

# MAHALO-Subaru:

## [OII] emission survey in the CIGJ0218.3-0510 cluster at z=1.62

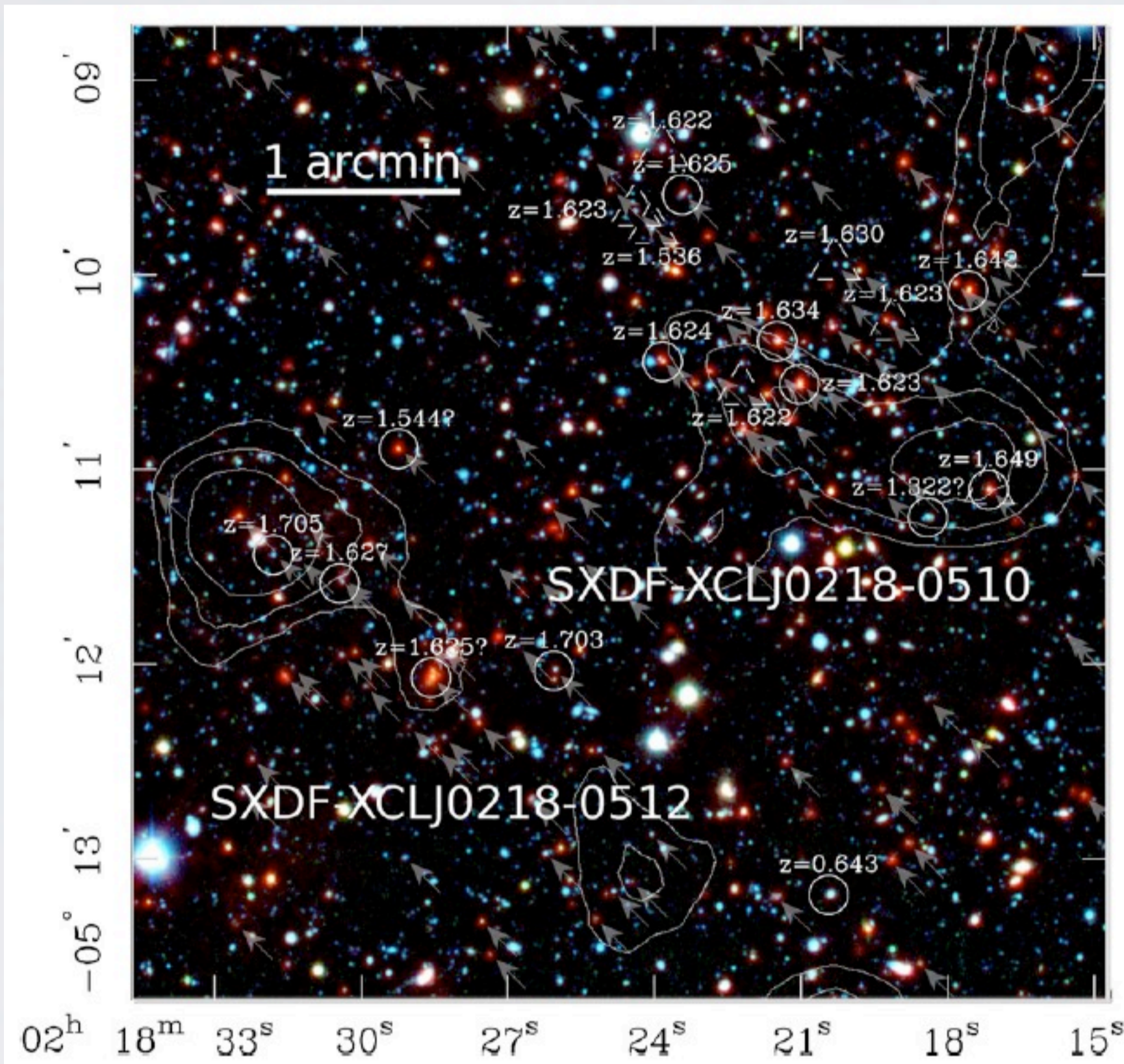
Ken-ichi Tadaki <sup>1</sup>, T. Kodama <sup>2,3</sup>, M. Hayashi <sup>2</sup>, Y. Koyama <sup>1</sup>, I. Tanaka <sup>3</sup>, K. Ota <sup>4</sup>, M. Tanaka <sup>5</sup>, C. Papovich <sup>6</sup>, M. Brodwin <sup>7</sup>

