第4回銀河進化研究会 (2017/6/9, 大阪大学)

The nature of Hα-selected galaxies along the huge cosmic web at z=0.4 revealed by HSC-SSP survey

Koyama et al. 2017, submitted to PASJ special issue, arXiv:1704.05979

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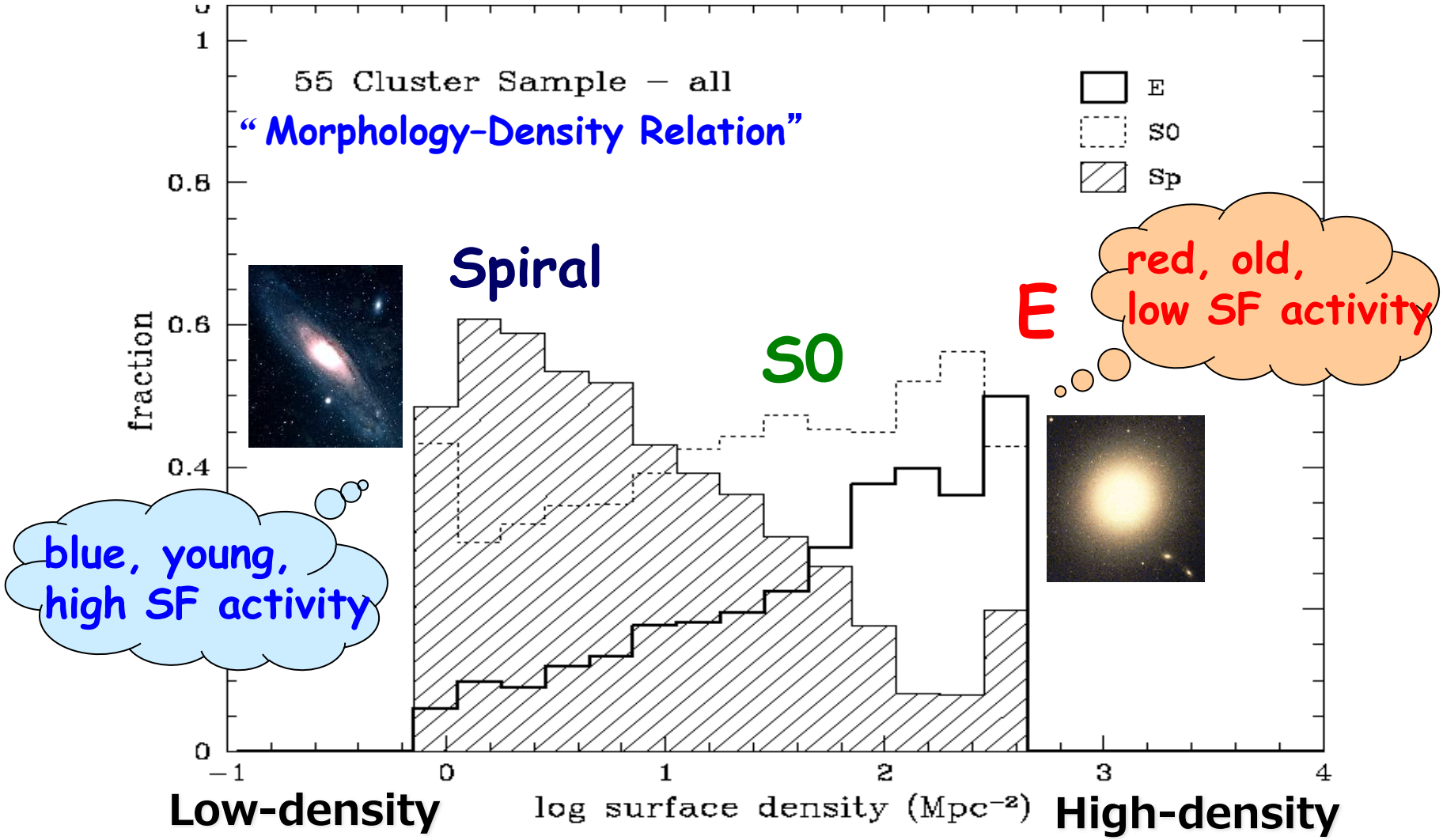
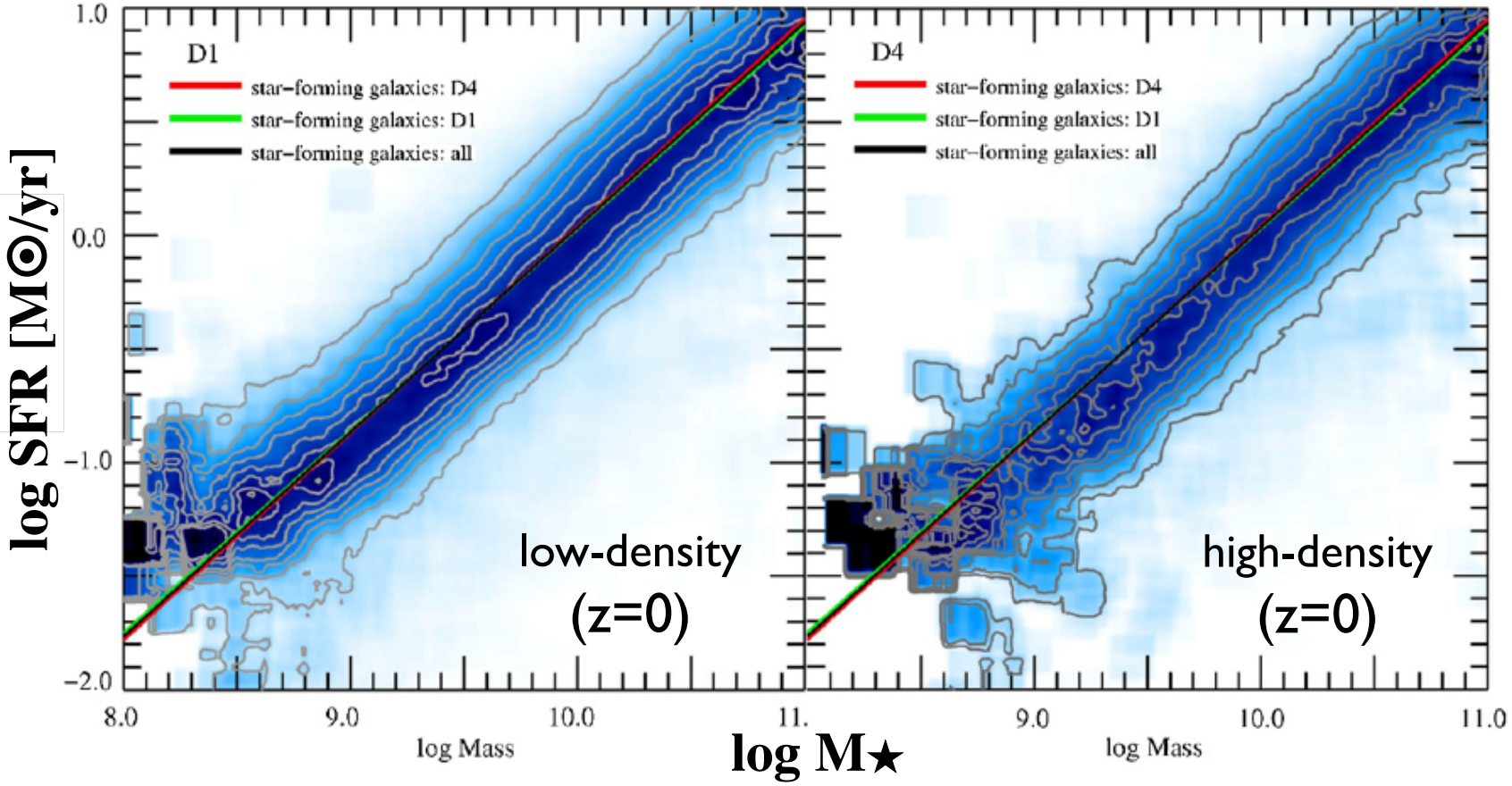
Galaxy evolution & environment



