

Dynamical and structural analysis of a large-scale structure at $z=0.65$ in CANDELS UDS

Environmental dependence of
early-type galaxy properties at $z=0.6-0.7$

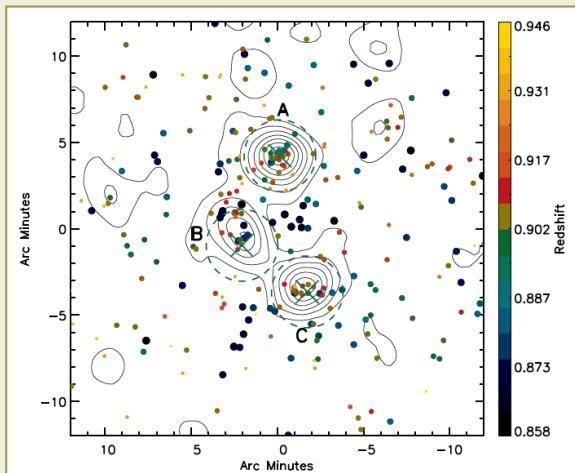
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In collaboration with the CANDELS clustering group
And the UKIDSS team



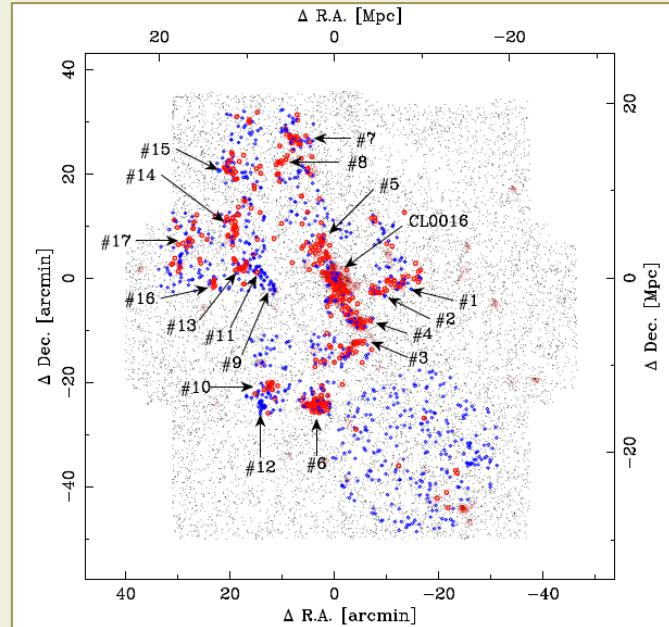
Motivation

- Large-Scale structures at $z > 0.5$
 - The largest density enhancements
 - Scales of $100\text{-}200 h^{-1} \text{Mpc}$
 - Powerful tool to constrain cosmological models
 - Offer a wide range of spatial and dynamical sub-environments
 - Few known at intermediate to high- z