<sup>1</sup> University of Tokyo, <sup>2</sup> NAOJ, <sup>3</sup> Subaru Telescope, <sup>4</sup> ICRR, <sup>5</sup> IPMU, <sup>6</sup> Texas A&M University, <sup>7</sup> Harvard-Smithsonian

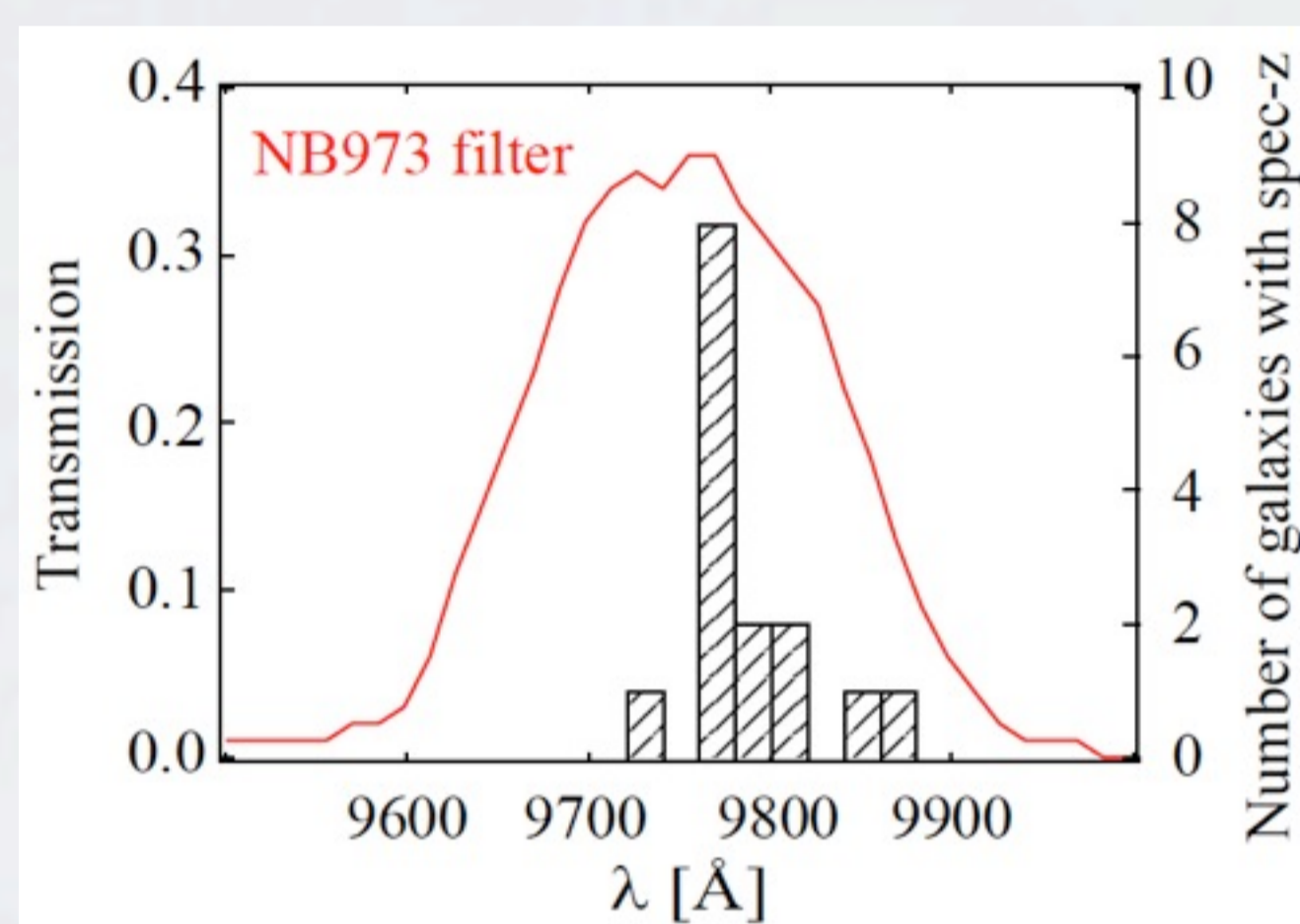
### Abstract

We present a narrow-band survey of [OII] emitters in the CIGJ0218-0510 cluster at z=1.62 with Suprime-Cam on Subaru telescope. The survey reached a 3σ limiting line flux of 2.0×10<sup>-17</sup> erg s<sup>-1</sup> cm<sup>-2</sup> over a 900 arcmin<sup>2</sup> area. From this survey, we identified 351 [OII] emitters on the basis of narrow-band excess and photometric redshifts. Also, we selected 267 red galaxies in "red sequence" on the color-magnitude diagram. From these two samples, we find that [OII] emitters are distributed even in cluster core (r < 1 arcmin), and that the fraction of [OII] emitters to red galaxies somewhat increases in high density region. This suggests that only some star-forming galaxies evolve into the passive phase at z=1.6, unlike low-z clusters. On the other hand, we also find that the mass of [OII] emitters in this cluster is slightly smaller than that of [OII] emitters in XCS2215 cluster at z=1.47 (Hayashi et al. 2010). It seems that this difference between two clusters at similar redshift is caused by the variety of galaxy clusters. Targeting even more distant clusters and general field, MAHALO-Subaru project will provide us to more comprehensive view of galaxy evolution in their most active phase of star formation and mass assembly.

### ● CIGJ0218.3-0510 cluster at z=1.62



$L_x = (3.4 \pm 1.6) \times 10^{43} \text{ erg s}^{-1}$   
 $M_{200} = (5.7 \pm 1.4) \times 10^{13} M_\odot$   
 $R_{200} = 0.44 \text{ Mpc}$   
 15 galaxies with spec-z  
 (Papovich et al. 2010, Tanaka et al. 2010)



Tanaka et al. 2010

### ● Observation

Date	2010.10.6-8
Instrument	Subaru / Suprime-Cam
Filter	$z_r$ ( $\lambda_{\text{eff}}=9860\text{\AA}, \Delta\lambda=590\text{\AA}$ )
Integration	327min (~5.5h)
Seeing	0.5-0.7"
Limiting	25.4 (AB, 5σ, 2")
Area	900 arcmin <sup>2</sup>

