Structures and galaxy populations in RXJ1347-11 cluster complex at z=0.45

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University of Vienna

Outline

- Observations & Data
- Mass estimates
- Large-scale structure
- Star formation activity

Most results based on:

Astronomy & Astrophysics manuscript no. rxj1347
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Just submitted

Galaxy evolution in the large scale structures around the most luminous X-ray cluster: RX J1347.5-1145 ⋆,⋆⋆,⋆⋆⋆

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Mon. Not. R. Astron. Soc. **000**, 1–?? (2010) Printed 1 June 2011 (MN LaTeX style file v2.2)

To be submitted

Multi-wavelength observations of Large-Scale Structures at z < 1.0:

Colour-magnitude relation, Butcher-Oemler effect, X-ray, kinematic and lensing mass estimate. ⋆

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Observations & Data utilized: Imaging / Photometry

Table 1: Sumary of the CFHT/MEGACAM observations.

Program / PI	Filter	Exp. Time [s]	M_{limit} [a] [mag]	seeing ["]
2006BH34 / H. Ebeling	u^*	4260	25.09	0.95
2005AC10 / H. Hoekstra	g'	4200	26.44	0.82
2005AC10 / H. Hoekstra	r'	6000	25.94	0.77
2005AC12 / M. Balogh	i'	1600	25.74	1.03
2005AC12 / M. Balogh	z'	3150	24.80	1.14

[a] S/N=5 in an aperture of 1". Magnitudes are in the AB system.

restframe

NUV

4000Å beak

r

GALEX GI3 103/Hicks NUV 9120s 24(ABmag) FUV
FUV 9120s *not used here*

ESO/MPG2.2m WFI: BVRIz *not used here*

Observations & Data utilized:
HST Imaging

CLASH *TOP SECRET*

Previous: ACS: 475,814,850 WFPC2: 606,702

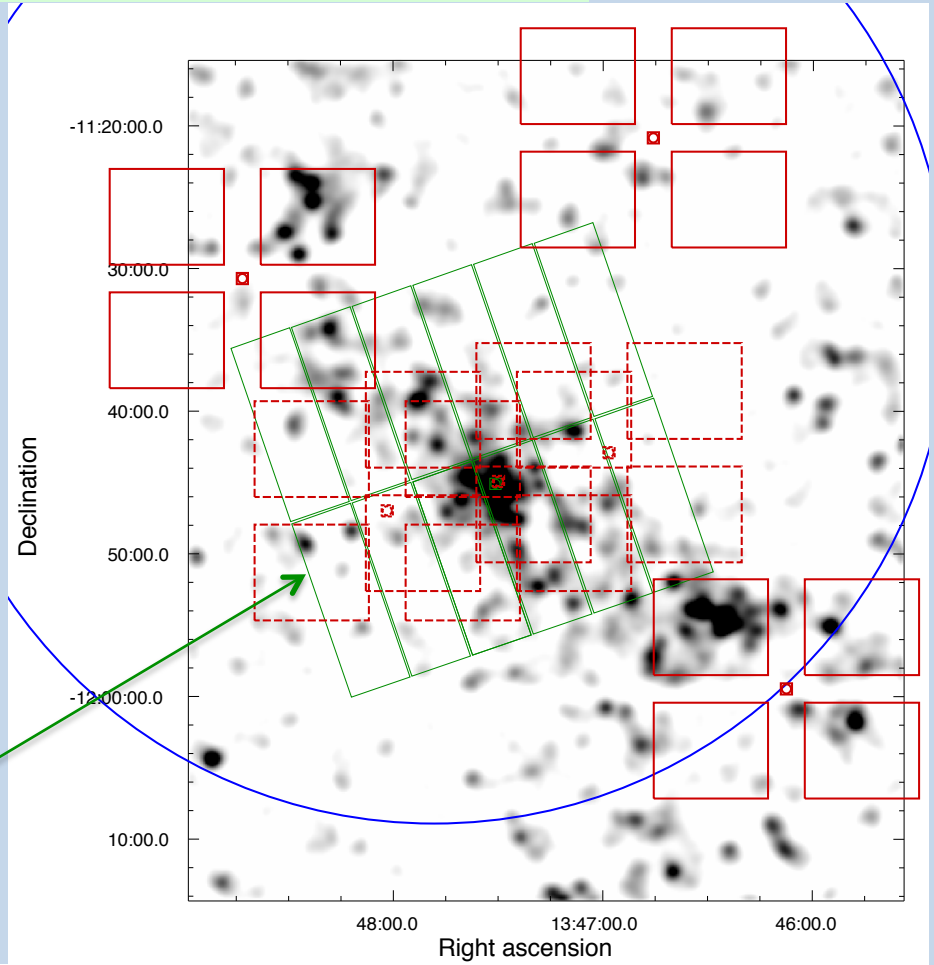
Observations & Data utilized: VIMOS spectroscopy

PID: 169.A-0595, LRblue grism
PI: Böhringer
dashed red squares

PID: 381.A-0823, MR grism
PI: Verdugo
red squares
750 redshifts

GALEX

XMM EPIC



Cluster	Telescope/Instrument	ObsID	Filter/Mode	total exposure [s]	clean exposure [s]	Net counts[a]
RXC J1347.5-1145	Chandra/ACIS-I	3592	VFAINT	57714	44152	24870
	XMM/MOS2	0112960101	Thin/FF	38122	30081	6918
	XMM/MOS1	0112960101	Thin/FF	38122	31283	7195
	XMM/EPN	0112960101	Thin/FF	38872	24365	19614

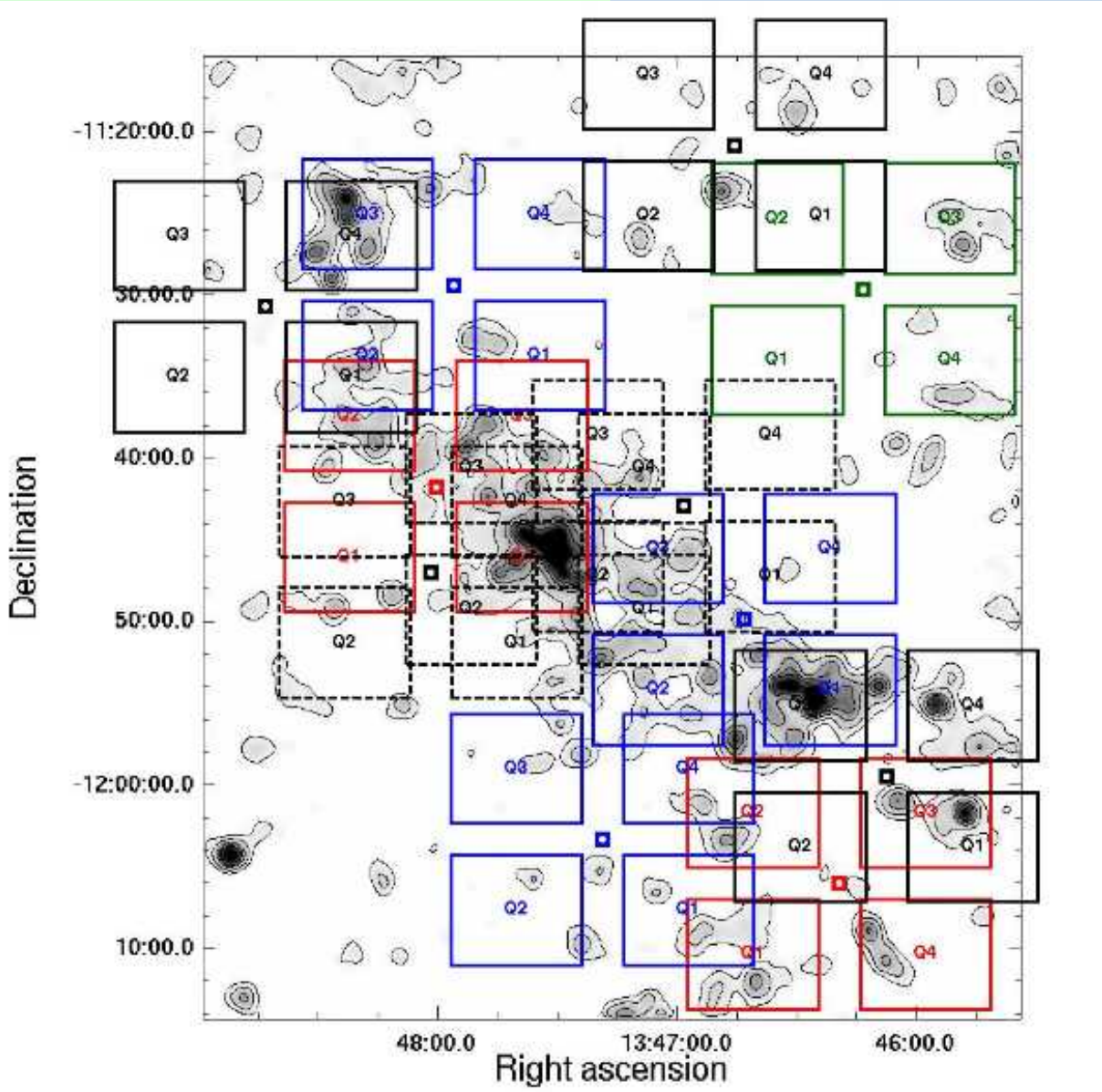
PI: Turner (0484)

Observations & Data utilized: VIMOS spectroscopy

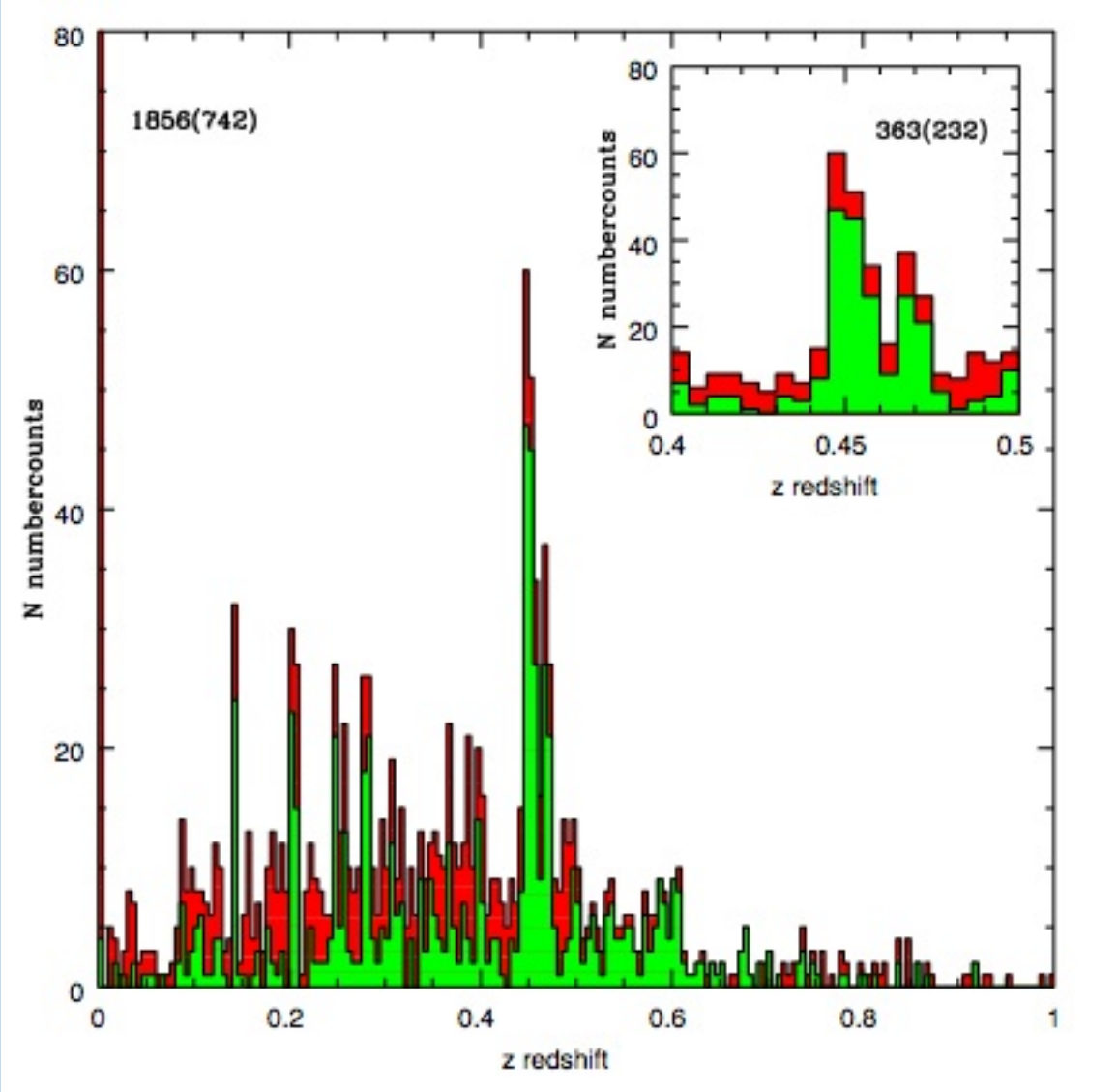
MR grism: **SF activity, AGN ...**
PID: 381.A-0823, PI: Verdugo
PID: 384.A-0909, PI: Ziegler
PID: 385.A-0819, PI: Verdugo

2500 targets
~1000 cluster members

HR grism: **gal. kinematics**
PI Ziegler:
386.A-0688
087.A-0361
088.A-0354 ?



