EFFECTS OF DENSE ENVIRONMENT ON THE STAR-FORMATION ACTIVITY OF HIGH-REDSHIFT GALAXIES

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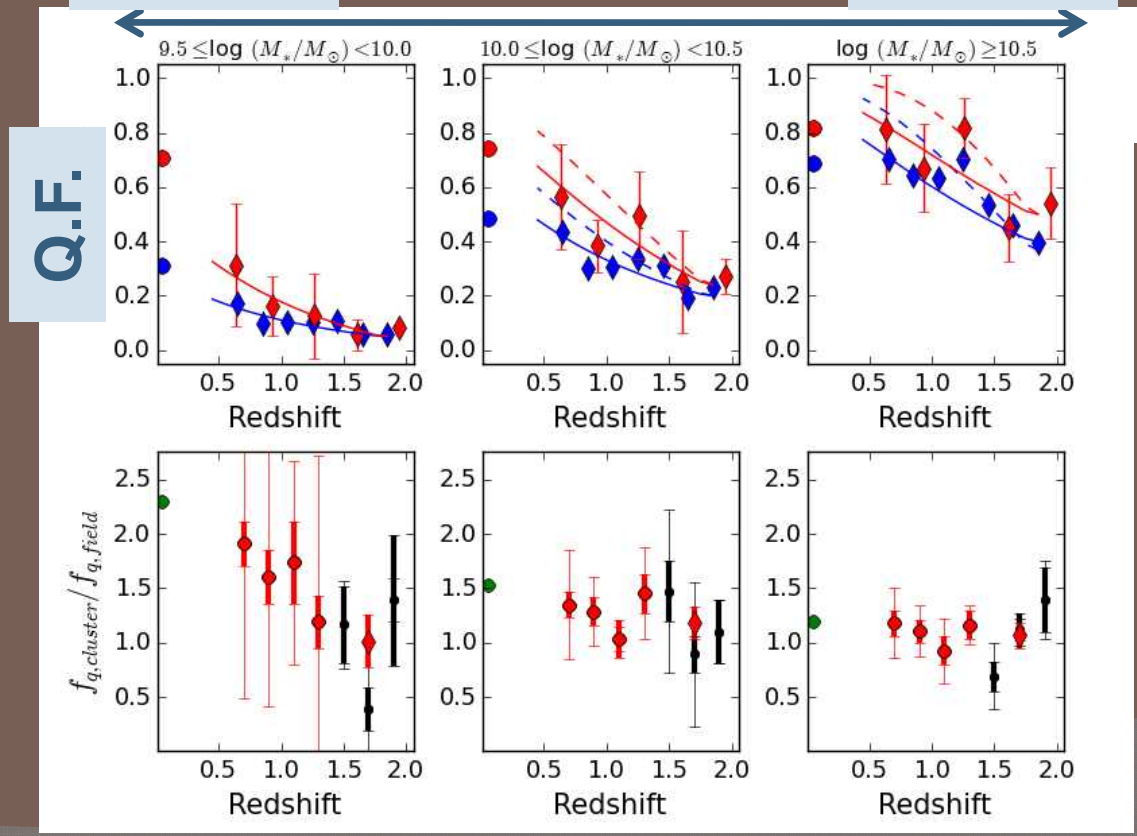
Motivation : Star-formation activity of high-redshift galaxies

- Important questions regaring the evolution of star-formation of galaxies:
  - ▷ What controls the star-formation activity of galaxies ?
    - relative contribution from internal (nature) versus external (nurture) origins
  - ▷ How it evolves at different environments (e.g., cluster versus field)?