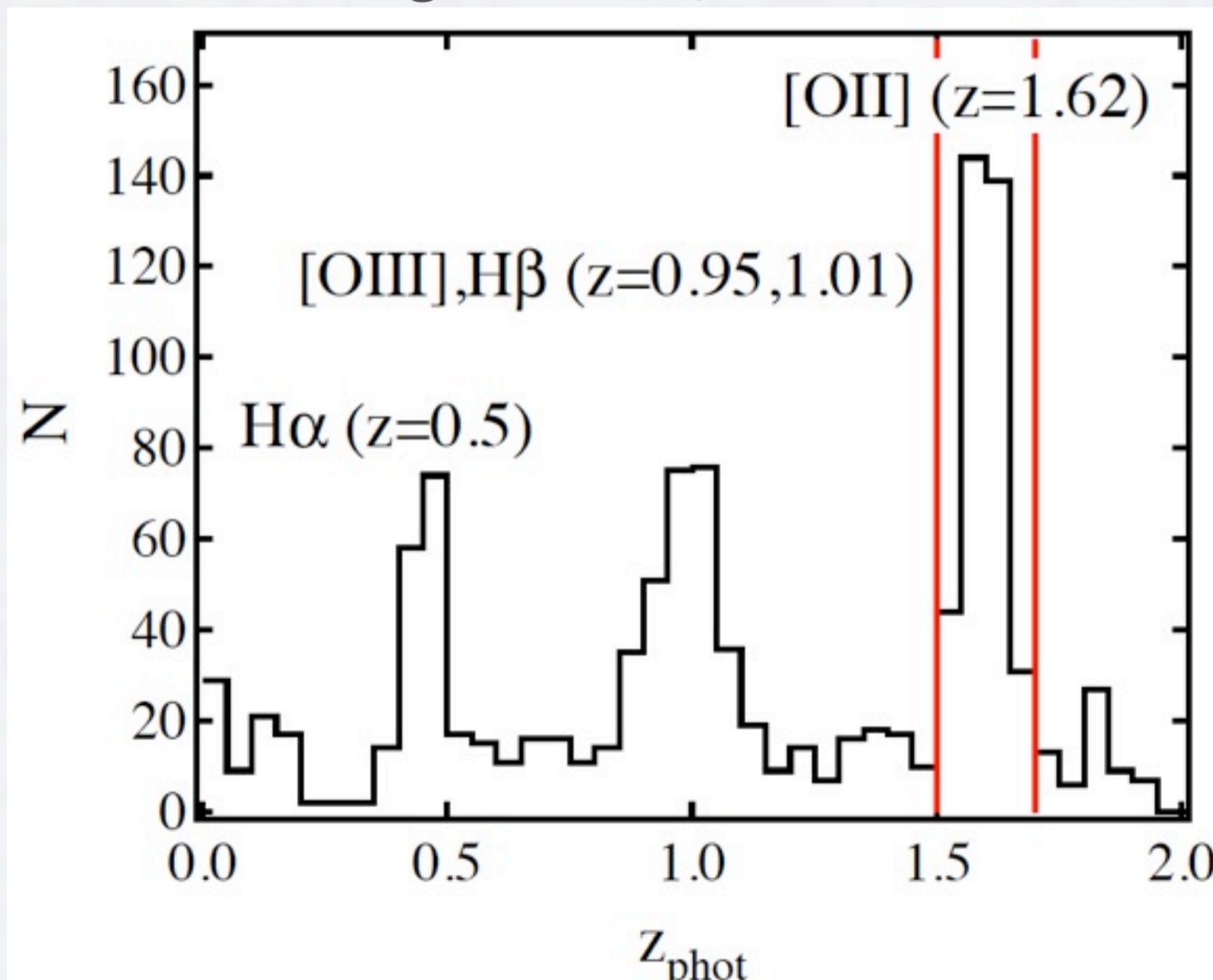
