

MAHALO-Subaru: [OII] emission survey in the CL0332-2742 cluster at $z=1.61$

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Abstract

We conduct a deep survey for star-forming galaxies in a cluster CL 0332-2742 at $z=1.61$. With a narrow-band filter (NB973; $\lambda=9755 \text{ \AA}$, $\Delta\lambda=202 \text{ \AA}$) and broad-band filter (z_R) on Subaru/Suprime-Cam, we select 44 [OII] emitters down to a 3σ limiting flux of $2.5 \times 10^{-17} \text{ erg/s/cm}^2$ in the cluster. Because the cluster resides in the GOODS-South region, deep multi-wavelength data are available. We then find that there are a lot of [OII] emitters in this cluster at $z=1.61$, suggesting that galaxies at $z=1.61$ still keep the active star formation even in high-density region. This fact supports the several recent results that clusters at $z>1.5$ have conducted the active star formation (Hayashi+10, Hilton+10, Tran+10).

The color-magnitude diagram shows that there is no red [OII] emitter. Such red emitters are seen in XMMXCS J2215.9-1738 clusters at slightly lower redshift of $z=1.46$ (Hayashi+10). Blue [OII] emitters in CL0332 cluster tend to be fainter by $\sim 1.0 \text{ mag}$ in K-band than those in XCS2215 cluster. In addition, HST/ACS z_{850} image shows that the morphology of many [OII] emitters seems to be irregular, and that [OII] emitters with a close galaxy have higher star formation rates than those of isolated [OII] emitters. This may suggest that the interaction induce the starburst in galaxies in high-density region.

Introduction

- Star forming activity of local galaxies is strongly dependent on environment. Local passive ellipticals prefer to be in higher density region. (e.g., Dressler+97)
- Investigation of star formation activity as a function of environment and cosmic time would provide us important clues to understanding the galaxy formation and evolution.

MAHALO-Subaru: **M**apping **H**Alpha and **L**ines of **O**xygen with **S**ubaru
(PI: T. Kodama)

This project aims to map the star formation activity in clusters and fields at $0.4 < z < 2.5$ by narrow-band imaging.

Target

- CL 0332-2742 cluster @ $z=1.61$
This cluster is found in GOODS-South region. (Kurk et al. 2009)

- $\sigma=500 \text{ +100/-100 km/s}$
- $L_x < 3.5 \times 10^{43} \text{ erg/s}$ (Kurk et al. 2009)