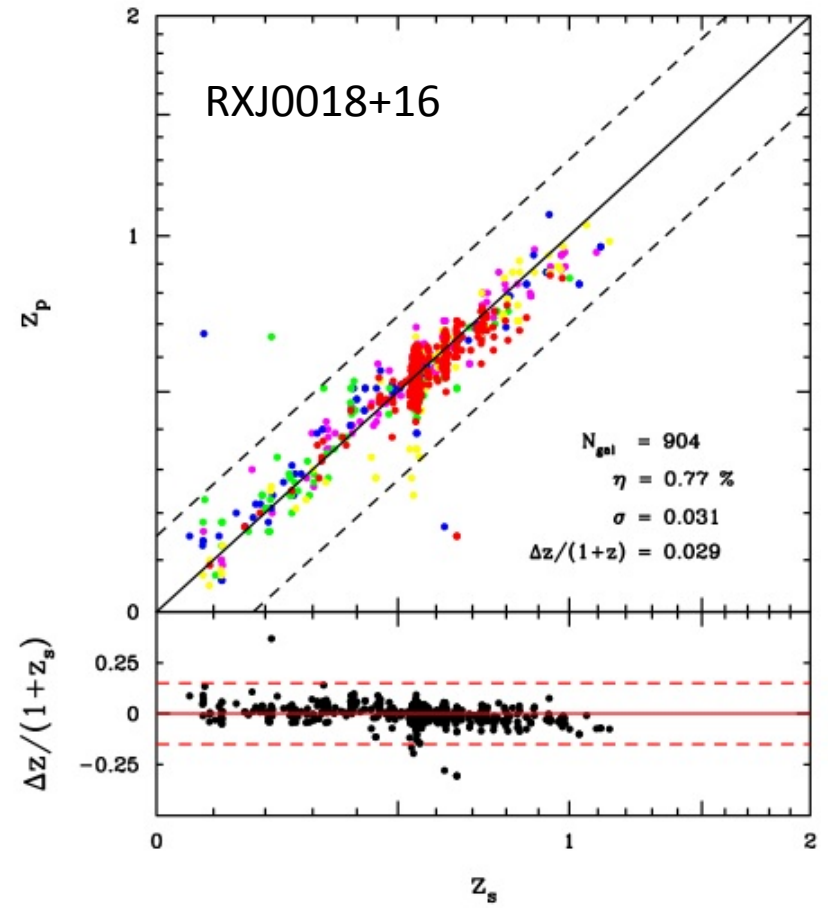
Redshift Distribution

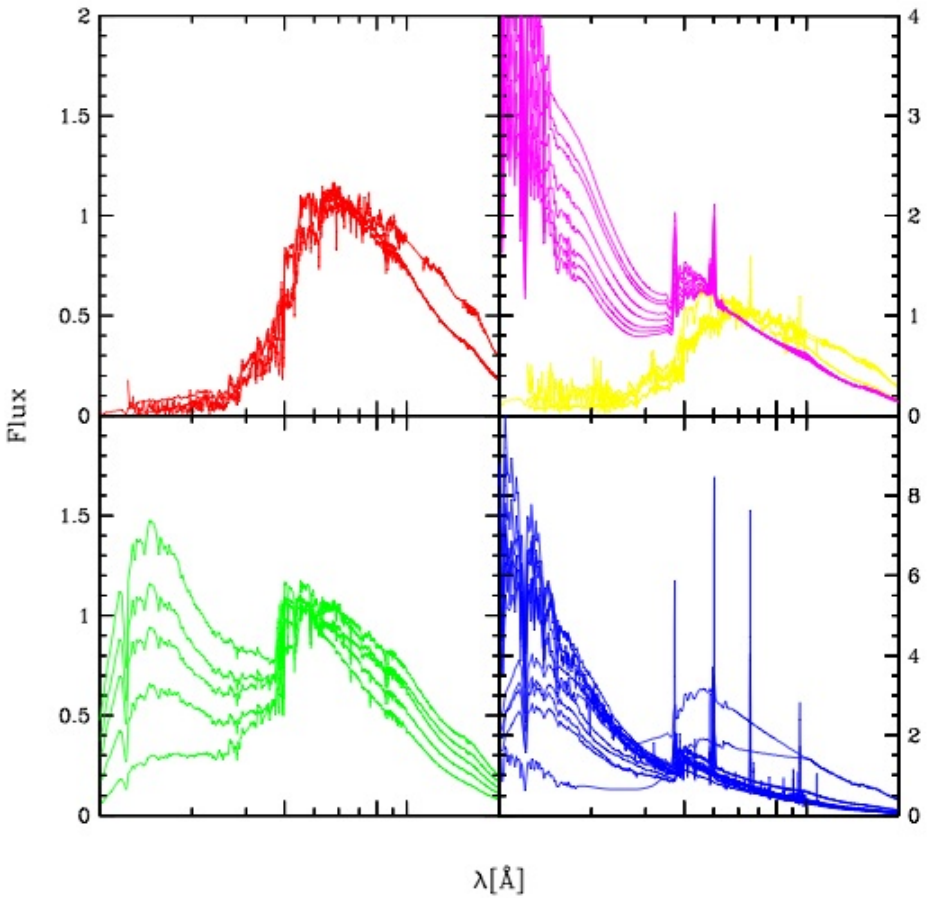


red: all spectra

green: high-confidence spectra

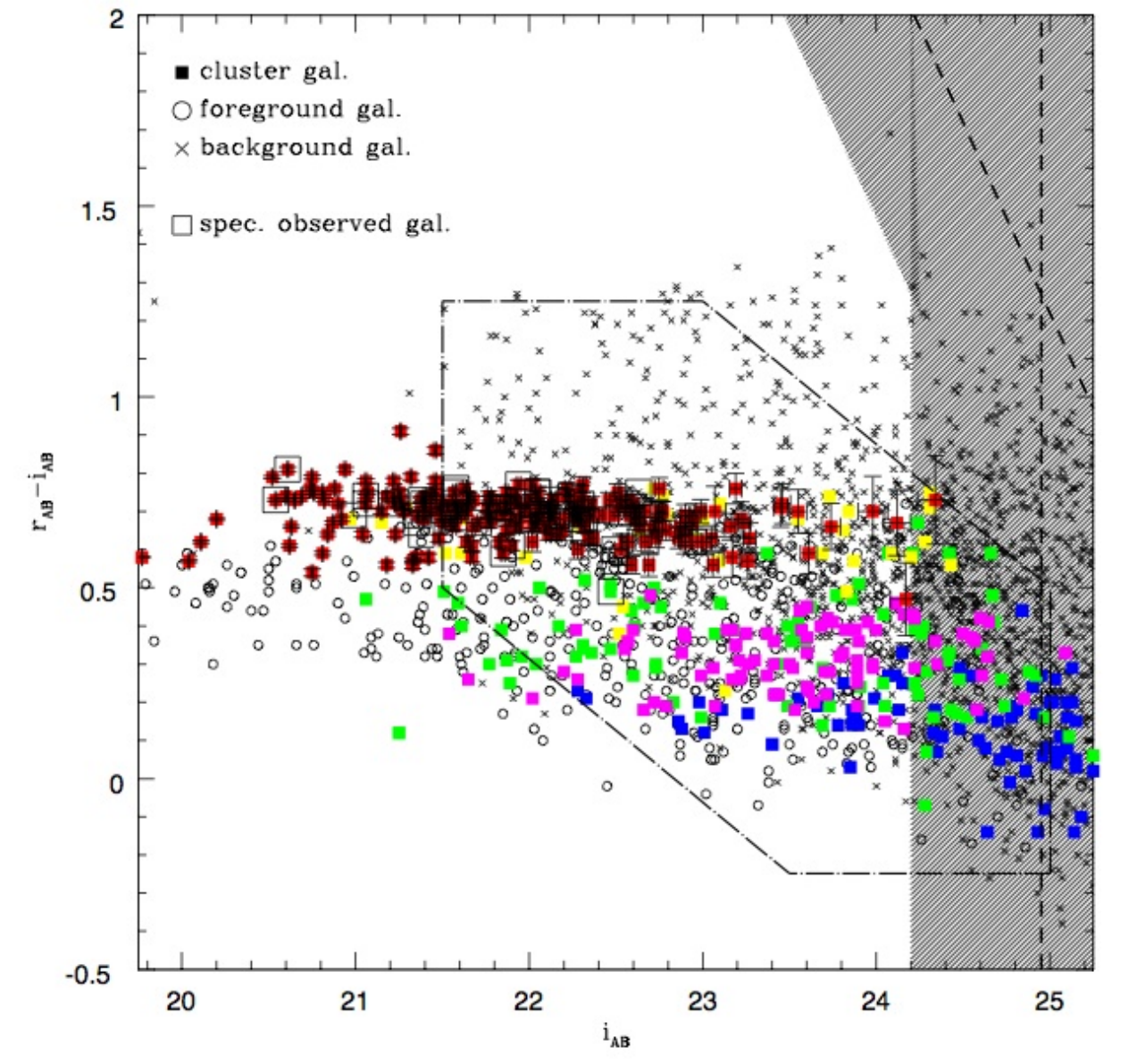
Photometric Redshifts



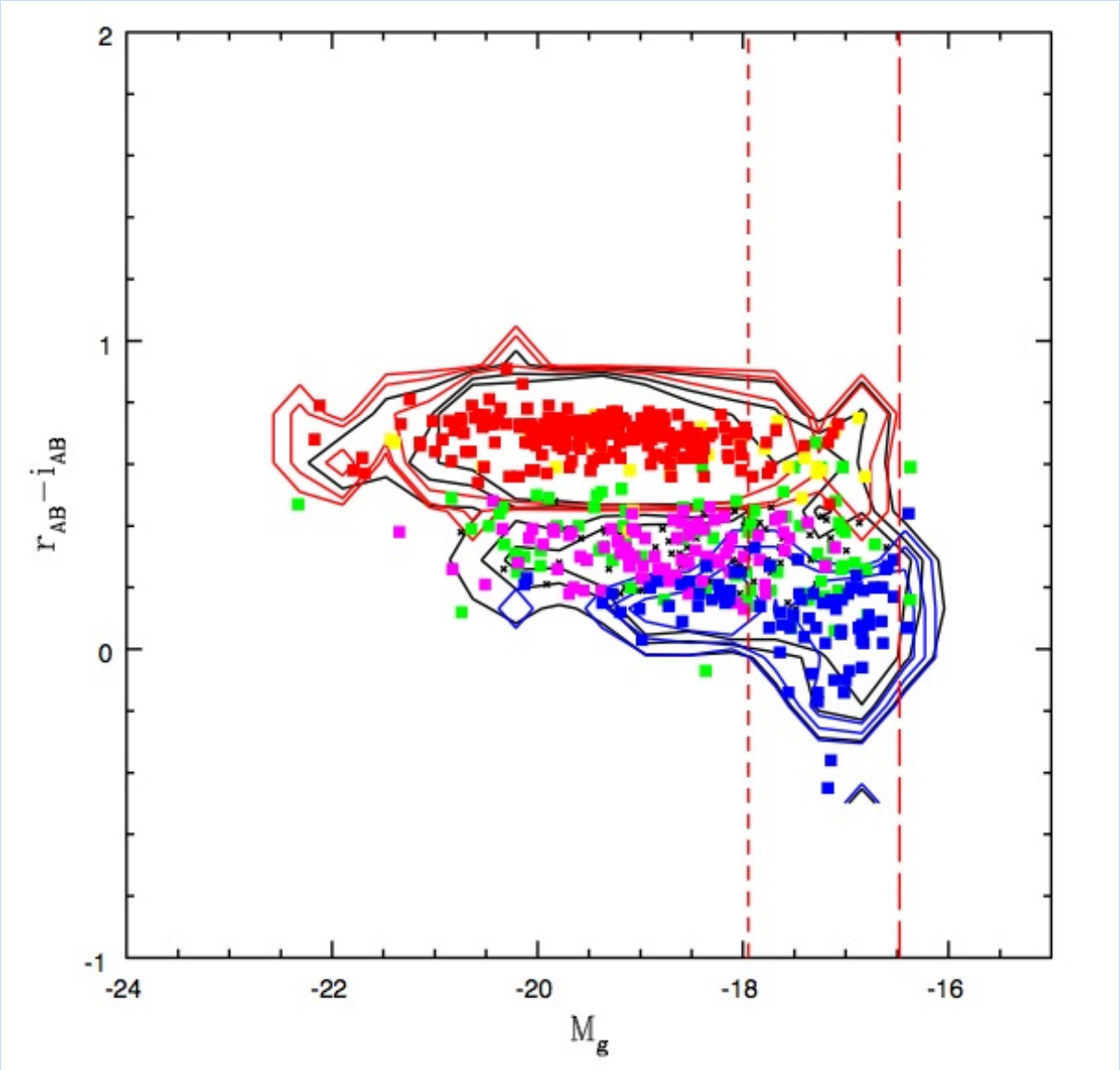


using PHOTO-z method of Bender

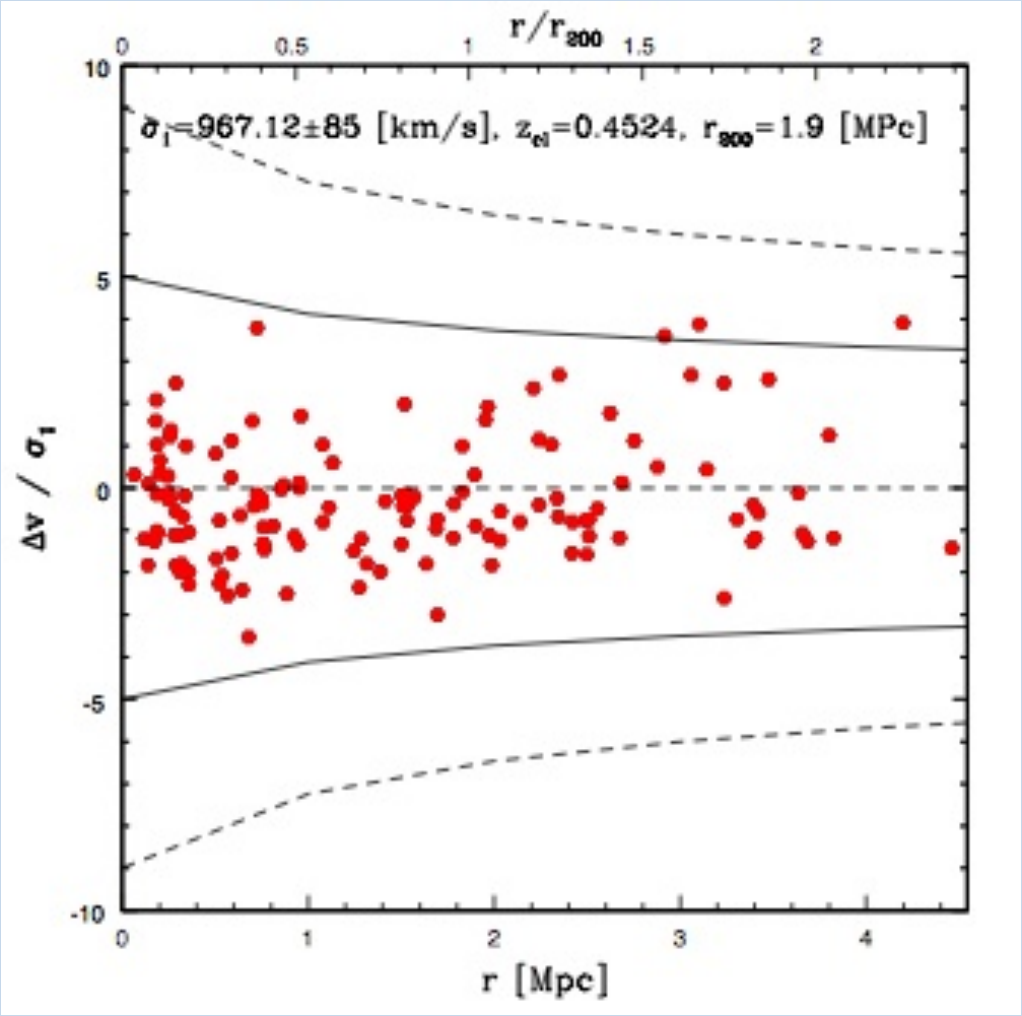
Color-Magnitude relation



Color-Magnitude relation



Cluster kinematics

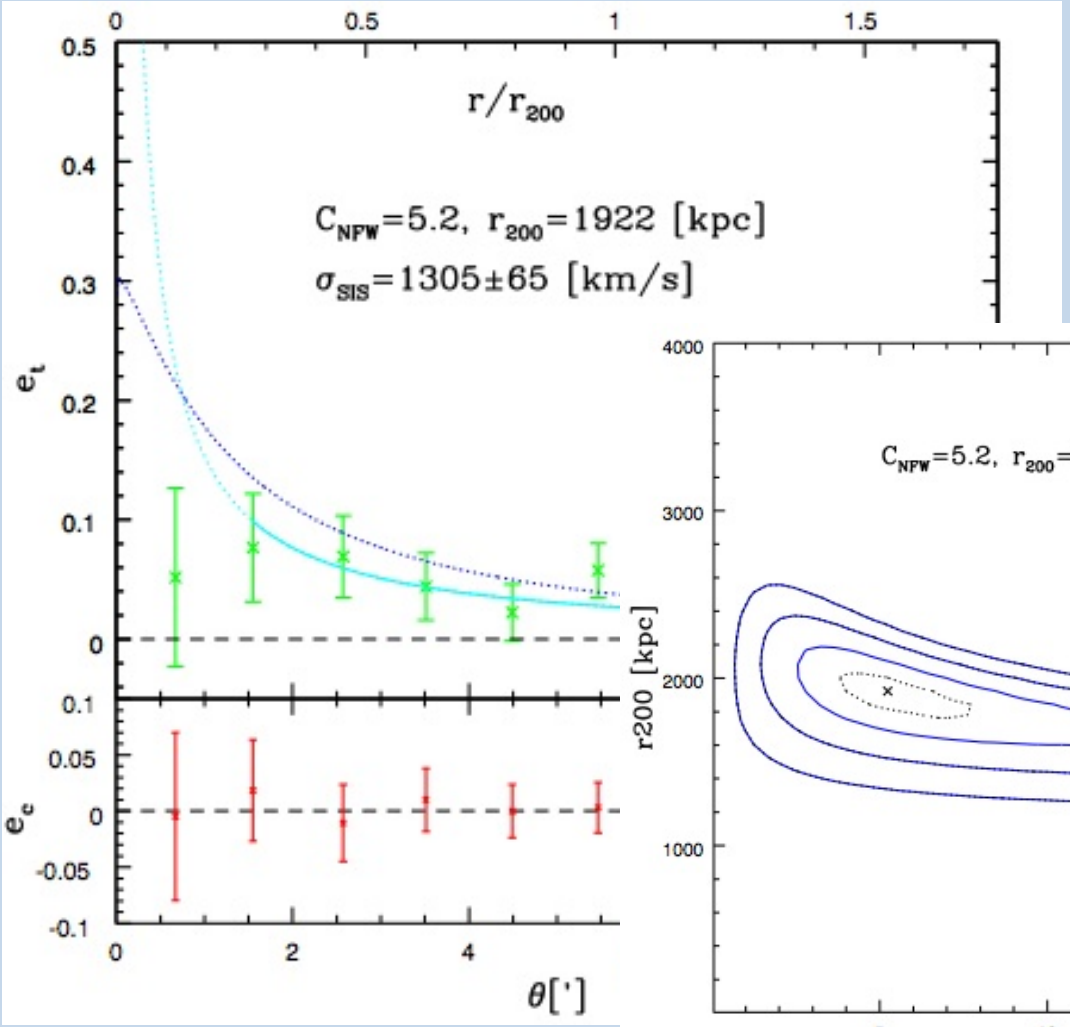


cluster membership according to Carlberg et al. 1997 method

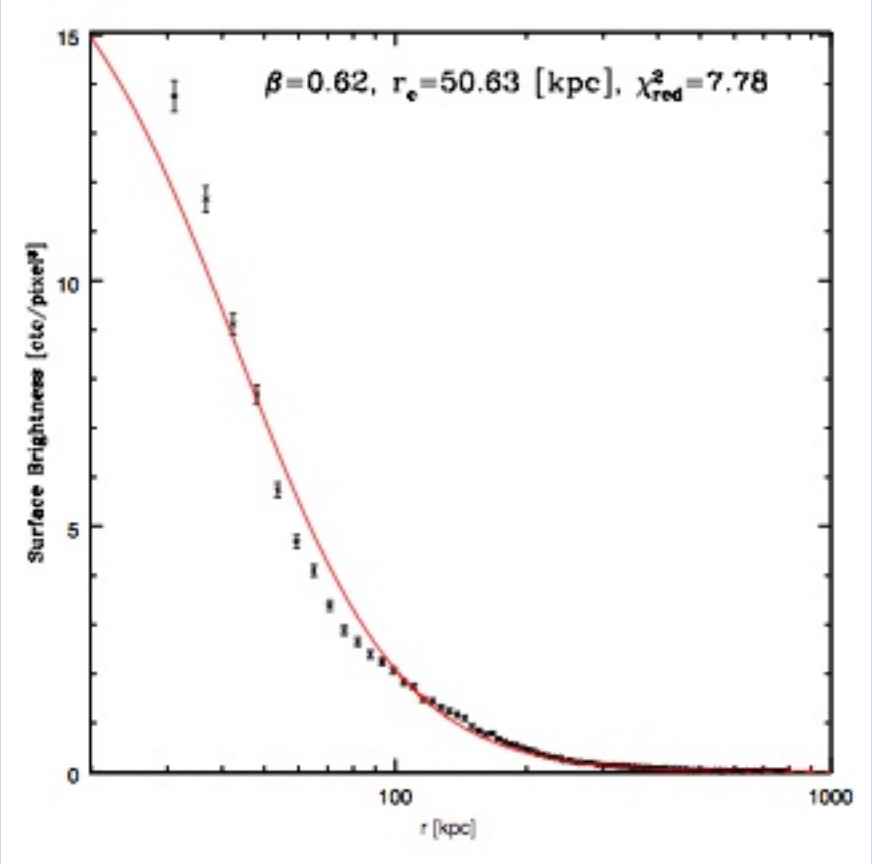
Weak Lensing

tangential shear

cross shear

