RCSLenS

a 1000deg^2 weak lensing survey

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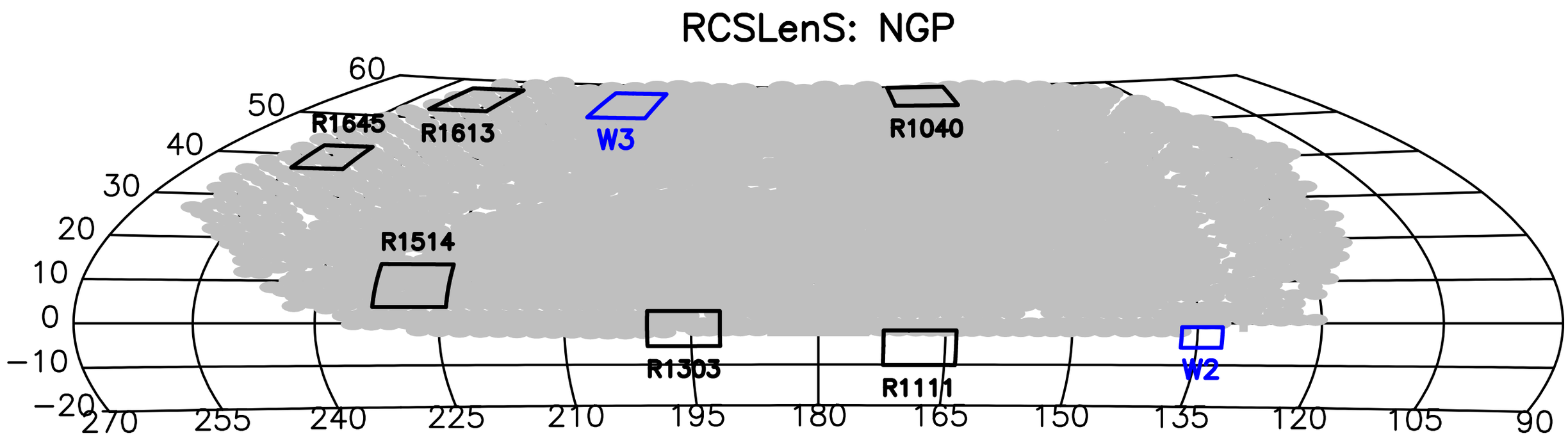
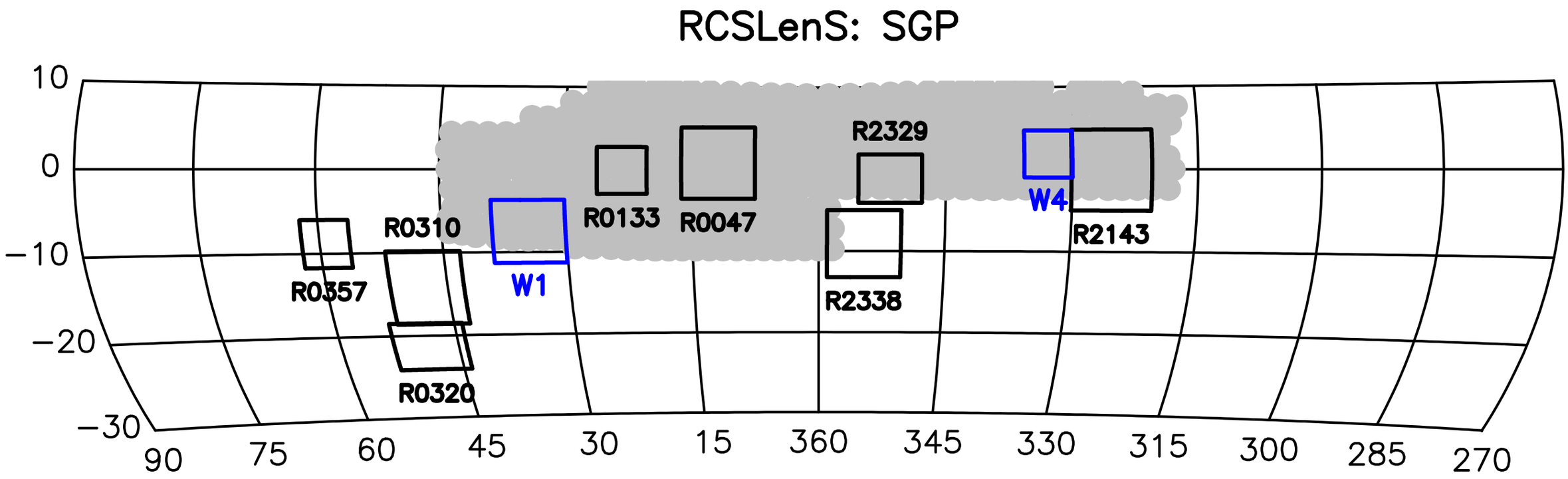
RCS LenS

- Based on RCS2 data (*griz*) and CFHTLenS pipeline
- 785deg^2 imaging to r~24 (7σ extended)
- Lensing catalogue: 5 gal. per sq. arcmin.
- Mean redshift of z~0.6.
- Overlap with SDSS, WiggleZ, DEEP2
- Combined with CFHTLenS ~1000deg^2