Observation and Data

Observation

- 2010.10.06-08
- Subaru / Suprime-Cam

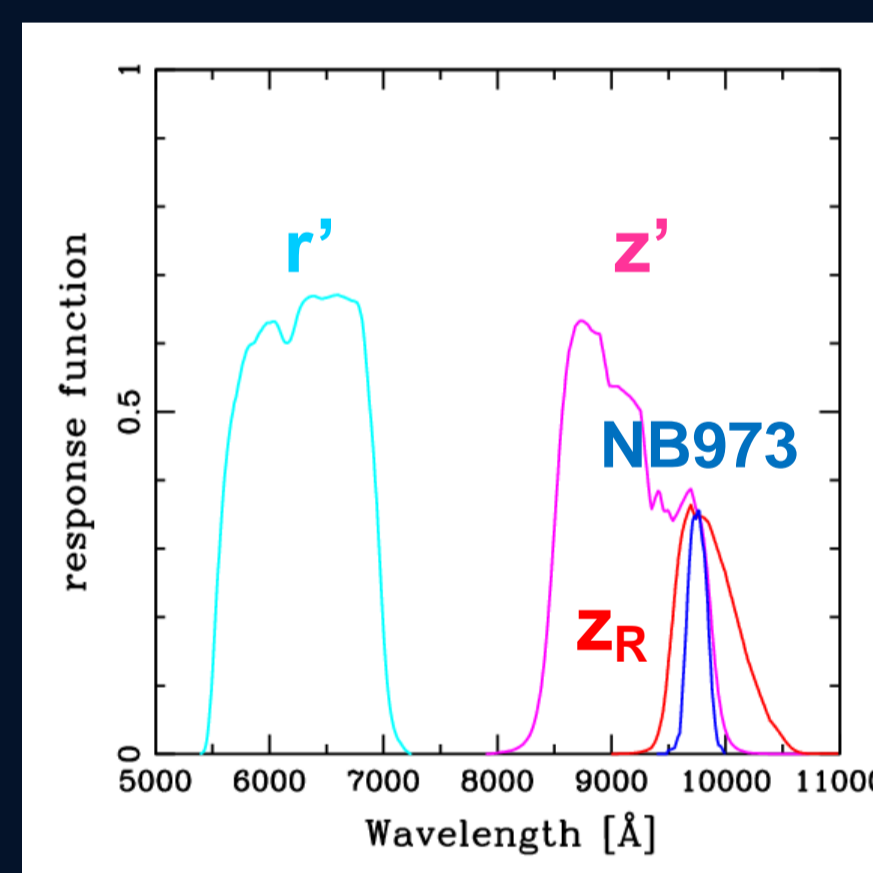
Data

	r'	z'	z_R	NB973
Integration	86min	56min	130min	320min
Seeing	0.72"			
Mag. limit (*)	27.98	26.27	25.88	25.94

