A Magellan M2FS Spectroscopic Survey of Galaxies at 5.5 < z < 6.7

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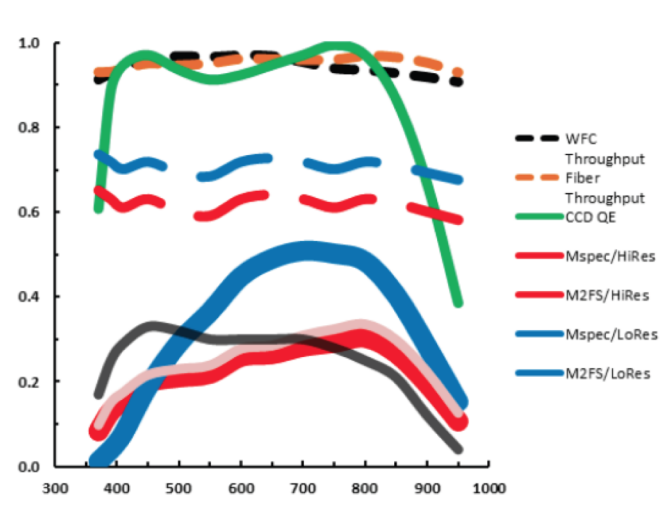
❖ Outline

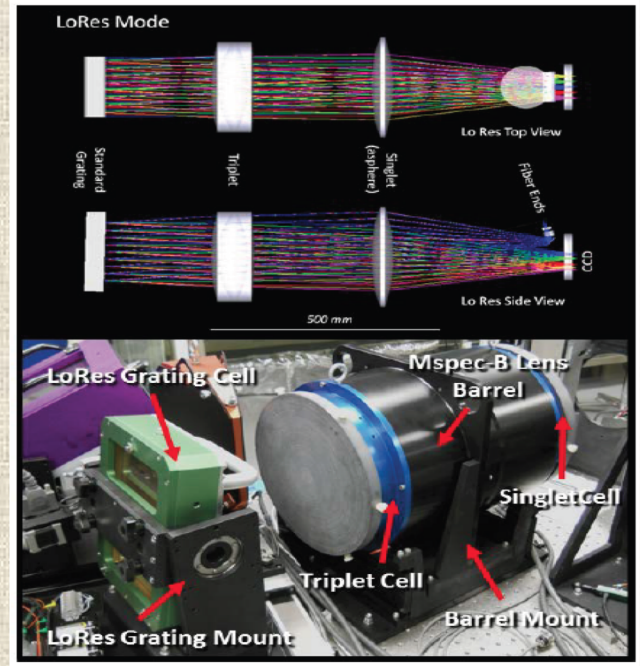
- Introduction
  - A little background
- Our Magellan/M2FS survey
  - Program details
  - Science goals
  - Current status
- Some results
  - Diffuse Lyα halos around LAEs at z~5.7
  - Lyα Luminosity function at z~5.7
  - …
- Summary

❖ The Magellan M2FS galaxy survey

- Goal: build a large and homogeneous sample of bright LAEs (and LBGs) at $5.5 < z < 6.7$ over ~3.5 deg^2
- Telescope/instrument: Magellan/M2FS
  - Fiber-fed, multi-object spectrograph on the Magellan Clay telescope
  - 256 optical fibers
  - A circular FoV of 30 arcminutes in diameter
  - Low-R mode with red-sensitive gratings
  - High throughput

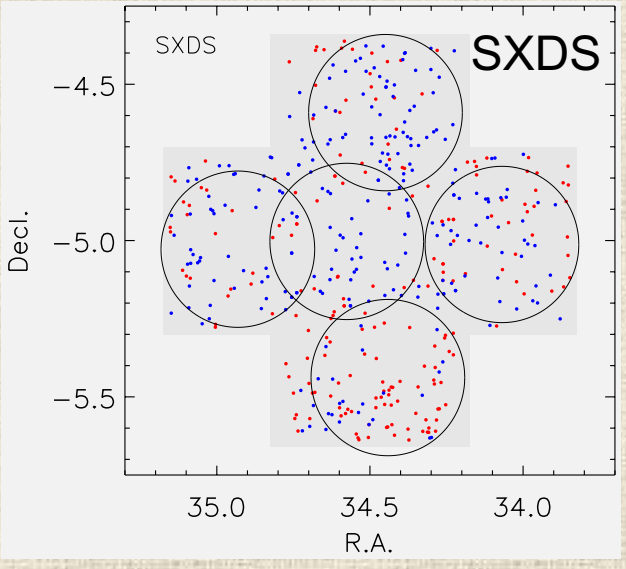


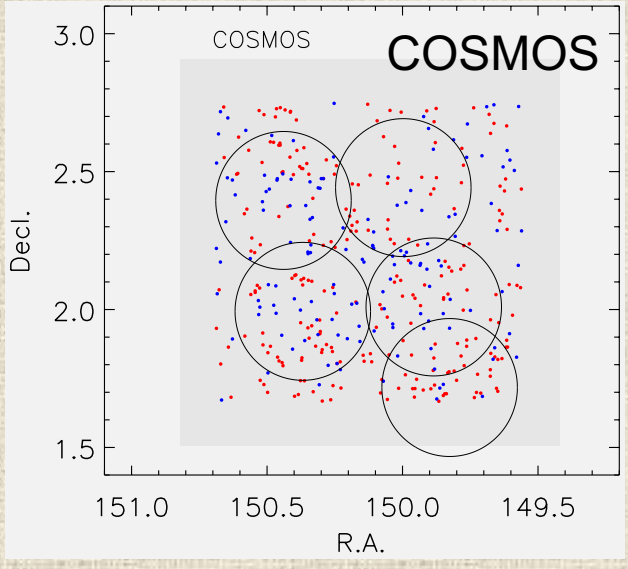
(Mateo et al. 2012)

