

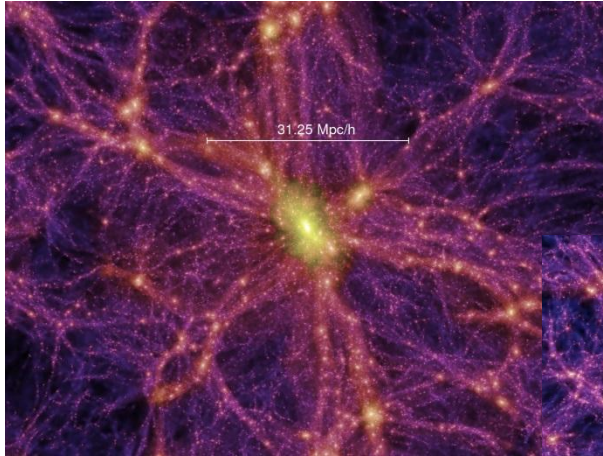
The Galaxy Environment of $z \sim 6$ Quasars

Eduardo Bañados (MPIA) banados@mpia.de

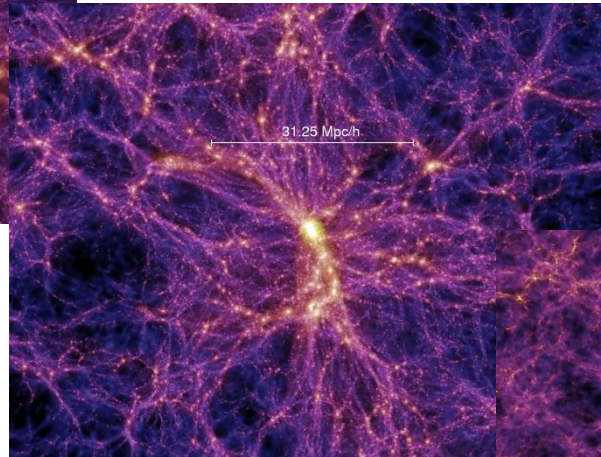
B. Venemans, F. Walter, **J. Kurk**, R. Overzier, M. Ouchi

Motivation

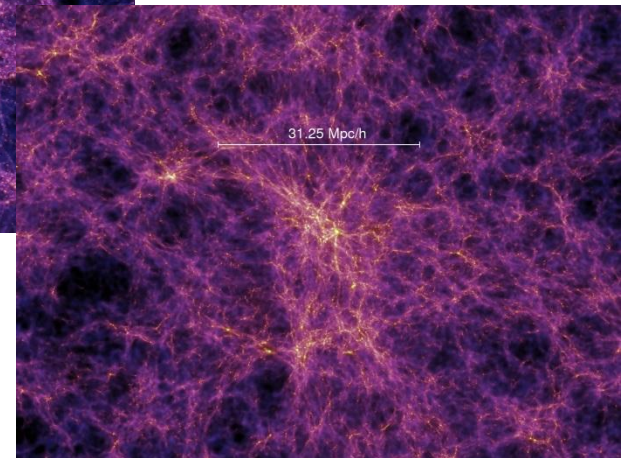
$z = 0$



$z = 1.4$



$z = 5.7$



Springel et al. 2005



Motivation

- ▶ Galaxy overdensities or protoclusters around radio galaxies (see Venemans et al. 2007)

Motivation

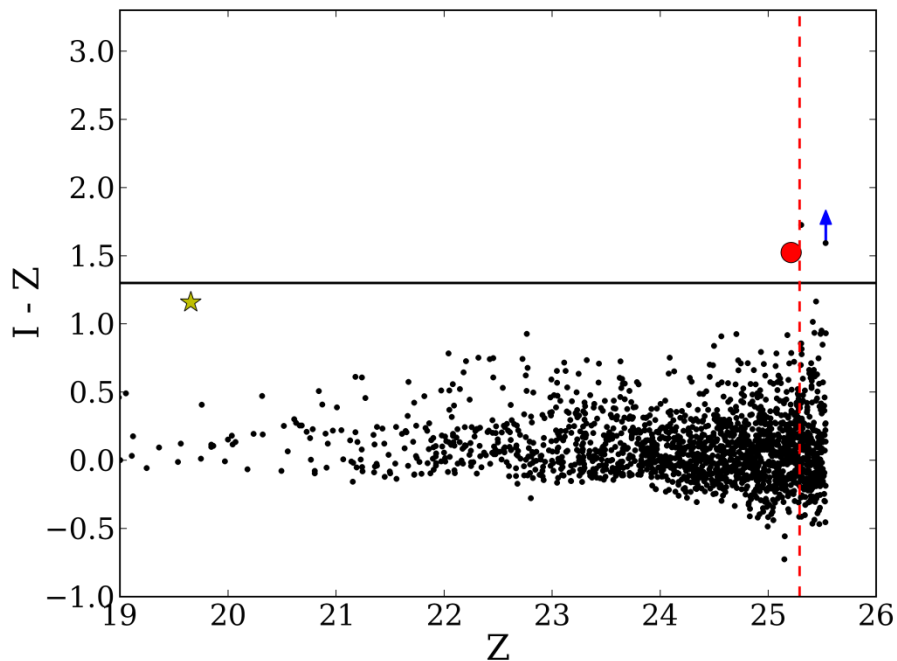
- ▶ Galaxy overdensities or protoclusters around radio galaxies (see Venemans et al. 2007)
- ▶ Ambiguous results based on *i*-dropout galaxies around $z \sim 6$ QSOs. $\Delta z \approx 1$

Motivation

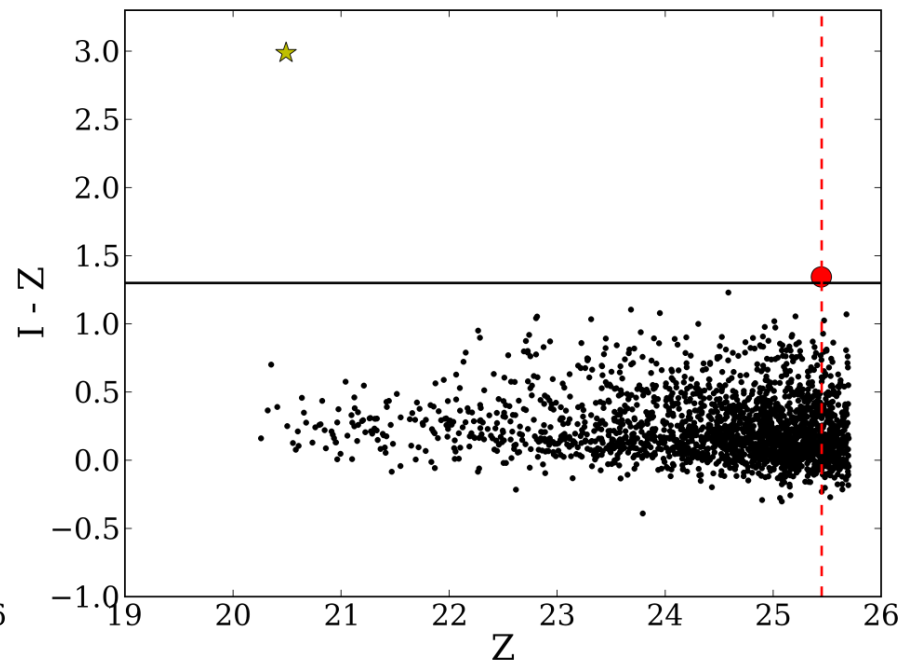
- ▶ Galaxy overdensities or protoclusters around radio galaxies (see Venemans et al. 2007)
- ▶ Ambiguous results based on *i*-dropout galaxies around $z \sim 6$ QSOs. $\Delta z \approx 1$
 - ▶ Willot et al. 2005 no-overdensity
 - ▶ Stiavelli et al. 2005 overdensity
 - ▶ Kim et al. 2009 find both over/under-densities

i-dropouts

SDSS 1306+0356 at $z=5.99$



SDSS 1030+0524 at $z=6.28$

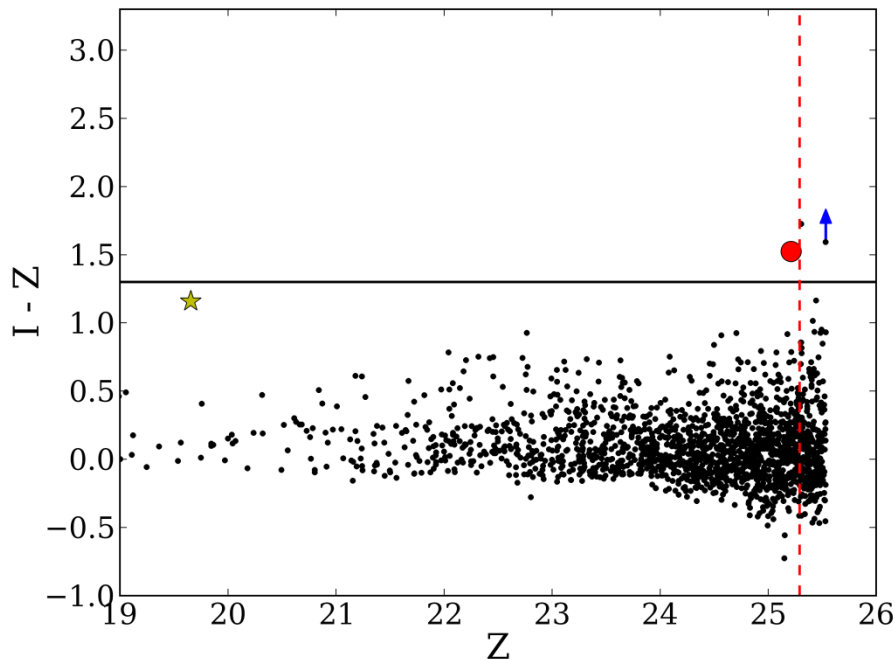


(Bañados+, in prep)

