Study of the environment of HFLS3, an extreme starburst at z=6.34

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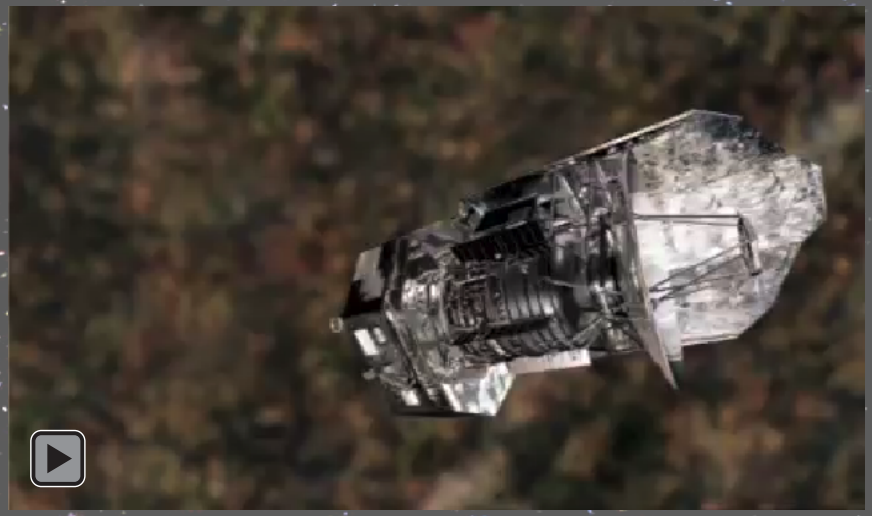
One of the most important questions of modern astronomy is undoubtedly the formation and evolution of the first luminous objects in our Universe. One possible way to constrain the evolution of these objects is to study the very massive sources in the early Universe, which are probably the result of several mergers of smaller galaxies formed at the beginning of the Universe. It has been shown by previous studies that several massive starburst at high-z could be proto-cluster members, but none of them has been identified at z>6 (Daddi et al. 2009, Capak et al. 2011).



Riechers et al. (2013)

Riechers et al. (2013) discovered the most massive object at z=6.34, called HFLS3, over 21 deg^2 of the Herschel /SPIRE data from the HerMES survey. This object is lensed by a two-component galaxy system at z≈2.1 involving a magnification of 2.2±0.3 (Cooray et al. 2014). Its physical properties based on the rest-frame UV emission results in a SFR of 1320 $M_\odot$/yr and dust and stellar masses of 3x10^8 $M_\odot$ and 5x10^{10} $M_\odot$ respectively.

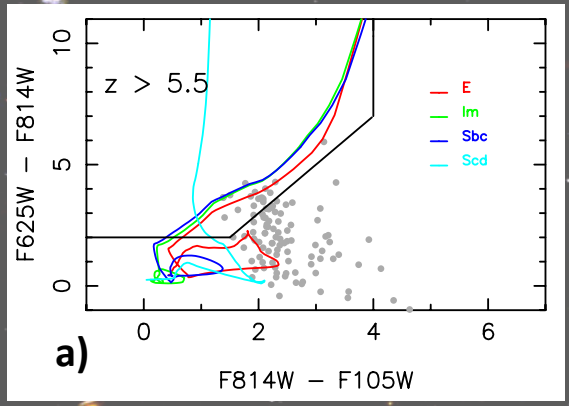
MAIN GOAL

Determine if HFLS3 is proto-cluster member at z=6.34 by combining data from the Hubble Space Telescope (HST) and the Gran Telescopio Canarias (GTC - 10.4m)

Search for z≈6 galaxies around HFLS3

Filter	λ_{eff} [nm]	m(5σ) [AB]	Instrument
g'	481.5	26.9	OSIRIS/GTC
r'	641.0	26.8	OSIRIS/GTC
i'	770.5	26.6	OSIRIS/GTC
z'	969.5	25.9	OSIRIS/GTC
F625W	629.6	26.1	ACS/HST
F814W	811.5	27.0	ACS/HST
F105W	1055.1	25.9	WFC3/HST
F125W	1248.6	26.3	WFC3/HST
F160W	1536.9	26.0	WFC3/HST
K_s	2150.0	23.1	LIRIS/WHT
3.6μm	3575.0	24.4	IRAC/Spitzer
4.5μm	4528.0	24.3	IRAC/Spitzer

We used the Lyman Break technique combining non-detection in bands blueward of the Lyman break and color-selection (Fig. a).