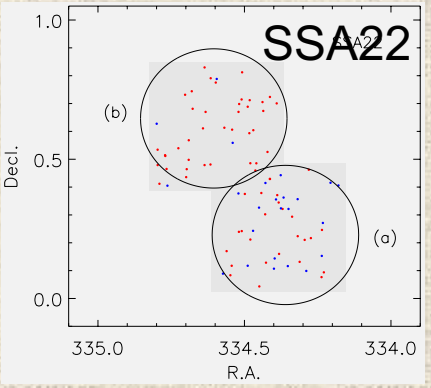


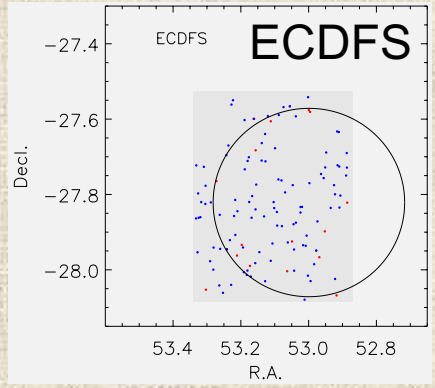
❖ The Magellan M2FS galaxy survey

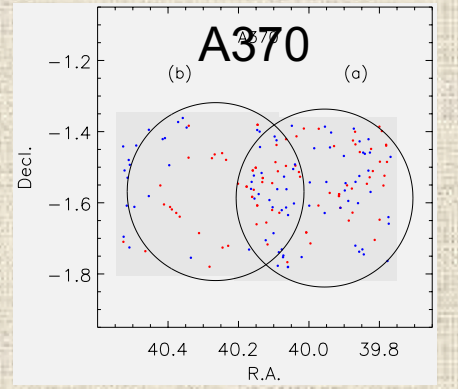
- ➢ Fields: well-studied fields
  - Including COSMOS, SXDS, ECDFS, SSA22, A370, etc.
  - Observing depth: ~ 5 hours per pointing





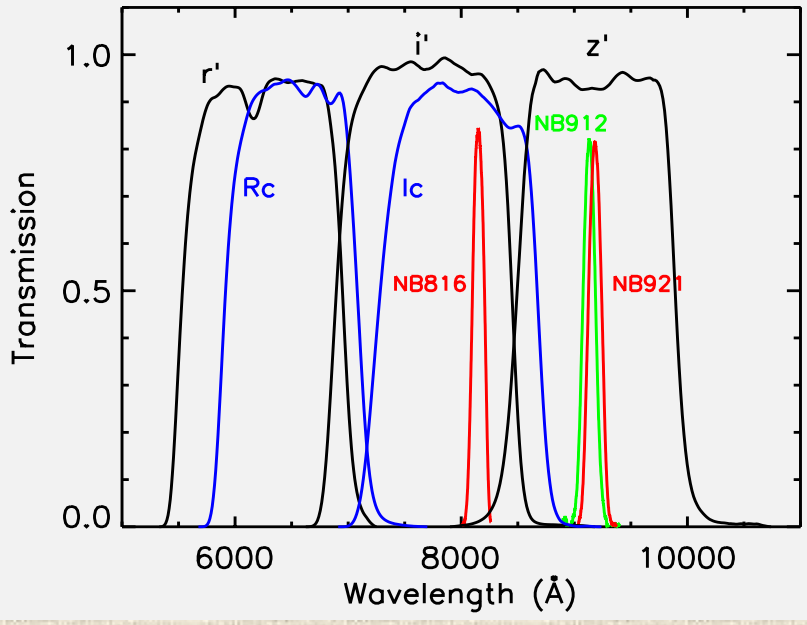






❖ The Magellan M2FS galaxy survey

- Imaging data and targets
  - Deep Subaru Suprime-Cam images in a series of broad and narrow bands
  - Typical depths: BVRi~27.5 mag (all AB); z~26.5 mag; NB~25.5–26 mag
- Targets
  - LAEs at z ~ 5.7 and 6.5; LBGs at 5.5 < z < 6.7
  - Many other targets in the same fields (we have 250 fibers)



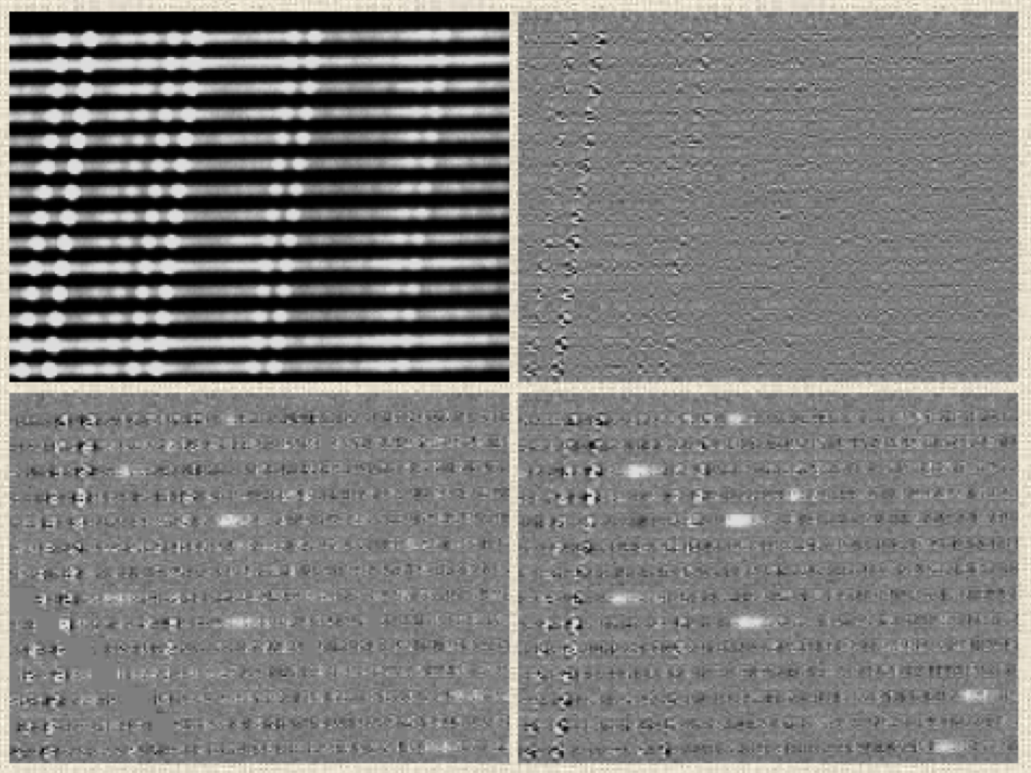
(Jiang et al. 2017)