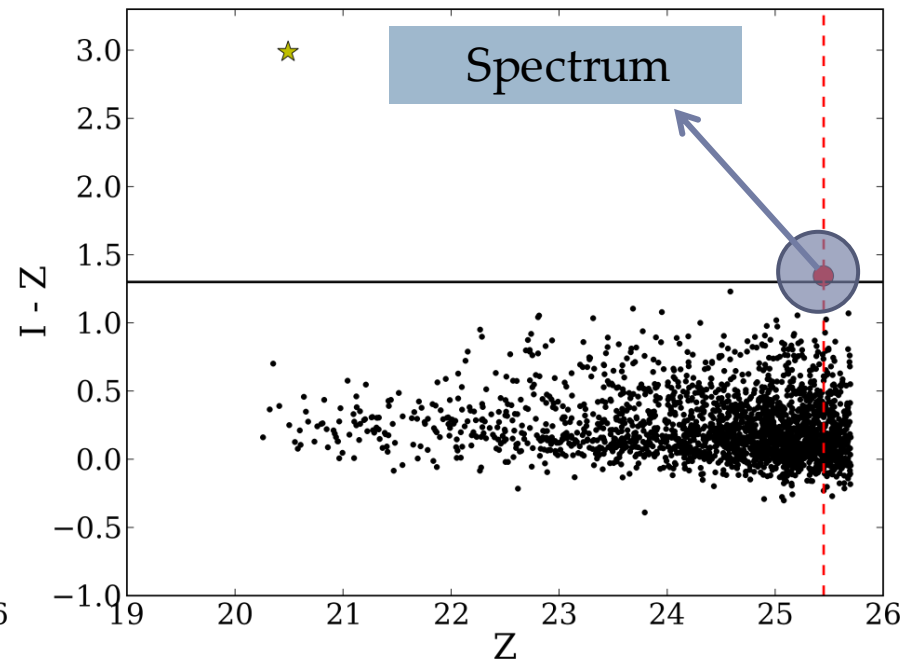


i-dropouts

SDSS 1306+0356 at $z=5.99$



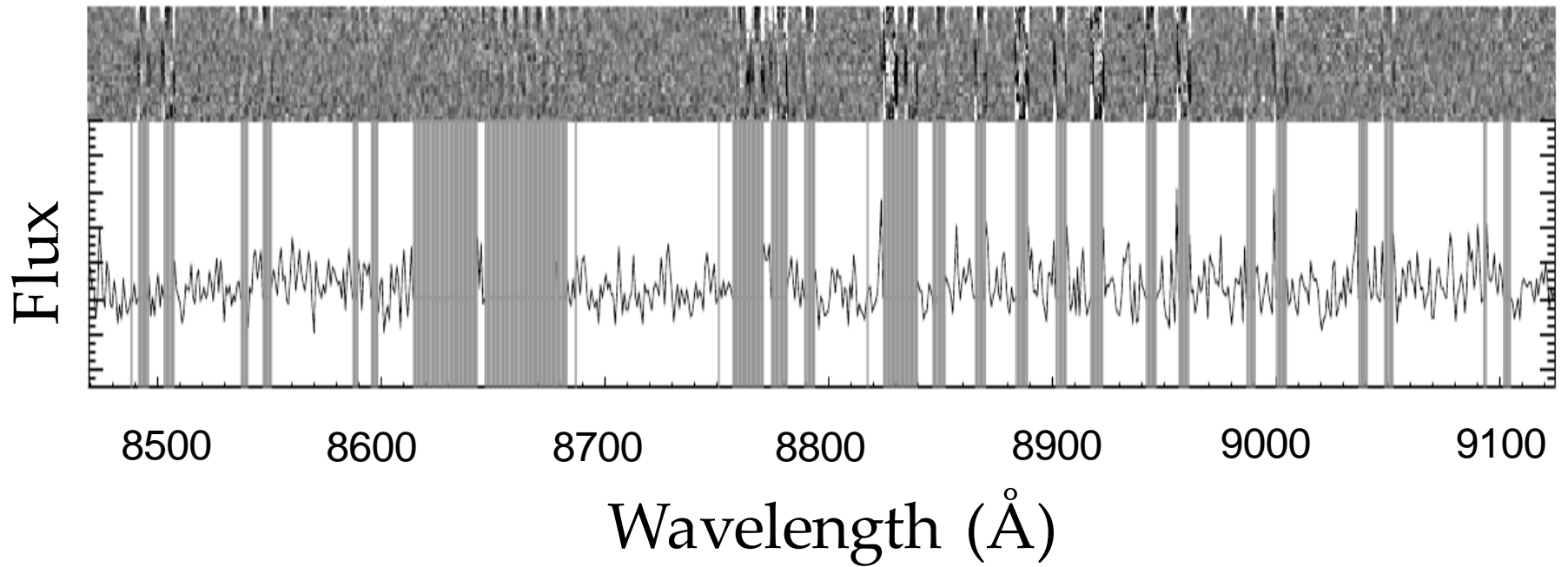
SDSS 1030+0524 at $z=6.28$



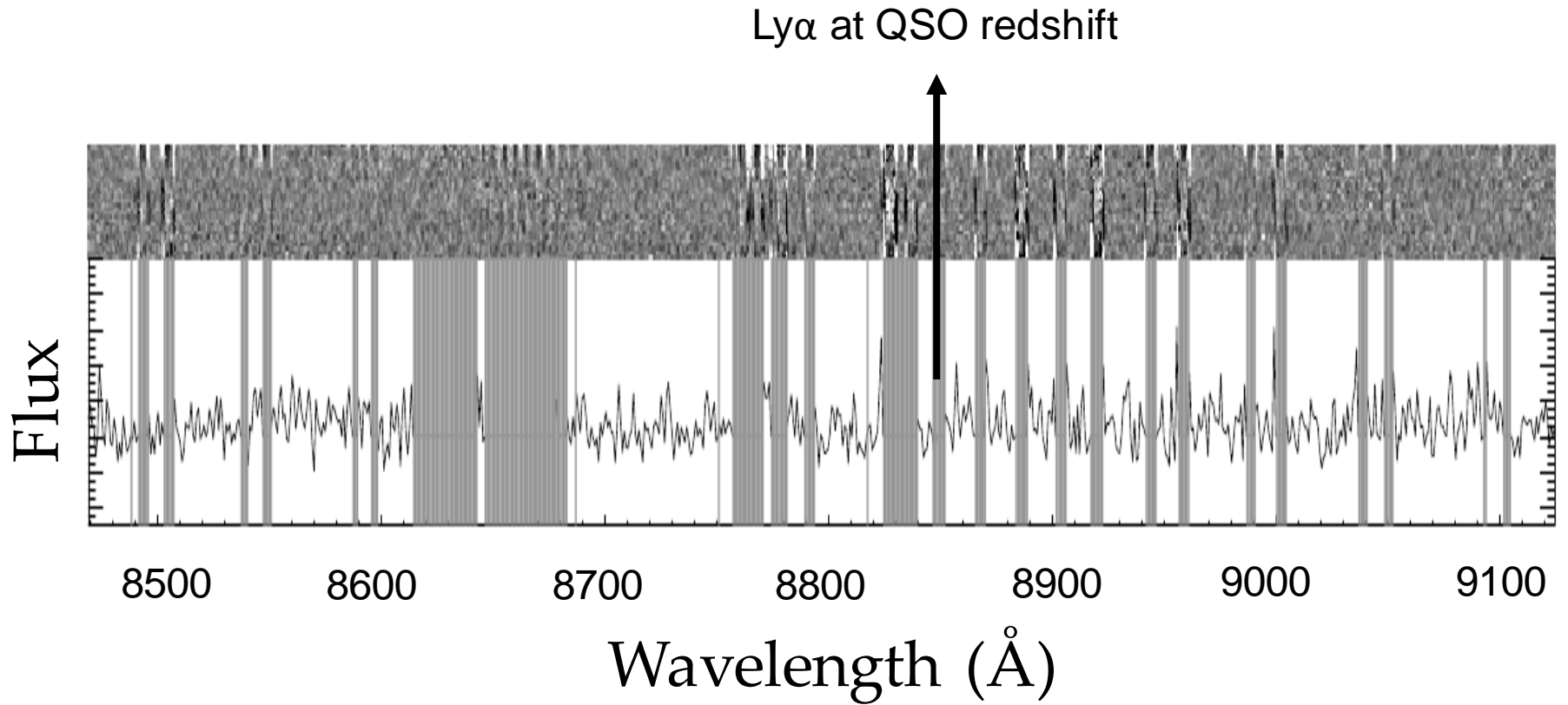
(Bañados+, in prep)