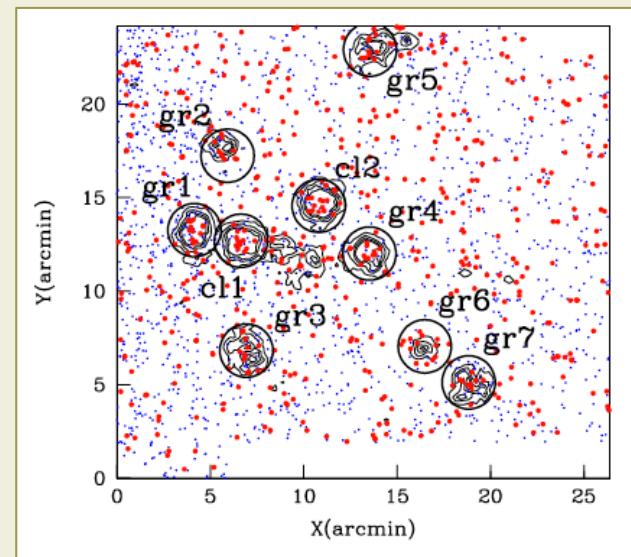


Gillbank2007; Falloon2013

RCS2319+00 – $z = 0.9$ – 30 Mpc
3 X-ray extended selected clusters

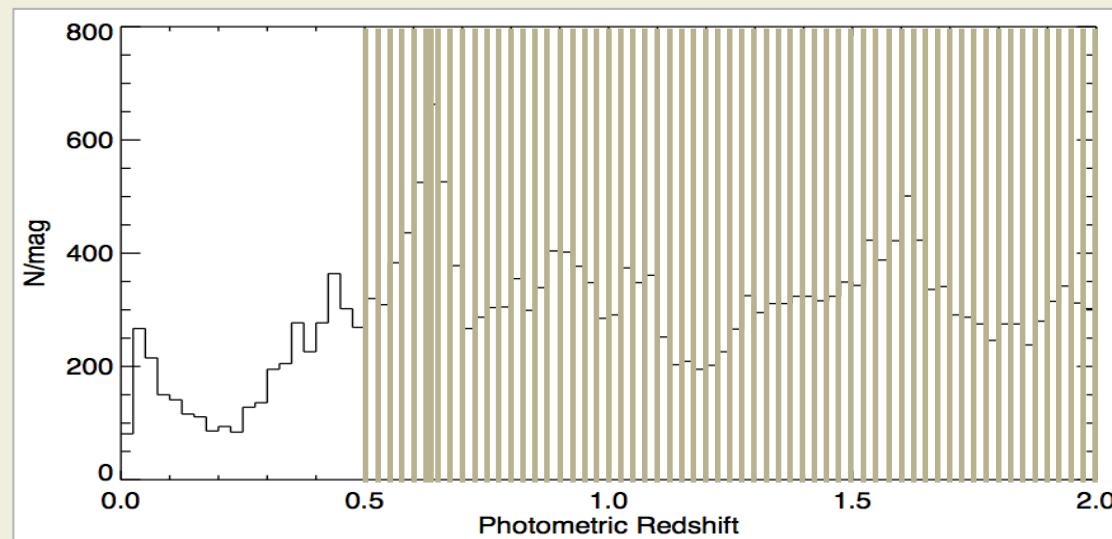
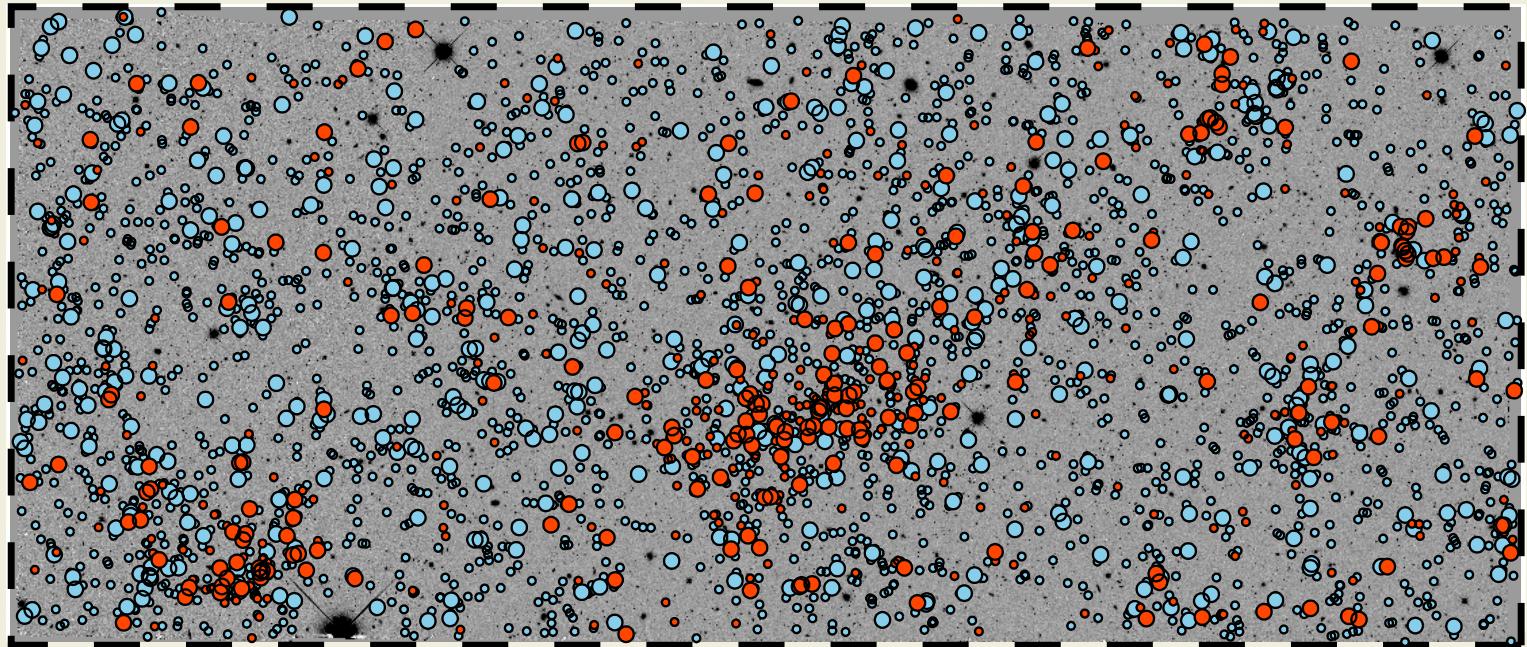


