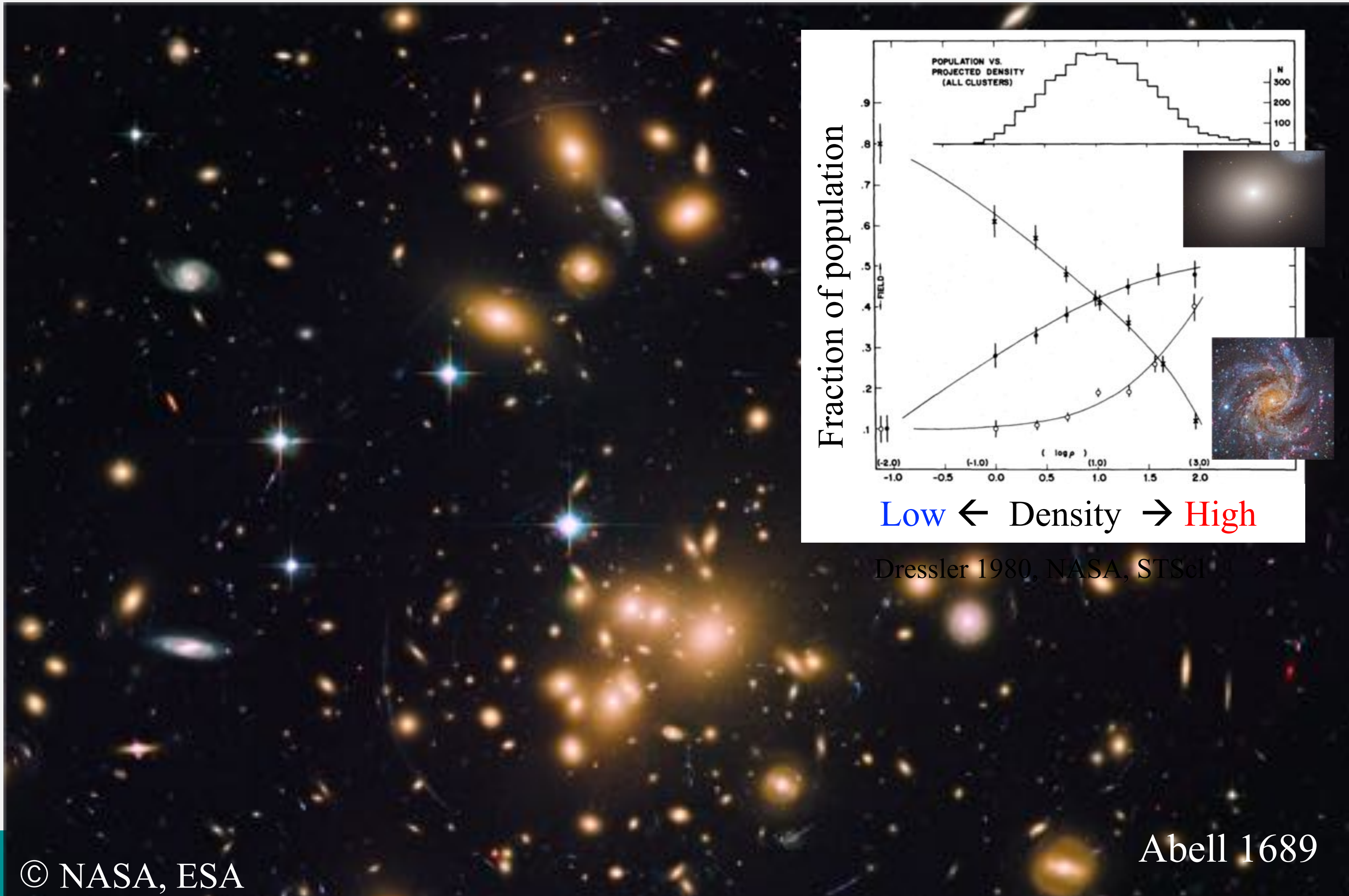
The environmental impacts on the mass-metallicity relation at z=1.52.

Shgieru V. Namiki (SOKENDAI/Subaru telescope)