* AB magnitude, 1.4" aperture, 3σ

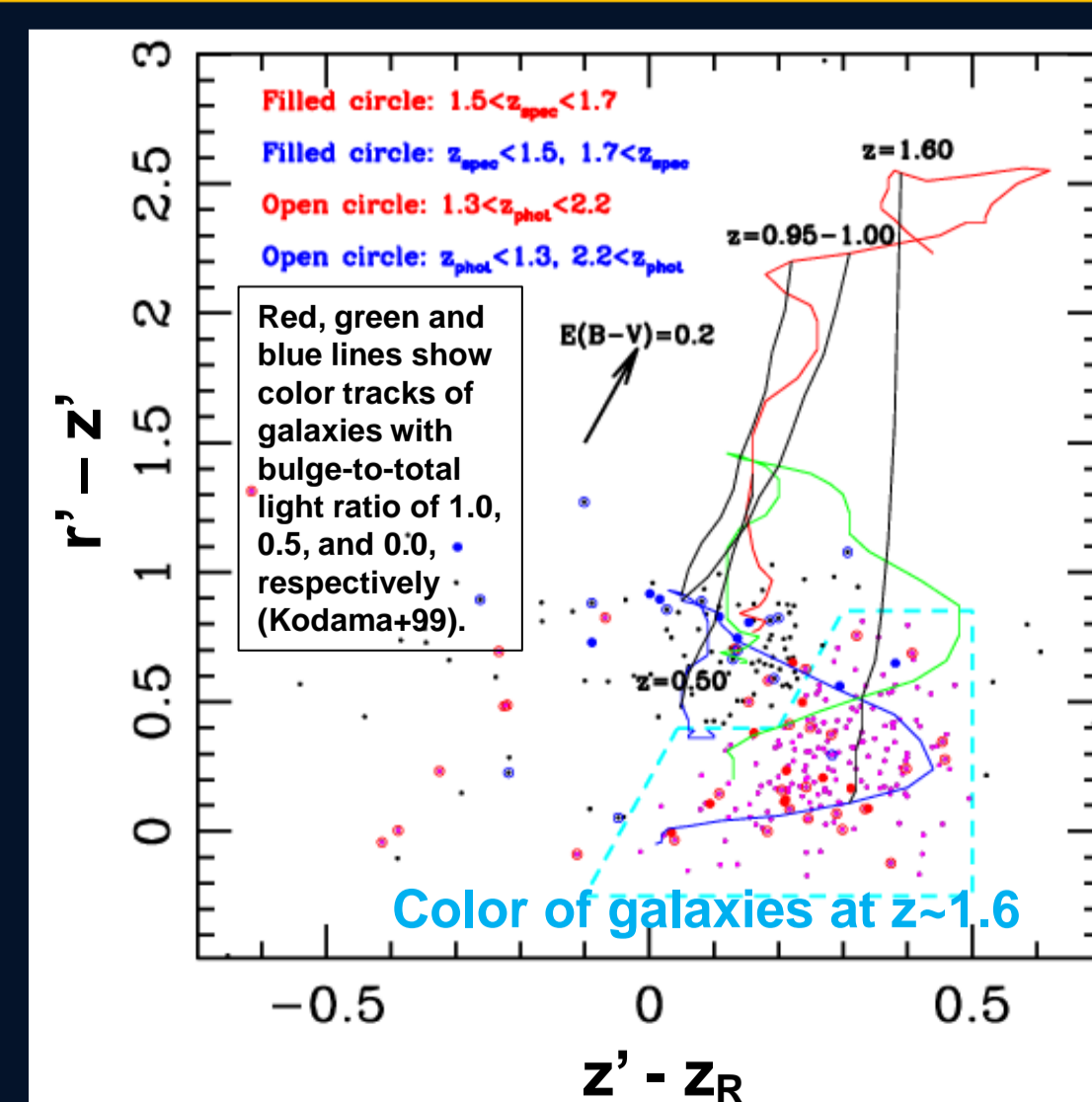