CL0016 - $z=0.55$ - +30Mpc - >10 members
One structure at $M>10^{14} M_{\odot}$

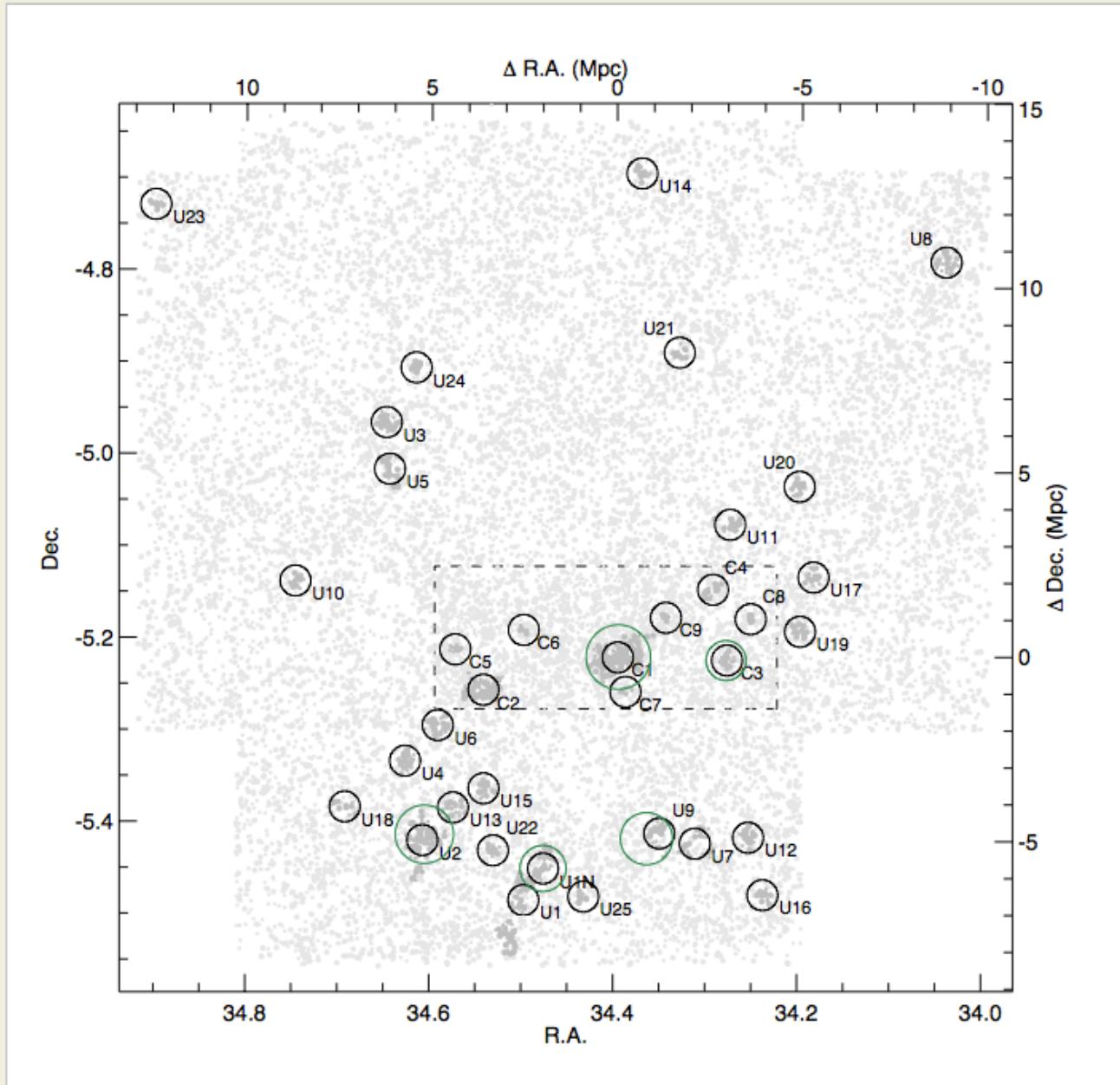


Rosati et al.1999
Nakata et al. 2005
Lynx supercluster – $z = 1.27$
At least 7 satellite groups around the twins

