How are far-IR galaxies distributed in different environments

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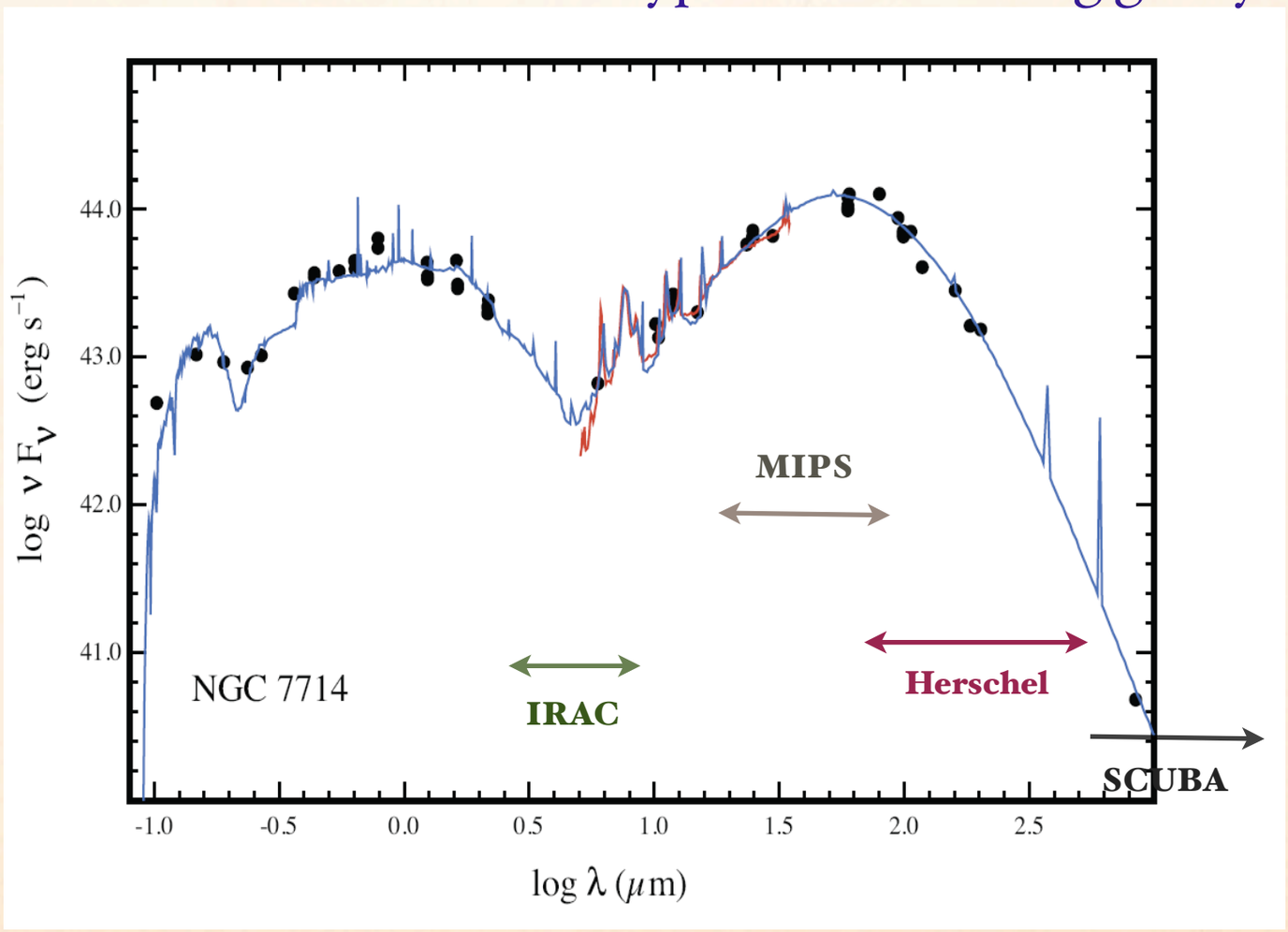
Far-IR observations

✦Half of the light is absorbed and re-emitted by dust.

✦Dust emission is closely related to star formation activity

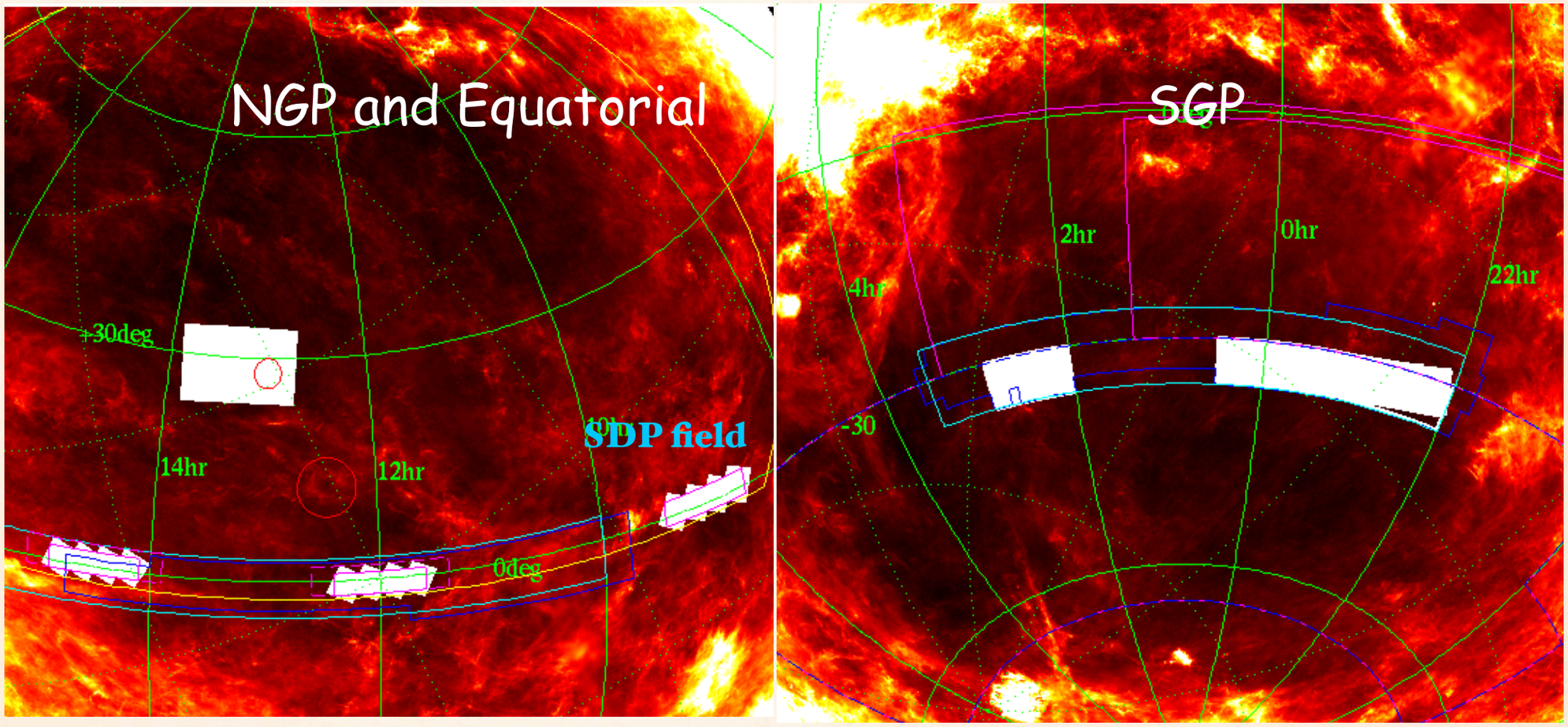
UV to subMM SED of a typical Star forming galaxy



