A KiDS weak lensing analysis of assembly bias in GAMA groups

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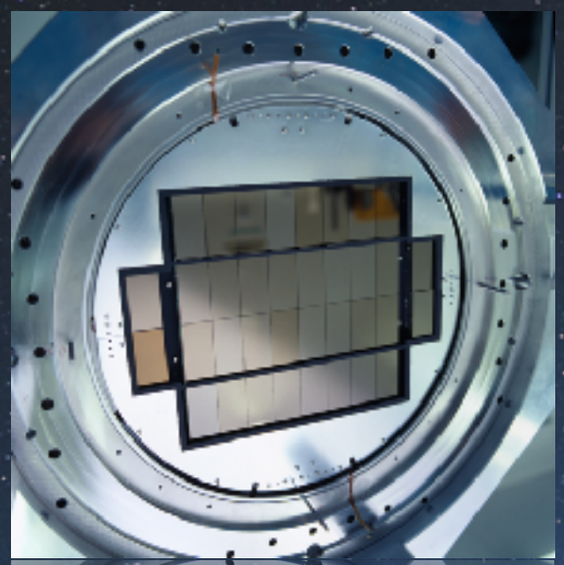
with Marcello Cacciato, Massimo Viola,
Konrad Kuijken, Henk Hoekstra & KiDS

Credit: Alex Tudorica

Outline

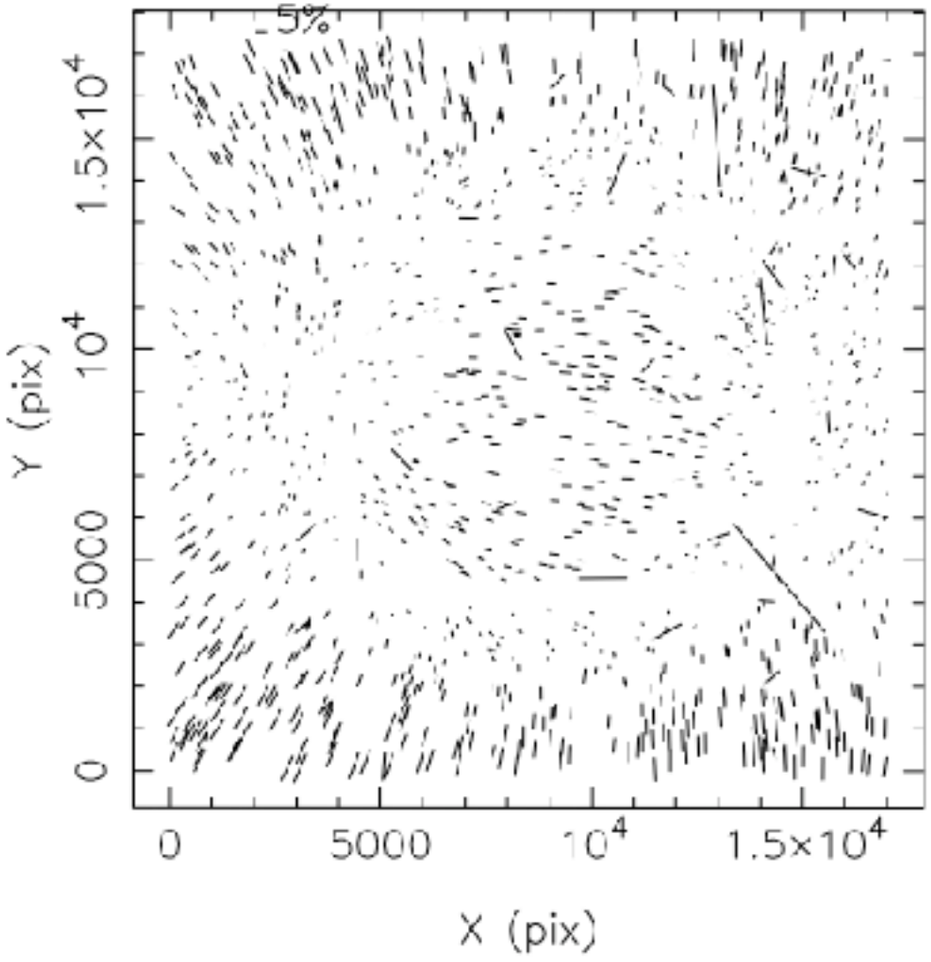
- Overview of the KiDS survey
- Sneak peek of GAMA survey
- Galaxy-galaxy lensing using KiDS and GAMA
- Assembly bias results
- Future prospects and conclusions

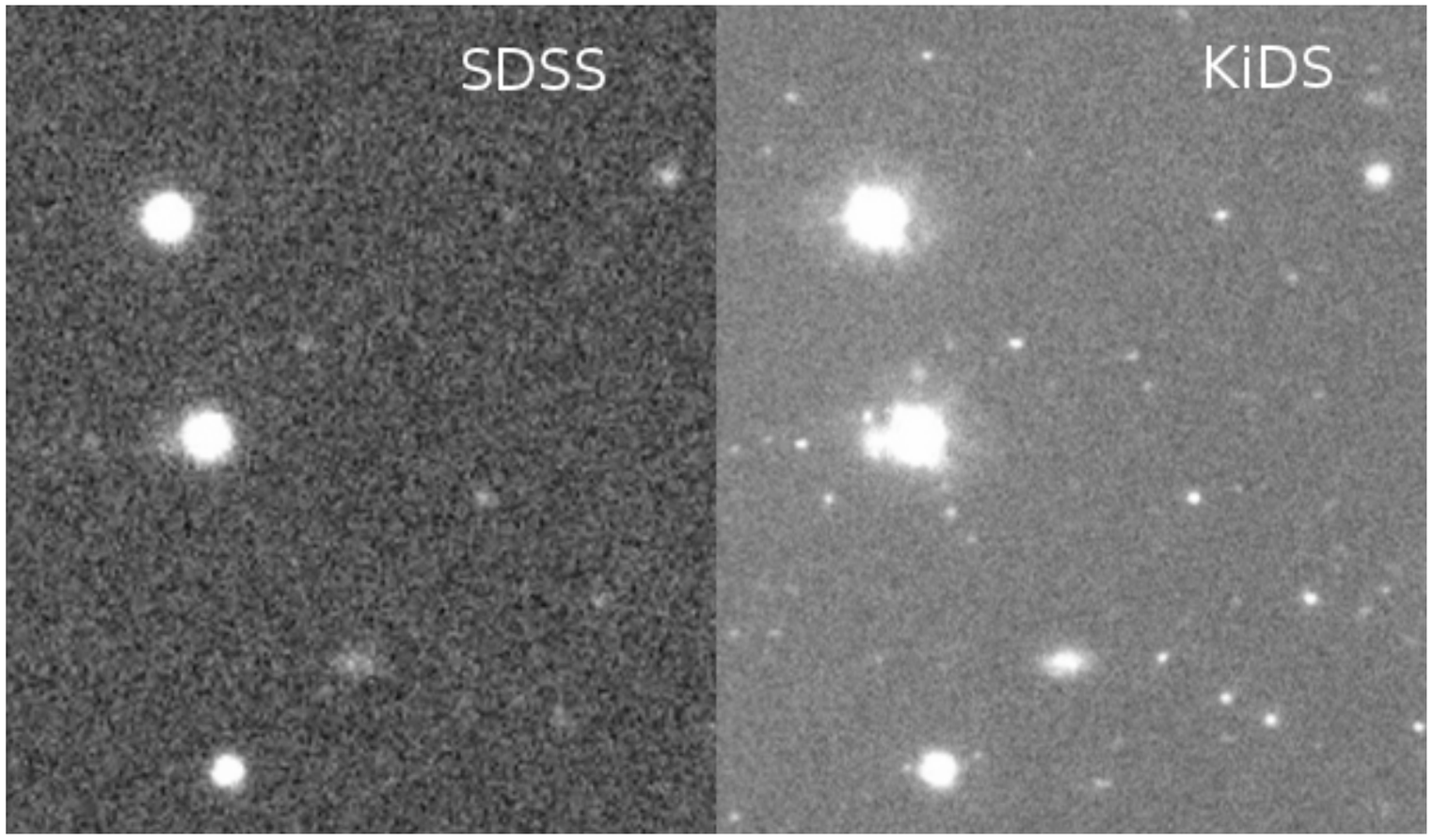


KiDS

- Location: 2.6m f/5.5 VST telescope, Paranal, Chile
- OmegaCAM: 32 CCD chips, 268 Mpix
- 1500 deg^2 at the end
- *ugri*
- Overlap with VIKING, SDSS, 2dF, COSMOS, GAMA, DEEP2