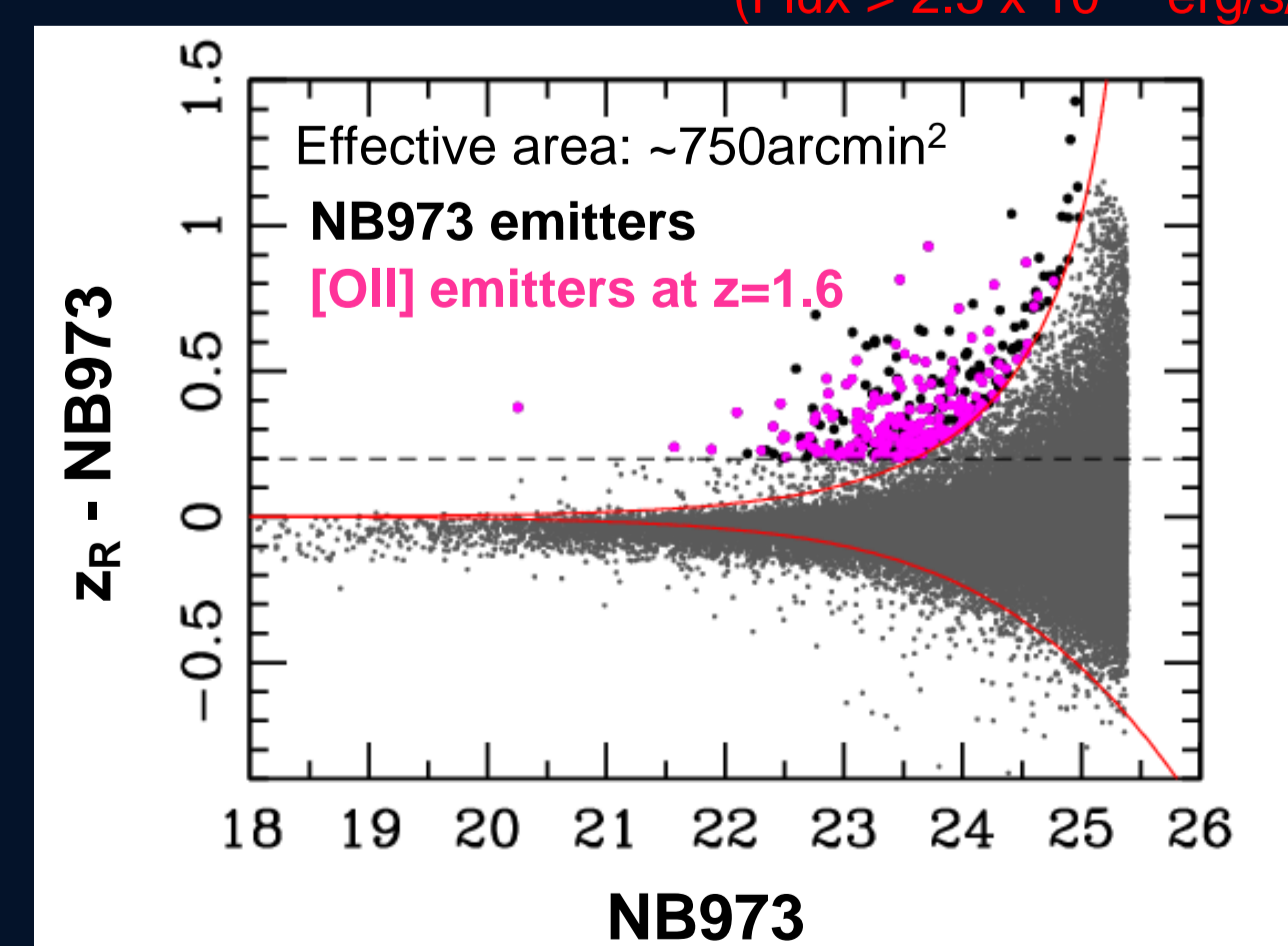
Public data (GOODS-South region)