Groves et al. (2008)

erschel ATLAS Survey

PI: Steve Eales



In total: 550 sq. deg

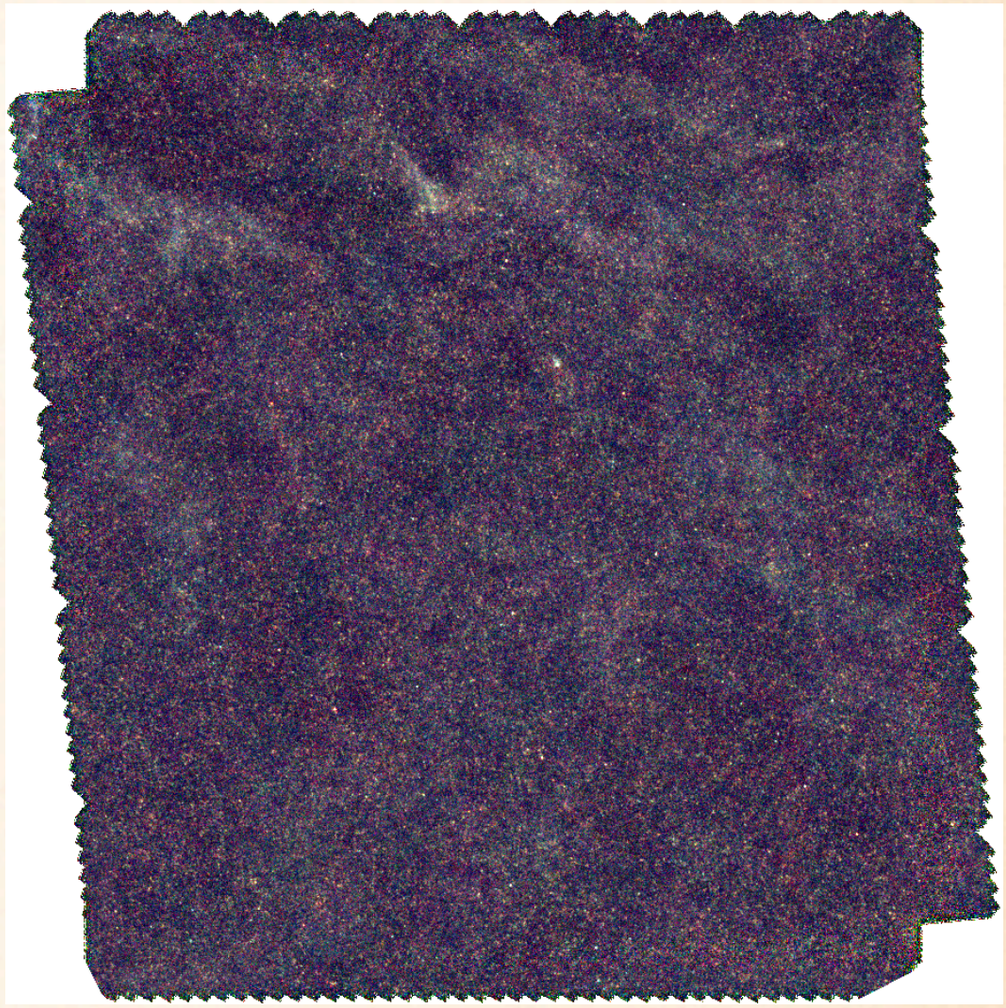
Multi-wavelength data in SDP and Phase I (Equatorial) fields:

2dF, SDSS, GAMA, VISTA(VIKING), UKIDSS, VST (KIDS), GALEX, GMRT

Clustering of H-ATLAS galaxies

SDP field

- 4 x 4 sq. deg, 60 times of the full moon, 1/30 of the full HATLAS area
- far-IR bands: 110, 170, 250, 350, 500 um
- redshift up to z ~3
- 6800 galaxies detected with >5 sigma, 2400 with reliable matching with SDSS optical counterparts
- 970 with spectroscopic redshift from GAMA



Clustering of H-ATLAS galaxies

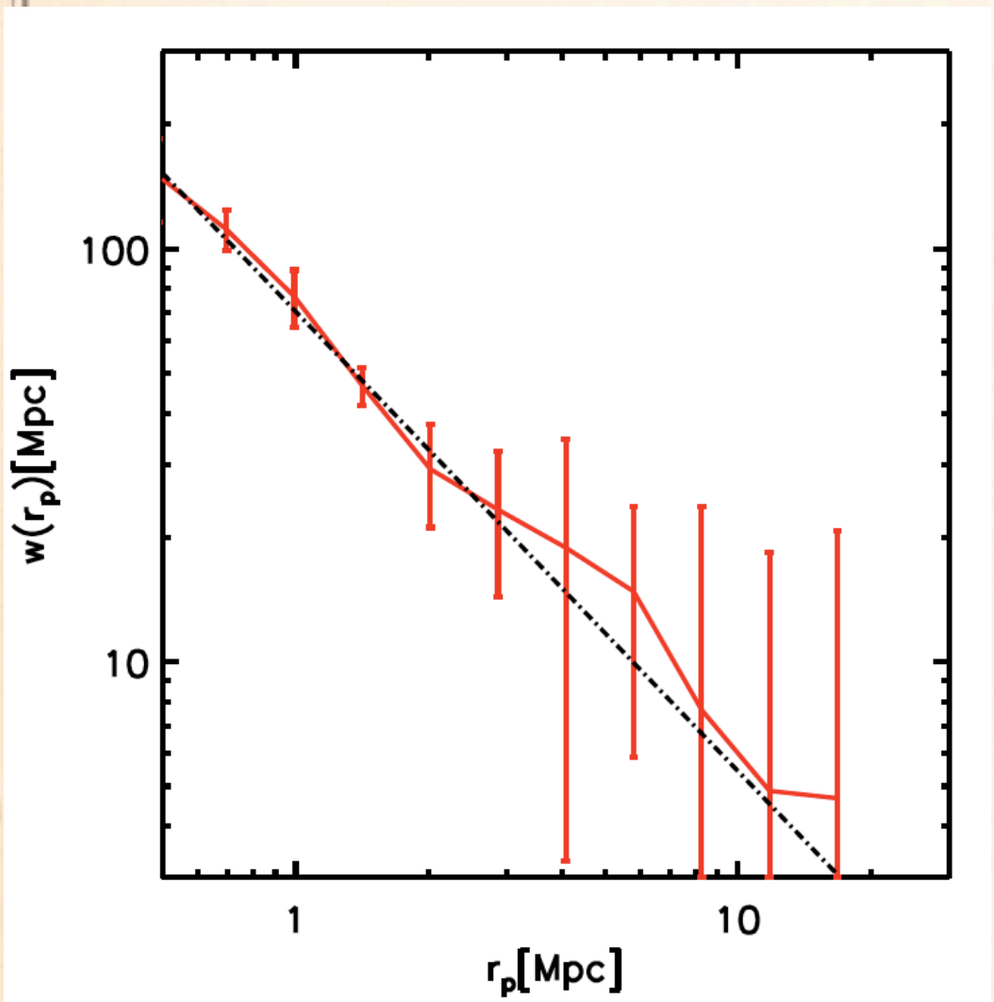
- Study the spatial distribution of H-ATLAS galaxy sample using two-point correlation functions.

- However, current sample is small. Direct measurement of its clustering is hard, even worse if to study the luminosity dependence

