Ly_α sources in the SHARDS Survey: GTC Spectroscopy of two LAEs at z=5.1

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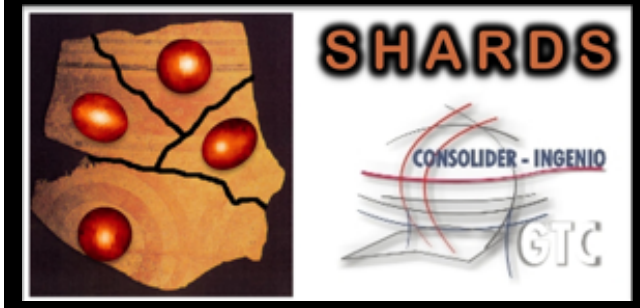
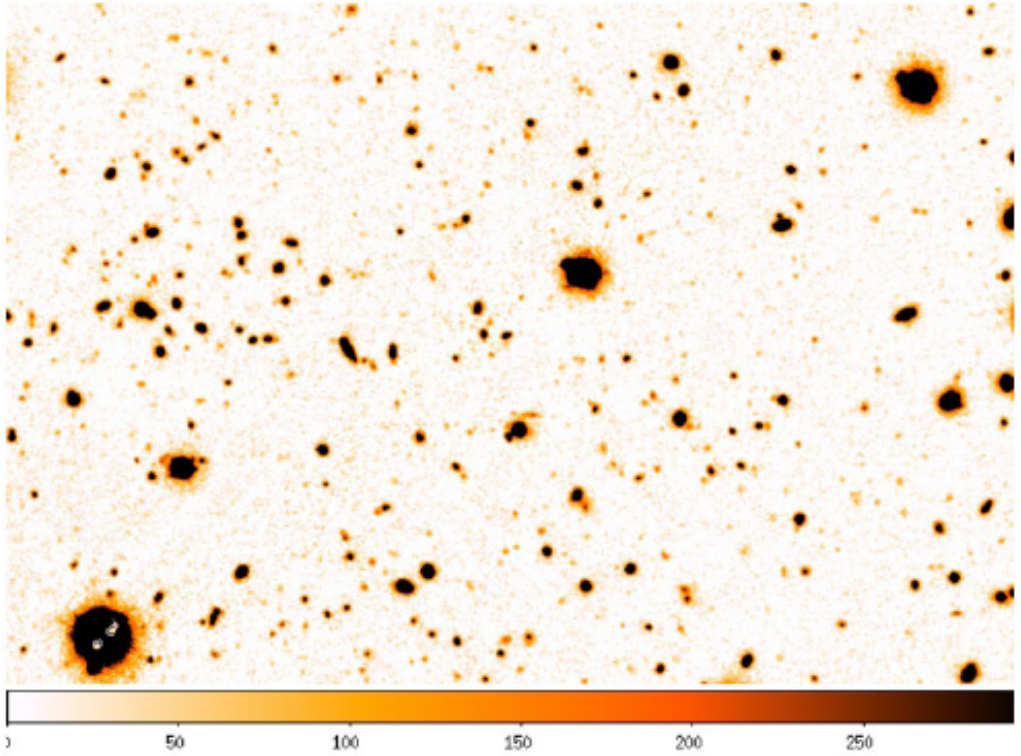


