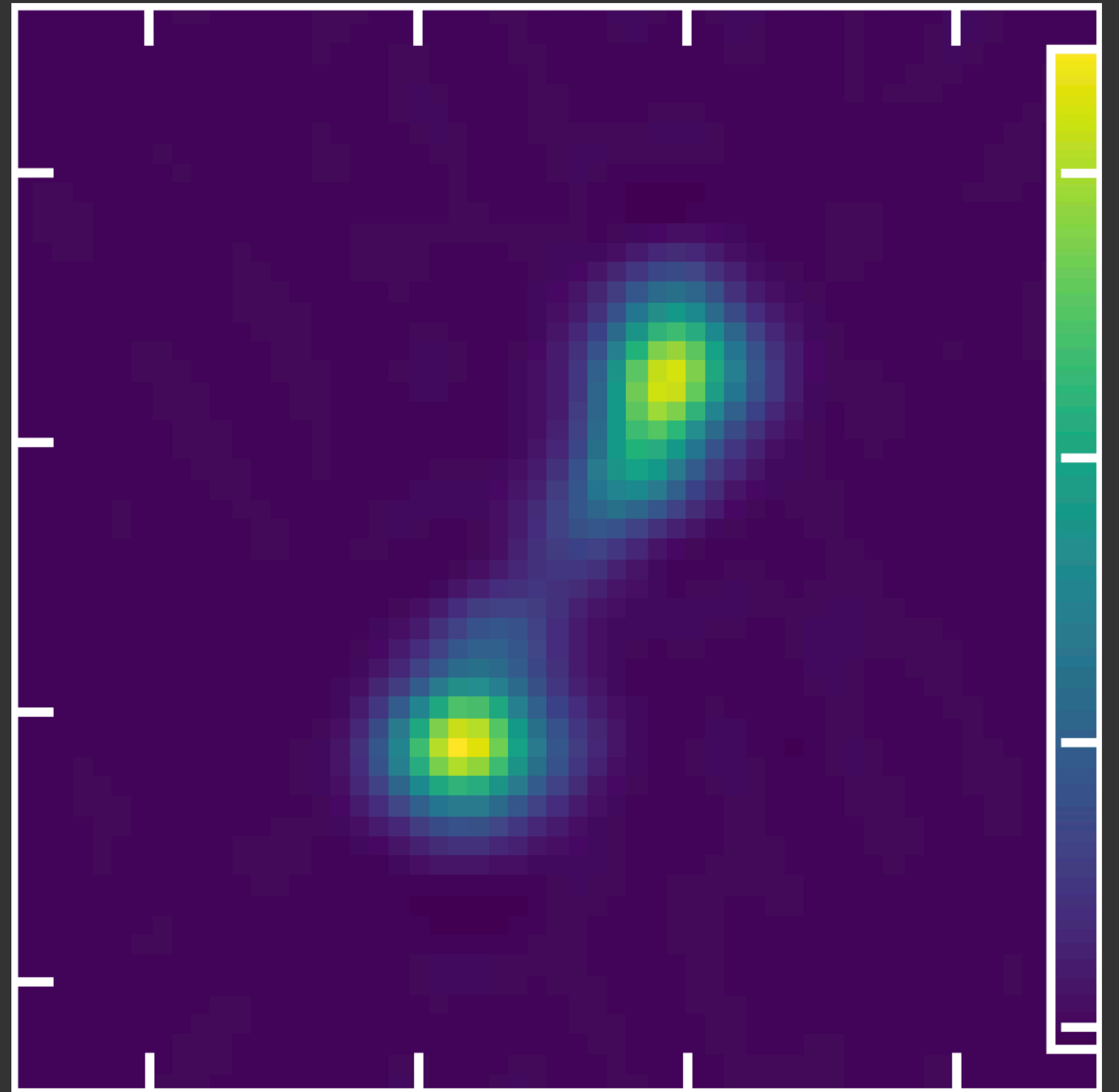


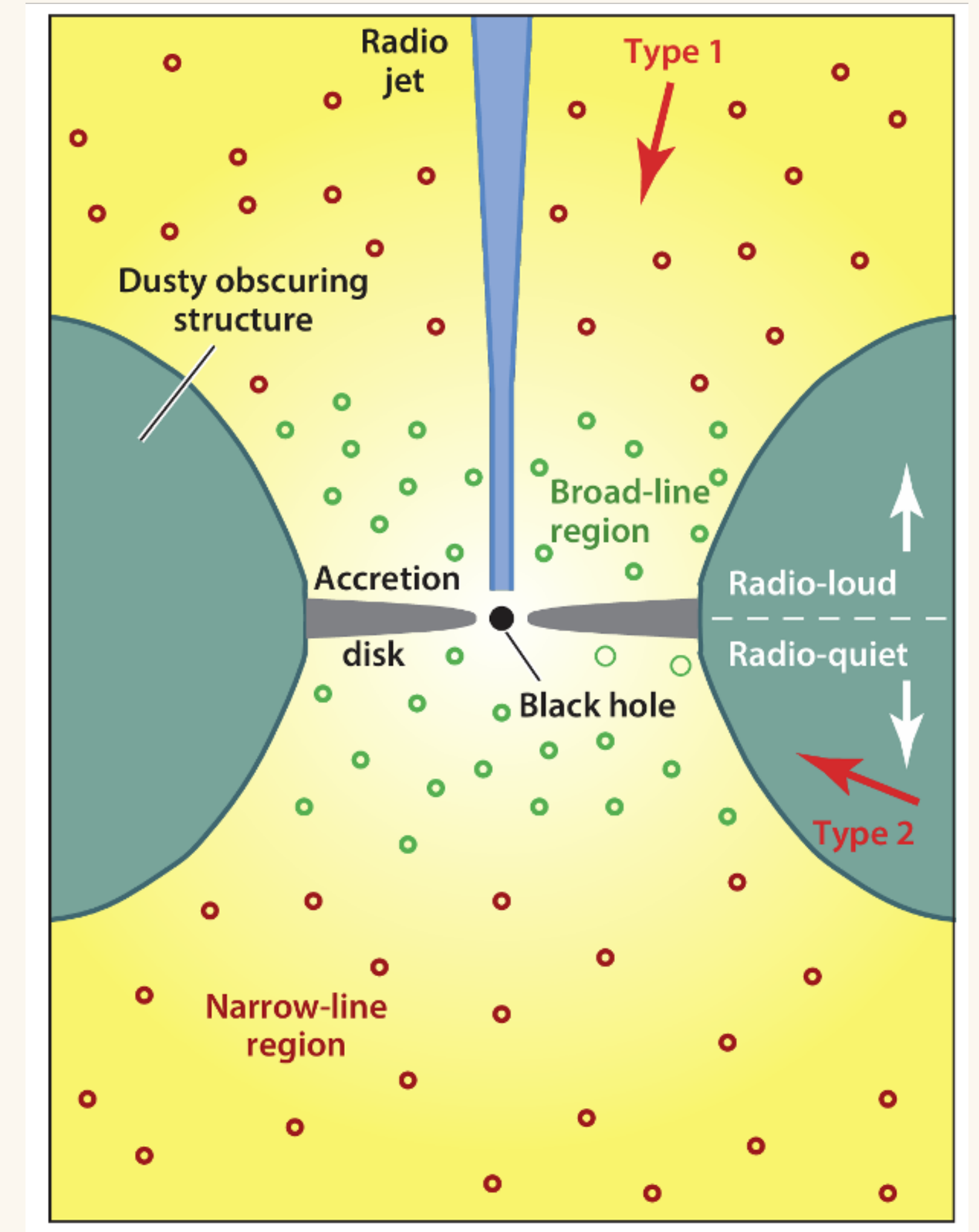
Environmental Drivers of Radio AGN Triggering and Host-Galaxy Quenching in Deep Extragalactic Fields



