of the universe



Science with dropouts / LBGs

- ❖ **UV Luminosity functions: star formation history (SFH) of the early universe** (e.g., Shimasaku et al. 2005, Yoshida et al. 2006, Tresse et al. 2007, Bouwens et al. 2007)
- ❖ **Clustering: importance of the environment for the SFH of galaxies**

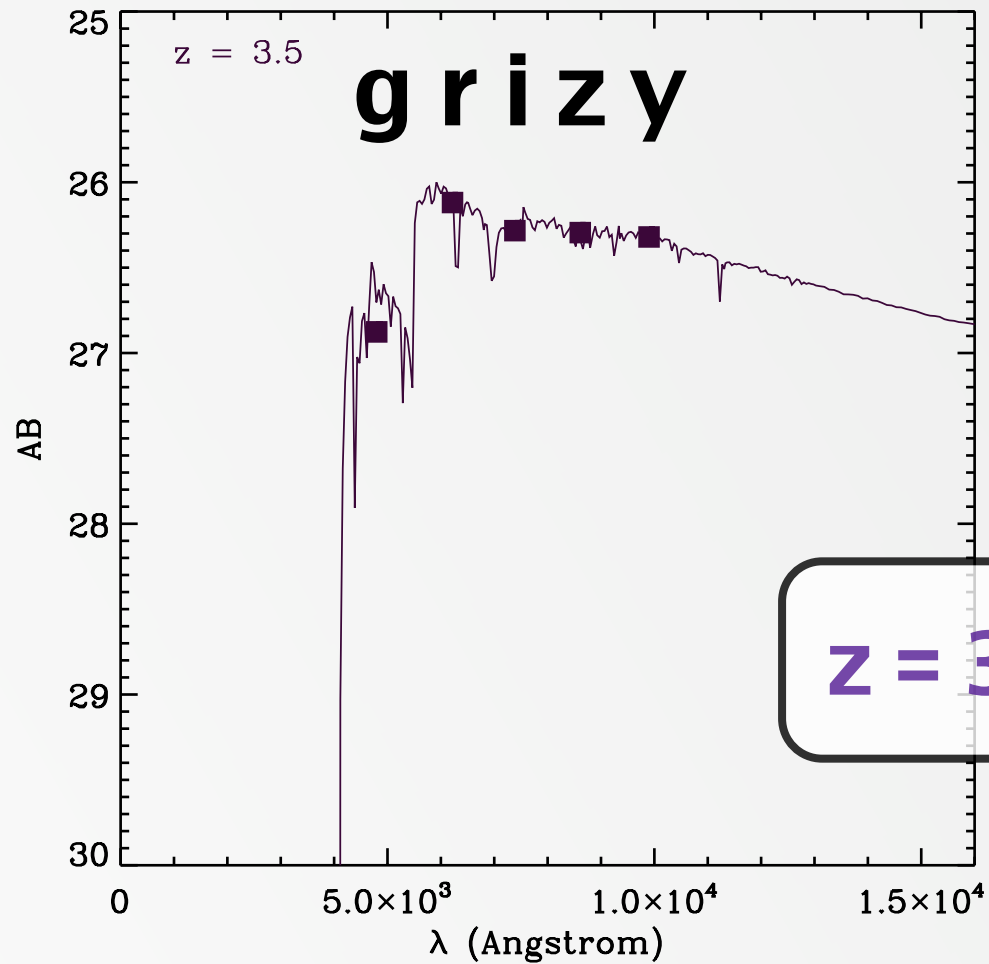
Clustering of dropouts



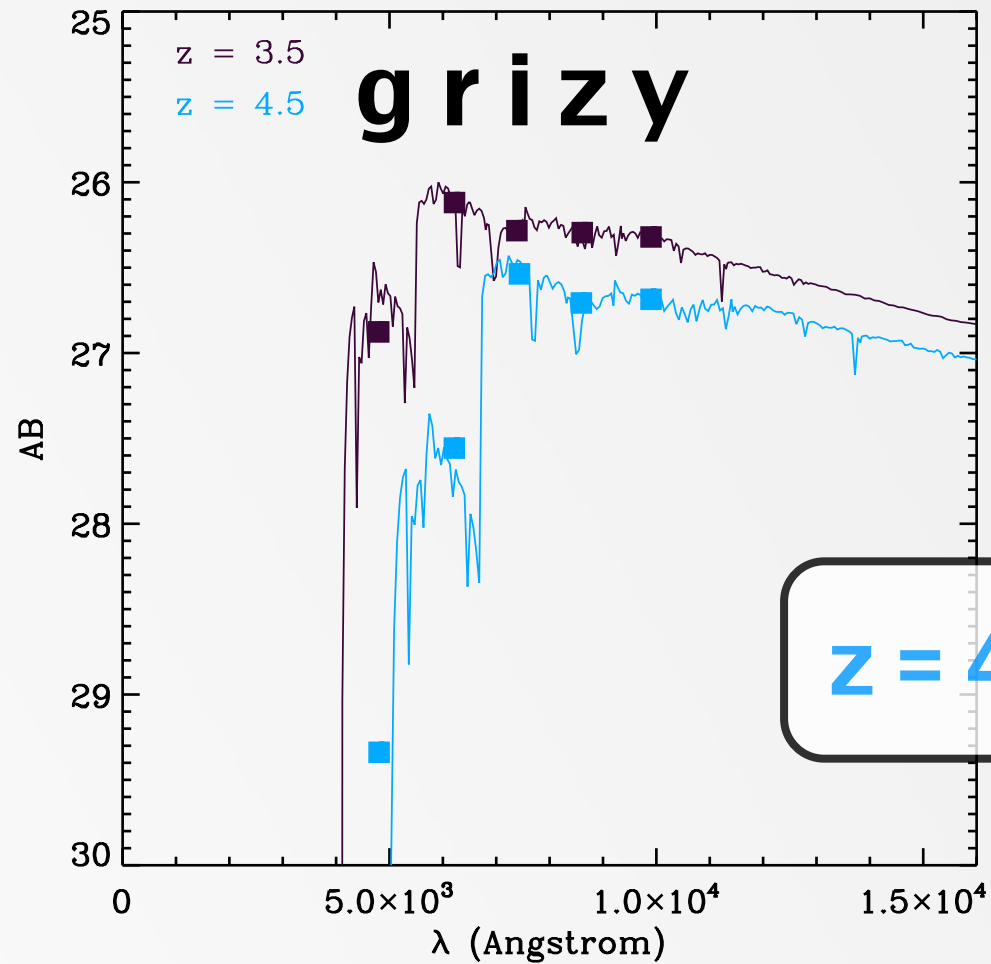
Ouchi et al. 2005:

**$z \sim 4$ LBGs in the
Subaru / XXM
Newton deep field
(1 deg²)**

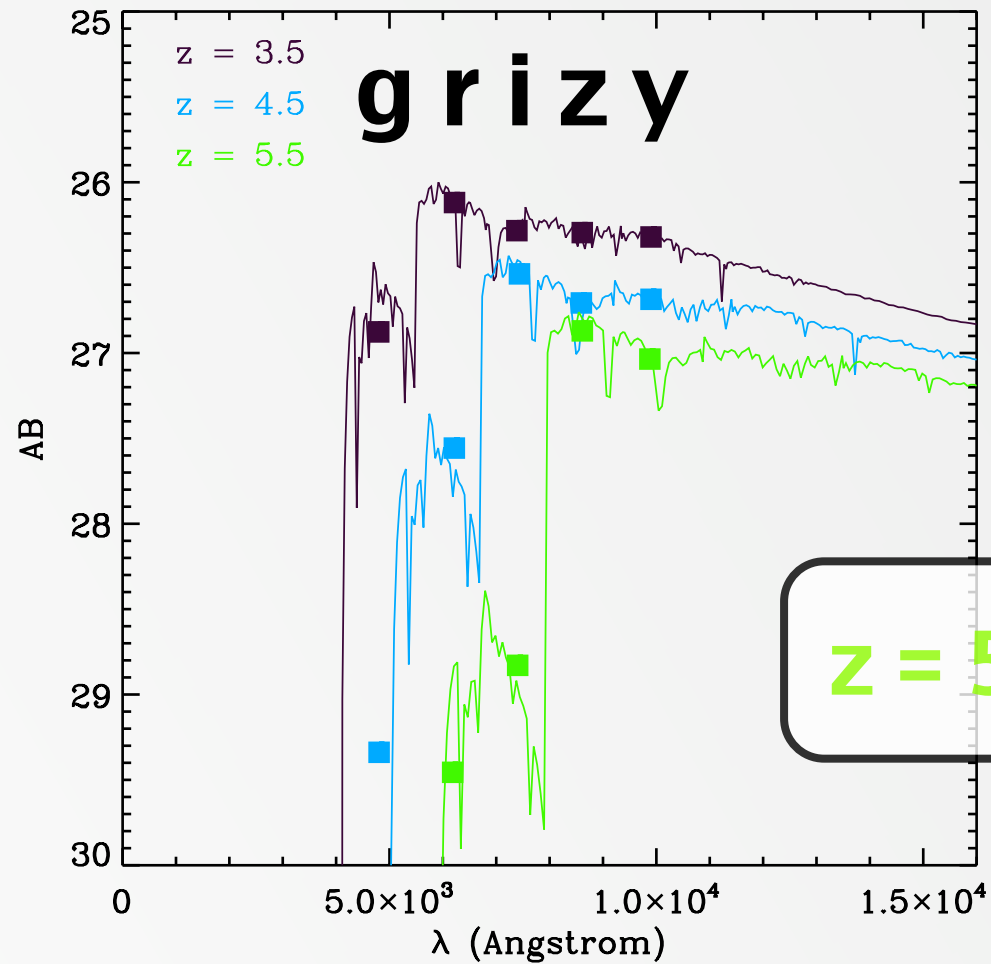
Dropouts in the deep layer



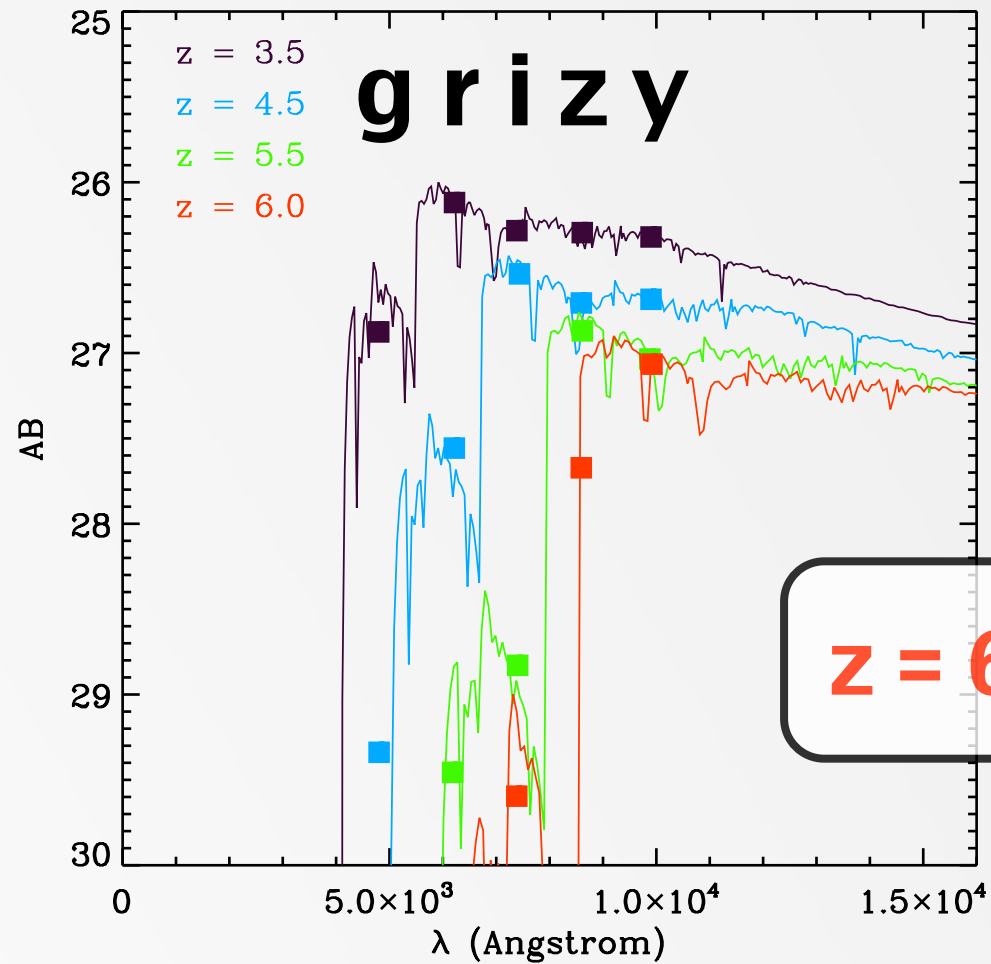