SHARDS

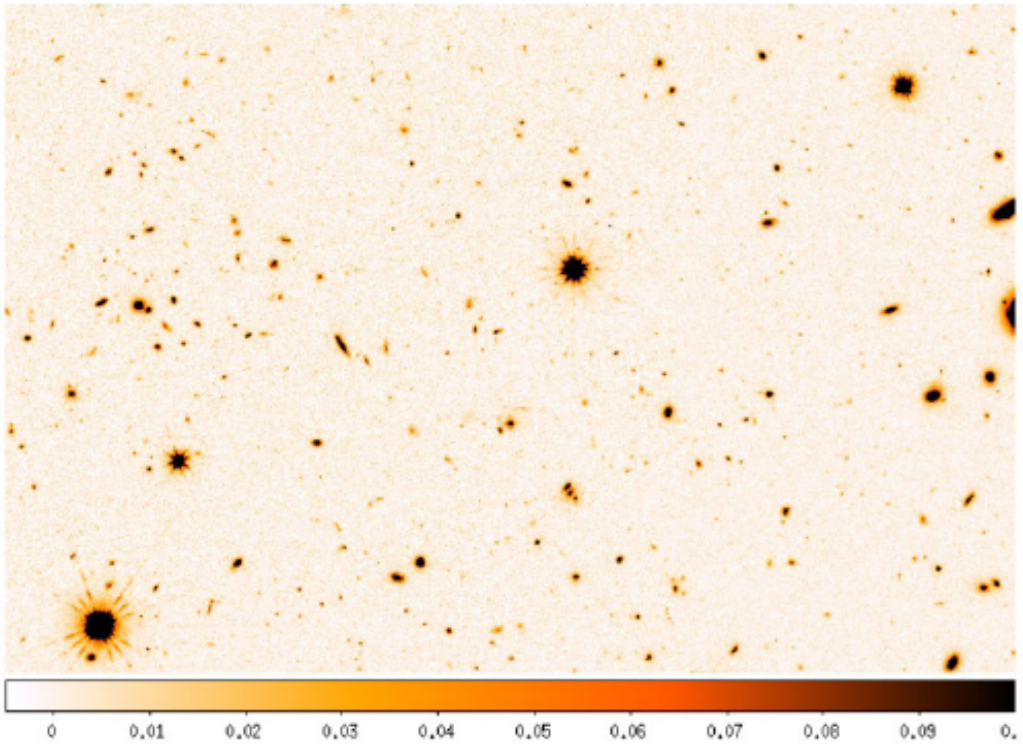
(Survey for High-z Absorption Red and Dead Sources)

- An ESO GTC survey of the entire GOODS-North in 25 medium band filters with GTC/OSIRIS covering the wavelength range from 500 to 950 nm
- To a depth of 26.5 AB mag 3σ (in all filters)
- This is the same depth as the HST ACS but in narrow filters
- More on SHARDS at:
- http://guaix.fis.ucm.es/~pgperez/SHARDS/