Galaxy Clusters in CANDELS-UDS



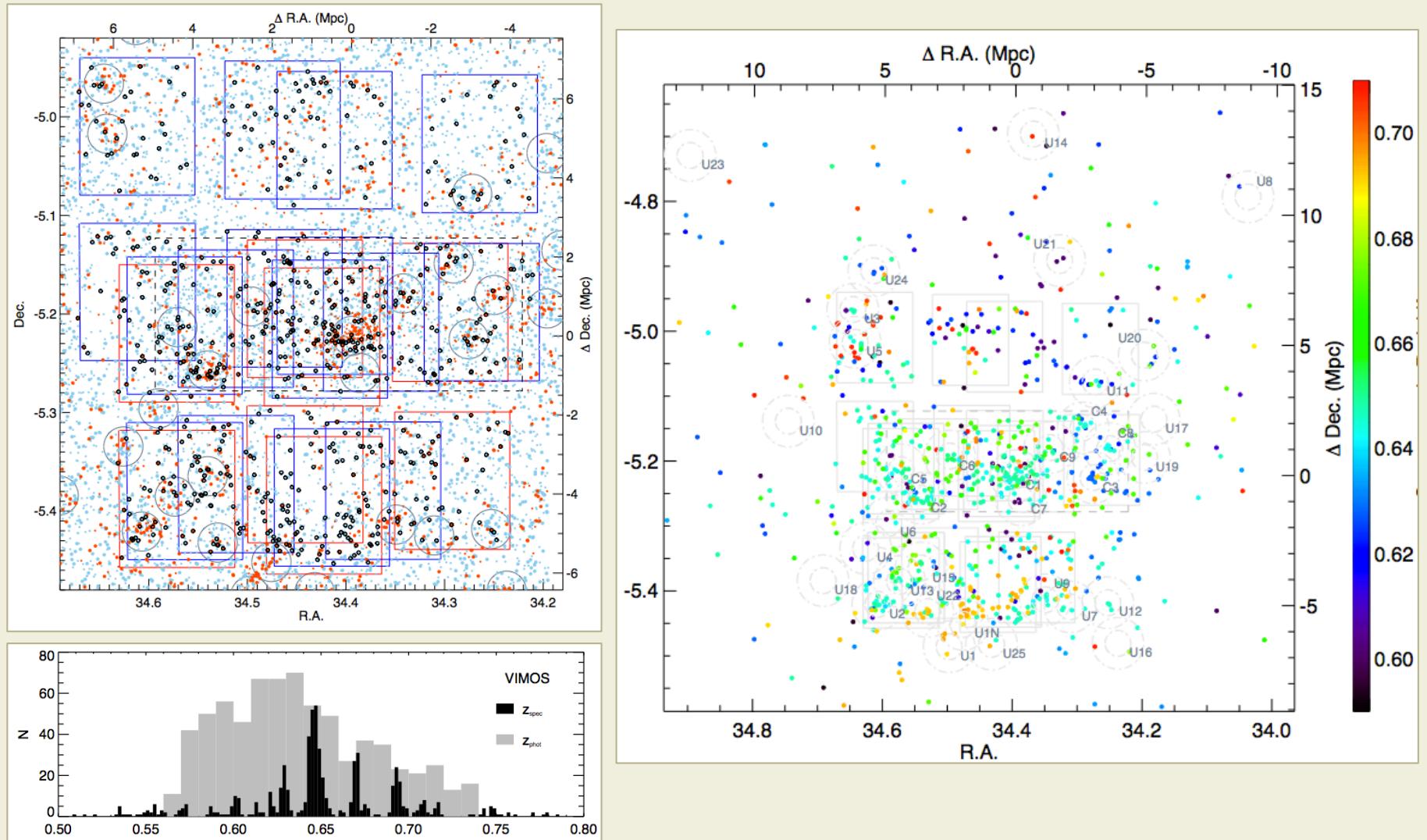
A large-scale structure at z~0.65



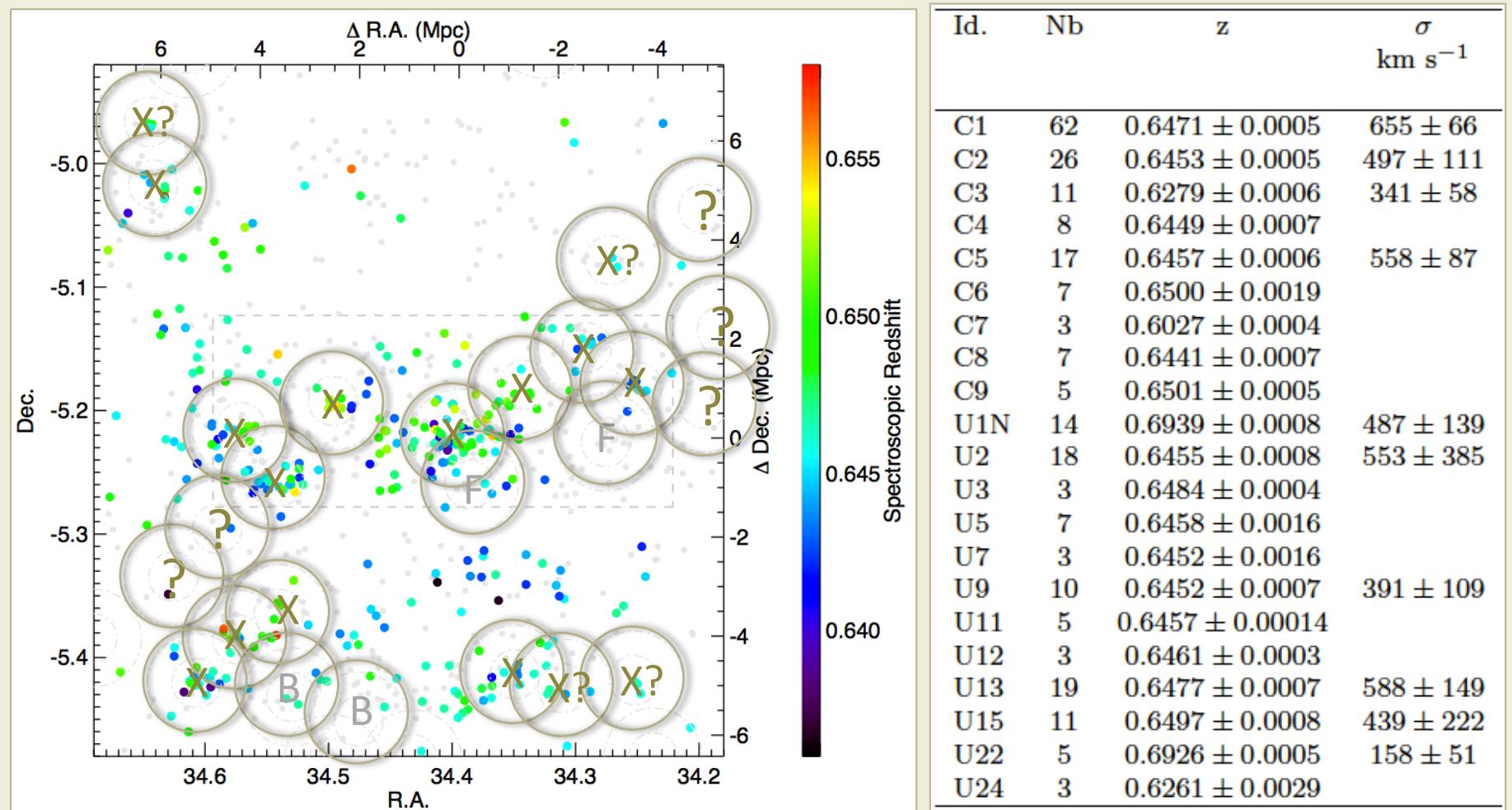
Spectroscopic follow-up - VLT/VIMOS

6 masks; ~ 700 $z_{\text{phot}} \sim 0.65$ targets
625 new spectroscopic redshifts ...

... combined with existing spectroscopy



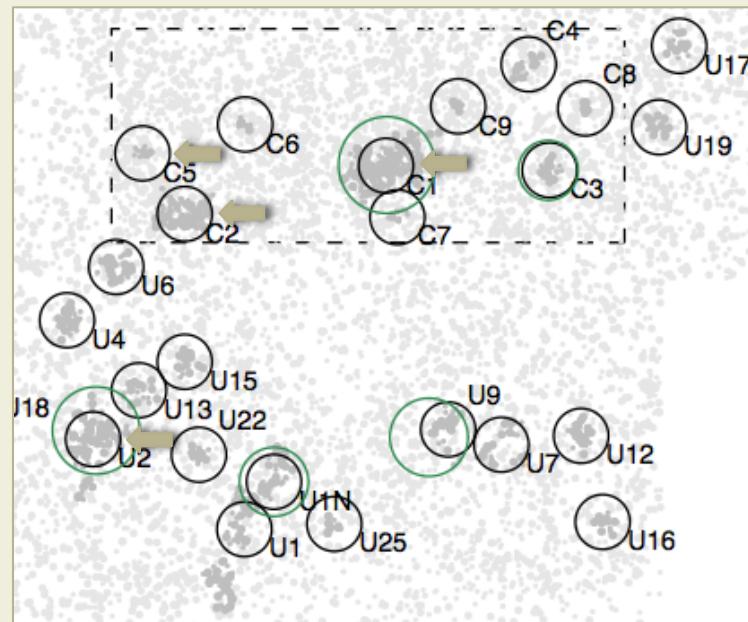
Galaxy Clumps at $z \sim 0.65$



12 confirmed structures at $z = 0.65$ – 4 additional strong candidates
 2 background (LSS at $z = 0.69?$)
 3 foreground clusters – 2 in the CANDELS FoV