SF Properties of High-redshift Cluster Galaxies

- Evolution of quiescent galaxy fraction (QF)

low mass → high mass



◆ : cluster
◆ : field

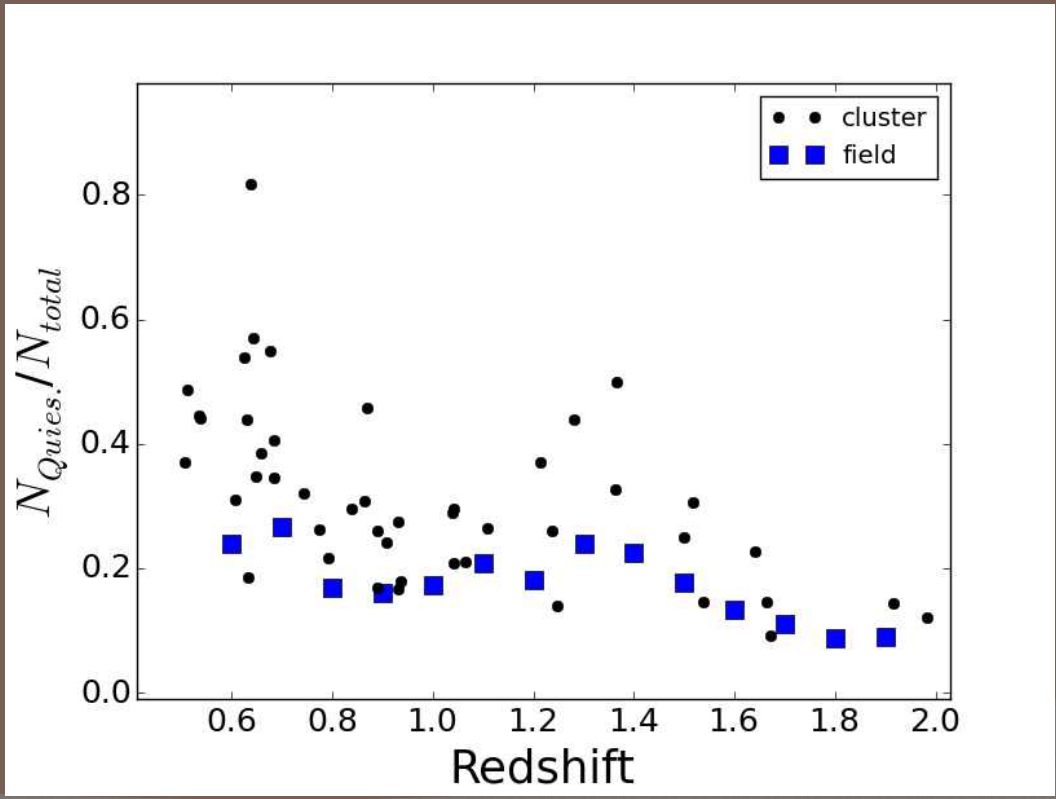
1. QF depends more strongly on stellar mass than environment

2. Environmental dependence becomes significant at z < 1.2-1.3 for low-mass galaxies

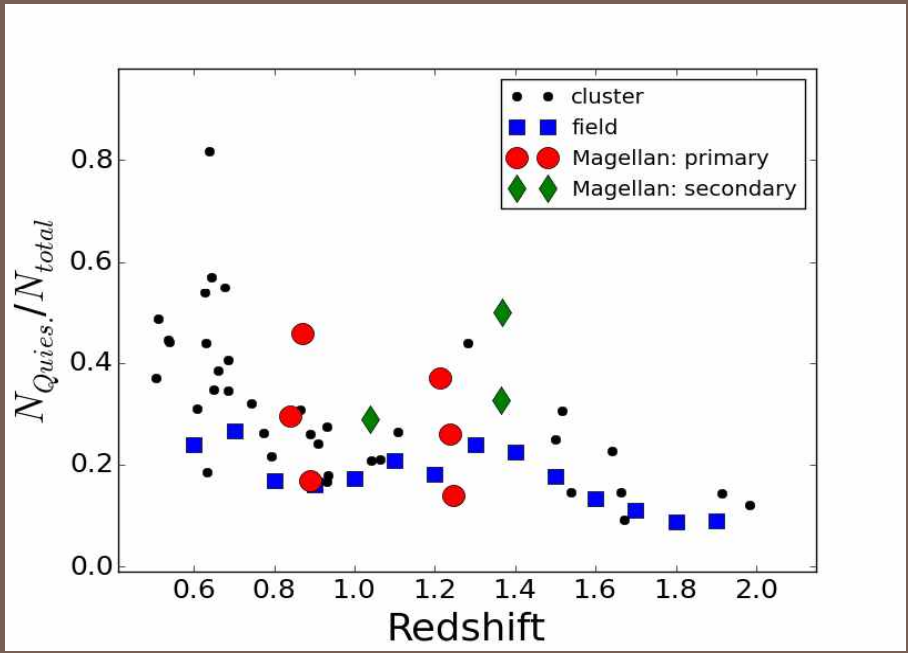
Lee,S.-K.,Im,M. et al. 2015.