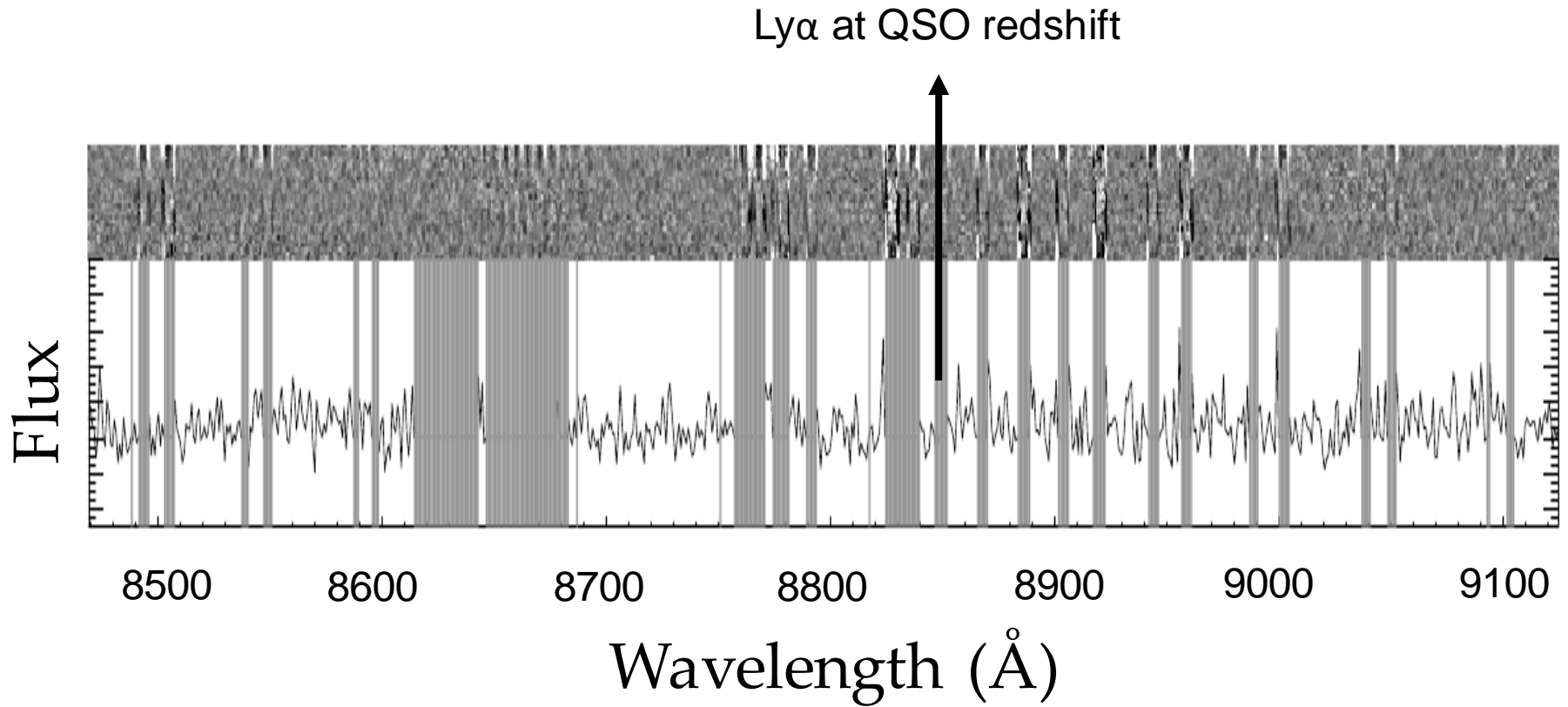
i-drop 5 hours FORS2@VLT spectrum



i-drop 5 hours FORS2@VLT spectrum



i-drop 5 hours FORS2@VLT spectrum



Nothing Clear!



Lyman Alpha Emitters (LAEs)



Lyman Alpha Emitters (LAEs)

- ▶ Narrower redshift range $\Delta z \approx 0.1$

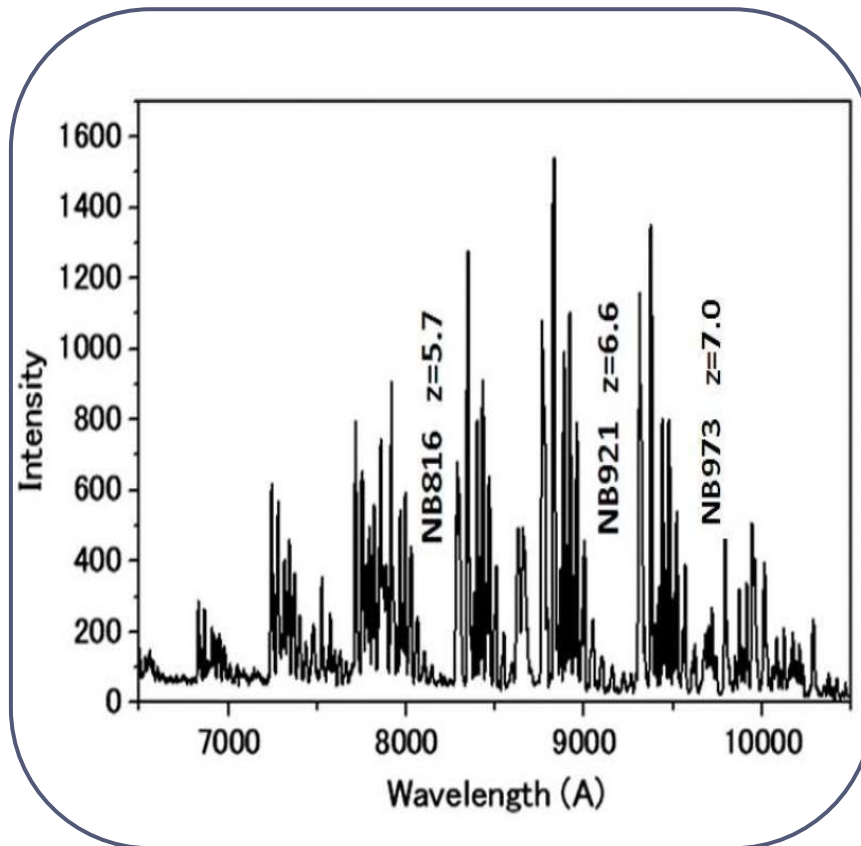


Lyman Alpha Emitters (LAEs)

- ▶ Narrower redshift range $\Delta z \approx 0.1$
- ▶ First study of LAEs around a high- z QSO ($z \geq 5.7$)

Lyman Alpha Emitters (LAEs)

- ▶ Narrower redshift range $\Delta z \approx 0.1$
- ▶ First study of LAEs around a high- z QSO ($z \geq 5.7$)