SHARDS F837W17

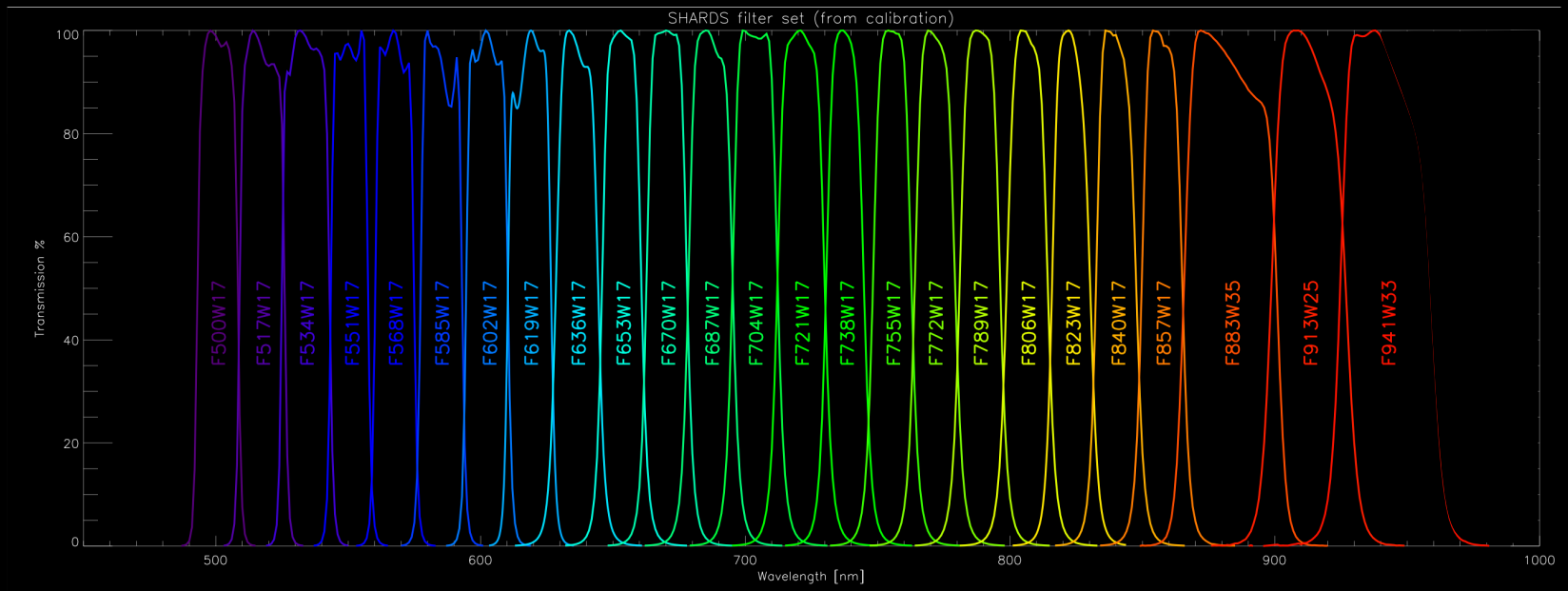


HST F160W



The SHARDS filters

- SHARDS filters are relatively narrow (17nm, except for the reddest ones)!
  - This improves the contrast for emission line sources
  - Provides a much better constrain for the redshift of the sources
  - Allows a much better determination of the drop-out wavelength

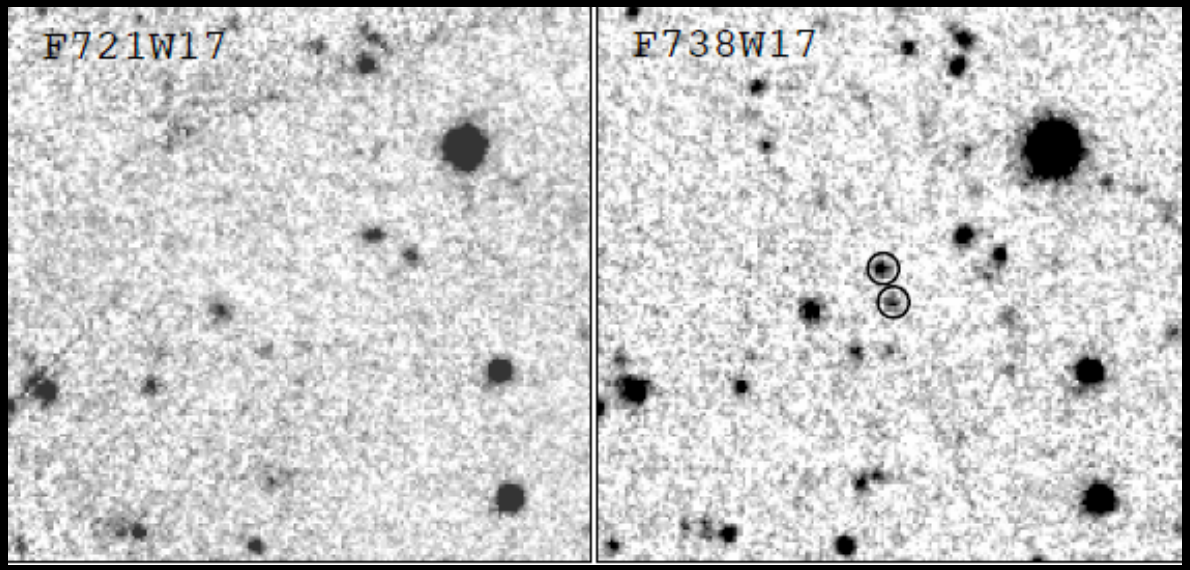


Digging in the SHARDS data

- Search for both Ly_α emitters and LBGs
  - Sources that show up in just one filter (LAE candidates)
  - Drop out sources (LBG candidates)
- Ancillary data is available for the GOODS-N field in the Rainbow database
  - Very valuable for discarding interlopers