❖ Scientific goals

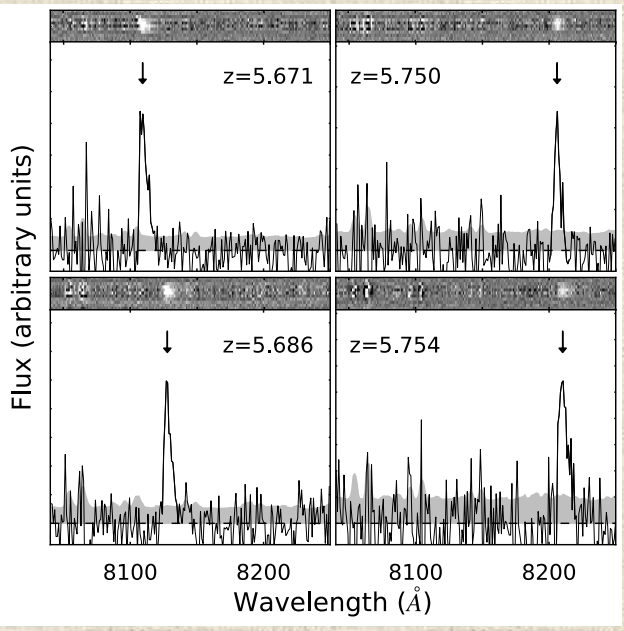
- A unique spectroscopically confirmed sample
  - Large area coverage (largest of its kind so far)
  - Same imaging data for target selection
  - Same target selection carried out by the same team
  - Same instrument for spectroscopic observations
  - Large number of fibers → highly complete
- Science goals: properties of high-z galaxies
  - Lyα LFs from a large spectroscopically confirmed sample
  - Physical properties and stellar populations (note the existence of numerous ancillary data in these deep fields)
  - Stacking images: Lyα emission halos, cool dust emission, etc.
- Science goals: understanding reionization
  - Evolution of Lyα LFs
  - Fraction of LBGs with strong Lyα emission
  - Patchy reionization: enhanced galaxy clustering
  - …

❖ Program status and some preliminary results

- Completed ~3 deg^2
- Depth: 4 – 7 hours per pointing (>25.5 mag in NB816)
- Expect to complete it this year or early next year



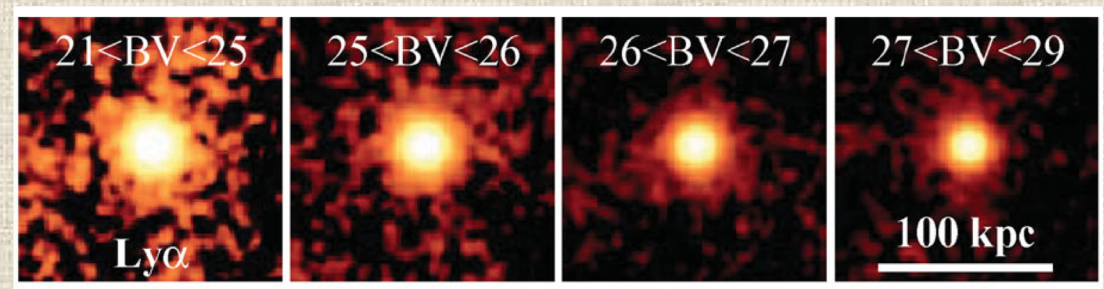
(Part of a fully reduced M2FS 2D image)



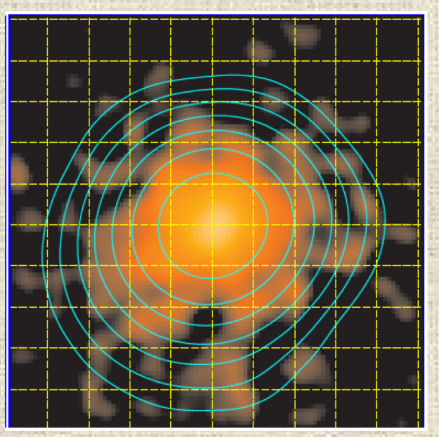
See details in our program overview paper Jiang et al. 2017

❖ Diffuse Lyα halos

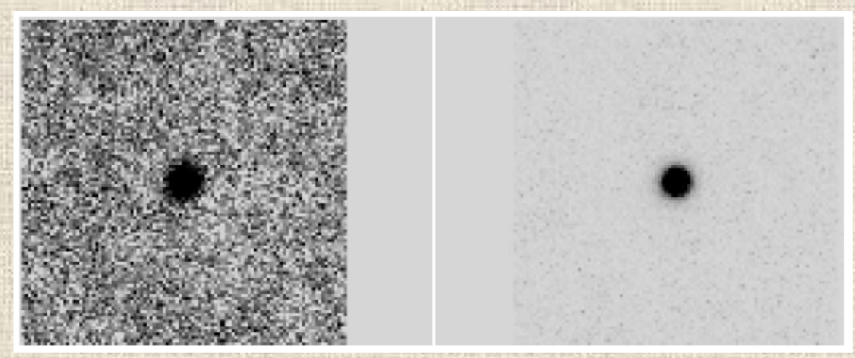
- By stacking ground-based NB (Lyα) images



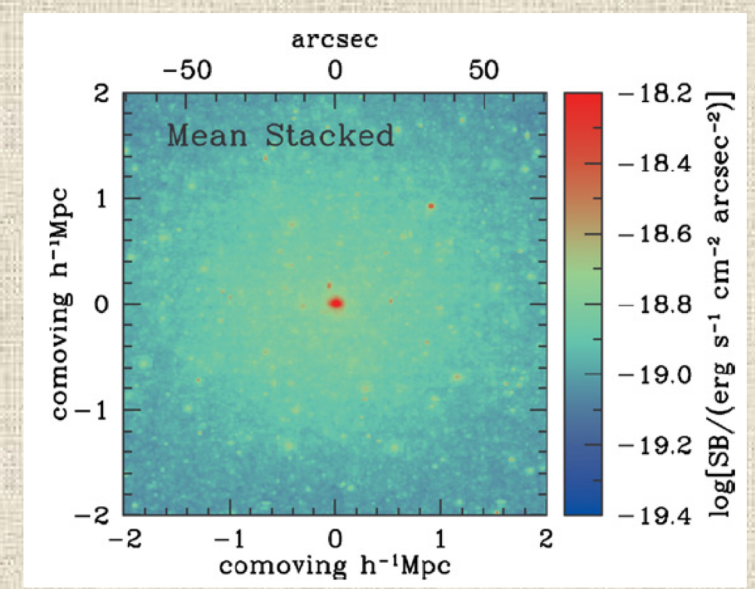
z = 3.1 LAEs (Matsuda 2012)