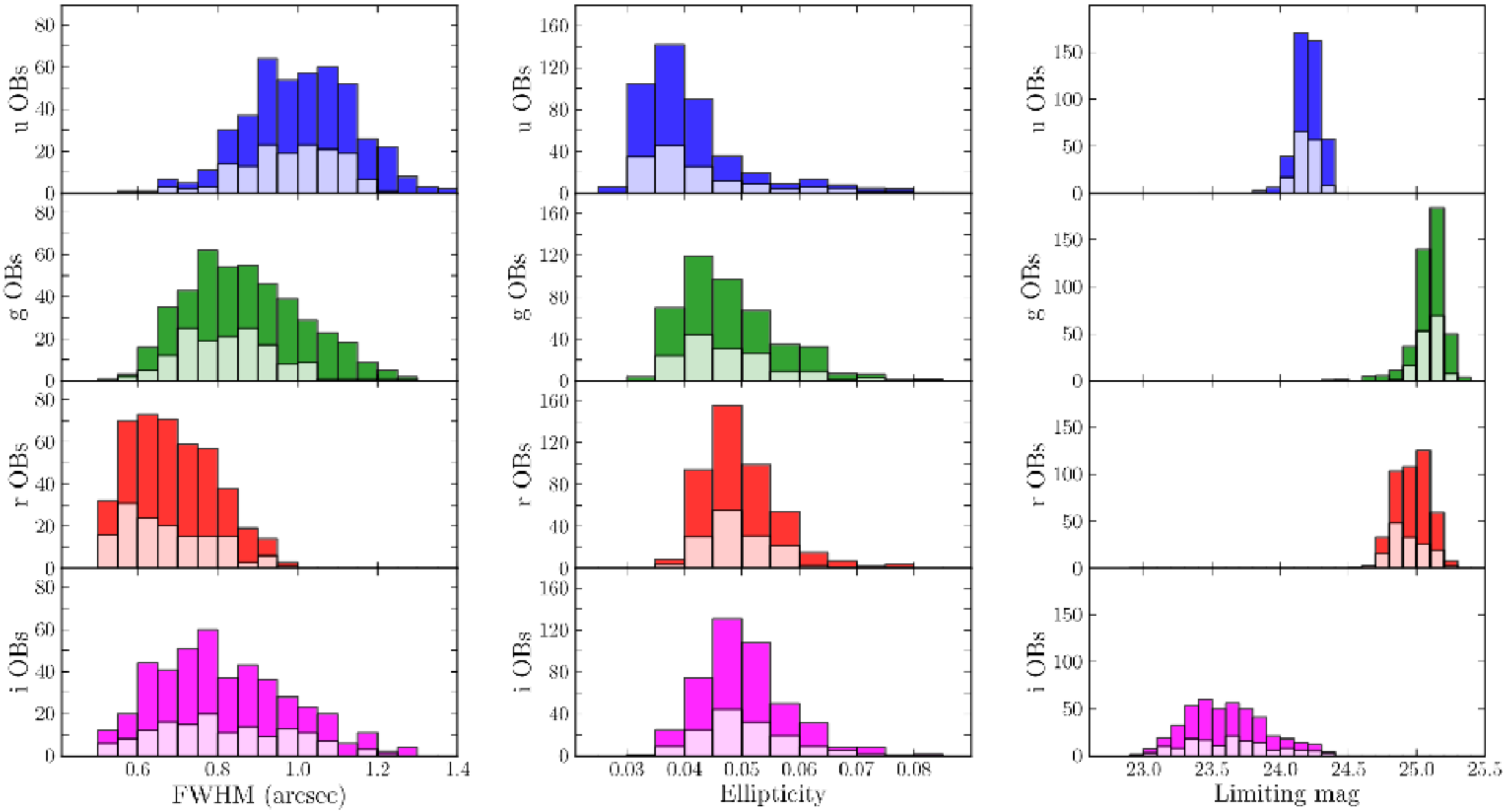
Designed with the weak lensing in mind…





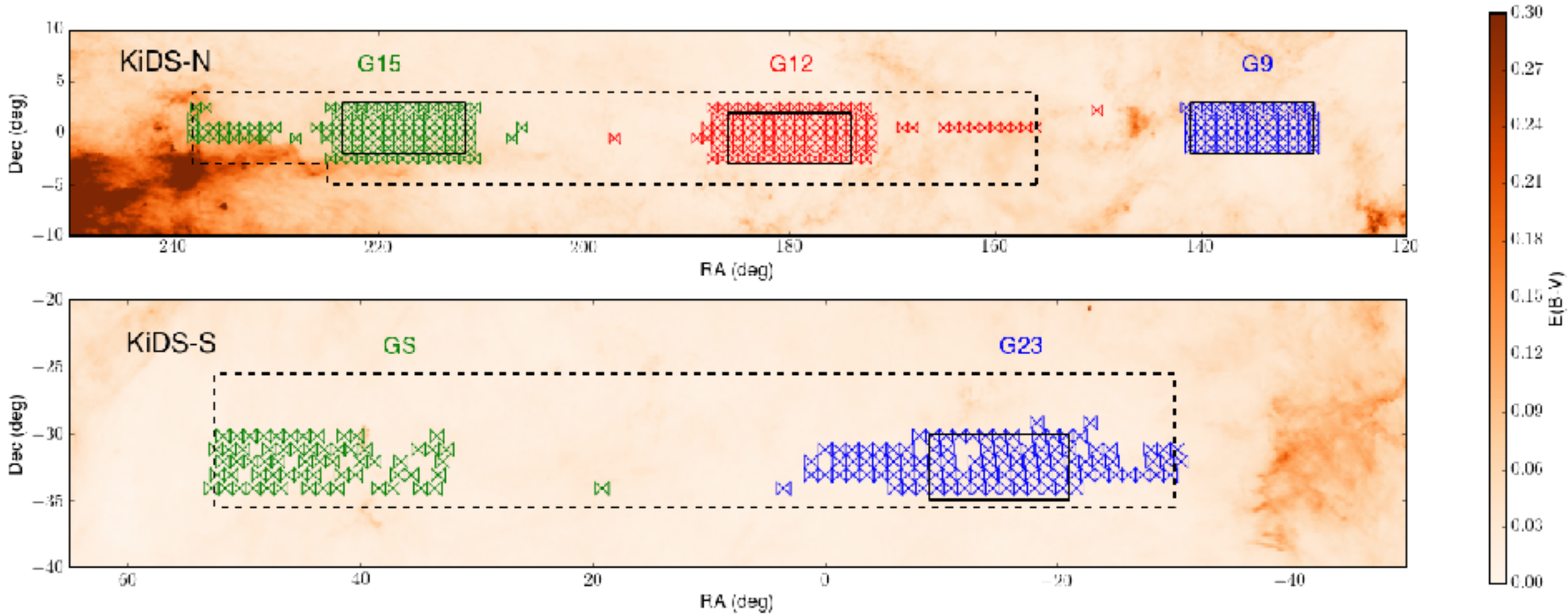
2 magnitudes deeper than SDSS (24.3, 25.1, 24.9, 23.8 in *ugri*) with sharper images