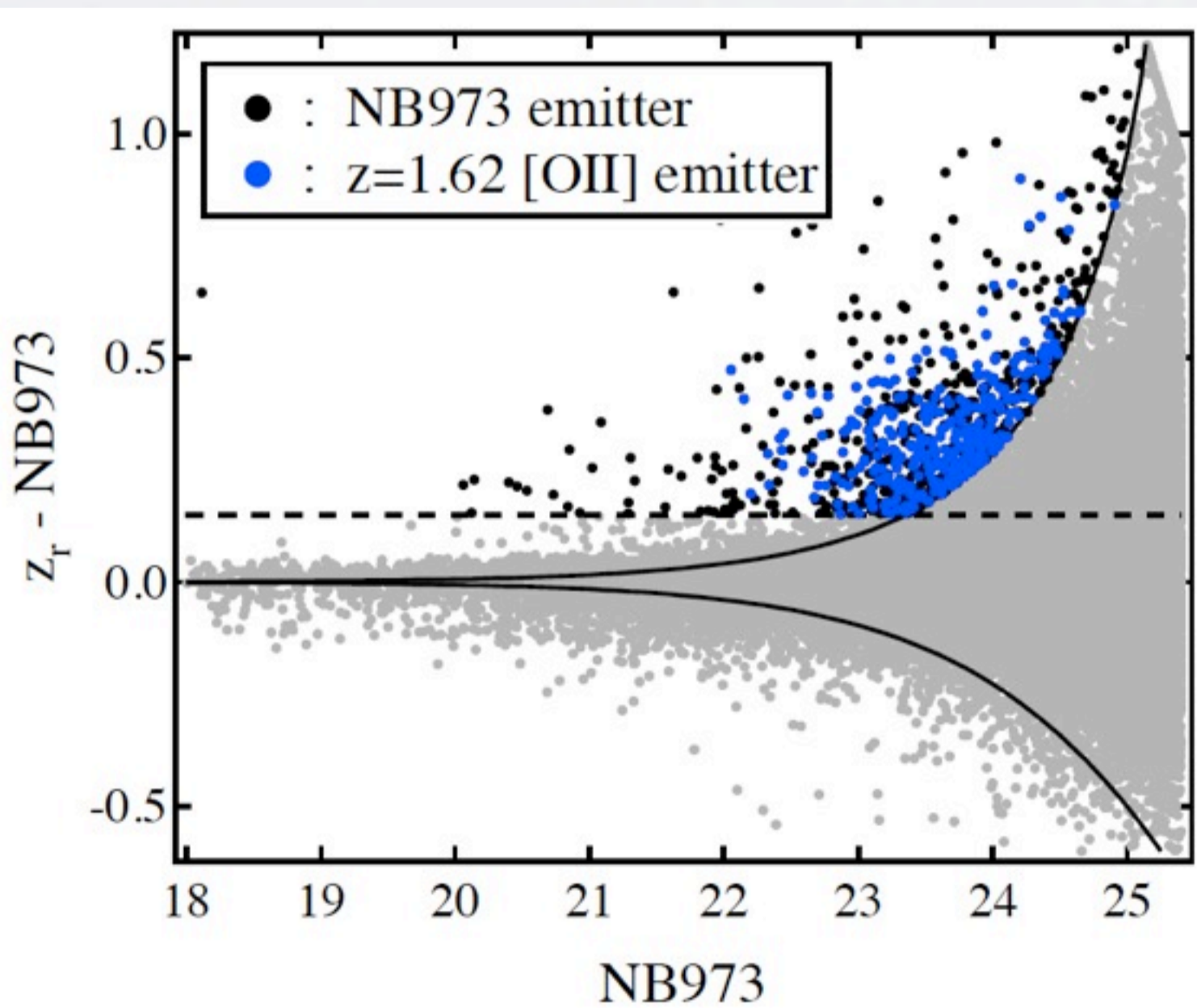
### ● Data