SF Properties of High-redshift Cluster Galaxies

- We also found there exists variation of QF among individual clusters

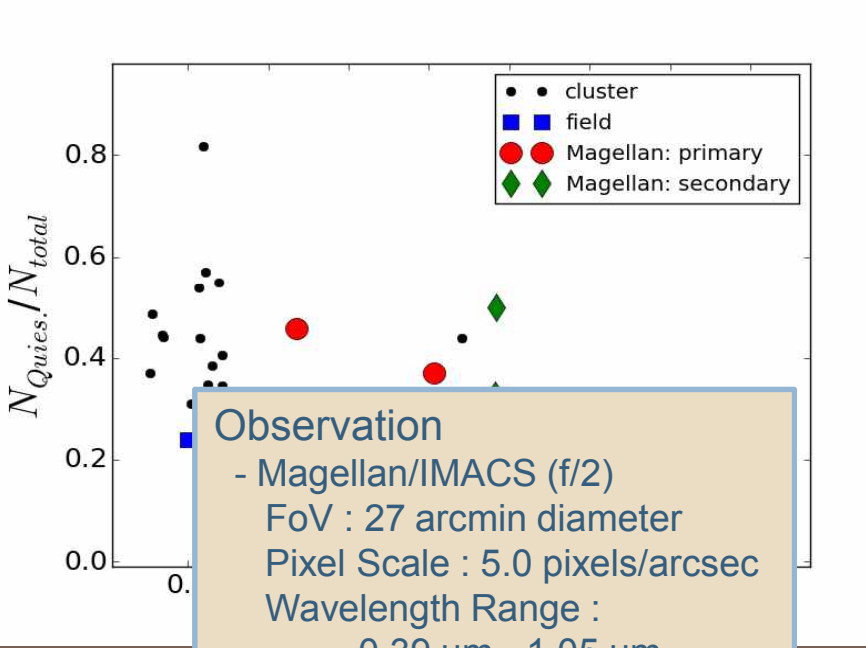


Spectroscopic Follow-up with Magellan

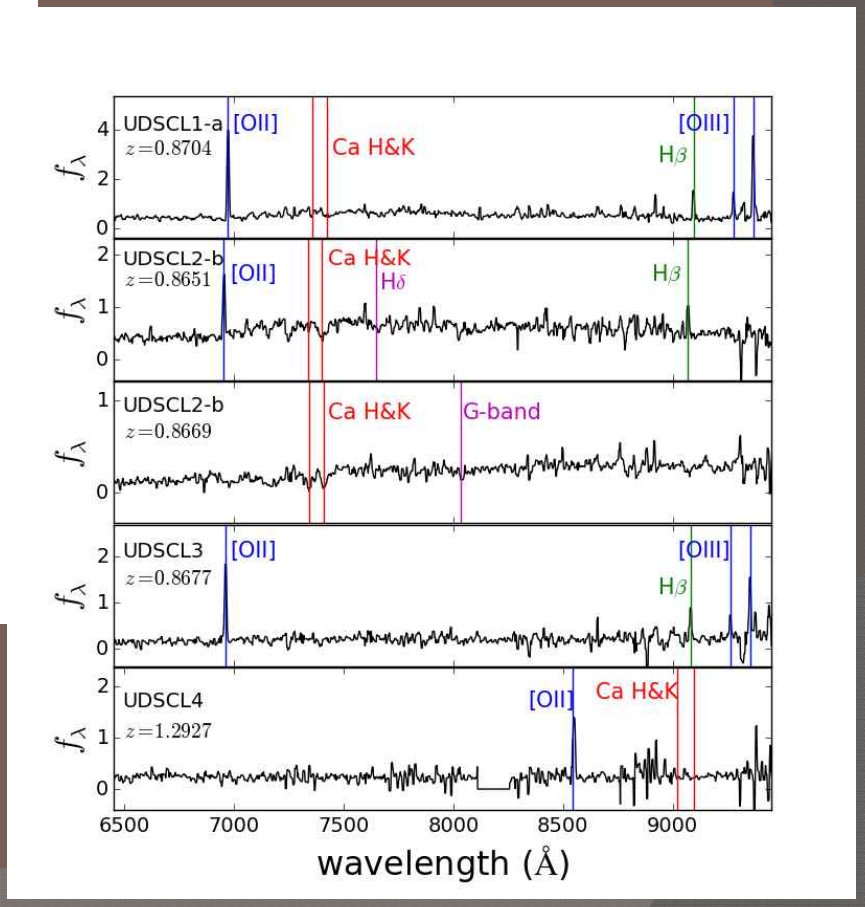


primary sample :
six (three at z~0.9 &
three at z~1.2)
clusters which show
largely different QF
while at similar redshift.