Dropouts in the deep layer



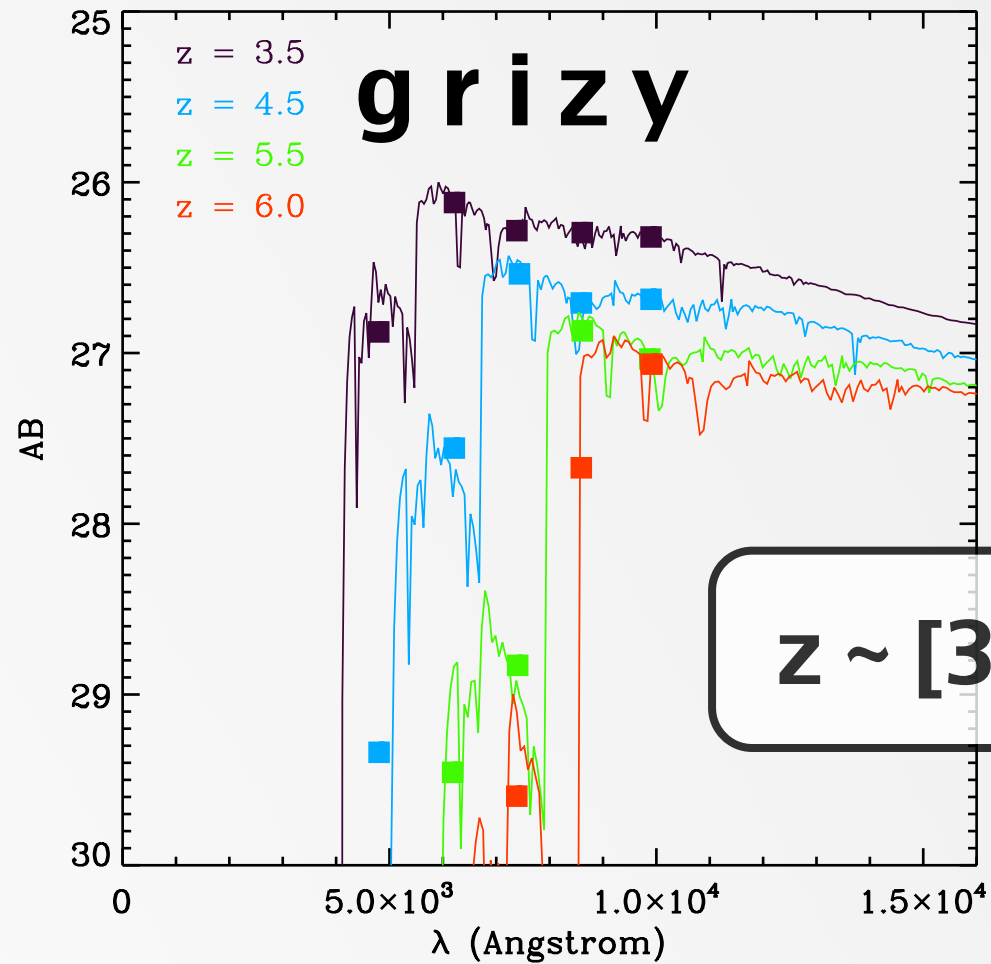
Dropouts in the deep layer



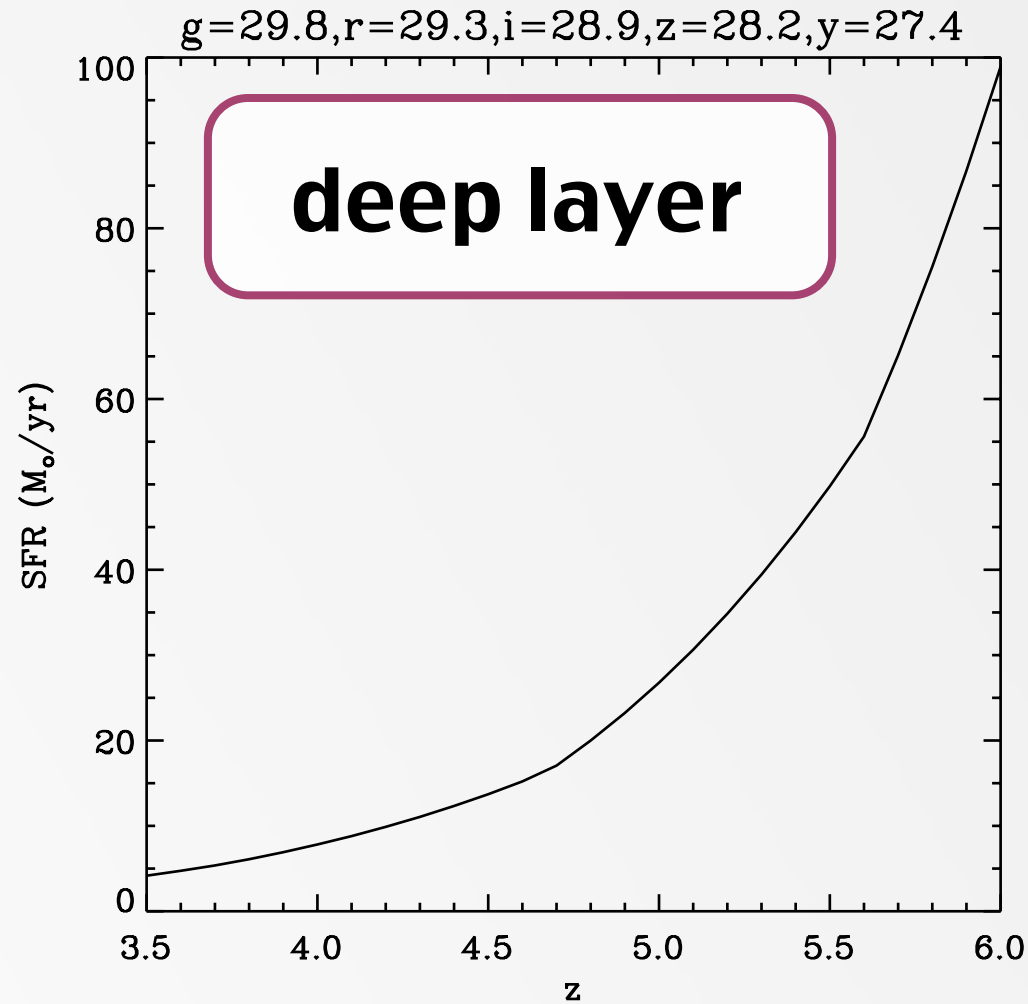
Dropouts in the deep layer



Dropouts in the deep layer