Therefor, cross-correlate with optical selected GAMA galaxies

Clustering of H-ATLAS galaxies

cross-correlation between H-ATLAS and GAMA



Clustering of H-ATLAS galaxies

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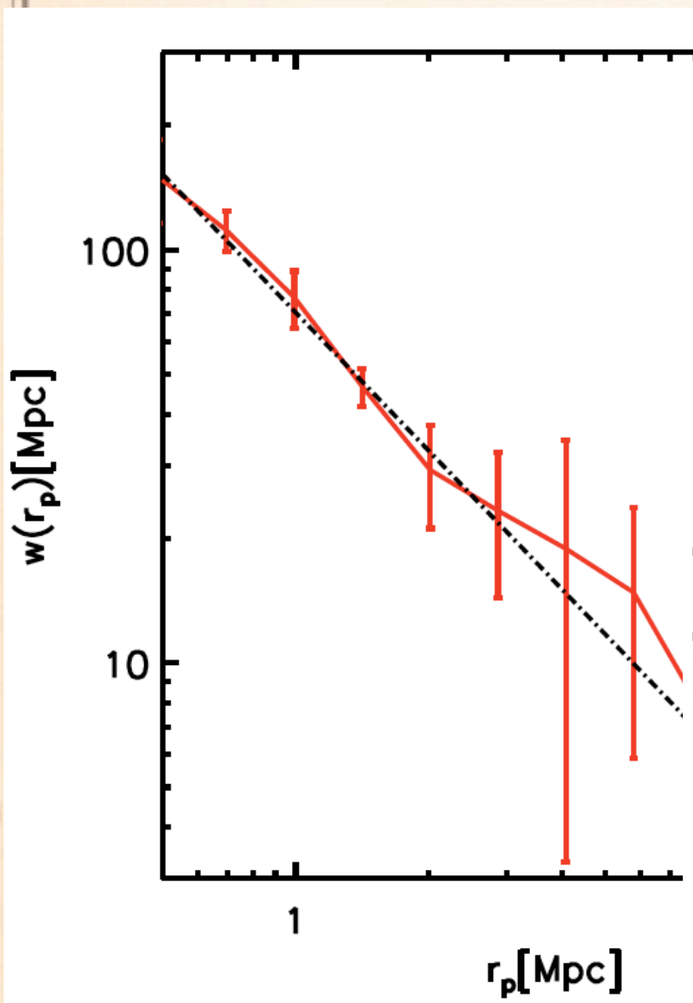
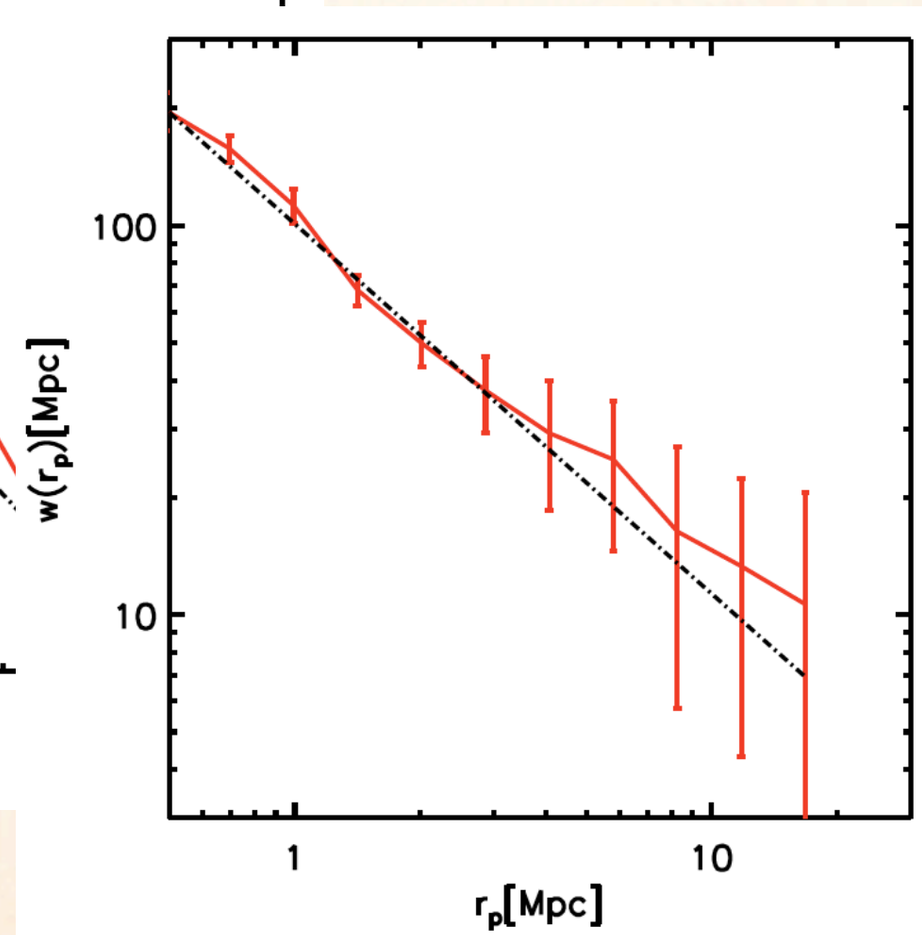


auto-correlation of GAMA



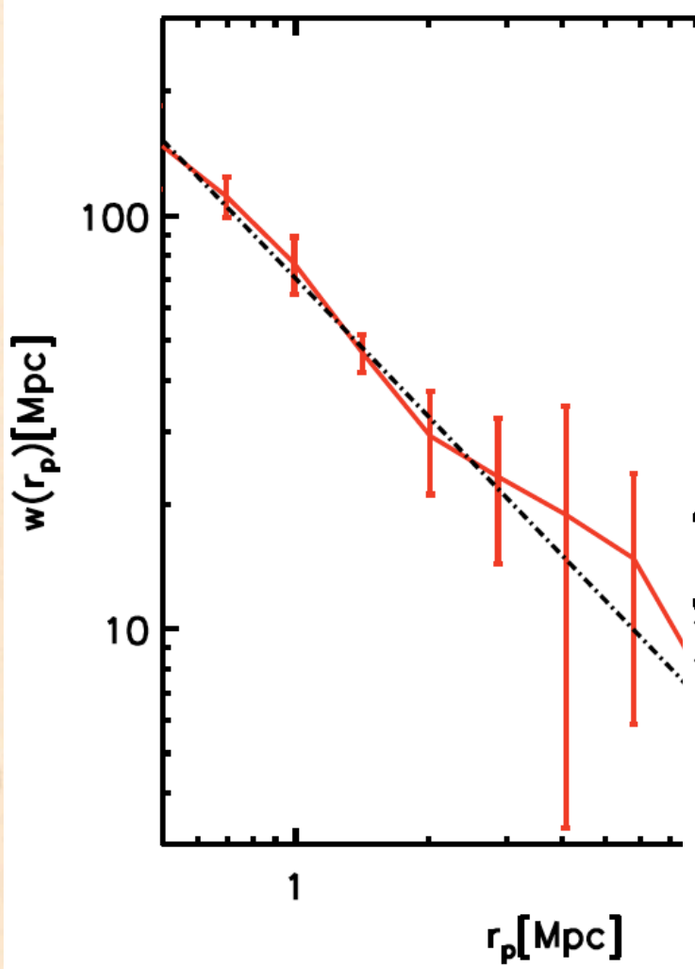
Clustering of H-ATLAS galaxies

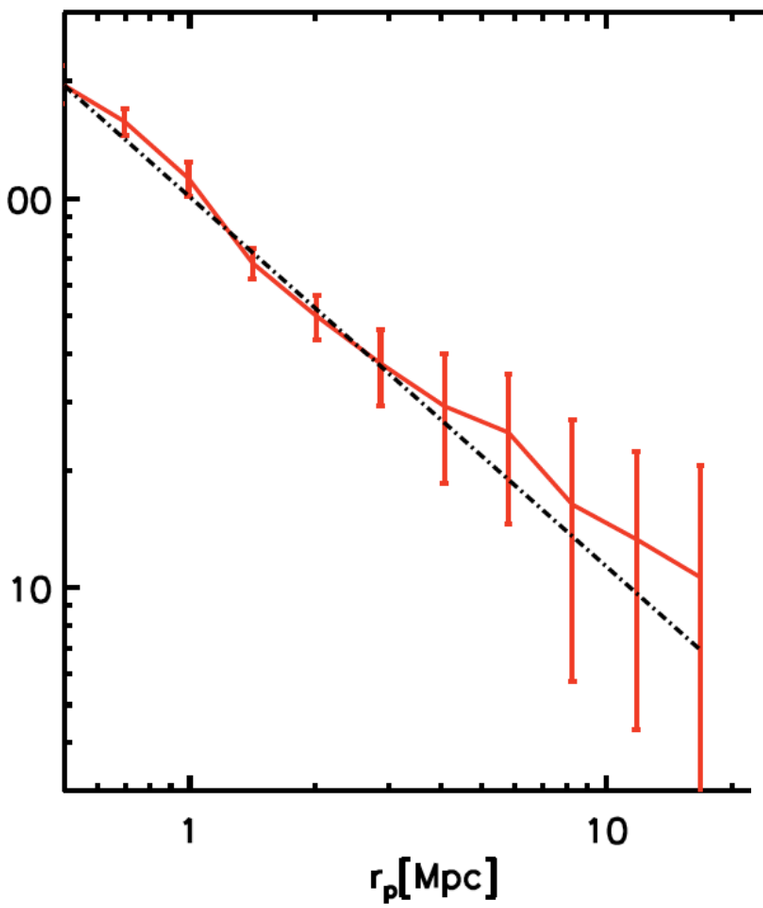
cross-correlation between H-ATLAS and GAMA