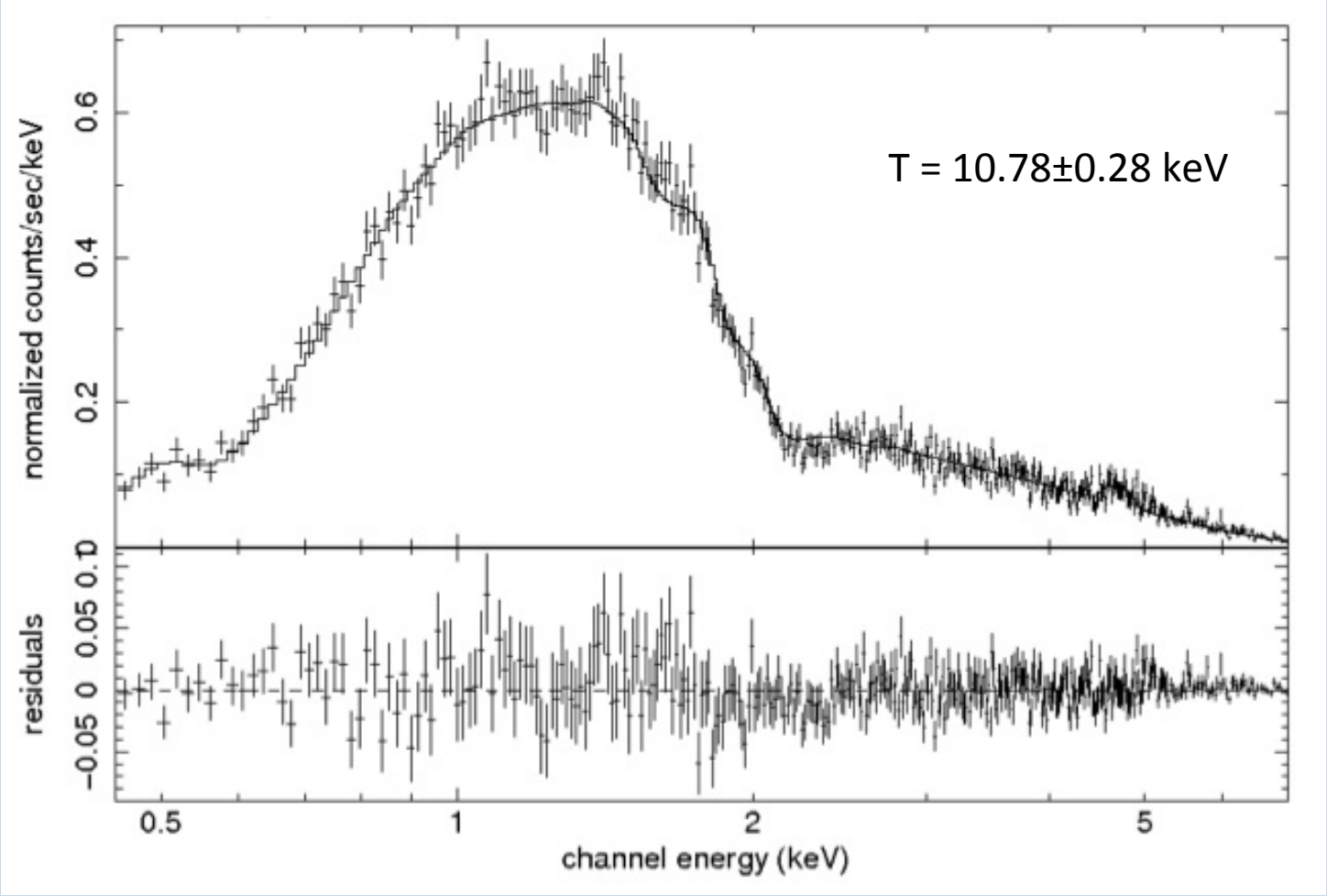


X-ray surface brightness profile



single β model fit for 0.4-7.0 keV range

X-ray spectrum



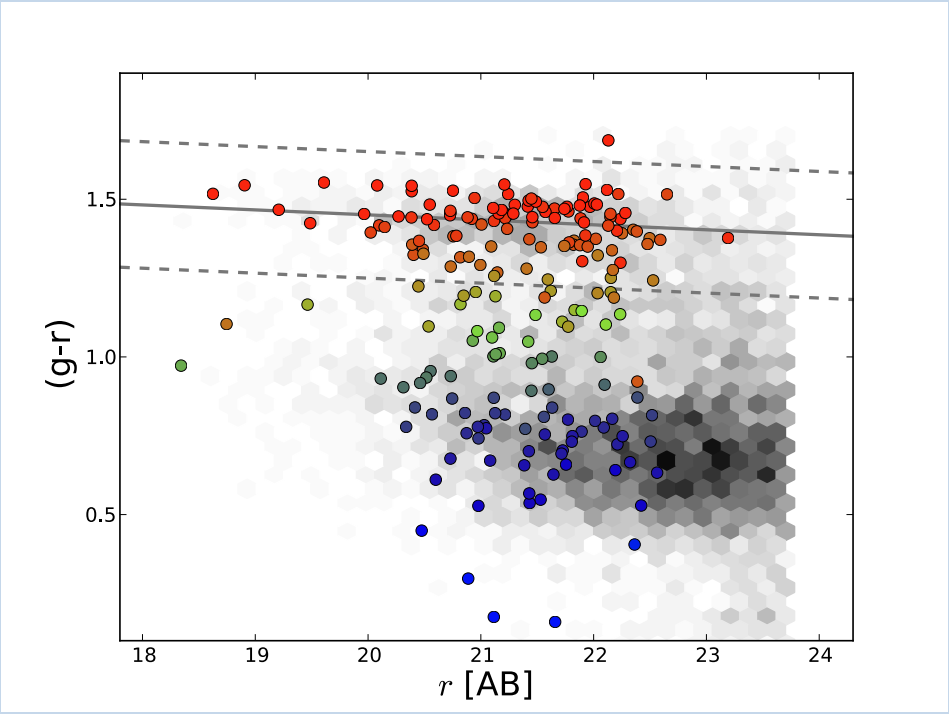
core spectrum XSPEC with single temperature model

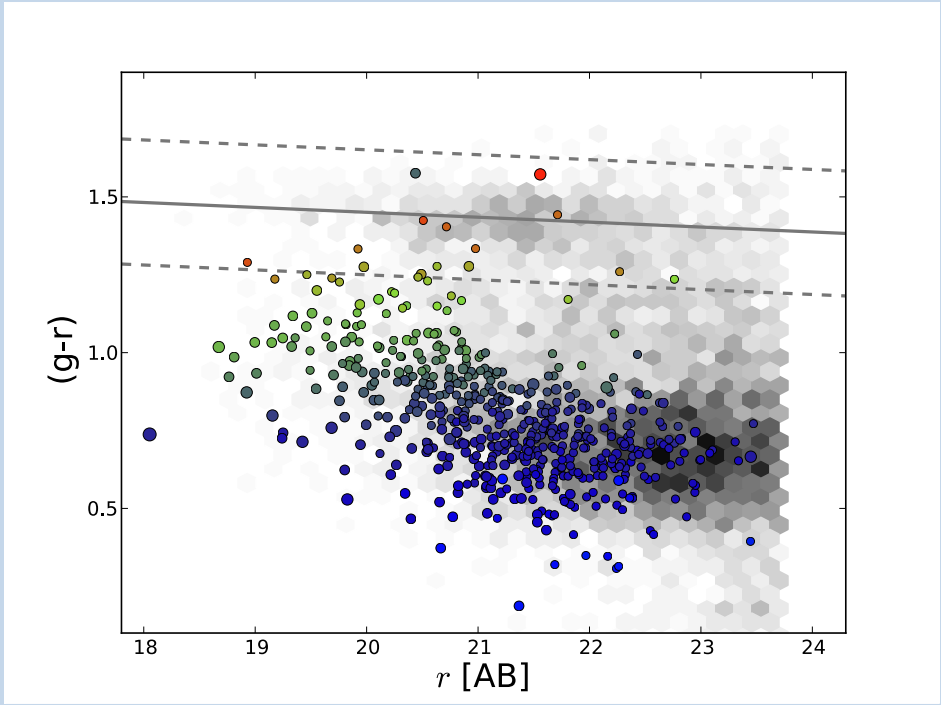
Cluster mass estimates

Cluster	r_{200} [kpc]	M_{200} [$10^{14} M_\odot$]	Method (Remark)
RXC J1347.5-1145	1865 ± 170	12.10 ± 3.32	Kinematic
RXC J1347.5-1145	1953 ± 70	14.0 ± 1.50	X-ray
RXC J1347.5-1145	1922 ± 200	13.30 ± 4.15	WL (NFW)
	2900	19.1 ± 6	optical richness (Reyes+08)

assuming spherical symmetry while there are sub-components...