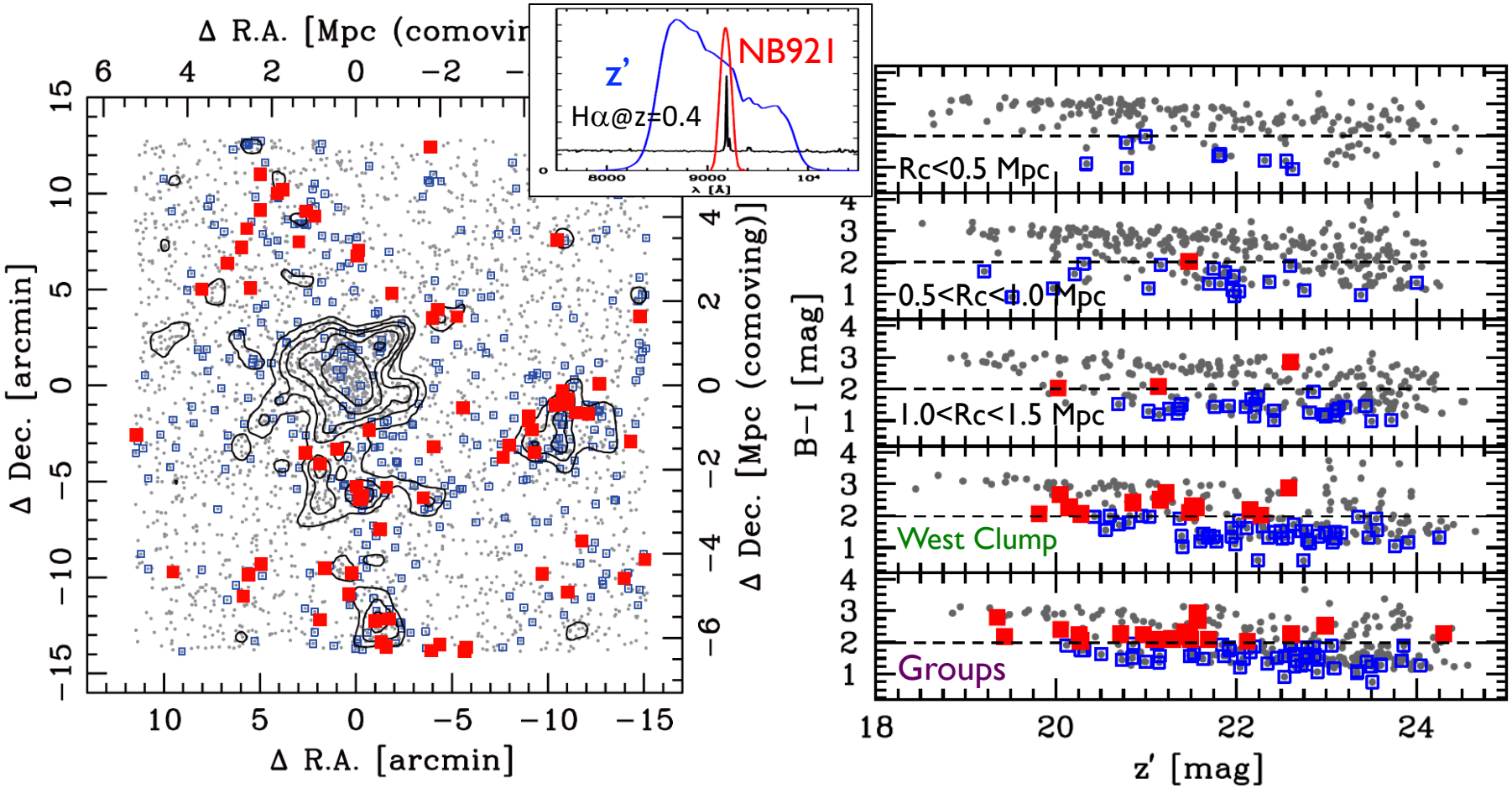
(Dressler 1980)

Environmental independence of the SF main sequence at z=0



From SDSS SF galaxies by Peng+2010, see high-z result by Koyama+2013

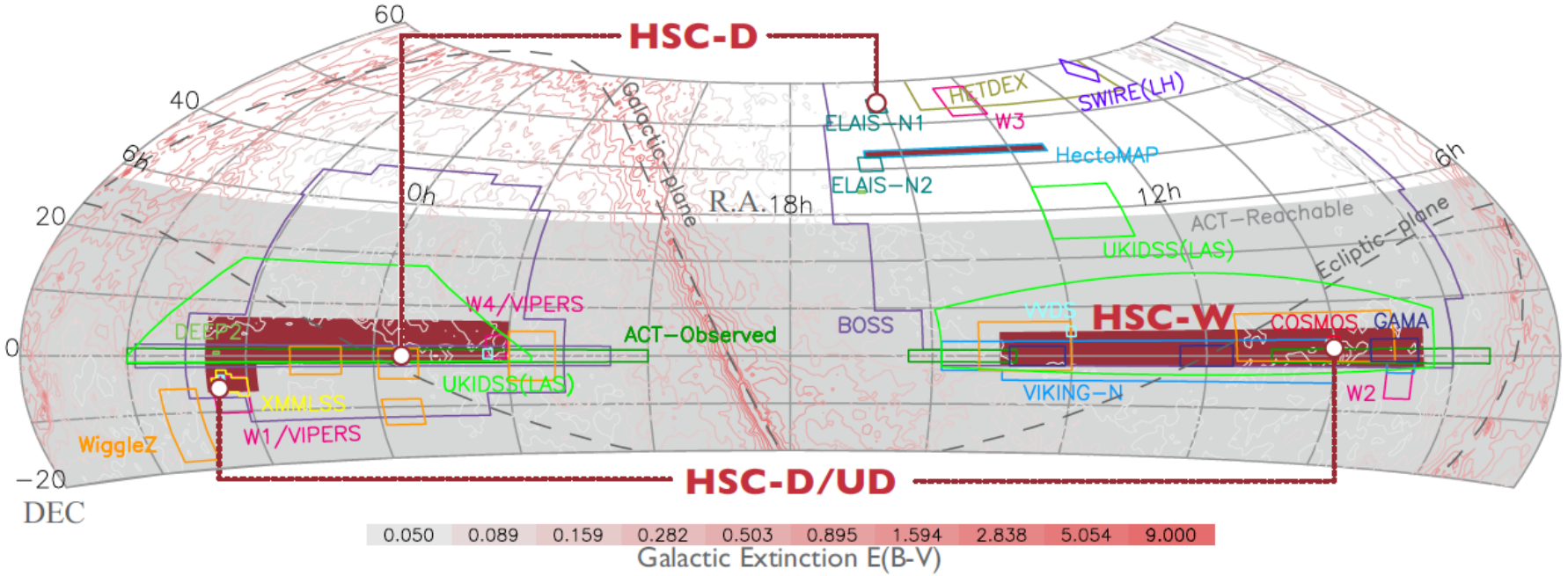
Red (dusty) SF galaxies: a key population for understanding environmental effects?



■: red HAE (B-I>2)
□: blue HAEs (B-I<2)

Narrow-band Hα survey of A851 cluster (z=0.4) with Subaru/Suprime-Cam by Koyama et al. (2011).

HSC-SSP for environment study



Layer	Area [deg^2]	# of pointings	Filters & Depth	Volume [h^{-3}Gpc^3]	Key Science
Wide	1400	916	$grizy$ ($i \simeq 26$)	$\sim 4.4 (z < 1.5)$	WL Cosmology, $z \sim 1$ gals, Clusters
Deep	26	15	$grizy$+3NBs ($i \simeq 27$)	$\sim 0.5 (1 < z < 5)$	$z \lesssim 2$ gals, SNeIa, WL calib.
UltraDeep	3.5	2	$grizy$+3NBs ($i \simeq 28$)	$\sim 0.07 (2 < z < 7)$	high-z gals (LAEs, LBGs), SNeIa

- HSC-SSP survey overview paper (Takada+, arXiv:1704.05858)
- HSC-SSP data release (DR1) paper (Tanaka+, arXiv:1702.08449)

A 16 deg^2 survey of emission line galaxies at z<1.5 in HSC-SSP PDR1

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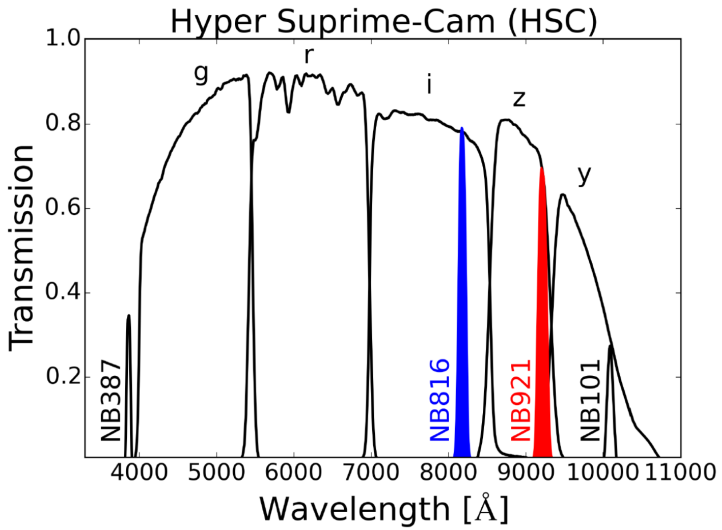
arXiv:1704.05978