- catalog: GOODS-MUSIC catalog (Santini et al. 2009)
 - UV, BViz, JHK, [3.6, 4.5, 5.8, 8.0], [24]
 - spec-z (if any), photo-z
- optical images: HST/ACS images (BViz)
- near-infrared images: VLT/ISAAC images (JHK)



[OII] emitters in CL0332-2742 cluster

Selection of NB973 emitters
3 sigma excess
(Flux > $2.5 \times 10^{-17} \text{ erg/s/cm}^2$)

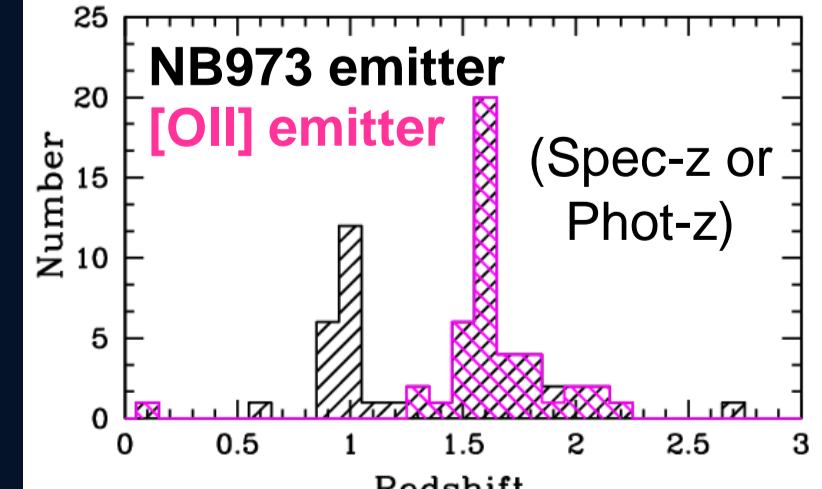


How to select [OII] emitters

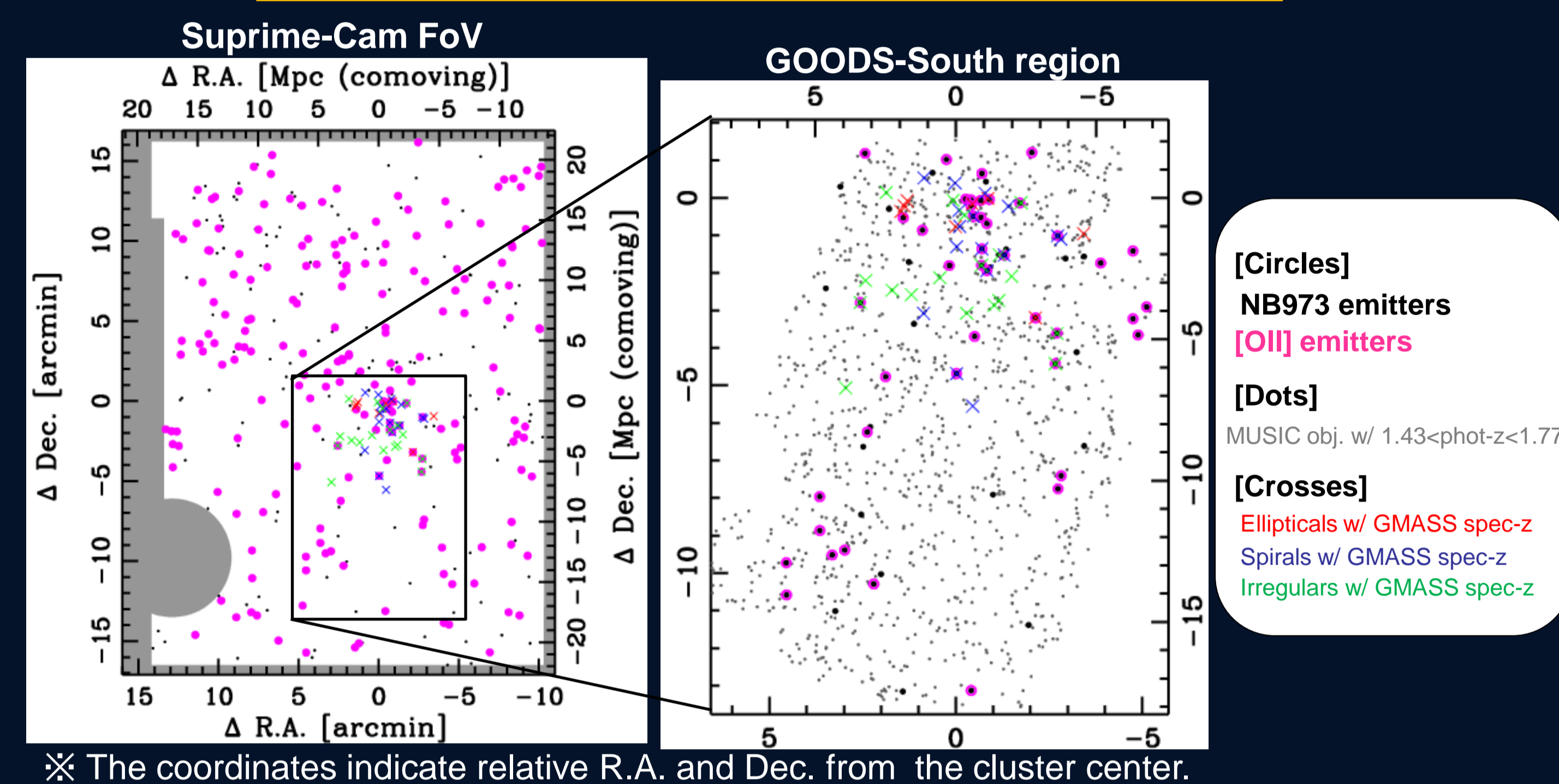
- $r'z'z_R$ colors in the cyan region enclosed by broken lines
- spec-z = 1.5-1.7 (if any)
- photo-z = 1.3-2.2