2 < z < 3 (Steidel 2011)



z = 3.1 LAEs (Feldmeier 2013)



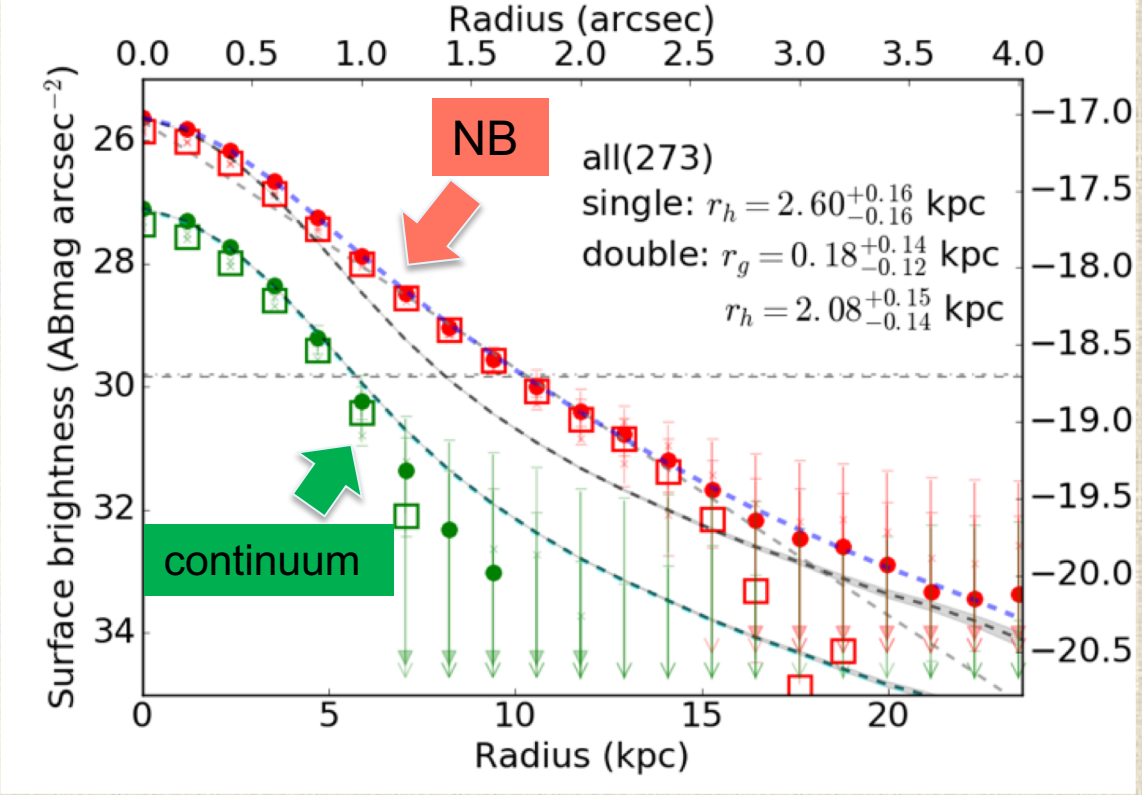
z = 5.7 LAEs (Zheng 2011)

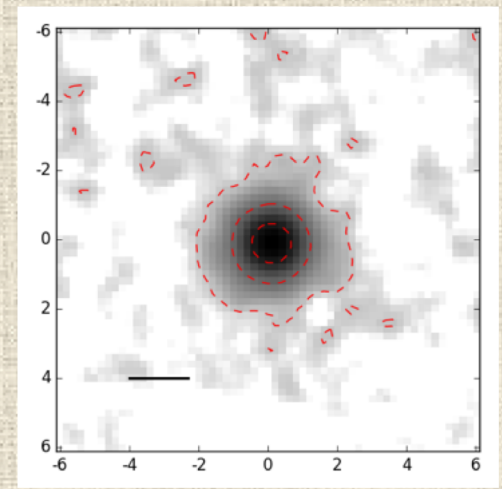
(Ref: Steidel+2011; Dijkstra+2012; Matsuda+2012; Feldmeier+2013; Jiang+2013; Momose+2014; Lake+2015; Mas-Ribas+2016; Wisotzki+2016; Xue+2017; and more)

❖ Diffuse Lyα halos at z ~ 5.7

- Now we are stacking ~270 spectroscopically confirmed LAEs at z ~ 5.7; Each LAE has ~10 hr integration with Subaru Suprime-Cam. (Wu, Jiang, et al. in prep.)