Environment affects galaxy evolution

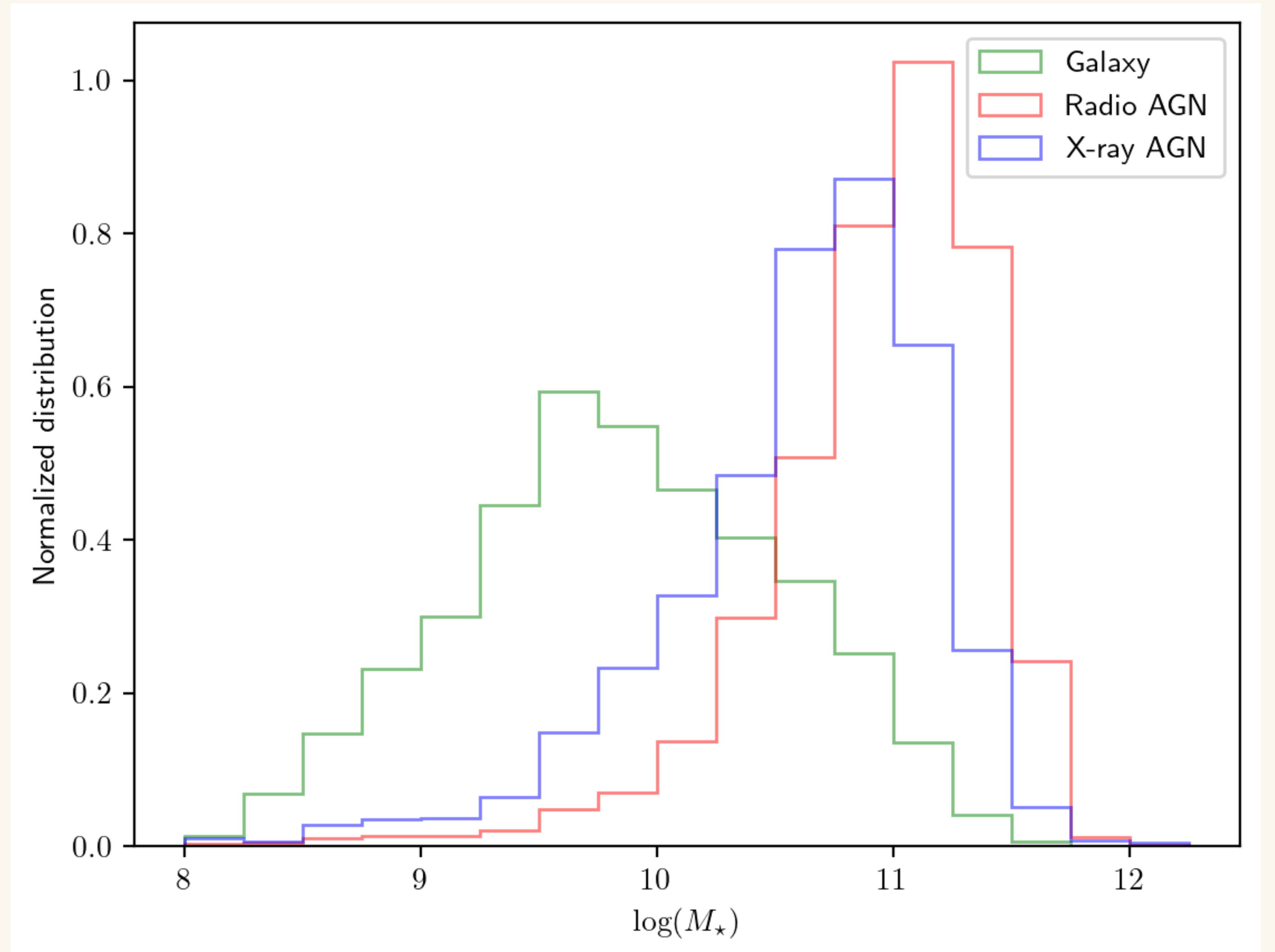
SMBH growth is related to galaxy evolution

Is the environment related to AGN activity?



Radio AGNs are often found in dense environments

Need to consider mass distribution effects.