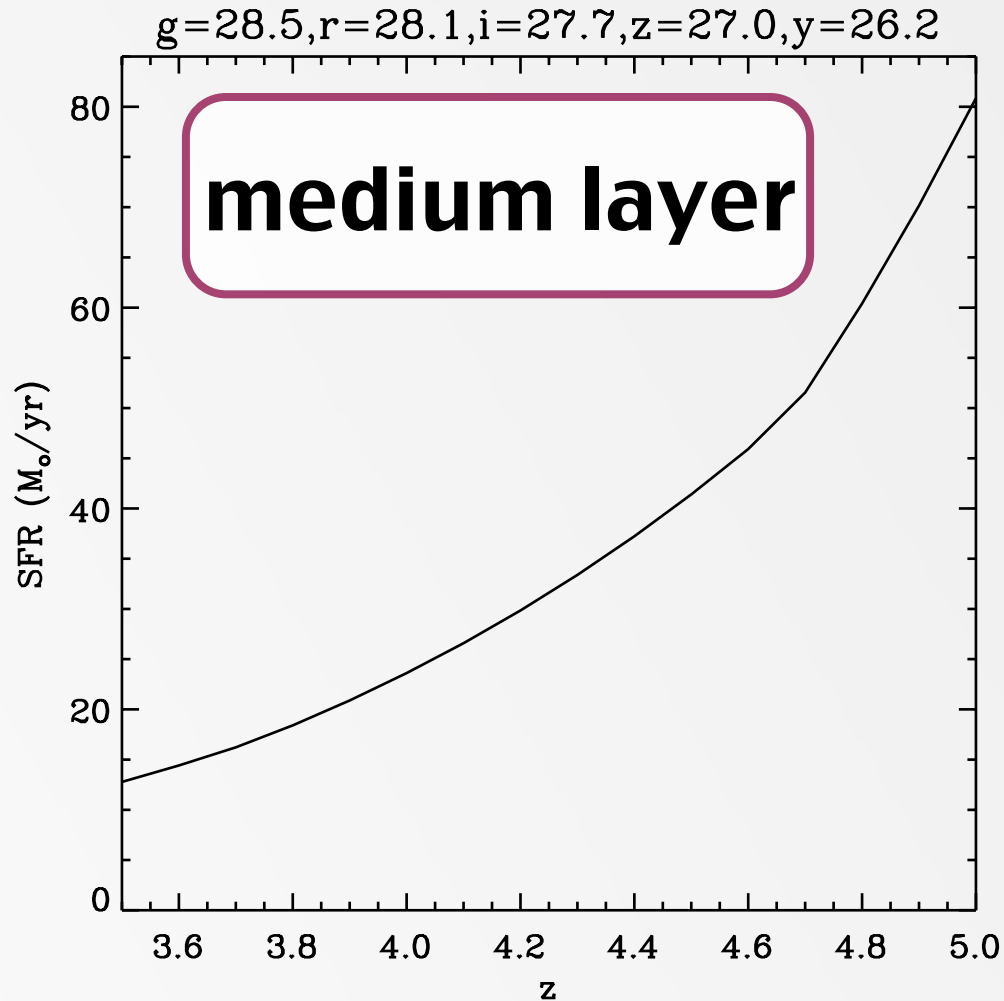


SFR limits from UV continuum



g=29.8
r=29.3
i=28.9
z=28.2
y=27.4

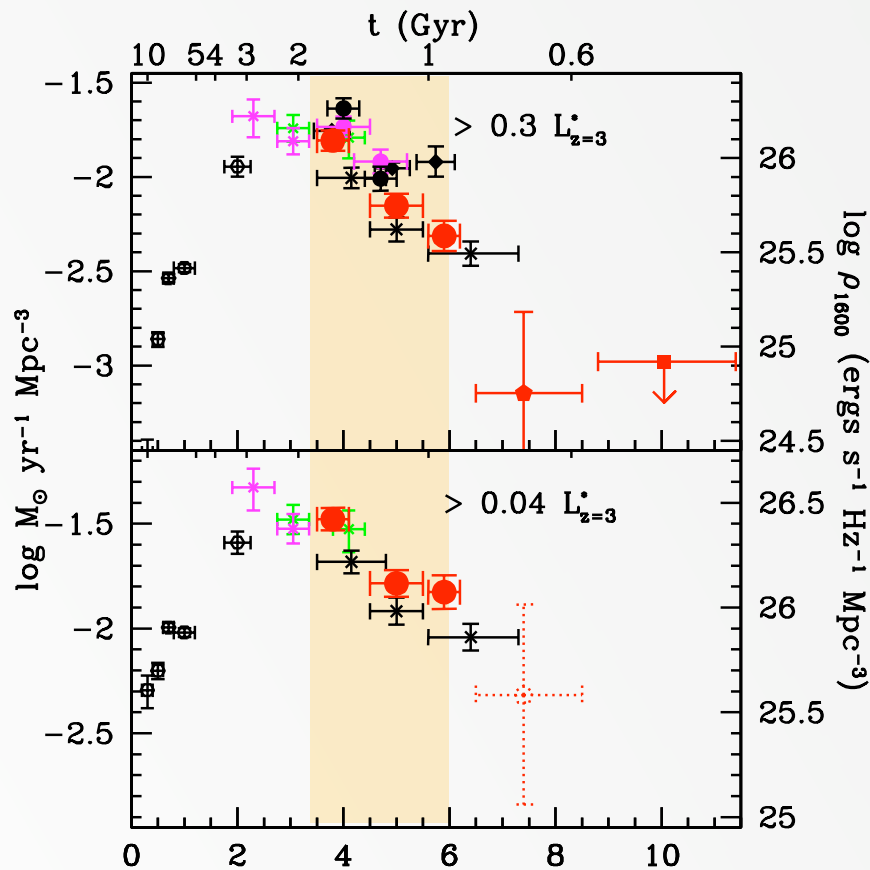
SFR limits from UV continuum