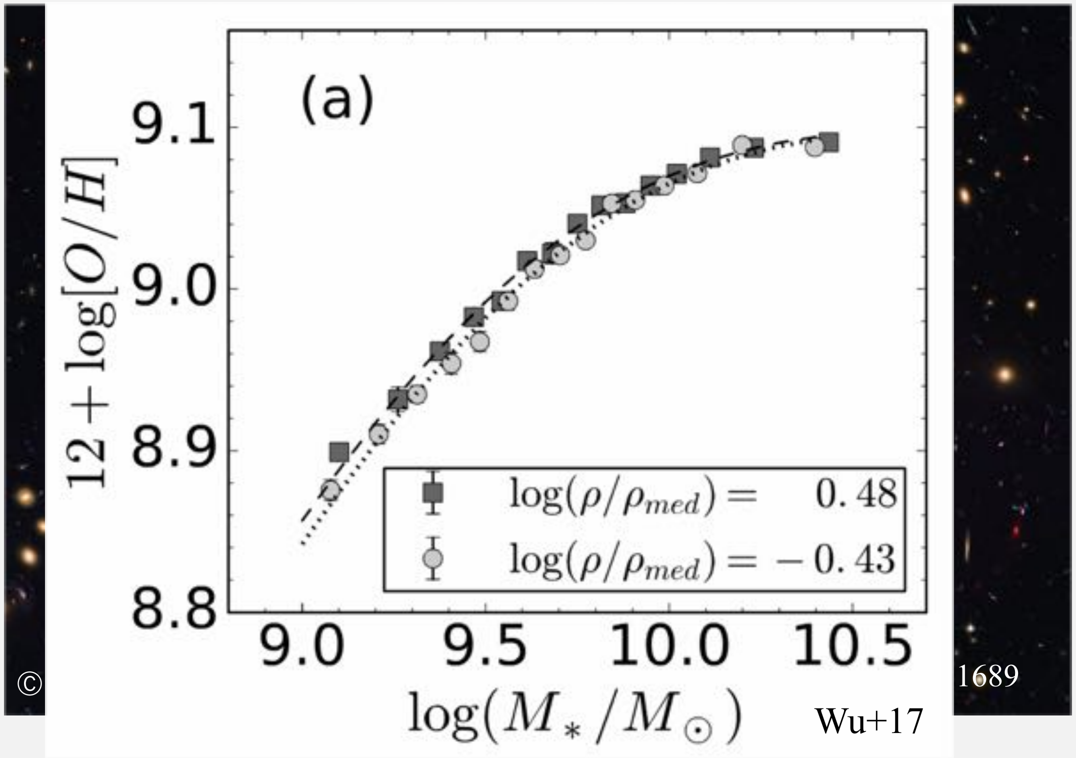
Collaborators: Y. Koyama, M. Hayashi, K. Tadaki, N. Kashikawa, M. Onodera, R. Shimakawa, T. Kodama, I. Tanaka, N. M. Forster Schreiber, J. Kurk, and R. Genzel

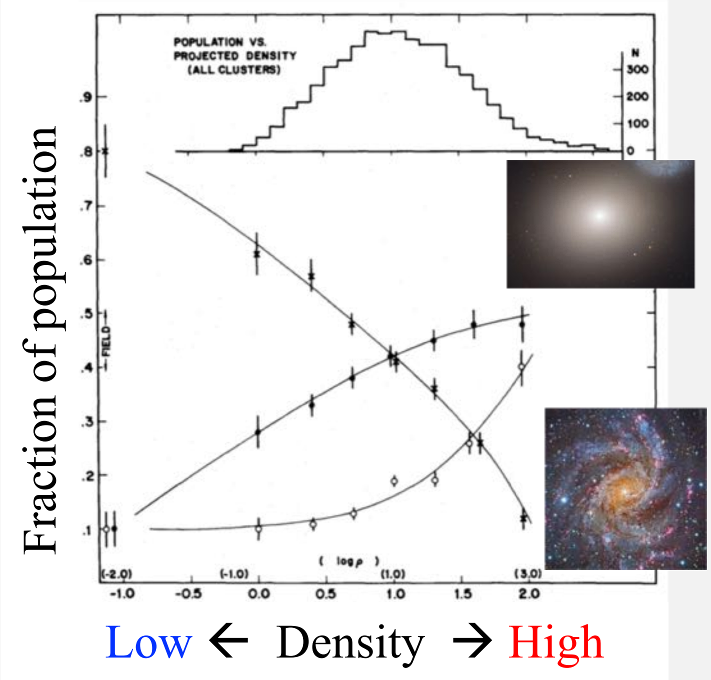
Galaxy population & environment



Dressler 1980, NASA, STScI

Galaxy population & environment



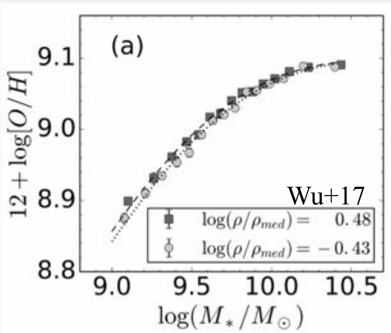


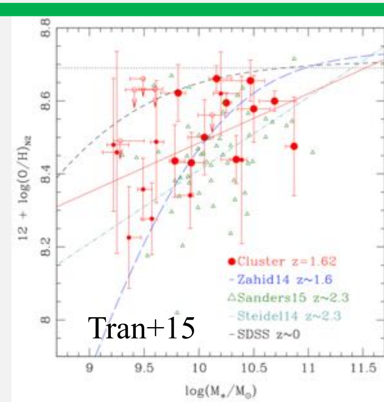
Dressler 1980, NASA, STScl

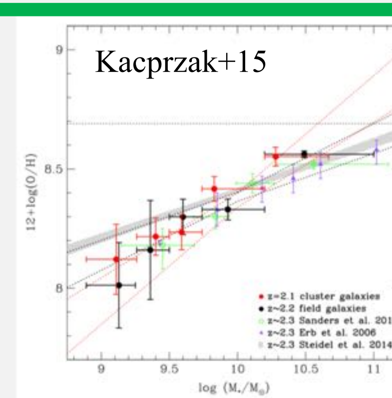
- High-density environment affects morphology and SF activity
- Metallicity is NOT affected by the environment

