Environmental impacts on star-forming galaxies in a z=0.9 cluster during course of galaxy accretion

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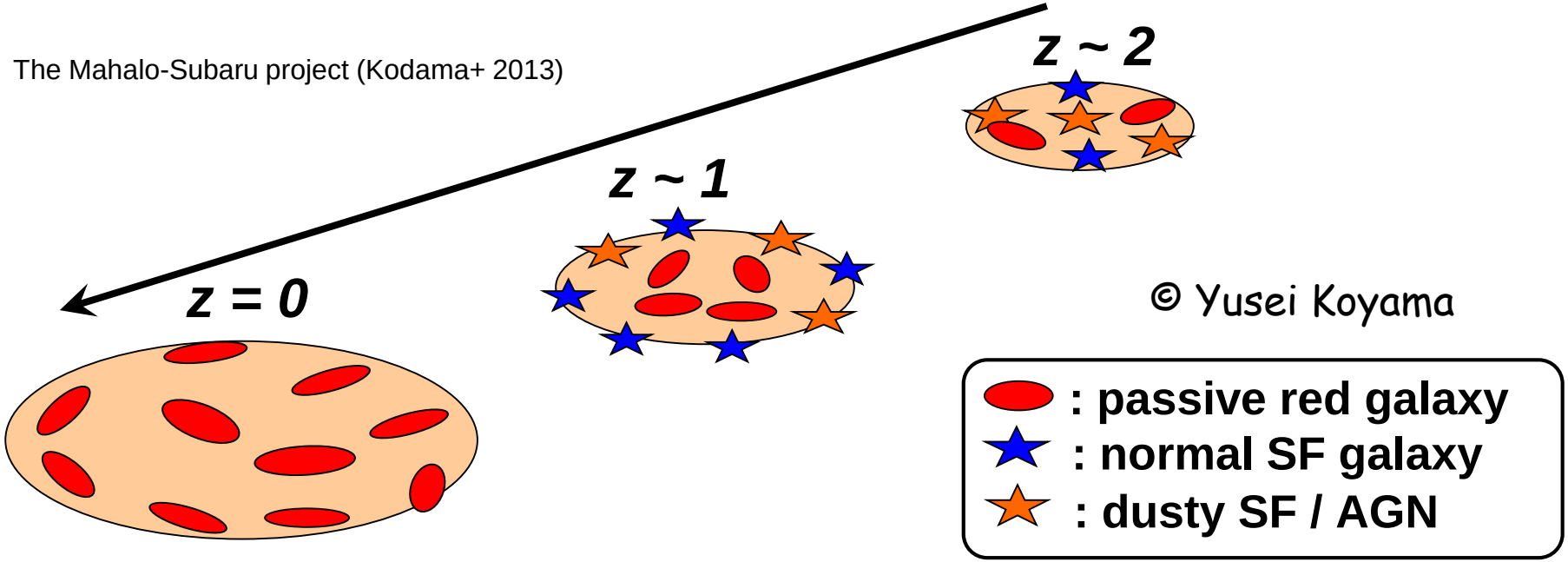
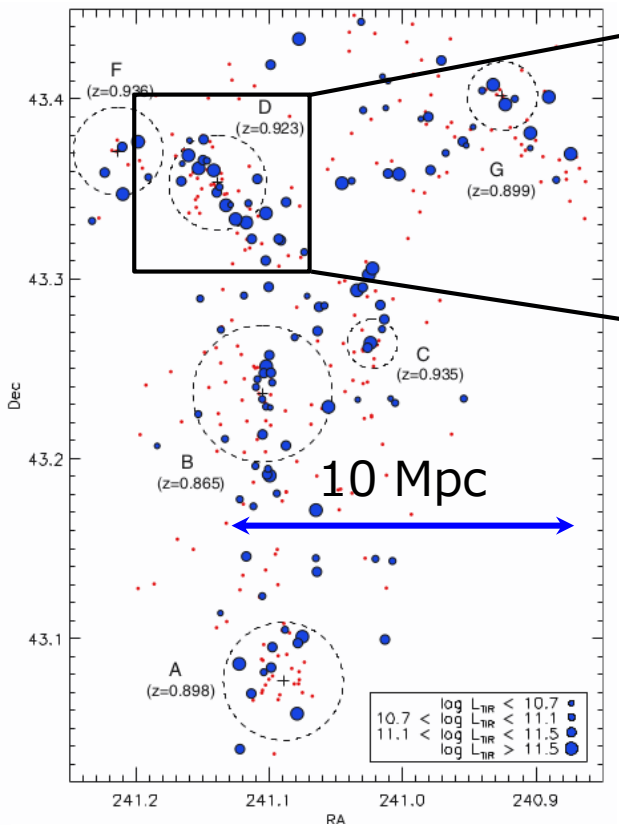
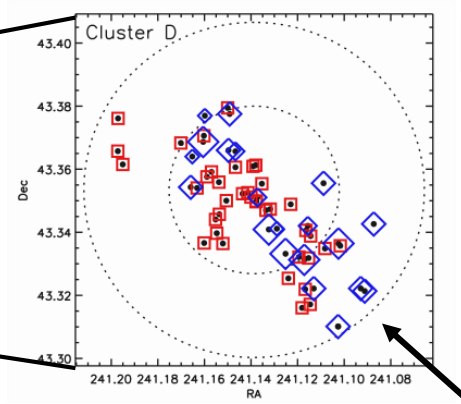
Introduction