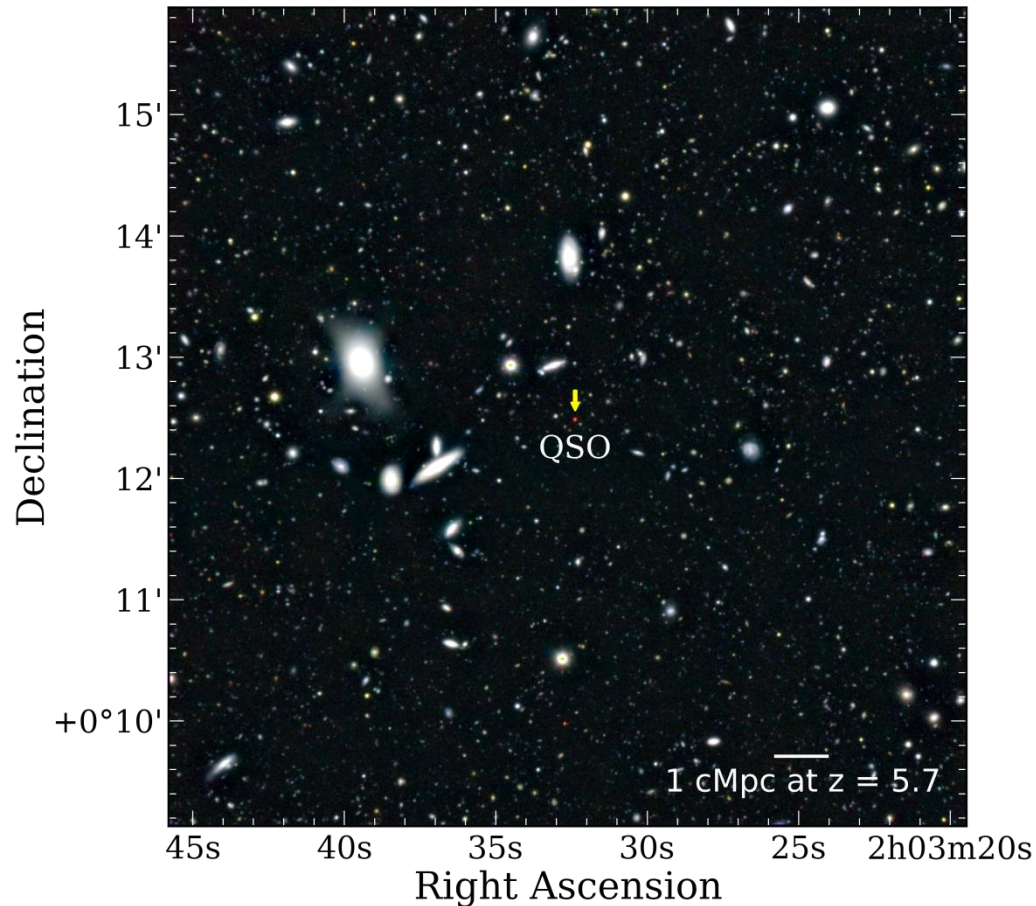


OH night sky
emission bands

Dunlop 2012

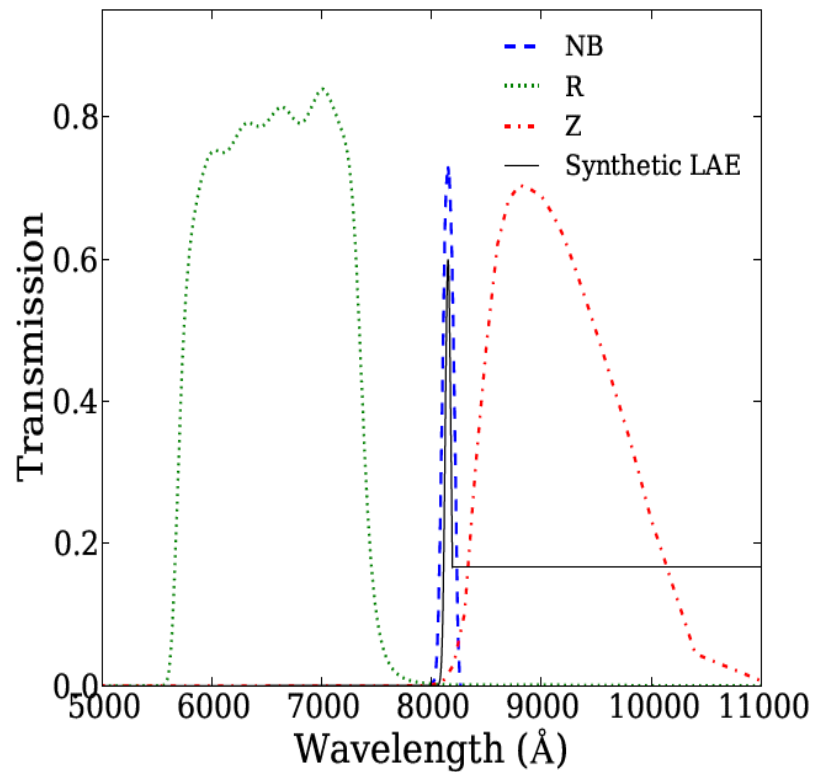
ULAS J0203+0012 at $z=5.72$

FORS2@VLT



Candidates Selection

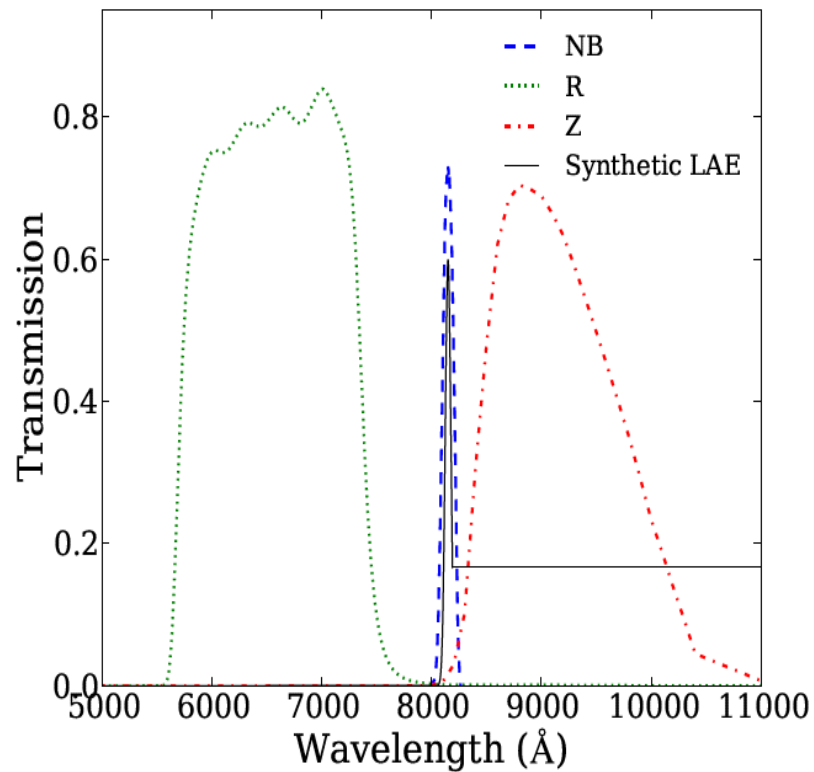
FORS2 Filters



Candidates Selection

FORS2 Filters

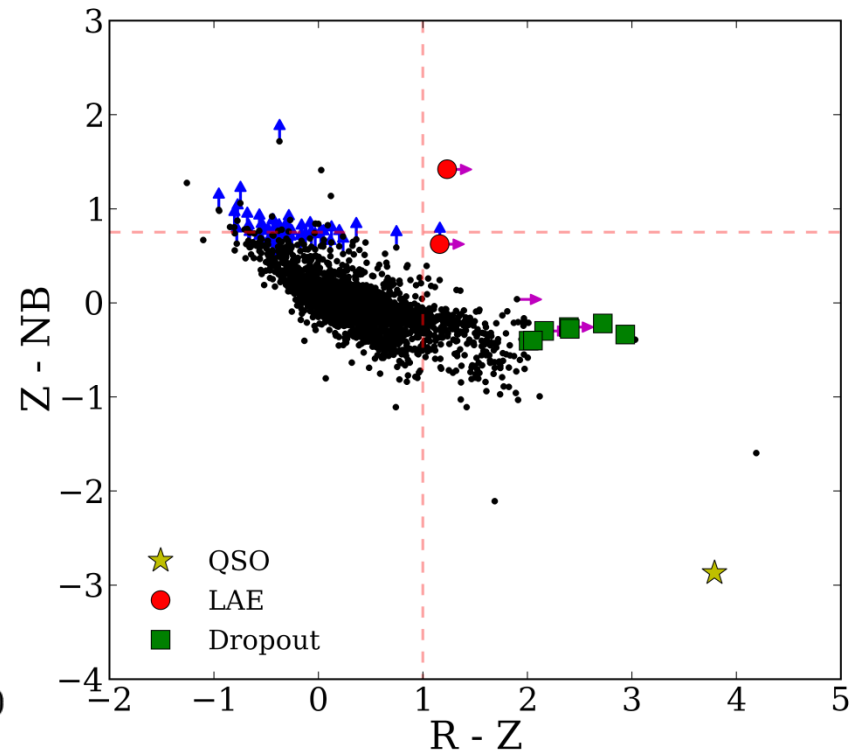
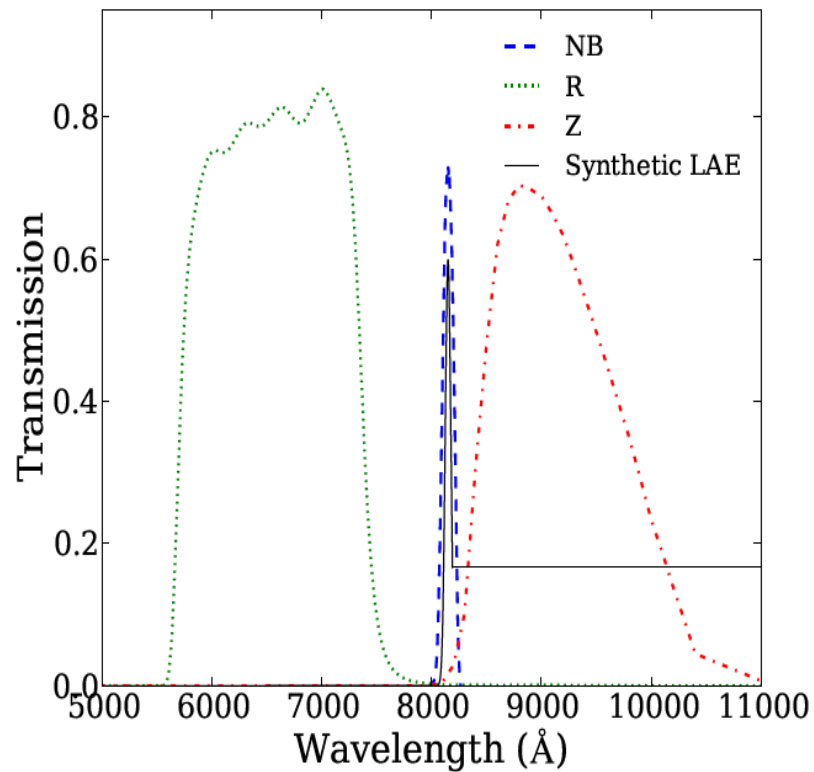
LAEs between $5.66 < z < 5.75$