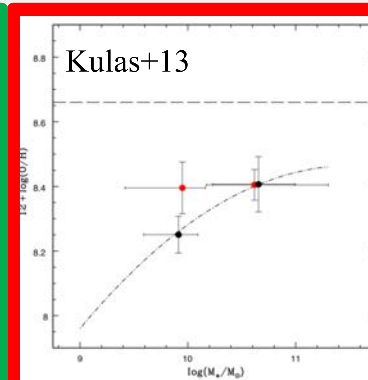
Environment vs MZR - current understanding

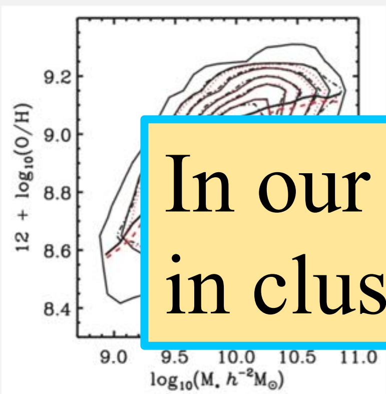
Higher



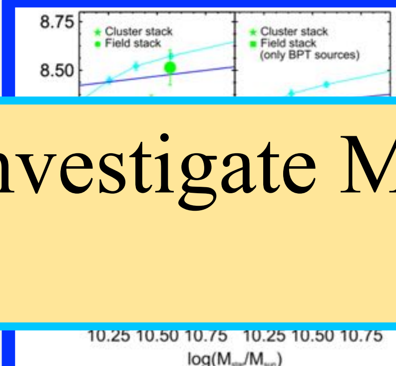


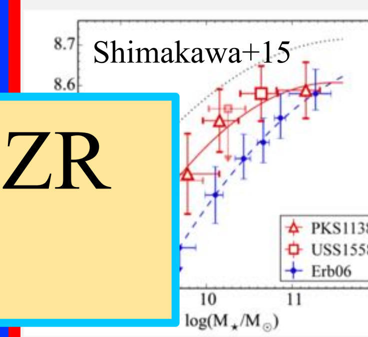






Consistent





In our study, we newly investigate MZR in cluster at z=1.52.