Methodology

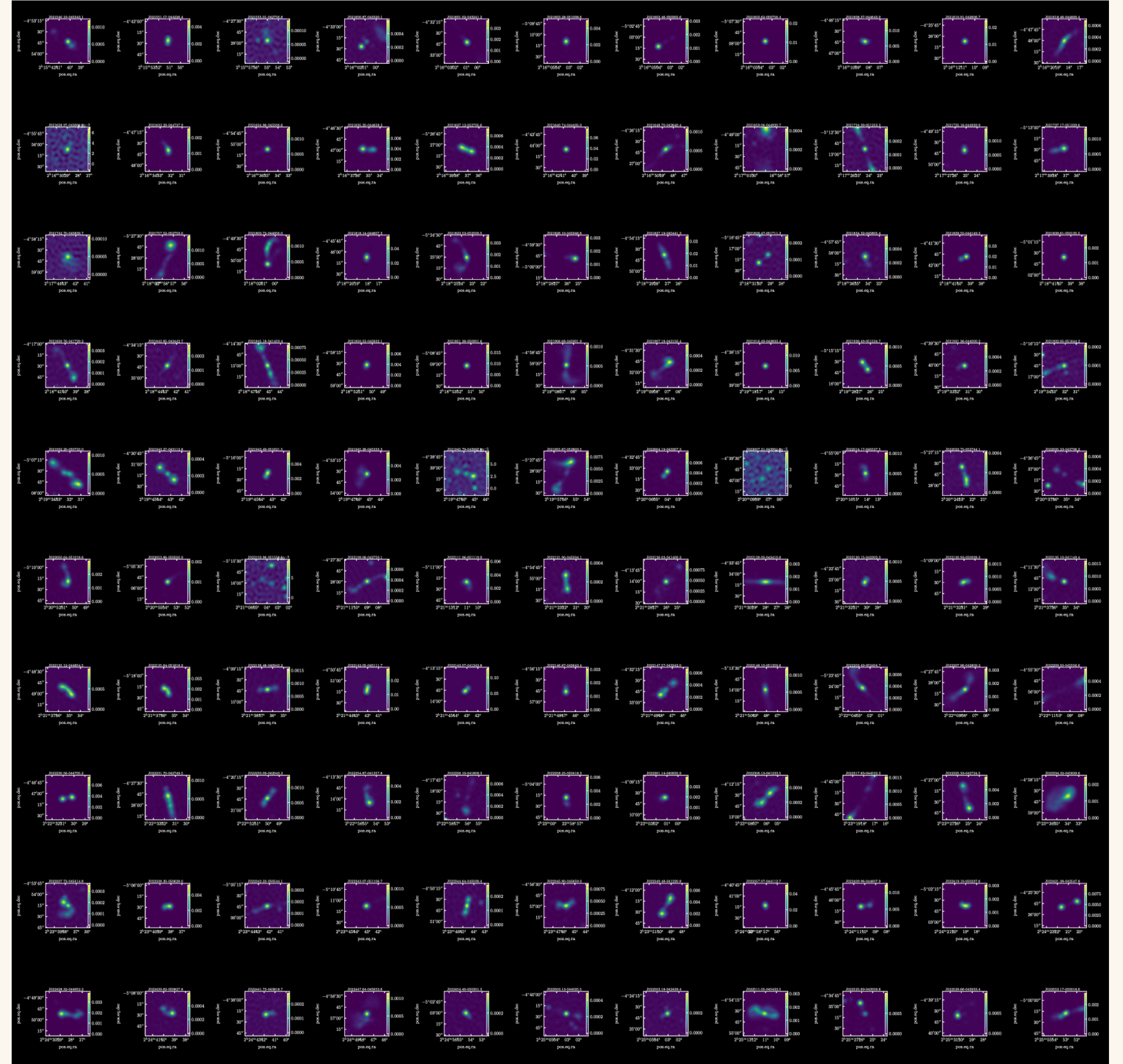
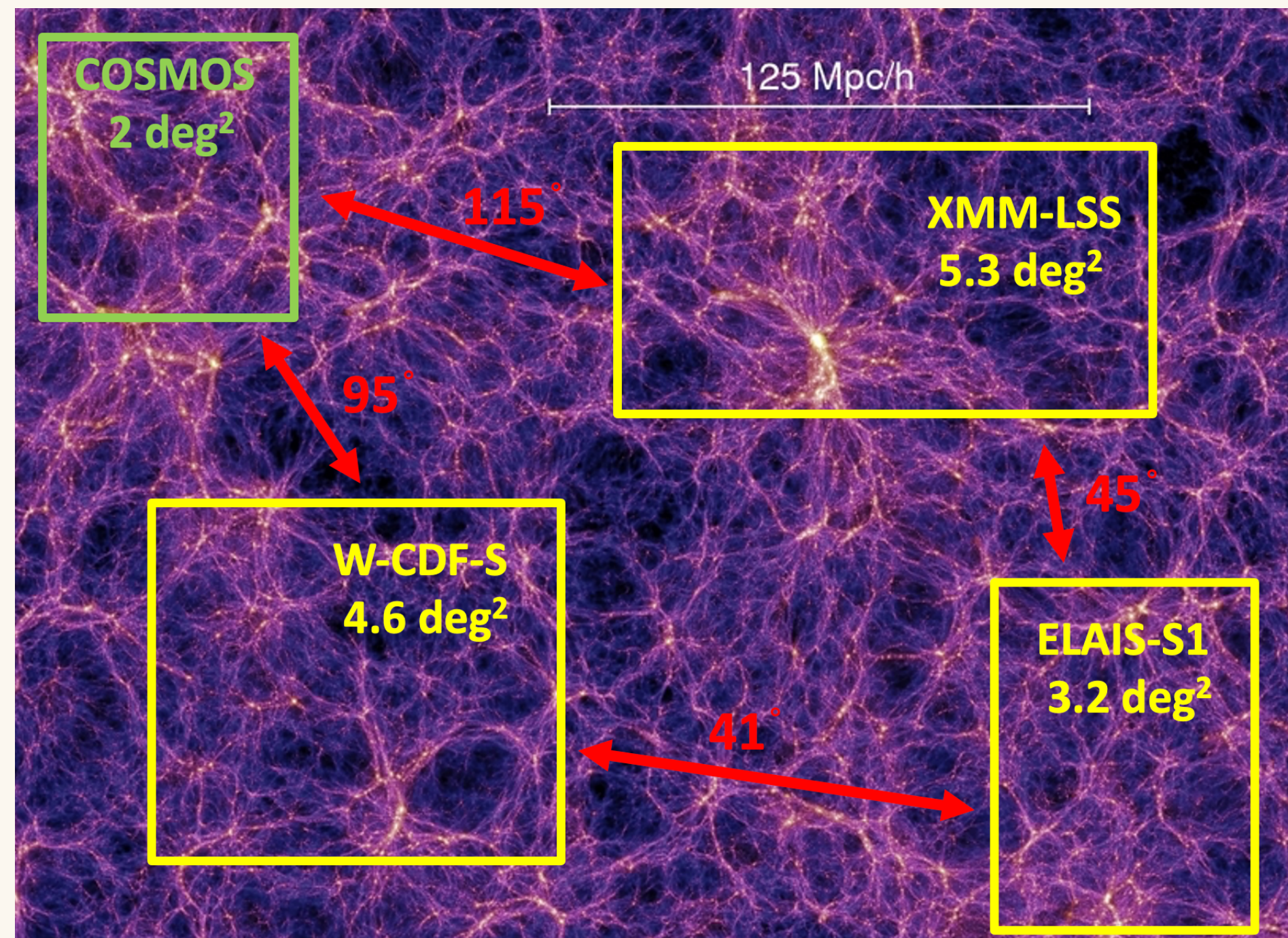
1. Clustering analysis: correlations and cross-correlations.

2. Direct pinpointing of sources within known large-scale structures/search for over-densities around known sources.

Sample

Galaxies: ≈ 720000 , $0 < z < 1.5$

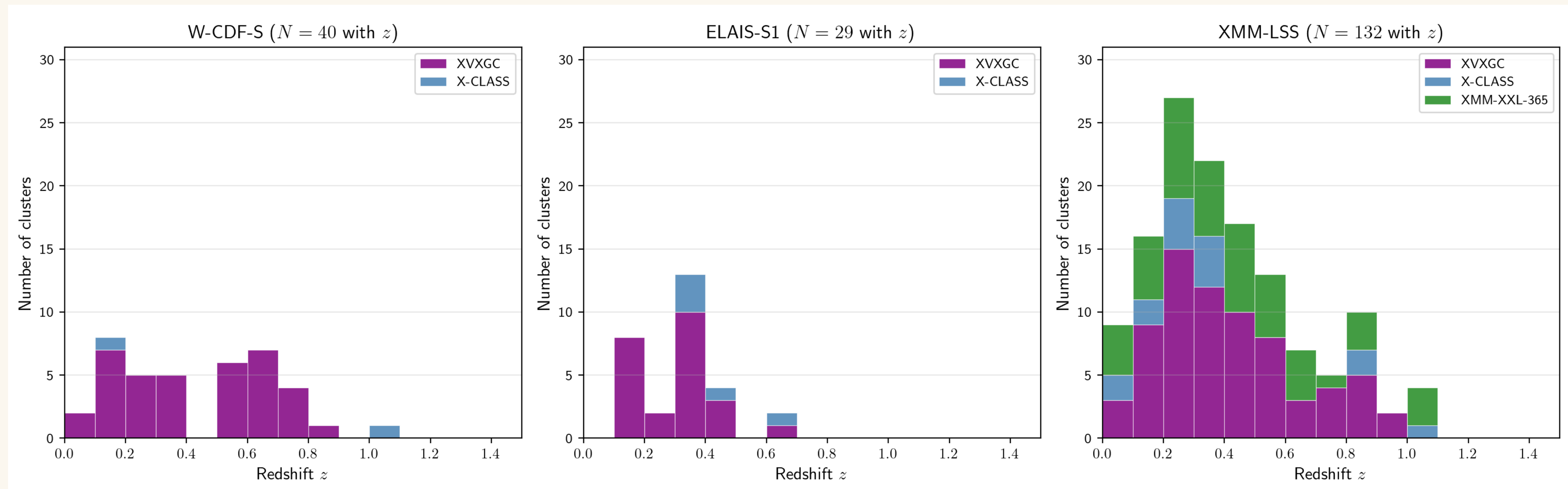
Radio AGNs: ≈ 4000 (≈ 150 extended)



Sample

Large scale structures: The XMM-SERVS X-ray eXtended Galaxy Cluster (XVXGC) Catalog, The X-CLASS Survey Catalog, The XXL-365-GC Catalog.