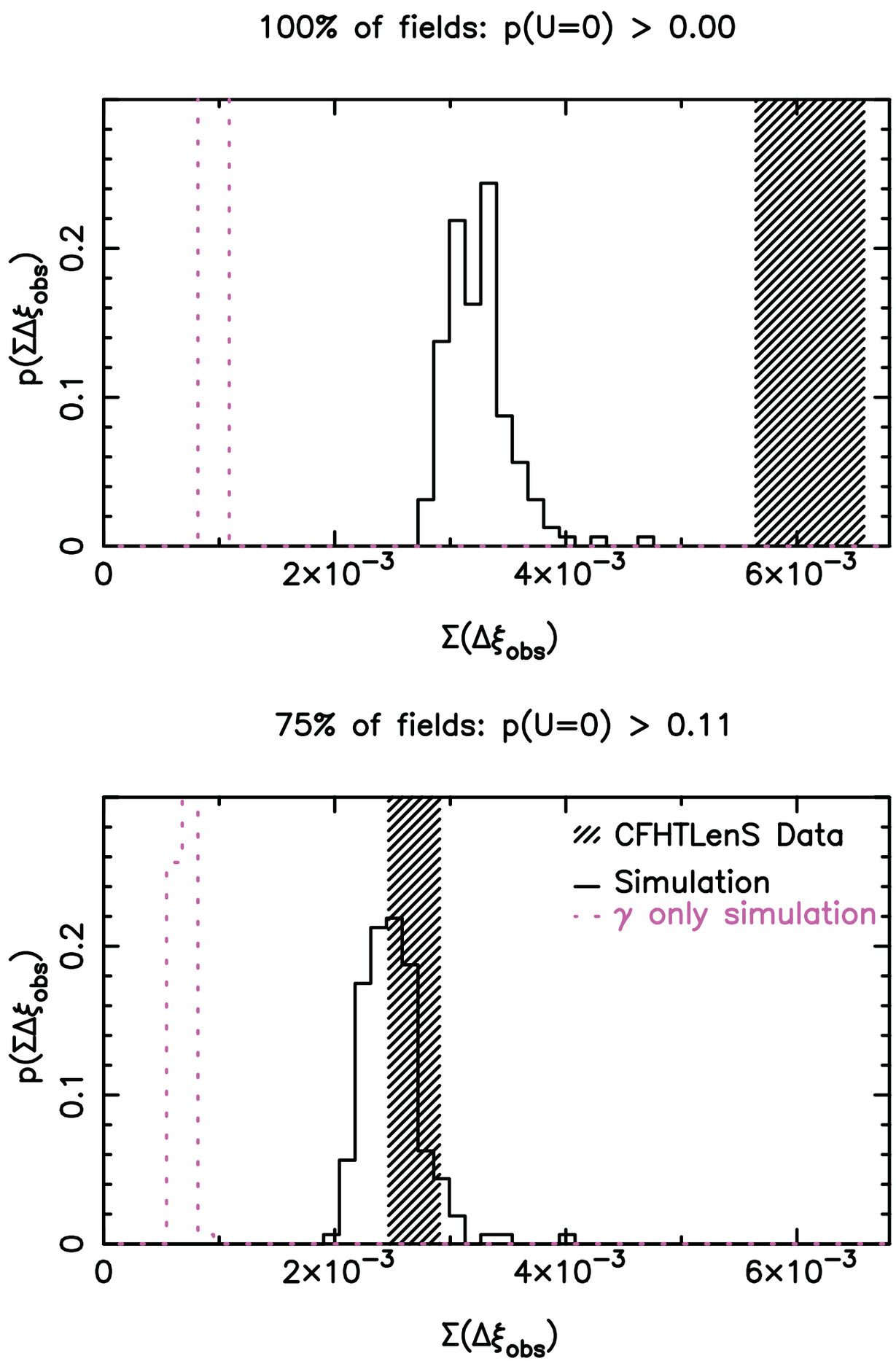
Hildebrandt et al. (2015 in prep.)

lensfit

- Bayesian forward-fitting of galaxy models to data
- Bulge + disk model
- Priors from SDSS (ellipticity) and HST (size; need r-band!)
- PSF from stars interpolated to galaxy position
- Fit convolved model to (multi-)image data
- Marginalise over size, position, bulge-to-disk ratio
- Multiplicative bias calibration with images simulations
- Additive bias empirically calibrated from data

RCSLenS systematic tests

- Cross-correlate galaxy and star ellipticities
- Amplitude is a measure of systematics
- Problem: net chance alignments with PSF for small areas
    1. noise
    2. intrinsic ellipticity
    3. cosmic shear
- Solution: use N-body mocks to calibrate