Median redshift: ~ 0.6



Seeing PSF

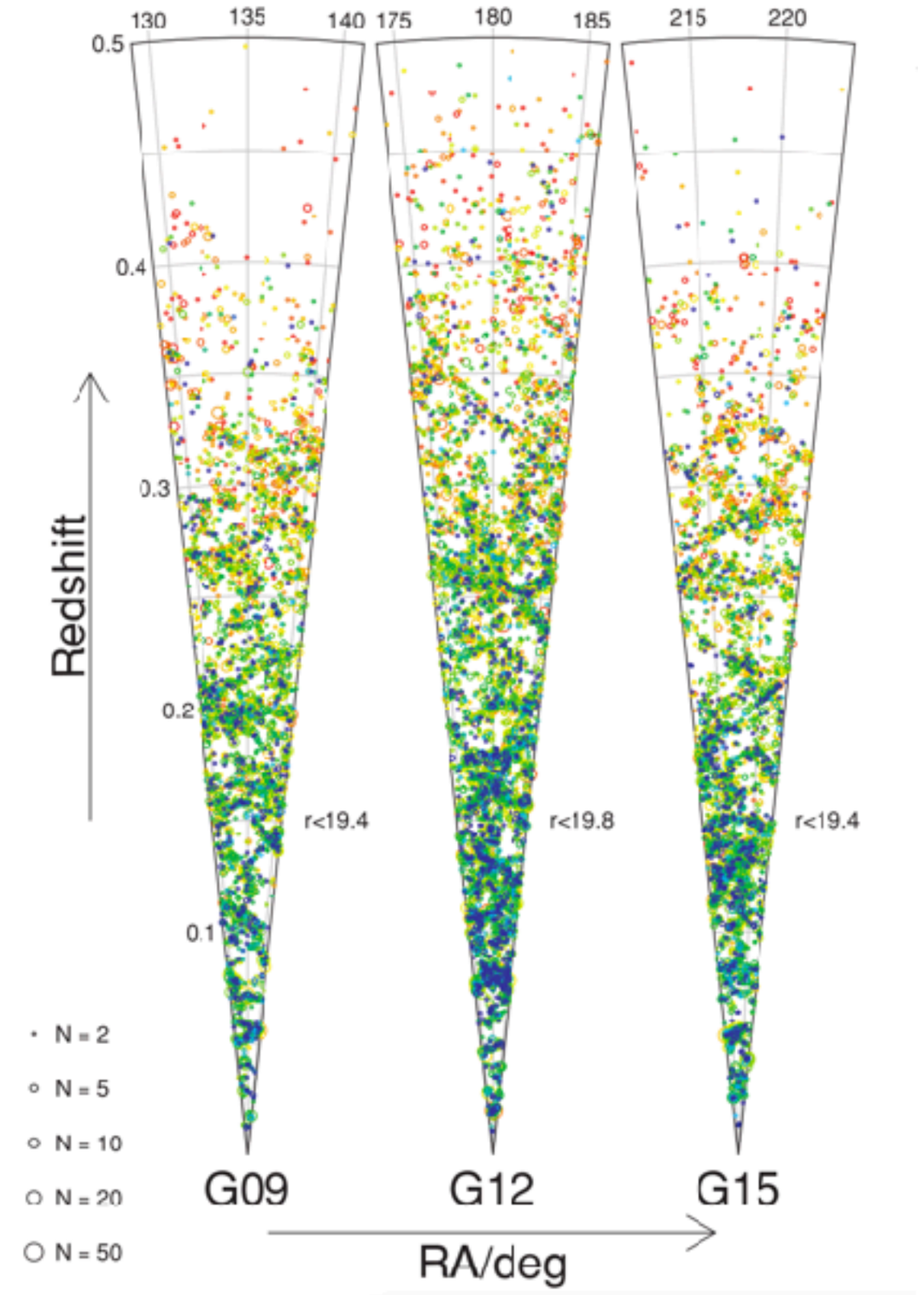
de Jong et al. 2017



- Currently: 450 deg^2 (with shape measurements), 900 deg^2 observed

GAMA survey

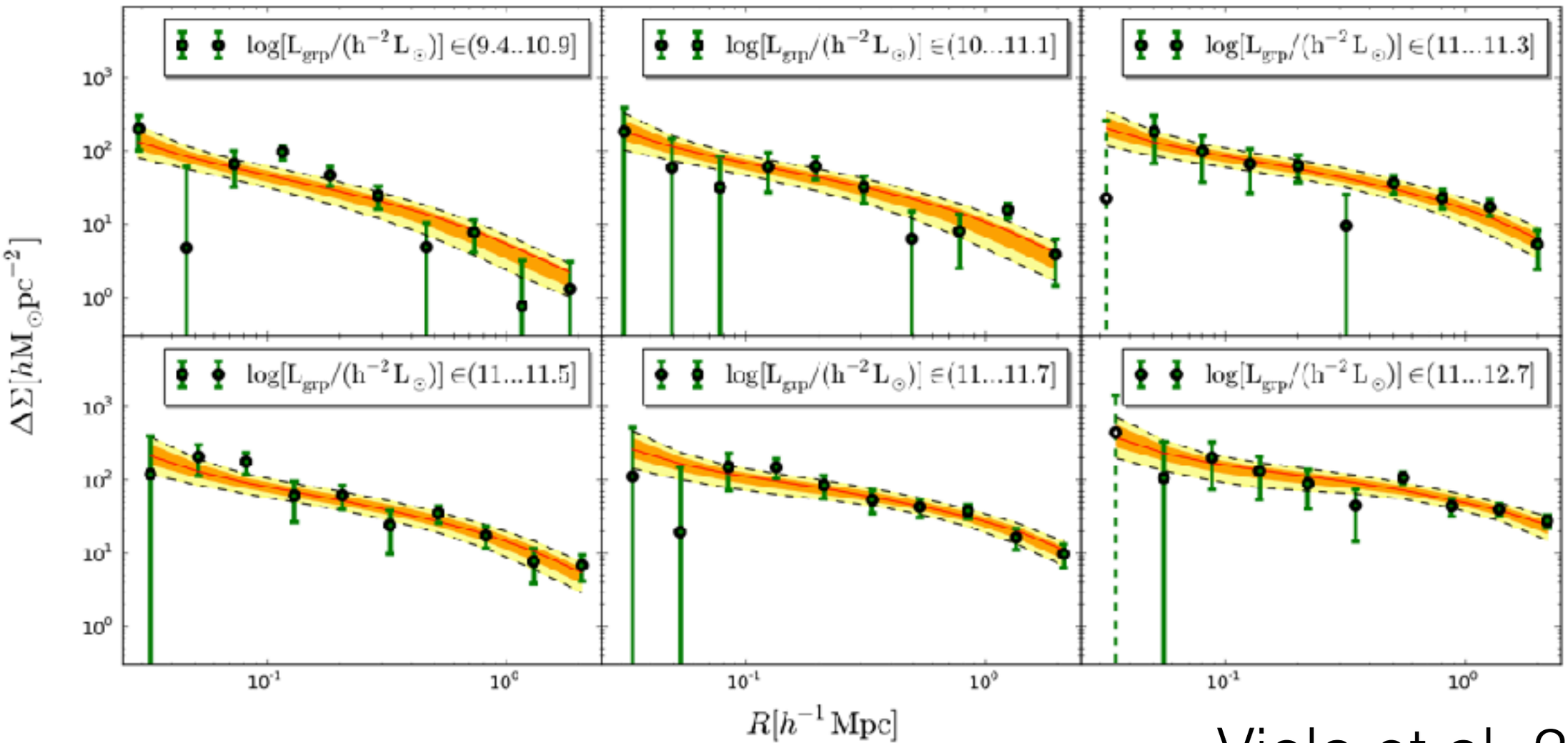
- Spectroscopic survey on AAT
- Highly complete down to *r*-band magnitude of 19.8
- 180 deg^2 of overlap with KiDS
- Group information using FoF