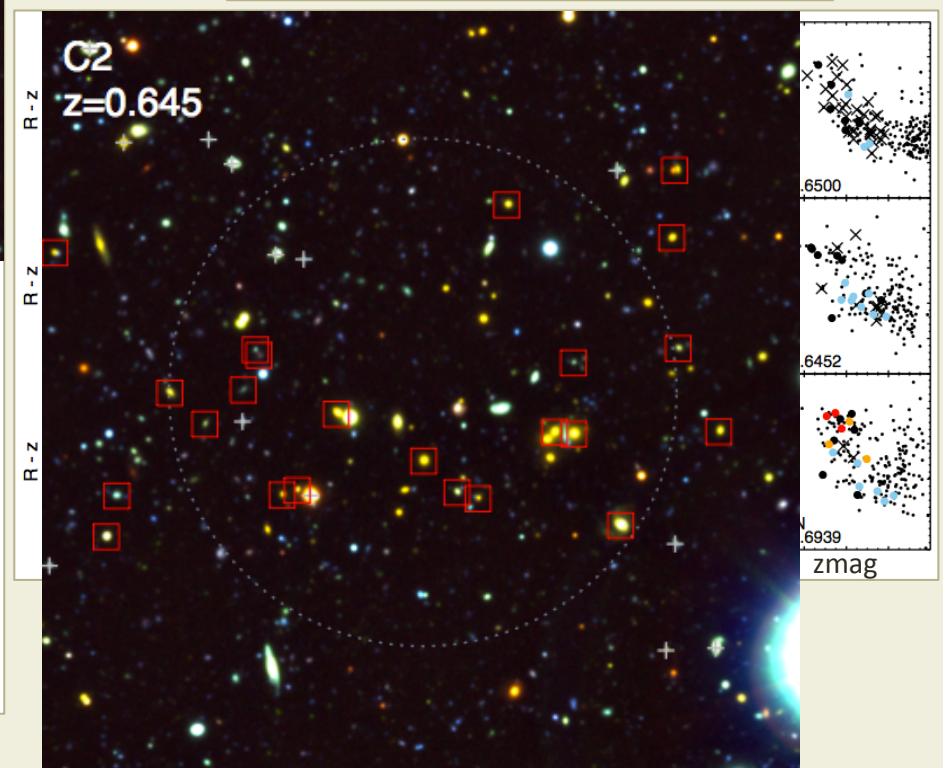
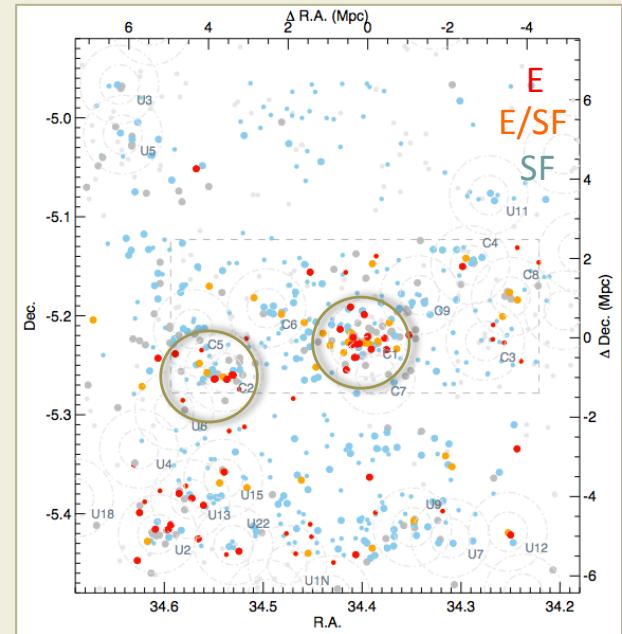
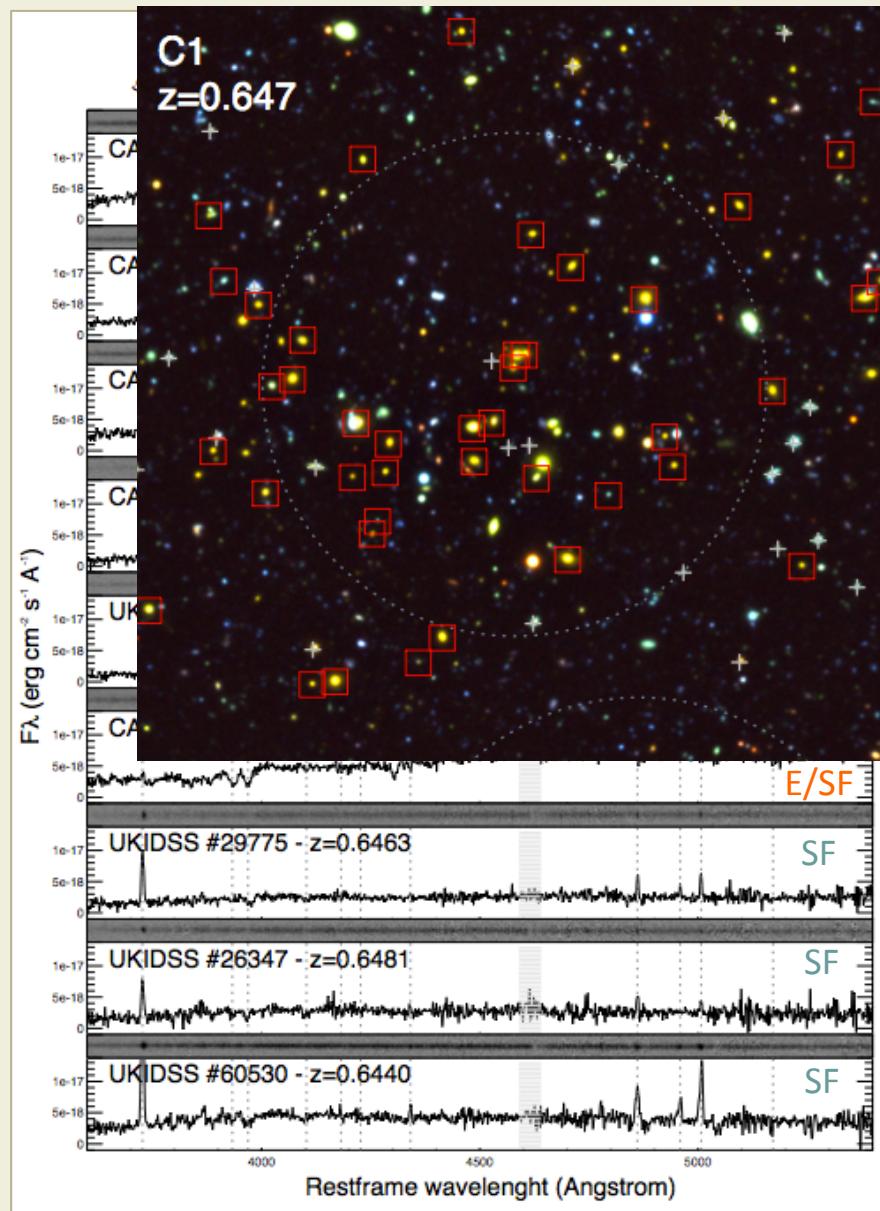
Dynamical analysis – Virial radius & mass