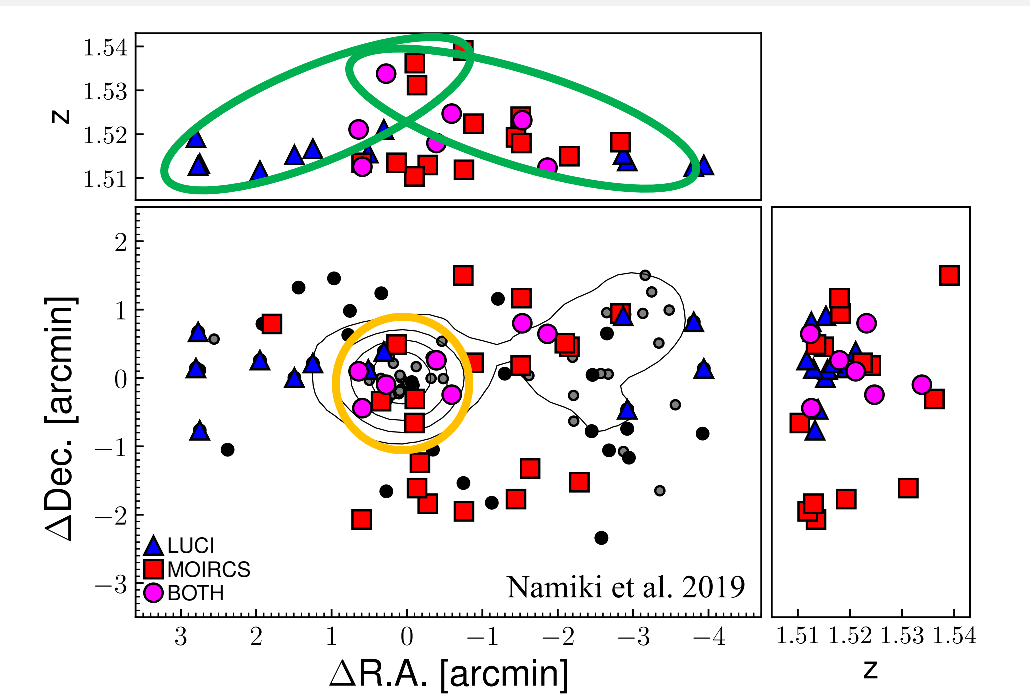
Lower

0 1 2

Redshift

Spectroscopy around 4C65.22

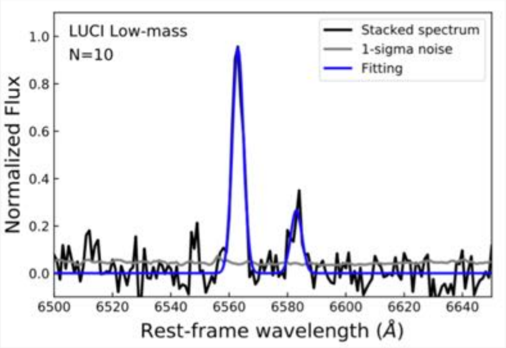
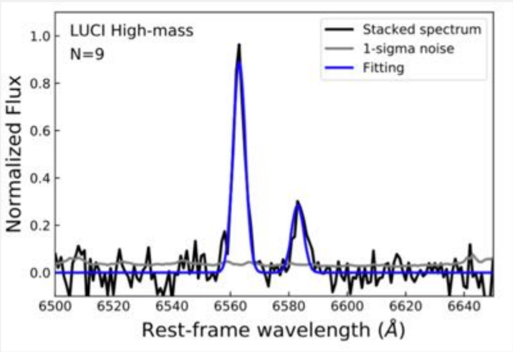
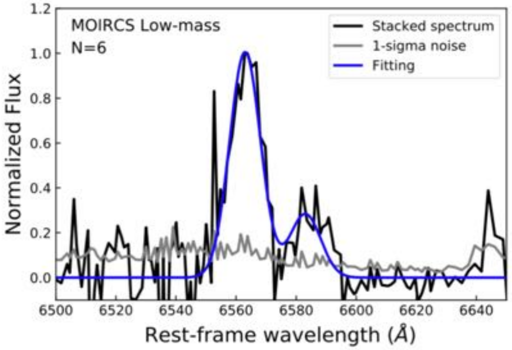
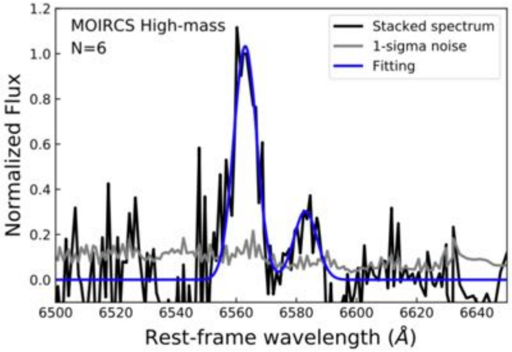
- This cluster is originally discovered by Koyama+14 with Subaru and NB technique.
- Near-Infrared (NIR) follow-up spectroscopy with LBT/LUCI & Subaru/MOIRCS.



- Our targets are mainly selected from NB-emitters in Koyama+14.
- 71 observed and 39 confirmed.
- We confirm 3-dimentional structure at z=1.52
- 2 filament / sheet structure?

Stacking Analysis

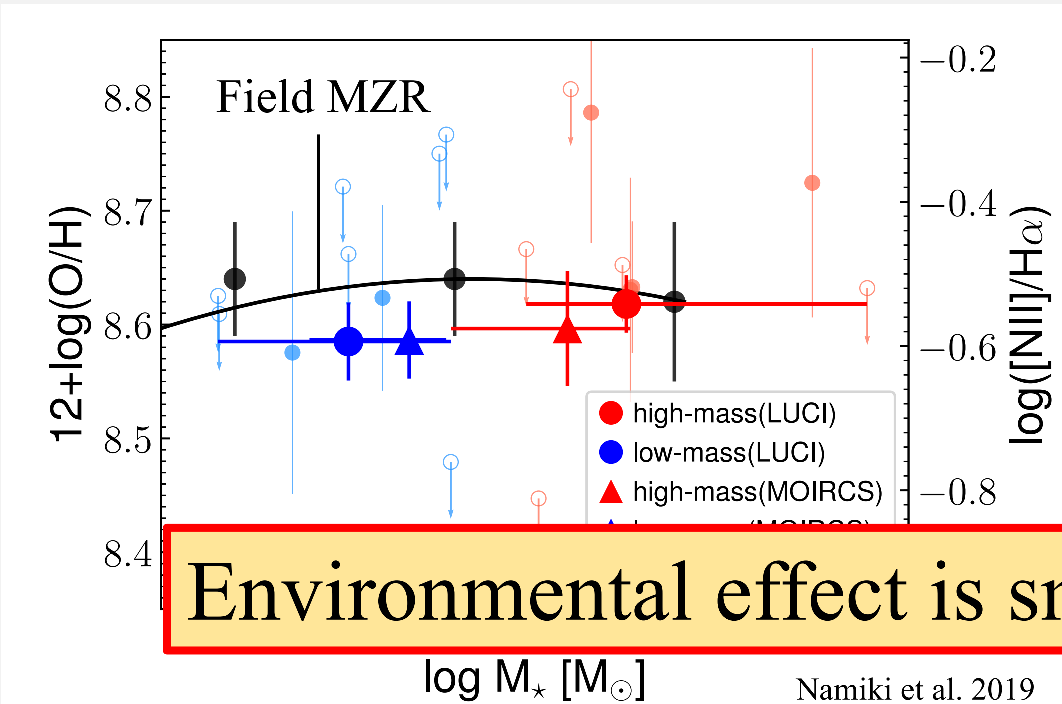
- Divide into 4 bin by stellar mass and instrument.
- Use stacking analysis in each bin.

	low-mass ($\log(M_*/M_{sun})<10.48$)	high-mass ($\log(M_*/M_{sun})>10.48$)
LUCI		
MOIRCS		

Environmental Impacts on MZR

- Calculate ISM gas-phase metallicity (O/H) with N2 index.

$$N2 \equiv \log\{[NII]\lambda6583 / H\alpha\},\ 12+\log(O/H) = 8.90+0.57\times N2$$