Color-Magnitude relation

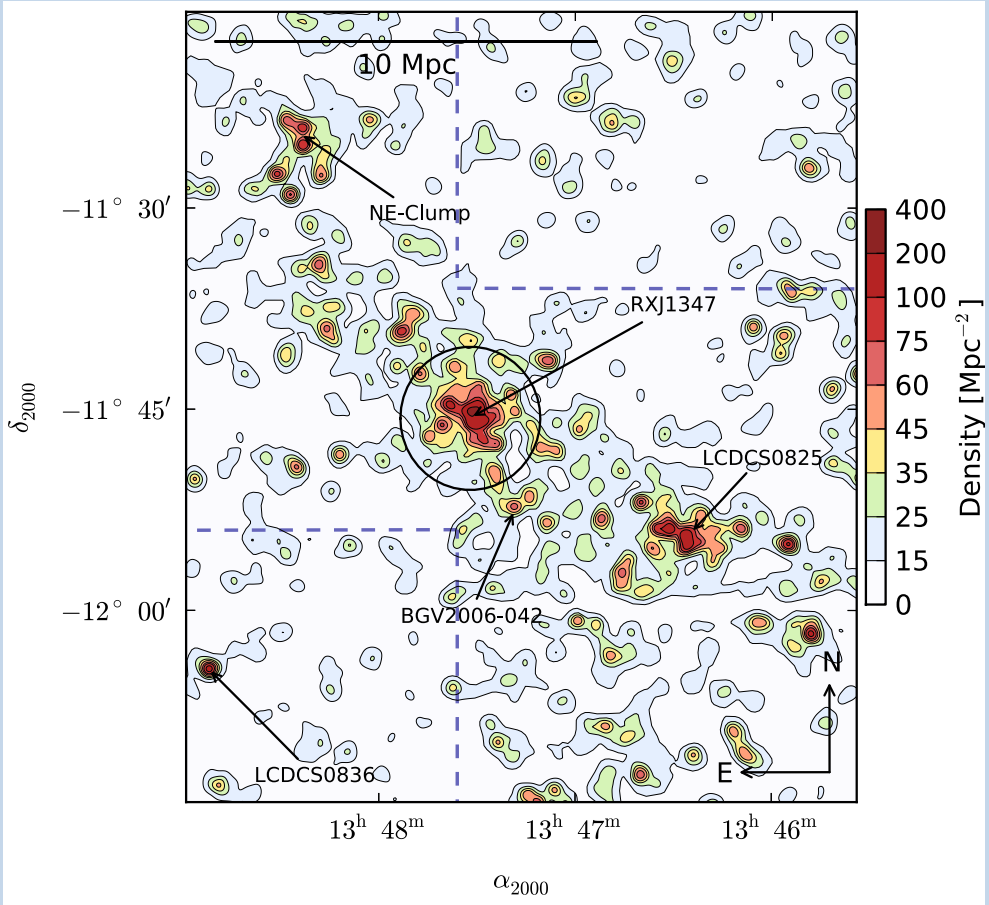




all spec. members in color
all phot. members in grey

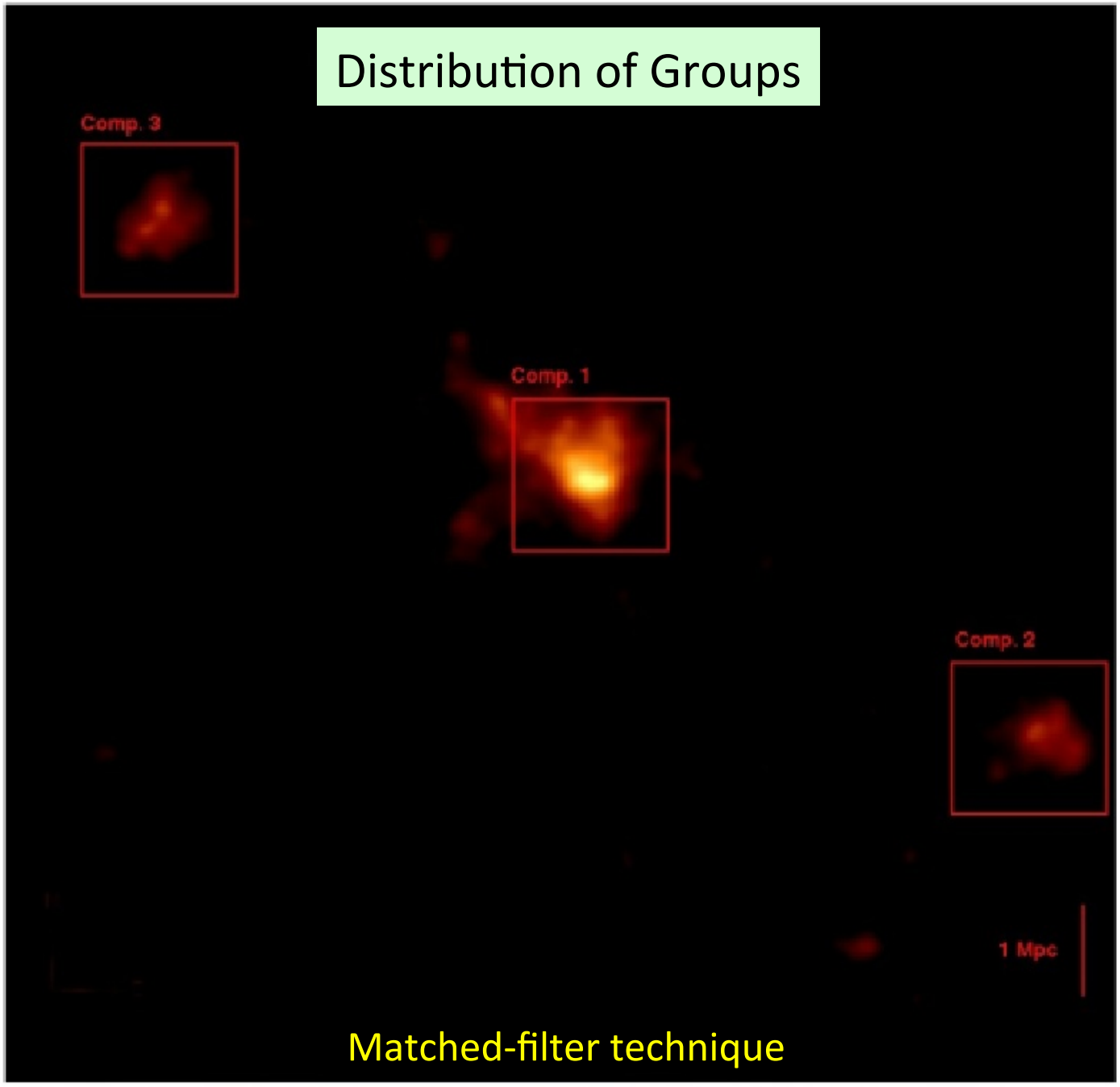
all NUV GALEX detections

Galaxy Number (Over)-Density



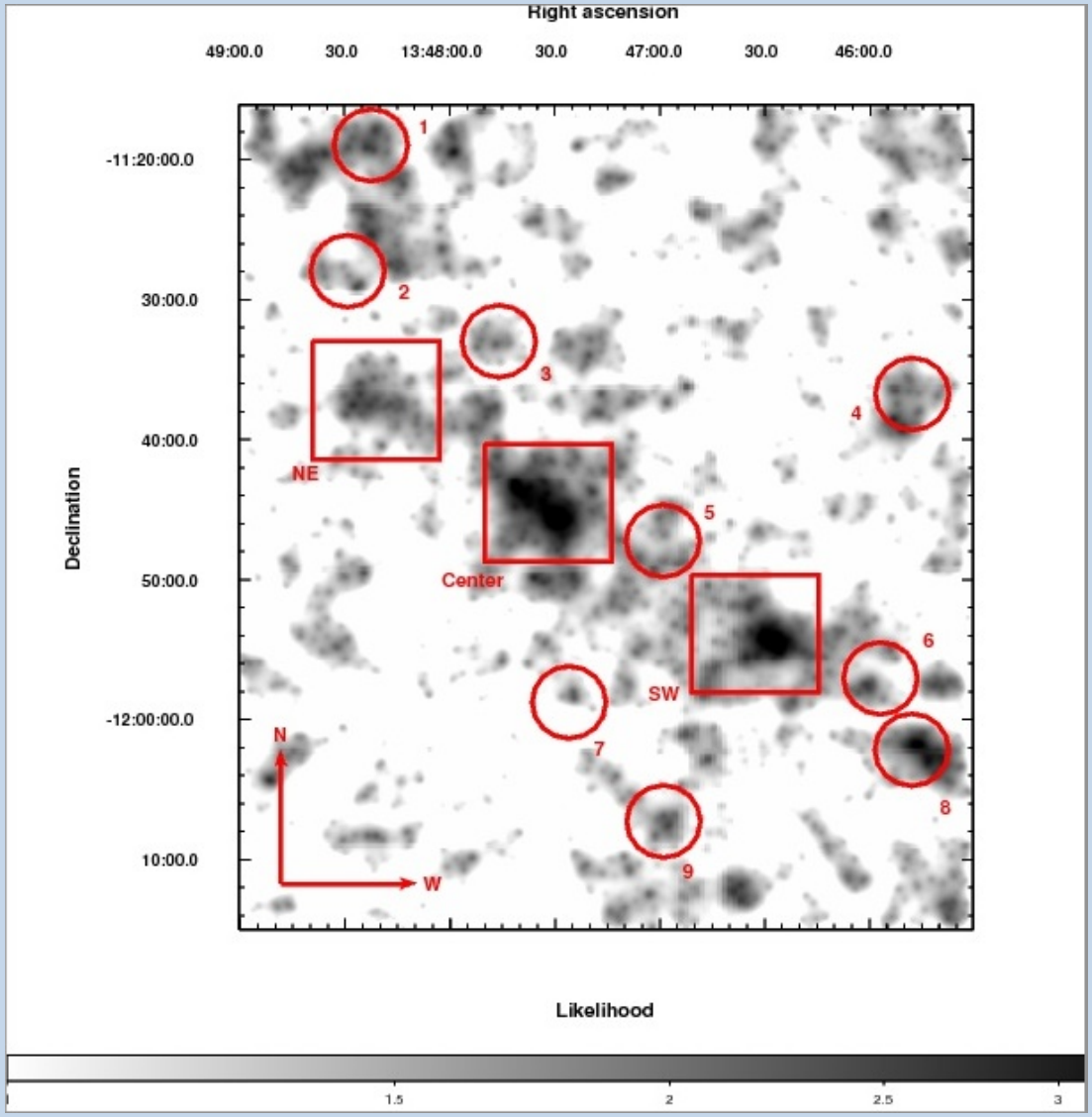
Nearest neighbor density $\Sigma_{10} = \frac{11}{\pi r_{10}^2}$ generalized: “cluster tomography” (Pello+09)

Distribution of Groups



Matched-filter technique

Distribution of Groups

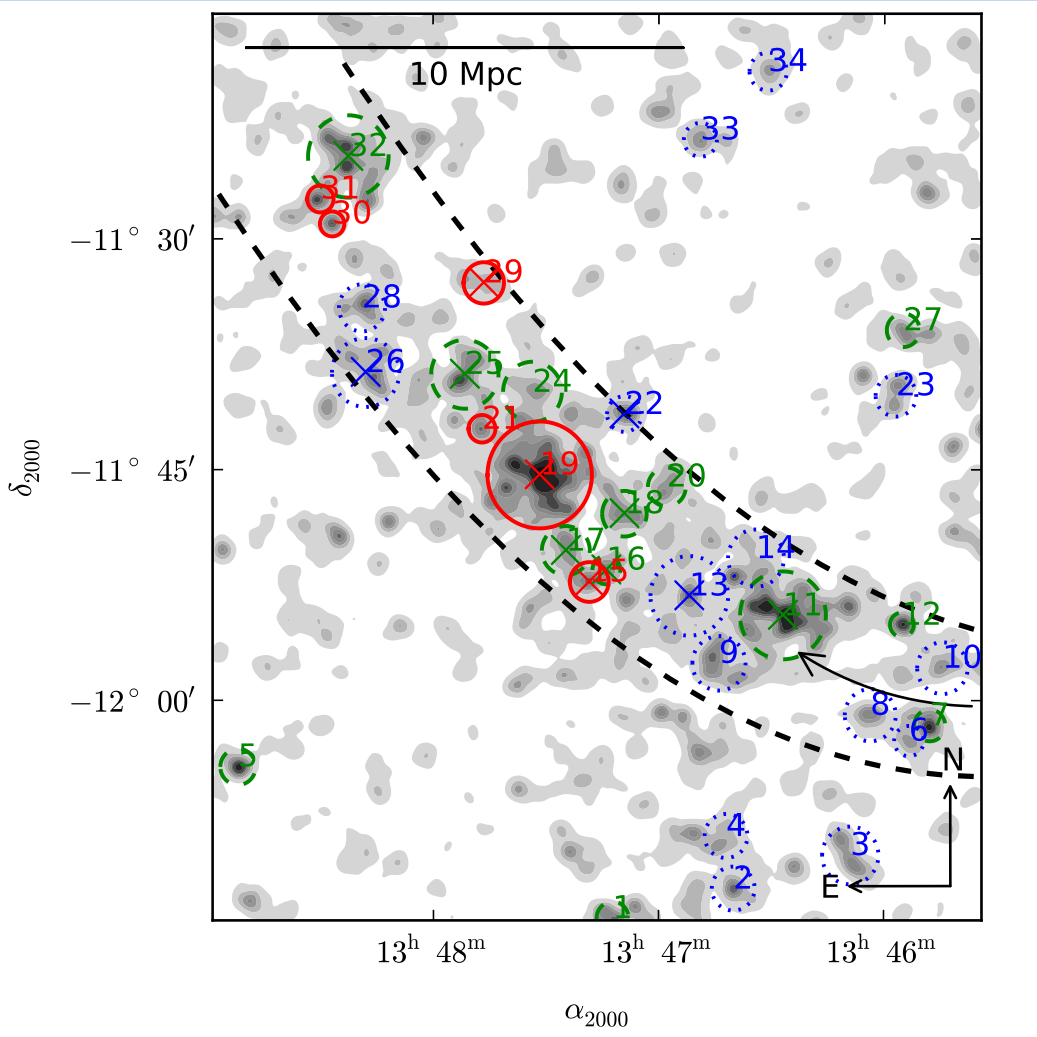


Matched-filter + red-sequence technique (Dietrich+09)