Id.	R_{200}	M_{200}	M_{200}	M_{200} Finoguenov 2010
	h_{70}^{-1} Mpc	10^{14} M_\odot Calberg et al. 1997	10^{14} M_\odot Evrard et al. 2008	
C1	1.13 ± 0.11	3.39 ± 1.07	2.24 ± 0.70	1.47
C2	0.86 ± 0.19	1.48 ± 1.08	0.987 ± 0.71	$<1.9\sigma$
C3	0.60 ± 0.10	0.48 ± 0.27	0.33 ± 0.18	0.31
C5	0.97 ± 0.15	2.10 ± 1.05	1.39 ± 0.68	64
U1N	0.82 ± 0.23	1.36 ± 1.29	0.902 ± 0.84	
U9	0.68 ± 0.19	0.723 ± 0.670	0.483 ± 0.443	0.81
U2	1.02 ± 0.26	2.45 ± 2.05	1.62 ± 1.35	1.07



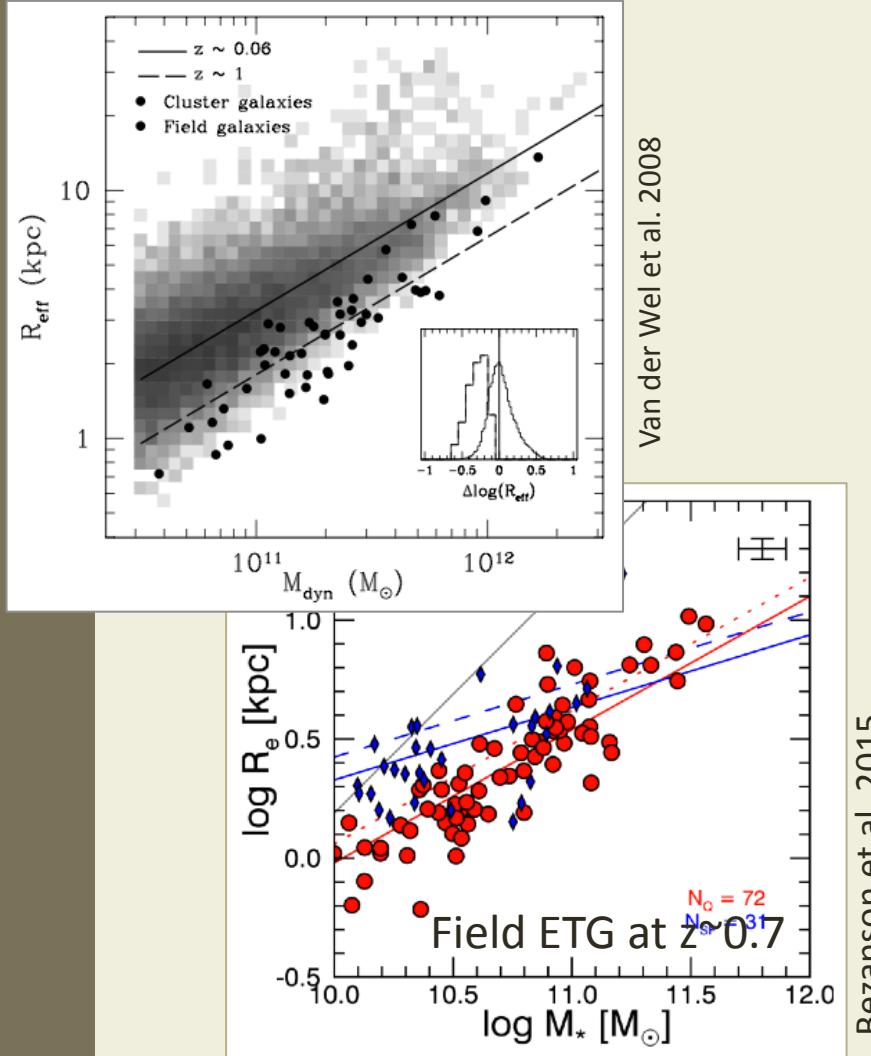
XMM 100ks

Galaxy spectral types

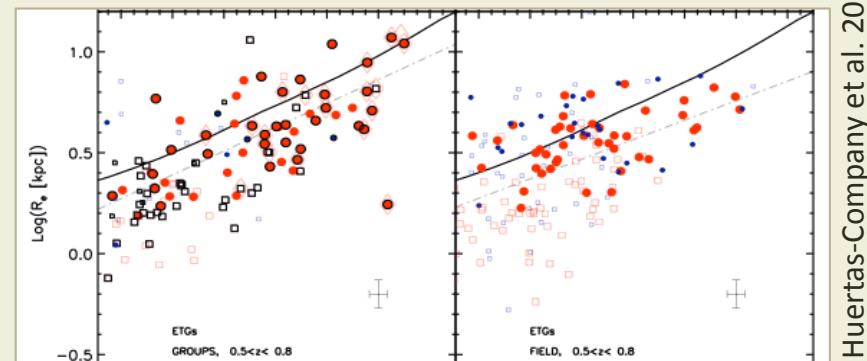