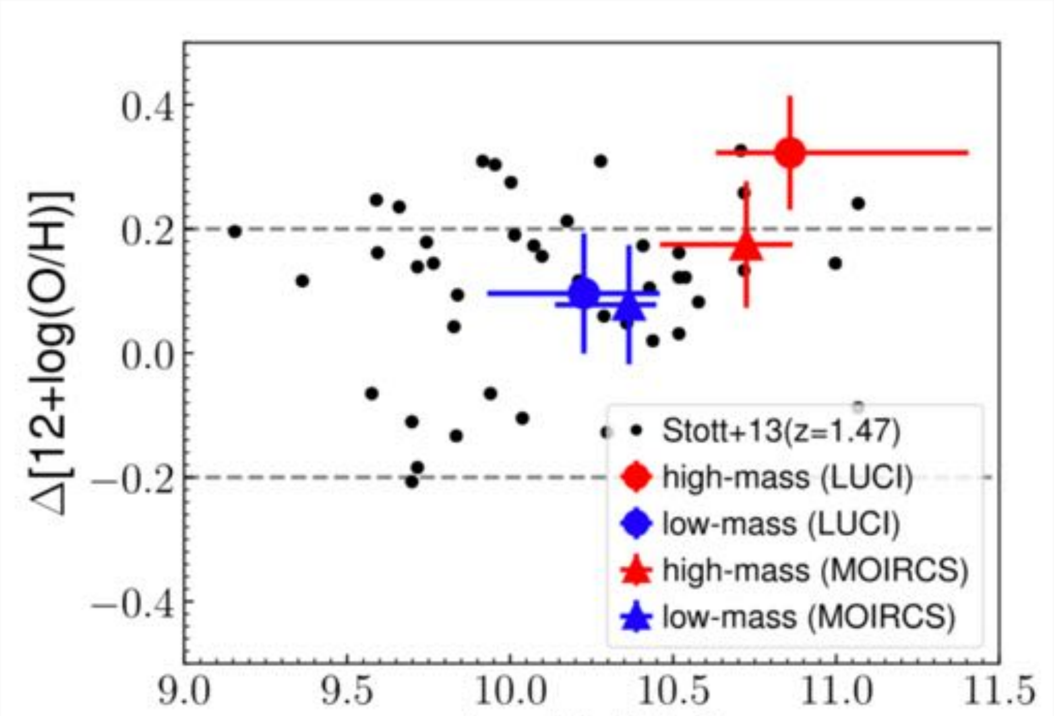
Namiki et al. 2019

- Blue and red big symbols express the mean of each mass bin.
- Black points and line are the field MZR derived from NB-emitters at z~1.4.
- Our MZR is consistent to

Environmental effect is small in this cluster

Comparison with FMR in Stott+13

- Fundamental metallicity relation (FMR, between stellar mass, metallicity, and SFR).