Star formation activity in clusters is quenched from inside to outer regions, but what physical process are actually playing role?



Our target: CL1604D cluster





MIPS 24 um detected

MIPS 24 um undetected

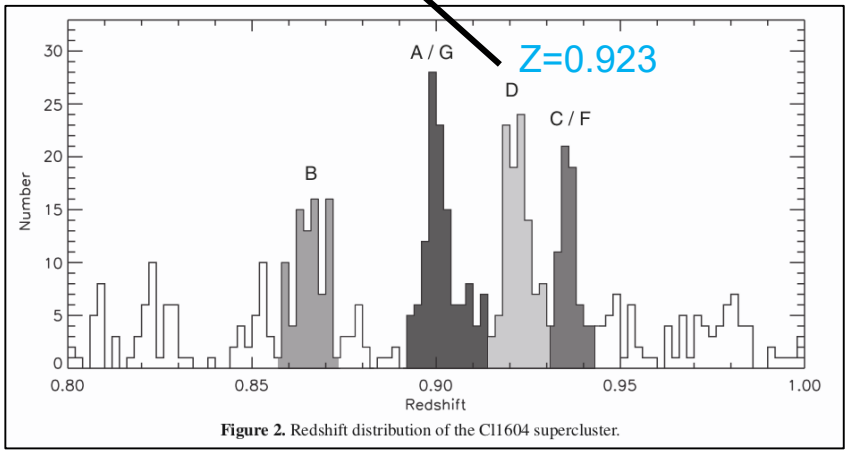
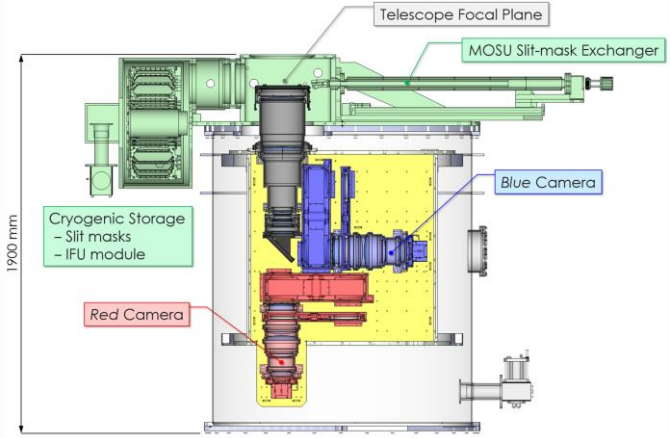


Figure 2. Redshift distribution of the Cl1604 supercluster.

Kocevski et al. 2011, ApJ, 736, 38

SWIMS

- A new camera/spectrograph for The University of Tokyo Atacama Observatory (TAO).
- SWIMS is now installed on Subaru Telescope for engineering observations.
- Although our observation is part of engineering runs, we unexpectedly/fortunately get some interesting results from NB imaging with SWIMS combined with HSC-SSP and rich set of existing data (HST, Spitzer and intensive spectroscopic survey).



Motohara+ 2016

Data

SWIMS

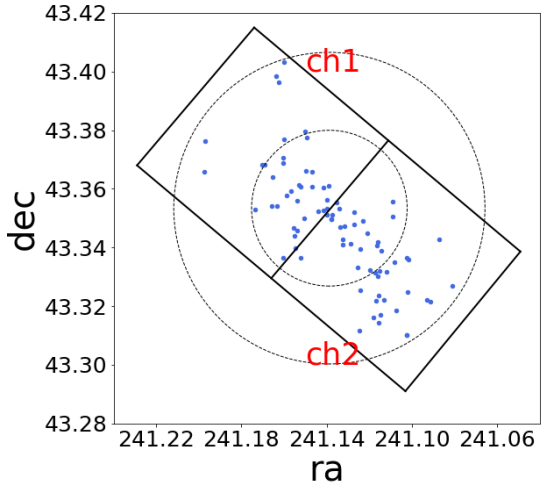
- J band (May 31 , 2018)
  - Exp. time : 27min
  - seeing : 0.6”
- NB1261(January 24, 2019)
  - Exp. time : 54min
  - seeing: 0.65”