ETG Mass-size relation – field vs. cluster

Field



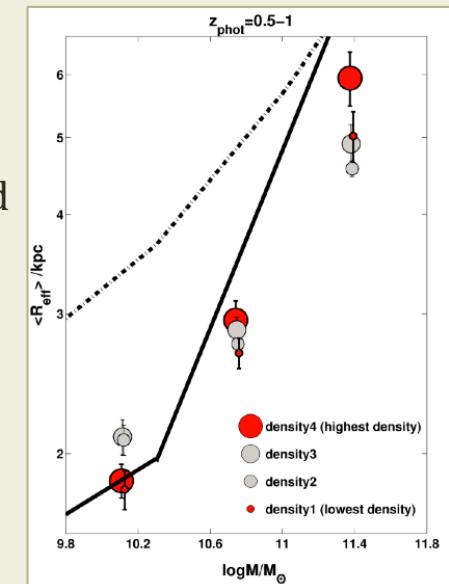
Cluster



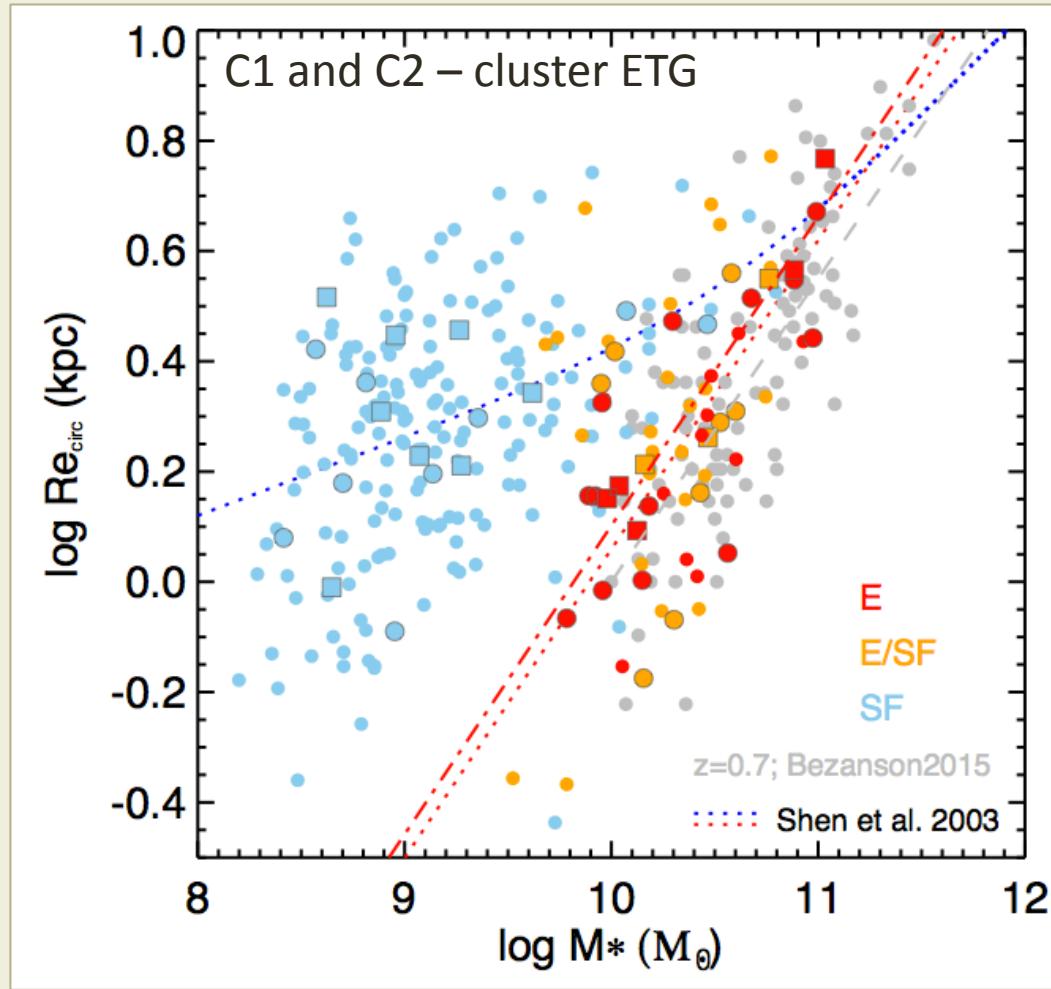
Vs.
Cluster ETG smaller than field at $z \sim 1$
(e.g., Raichoor et al. 2012; Lynx clusters)

Vs.
Faster size growth in
dense environment vs. field
e.g., Lani et al. 2013
here at $0.5 < z < 1$

See also Lani et al. 2013
And Papovich et al. 2010
For $z > 1$ studies



Mass-size relation for cluster ETG at z~0.65



At $M_* > 10^{10.5} M_{\odot}$:
ETG sizes in C1/C2 are 0.07dex
larger than field ETG at $z=0.65$