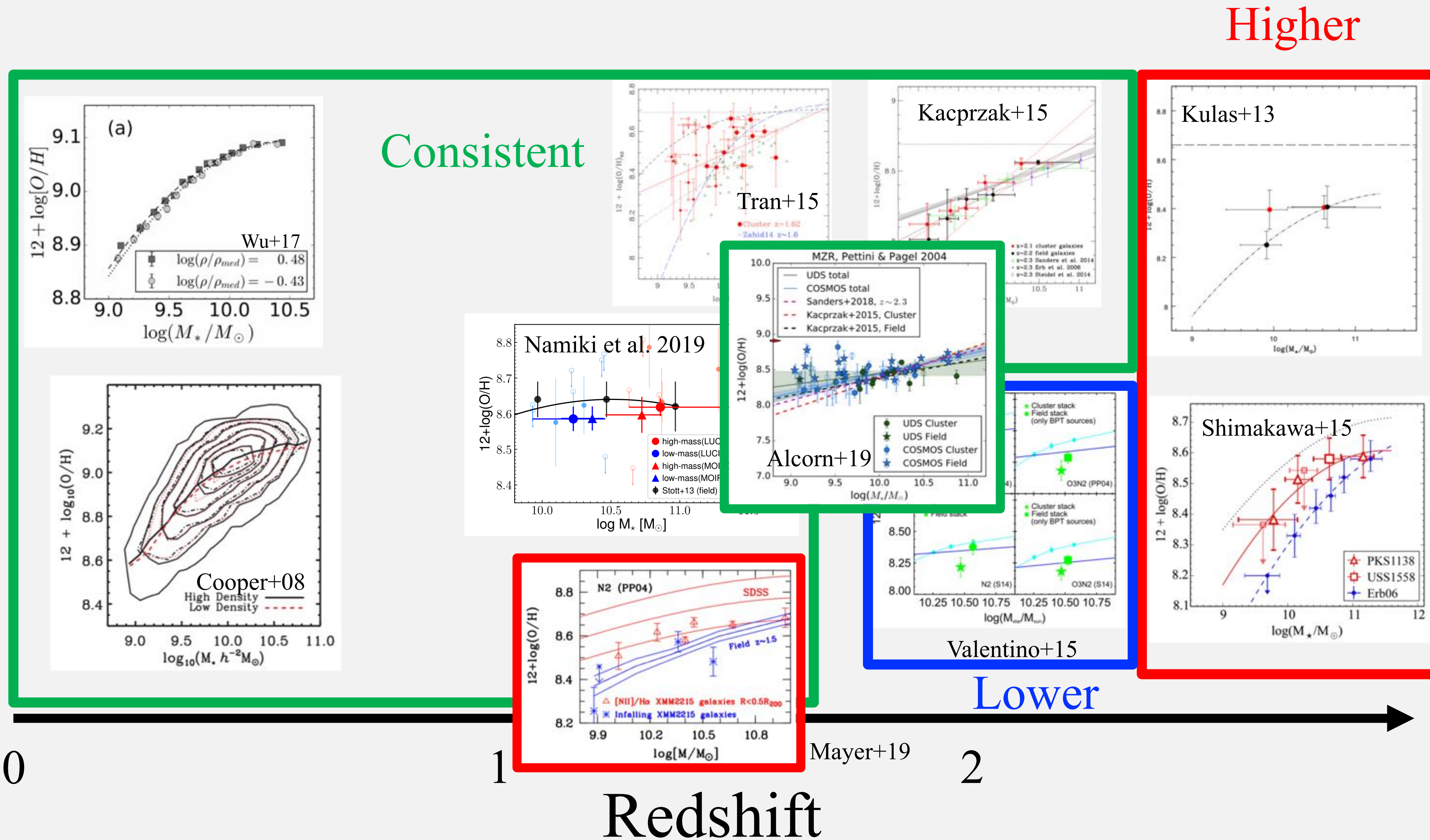


Namiki et al. 2019

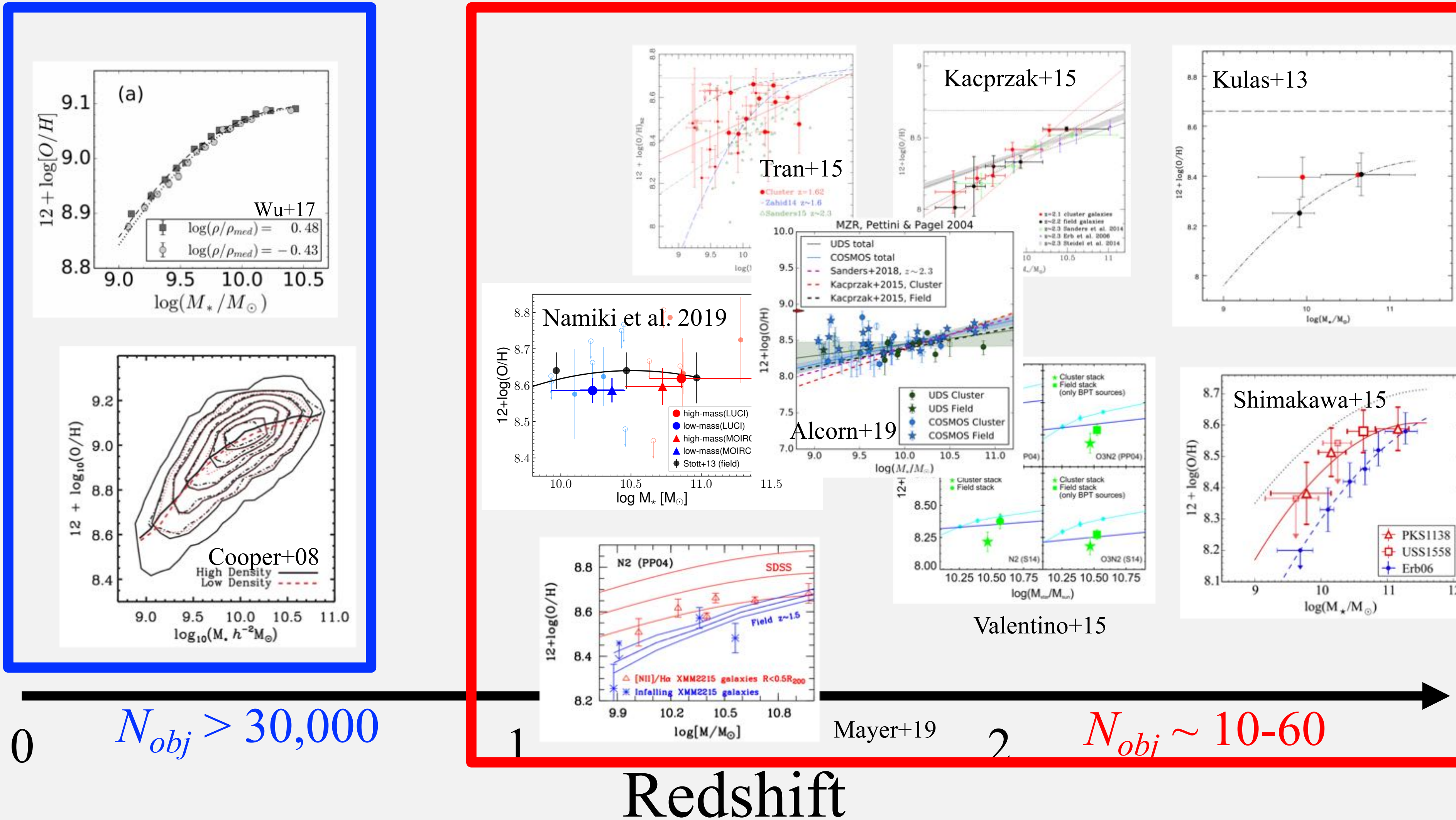
- The residual from FMR in Stott+13 is less than 0.4 dex (~2σ).
- Again, FMR in our cluster is consistent to the field.