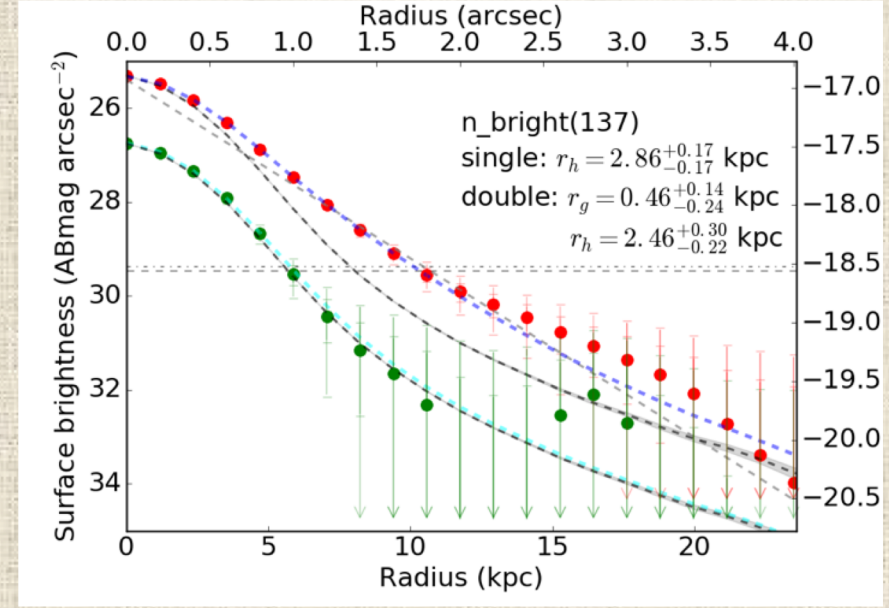
All 273 LAEs



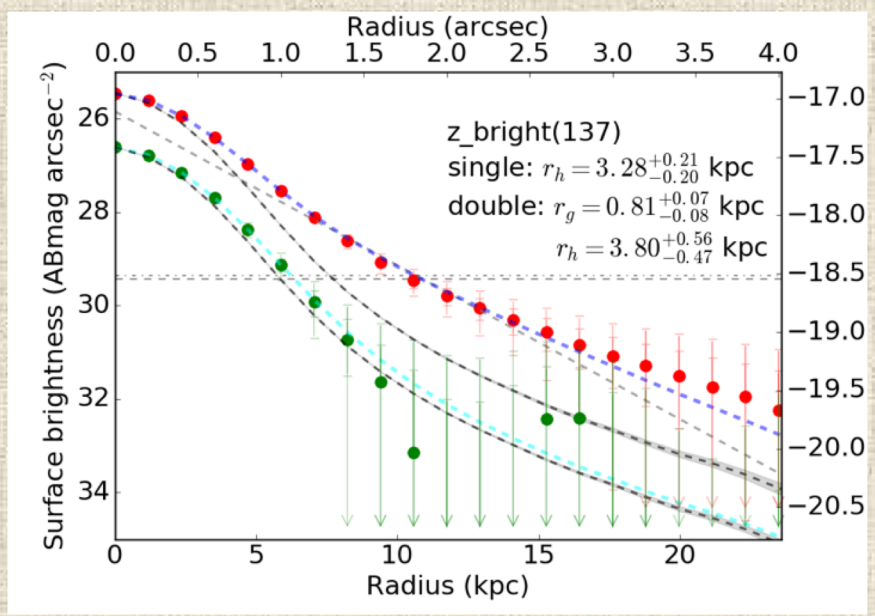


(See J. Wu's poster for more details)