≈200 galaxy clusters and groups at $0 < z < 1.1$



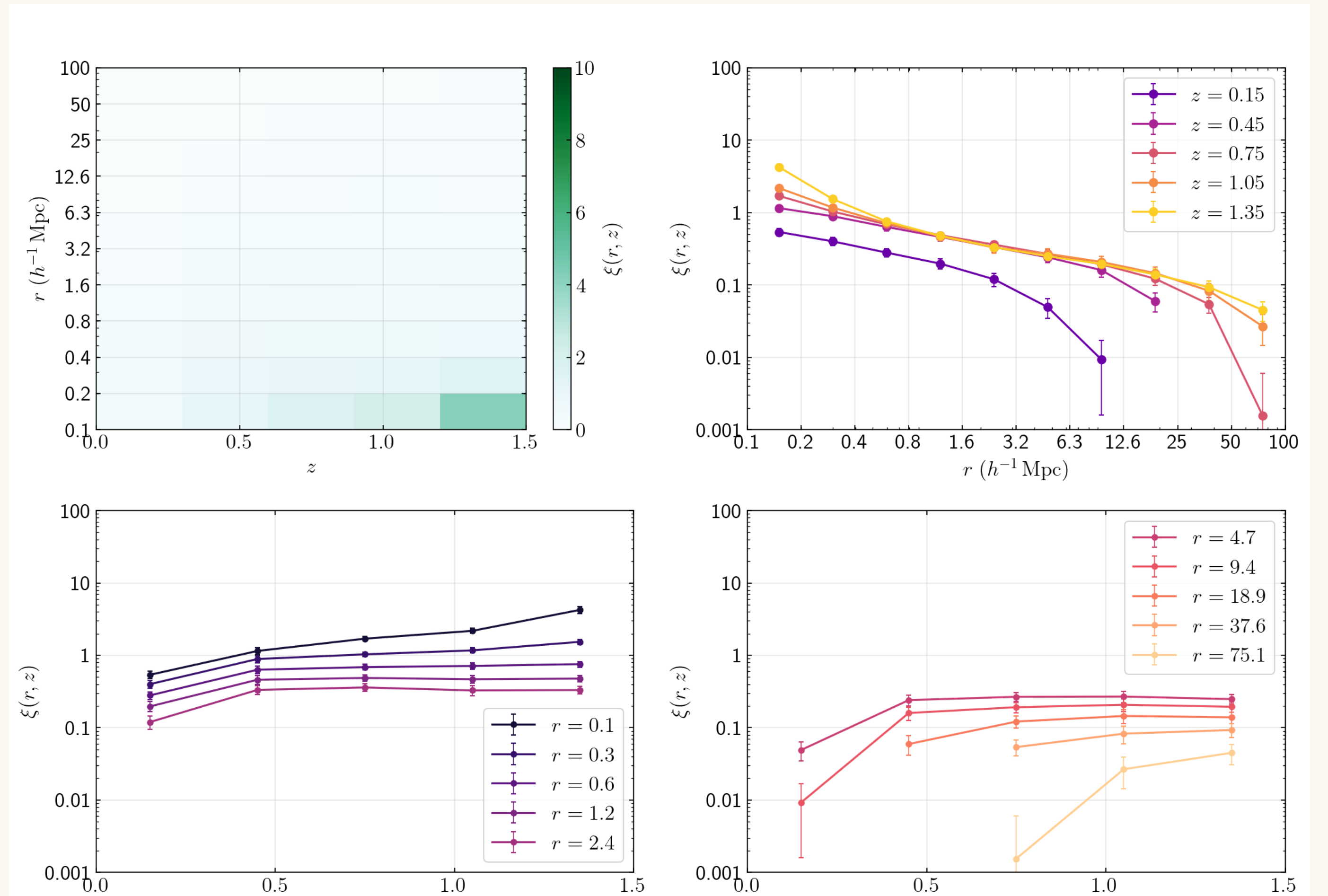
2-point correlation

$$dP = n^2 [1 + \xi(r)] dV_1 dV_2$$

Estimator:

$$\xi(r) = \frac{DD(r) - 2DR(r) + RR(r)}{RR(r)}$$

Error estimates: delete-one-jackknife



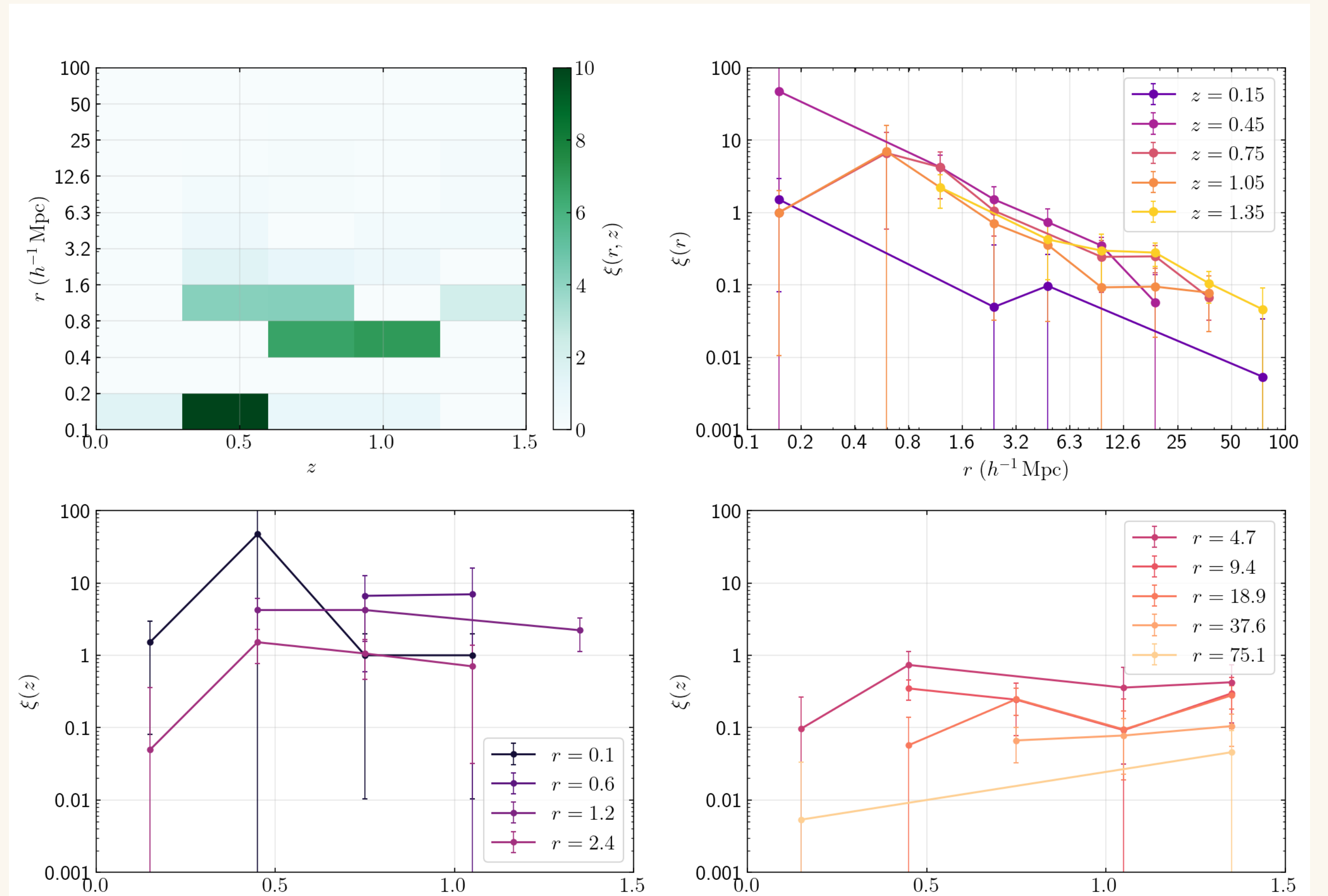
2-point correlation for radio AGNs

$$dP = n^2 [1 + \xi(r)] dV_1 dV_2$$

Estimator:

$$\xi(r) = \frac{DD(r) - 2DR(r) + RR(r)}{RR(r)}$$

Error estimates: delete-one-jackknife



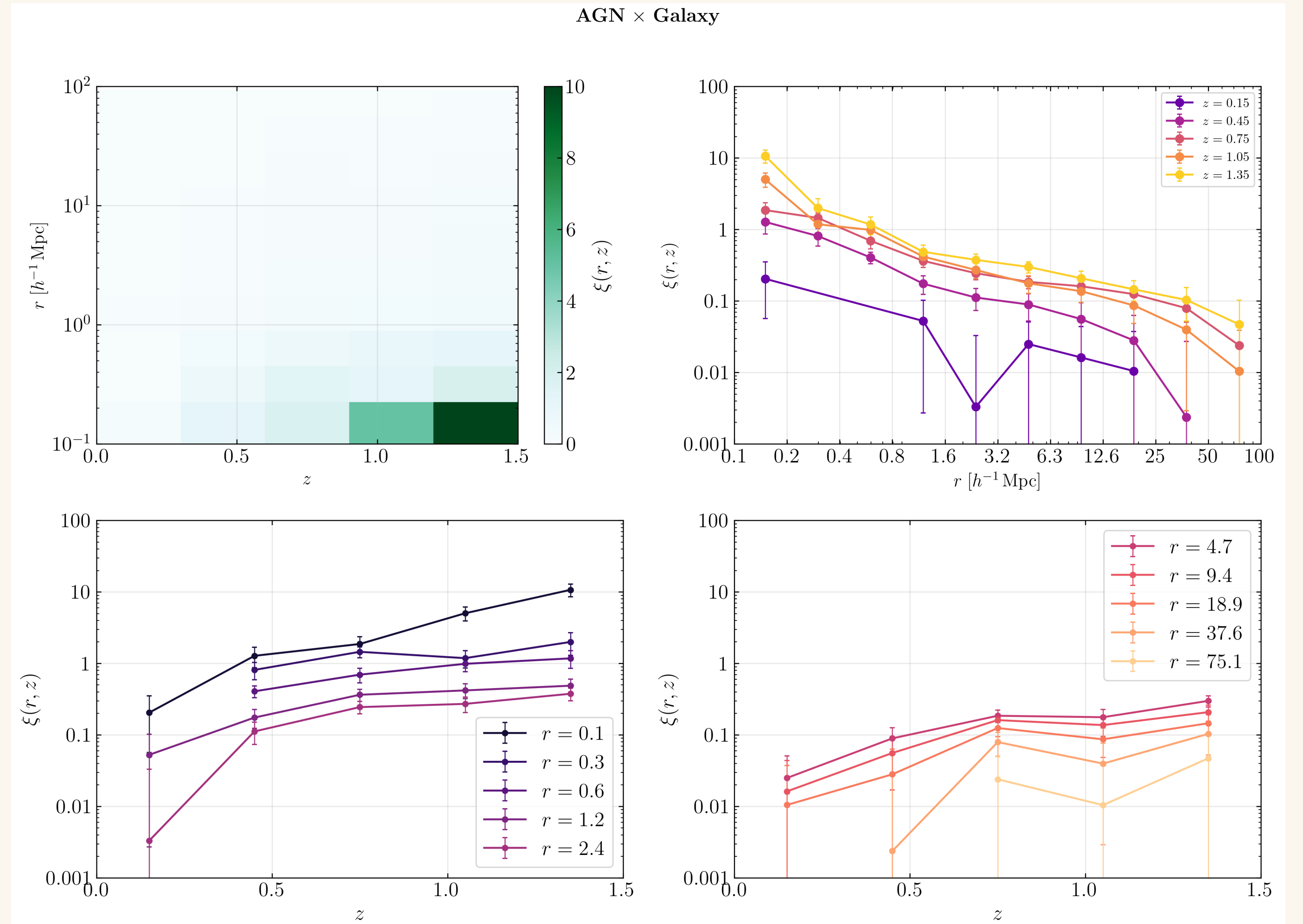
Cross-correlation

The excess joint probability of finding an AGN and a galaxy separated by distance r