NB emitter catalog from HSC-D & HSC-UD data by Hayashi et al. (2017)



- ~8,100 Hα emitters
- ~8,700 [OIII] emitters
- ~16,900 [OII] emitters

The catalogs will be made public after the paper is accepted

Hα emitters (HAEs)

	NB816 ($z = 0.25$)				NB921 ($z = 0.40$)			
Field	# of objects	Limit mag.	Limit flux	Volume	# of objects	Limit mag	Limit flux	Volume
UD-COSMOS	···	···	···	···	471	24.0	2.0×10^{-17}	1.5×10^5
					(441)			(1.5×10^5)
UD-SXDS	304	24.0	1.5×10^{-17}	5.0×10^4	422	24.0	2.0×10^{-17}	1.2×10^5
D-COSMOS	···	···	···	···	975	23.5	3.0×10^{-17}	5.3×10^5
					(772)			(4.2×10^5)
D-DEEP2-3	889	23.5	2.0×10^{-17}	4.5×10^5	2,916	23.5	3.0×10^{-17}	2.0×10^6
D-ELAIS-N1	···	···	···	···	2,311	23.5	3.0×10^{-17}	1.6×10^6

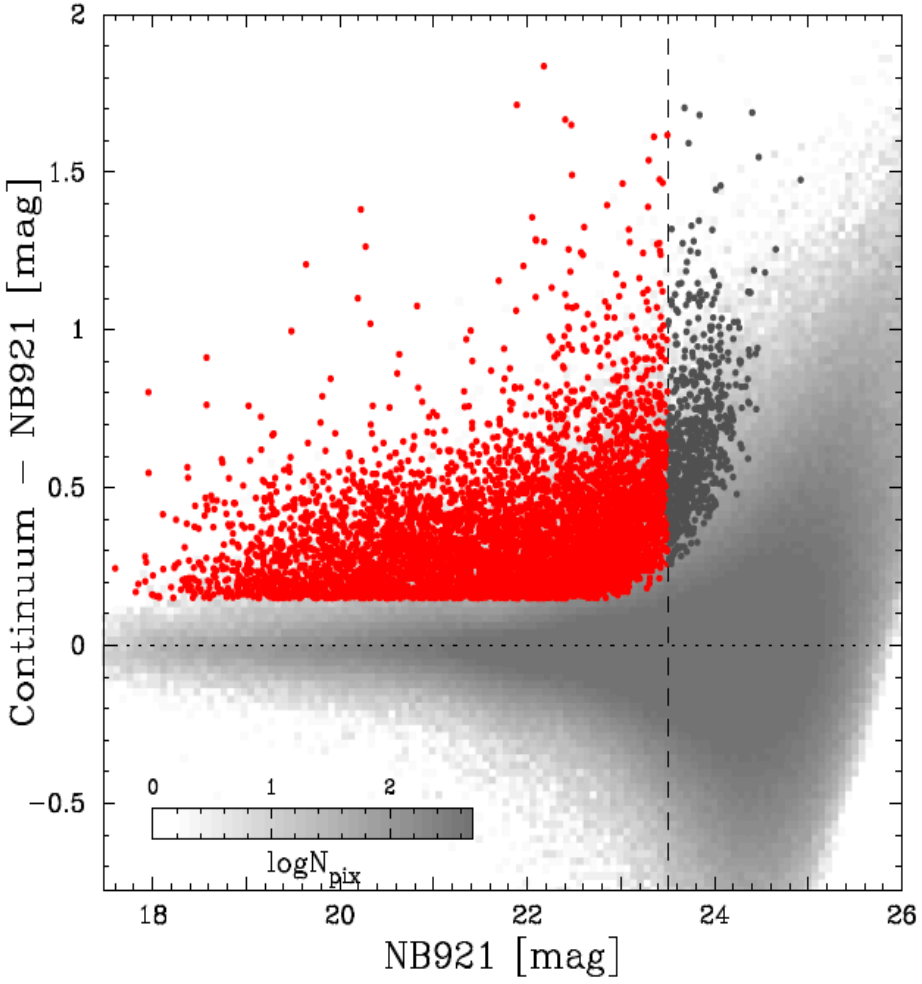
[OIII] emitters (O3Es)

	NB816 ($z = 0.63$)				NB921 ($z = 0.84$)			
Field	# of objects	Limit mag.	Limit flux	Volume	# of objects	Limit mag	Limit flux	Volume
UD-COSMOS	···	···	···	···	1,127	24.0	2.0×10^{-17}	5.5×10^5
					(1,074)			(5.2×10^5)
UD-SXDS	894	24.0	1.5×10^{-17}	2.9×10^5	762	24.0	2.0×10^{-17}	4.6×10^5
D-COSMOS	···	···	···	···	851	23.5	3.0×10^{-17}	1.6×10^6
					(609)			(1.3×10^6)
D-DEEP2-3	1,341	23.5	2.0×10^{-17}	2.5×10^6	2,418	23.5	3.0×10^{-17}	6.4×10^6
D-ELAIS-N1	···	···	···	···	1,574	23.5	3.0×10^{-17}	5.3×10^6

[OII] emitters (O2Es)

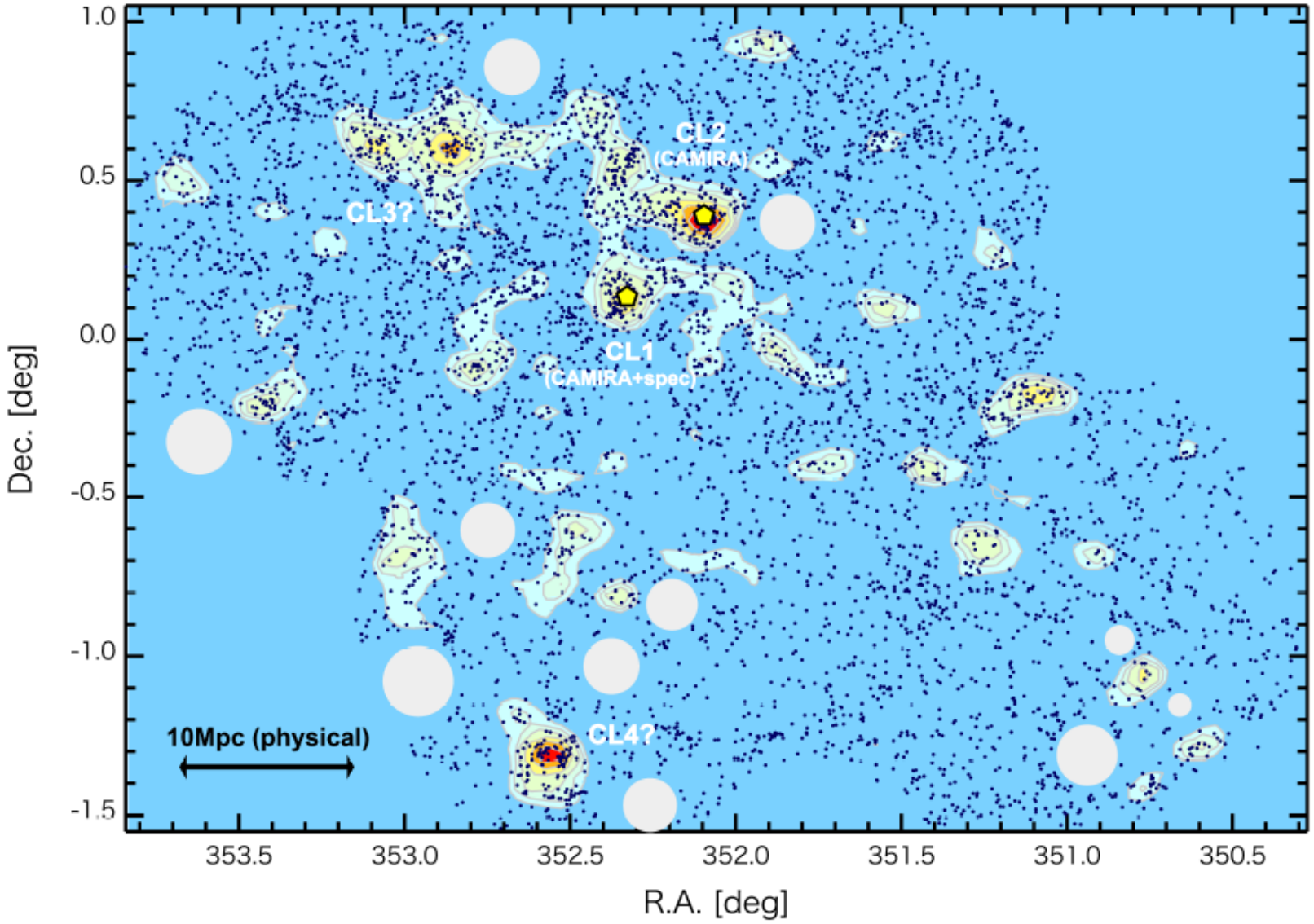
	NB816 ($z = 1.19$)				NB921 ($z = 1.47$)			
Field	# of objects	Limit mag.	Limit flux	Volume	# of objects	Limit mag	Limit flux	Volume
UD-COSMOS	···	···	···	···	1,309	24.0	2.0×10^{-17}	1.0×10^6
					(1,246)			(9.9×10^5)
UD-SXDS	1,868	24.0	1.5×10^{-17}	6.9×10^5	2,231	24.0	2.0×10^{-17}	9.0×10^5
D-COSMOS	···	···	···	···	1,447	23.5	3.0×10^{-17}	3.3×10^6
					(1,222)			(2.0×10^6)
D-DEEP2-3	3,996	23.5	2.0×10^{-17}	5.9×10^6	3,055	23.5	3.0×10^{-17}	1.2×10^7
D-ELAIS-N1	···	···	···	···	3,263	23.5	3.0×10^{-17}	1.1×10^7