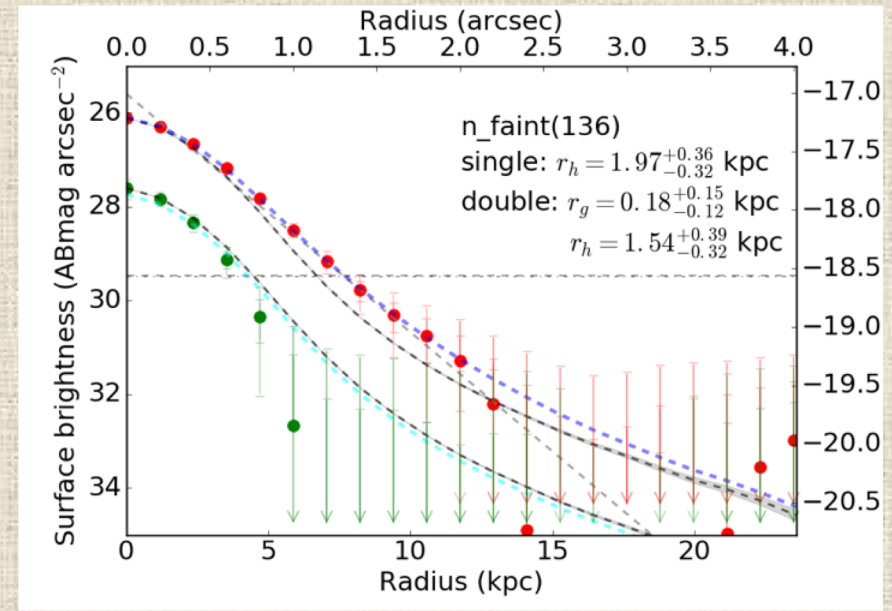
137 LAEs bright in NB



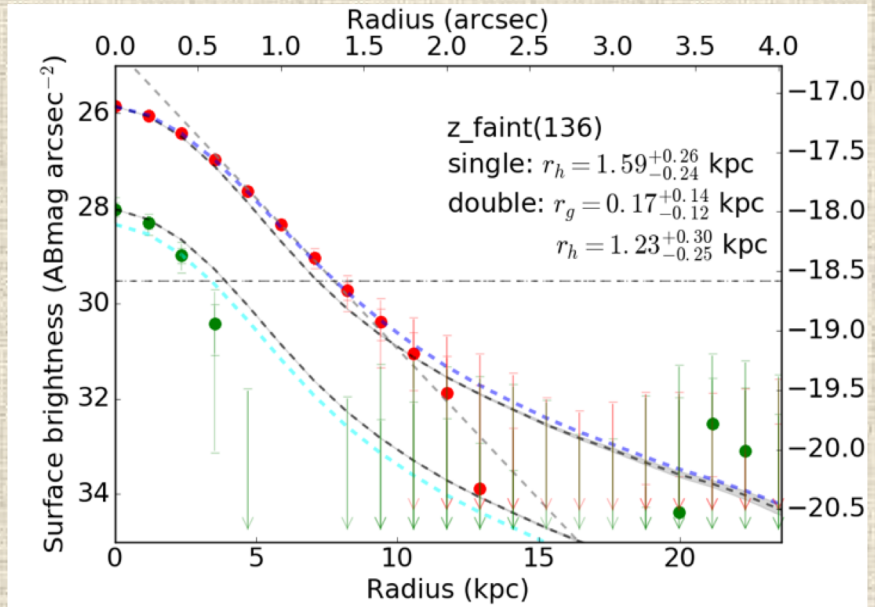
137 LAEs bright in z



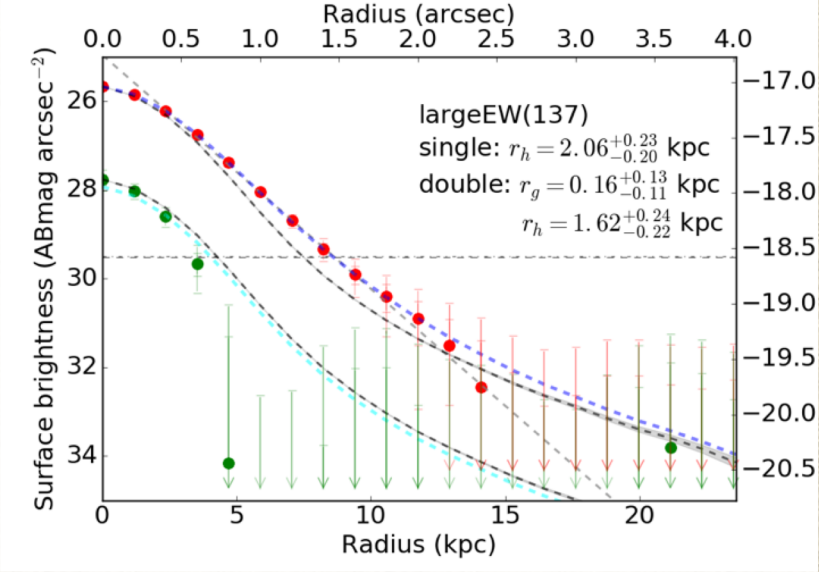
136 LAEs faint in NB



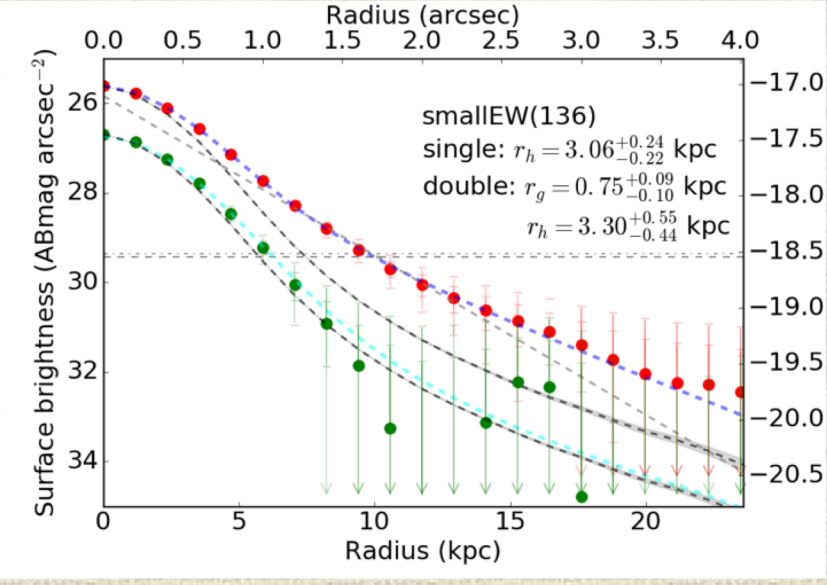
136 LAEs faint in z

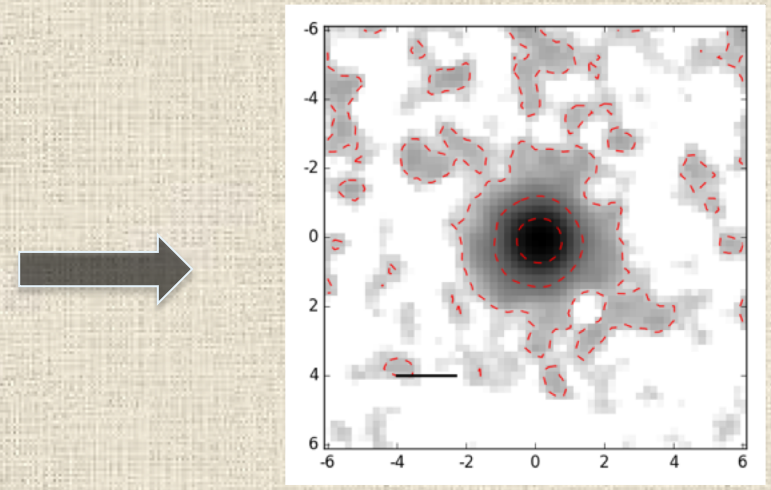


137 LAEs with large Lyα EWs

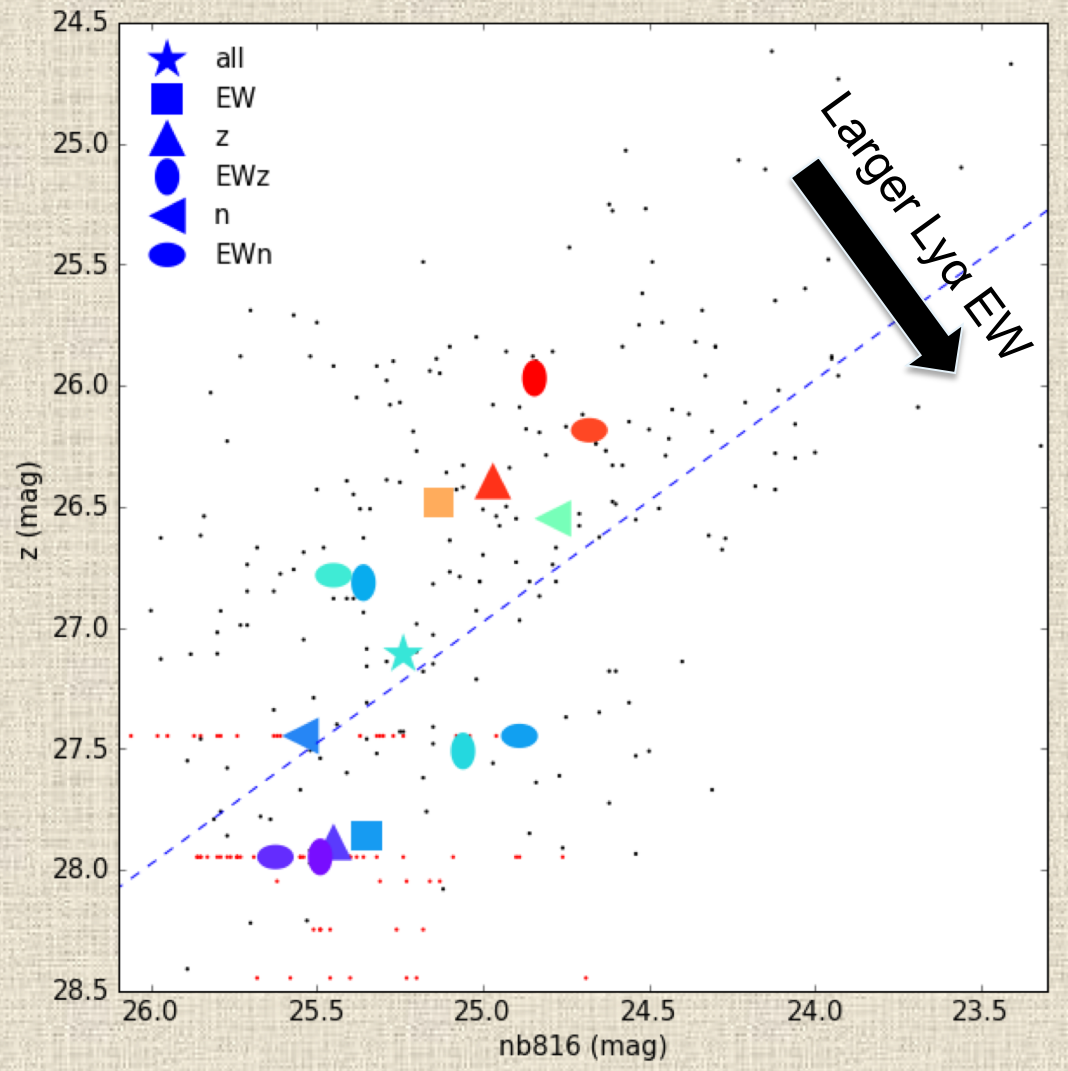


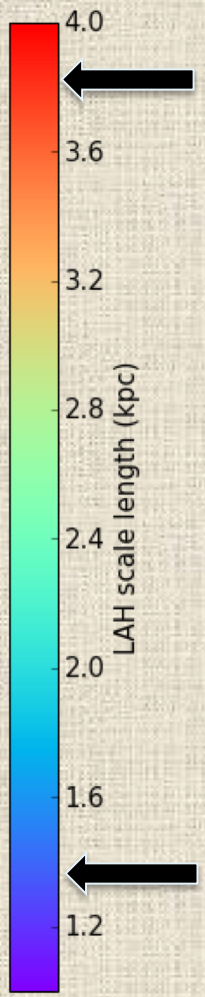