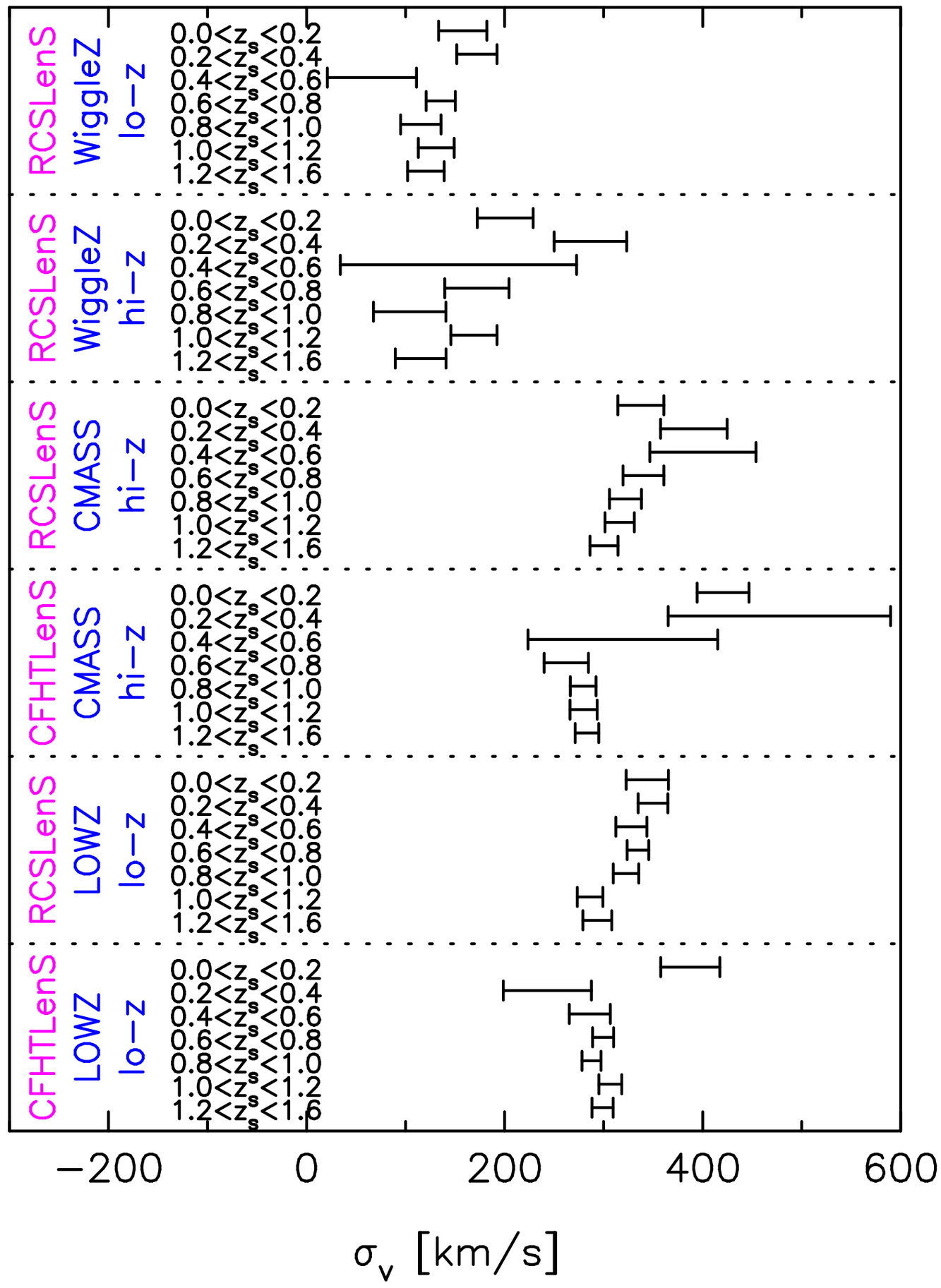
Heymans et al. (2012)