BVRiz	Subaru / Suprime-Cam (Furusawa et al. 2008)
NB973	Subaru / Suprime-Cam (Ota et al. 2010)
JHK	UKIRT / WFCAM (UKIDSS)
X-ray	XMM-Newton (Ueda et al. 2008)

### ● Target selection

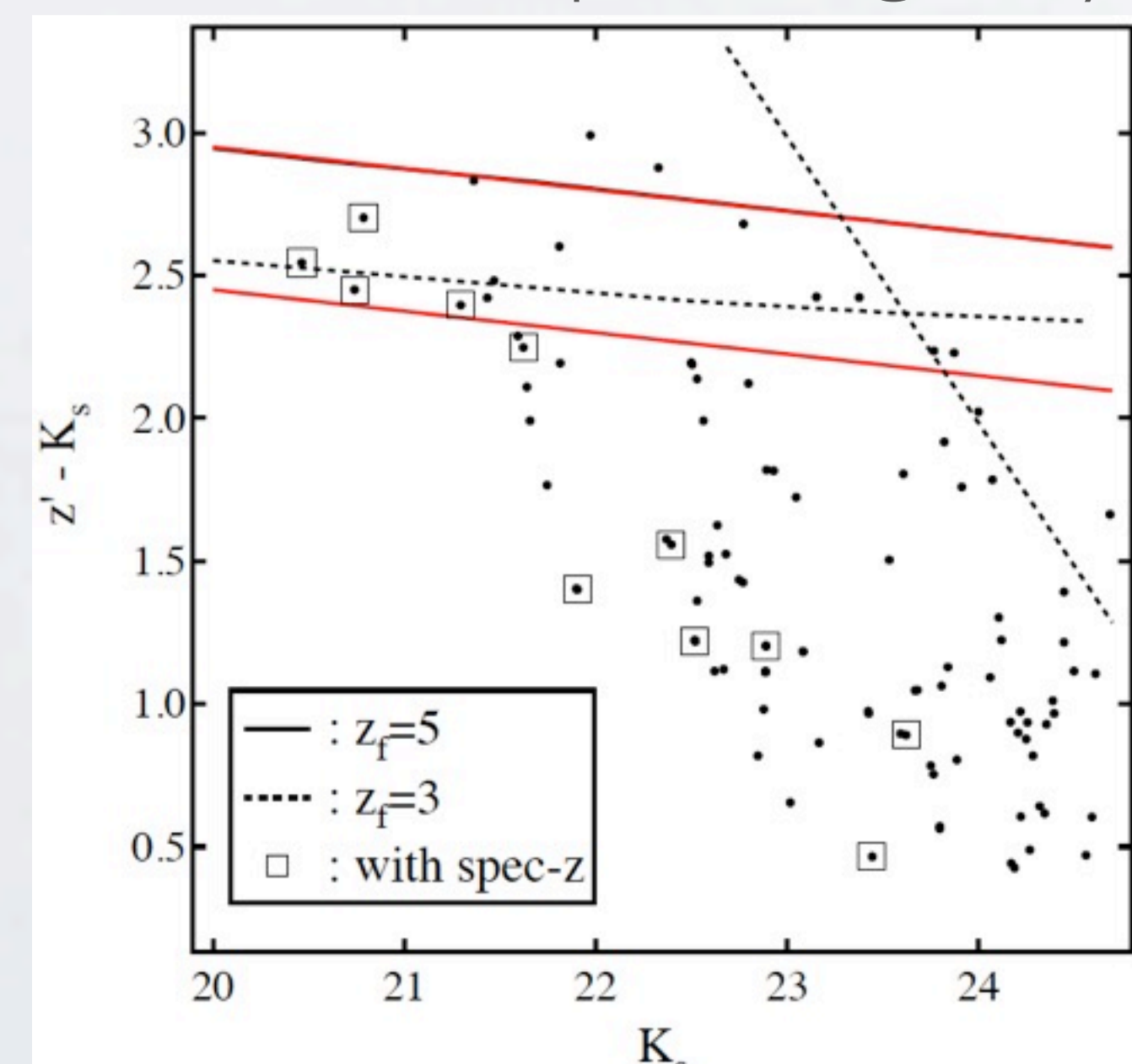
#### ● [OII] emitter selection

photo-z code :  
 "Hyperz" (Bolzonella et al. 2000)  
 with using BVRiz'zrJHK bands