136 LAEs with small Lyα EWs





Summary of halo sizes





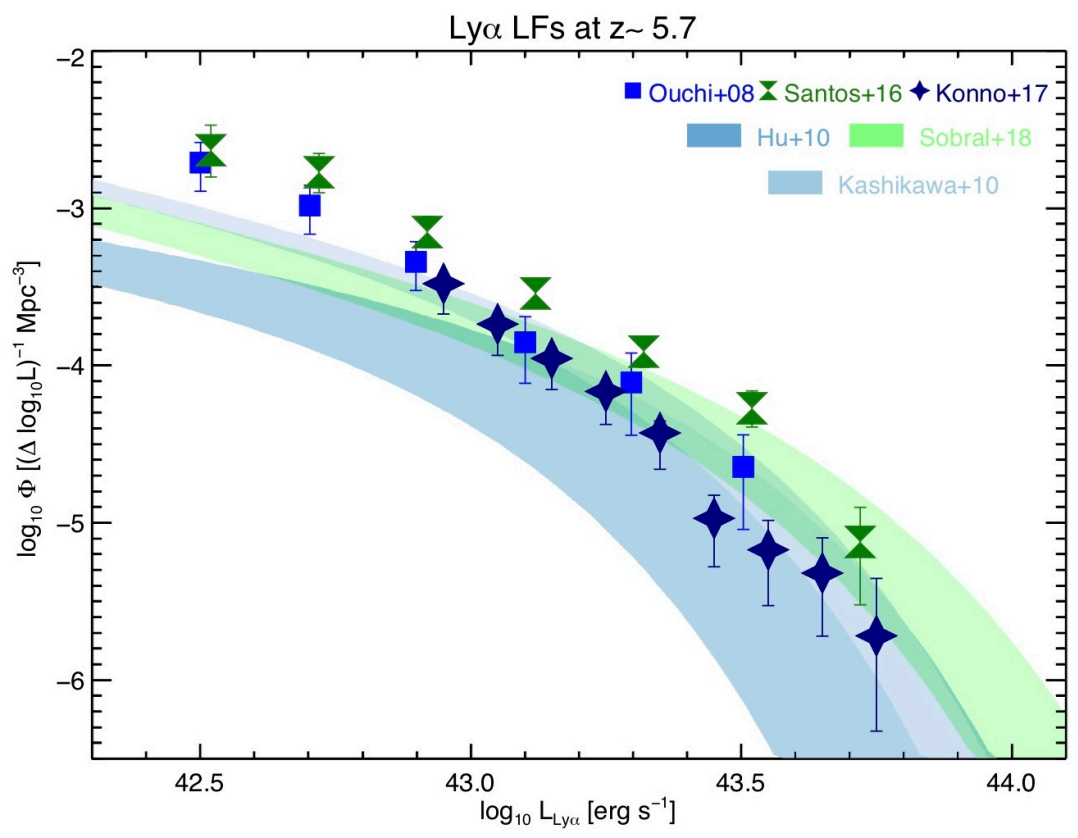
Large halo sizes

Small halo sizes

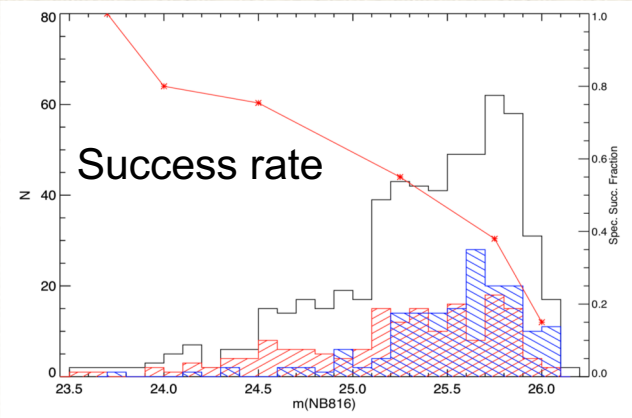
Brighter in continuum

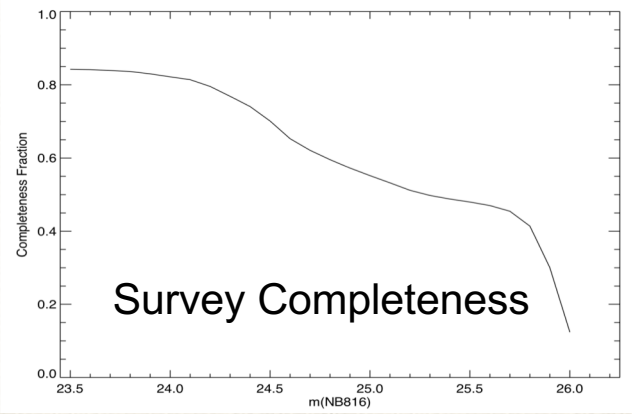
Brighter in NB

- Lyα LF at z=5.7
  - Evolution of high-z LAEs
  - Lyα LF at z=5.7 is the benchmark of Lyα LF test in the epoch of reionization