Robotham et al. 2011

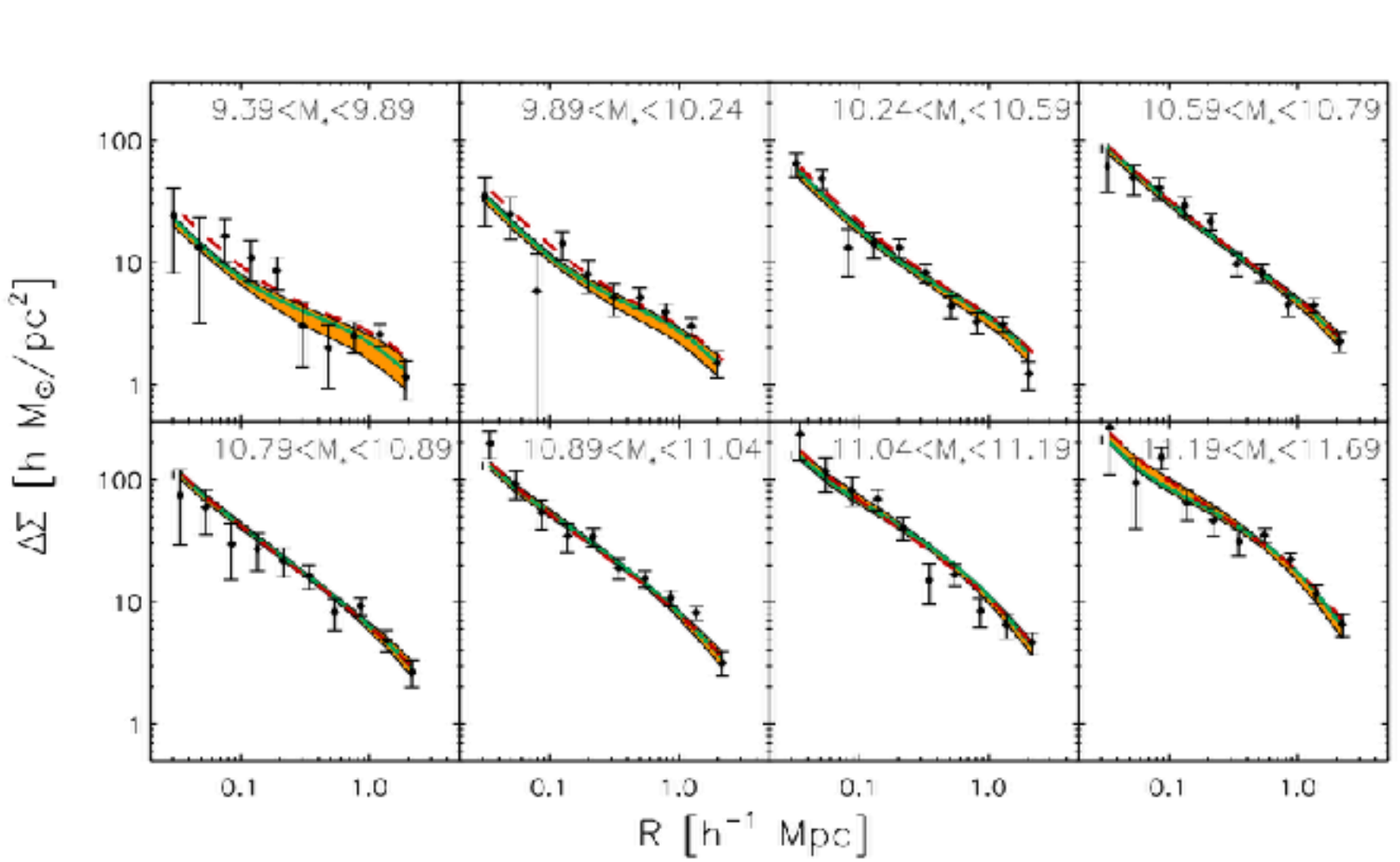
KiDS + GAMA

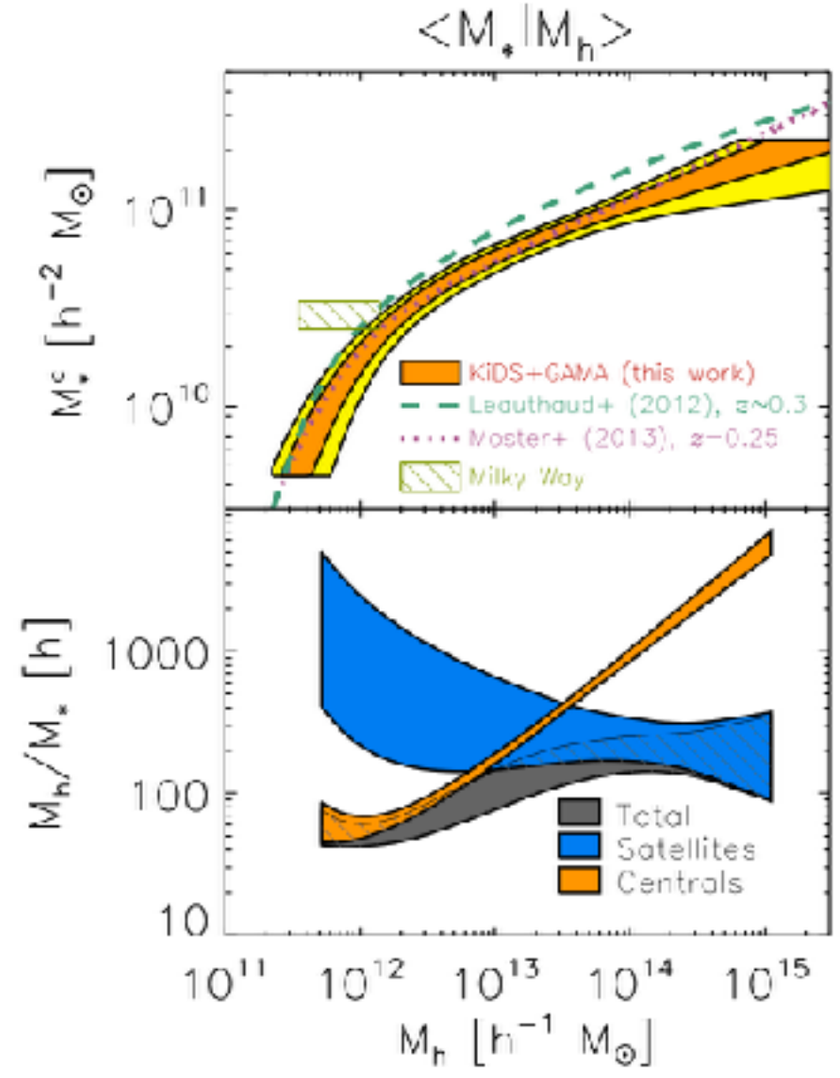
Scaling relations of GAMA groups



Viola et al. 2015

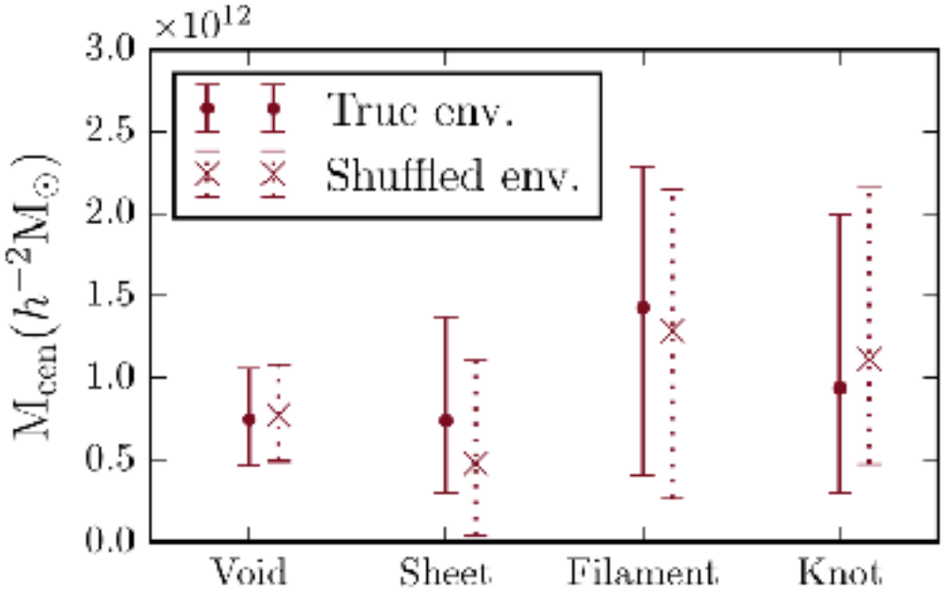
Probing stellar-to-halo mass relation



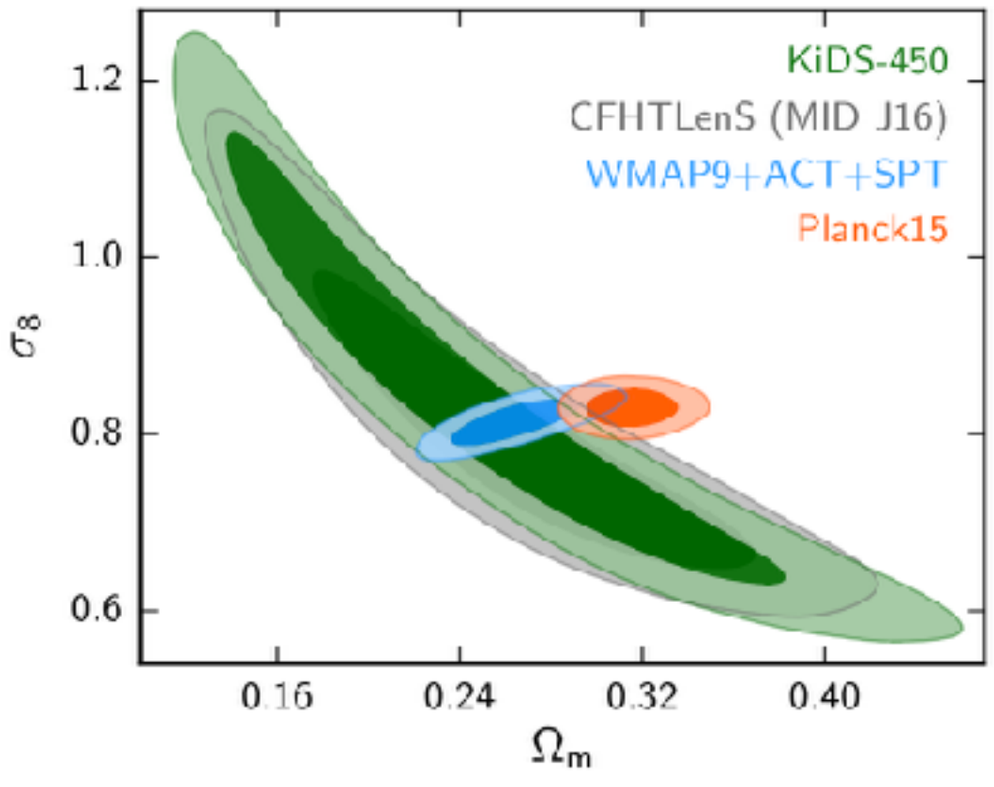


van Uitert et al. 2016

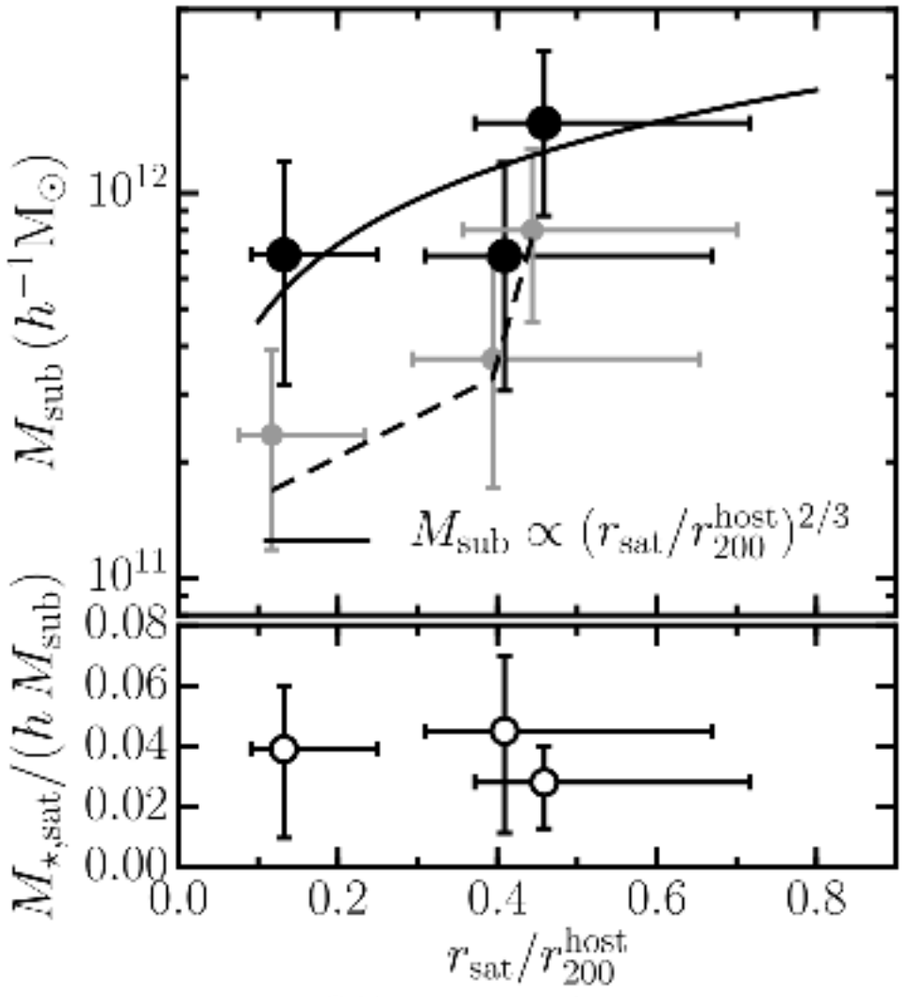
and many more …



Brouwer et al. 2016



Hildebrandt et al. 2017



Sifón et al. 2015

… including a study of halo assembly bias

- GAMA:
  - Spectroscopic redshifts
  - Group information
- KiDS:
  - Exquisite shape measurements

On Assembly Bias

- Halo mass - property of halos that most strongly influences the properties of galaxies within them

- But! - as seen in simulations, spatial distribution depends also on other properties (i.e. formation time, concentration, star formation rate, …)