This study: a case study in DEEP2-3 field

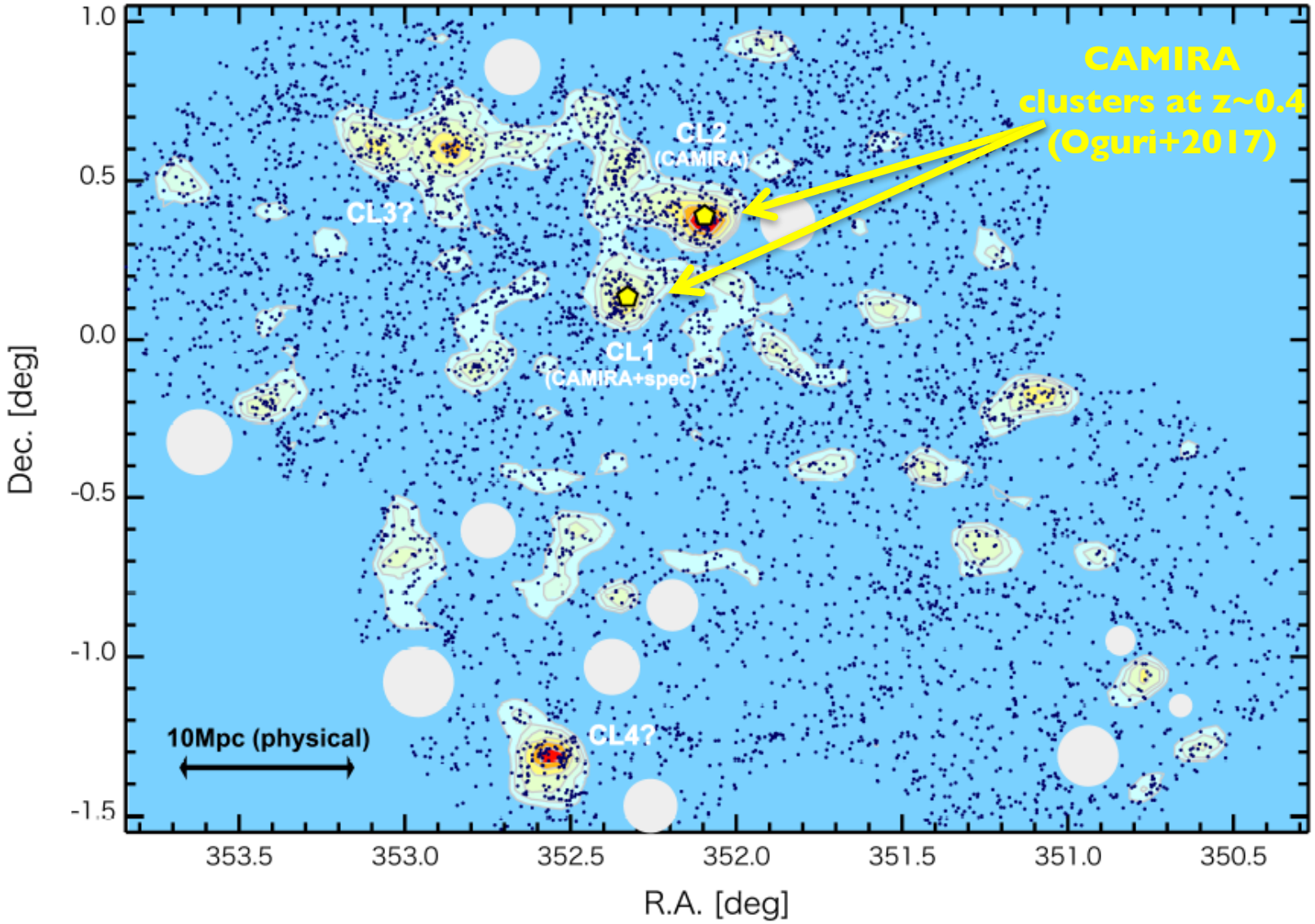


- grizy + NB921 (~5-deg^2)
- NB921 < 23.5 mag (AB)
- Hα emitters (HAEs) at z=0.40
  - NB excess
  - Spec-z / Photo-z / Color
- All "member" galaxies at z~0.4
  - Galaxies with 0.35<z(phot)<0.45
  - HAEs (regardless of photo-z)

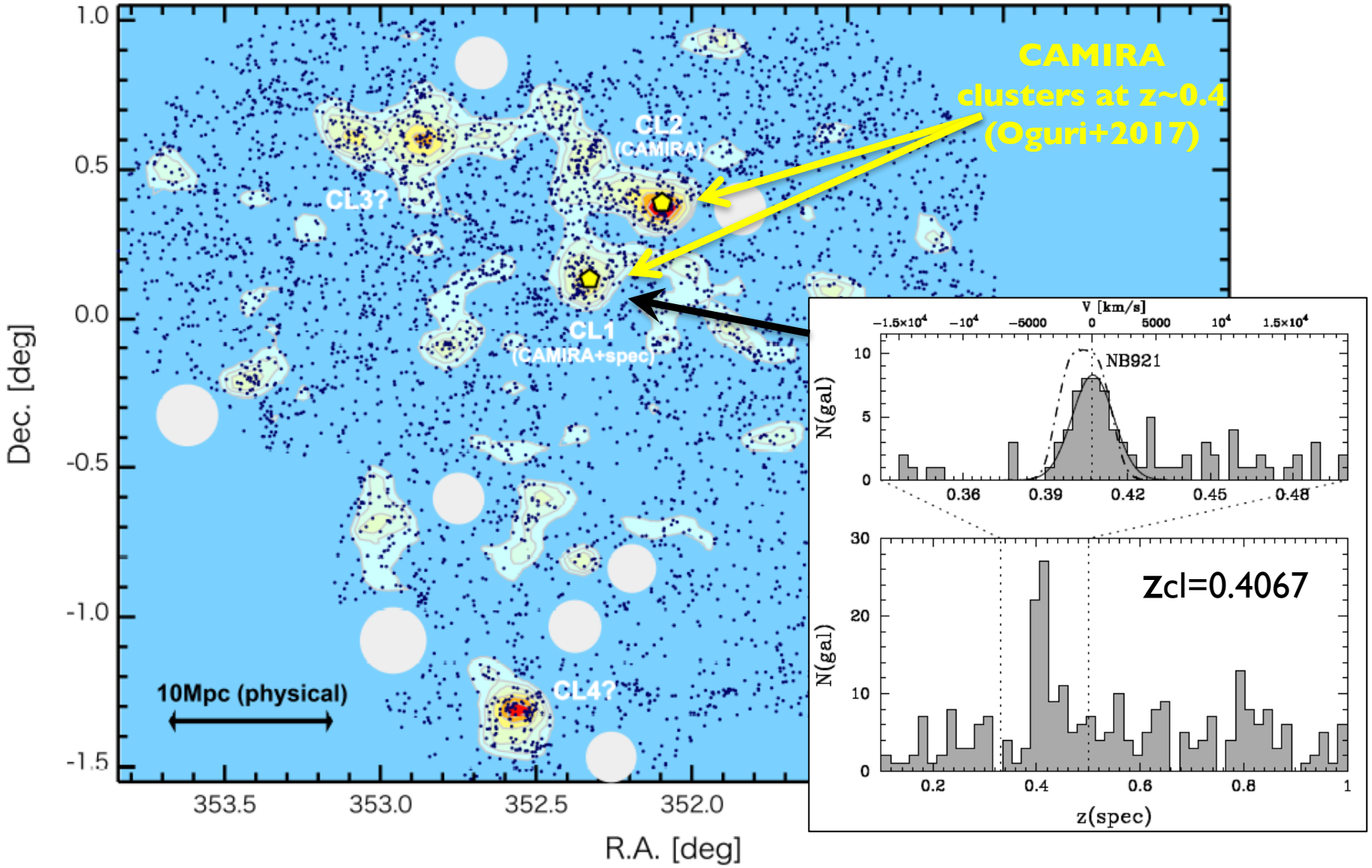
Huge cosmic web hosting twin clusters at z=0.4 traced by N921-selected Hα emitters in DEEP2-3