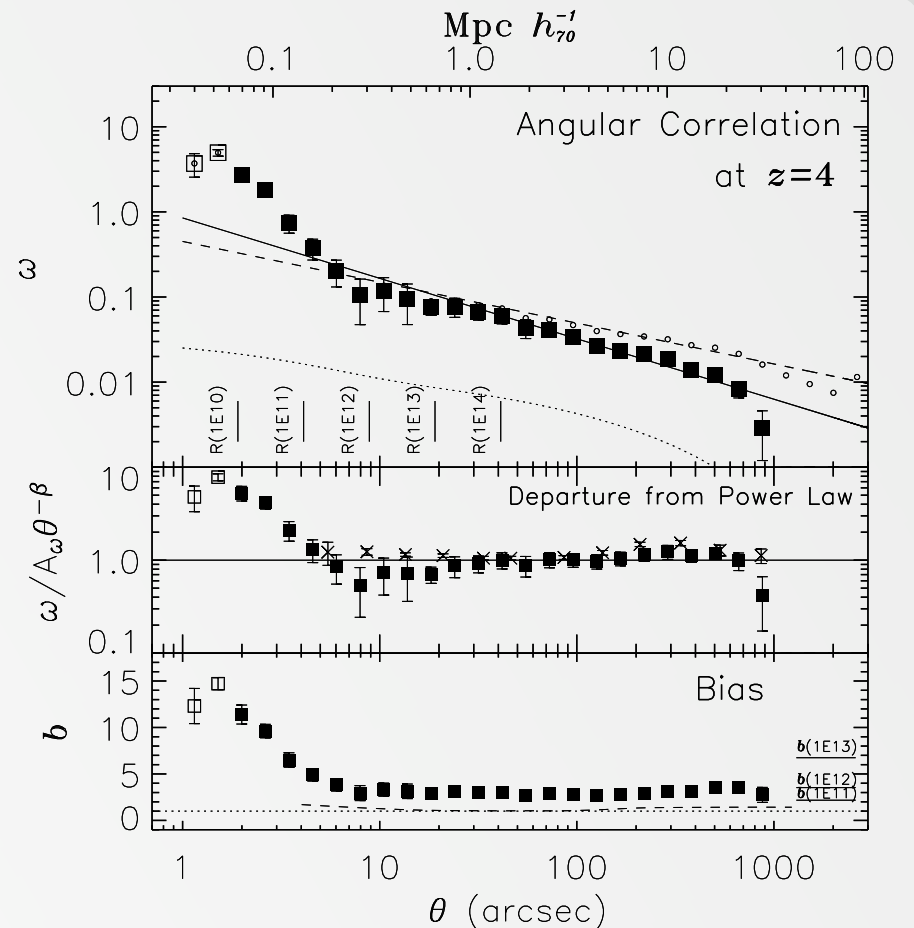
g=28.5
r=28.1
i=27.7
z=27.0
y=26.2

Comparison to current LBG studies

Clustering: deep layer 5 x larger area & about 1.5 mag deeper or 20 x larger area at the same depth