RCSLenS

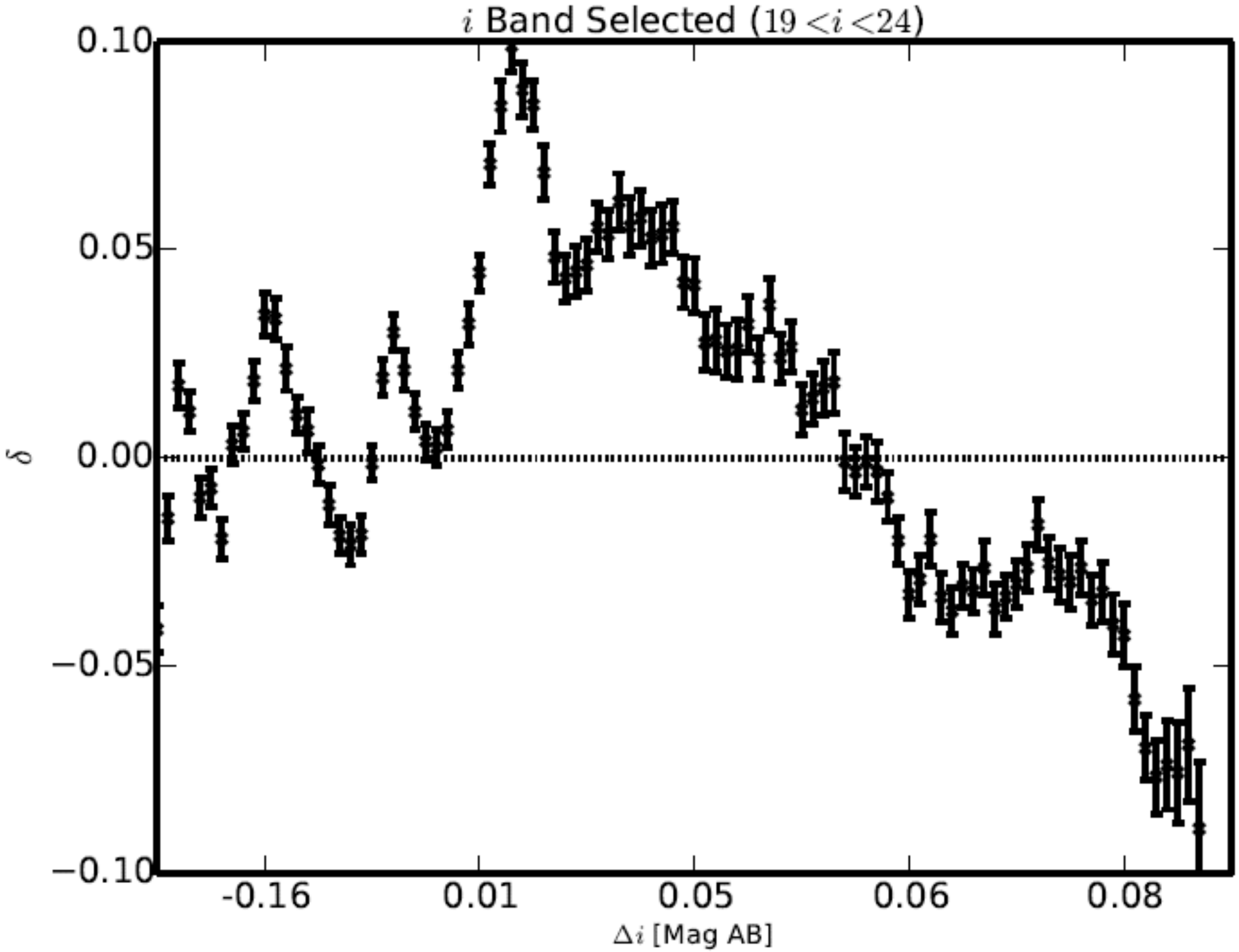
Challenges for systematic tests

- Larger volume, larger angular scales -> lower cosmic shear signal
- Lower redshift -> lower cosmic shear signal, stronger IA (DEEP2 data)
- Lower density, more noise -> tests less sensitive
- Just one exposure -> larger PSF systematics
- More complicated systematics

Need to be much more careful when rejecting fields. Hard to distinguish between additive shear calibration and PSF systematics. Blinding much more important!

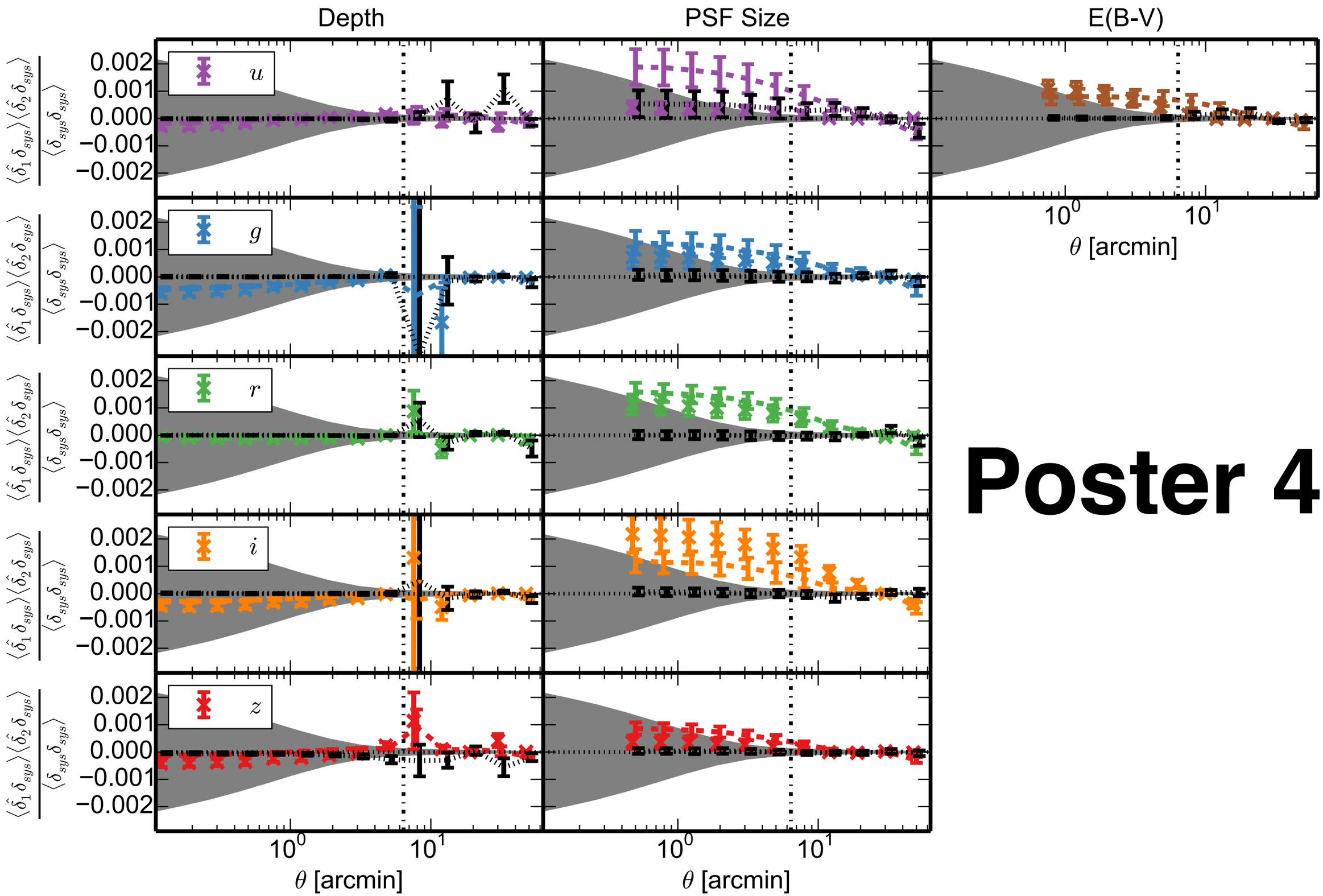


Blake et al. (2015)



Inhomogeneities in photometric surveys

Morrison & Hildebrandt (2015)