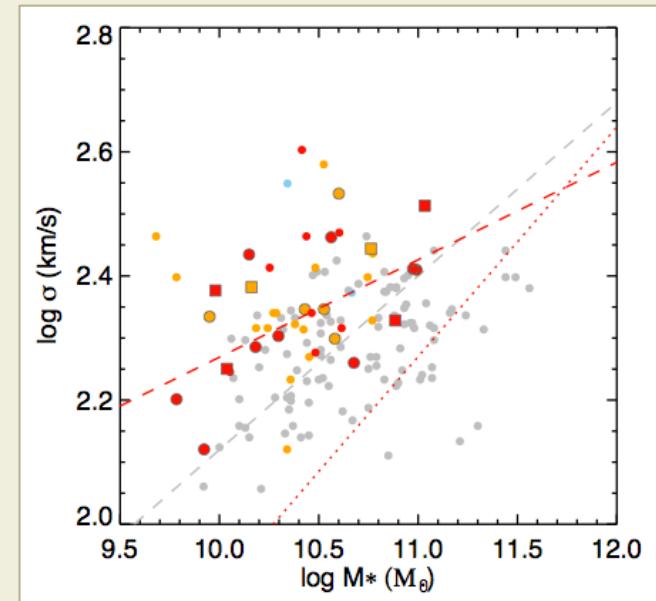
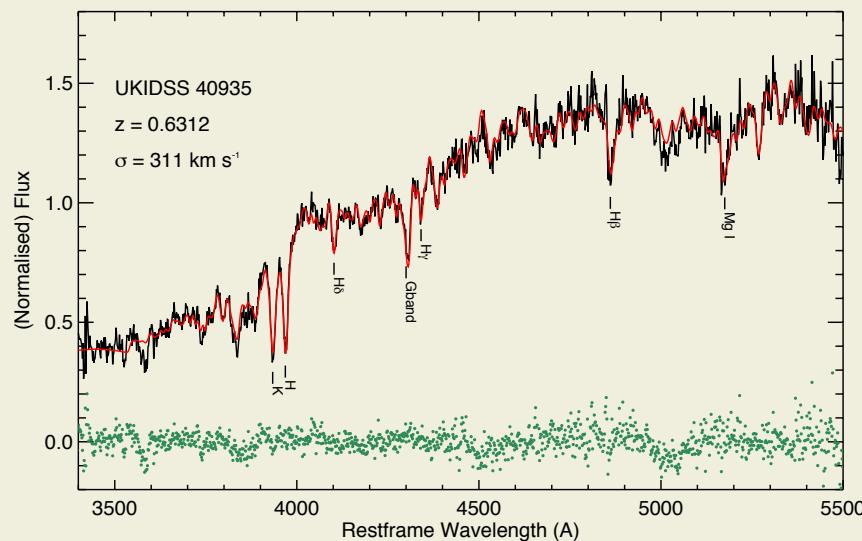
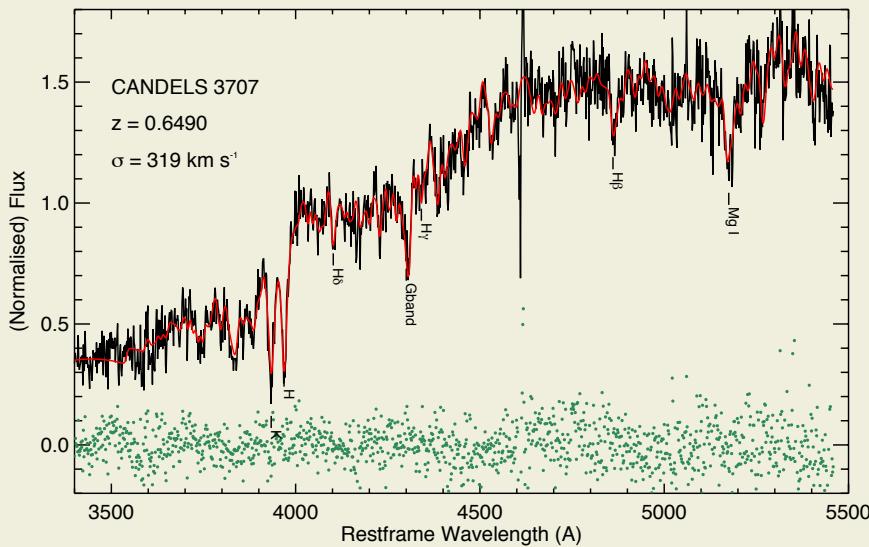
At $M_* < 10^{10.5} M_{\odot}$:
ETG sizes in C1/C2 are on average
larger than field ETG but with a
much broader range of R_e

**Accelerated size growth
in clusters vs. field
Dependence with stellar mass**

The “E/SF” have a broader range
of size: both consistent with
“SF” and ETG field at $z=0.65$

Spectral diagnostics - Preliminary

- Stellar velocity dispersion ~115 sources



Measurements of
D4000, H δ abs., EW[OII]
Etc...
On-going ...

Conclusions & Perspectives

- CANDELS/UKIDSS-UDS hosts a large-scale structure at z=0.65
 - 12 members confirmed including at least 4 “clusters” ($M_{200} > 10^{14} M_\odot$)
 - A unique playground to study of dependence of properties with density
 - Impact on high-z studies e.g., on the luminosity function at high-z.
Magnification bias from group-/cluster-scale lensing?
 - First analysis (structural measurements, velocity dispersion estimates) of ETG in the two main clusters (C1, C2) vs. field.
- Improvements on statistics:
 - Collect 1D spectra for galaxies with zspec from past spectroscopy and (re)derivation of spectral measurements
 - Extend the analysis beyond the CANDELS FoV – need M_*/Re from UKIDSS
- Perspectives:
 - Map the star-formation distribution in the LSS (from e.g., MIPS, SED)
 - Hunt for K+A galaxies
 - Derive the LSS AGN distribution/fraction (Chandra data coming - 1.25 Msec PI: Hasinger/Kocevski)



Back at the Edge of the Universe, Sintra, Portugal, March 2015

Star-formation in UDS0217-05

- Star-formation rates derived from SED fitting
- Star-formation as seen in the mid-infrared:

MIPS 24 μ m-detected cluster/structure members