HSC-SSP survey (Wide region)

- g, r, i ,z and y bands photometry
- Some physical quantities by the SED fitting.
- Photometric redshift

Existing Data

- Optical spectroscopy (KECK I/II LRIS, DEIMOS)
  - Gal & Lubin 2004
  - Gal et al. 2008
  - Lemaux et al. 2010
- MIR imaging (Spitzer MIPS 24μm)
  - Kocevski et al. 2011
- HST imaging (ACS F606W F814W)
  - Kocevski et al. 2009



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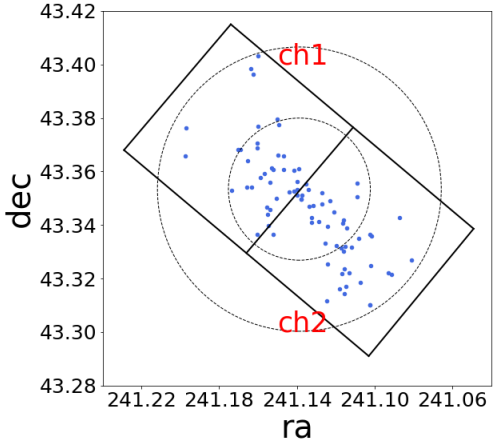
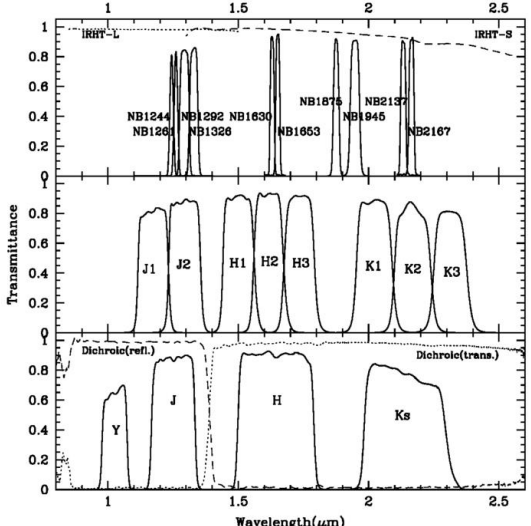
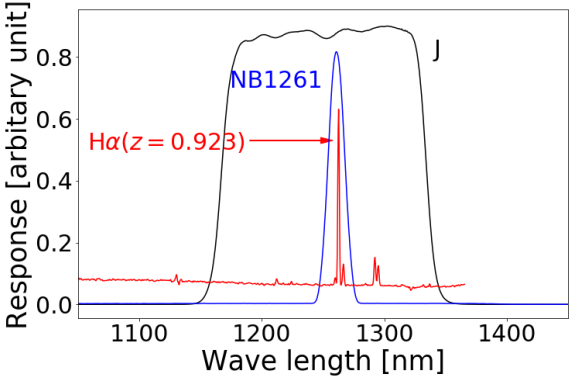
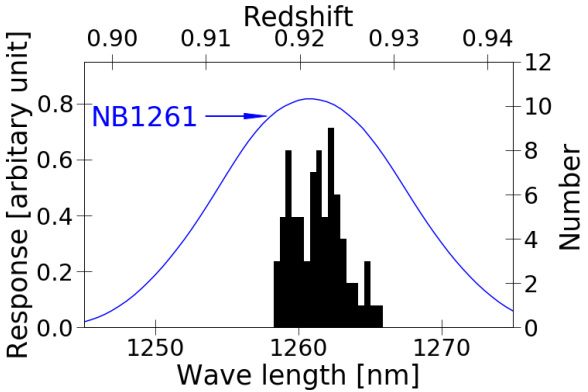
FoV of our observation





Filter set for SWIMS-18 survey





Data

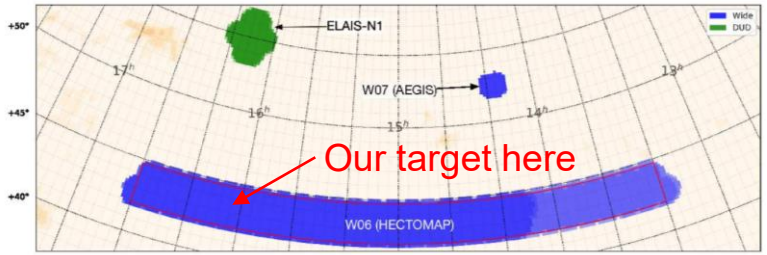


Fig. 1. The area covered in this release shown in equatorial coordinates. The blue and green areas show the Wide and Deep+UltraDeep layers, respectively. For the Wide layer, the darker color means that the area is observed in more filters (up to 5 filters). The red boxes indicate the approximate boundaries of the three disjoint regions that will make up the final Wide survey. The Galactic extinction map from Schlegel et al. (1998) is shown in the background.