$$\Delta\left[12+\log\left(\frac{O}{H}\right)\right] = \left[12+\log\left(\frac{O}{H}\right)\right]_{obs} - \left[12+\log\left(\frac{O}{H}\right)\right]_{HzFMR}$$

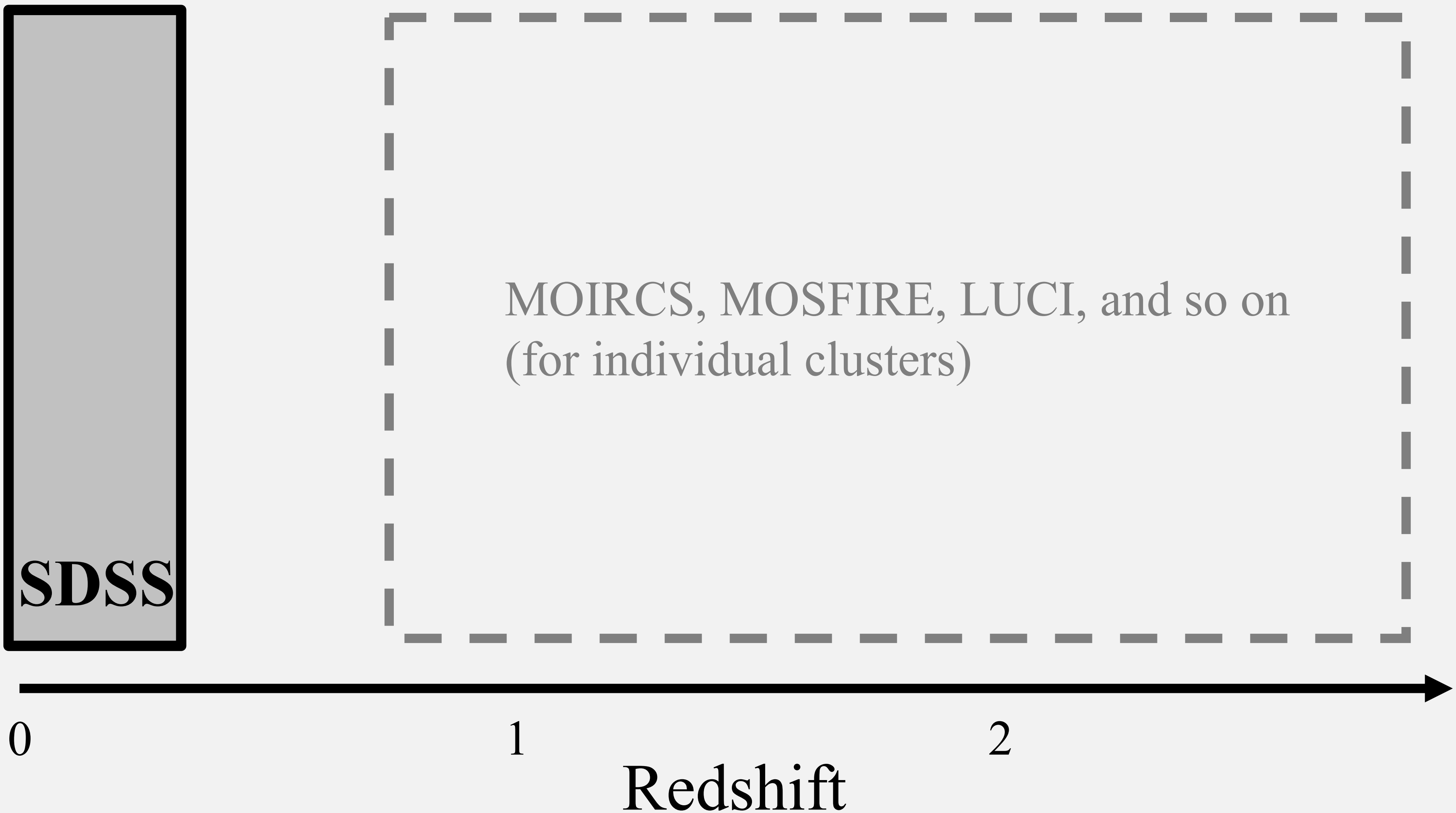
Environment vs MZR - current status



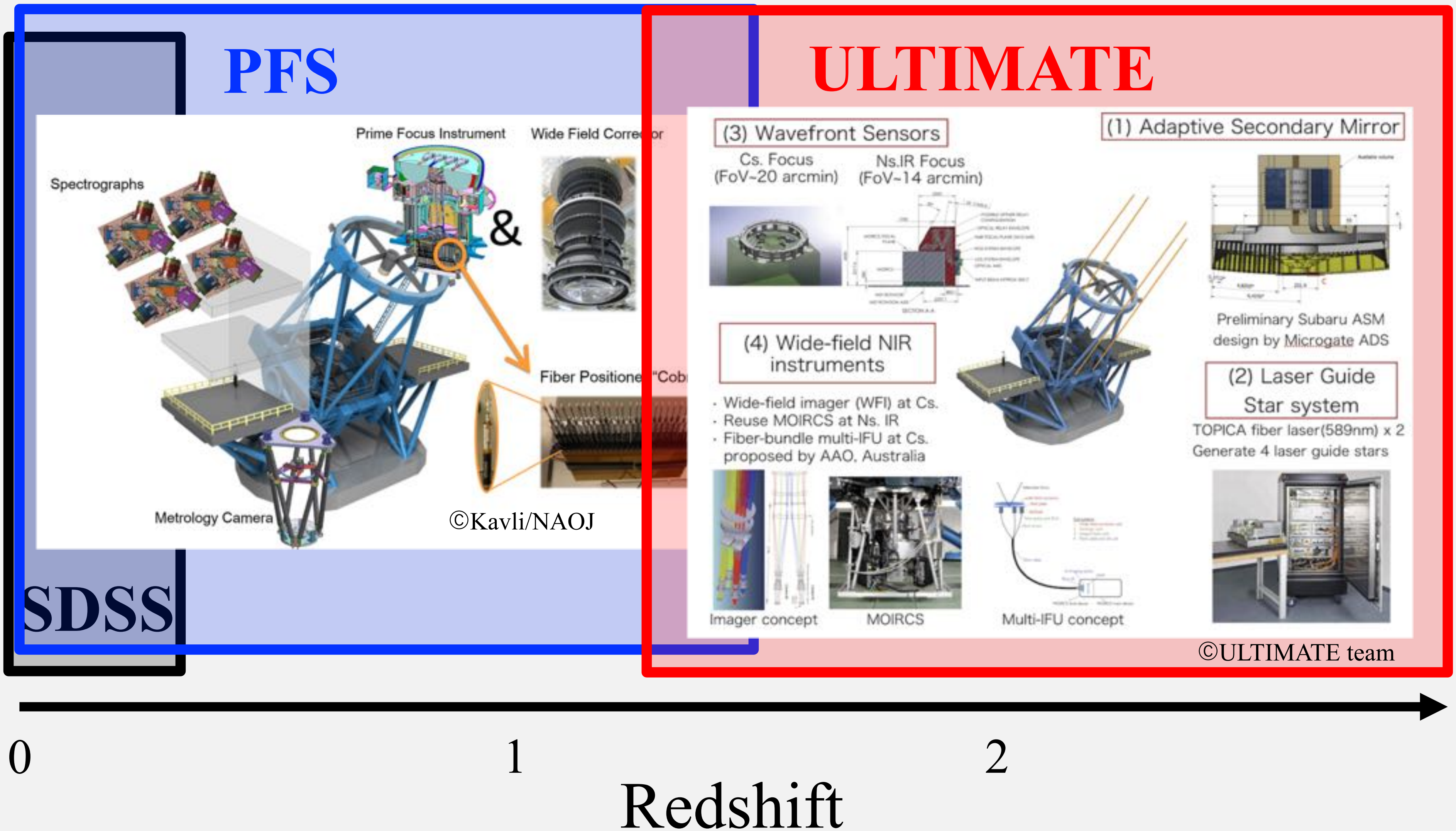
Environment vs MZR - current status



Environment vs MZR – future development