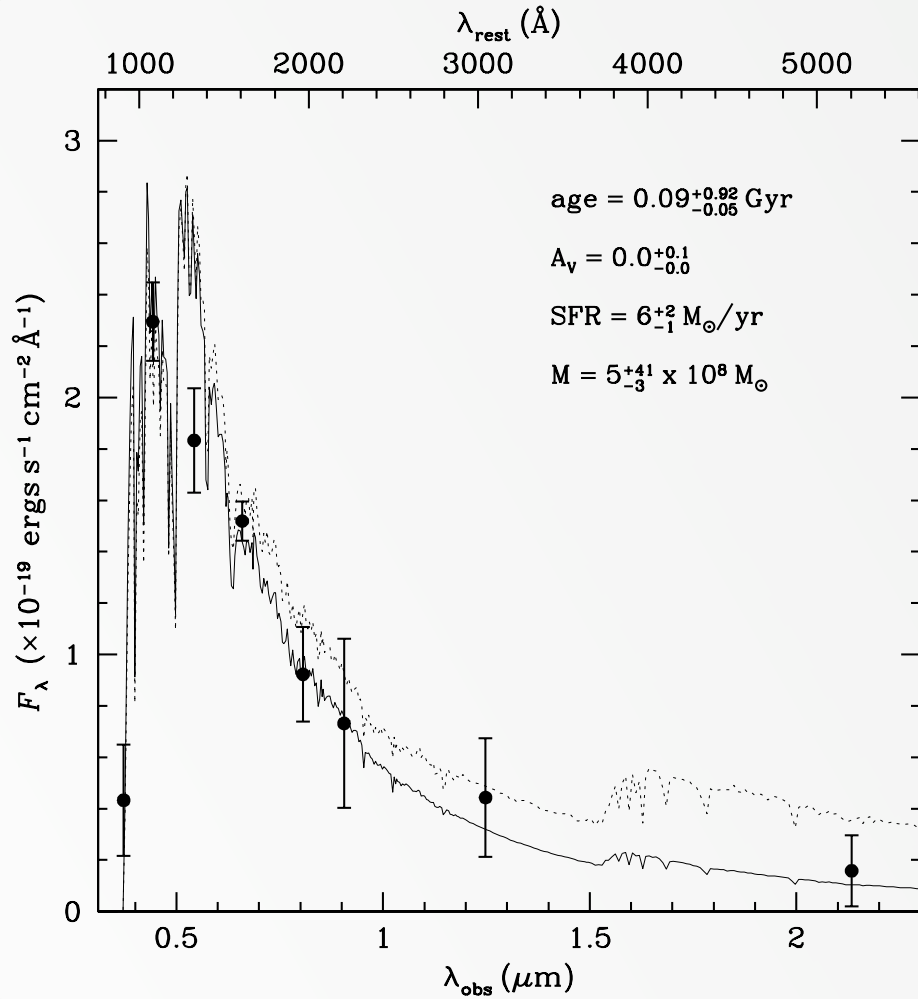
UV Luminosity function: less influenced by cosmic variance



Science with LAEs

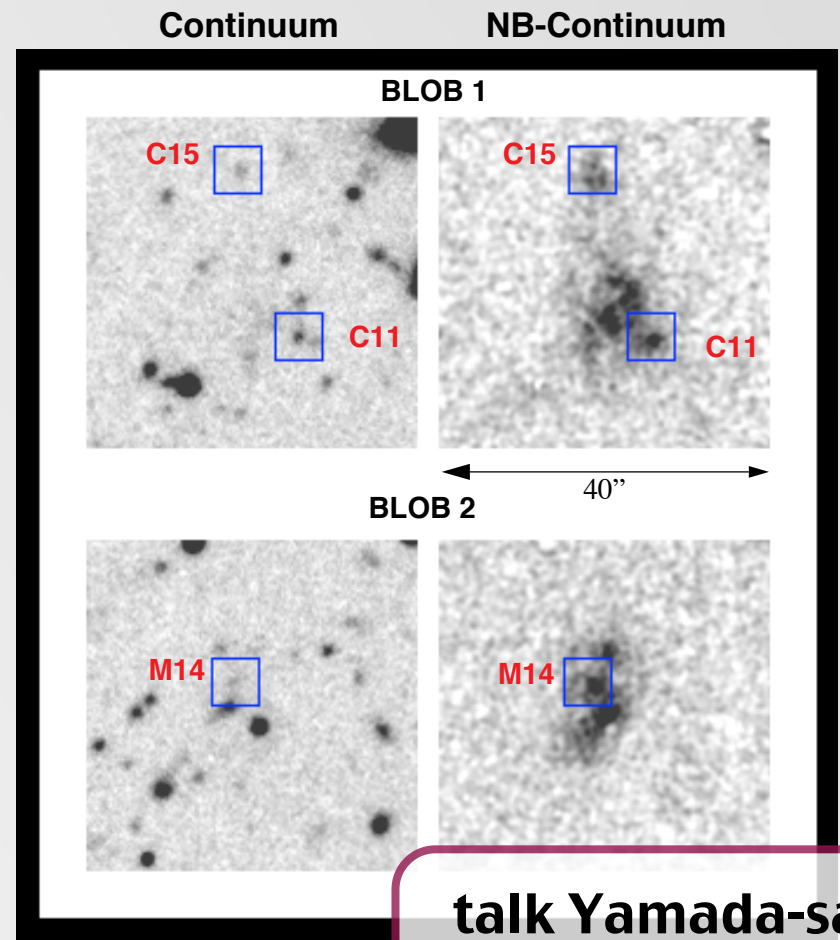
- ❖ **Nature of Lyman Alpha emitters**
 - ◆ **Early phases of star formation, low-mass galaxies**
 - ◆ **High EW sources: Lyman alpha blobs**
- ❖ **Probing reionization**
 - ◆ **Clustering of LAEs**

Nature of LAEs?