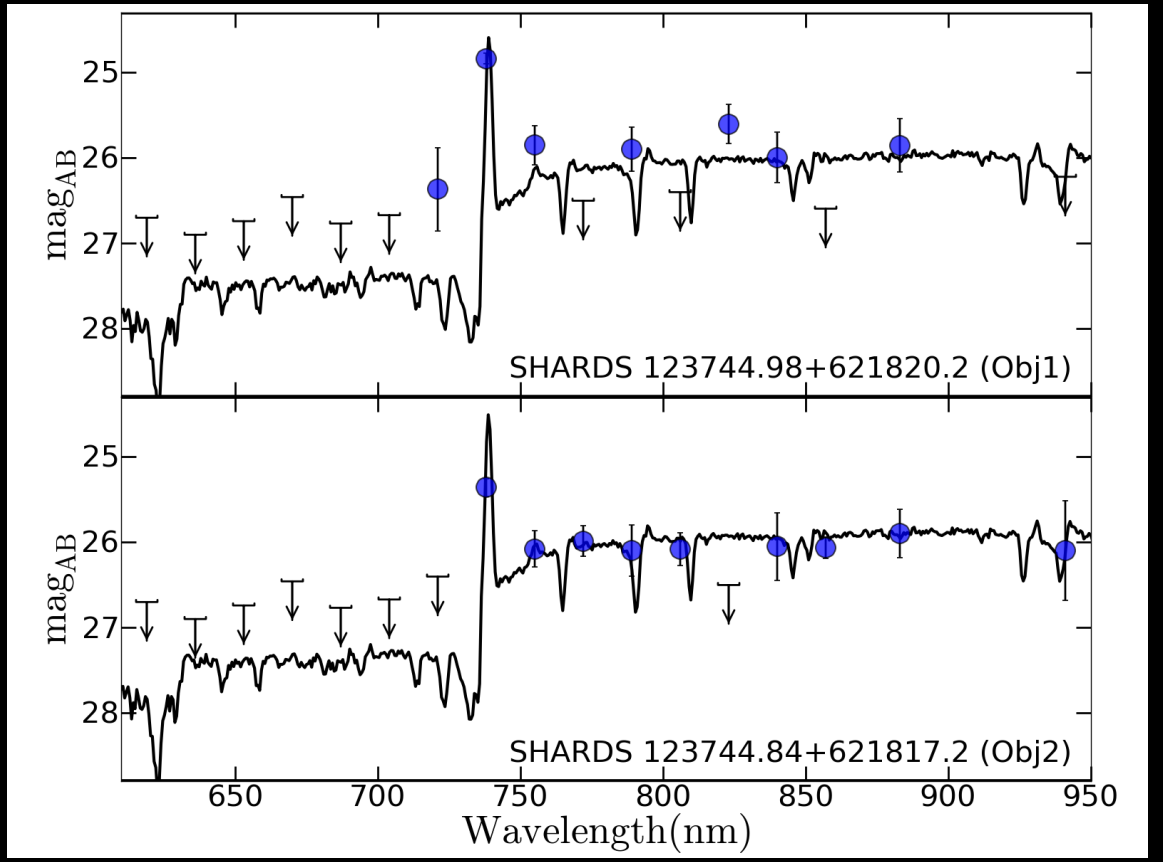
Two special sources

- Two sources were spotted in F738W17, not present in any bluer filters
  - Preliminary fits suggested a z ~ 5