- NB973 > 5σ
- $z_r - \text{NB973} > 2.5\sigma, 0.15\text{mag}$
- $1.3 < z_{\text{phot}} < 1.7$
- reject X-ray point source

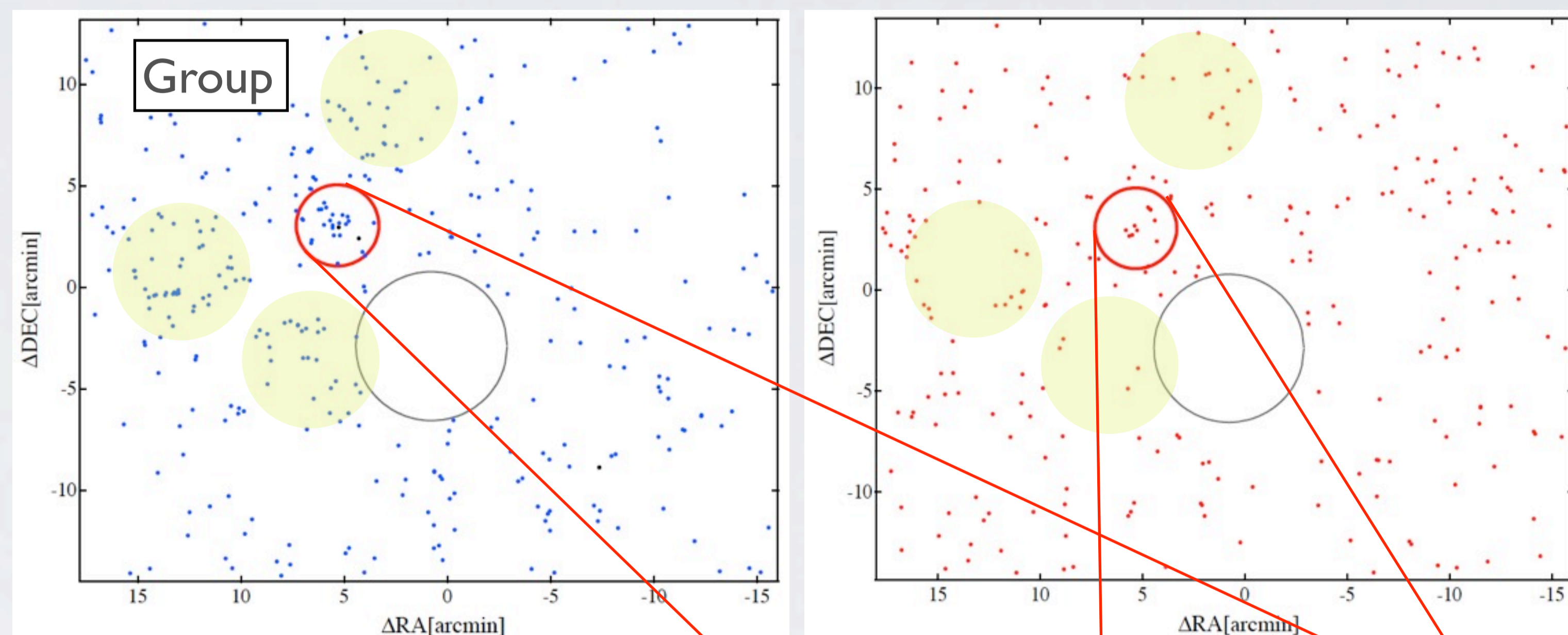
#### ● red sequence galaxy selection



color-magnitude diagram in cluster center (r < 2 arcmin)