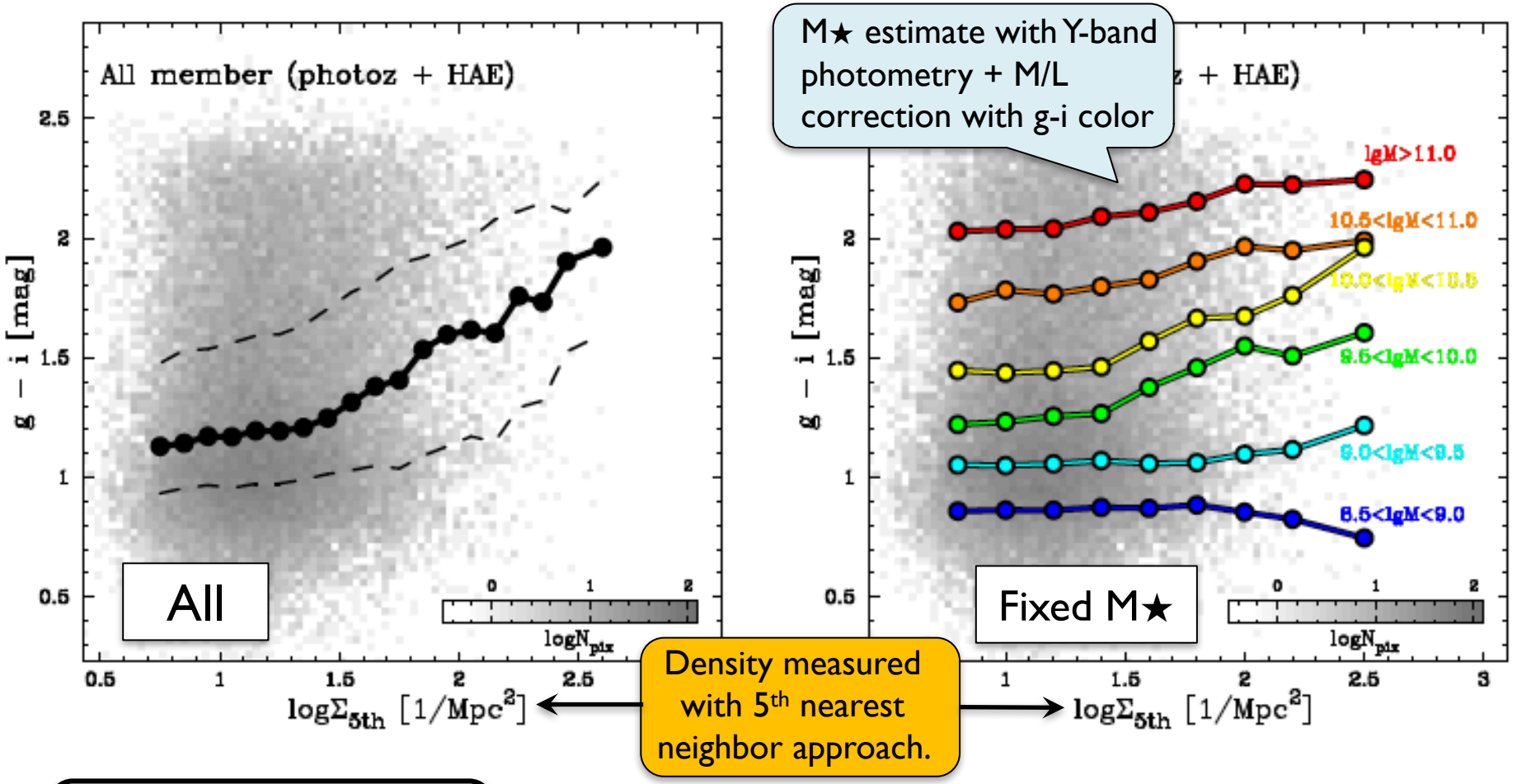
Huge cosmic web hosting twin clusters at z=0.4 traced by N921-selected Hα emitters in DEEP2-3



Huge cosmic web hosting twin clusters at z=0.4 traced by N921-selected Hα emitters in DEEP2-3