$$dP = n_A n_G [1 + \xi_{AG}(r)] dV_A dV_G$$

$$\xi_{AG}(r) = \frac{D_A D_G - D_A R_G - R_A D_G + R_A R_G}{R_A R_G}$$

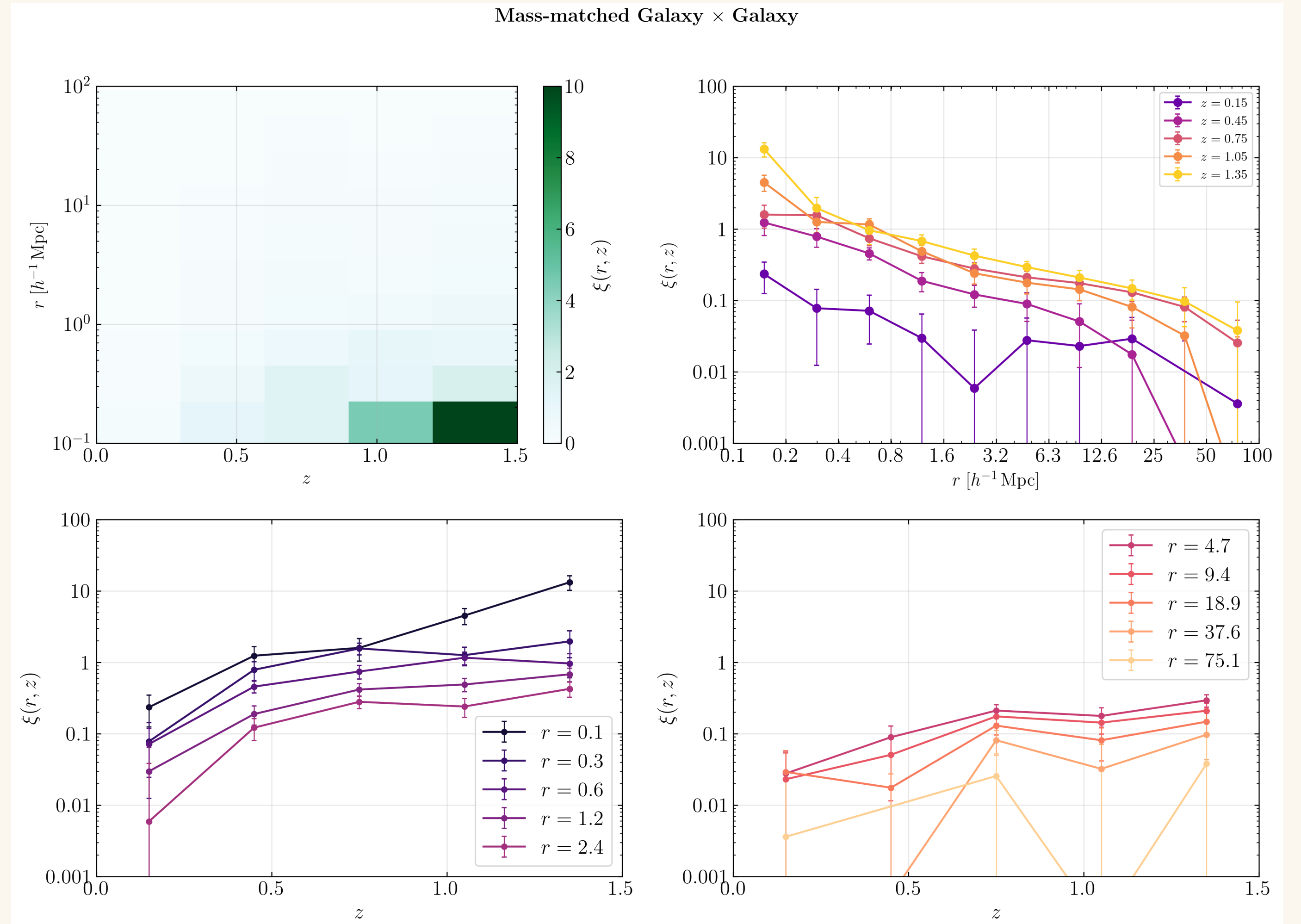
Error estimates: delete-one-jackknife



Cross-correlation

But radio AGNs prefer massive galaxies
-environmental effect originating from mass?

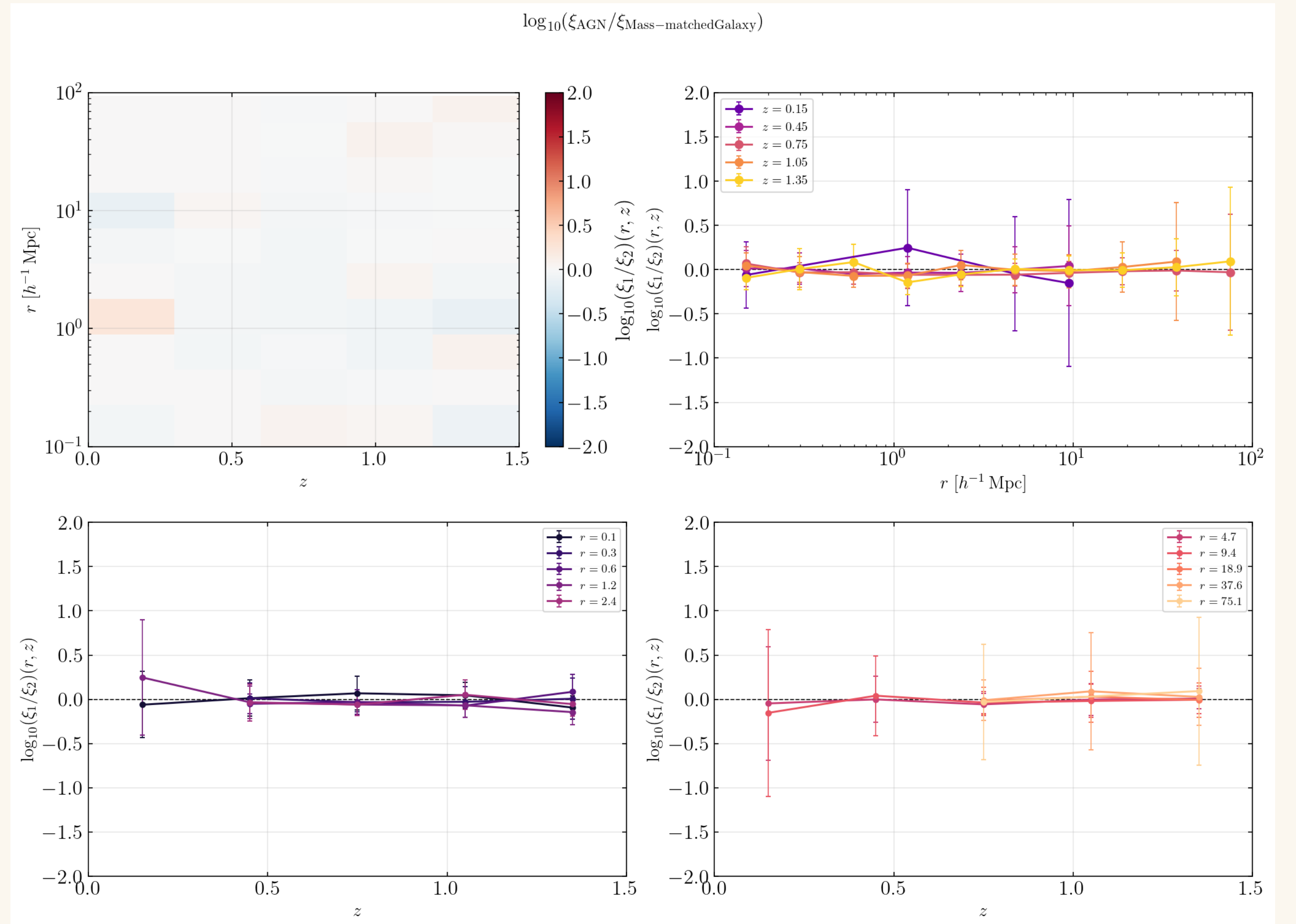
Use mass-matched galaxy sample.