- Dependence of the spatial distribution of DM halos upon properties beside mass

Assembly Bias

What we are after

↓

Violation of standard halo model assumption

↓

Halo model not able to predict the lensing and clustering correctly

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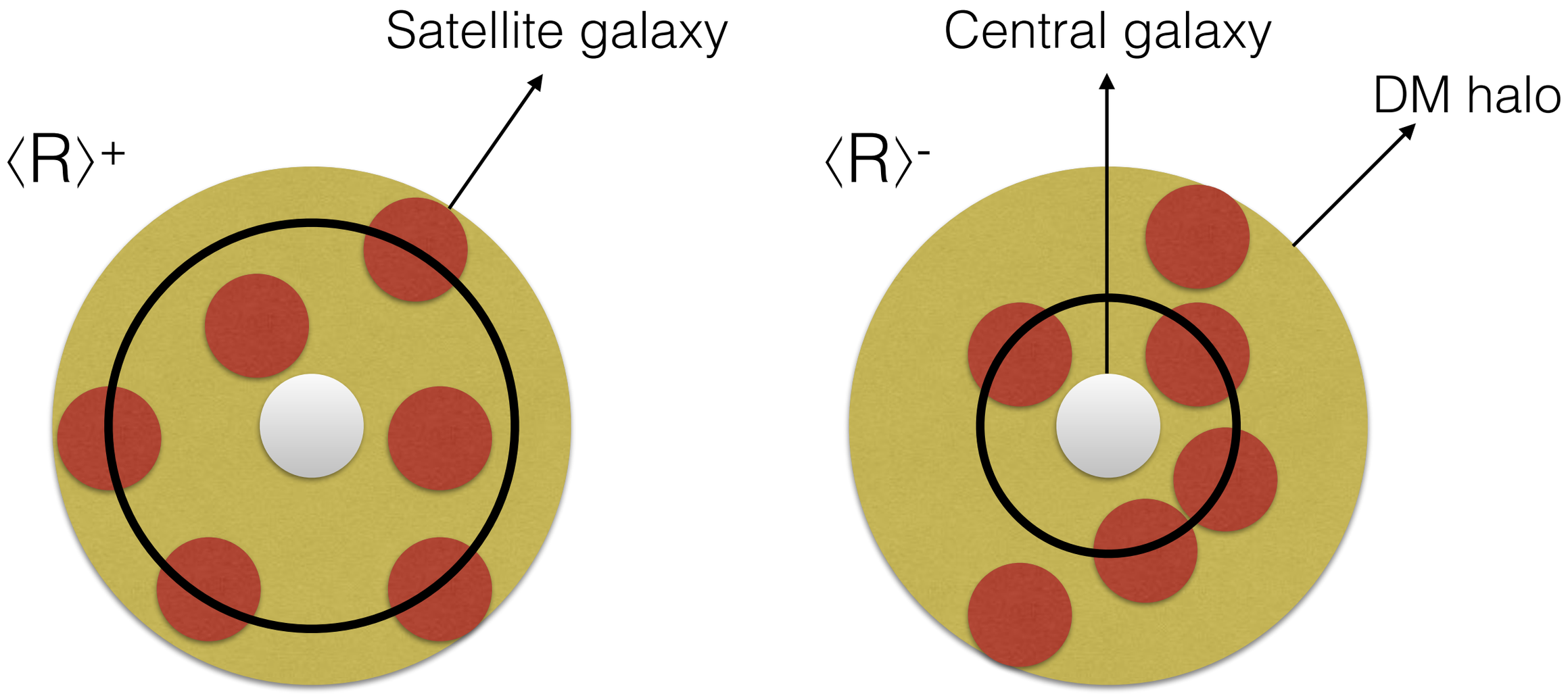
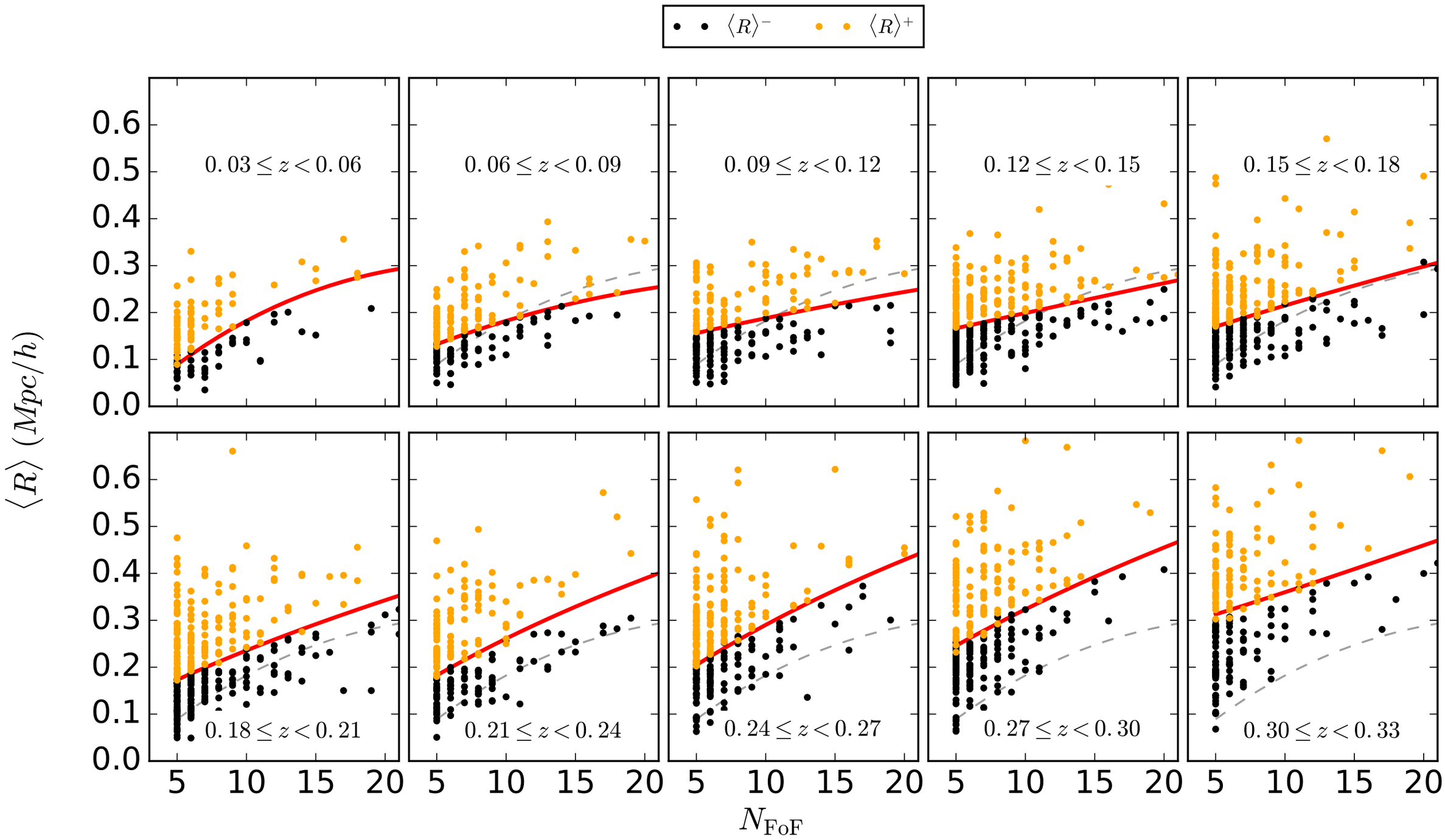
Manifestation in the data as different lensing profiles