Candidates Selection

FORS2 Filters

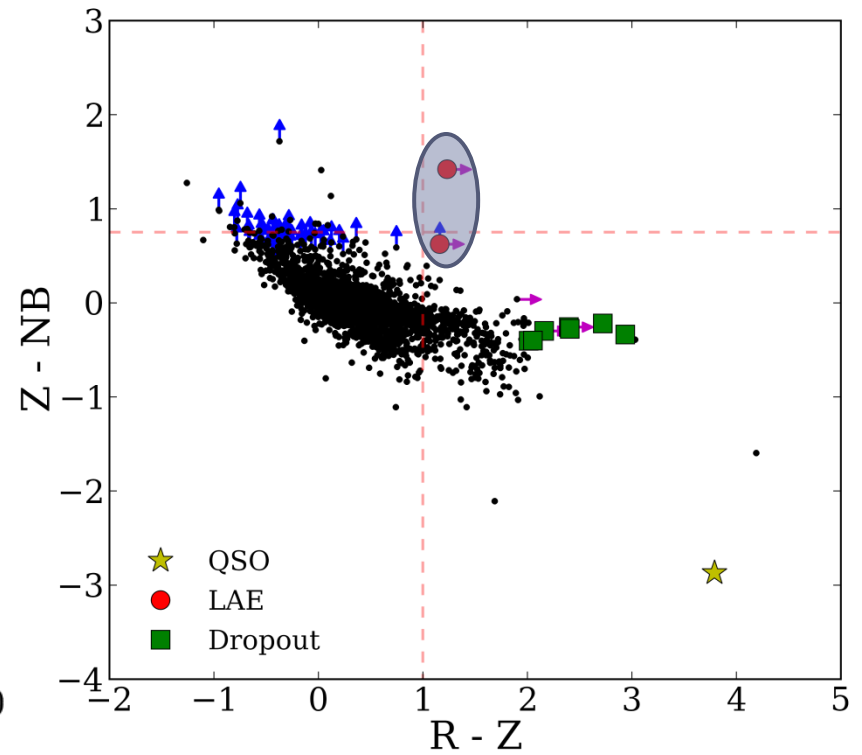
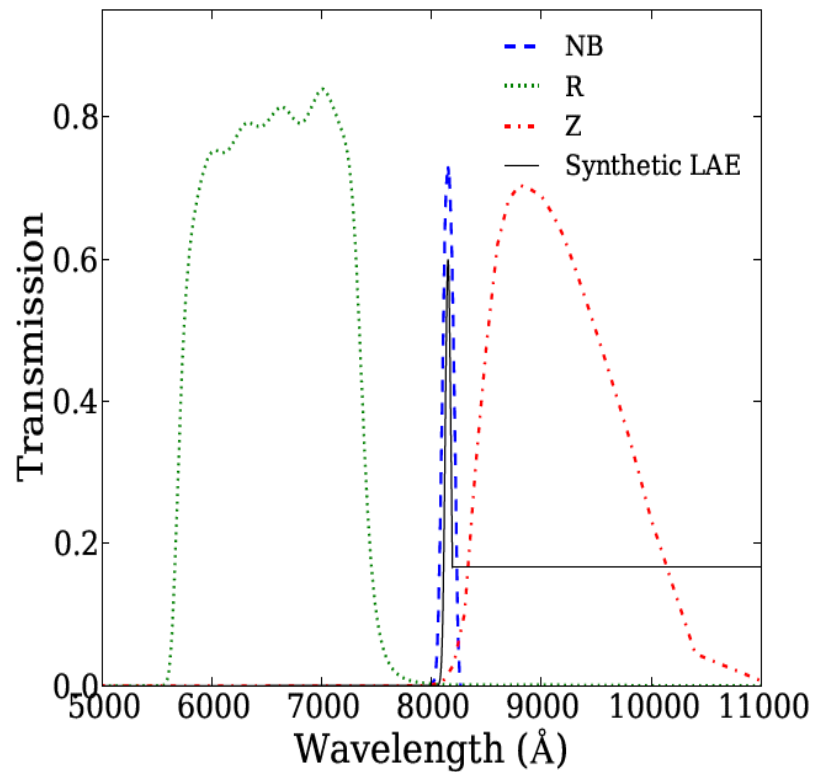
LAEs between $5.66 < z < 5.75$



