Science with the deep layer

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for Princeton University
The deep layer

- Depth: $g=29.8$, $r=29.3$, $i=28.9$, $z=28.2$, $y=27.4$
- Area: 5 arcmin$^2$
- 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~2.5 and z~3.5

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

Use dropout technique to find massive galaxies beyond z~3.5

Brammer & van Dokkum 2007
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

Bouwens et al. 2007
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~4 LBGs in the Subaru / XXM
Newton deep field
(1 deg²)
Dropouts in the deep layer
Dropouts in the deep layer

\[ z = 3.5 \]
\[ z = 4.5 \]
Dropouts in the deep layer

\[ z = 5.5 \]
Dropouts in the deep layer
Dropouts in the deep layer

\[ z \sim [3.5, 6.0] \]
SFR limits from UV continuum

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

deep layer

SFR (M_⊙/yr) vs. z
SFR limits from UV continuum

\[ g=28.5, r=28.1, i=27.7, z=27.0, y=26.2 \]

medium layer
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?

Steidel et al. 2000

Gawiser et al. 2006

talk Yamada-san
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

McQuinn et al. 2007
SFR limits for the deep layer from Ly\(\alpha\)

Volumes in Mpc\(^3\):
- \(z\sim4\): 4.6x10\(^6\)
- \(z\sim5\): 4.2x10\(^6\)
- \(z\sim6\): 3.7x10\(^6\)
- \(z\sim7\): 3.4x10\(^6\)
Comparison to current LAE studies

❖ Ouchi et al. (2007):
   ✦ z~3.1: AB = 25.3, 1 deg²
   ✦ z~3.7, AB = 24.7, 1 deg²
   ✦ z~5.7, AB = 26.0, 1 deg²

❖ Kashikawa et al. (2006):
   ✦ z~6.5, AB = 26.0, 0.25 deg²

❖ Ota et al. (2007):
   ✦ z~7.0, AB = 24.9, 0.25 deg²
LAEs at z~7.0
Comparison to current LAE studies

❖ Ouchi et al. (2007):

✦ z~3.1: AB = 25.3, 1 deg²
✦ z~3.7, AB = 24.7, 1 deg²
✦ z~5.7, AB = 26.0, 1 deg²

❖ Kashikawa et al. (2006):

✦ z~6.5, AB = 26.0, 0.25 deg²
✦ z~4: AB = 26.9, 5 deg²
✦ z~5: AB = 26.8, 5 deg²
✦ z~6: AB = 26.3, 5 deg²
✦ z~7: AB = 25.7, 5 deg²

❖ Ota et al. (2007):

✦ z~7.0, AB = 24.9, 0.25 deg²

Deep layer (300 min)

✦ z~4: AB = 26.9, 5 deg²
✦ z~5: AB = 26.8, 5 deg²
✦ z~6: AB = 26.3, 5 deg²
✦ z~7: AB = 25.7, 5 deg²
Thank you!