Color-density relation for all galaxies

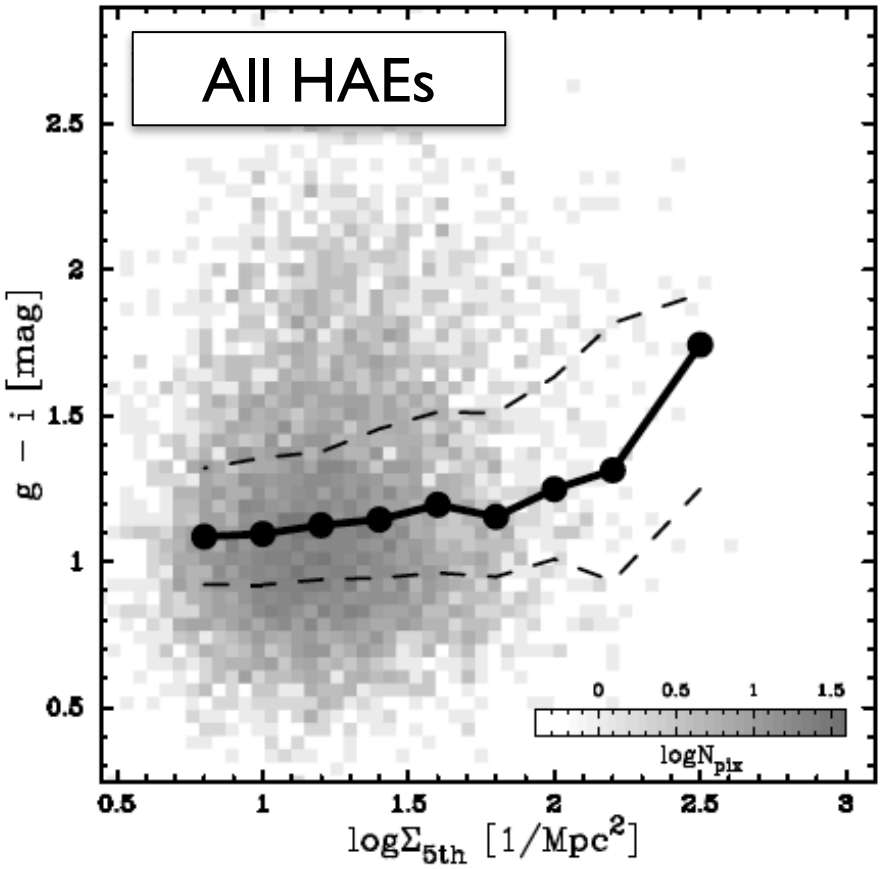


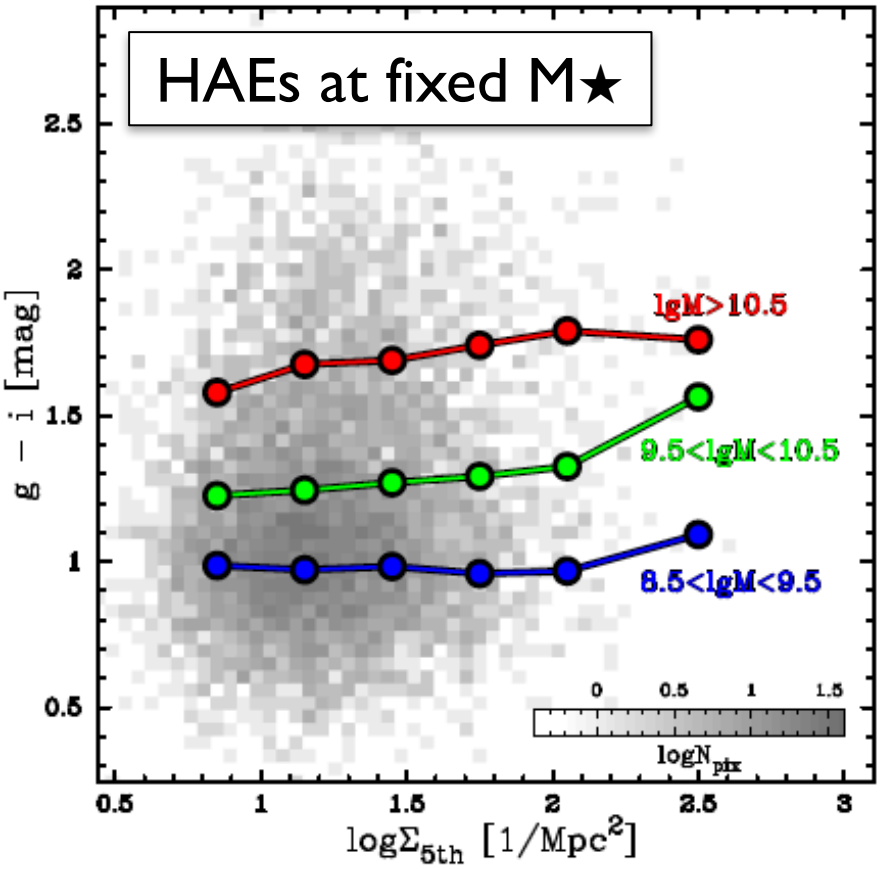
: **Median**

: **25%/75%**

As expected, galaxies in higher-density environment tend to be redder.

Color-density relation for HAEs

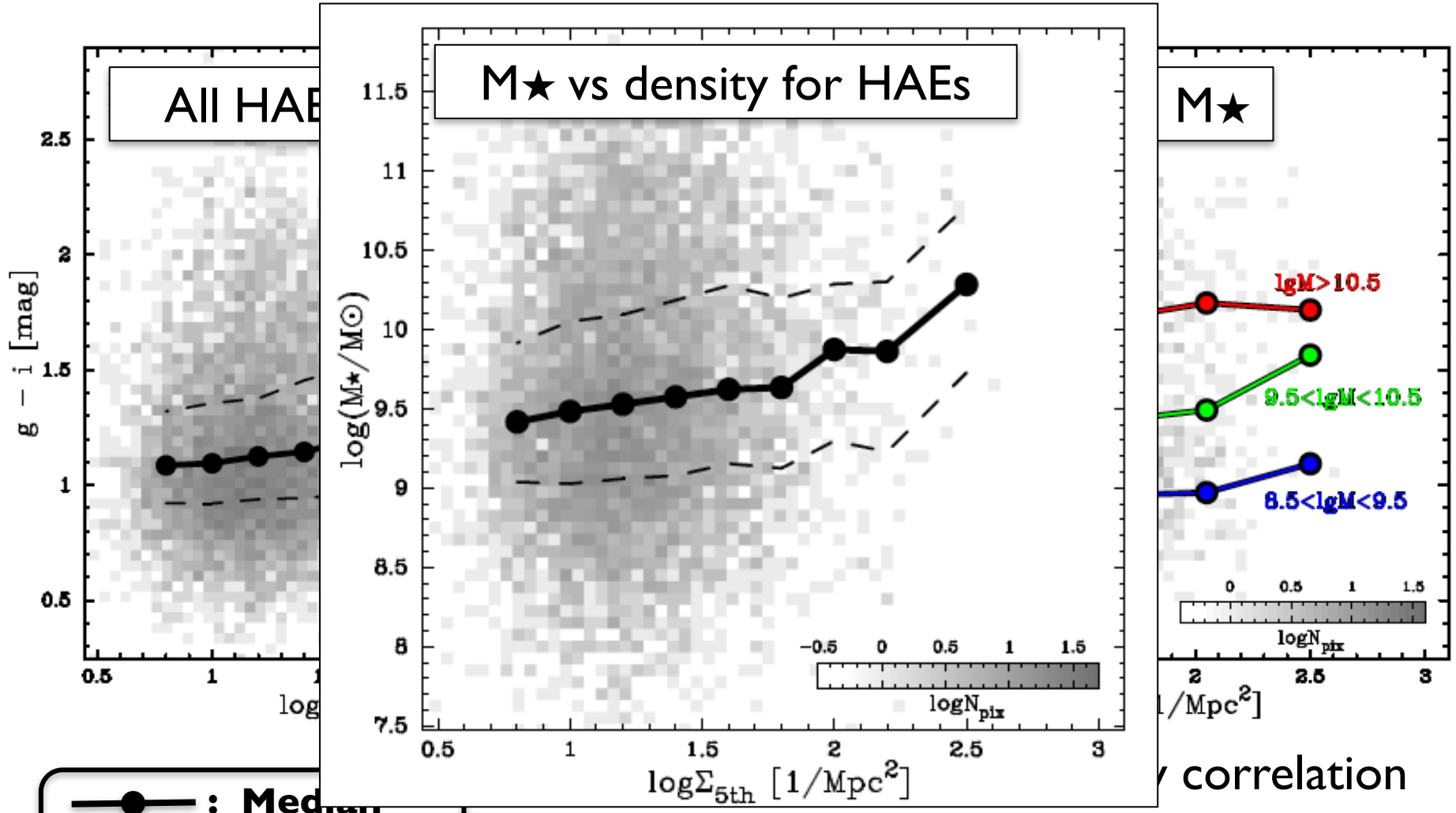




: **Median**
: **25%/75%**

There still remains color-density correlation for HAEs, driven by massive HAEs in highest-density environment.