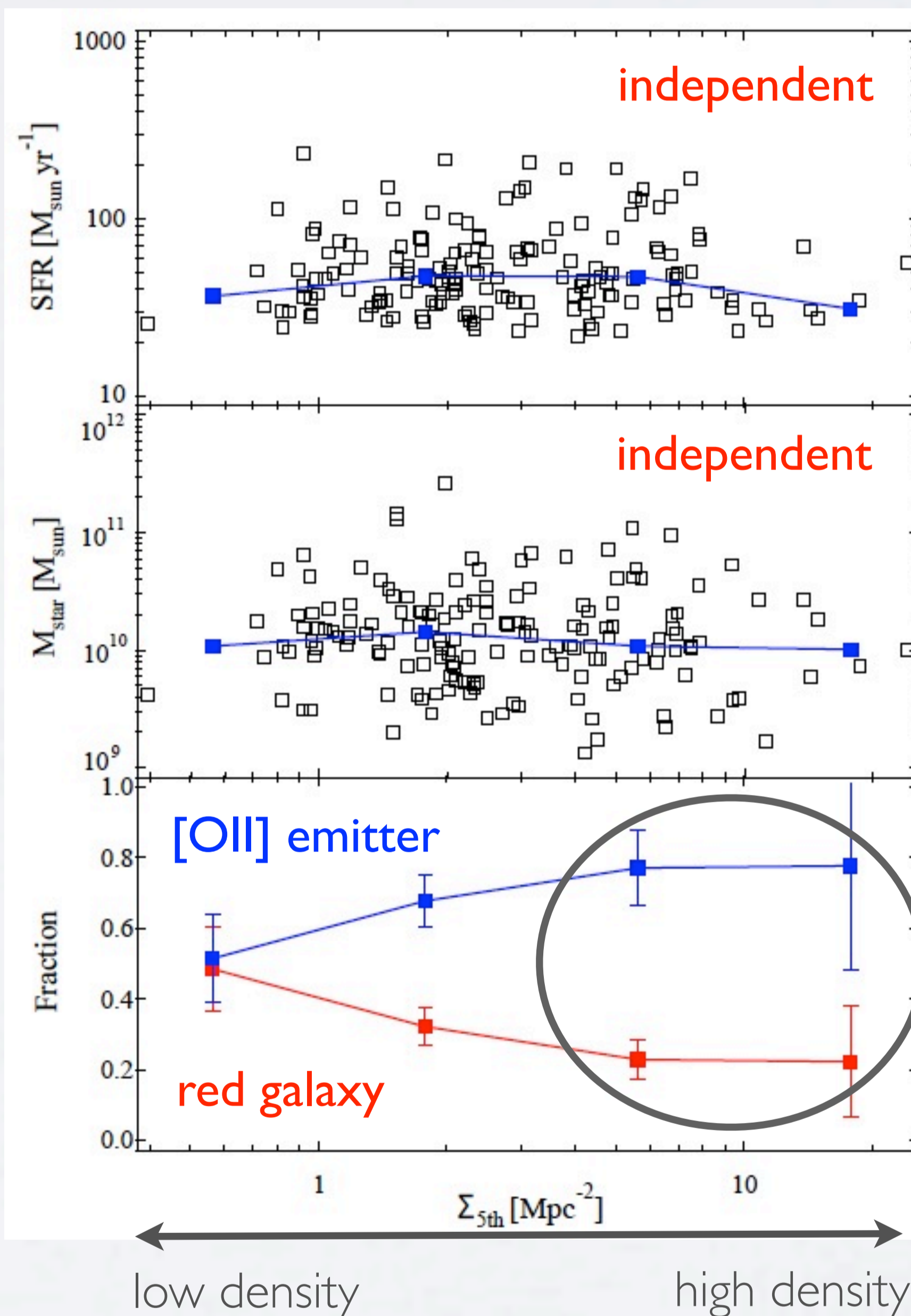
- $K > 5\sigma$
- $1.5 < z_{\text{phot}} < 1.65$
- $z - K = -0.075 + 4.2$  (Kodama et al. 1999)  
 $\Delta z - K < 0.25$

### ● Distribution of [OII] emitters and red galaxies



[OII] emitters distributed in cluster center region. While some groups around cluster are seen in the left panel ([OII] emitter), there is no pronounced structure in the right panel (red sequence galaxy).