SHARDS Photometry

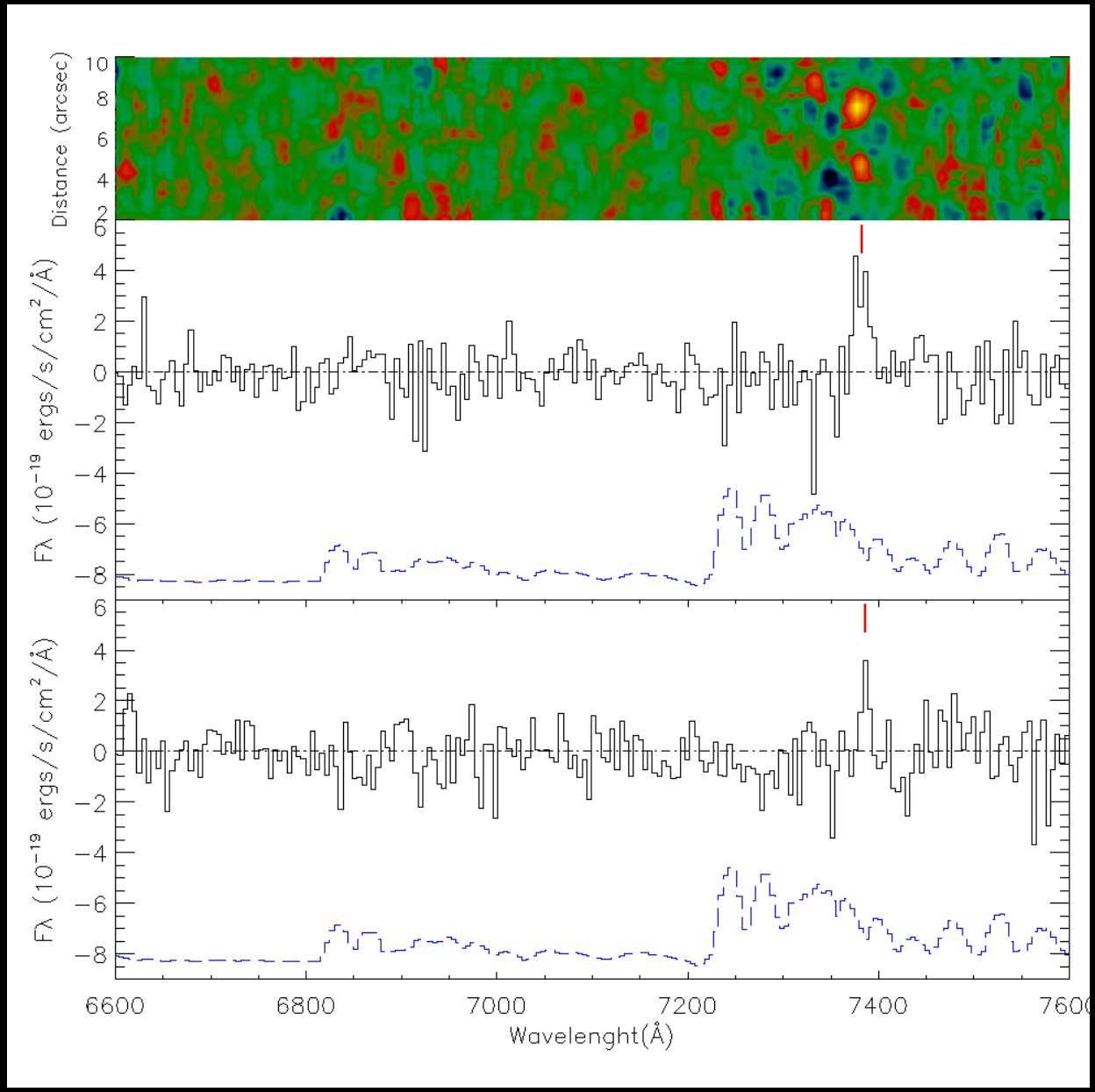
- SHARDS SEDs of the two sources
- With Rainbow we could also see the sources in HST/ACS red filters as well as in two Spitzer/IRAC filters



The LBG template is from Shapley 2003

GTC Spectroscopy

- The spectra were taken in February 2013
- 2 hours exposure time, with the Red 500 grating, 1.2 arcsec slit width
- Seeing was 0".8