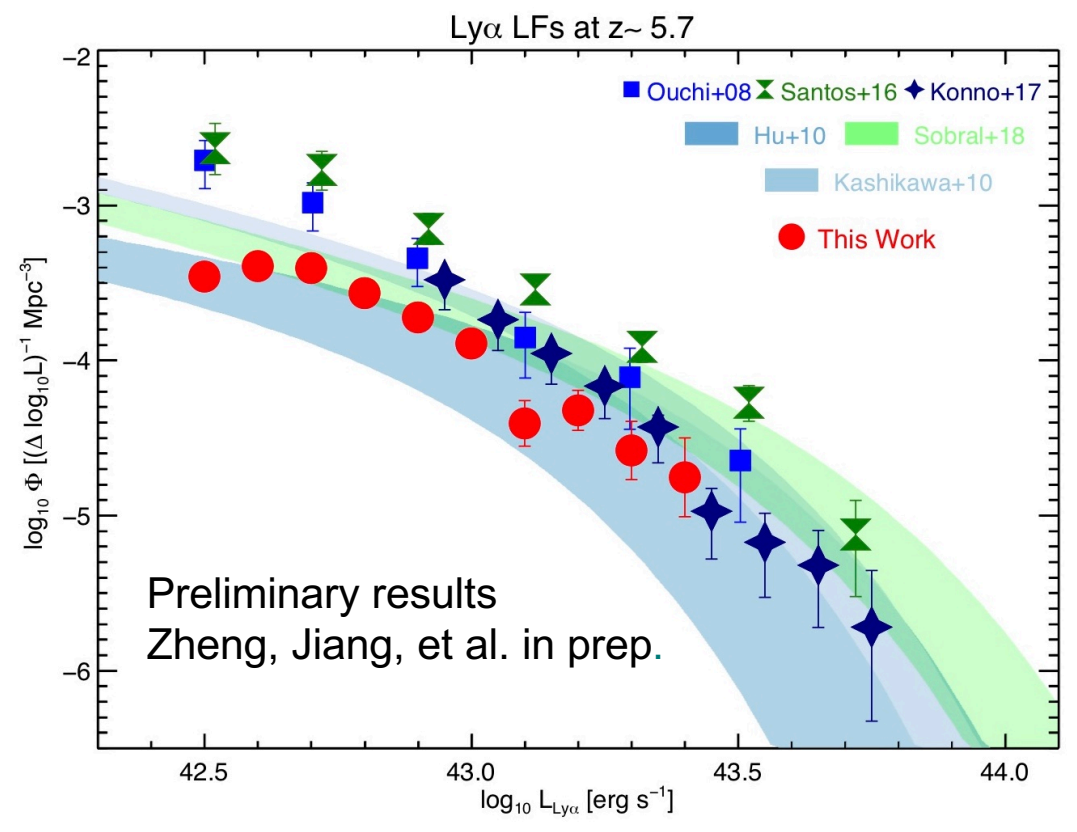


Our sample is the largest spectroscopic sample of LAEs at z=5.7



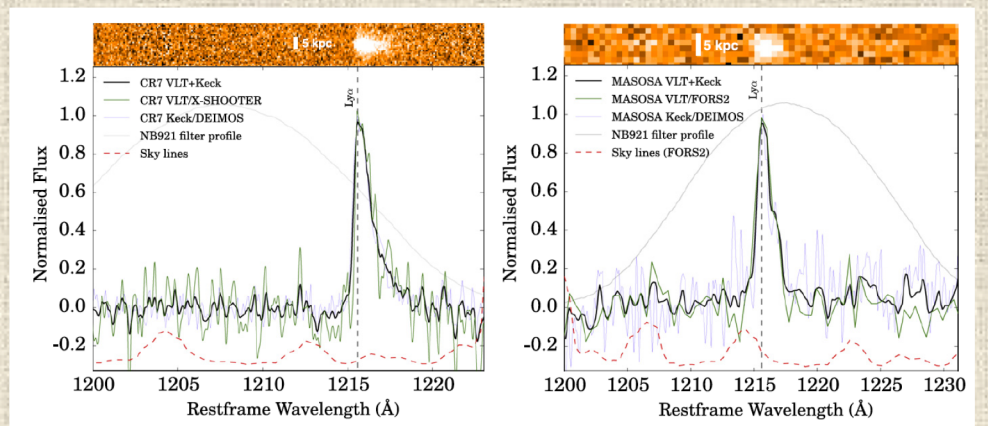


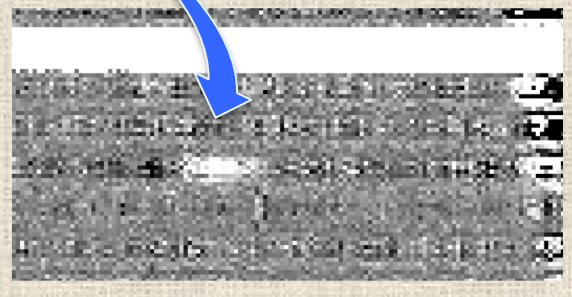
New LF at z=5.7



- Very luminous LAEs at z=5.7 and 6.5
  - Large area coverage → rare, luminous objects
  - NB921 ~ 24 mag; NB816 < 24 mag

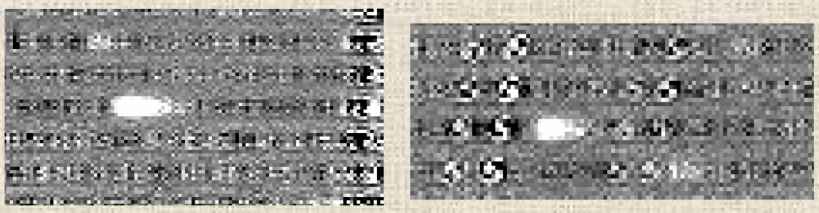
CR7 MOSOSA





(Sobral et al. 2015)

z=5.7 LAEs



z~6 LBGs

(Jiang et al. 2017)

Summary

- We are carrying out an extensive survey of bright LAEs and LBGs at $5.5 < z < 6.7$ over ~3.5 deg^2
- The sample will be used to
  - Study physical properties of spectroscopically confirmed galaxies
  - Probe cosmic reionization
- We have some interesting results
  - Lyα halos around z~5.7 LAEs
  - Lyα LF at z~5.7