* 1. → whole region of SupCam FoV

* 2, 3. → GOODS-S region



Distribution of [OII] emitters



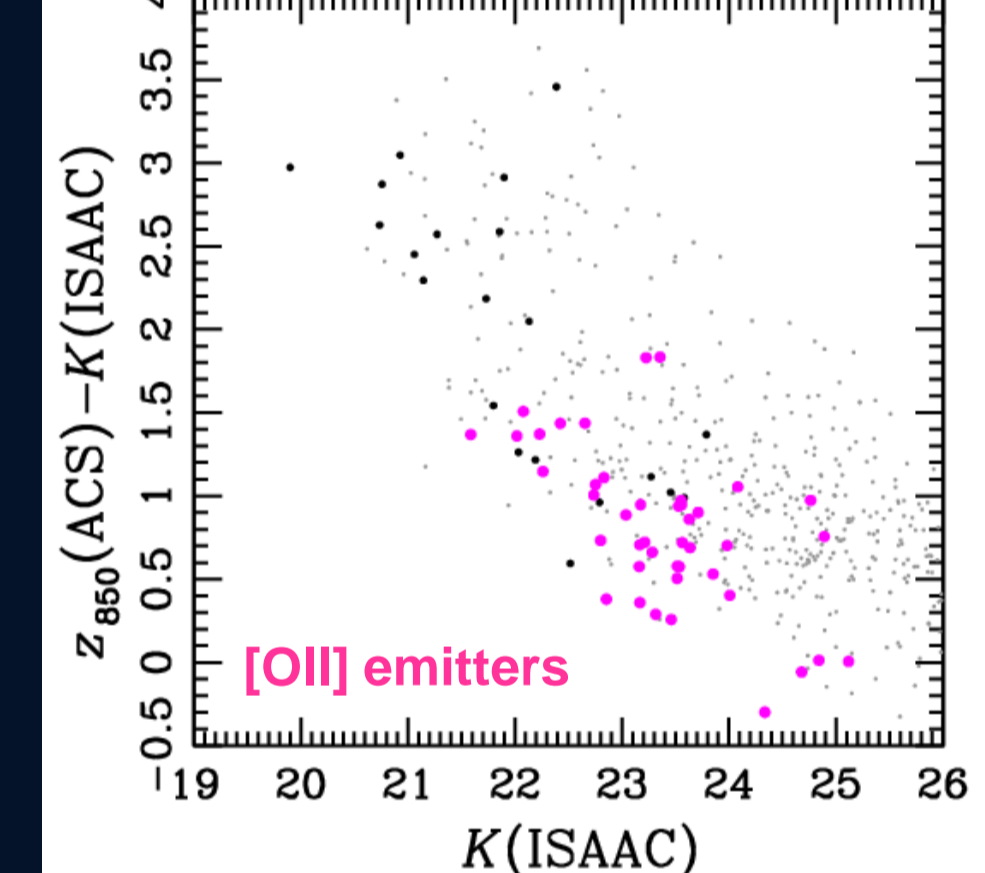
There are a lot of [OII] emitters even in the high density region at $z=1.61$.