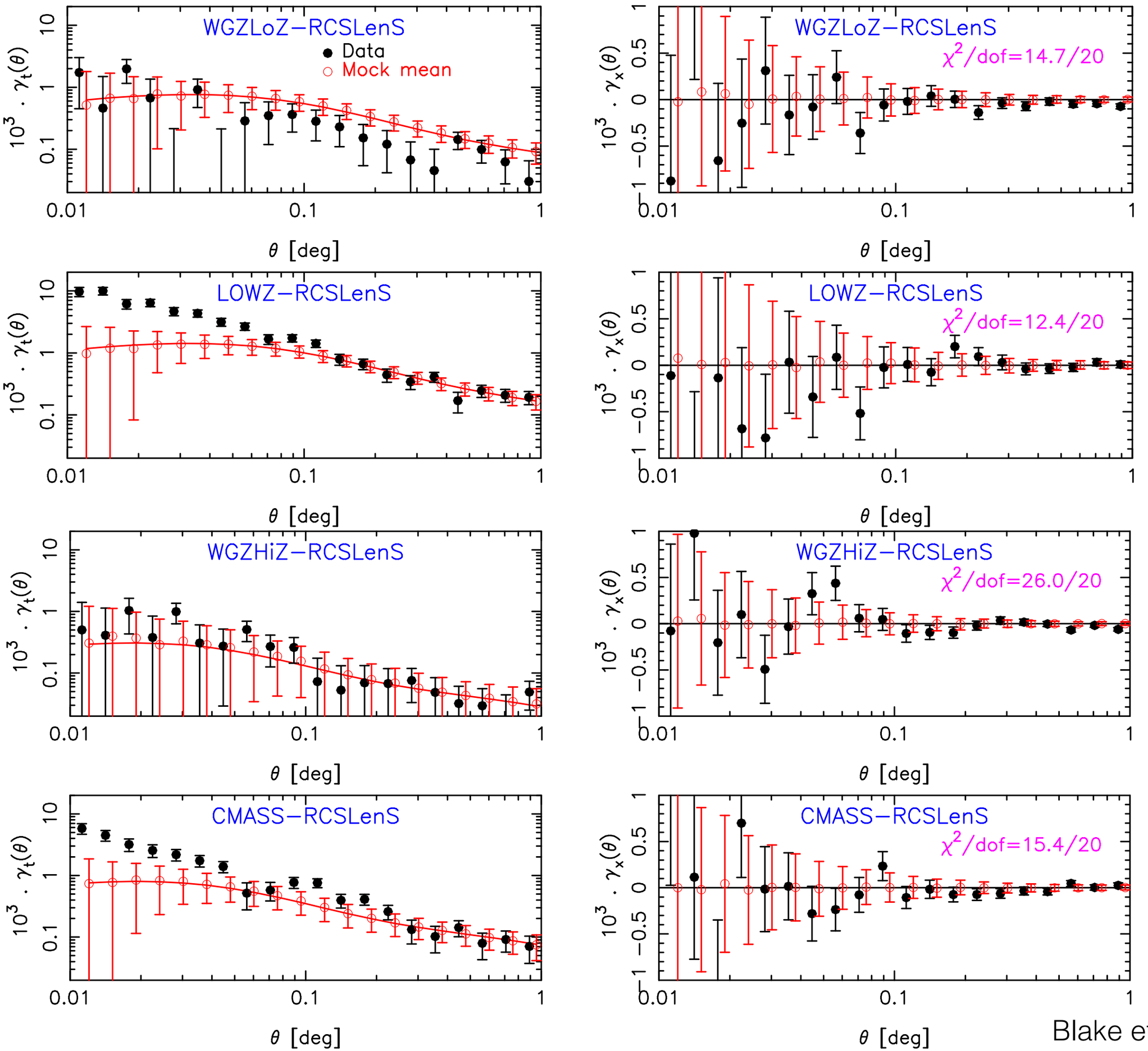


Poster 4!

Inhomogeneities in photometric surveys

Morrison & Hildebrandt (2015)

arxiv:1507.03086



Blake et al. (2015)