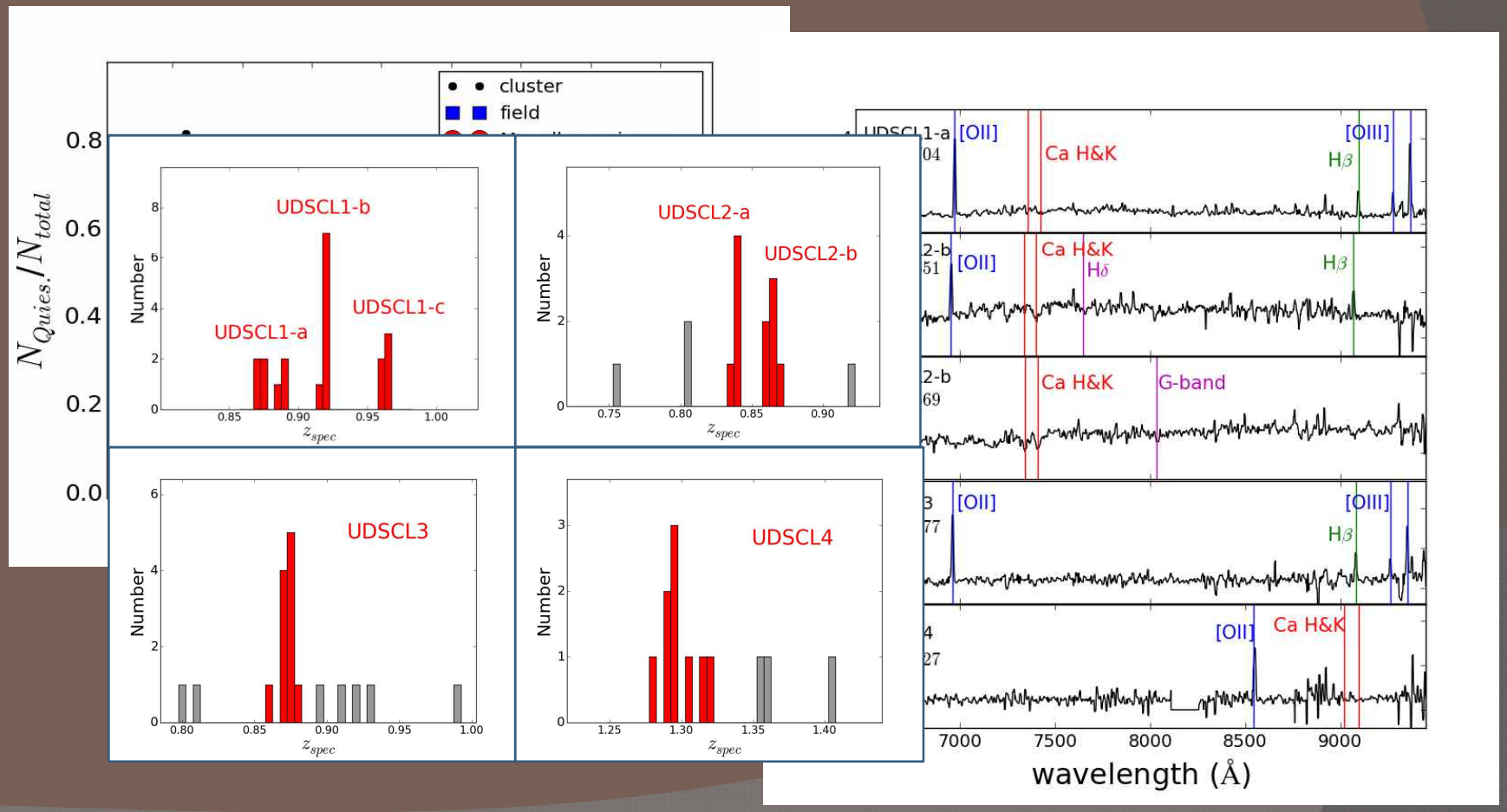
Spectroscopic Follow-up with Magellan



Observation
- Magellan/IMACS (f/2)
  FoV : 27 arcmin diameter
  Pixel Scale : 5.0 pixels/arcsec
  Wavelength Range :
  0.39 μm - 1.05 μm
- Disperser : Grism 200
  (R~600-900)