Color-magnitude diagram

CL0332-2742 @ $z=1.61$

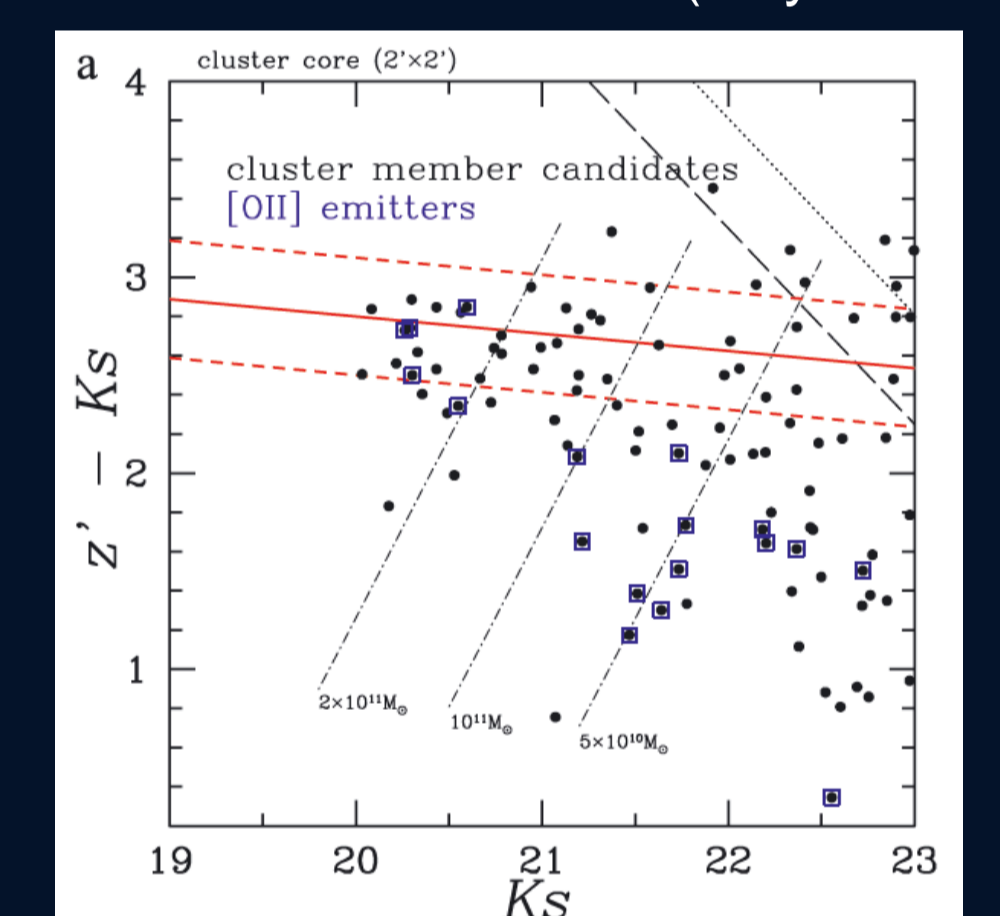
Members with spec-z of 1.600-1.622

Galaxies with photo-z of 1.50-1.70



XMMXCS J2215.9-1738 @ $z=1.46$

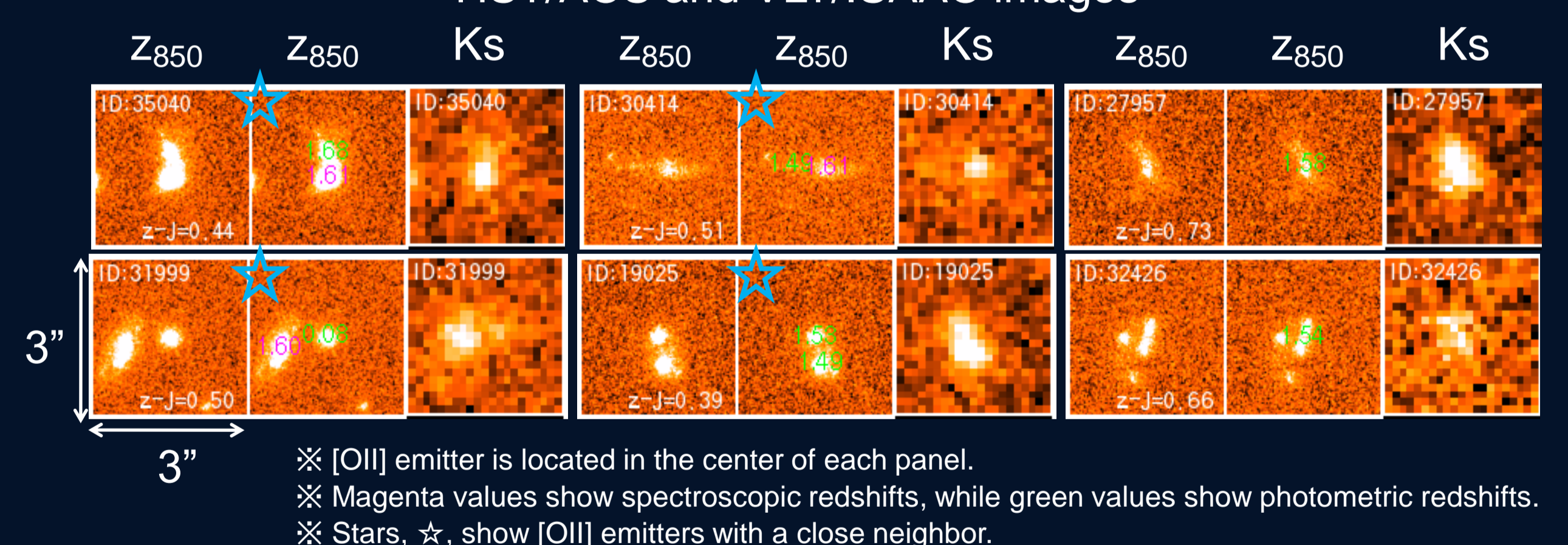
(Hayashi et al. 2010)



No [OII] emitter on the red sequence is seen in CL0332 cluster.