Inspired by the work of Miyatake et al. 2016 …



Selection of galaxy groups



Dvornik et al. 2017

Redshift

$p(z)$

z

Richness

n

N_{FoF}

Stellar mass

n

$\log(M_\star)$

Environment

n

$\langle R \rangle^+$

$\langle R \rangle^-$

Knot

Filament

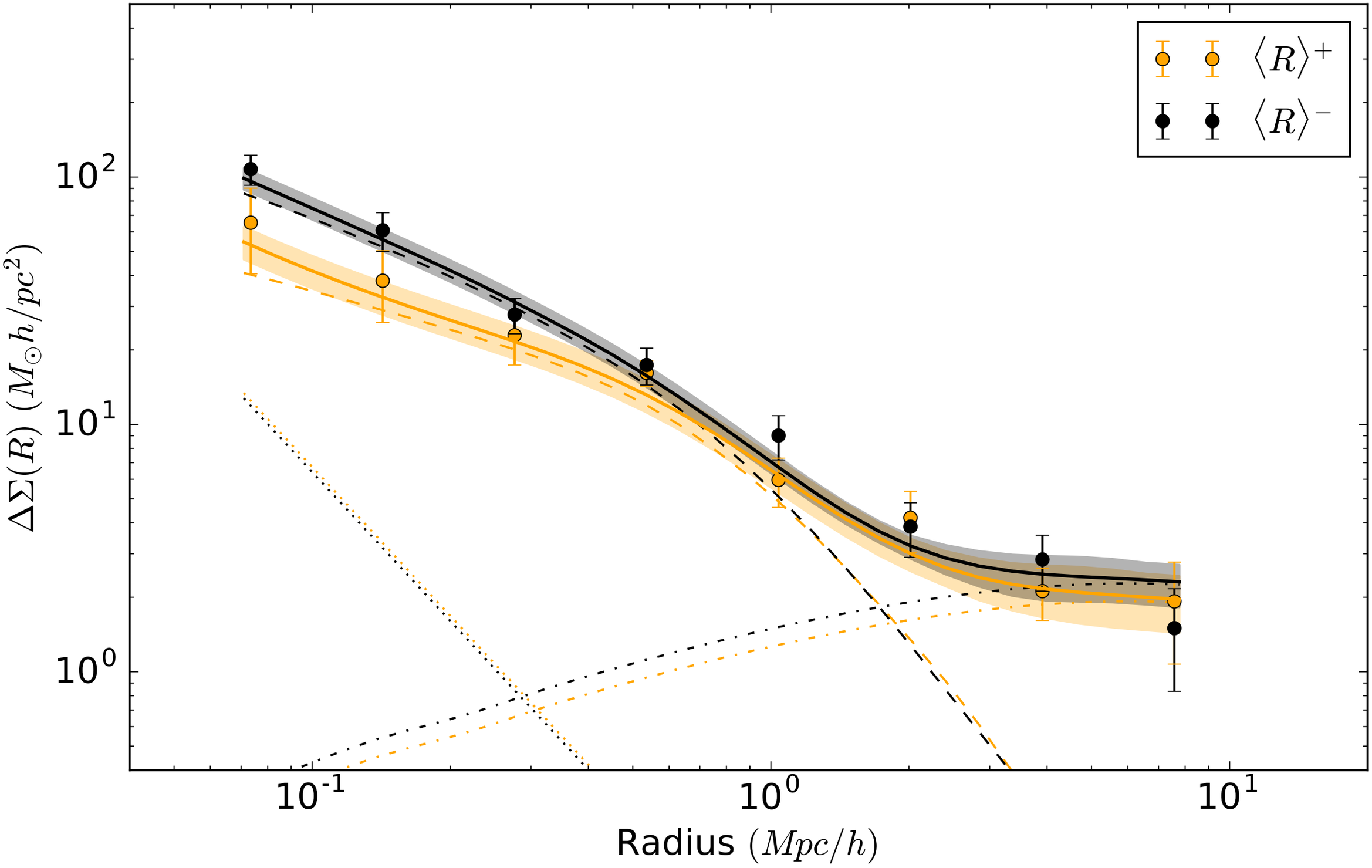
Sheet

Void

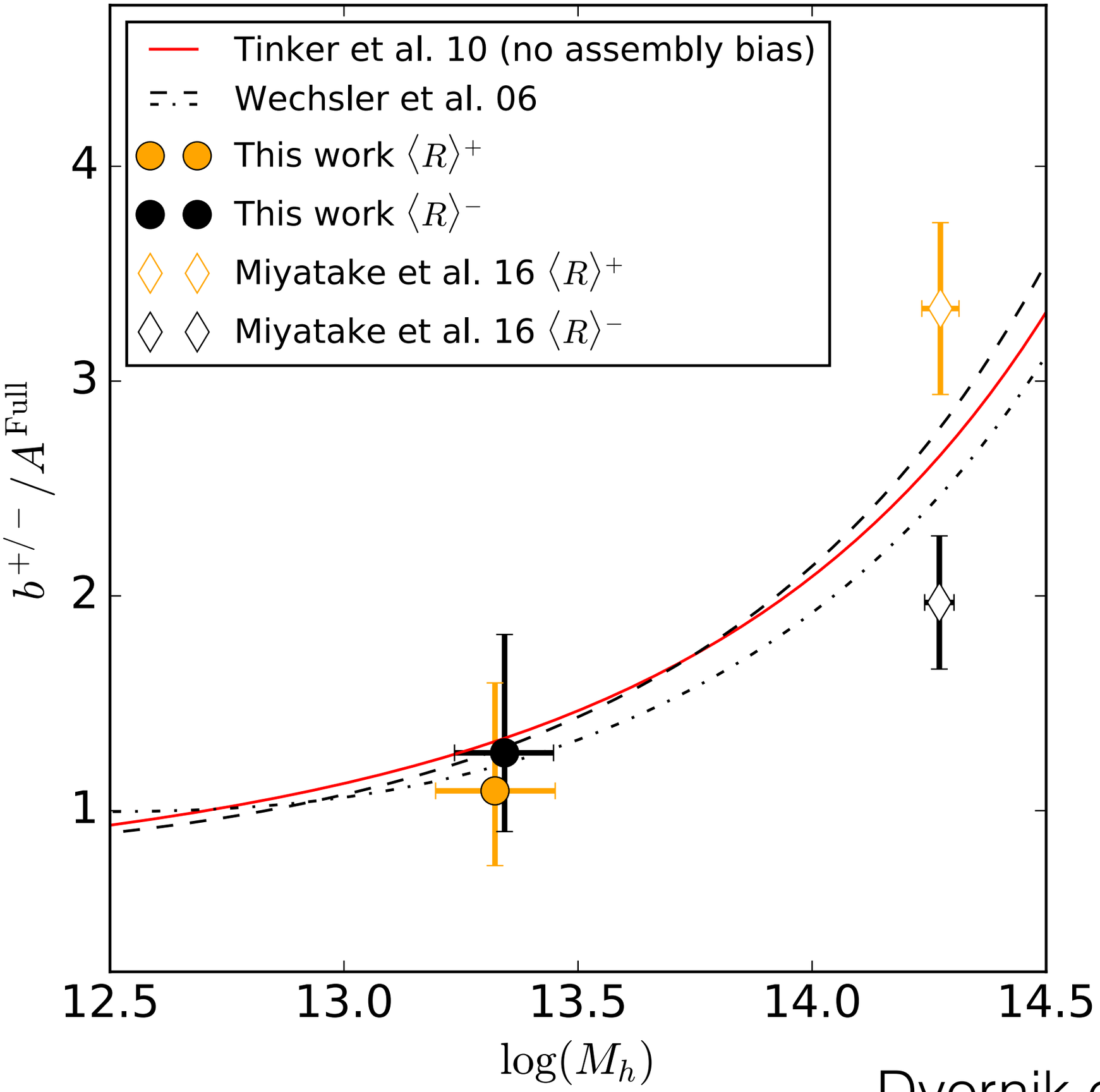
… and

We still use the standard halo model

Lensing results



Dvornik et al. 2017



Dvornik et al. 2017

Future prospects

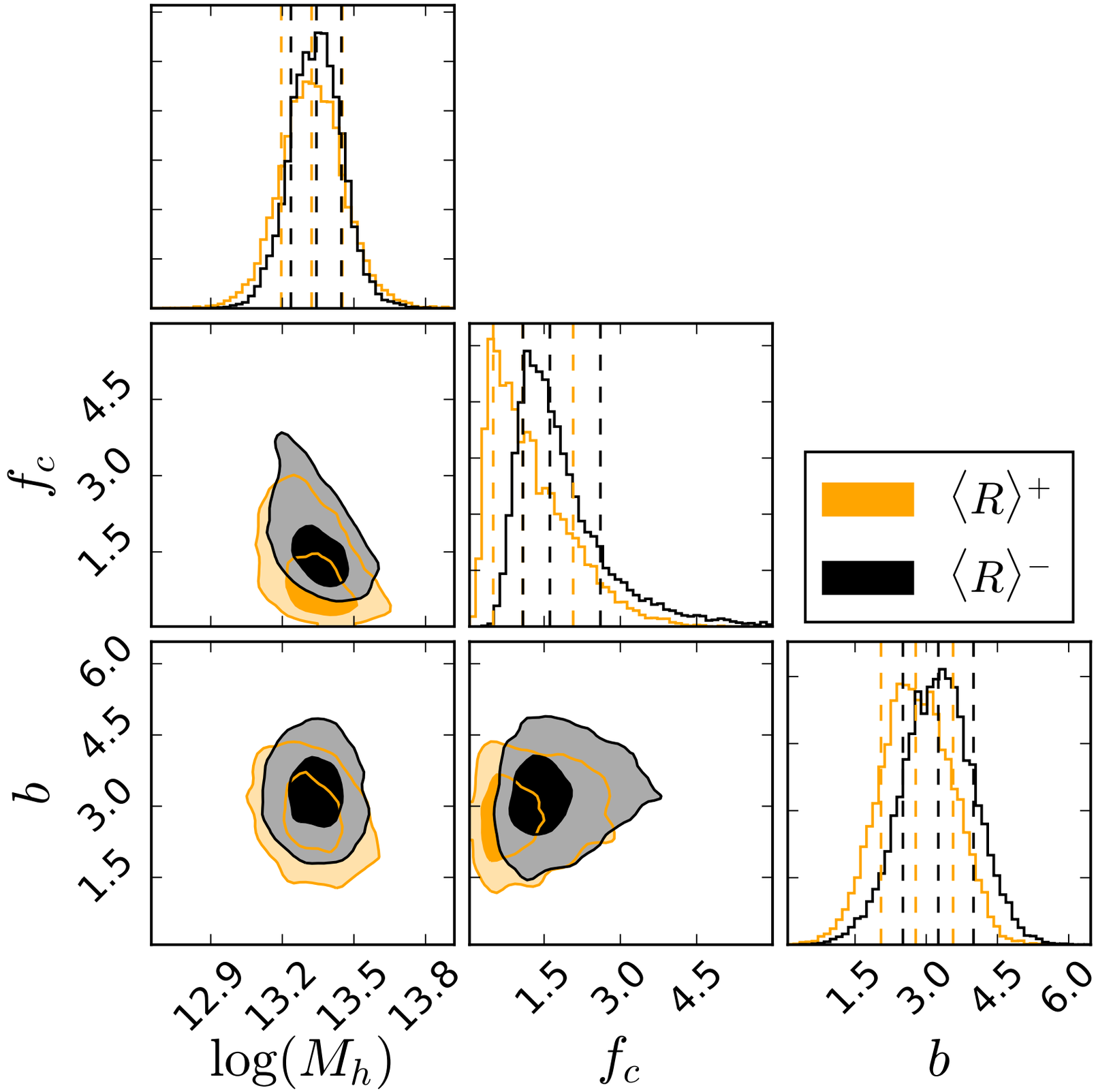
- Extend the study over to full KiDS area - WAVES survey

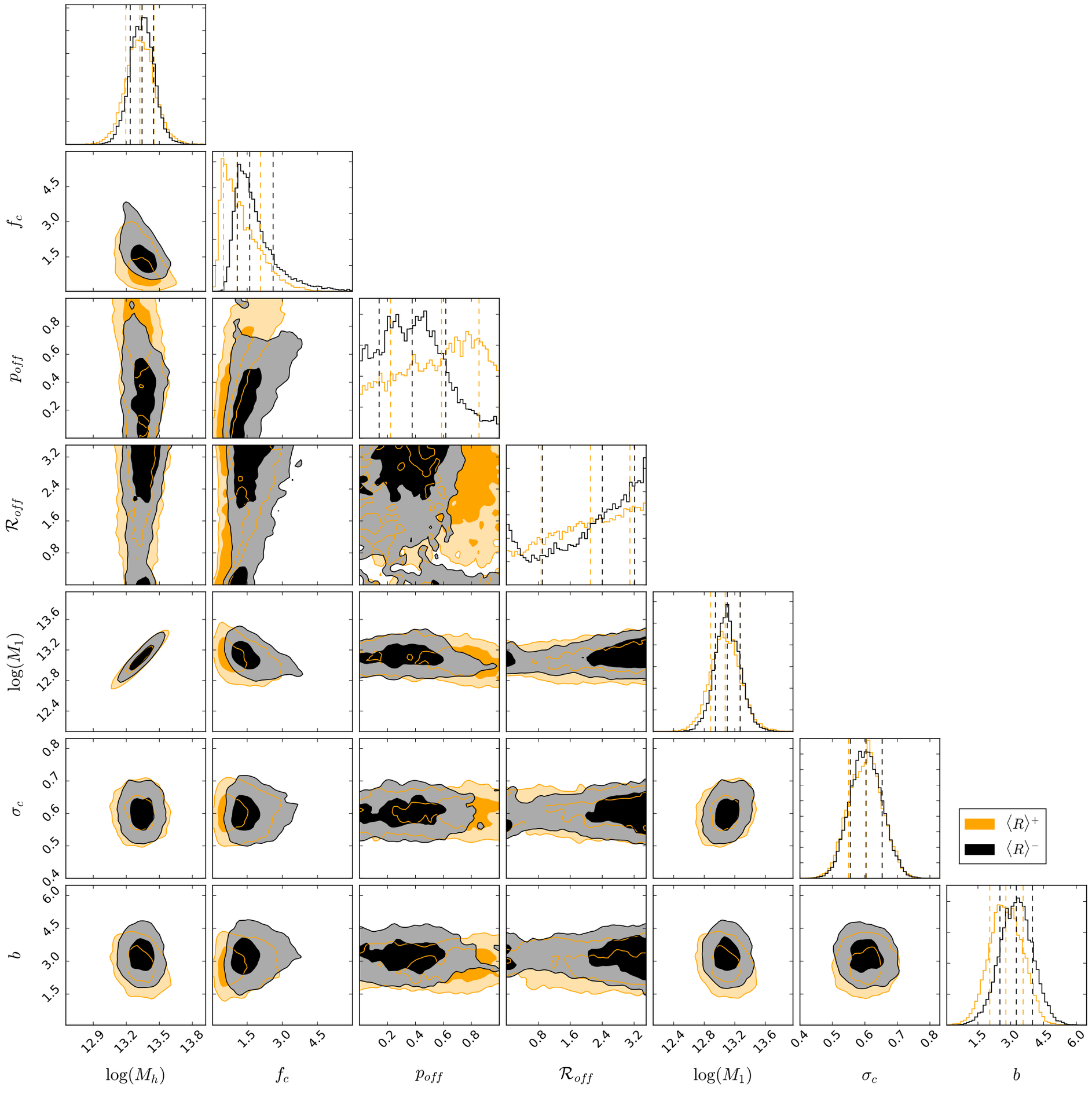
- Larger sample of galaxy groups and extension to galaxy scales

- Spectroscopic group/cluster membership information is a necessity

Conclusions

- Halo assembly bias not detected on galaxy group scales
- It still needs to be considered in halo models (due to Euclid, LSST and WFIRST)
- Lensing not limiting factor - spectroscopic information on galaxy groups/clusters
- For detailed information, please ask me questions and/or see: MNRAS (2017) 468: 3251


$\langle R \rangle^+$
$\langle R \rangle^-$
$\log(M_h)$
f_c
b
12.9
13.2
13.5
13.8
1.5
3.0
4.5
6.0


$\log(M_h)$
f_c
p_{off}
$\mathcal{R}_{off}$
$\log(M_1)$
σ_c
b
$\langle R \rangle^+$
$\langle R \rangle^-$