Candidates Selection

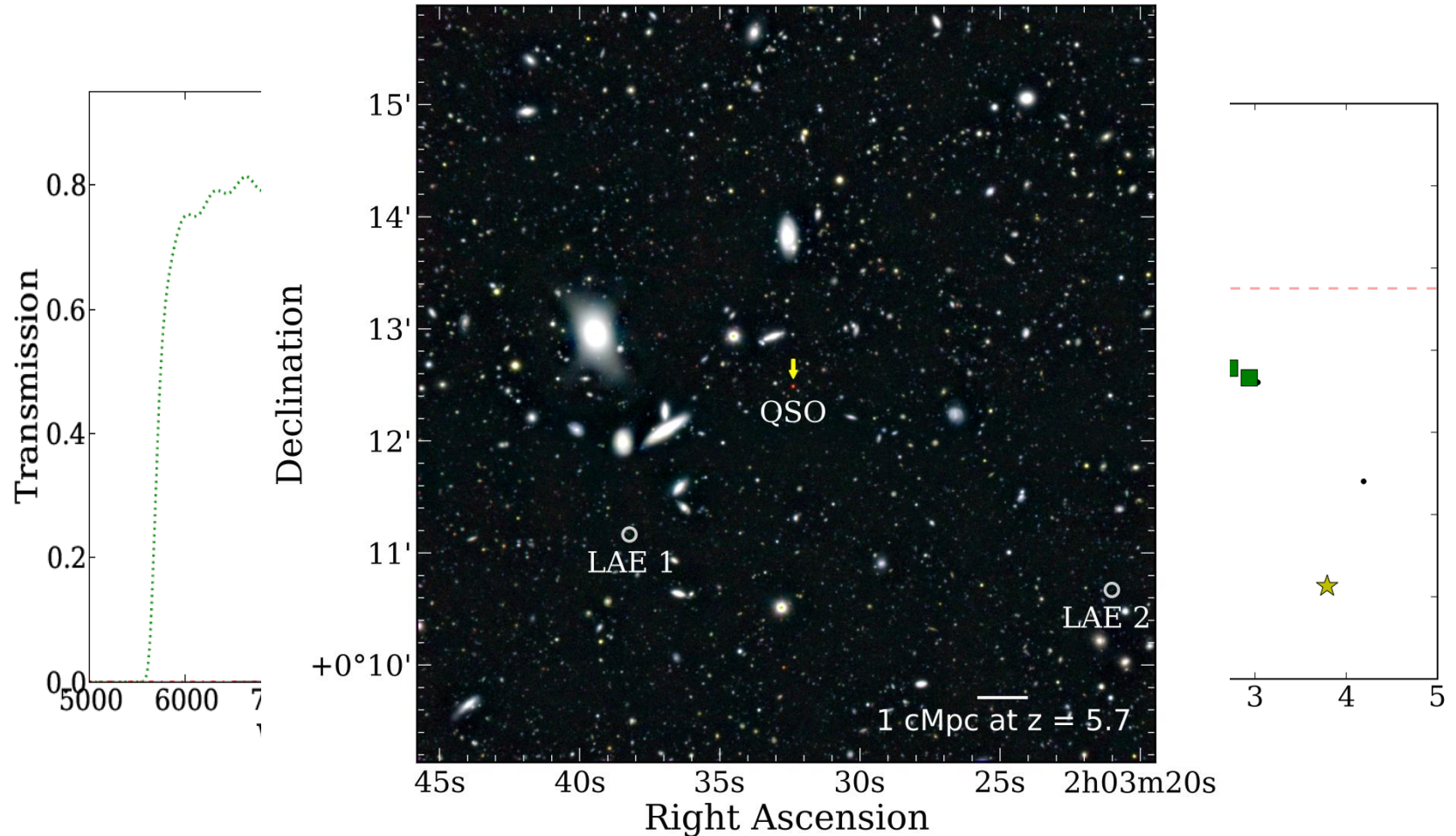
FORS2 Filters

LAEs between $5.66 < z < 5.75$



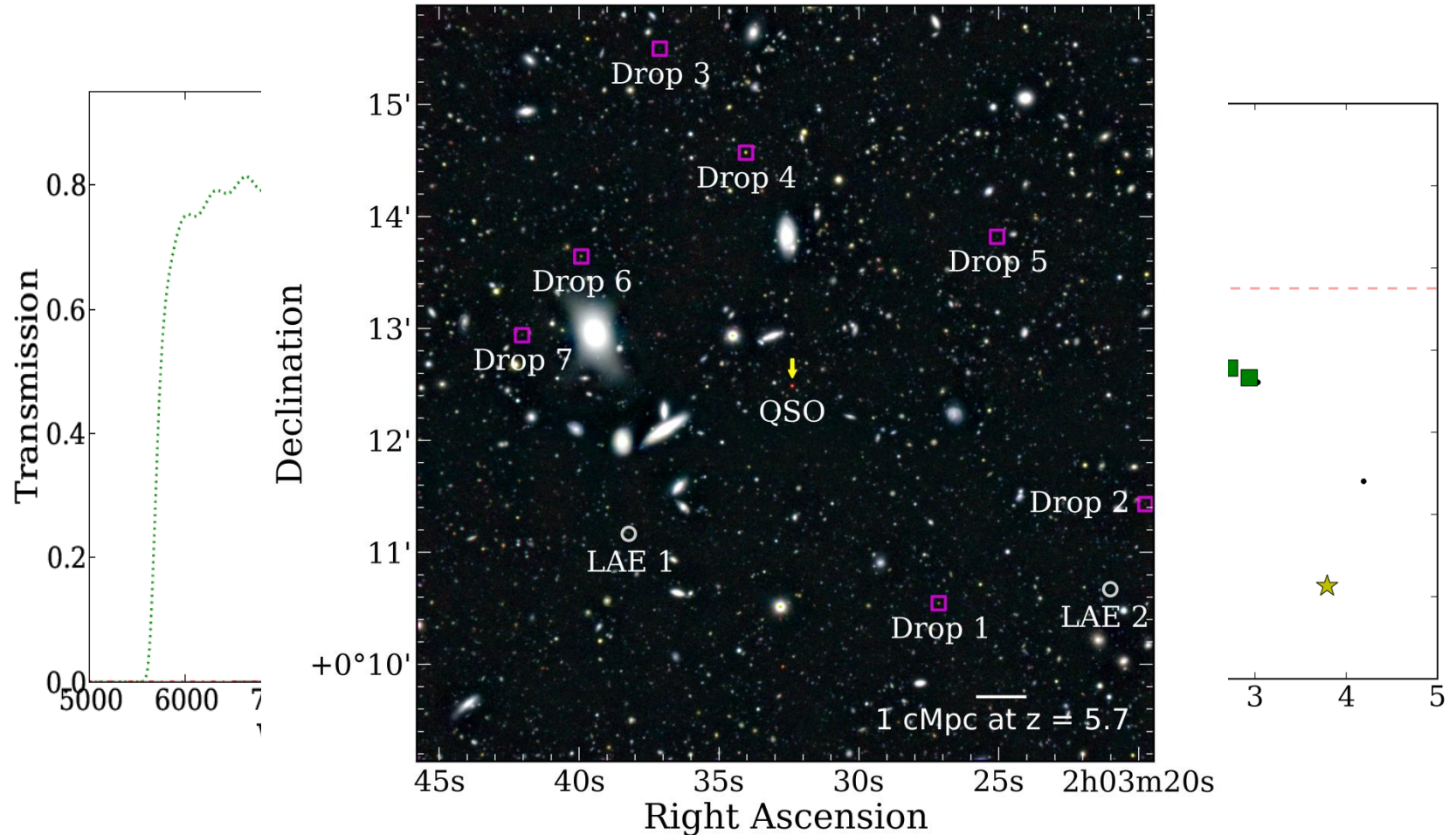
Candidates Selection

ULAS J0203+0012 at $z = 5.72$



Candidates Selection

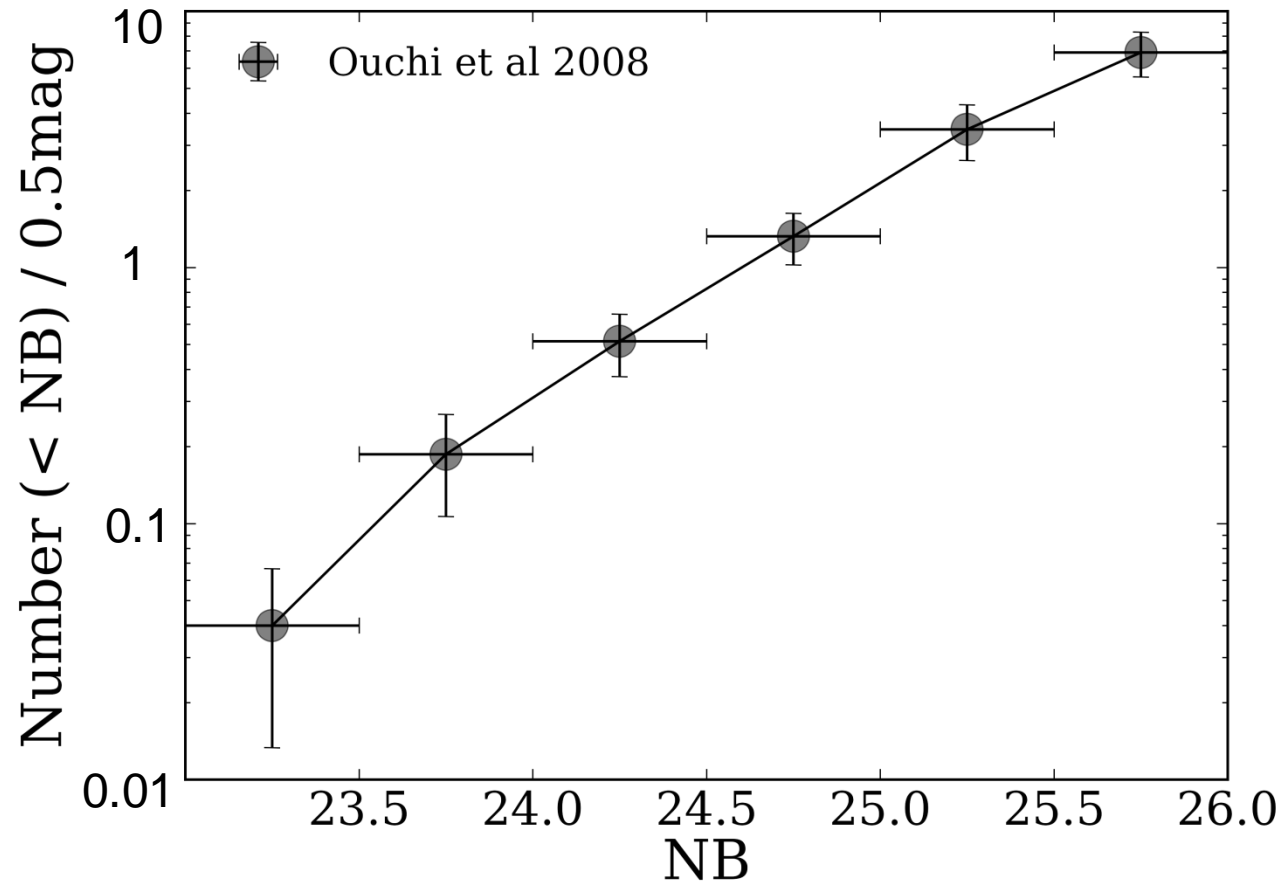