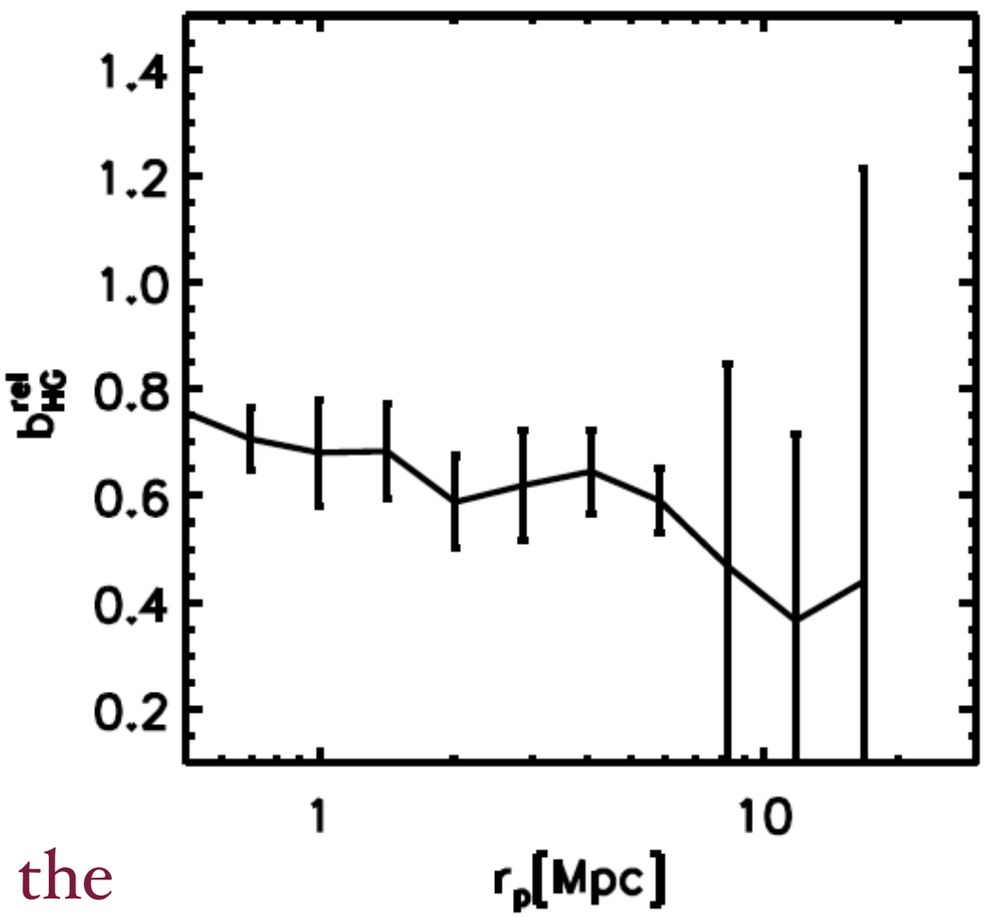
auto-correlation of GAMA

relative bias

$$b_{\rm HG}^{\rm rel} = w_{\rm GH}(r_p)/w_{\rm GG}(r_p)$$



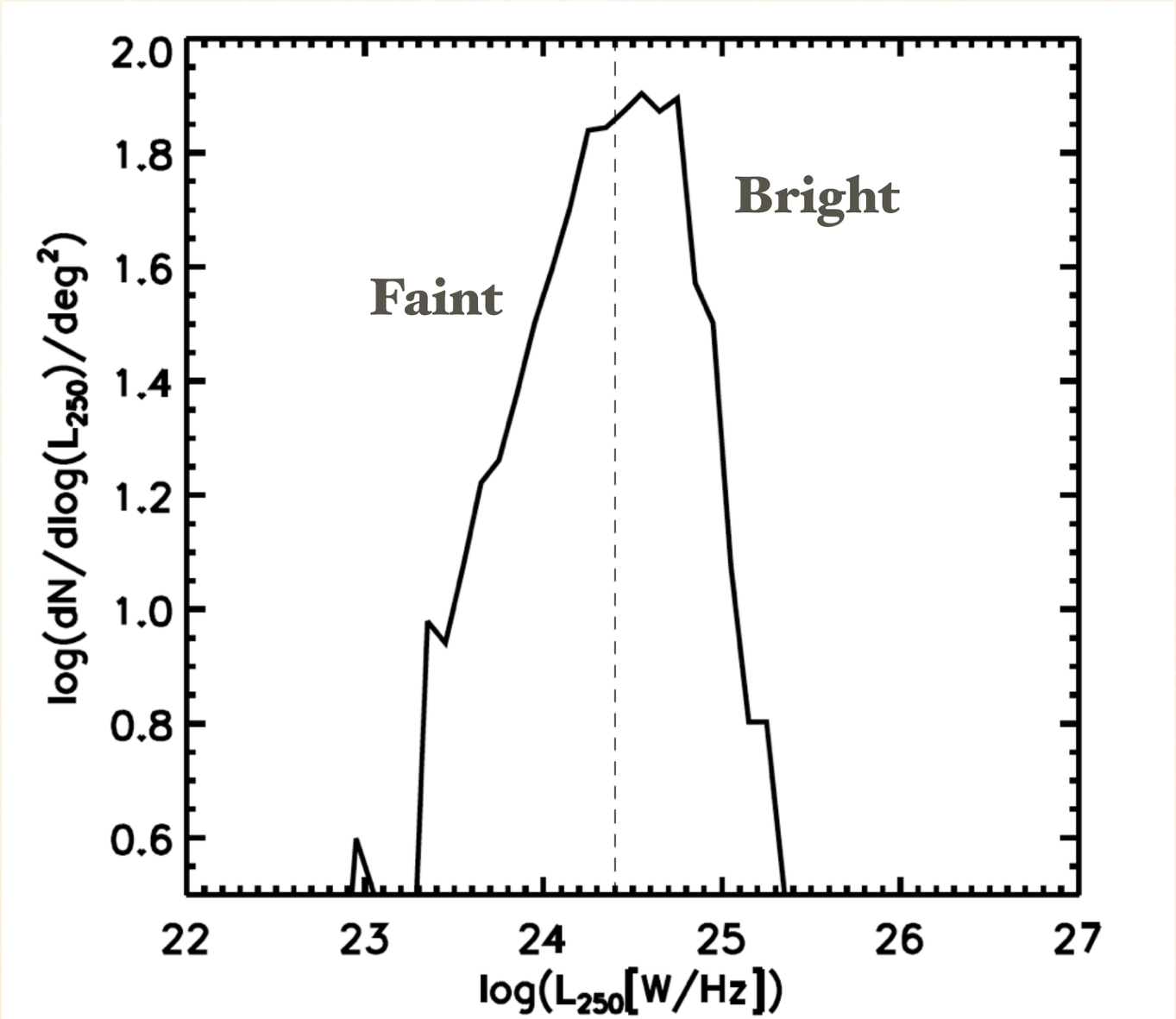




HATLAS galaxies are less strongly clustered than the optical selected GAMA galaxies.