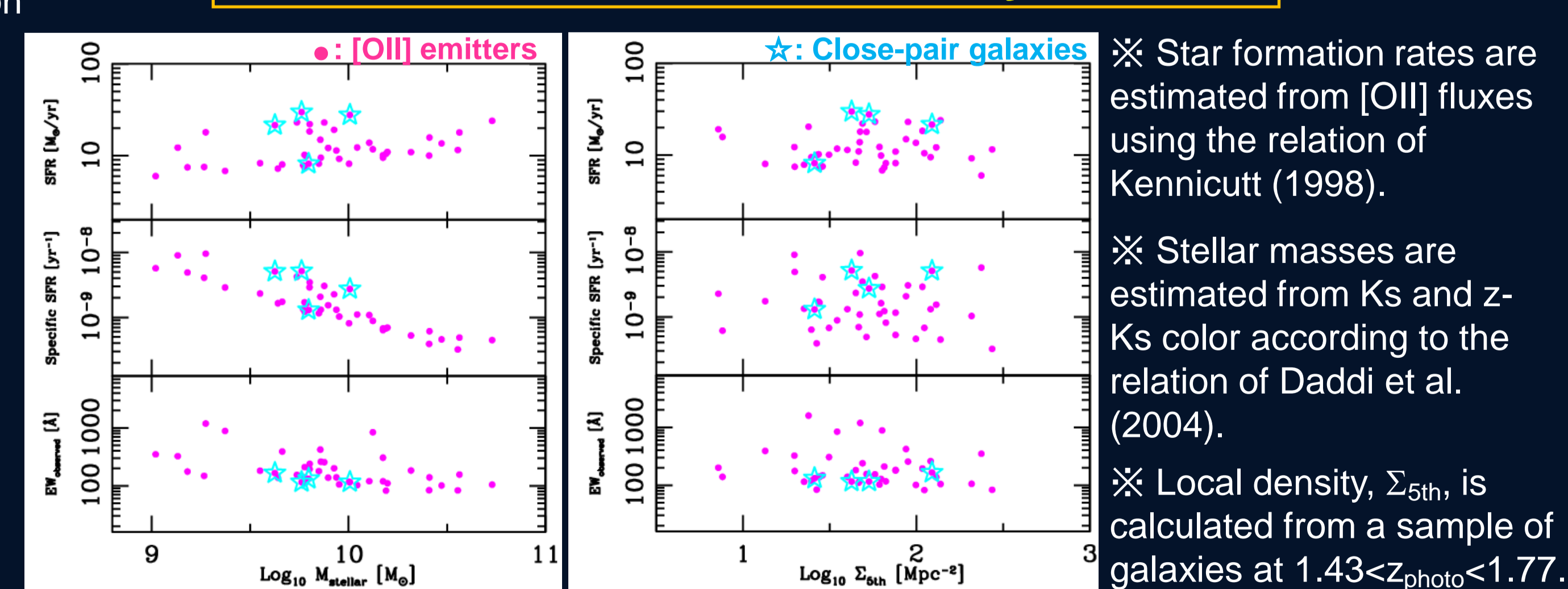
[OII] emitters with a close neighbor

HST/ACS and VLT/ISAAC images



Morphology of many [OII] emitters seems to be irregular.

Star formation activity



* Star formation rates are estimated from [OII] fluxes using the relation of Kennicutt (1998).

* Stellar masses are estimated from K_s and z - K_s color according to the relation of Daddi et al. (2004).

* Local density, Σ_{5th} , is calculated from a sample of galaxies at $1.43 < z_{photo} < 1.77$.

[OII] emitters with a close galaxy have higher star formation activity.

Other related presentations

- [Talk] T. Kodama, "MAHALO-Subaru: Narrow-band mapping of star formation at the peak epoch of galaxy evolution"
- [Poster (P19)] Y. Koyama, "MAHALO-Subaru: A panoramic H-alpha imaging survey for the Abell 851 cluster at $z=0.41$ "
- [Poster (P21)] K. Tadaki, "MAHALO-Subaru: [OII] emission survey in the CIGJ0218.3-0510 cluster at $z=1.62$ "

We find 44 (204) [OII] emitters in the GOODS-South region (Suprime-Cam FoV) around CL0332 cluster.