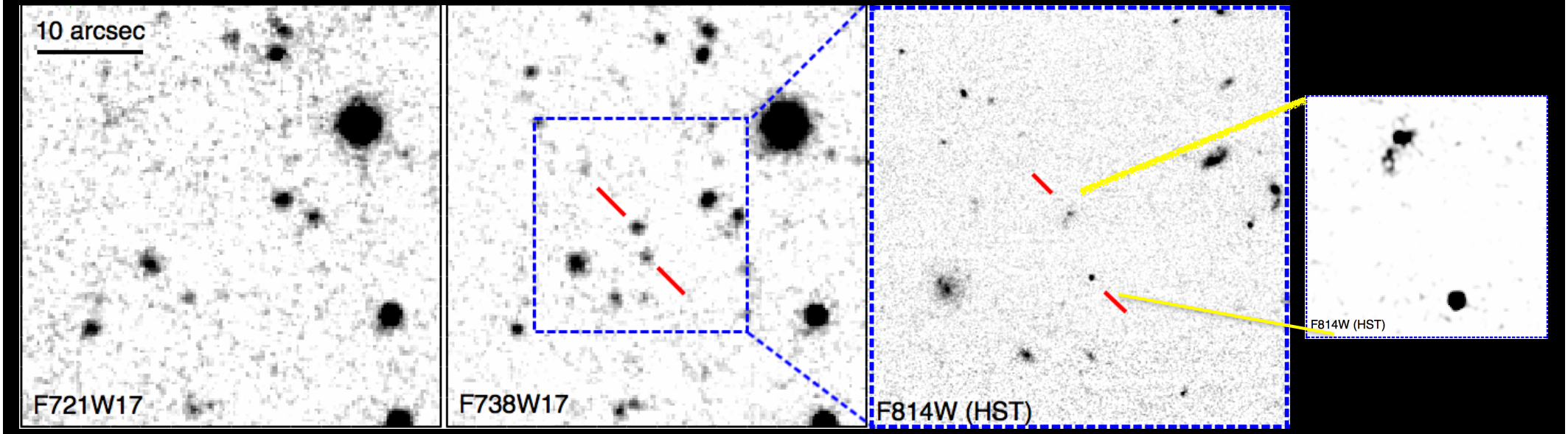
Rodriguez Espinosa+ 2014

Results from the spectroscopy

- The sources resulted to be at z~5.07
- Their separation in the plane of the sky is only ~3".2 (~20kpc)
- Besides the northern source shows signs of either clumpiness or being in interaction
- From the spectroscopy we determined Lyα fluxes, Luminosities and Star Formation rates

	R.A.(J2000)	Dec.(J2000)	Redshift	Lyα flux $ergs^{-1}cm^{-2}$	$L_{Ly\alpha}$ erg/s	SFR $M_\odot/yr$
SHARDS123744.98+621820.2	12:37:45.02	+62:18:20.33	5.0722 ± 0.0012	$1.63 \pm 0.03 \times 10^{-17}$	4.57×10^{42}	4.2
SHARDS123744.84+621817.2	12:37:44.87	+62:18:17.30	5.0754 ± 0.0012	$6.85 \pm 0.16 \times 10^{-18}$	1.92×10^{42}	1.7