Dependence on luminosity

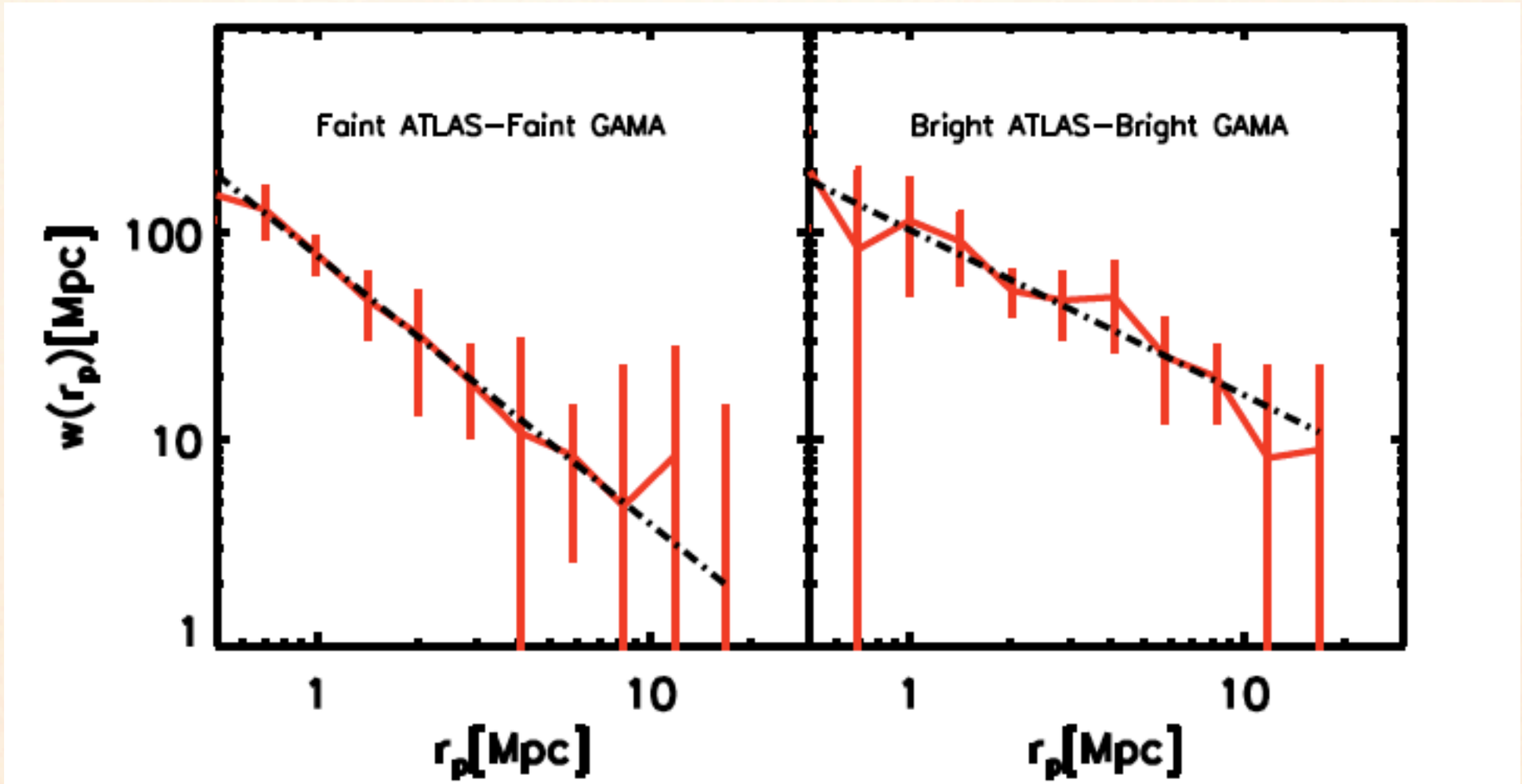
Luminosity distribution



Typical luminosity L250 = 2.5 x 10^24 W/Hz, ~ L*

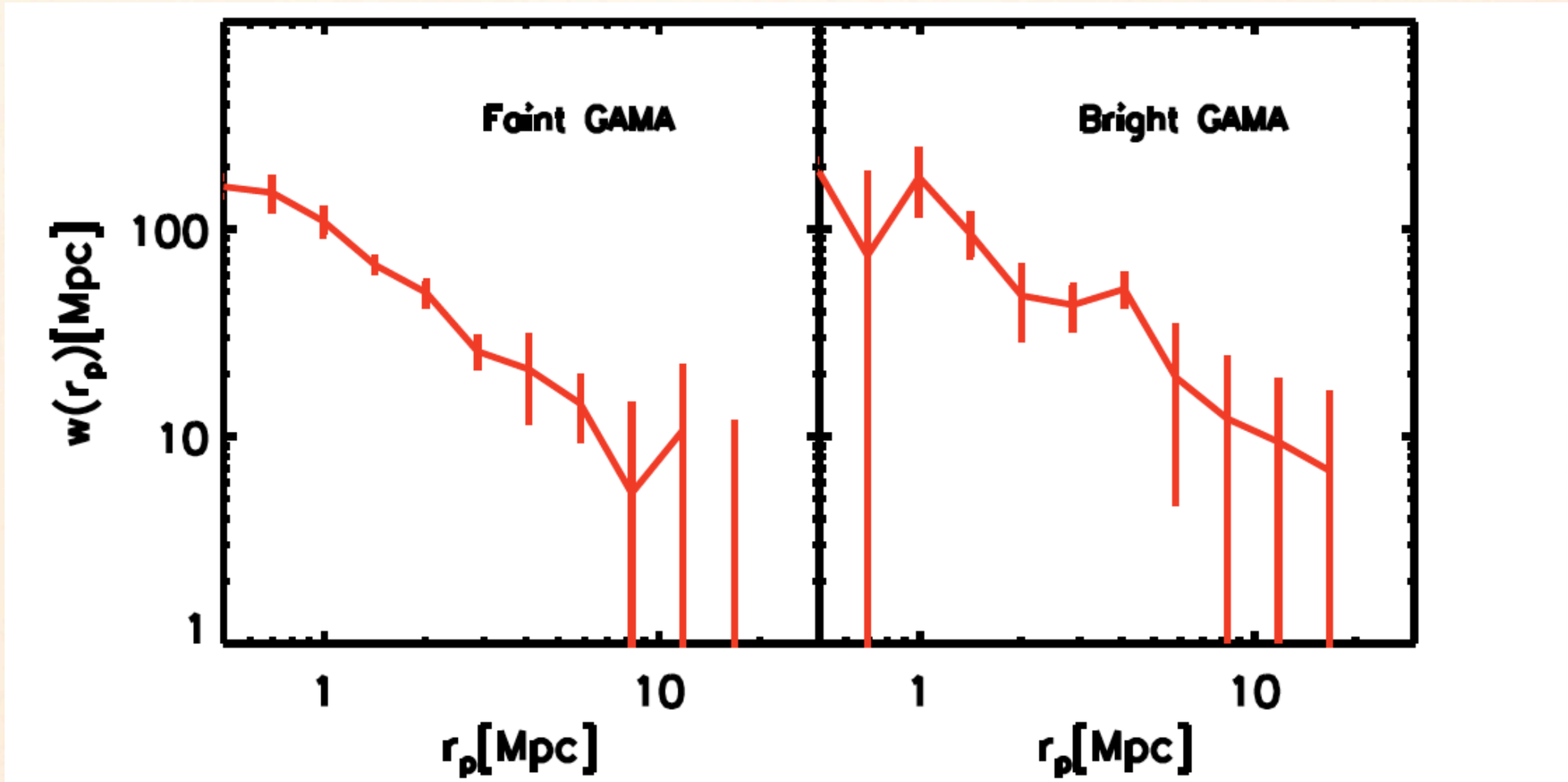
Dependence on luminosity

cross-correlation functions between faint/bright H-ATLAS and faint/bright GAMA

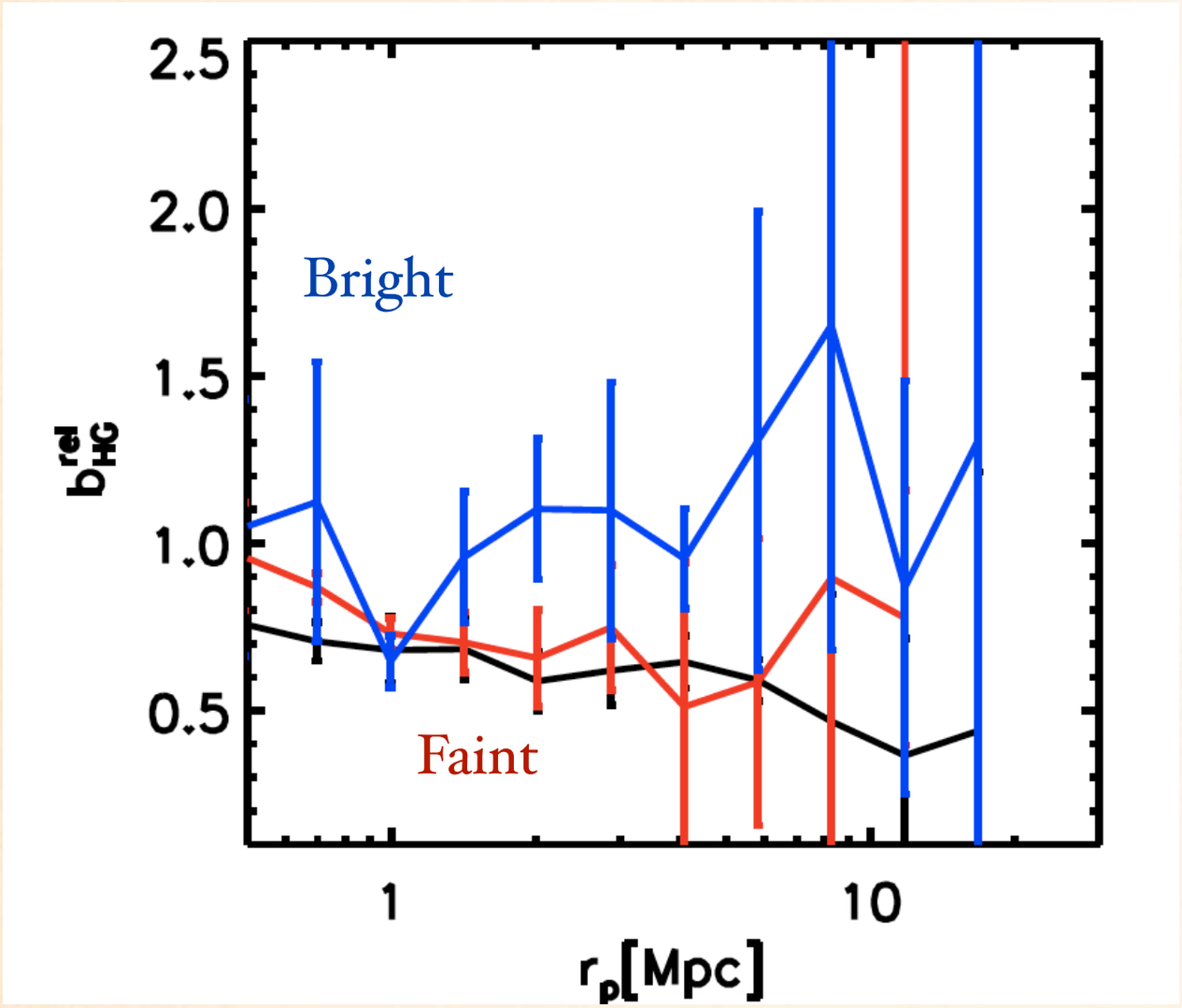