Distribution of Groups

$f_{blue} < 0.5$

$f_{blue} > 0.75$

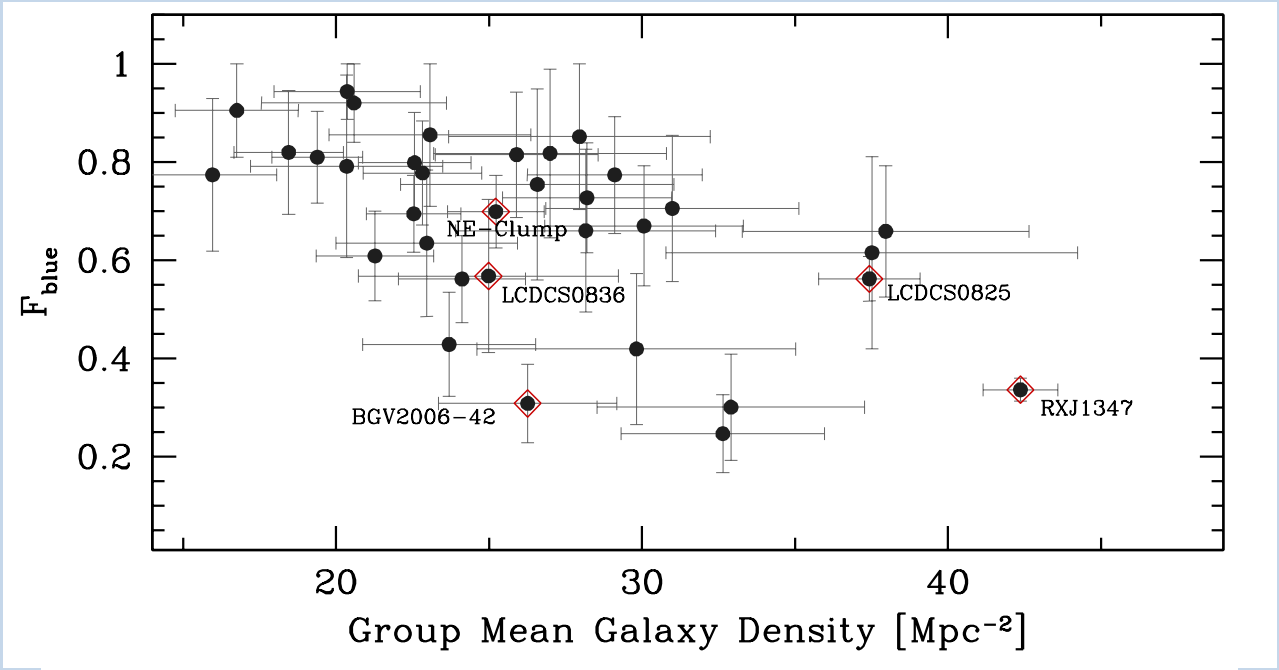


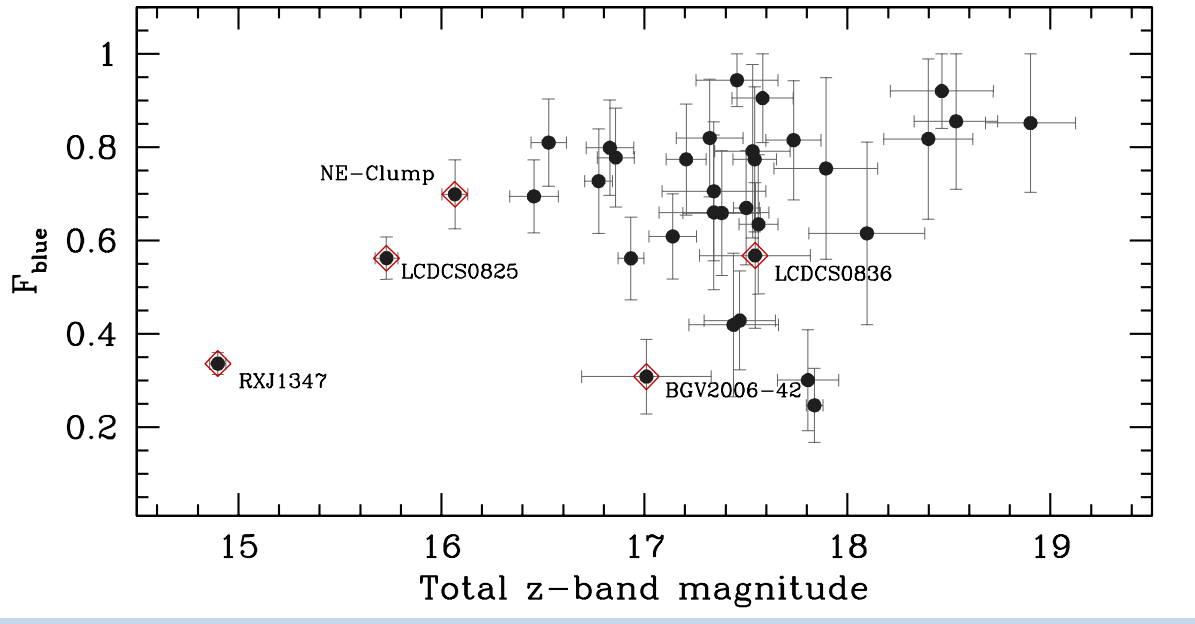
$0.75 > f_{blue} > 0.5$

X: x-ray detection

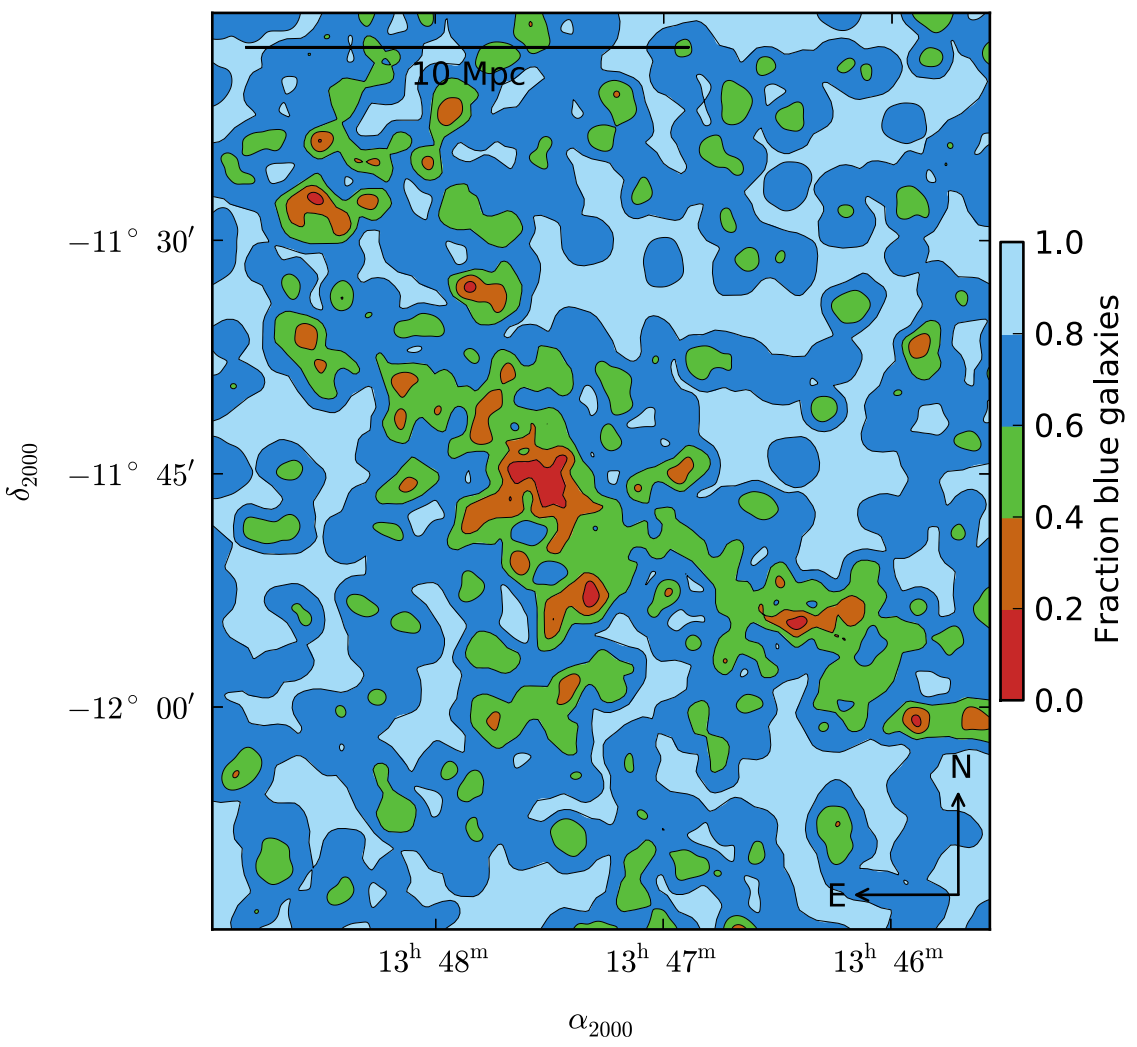
Voronoi-Delaunay tesselation algorithm (Ramella+01)