### ● Environmental dependence



- star formation rate  
 (case-B assumed, Gam et al. 2010, Kennicutt et al. 1998)

$$L_{[\text{OII}]} / L_{\text{H}\alpha} = 0.56$$

$$A(\text{H}\alpha) = -19.46 + 0.5 \log_{10} L_{\text{H}\alpha, \text{obs}}$$

$$\text{SFR} [M_\odot \text{yr}^{-1}] = 7.9 \times 10^{-42} L_{\text{H}\alpha, \text{int}}$$

- stellar mass (Kodama et al. 1999)

$$\log(M_{\text{star}} / 10^{11} M_\odot) = -0.4(K - K^{11})$$

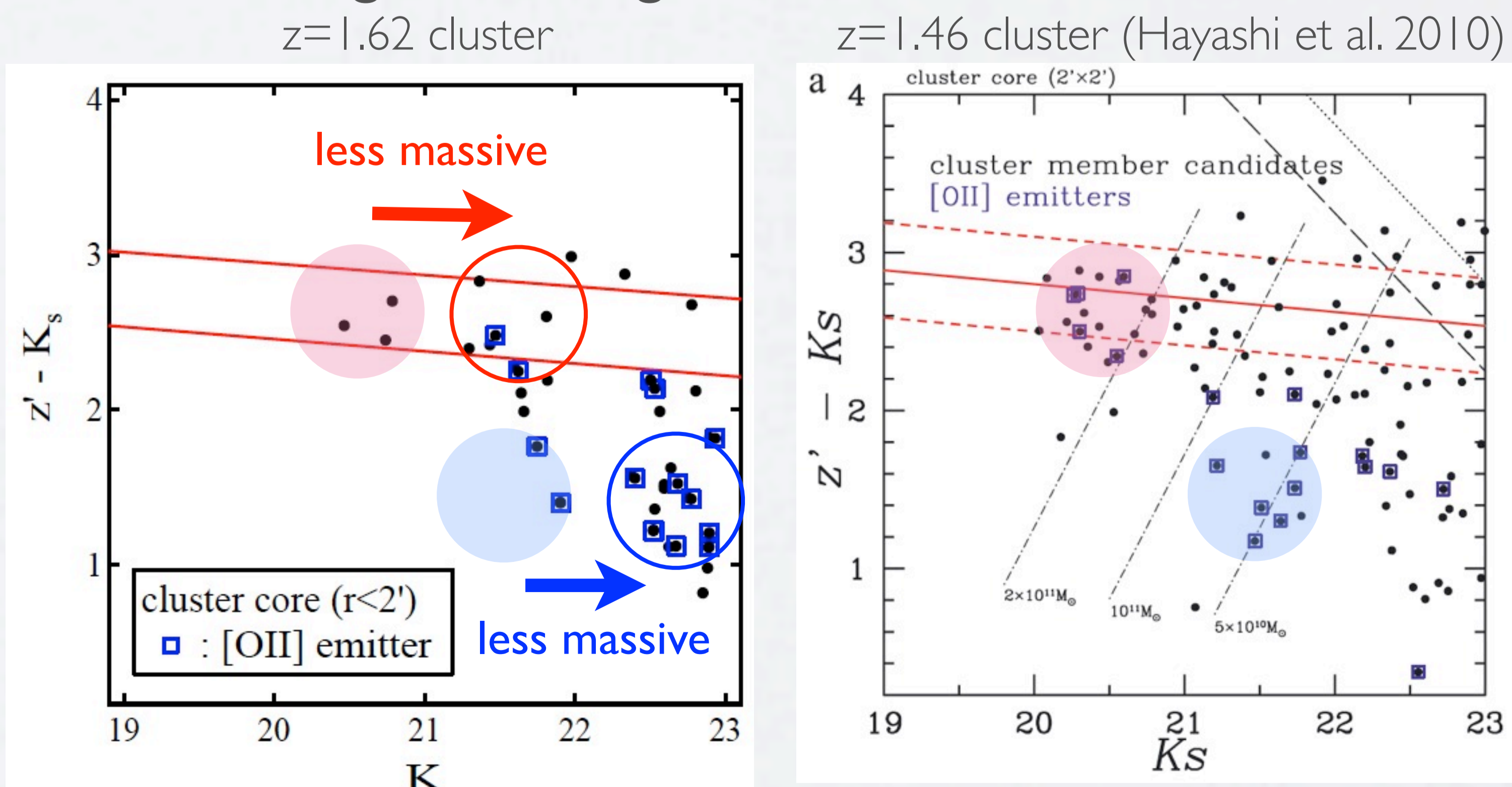
$$\Delta \log M = 0.145[(z - K) - 1.73]$$

- [OII] emitter fraction

$$f_{\text{emitter}} = \frac{N_{\text{emitter}}}{N_{\text{emitter}} + N_{\text{red galaxy}}}$$

The fraction of [OII] emitter increases in high density region.

### ● Color-magnitude diagram



The difference between [OII] emitters with same color implies that there is a variety of clusters in same epoch.