Dependence on luminosity

Auto-correlation functions of faint/bright GAMA



Relative bias of bright/faint H-ATLAS galaxies to bright/faint GAMA galaxies



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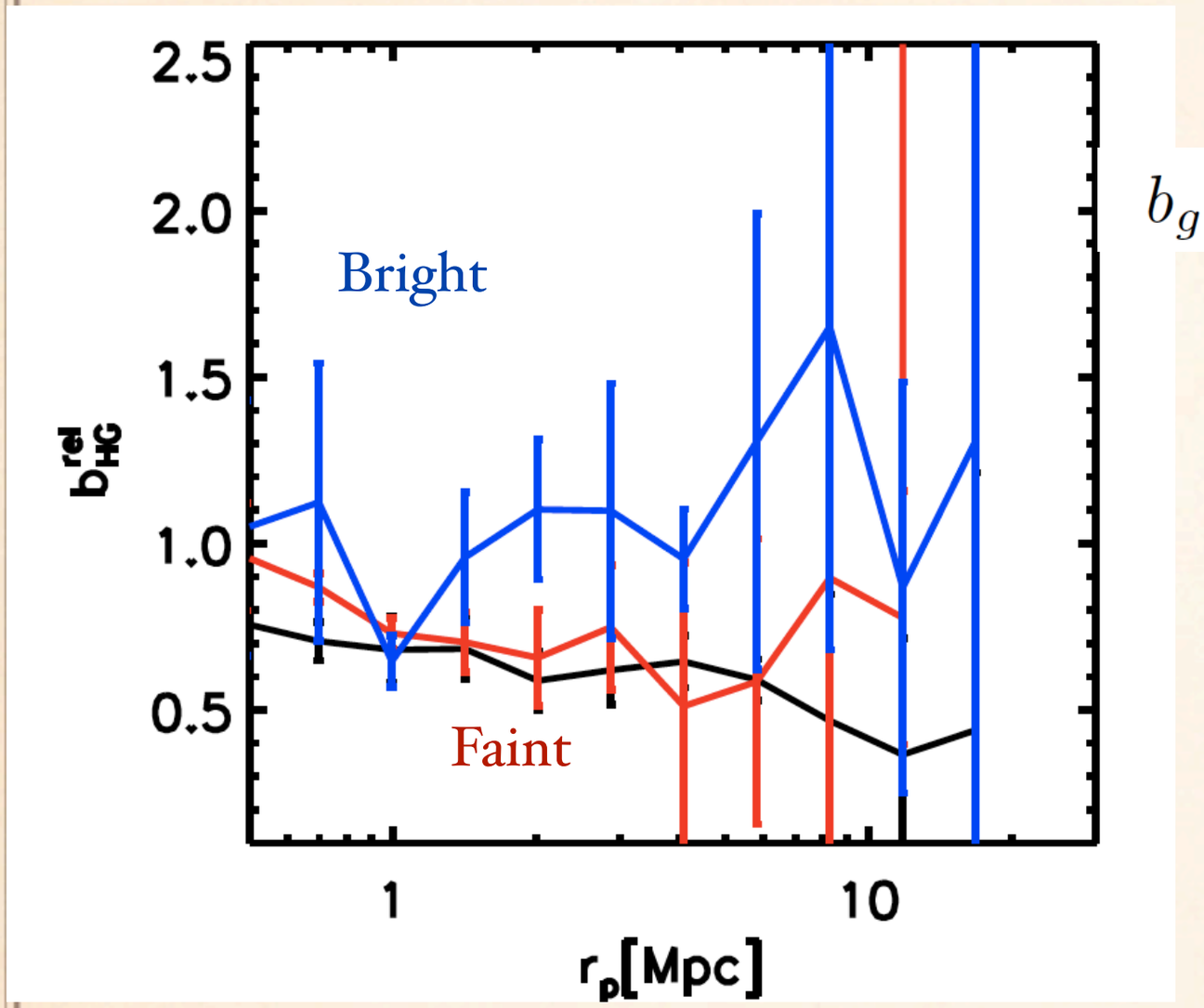
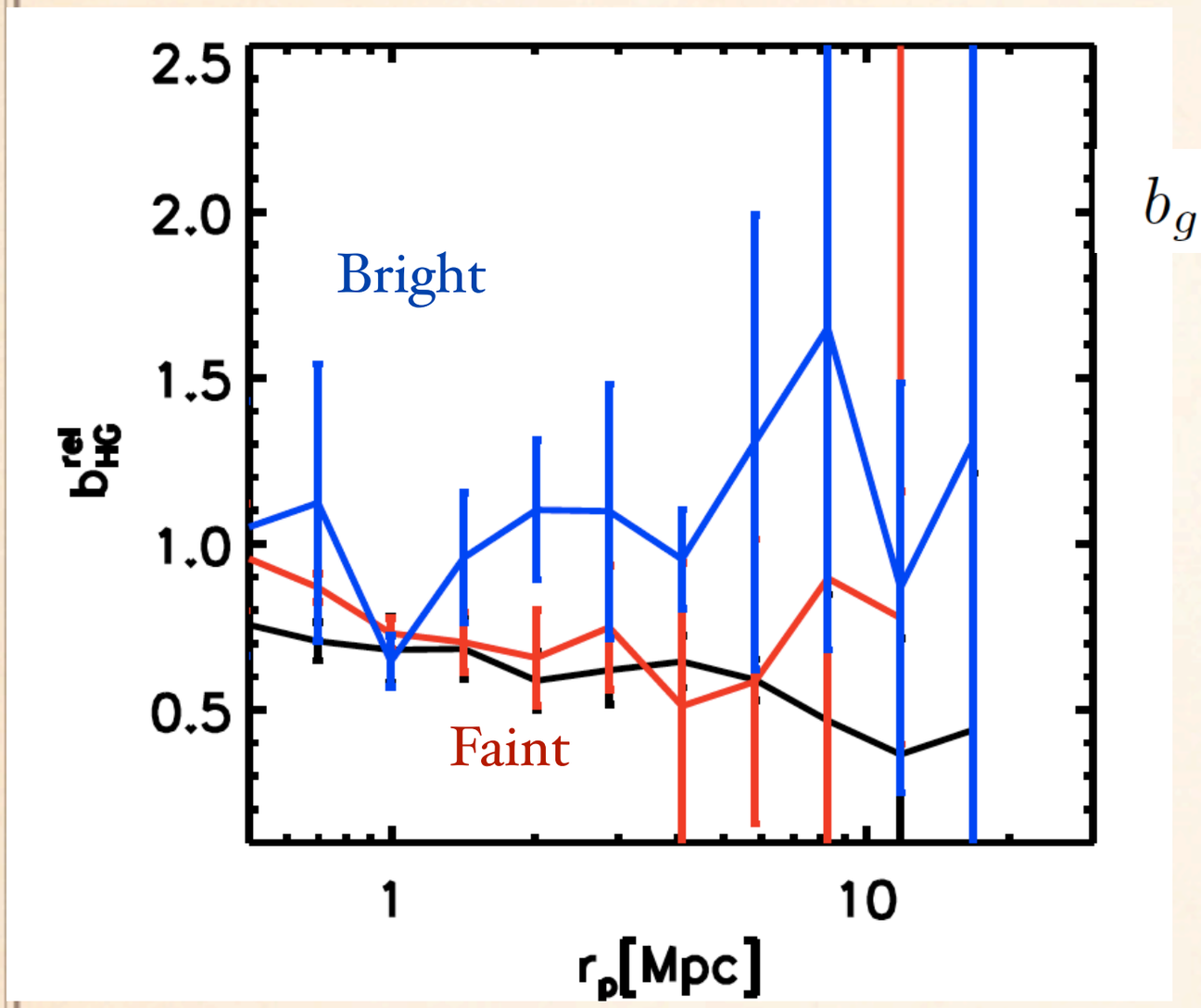