- Filter : WB6300-9500
- Spectroscopic redshift
  of ~170 galaxies



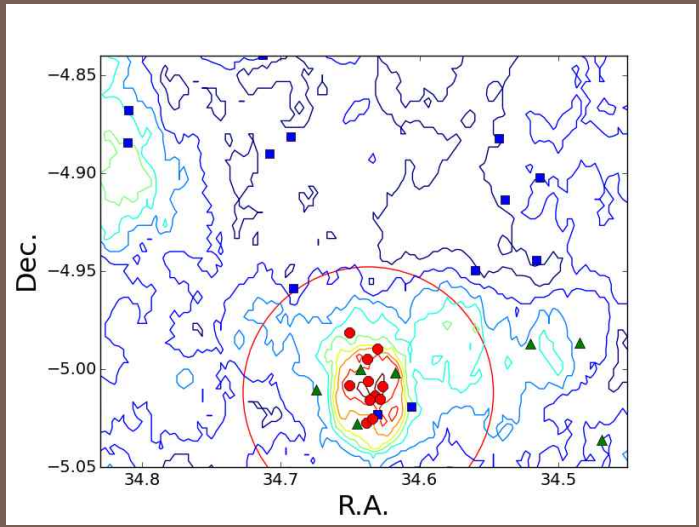
Spectroscopic Follow-up with Magellan



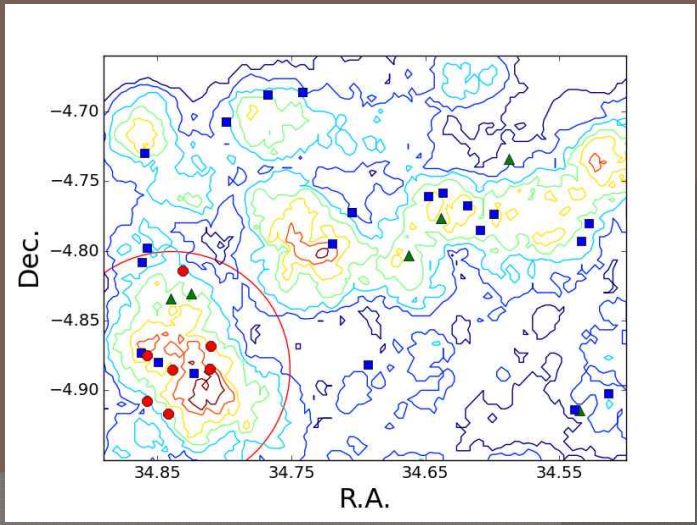
SF Properties of Galaxy Clusters and their Large Scale Structures