ULAS J0203+0012 at $z = 5.72$



Blank Field Comparison

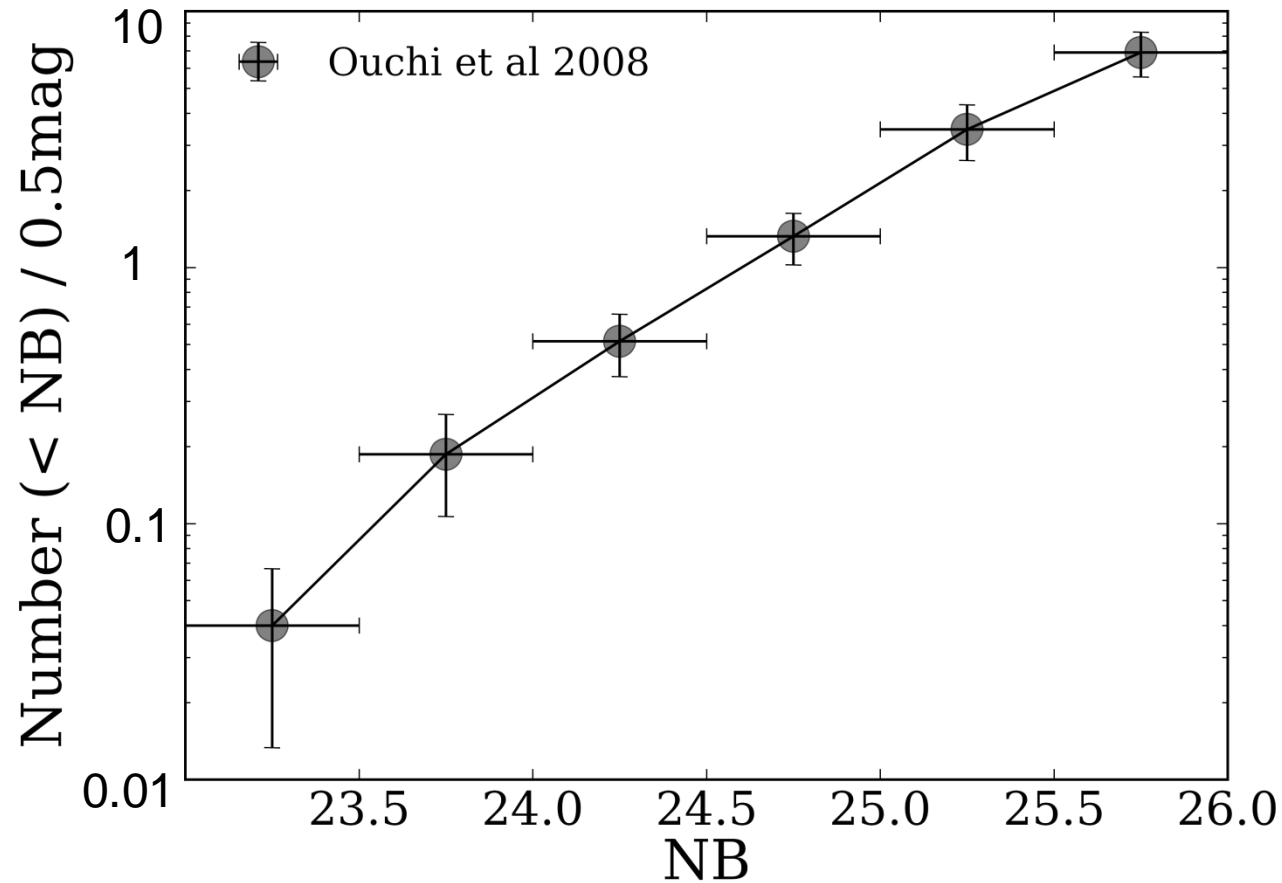


Blank Field Comparison



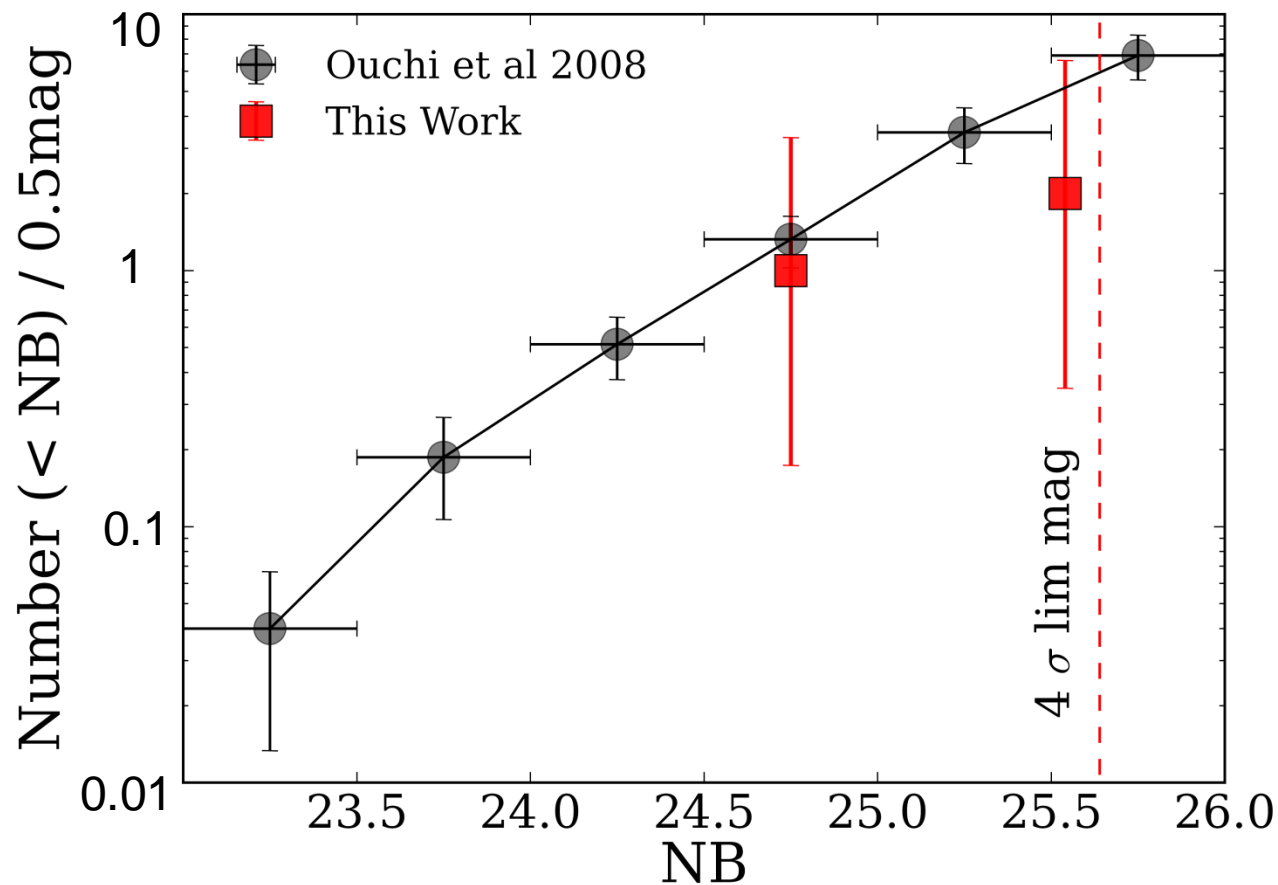
Blank Field Comparison

Overdensity?



Blank Field Comparison

Overdensity?