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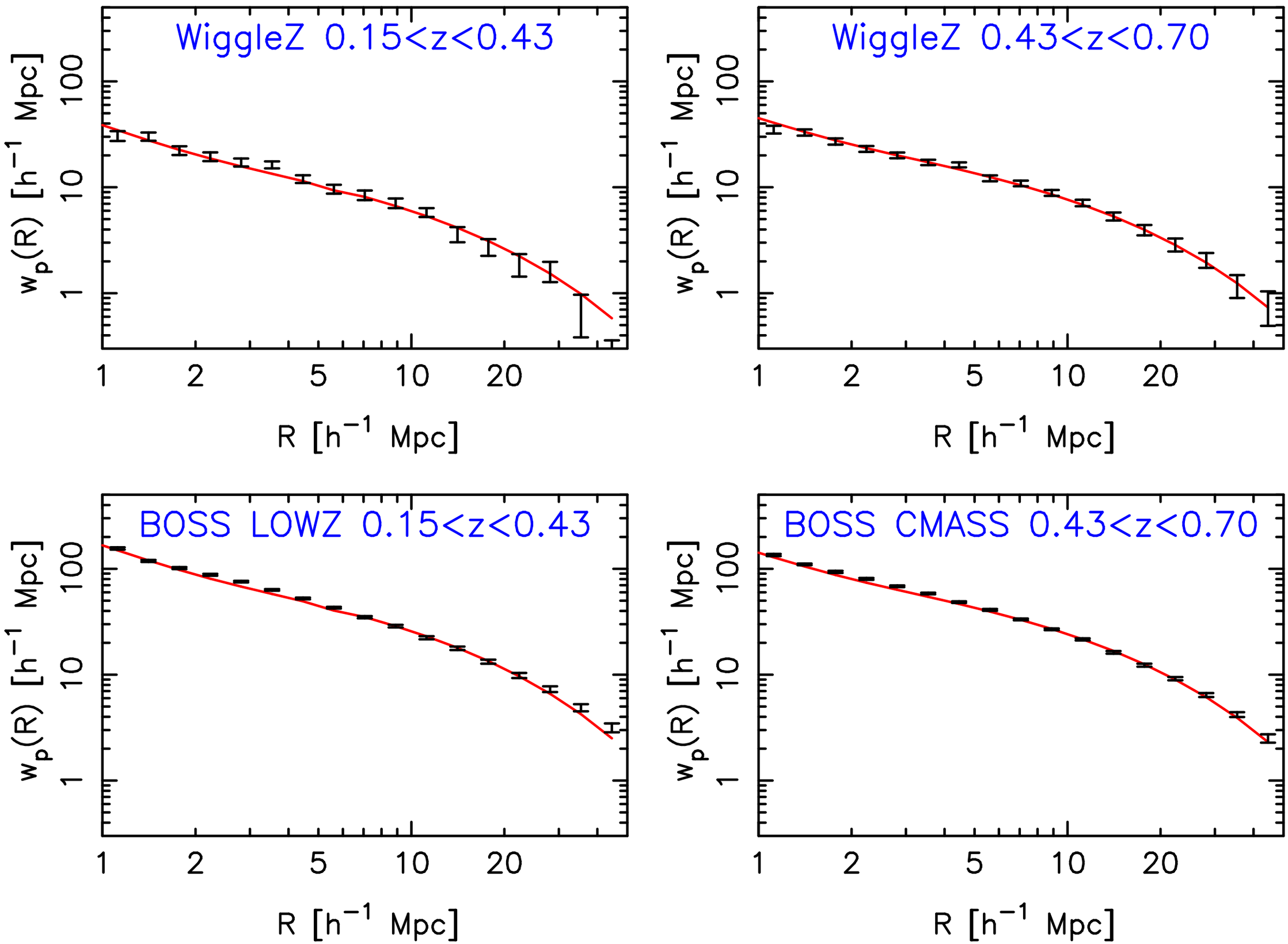
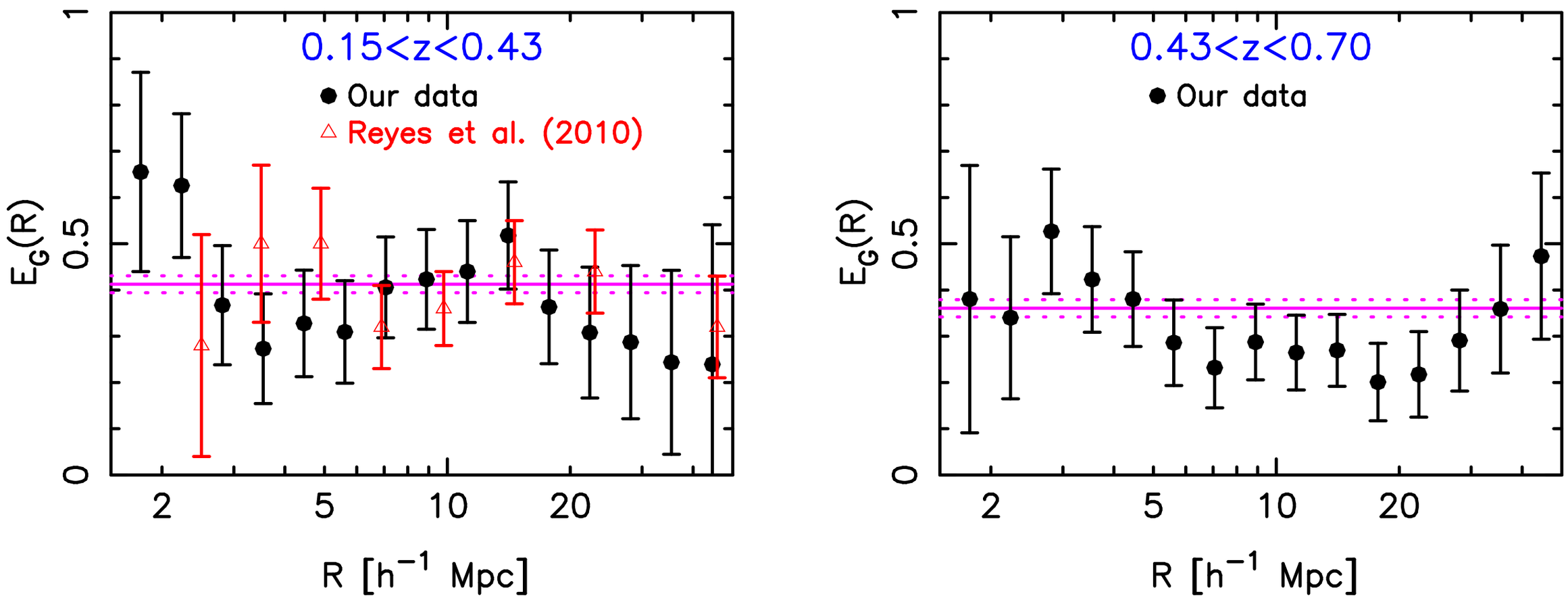


Blake et al. (2015)