- Connection between quiescent galaxy fraction and surrounding LSS

Q.F.=0.44



Q.F.=0.19



Effects of Dense Environment on the Star-formation Activity of High-redshift Galaxies

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It is an intriguing question why and when galaxies stopped their star formation activity and become quiescent. It has been suggested that both of intrinsic and environmental origins affect star-formation properties of galaxies and their relative importance differ depending on their redshift and mass. Studies have suggested that the redshift of $z \sim 1$ is a critical era in the evolution of star-formation properties of galaxy clusters (e.g. **Lee, S.-K. et al. 2015, *ApJ*, 810, 90**). Also, interestingly, galaxy clusters at this epoch show large variation in their star-formation properties among individual clusters. Here, we present our results of high-redshift cluster confirmation and study done using 6.5-meter *Magellan*/IMACS. From this observation, we confirm four overdensities in the redshift range between z~0.8 and 1.3, among which two are found to contain projected two or three structures. Also, we investigate large scale structures near these four confirmed overdensities to find that galaxy overdensities connected with large scale structures show relatively lower fraction of quiescent galaxies.

Introduction

- Stellar population of high-z cluster galaxies differs from that of local counterparts, and star-formation properties of galaxies within galaxy clusters rapidly evolve at z~1 (e.g. **Lee, S.-K. et al. 2015, *ApJ*, 810, 90**).
- Also, there exists large variation in the star-formation properties among individual galaxy clusters at high-redshift (Figure 1).
- We observed galaxy cluster candidates with diverse quiescent galaxy fractions (measured for galaxies with $\log M_* \geq 9.1$; Figure 1) with *Magellan*/IMACS which is ideal for this study thanks to its large FoV.
- For spectroscopic observation we select 6 cluster candidates (3 at z~0.9 and 3 at z~1.2), which show various quiescent galaxy fractions, as primary targets (red circles in Figure 1) and 3 candidates, which are in the IMACS field FoV, as secondary targets (green diamonds in Figure 1).

Observation & Results

- **Target field: *UKIDSS*/UDS (Ultra-Deep Survey)**
- **Telescope/Instrument: *Magellan* (Badde) / IMACS** (*f*/2 mode)
- **Grism 200 & WB6300-9500 filter**, ~250 slits(1"x6") per mask
- Among ~250 slits, 43% are cluster galaxy candidates
- **Observation: 2014 Sept. (2.5hrs,** seeing:0.8") **+ 2015 Sept. (2.5 hrs,** seeing:1.1")

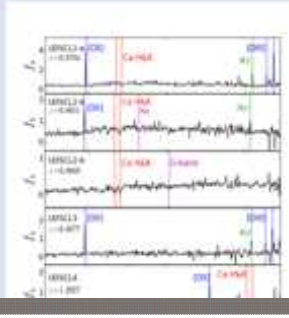
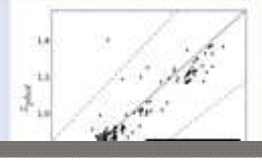


Figure 3. Comparison of spectroscopic redshift (from our *Magellan*/IMACS observation) and photometric redshift (from Lee, S.-K. et al. 2015)



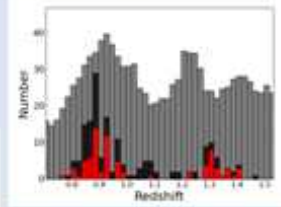


Figure 4. Distribution of spectroscopic redshifts from *Magellan* observation.