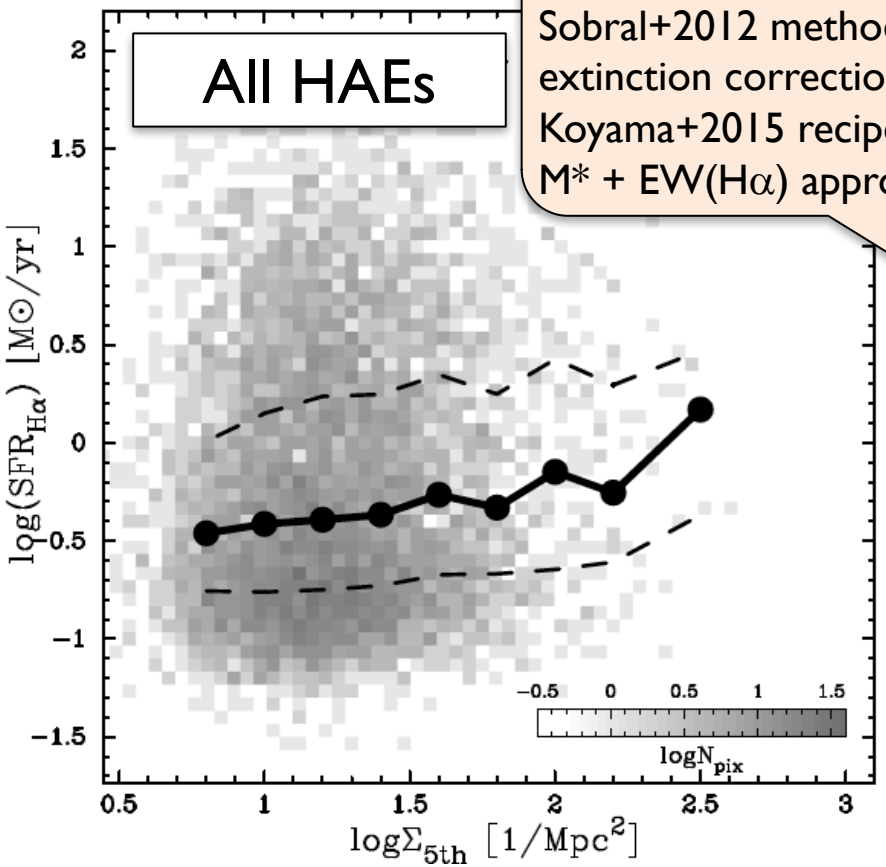
Color-density relation for HAEs

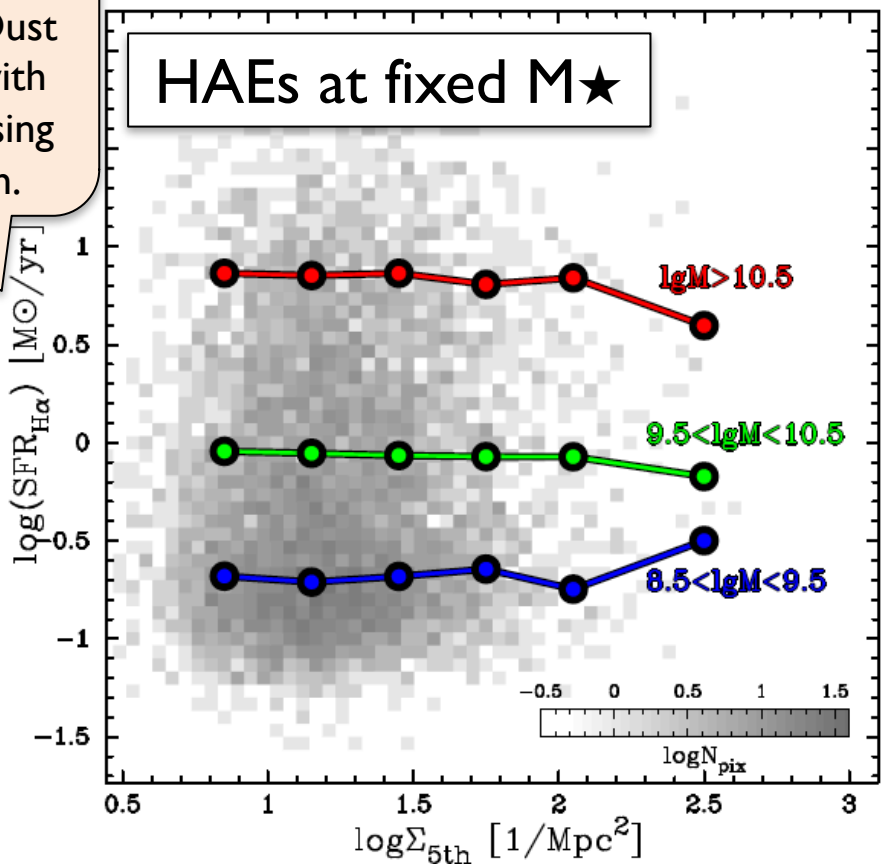


correlation for HAEs, driven by massive HAEs in highest-density environment.

SFR(Hα) vs. density for HAEs

[NII] correction with Sobral+2012 method. Dust extinction correction with Koyama+2015 recipe using M* + EW(Hα) approach.

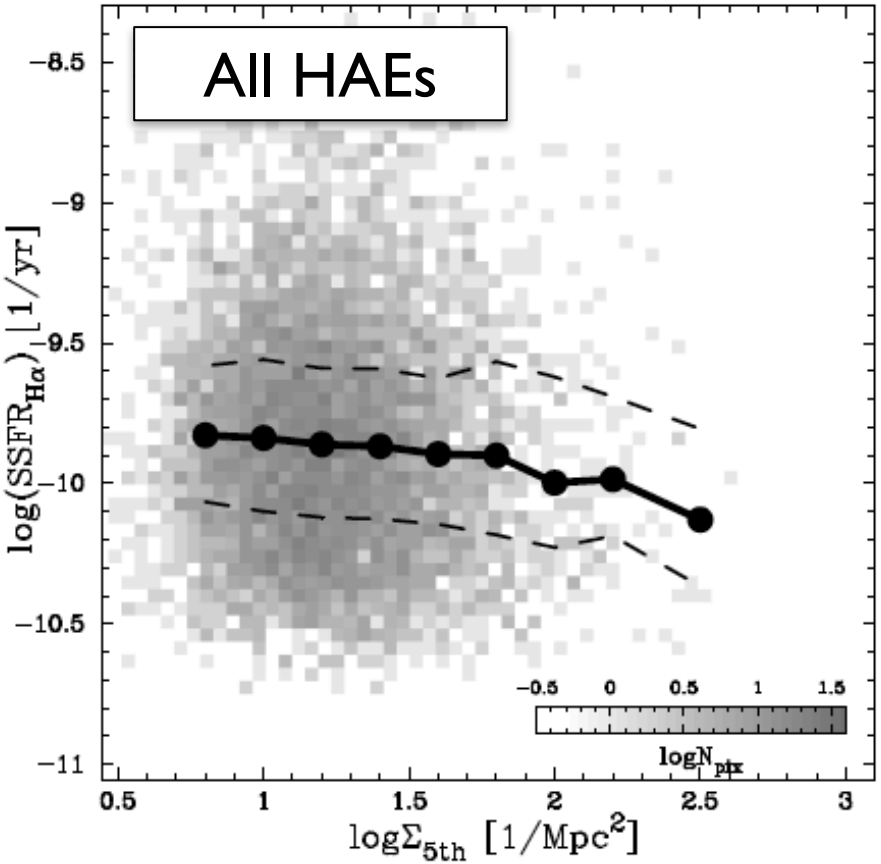


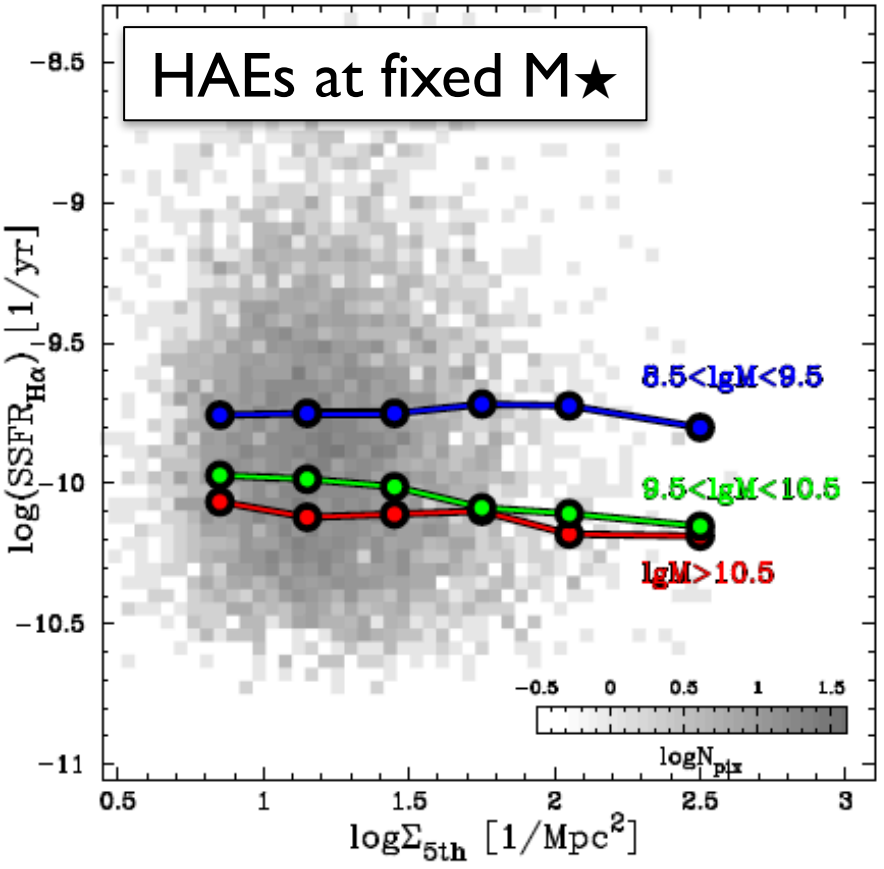


: **Median**
: **25%/75%**

Mild increase of SFR toward high-density environment, again driven by massive HAEs in high-density environment.