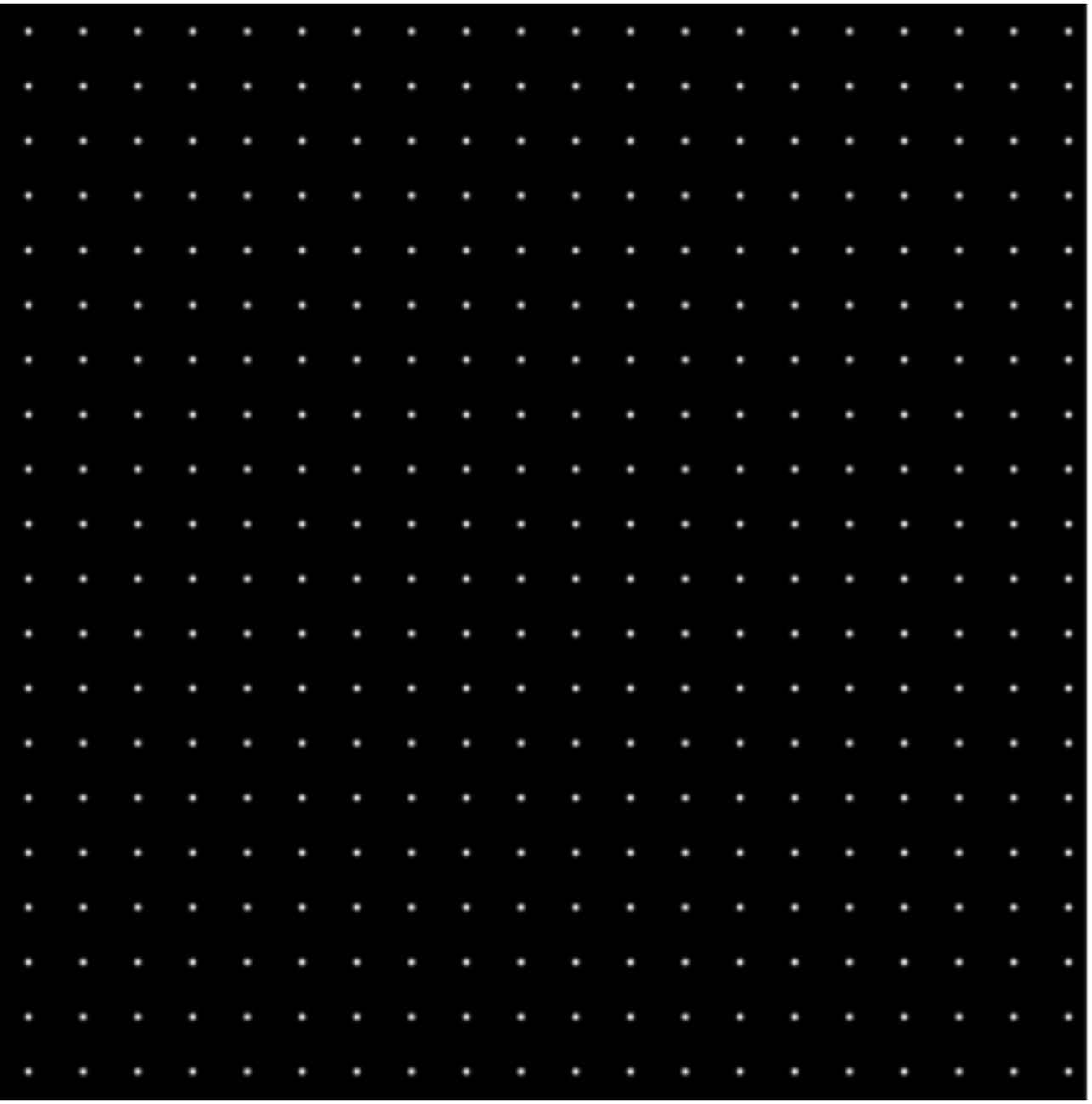
$$E_G(R) = \frac{1}{\beta}\frac{\Upsilon_{gm}(R, R_0)}{\Upsilon_{gg}(R, R_0)}$$