Distribution of Groups

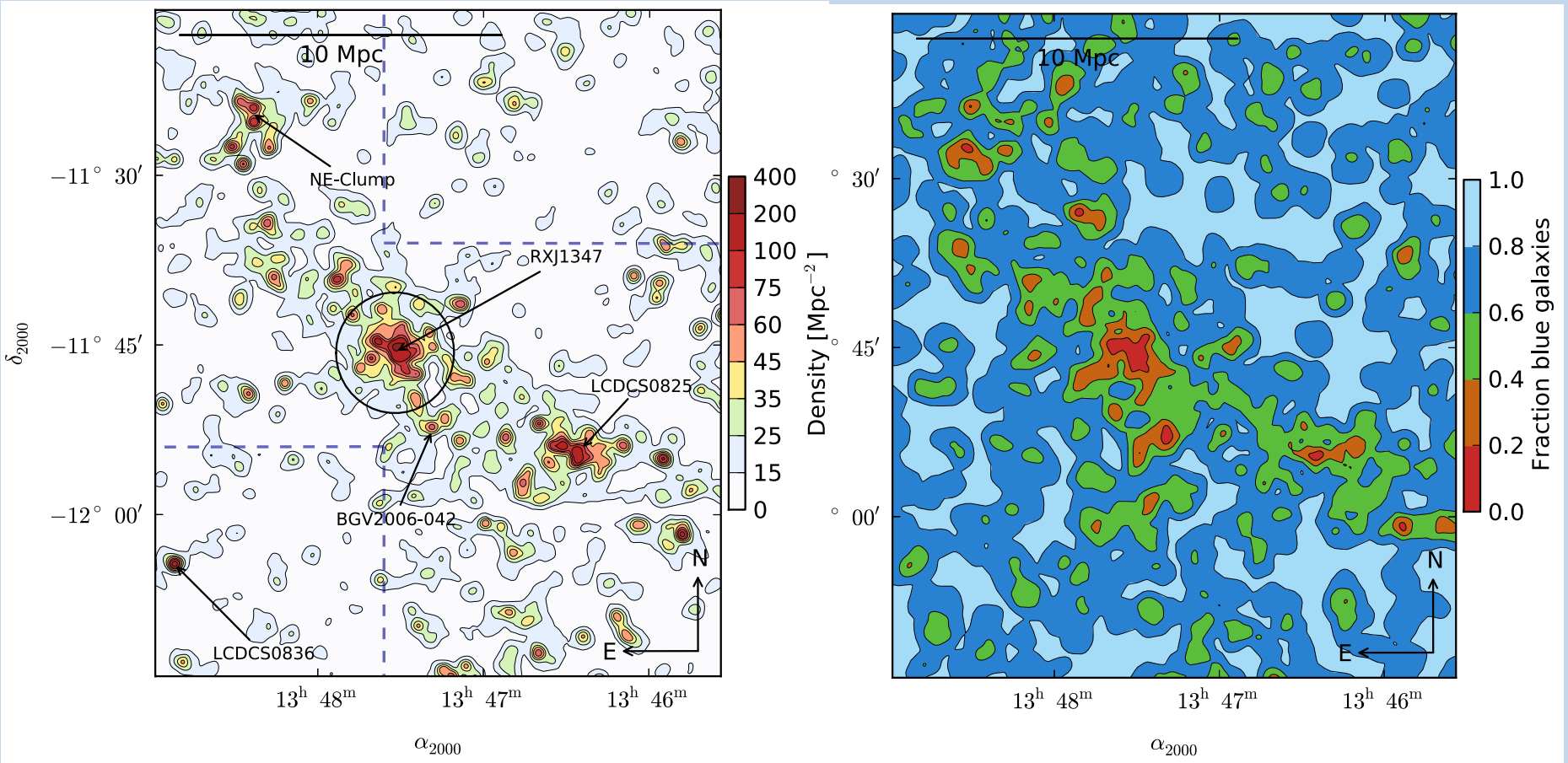




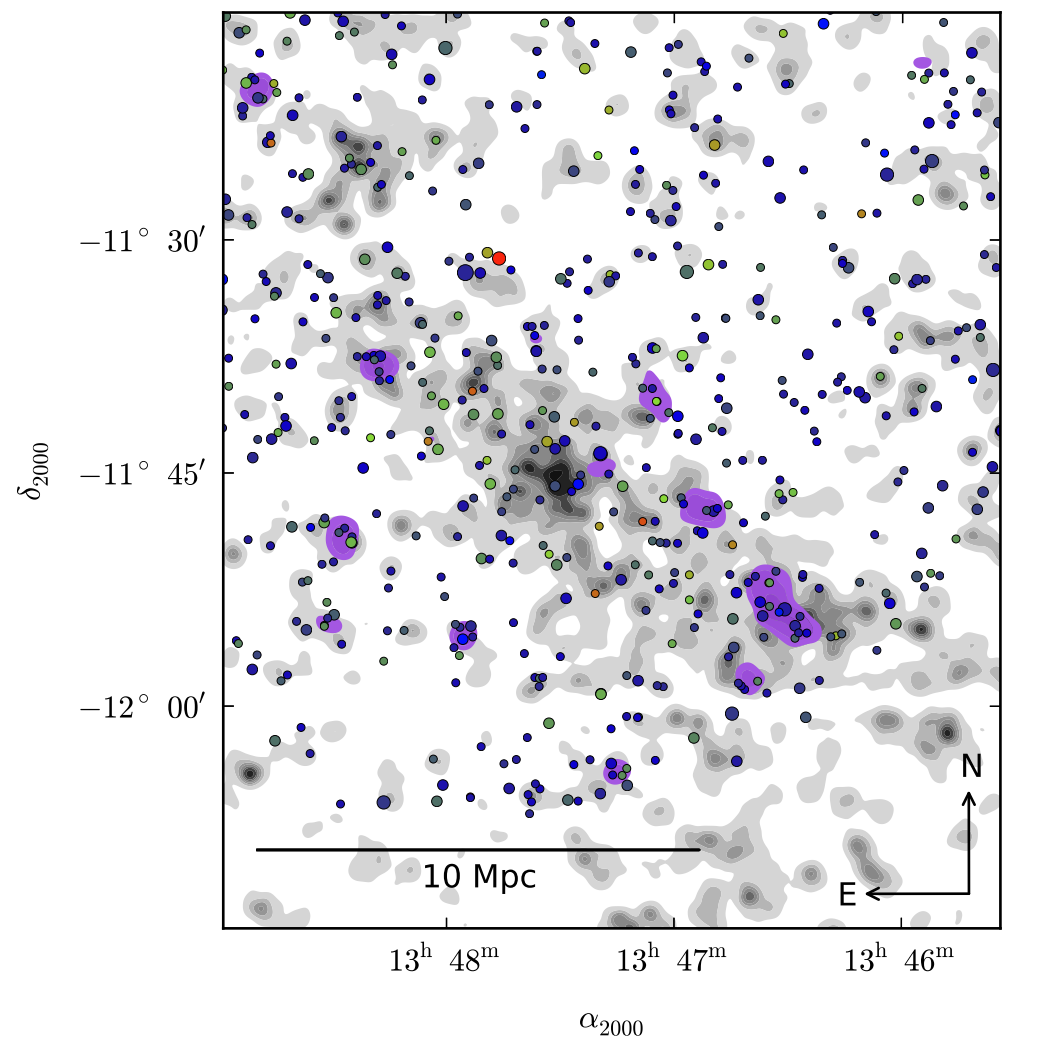
Distribution of Blue Galaxies



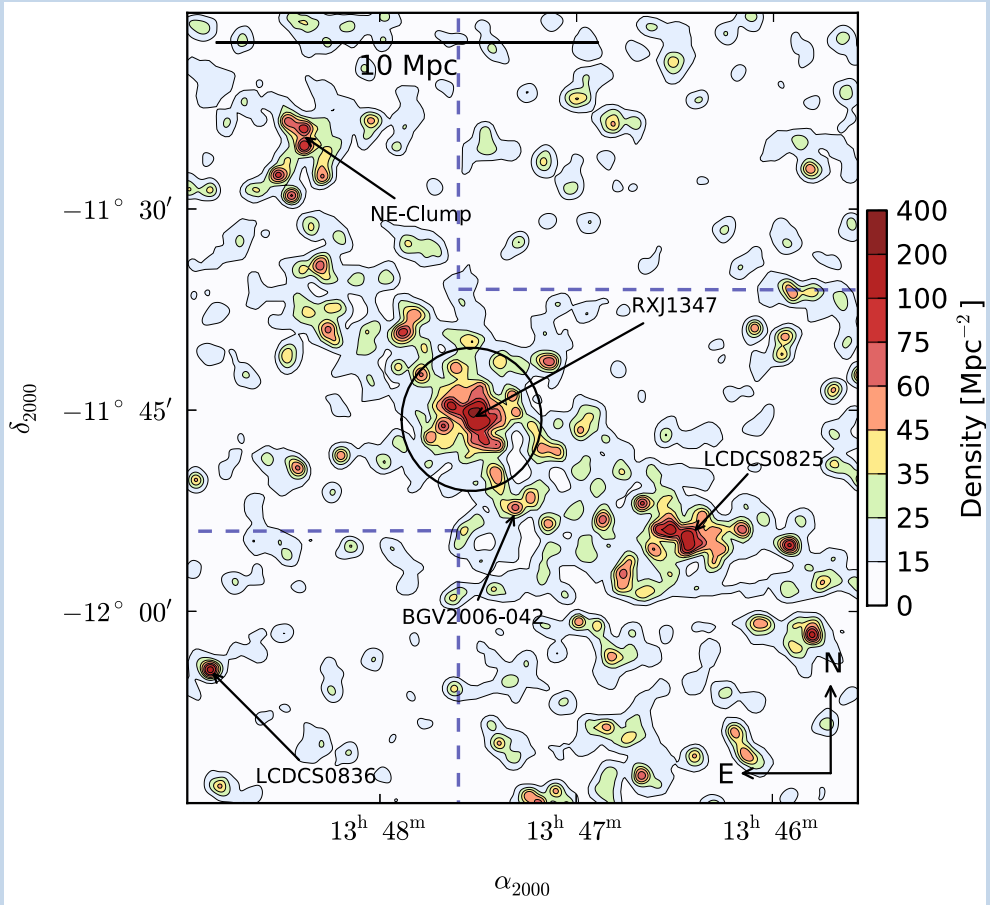
Distribution of Blue Galaxies

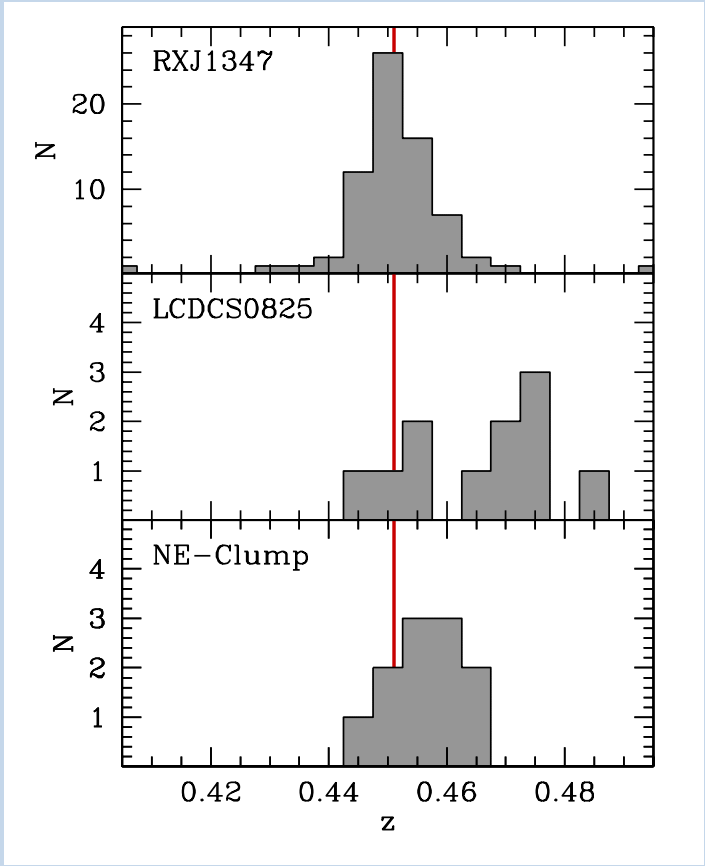


Distribution of GALEX NUV sources



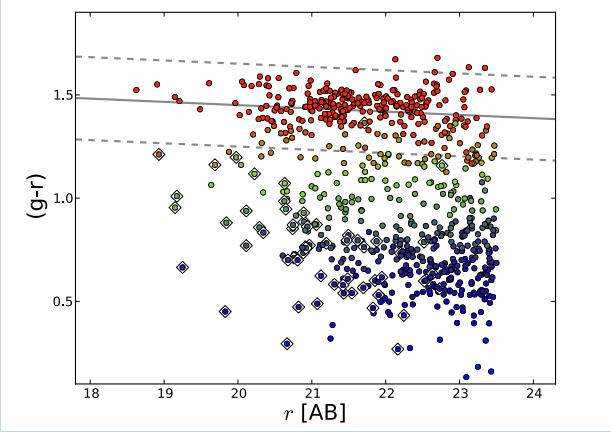
RXJ1347-11 cluster complex at *z≈0.45*

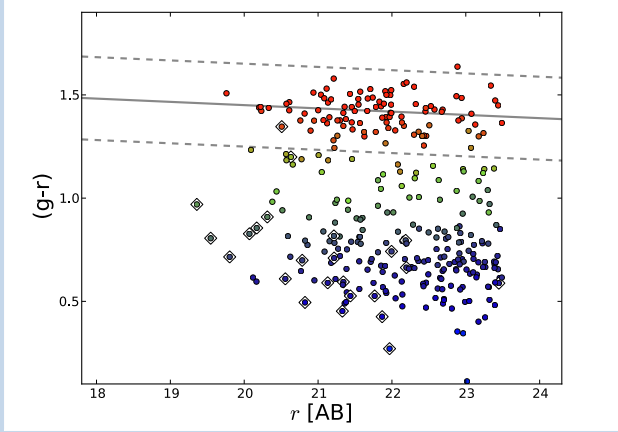


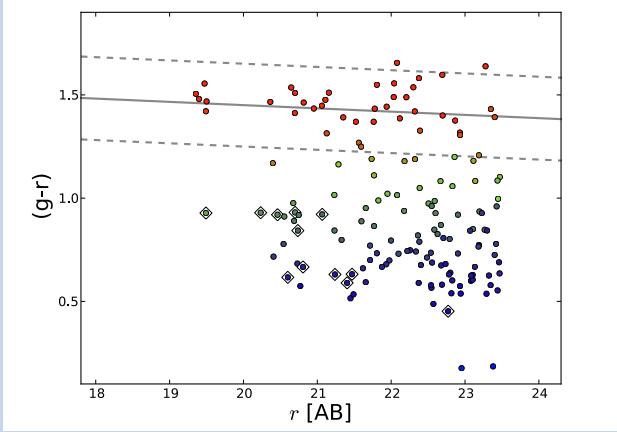


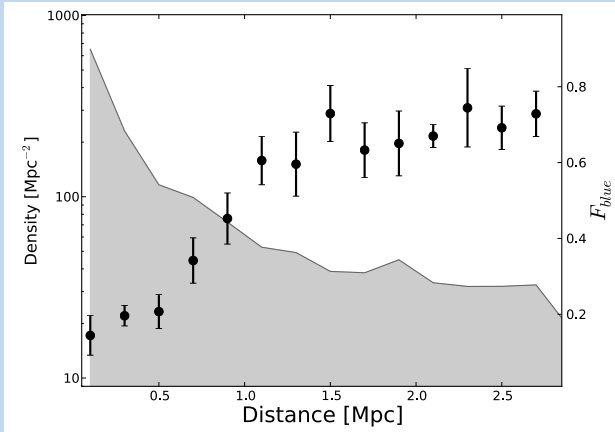
spec. redshifts

RXJ1347-11 cluster complex at *z≈0.45*

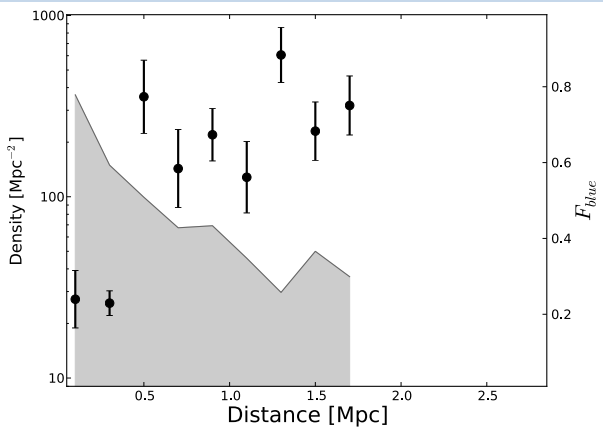




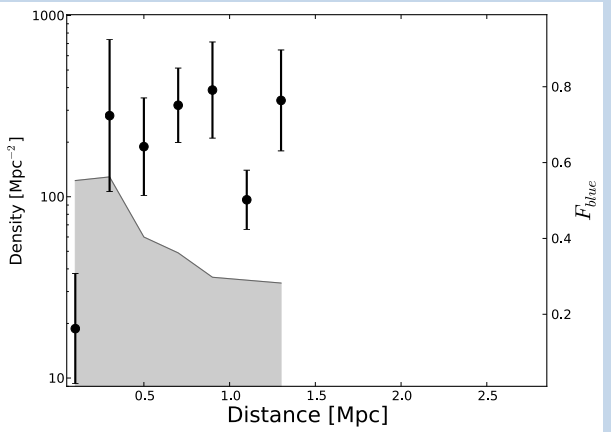




(a) RXJ1347