sSFR(Hα) vs. density for HAEs



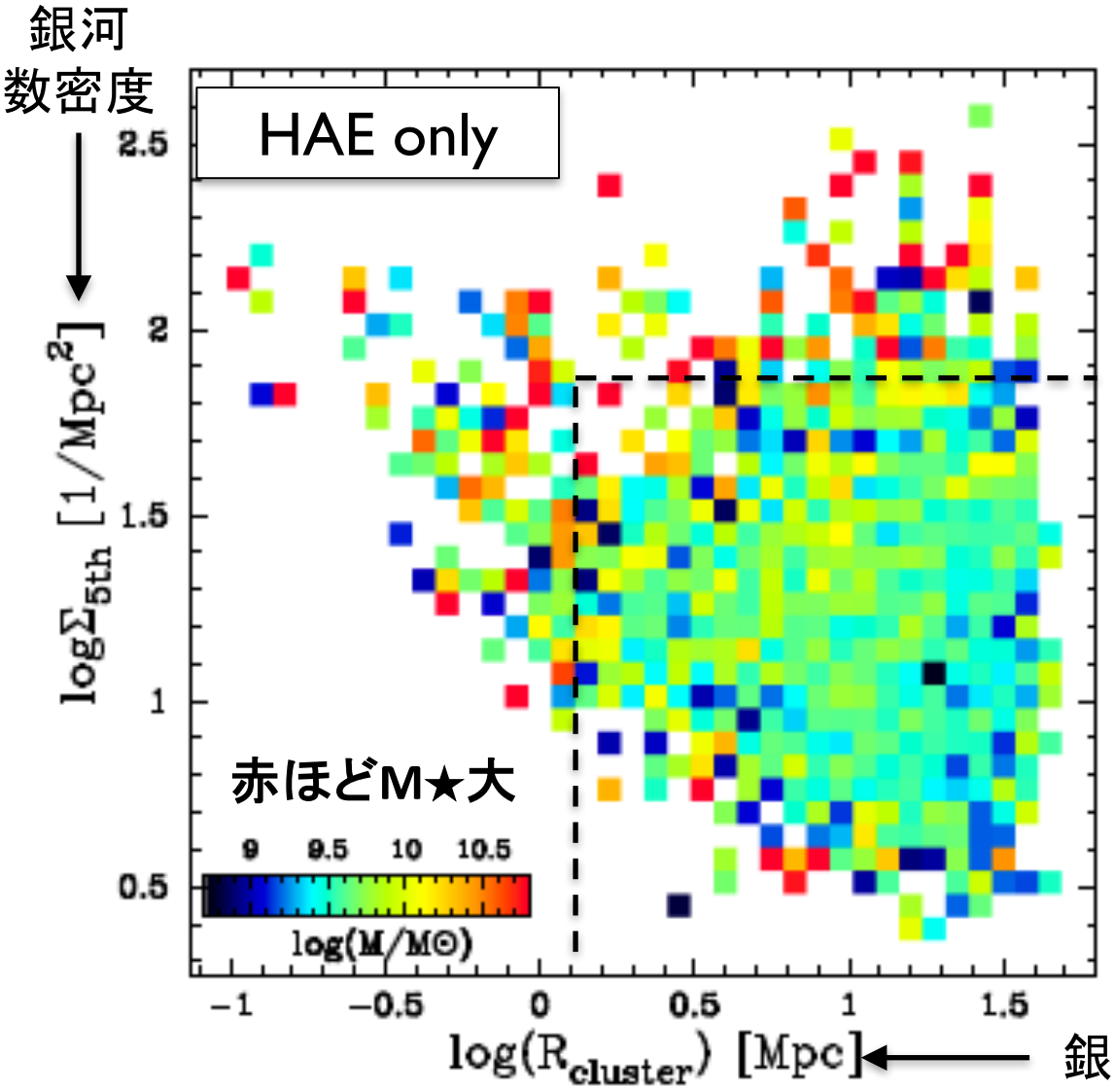


: **Median**
: **25%/75%**

No significant environmental dependence of sSFR at fixed M★, consistent with environmental independence of SFMS.

Discussion 1:

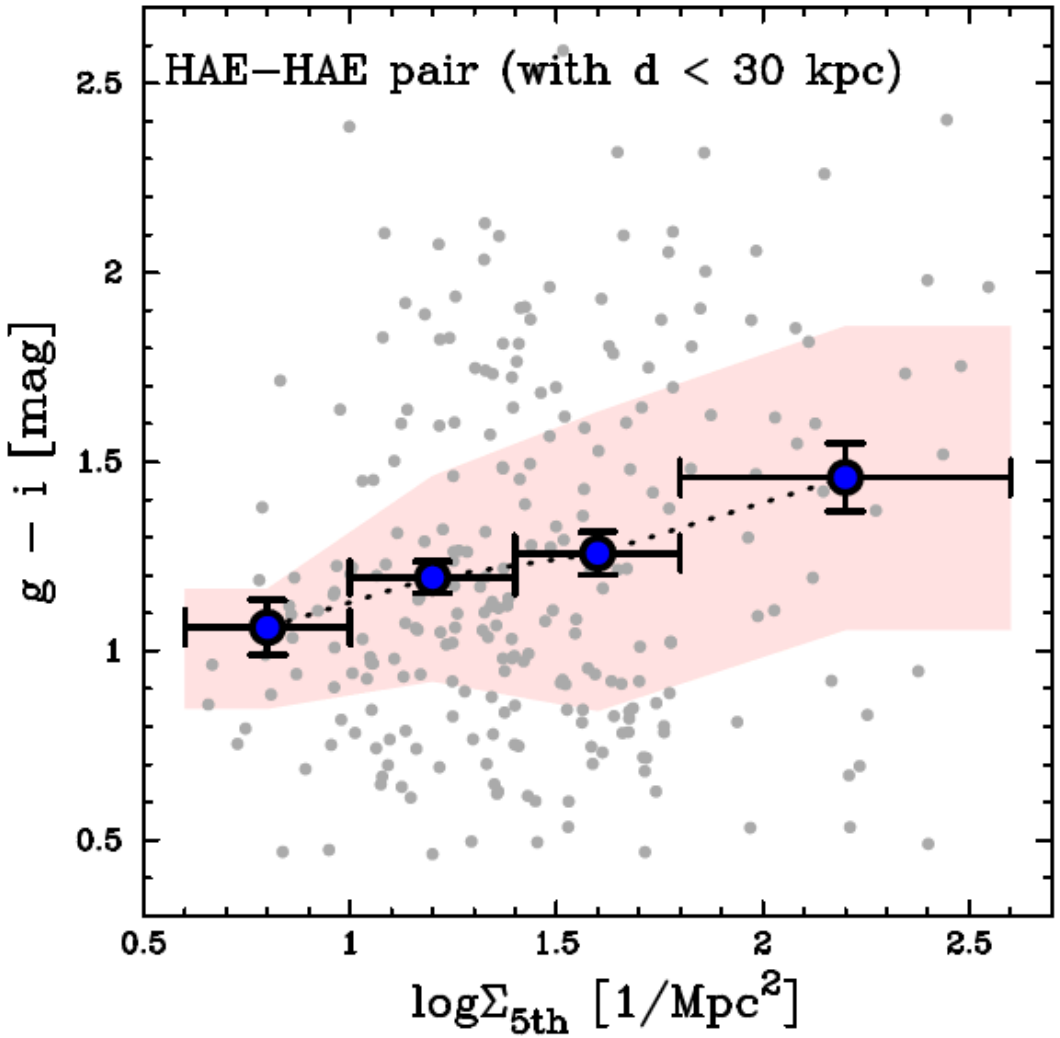
"Global" vs. "Local" environment



- Both "Global" and "Local" environment play an important role to change the nature of galaxies.
- Need further investigation with full HSC-SSP data (and PFS in future)

Discussion 2:

Color vs density for HAE-HAE pair



- NB imaging data has advantage in finding SF galaxy pairs.
- Redder colors of HAE pairs in high-density environment?
- Again, interesting to do further investigation with full HSC-SSP data

Summary

- Discovery of large-scale structure hosting twin clusters at z=0.4, traced by Hα emitters in DEEP2-3 field with HSC-Deep data.
- Hα emitters in higher-density environments tend to have redder colors, higher M*, and higher SFR.
- Median (s)SFR of Hα-selected galaxies is independent of environment at fixed M*.
- Colors of HAE-HAE pairs might be affected by global environment – need further investigation with full HSC data (+ PFS in future).