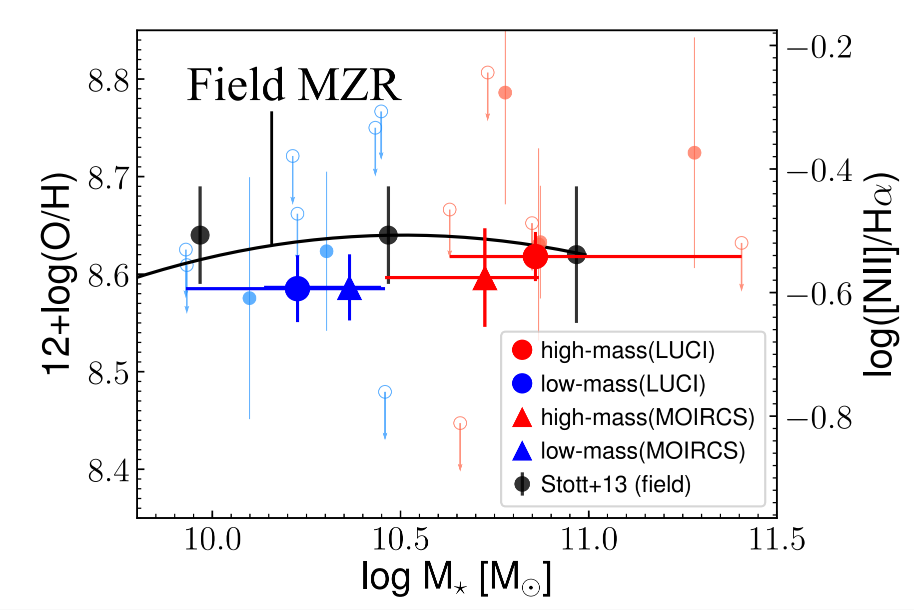


Environment vs MZR – future development



Summary

- We observe 71 galaxies and obtain redshift for 39 of them.
- Using N2 index, we derive mean ISM gas-phase metallicity of the sample.



- Our samples have similar metallicity to the field galaxies.
- Environmental effect is small.
- In the future, PFS can reach z~1.5 and ULTIMATE can reach z~3.5.