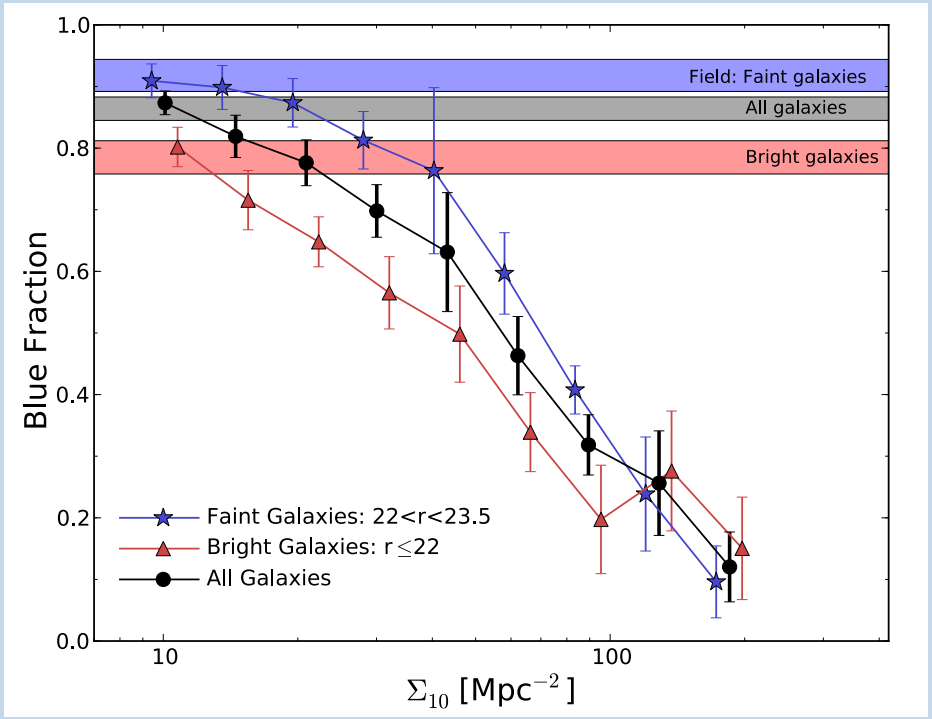


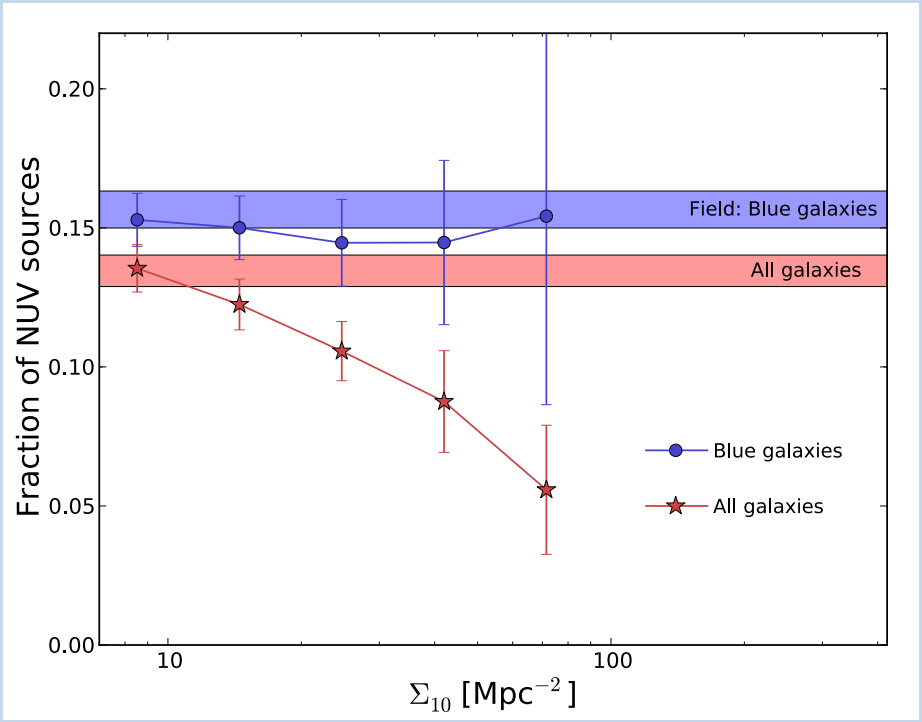
(b) LCDCS0825



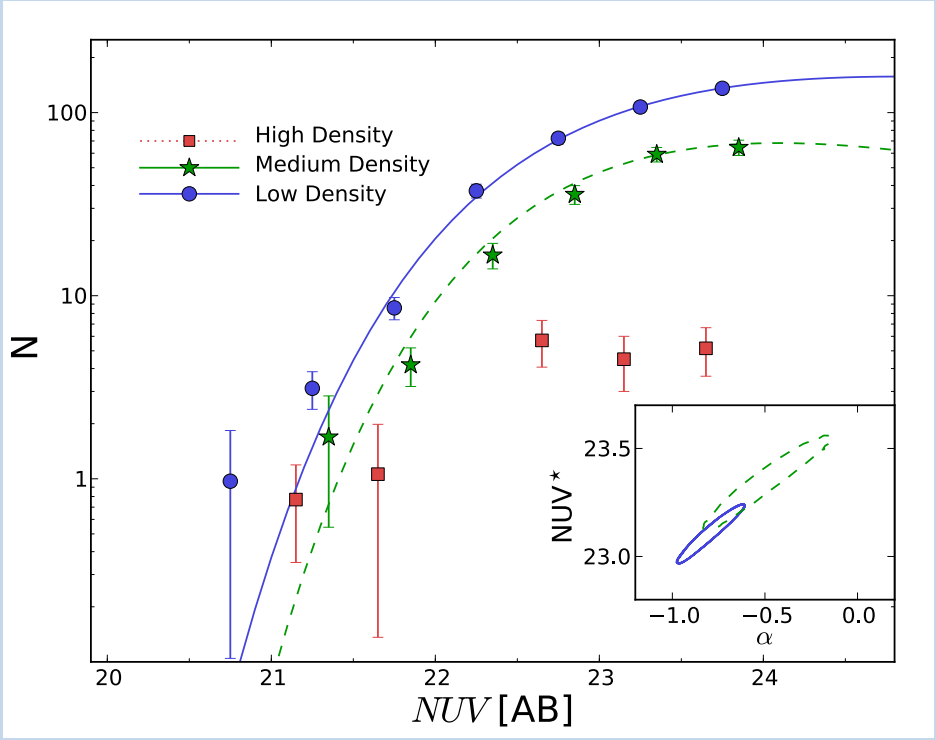
(c) NE-Clump

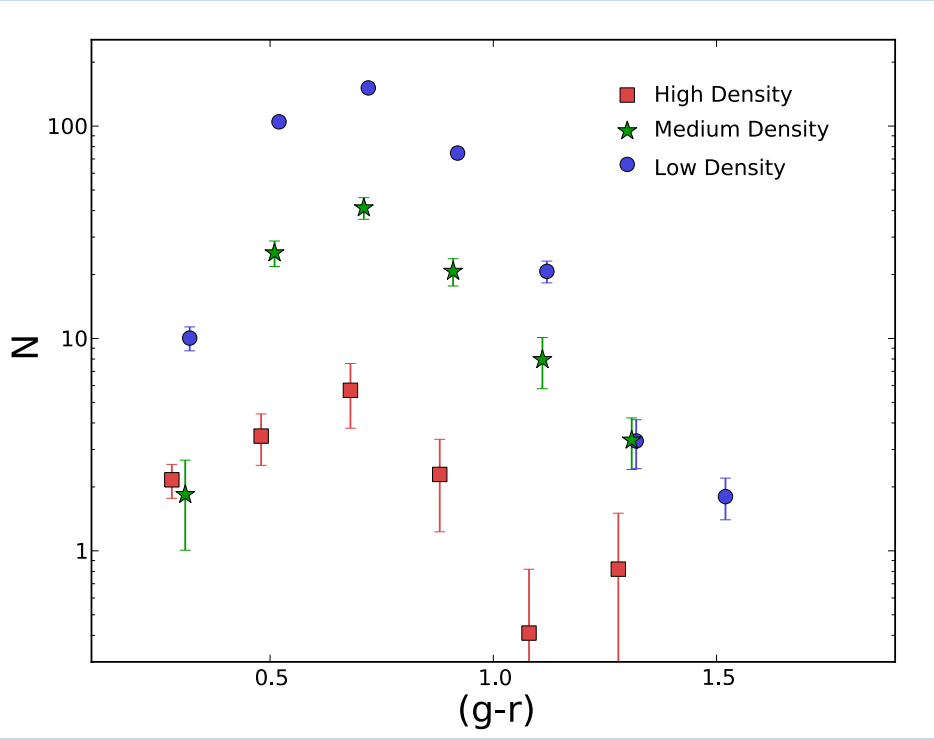
Star Formation Activity





Star Formation Activity

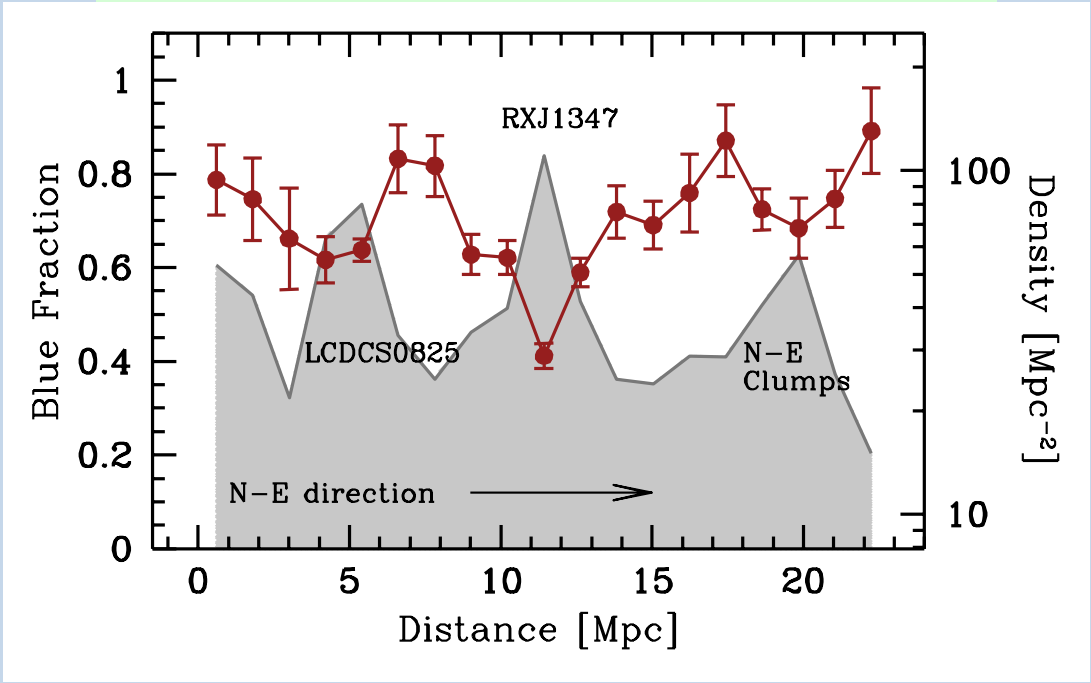


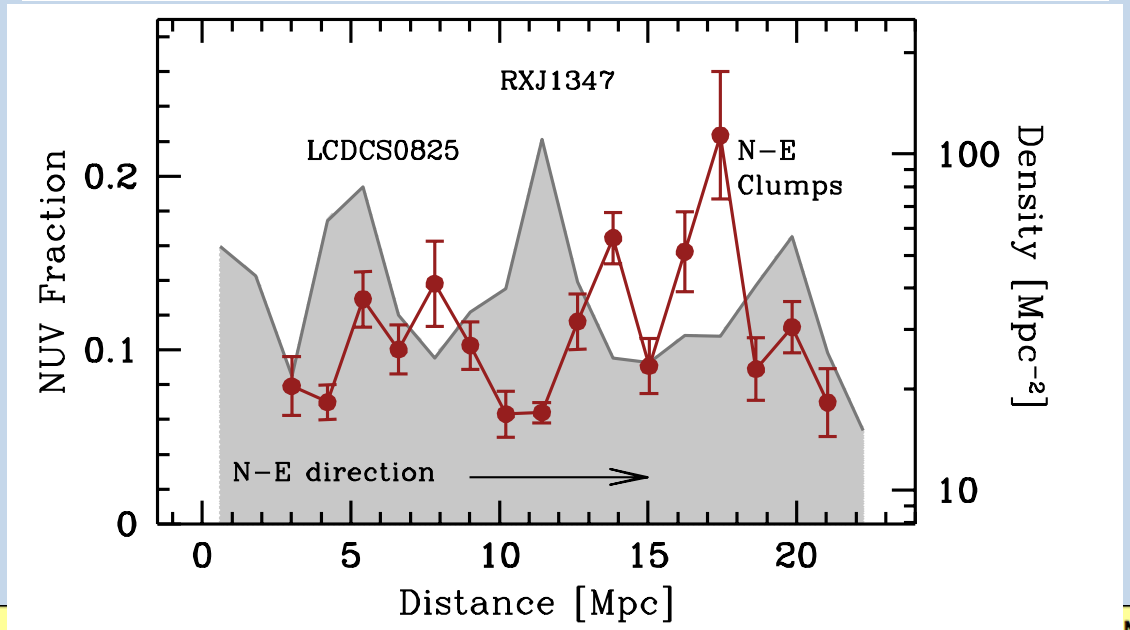


Optical properties of NUV sources do not depend on environment

➔rapid transformation of galaxy types

Evolution along Cluster Complex



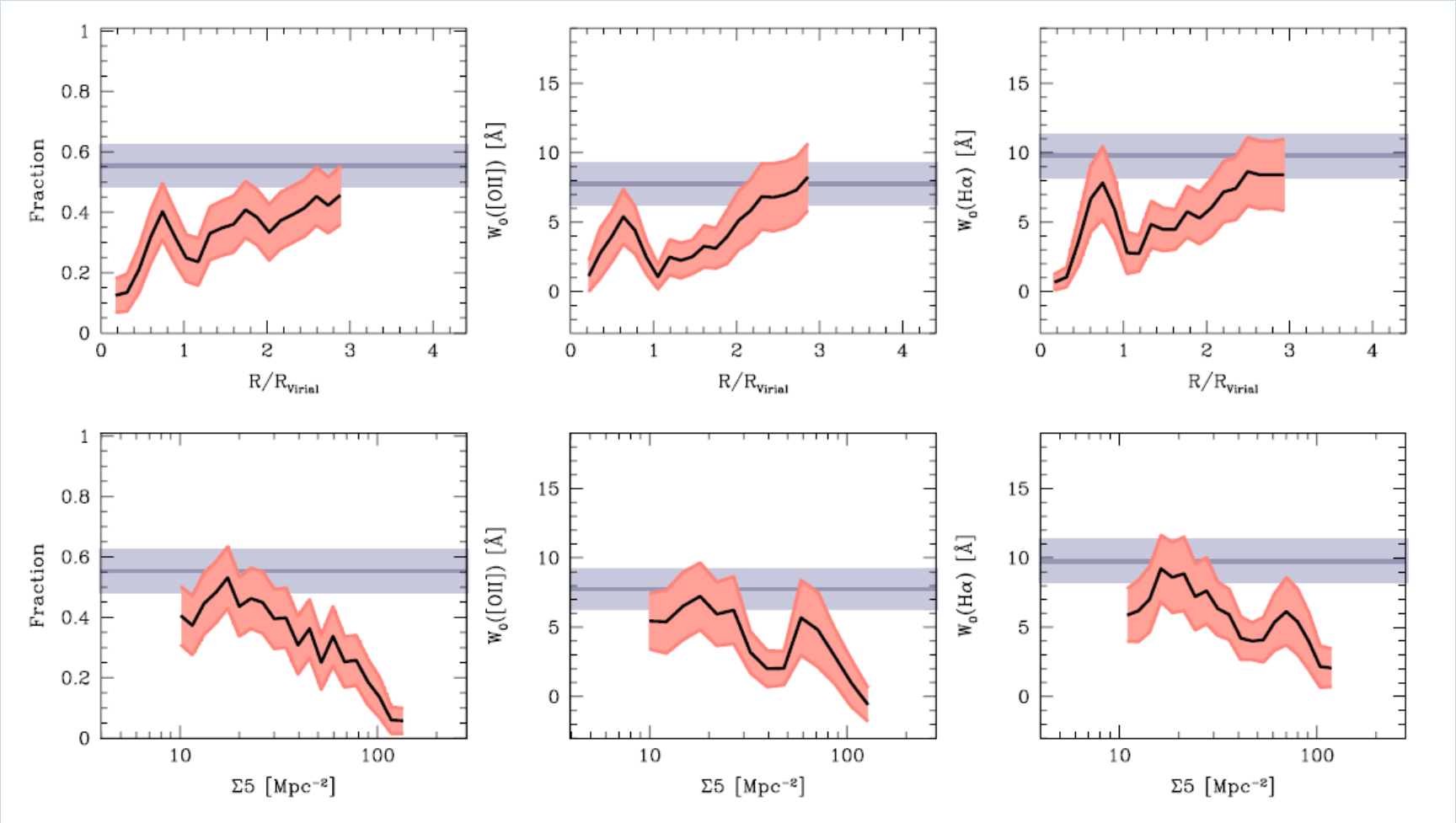


Summary

- Mass estimates (gal. kinematics, weak lensing, x-ray)
- LSS: 3 rich structures, several groups within 20x20Mpc^2
- fraction blue galaxies has mass-dependent behavior