Criteria for the HST sample :

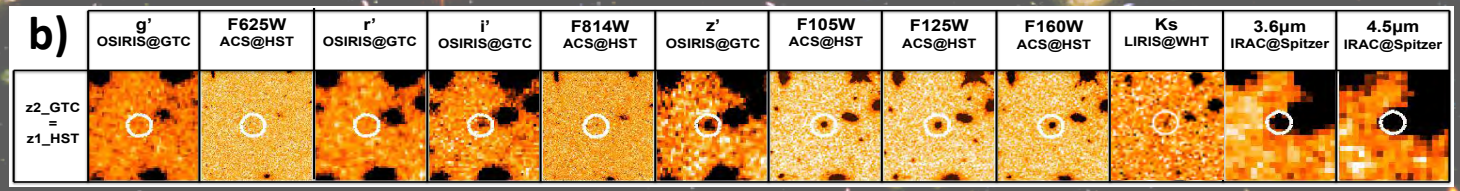
F625W > m(2σ)
F105W < m(5σ)
F125W < m(5σ)

And for the GTC sample :

g'> m(2σ)
r'> m(2σ)
z'<m(5σ)

RESULTS

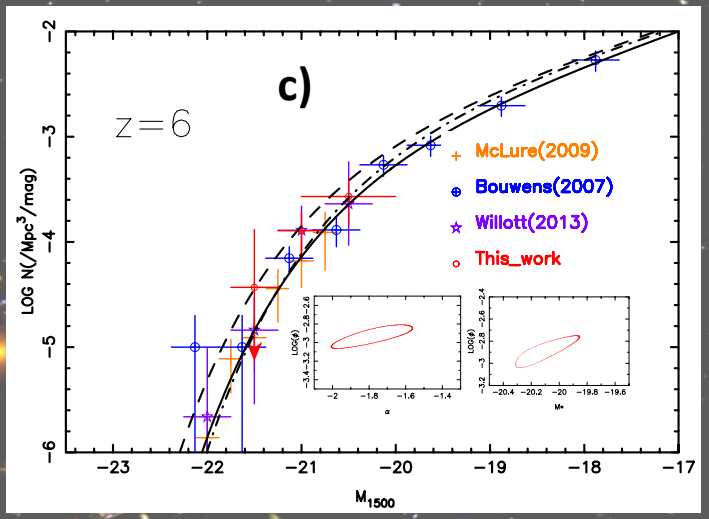
- 2 objects selected over the 55.5 arcmin² covered by OSIRIS/GTC
- 9 objects selected over the 4.54 arcmin² covered by HST instruments

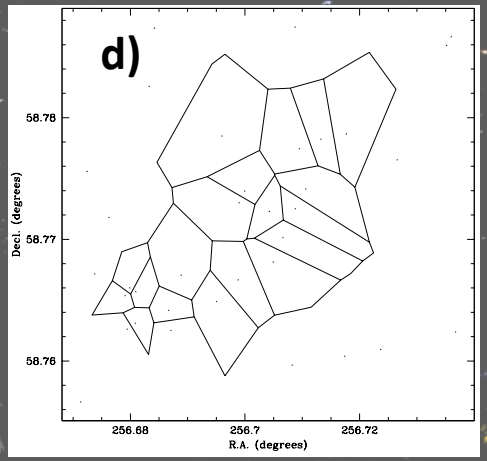


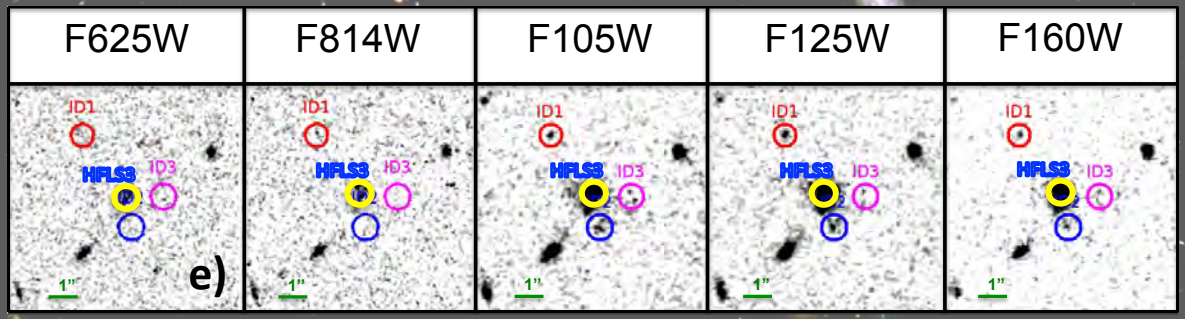
Laporte et al. 2015

Evidence for an over-density of objects ?

- The expected number of objects computed from the evolution of the UV LF *(Bouwens et al. 2015)* is : 6 ± 3 (HST) and 1 ± 1 (GTC)
  - ➔ No over-density from this point of view
- The distribution in luminosity of our candidates is consistent with a "normal" field distribution (Fig. c).
  - ➔ No over-density from this point of view
- A Voronoi tessellation analysis shows that the distribution of fainter objects (2-5σ in F105W) over the field of view makes the over-density hypothesis unlikely (Fig. d)
  - ➔ No over-density from this point of view
- However, 3 "detections" closed to HFLS3 have F105W and F125W colors consistent with z≈6 objects but the size of the break is not sufficient to draw any conclusion without spectroscopy (Fig. e).
  - ➔ Spectroscopy needed to confirm / refute a possible over-density of objects close to HFLS3







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