Bias of optical selected galaxies (Zehavi et al. 2011, SDSS)

$$b_g(L) \times (\sigma_8/0.8) = 0.97 + 0.17(L/L_*)^{1.04}$$

Relative bias of bright/faint H-ATLAS galaxies to bright/faint GAMA galaxies



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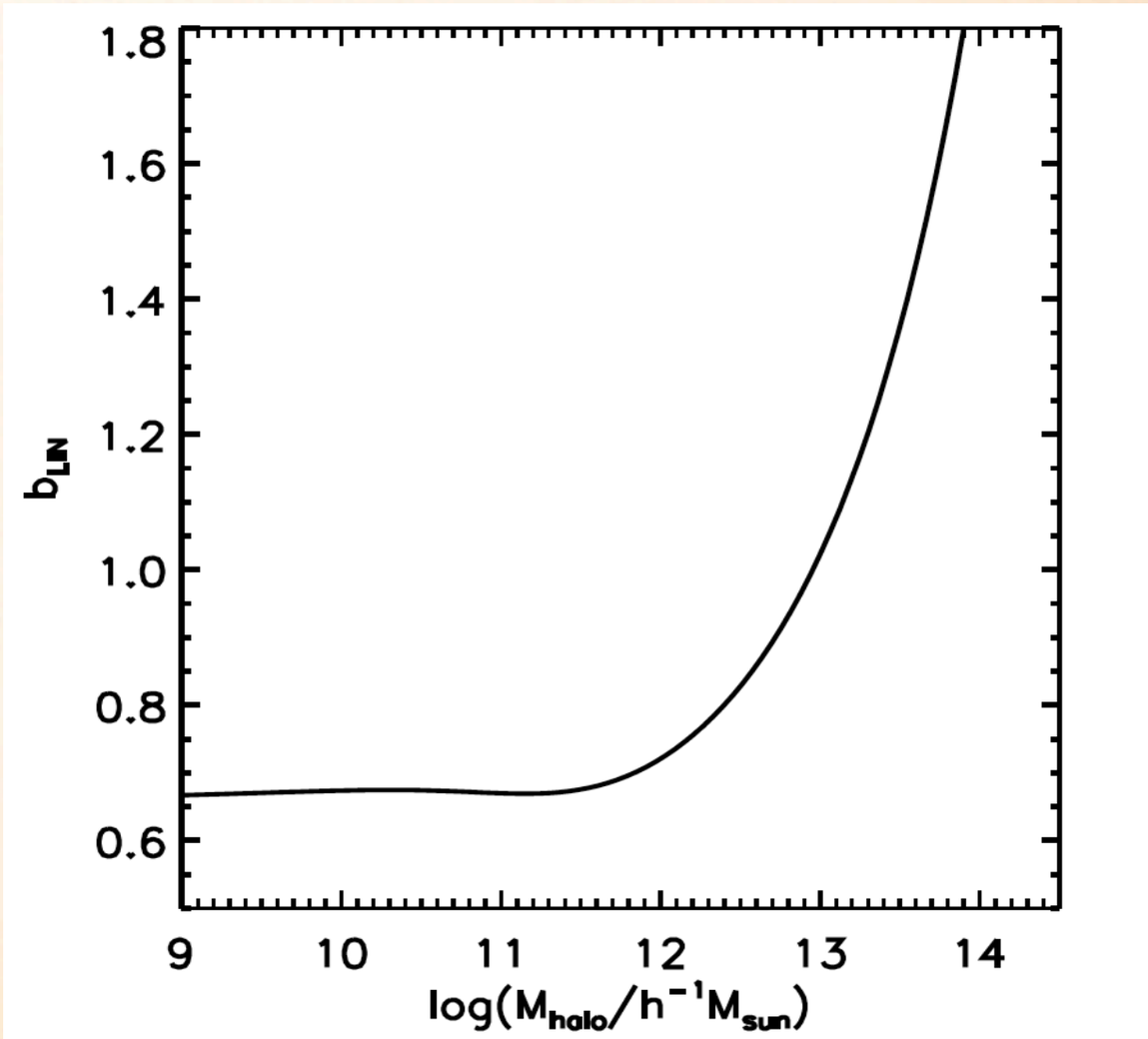
Bias as a function of halo mass



Seljak & Warren(2004)

Host halo of H-ATLAS galaxies

	ALL H-ATLAS	Bright H-ATLAS	Faint H-ATLAS
Relative bias	0.61+/-0.68	1.04+/-0.22	0.67+/-0.13
GAMA bias	0.71+/-0.09	1.34+/-0.28	0.70+/-0.14
Host halo mass [log M]	12.1+0.5 -∞	13.6+0.3 - 0.4	12.0+0.71 -∞

❖Bright H-ATLAS are more strongly clustered in comparison with faint HATLAS at the 2σ significance

❖Note that evolution of clustering with redshift may also contribute!

IR galaxy distribution in groups

IR galaxy distribution in groups

in progress...

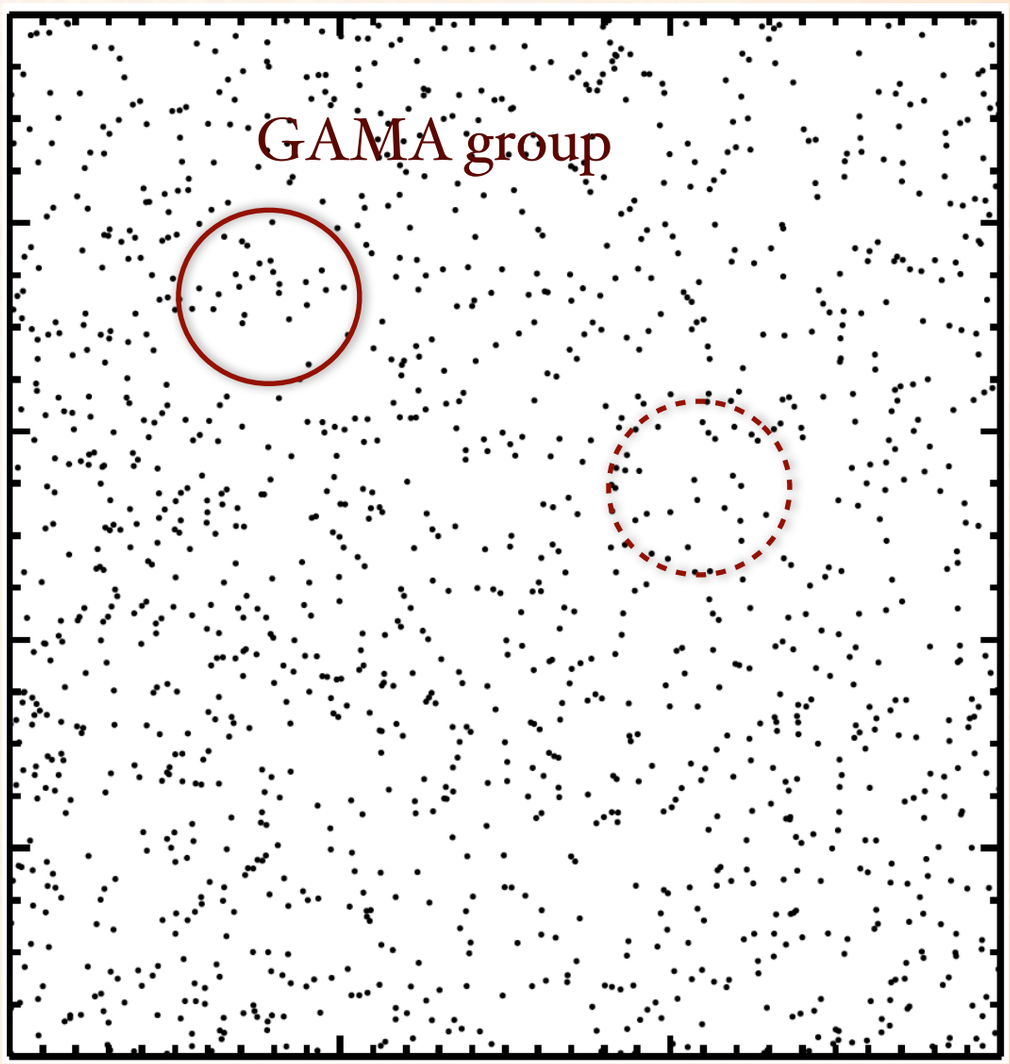
H-ATLAS PHASE I:

- ~10 times of the SDP field
- ~67 k sources, 25k matched to SDSS
- ~overlap with GAMA 09, 12 and 15 hour fields

GAMA Groups (talk by Robotham):