- few dense groups have high fraction blue galaxies
- NUV detected sources follows trend of blue galaxies

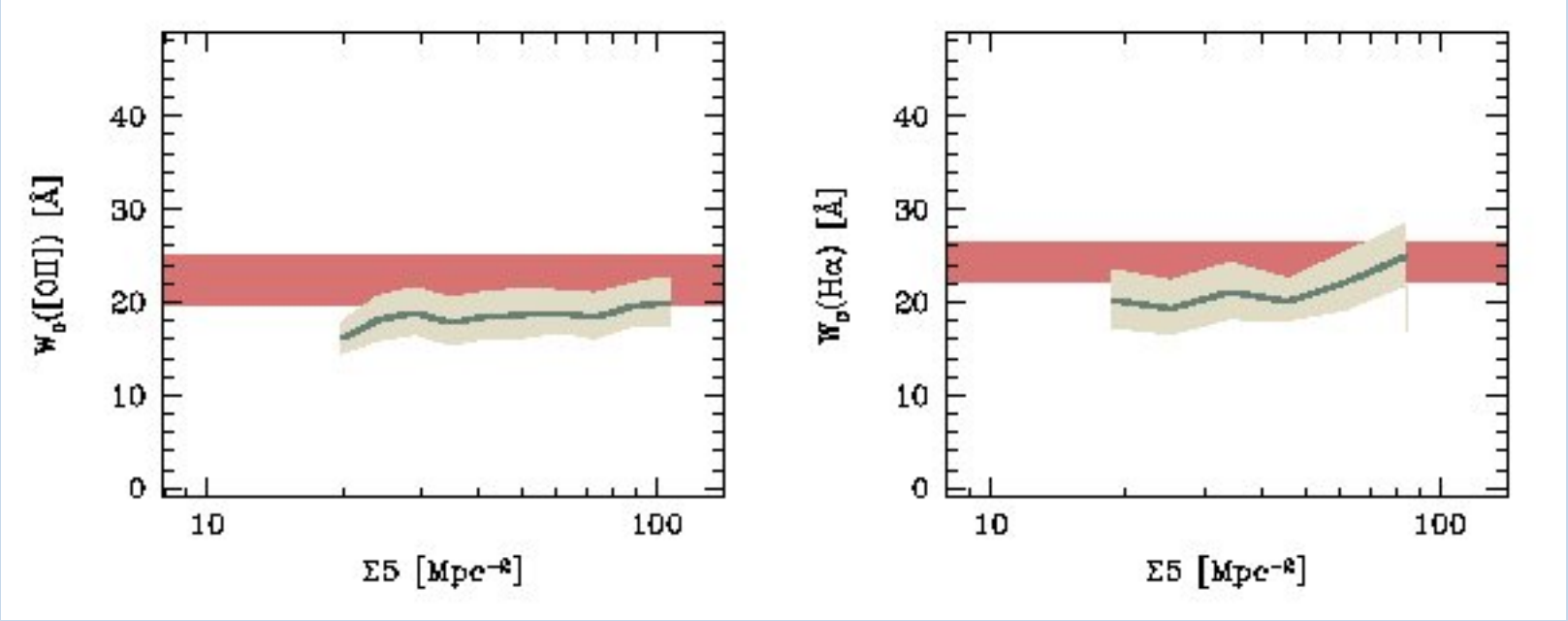
Outlook Lookback

Verdugo, Ziegler, Gerken 2008



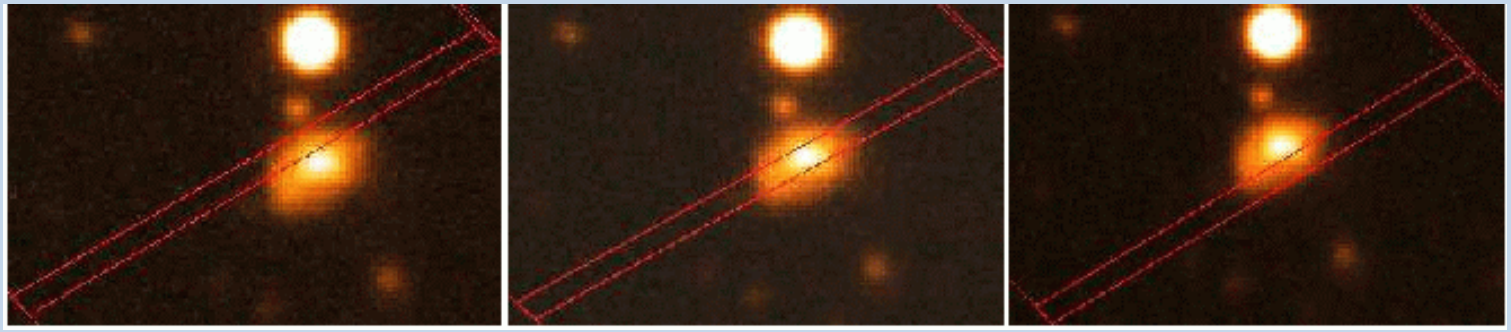
“stacking” of 6 z~0.25 clusters

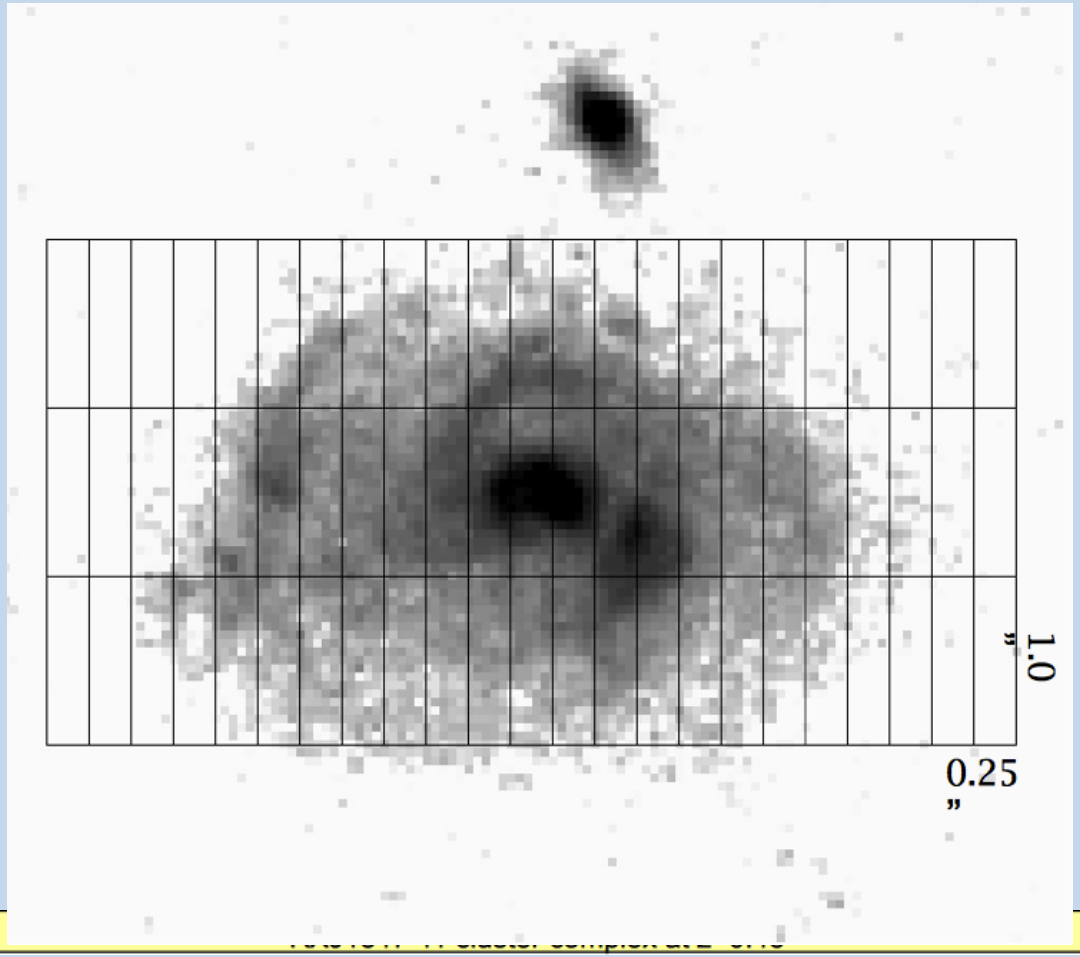
Star formation activity in distant cluster galaxies



[O II]3727 & H α equivalent widths of **SF** galaxies as f(density).

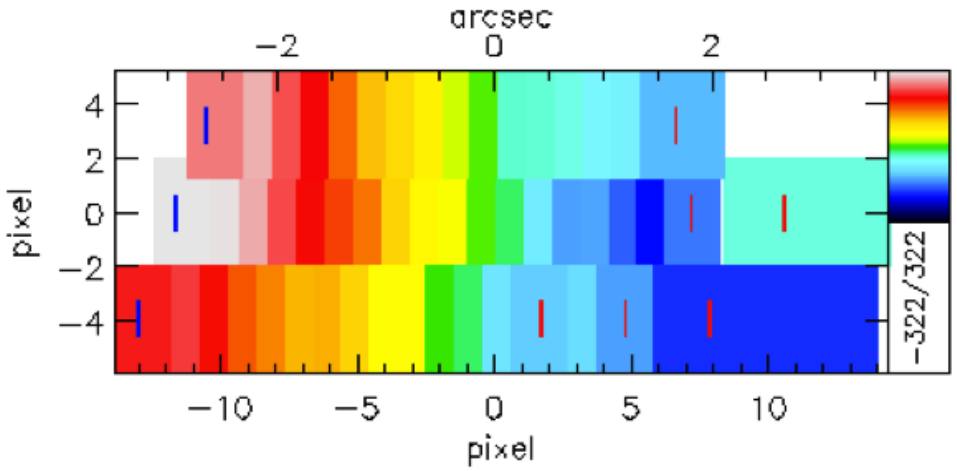
Velocity Fields

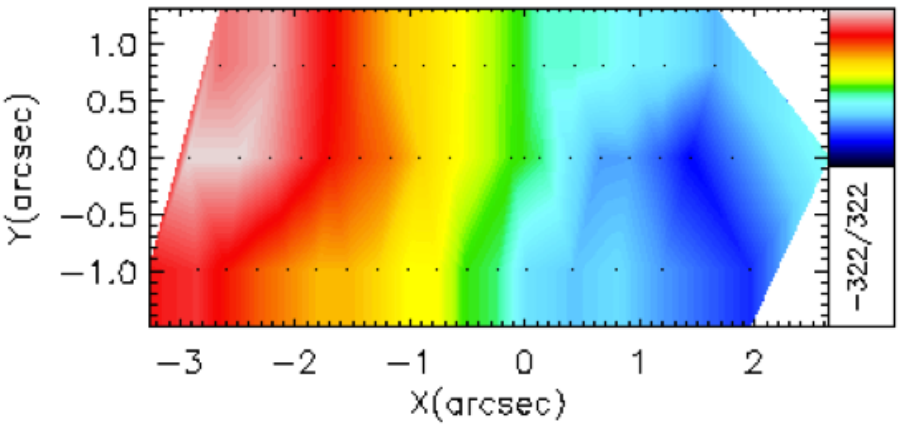




Ziegler et al.
2007 & 2009
Messenger 137

Velocity Fields





Kutdemir et al. 2008

MS0451-03 z=0.53