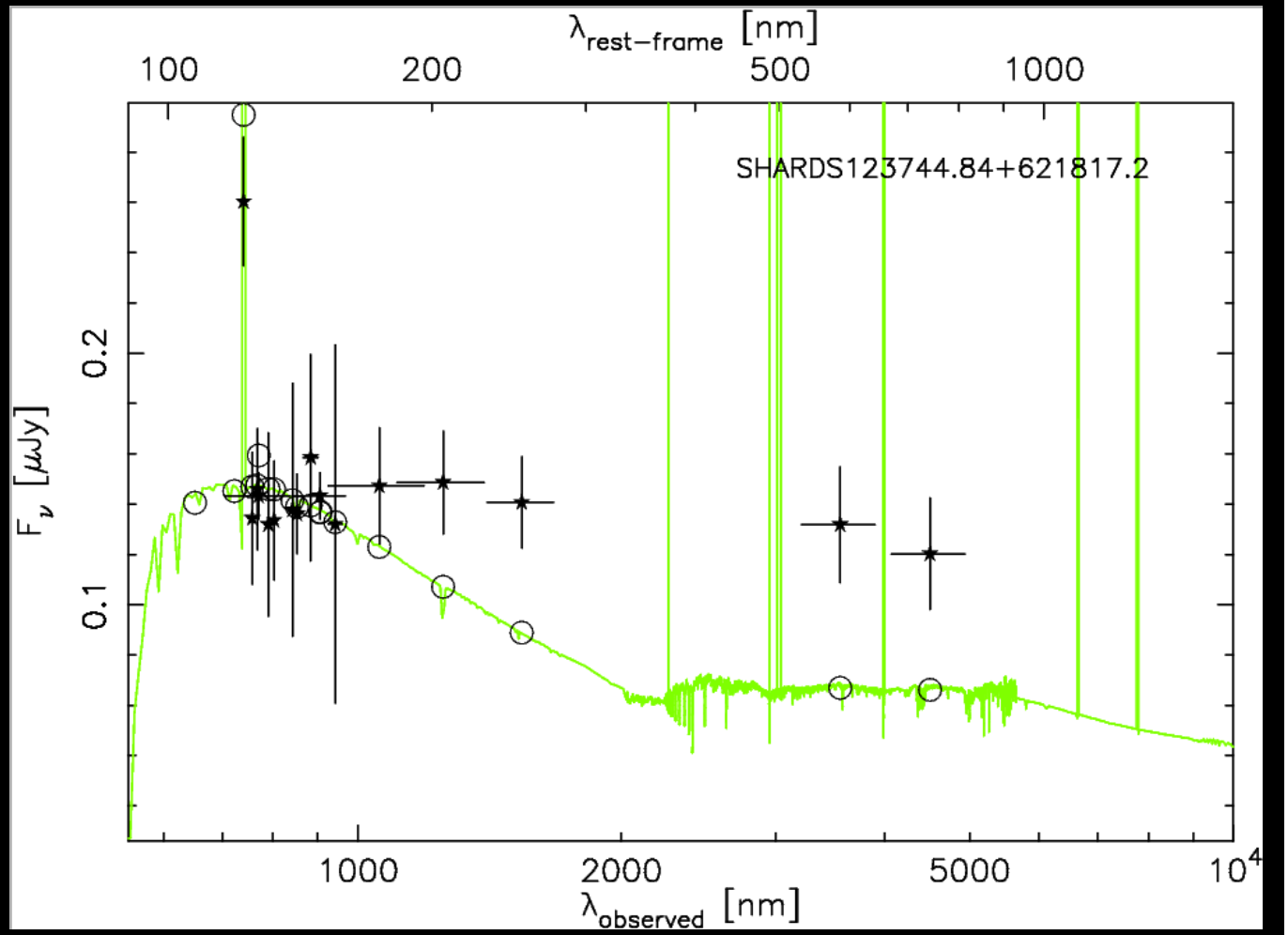
Both sources are close in the sky



Note the northern source where
we see clumps of a galaxy in formation or an ongoing interaction