Discussion

No clear enhancement of LAEs (LBGs) in the QSO vicinity in comparison with blank fields



Discussion

No clear enhancement of LAEs (LBGs) in the QSO vicinity in comparison with blank fields

- Low number of statistics



Discussion

No clear enhancement of LAEs (LBGs) in the QSO vicinity in comparison with blank fields

- Low number of statistics
- Strong ionizing radiation from the quasar prevents galaxy formation



Discussion

No clear enhancement of LAEs (LBGs) in the QSO vicinity in comparison with blank fields

- Low number of statistics
- Strong ionizing radiation from the quasar prevents galaxy formation
- High- z QSOs may not always reside in highly overdense, large-scale environments



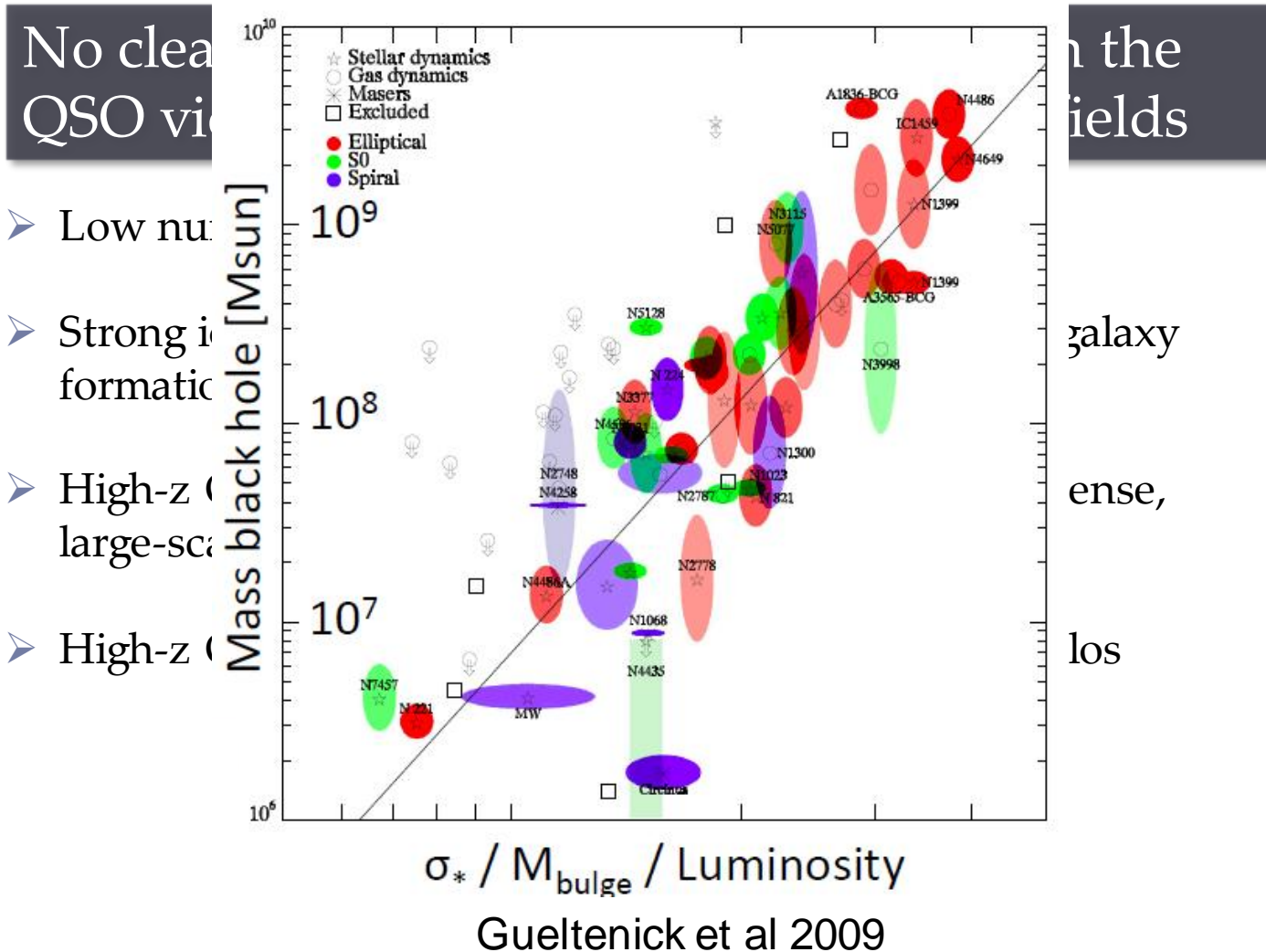
Discussion

No clear enhancement of LAEs (LBGs) in the QSO vicinity in comparison with blank fields

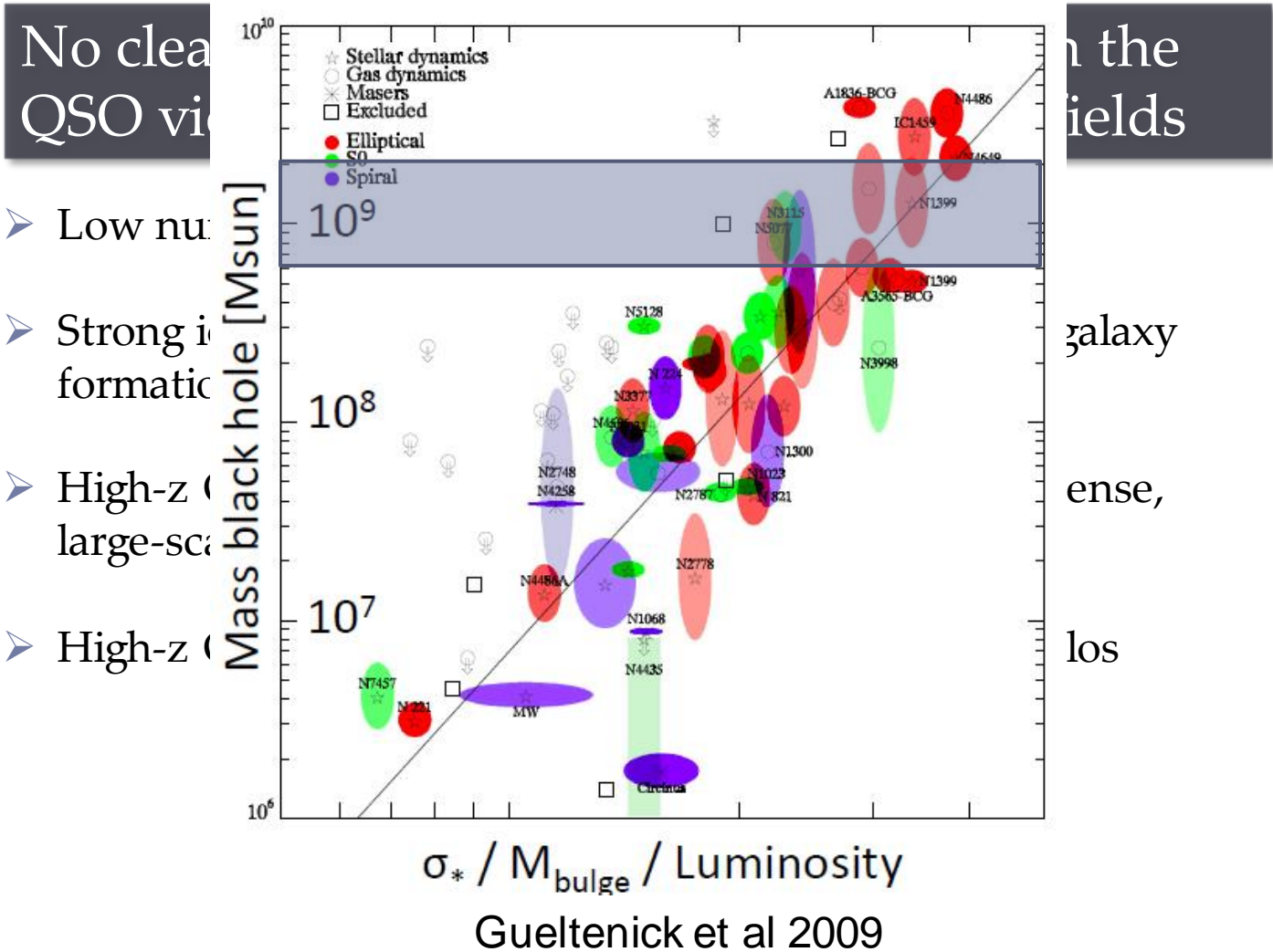
- Low number of statistics
- Strong ionizing radiation from the quasar prevents galaxy formation
- High- z QSOs may not always reside in highly overdense, large-scale environments
- High- z QSOs may not reside in the most massive halos



Discussion



Discussion



Discussion

No clear enhancement of LAEs (LBGs) in the QSO vicinity in comparison with blank fields

- Low number of statistics
- Strong ionizing radiation from the quasar prevents galaxy formation
- High- z QSOs may not always reside in highly overdense, large-scale environments
- High- z QSOs may not reside in the most massive halos
- Fanidakis & Orsi (in prep.) show that QSOs inhabit halos of $\sim 10^{12} M_{\odot}$ and radio galaxies halos of $\geq 10^{13} M_{\odot}$



Discussion

No clear enhancement of LAEs (LBGs) in the QSO vicinity in comparison with blank fields

- Low number of statistics
- Strong ionizing radiation from the quasar prevents galaxy formation
- High- z QSOs may not always reside in highly overdense, large-scale environments
- High- z QSOs may not reside in the most massive halos
- Fanidakis & Orsi (in prep.) show that QSOs inhabit halos of $\sim 10^{12} M_{\odot}$ and radio galaxies halos of $\geq 10^{13} M_{\odot}$

THANKS!