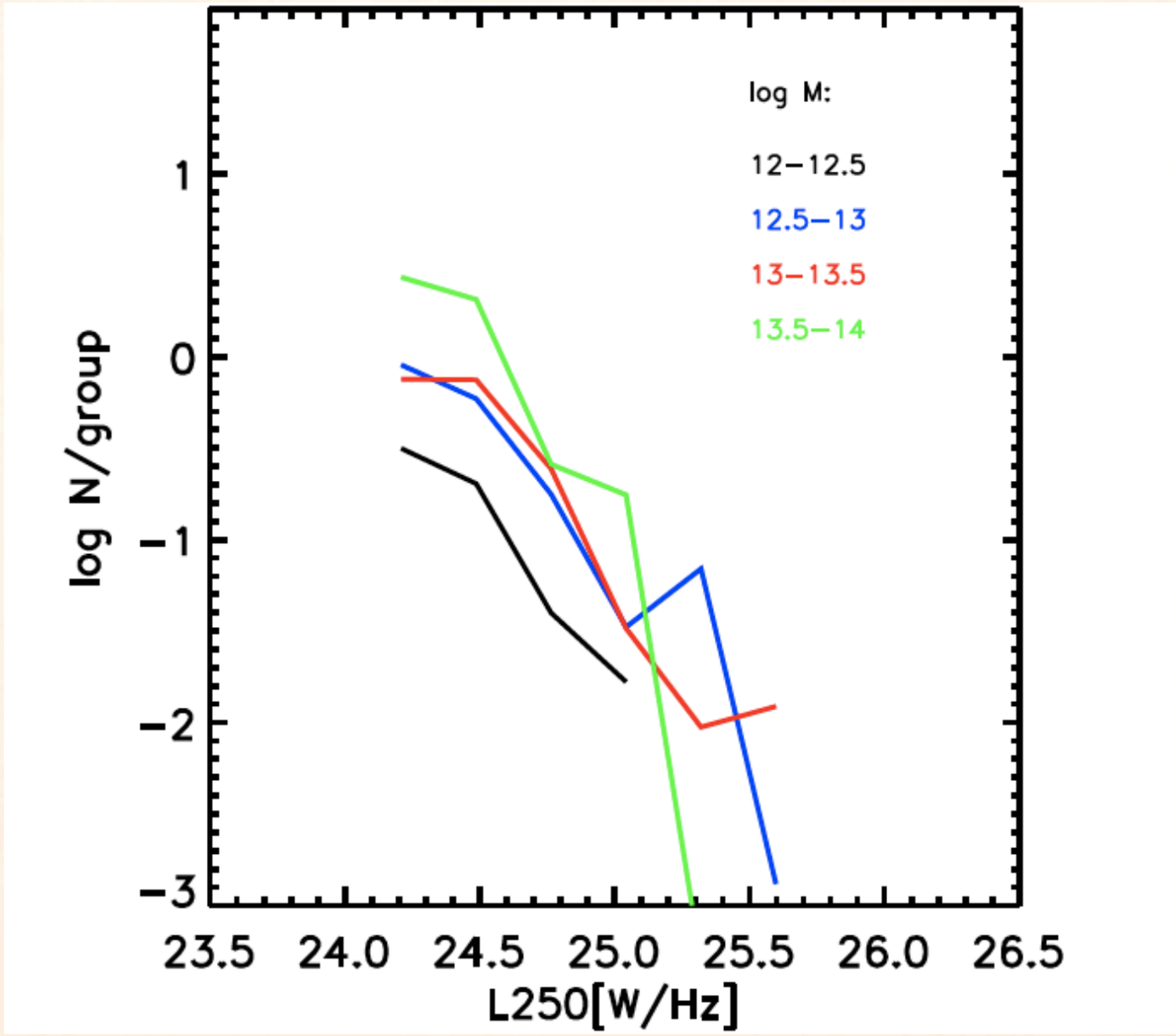
- ~12 k groups are identified in GAMA 09, 12, 15 hour fields

H-ATLAS in groups



Halo mass dependence of the conditional luminosity functions

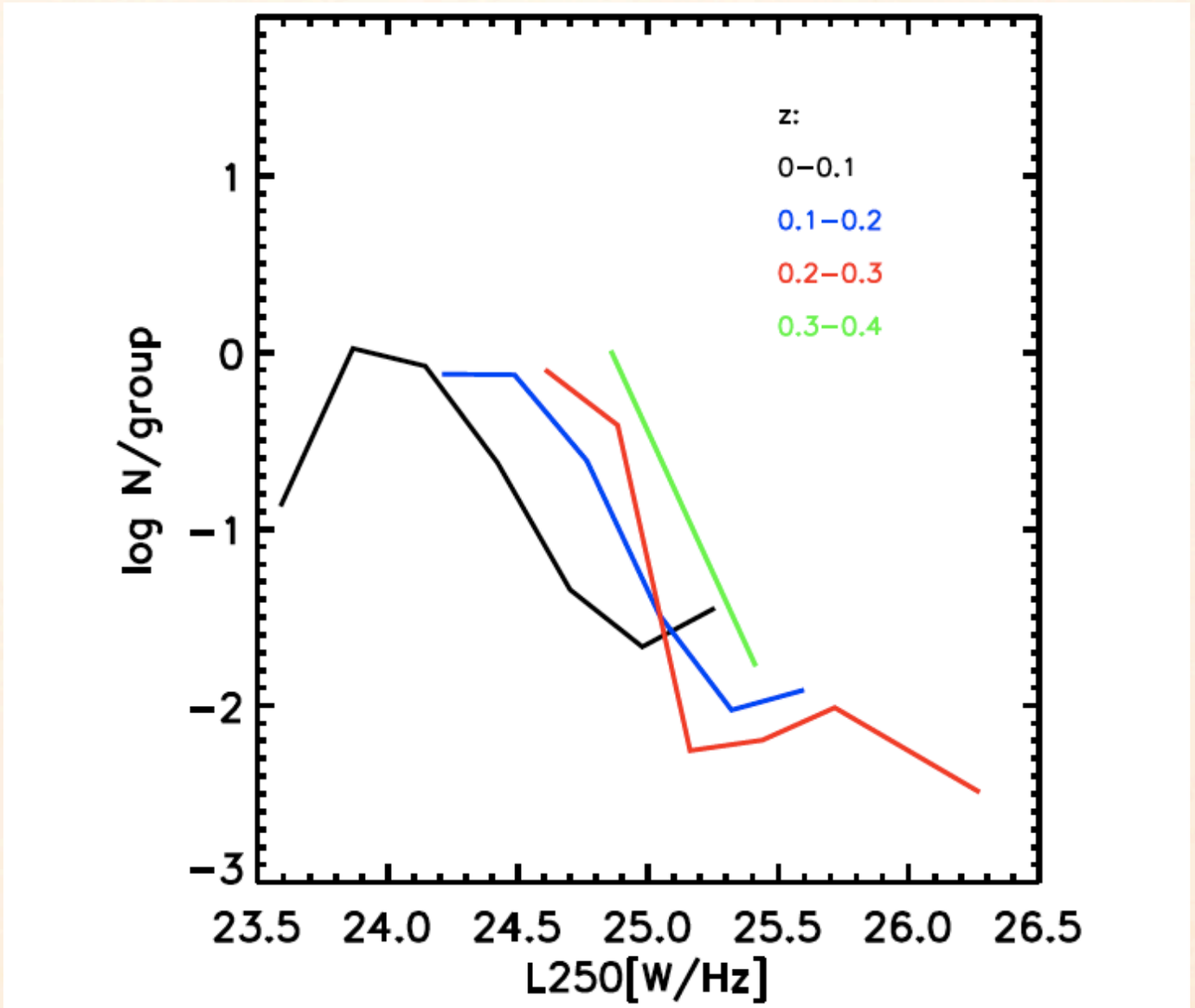
redshift range: $0.1 < z < 0.2$



- Total luminosity is a function of the halo mass
- L* does not depend on halo mass very much

Redshift dependence of the conditional luminosity functions

Halo mass: logM [Msun] : 13 - 13.5 (the Local group)



Strong evolution of the luminosity function of H-ATLAS galaxies in groups

Summary

- Most of the local H-ATLAS galaxies are hosted by halos with masses comparable to that of the Milky Way

- The clustering of HATLAS galaxies is a function of luminosity: the more luminous, the stronger the correlation function.

- Strong redshift evolution of the distribution of the H-ATLAS galaxies in halos of given mass

- The total luminosity is higher in more massive halos, while the L* only depends on halo mass very weakly.

Future work:

- Convert FIR luminosity to SFR and study the environmental dependence of star formation

- Compare to current galaxy formation models