Models

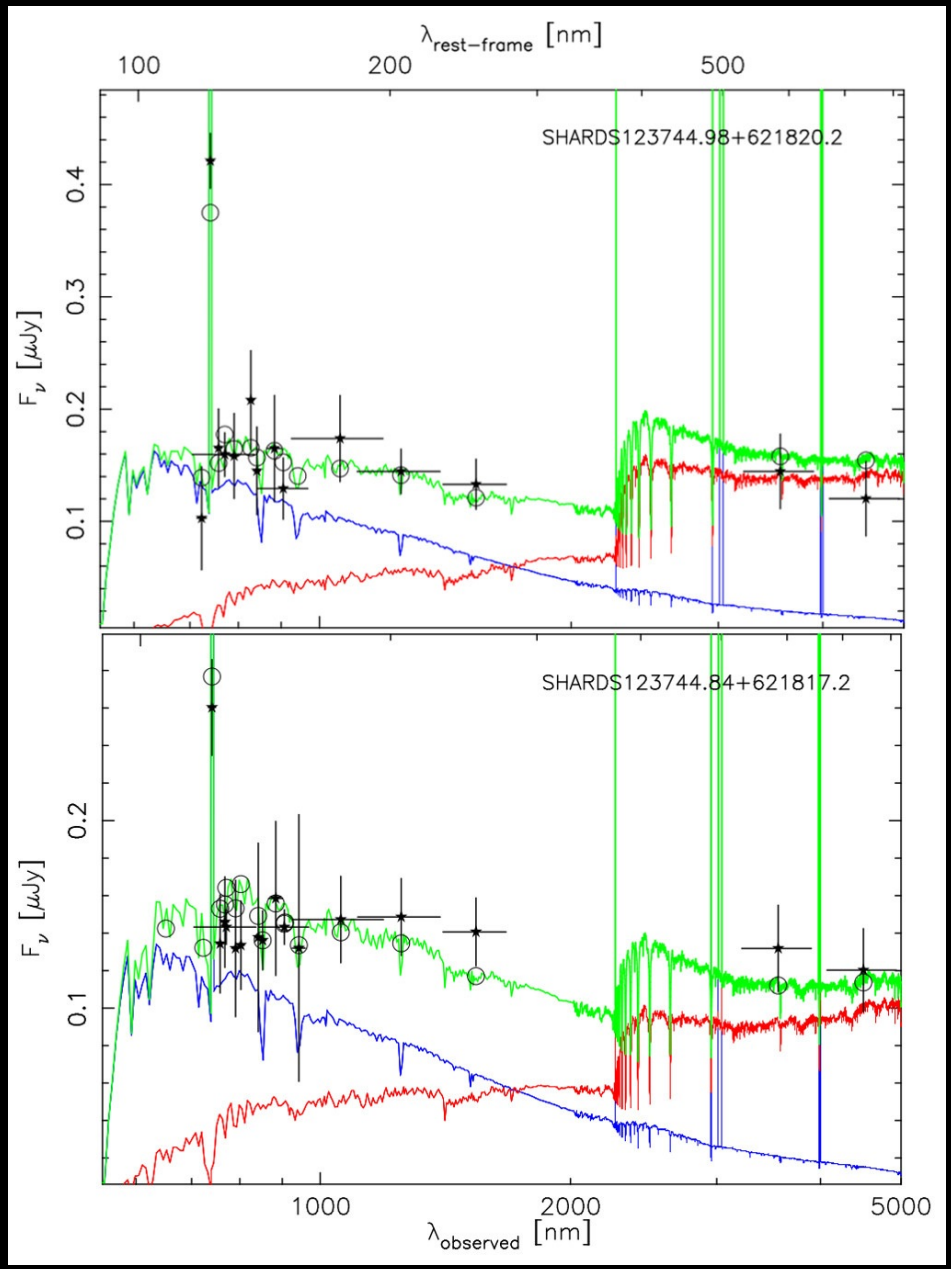
- Run population synthesis models based on BC03, Chabrier (2003) IMF, and Calzetti+(2000) extinction
- Exponentially declining SFH
- H & He nebular lines and their continua included
  - First tried one SSP model
  - Complicate to fit simultaneously the UV rest-frame and the optical rest frame
  - Short by nearly one magnitude in the IRAC data (optical red in rest frame)
  - Obscuration only not a solution



2 Populations

- We tried two distinct stellar populations
- These gave reasonable fits for both sources
- The Populations were
  - A young population (~1.5 Myr) responsible for the Lyα emission (blue in the plots)
  - An older population (~100 Myr) accounting for most of the mass (~$10^9 M_\odot$) in these sources (red in the plots)
- This is by far the best fit we could get!
- Consistent with two bursts of Star Formation

	Obj1		Obj2	
	young	old	young	old
$Z(Z_\odot)$	1.0	1.0	1.0	1.0
τ(Myr)	$1.18^{+0.32}_{-0.21}$	$4.76^{+1.08}_{-0.78}$	$10.98^{+49.66}_{-9.12}$	$5.91^{+4.24}_{-1.84}$
Age (Myr)	$1.7^{+0.3}_{-0.2}$	127^{+17}_{-14}	$1.6^{+0.7}_{-0.5}$	66^{+32}_{-26}
A_v (mag)	$0.00^{+0.05}_{-0.00}$	$0.00^{+0.05}_{-0.00}$	$0.09^{+0.10}_{-0.09}$	$0.12^{+0.19}_{-0.12}$
M (log $M_\odot$)	$7.84^{+0.18}_{-0.18}$	$9.30^{+0.07}_{-0.07}$	$7.81^{+0.25}_{-0.34}$	$8.90^{+0.14}_{-0.20}$



Episodic Star Formation

- We have found two sources undergoing episodic star formation
- Episodic Star formation is a matter of discussion in the literature
  - It has been proposed by several authors (Stark et al. 2013; Stark et al. 2009)
  - Episodic Star Formation help understand the evolution of the M_* - M_{1500}, the UV LF evolution, and the clustering properties of $z<4$ sources
- In our case,however, it is not clear if the Episodic Star Formation found is genuine, or it is triggered by the interaction of these sources

Thanks!