HSC-SSP DR2 paper (arXiv:1905.12221)

HSC-SSP survey (Wide region)

- g, r, i ,z and y bands photometry
- We use **stellar mass** and **amount of dust attenuation** by MIZUKI code.

Existing Data

- Optical spectroscopy (KECK I/II LRIS, DEIMOS)
  - Gal & Lubin 2004
  - Gal et al. 2008
  - Lemaux et al. 2010
- MIR imaging (Spitzer MIPS 24μm)
  - Kocevski et al. 2011
- HST imaging (ACS F606W F814W)
  - Kocevski et al. 2009

Spec-z →

HST imaging ↓

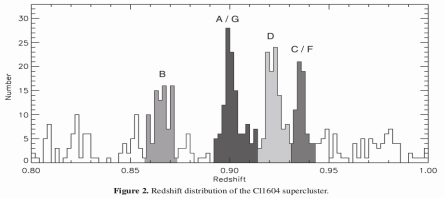


Figure 2. Redshift distribution of the Cl1604 supercluster.

Kocevski + 2011

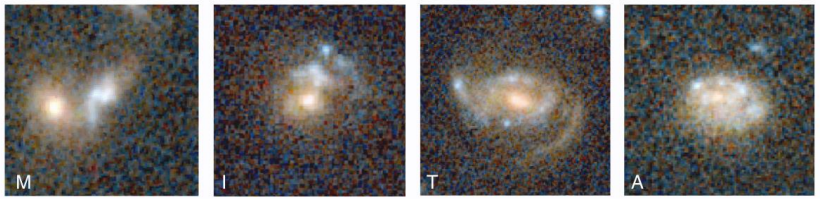


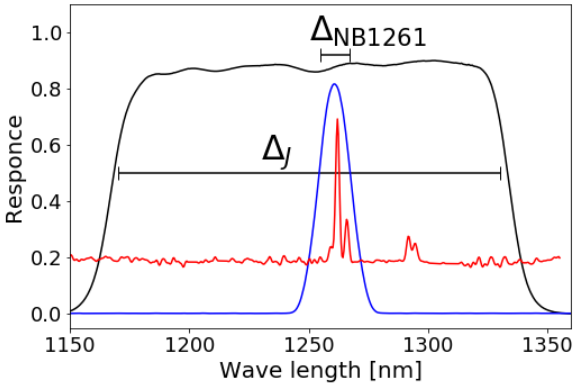
Figure 14. Color ACS thumbnails showing examples of our four interaction classifications: M: ongoing mergers, I: galaxies that exhibit tidal features and have a nearby companion, T: galaxies that exhibit tidal features but do not have an obvious companion, and A: galaxies with asymmetric light distributions. The color components are F606W and F814W for blue and red, respectively, while green is represented by a weighted average of the two.

Derivation of Physical Quantities

Ha Line Flux

$$F_{\mathrm{H}\alpha+[\mathrm{NII}]} = \frac{f_{\mathrm{NB1261}} - f_J}{1 - \Delta_{\mathrm{NB1261}}/\Delta_J} \Delta_{\mathrm{NB1261}}$$

We assume [N II] contribution is 30 per cent. (Tresse+ 1999)



Star Formation Rate

Kennicutt (1998)

$$\mathrm{SFR}(M_\odot\,\mathrm{yr}^{-1}) = 7.9 \times 10^{-42} L_{\mathrm{H}\alpha}\,(\mathrm{erg\,s}^{-1})$$

$$\mathrm{SFR}(M_\odot\,\mathrm{yr}^{-1}) = 4.5 \times 10^{-44} L_{\mathrm{IR}}\,(\mathrm{erg\,s}^{-1})$$

Bell et al. (2005)

$$\mathrm{SFR}(M_\odot\,\mathrm{yr}^{-1}) = 2.5 \times 10^{-44} (L_{\mathrm{IR}} + 2.2 L_{\mathrm{UV}})$$

We convert these SFRs to the Chabrier IMF assumed ones.

Summary and Conclusion

1. LIRGs trace only starbursts, while HAEs trace both normal star-forming galaxies and starbursts.
2. Ha based SFRs are underestimated for dusty starbursts even after SED based extinction correction.
3. Star-forming activity is fully quenched in the cluster core, while starbursts and merger/interaction are seen in in-falling groups.