Compare

$$\log_{10}(\xi_1/\xi_2)$$

Mean: -0.06, standard deviation: 0.23



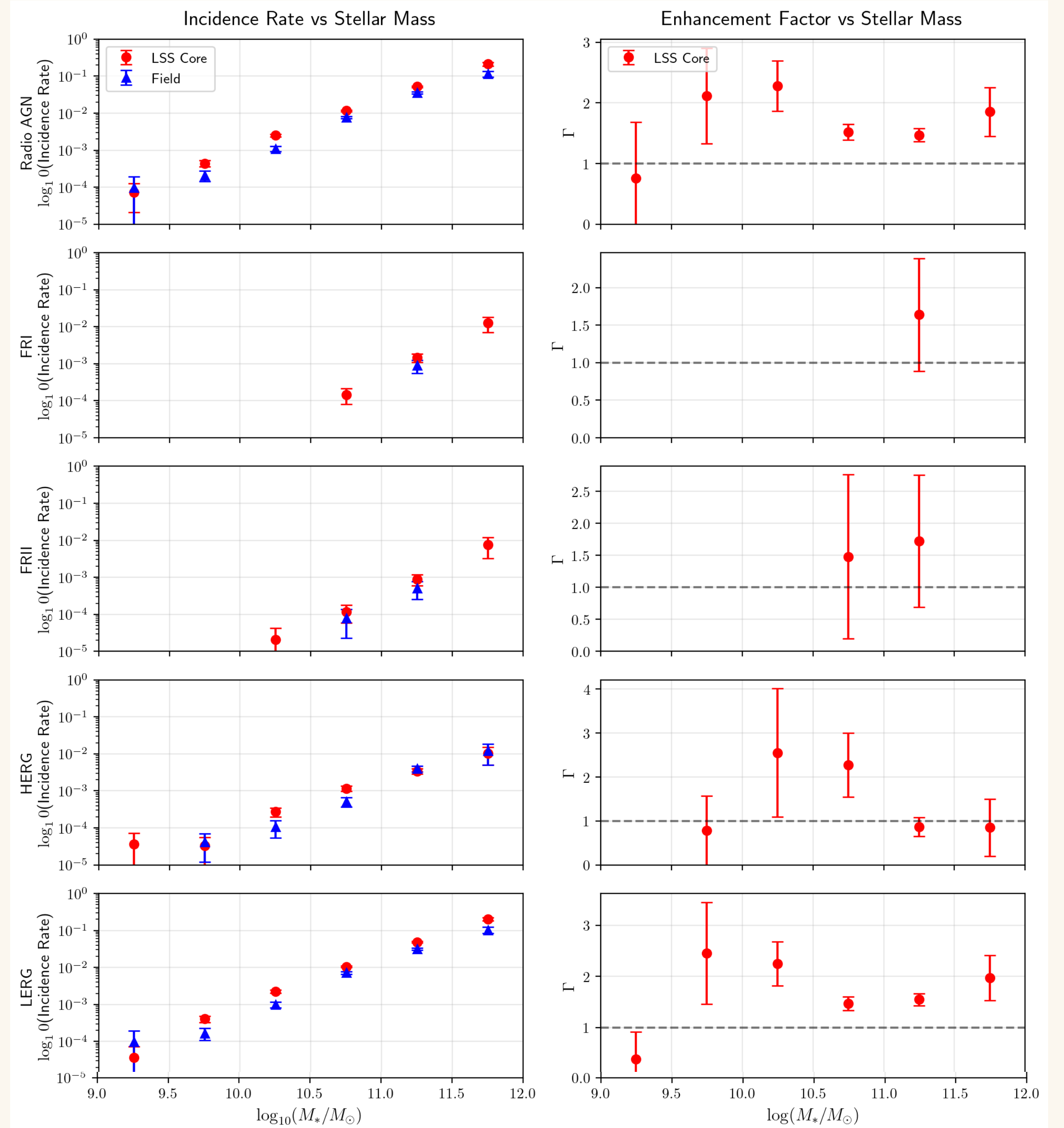
Incidence of AGNs

Within R_{500} : considered within the cluster

$$f_{\text{AGN}}(M_{\star}, z, \rho) = \frac{N_{\text{AGN}}(M_{\star}, z, \rho)}{N_{\text{total}}(M_{\star}, z, \rho)} \times C_{\text{complete}}$$

Also accounts for the varying sensitivity of radio selection across the fields.

$$\Gamma(M_{\star}) = \frac{f_{\text{AGN}}(\text{LSS} | M_{\star})}{f_{\text{AGN}}(\text{Field} | M_{\star})}$$



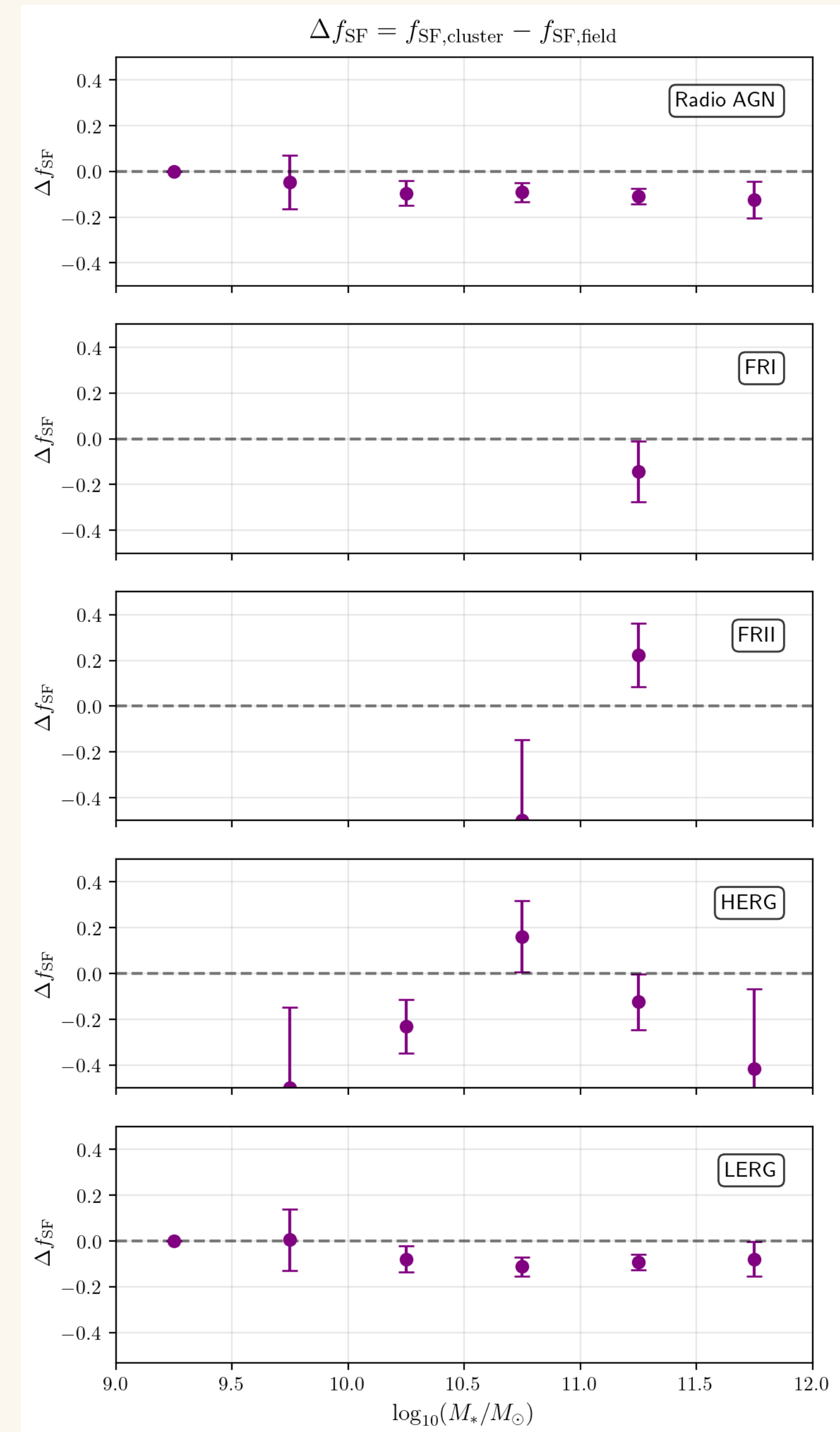
Star-formation

The star-forming fractions of AGN-host galaxies: in cluster vs field

Star-forming:

$$n\text{SFR}(z) = \text{SFR}(z)/M_{\star}(z) \times t_H(z) > 1/5$$

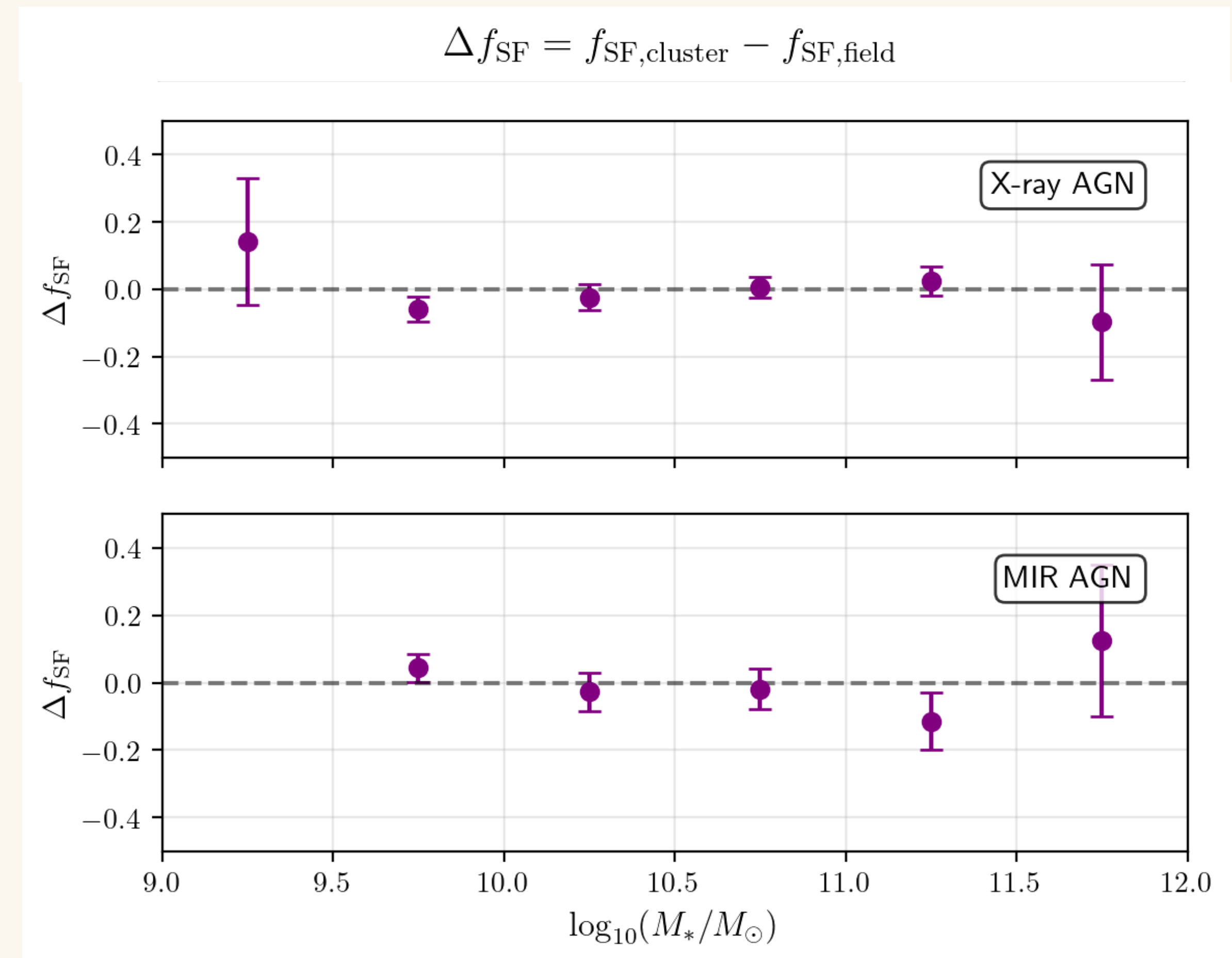
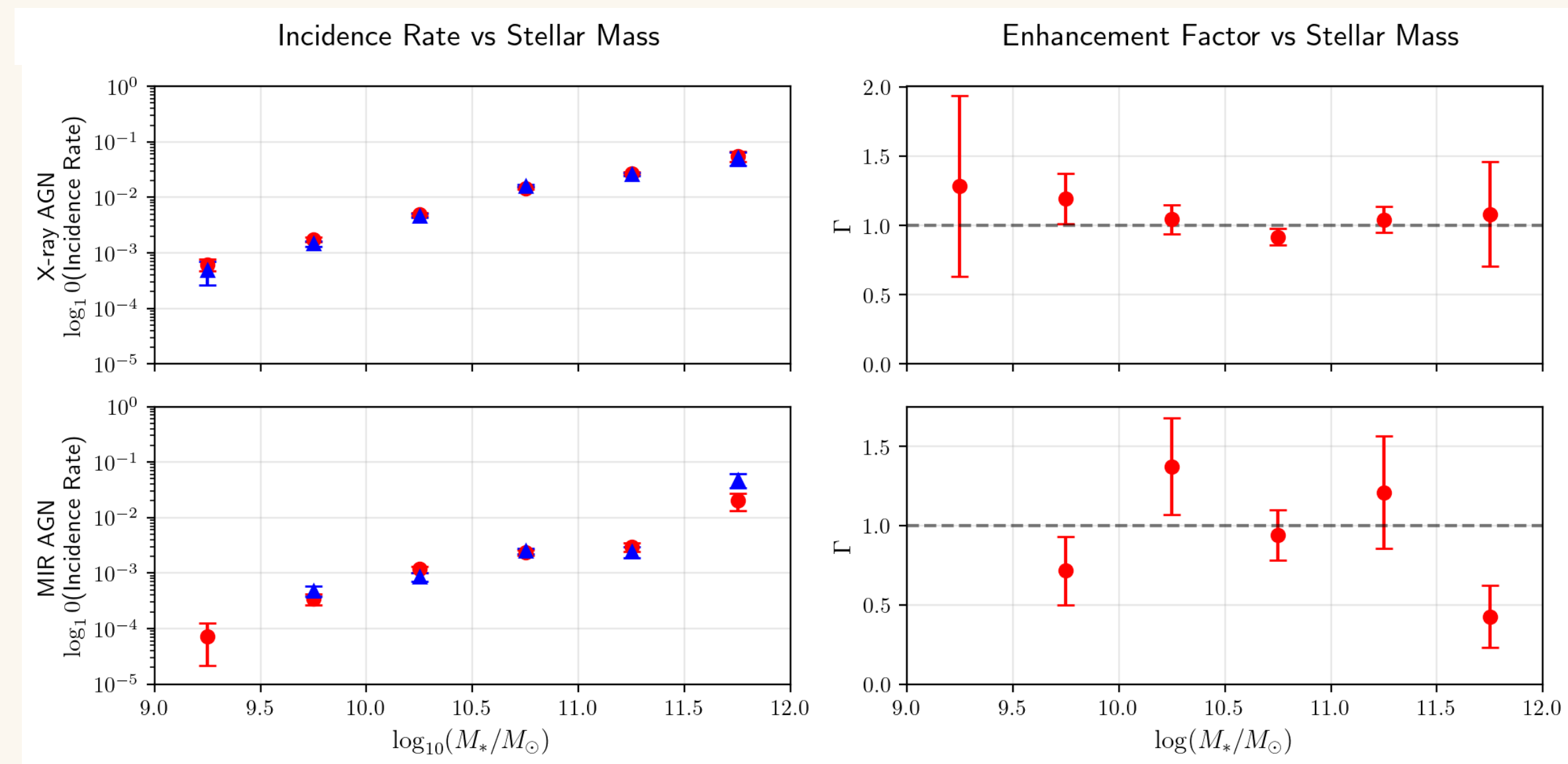
$$f_{\text{SF}} = N_{\text{SF}}/N_{\text{Total}}$$



X-ray AGNs & MIR AGNs

X-ray AGNs (Ni et al., 2021): apply threshold $L_X > 10^{42}$ erg s $^{-1}$, N \approx 2800

MIR AGNs (Donley et al. 2012): N \approx 500



Conclusion

1. Clustering analysis

At $0.5 < z < 1.5$, clustering analysis does not point to environment dependence of radio AGNs, once controlled for stellar mass.

2. Direct pinpointing of sources within known LSS

At $0 < z < 0.8$, radio AGNs could show a factor-of-2 increase of incidence in LSS.

Host galaxies of radio AGNs could have a 10% decrease of SFR in LSS.

Environments do not influence the incidence of X-ray AGNs and MIR AGNs, once controlled for stellar mass.

Future works

Using Corrfunc to compute correlation functions; remove potential bias.

Does the environment affect radio AGN luminosities?

LSS verification.



The background features several horizontal watercolor strokes. At the top is a wide, light blue stroke. Below it is a narrower, vibrant purple stroke. Further down is another wide, light blue stroke. At the bottom is a wide, yellow-green stroke. The strokes are layered and have soft, feathered edges.

Thanks!