Gawiser et al. 2006

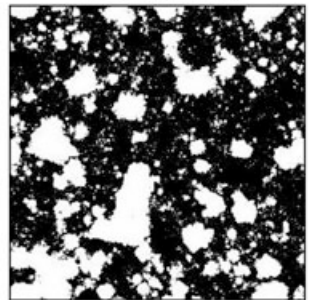
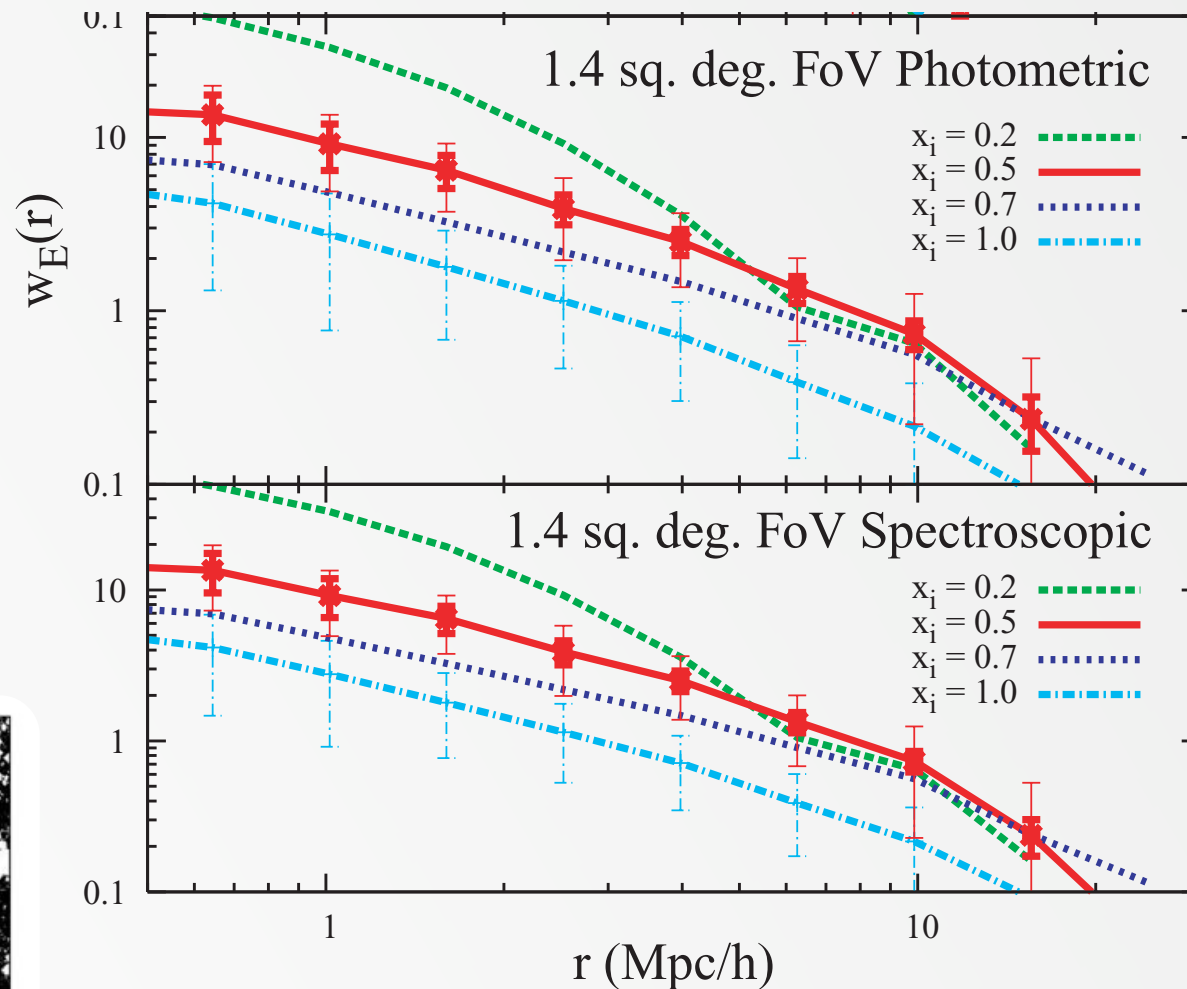
Steidel et al. 2000



Science with LAEs

- ❖ **Nature of Lyman Alpha emitters**
 - ◆ **Early phases of star formation, low-mass galaxies**
 - ◆ **High EW sources: Lyman alpha blobs**
- ❖ **Probing reionization**
 - ◆ **Clustering of LAEs**

Clustering of LAEs and Reionization



SFR limits for the deep layer from Ly α

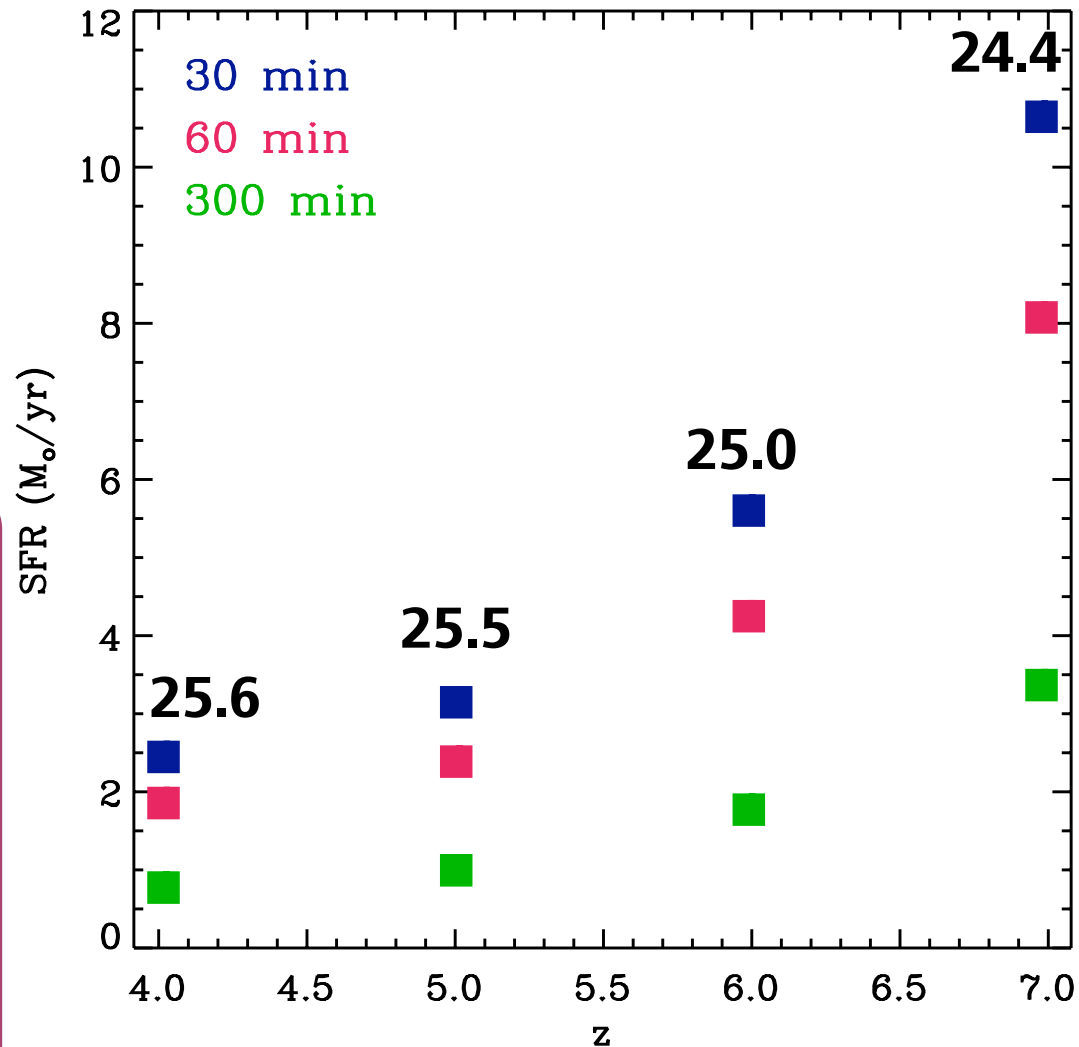
Volumes in
Mpc³:

z~4: 4.6×10^6

z~5: 4.2×10^6

z~6: 3.7×10^6

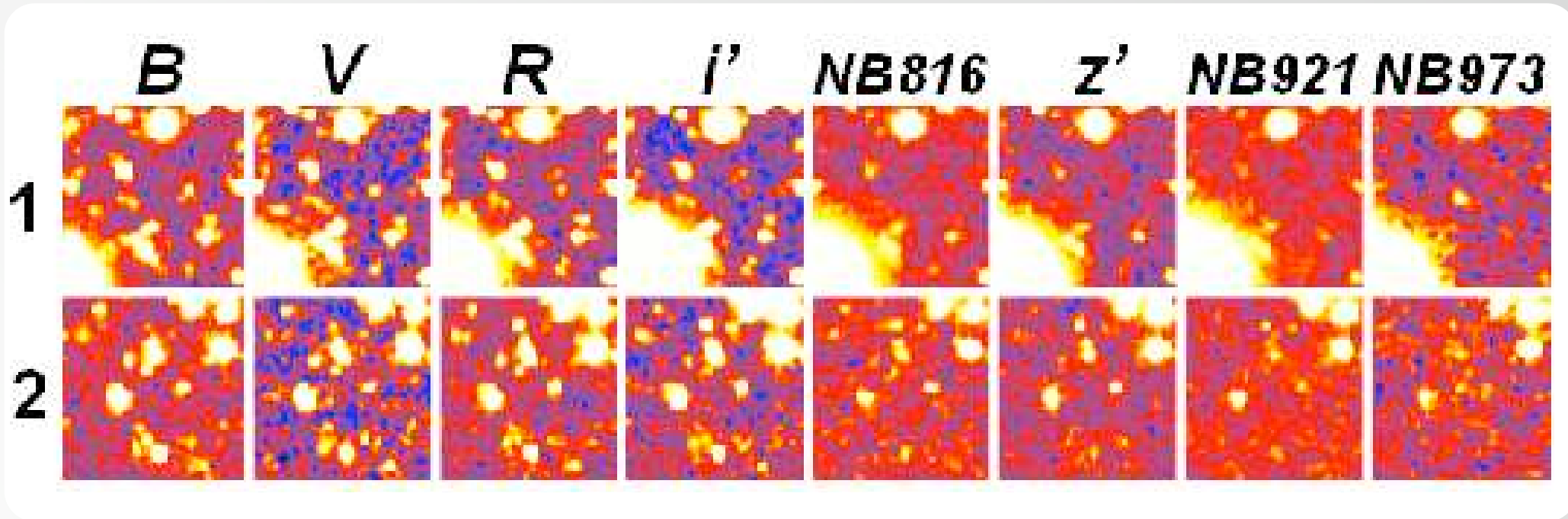
z~7: 3.4×10^6



Comparison to current LAE studies

- ❖ **Ouchi et al. (2007):**
 - ◆ $z \sim 3.1$: AB = 25.3, 1 deg²
 - ◆ $z \sim 3.7$, AB = 24.7, 1 deg²
 - ◆ $z \sim 5.7$, AB = 26.0, 1 deg²
- ❖ **Kashikawa et al. (2006):**
 - ◆ $z \sim 6.5$, AB = 26.0, 0.25 deg²
- ❖ **Ota et al. (2007):**
 - ◆ $z \sim 7.0$, AB = 24.9, 0.25 deg²

LAEs at $z \sim 7.0$



Comparison to current LAE studies

- ❖ **Ouchi et al. (2007):**
 - ◆ $z \sim 3.1$: AB = 25.3, 1 deg²
 - ◆ $z \sim 3.7$, AB = 24.7, 1 deg²
 - ◆ $z \sim 5.7$, AB = 26.0, 1 deg²
- ❖ **Kashikawa et al. (2006):**
 - ◆ $z \sim 6.5$, AB = 26.0, 0.25 deg²
- ❖ **Ota et al. (2007):**
 - ◆ $z \sim 7.0$, AB = 24.9, 0.25 deg²

Deep layer (300 min)

- ◆ $z \sim 4$: AB = 26.9, 5 deg²
- ◆ $z \sim 5$: AB = 26.8, 5 deg²
- ◆ $z \sim 6$: AB = 26.3, 5 deg²
- ◆ $z \sim 7$: AB = 25.7, 5 deg²

Thank you!