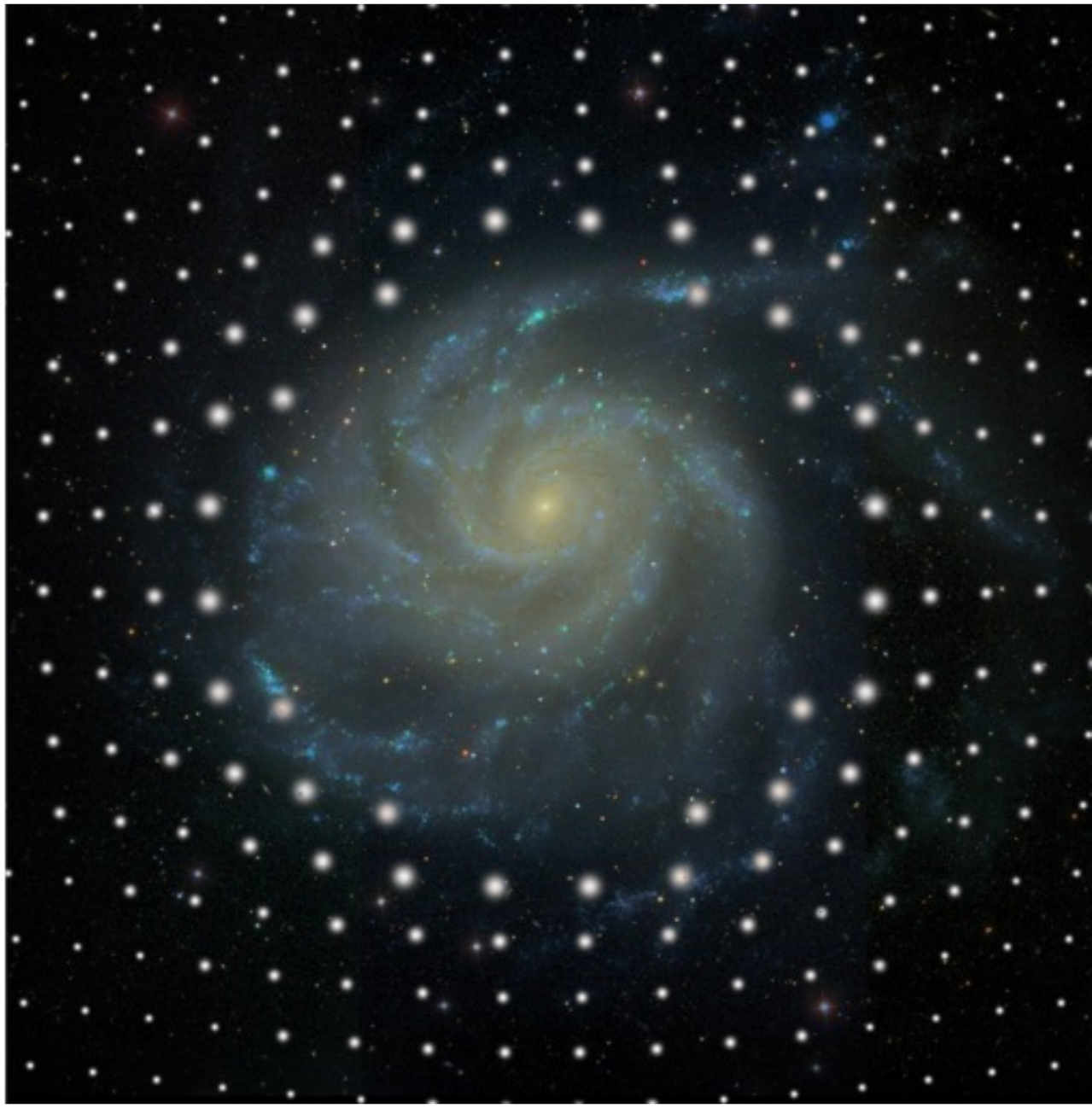
arxiv:1507.03086



Blake et al. (2015)

Magnification





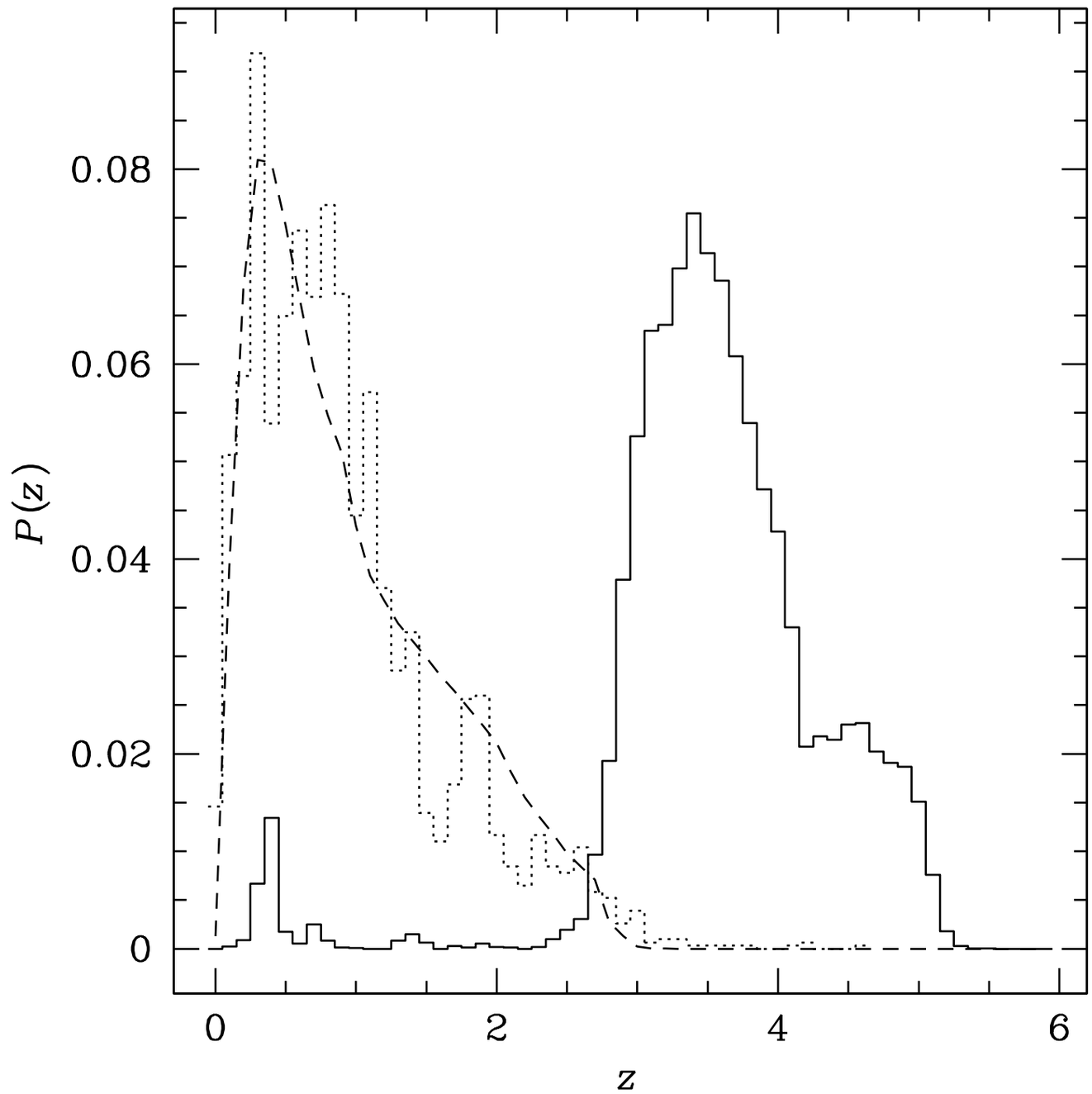
Credit: SDSS press release 2005

Advantages

- full use of data
- cross-checks for systematics
- flux magnification:
  - not limited by resolution
  - more sources
  - higher redshifts

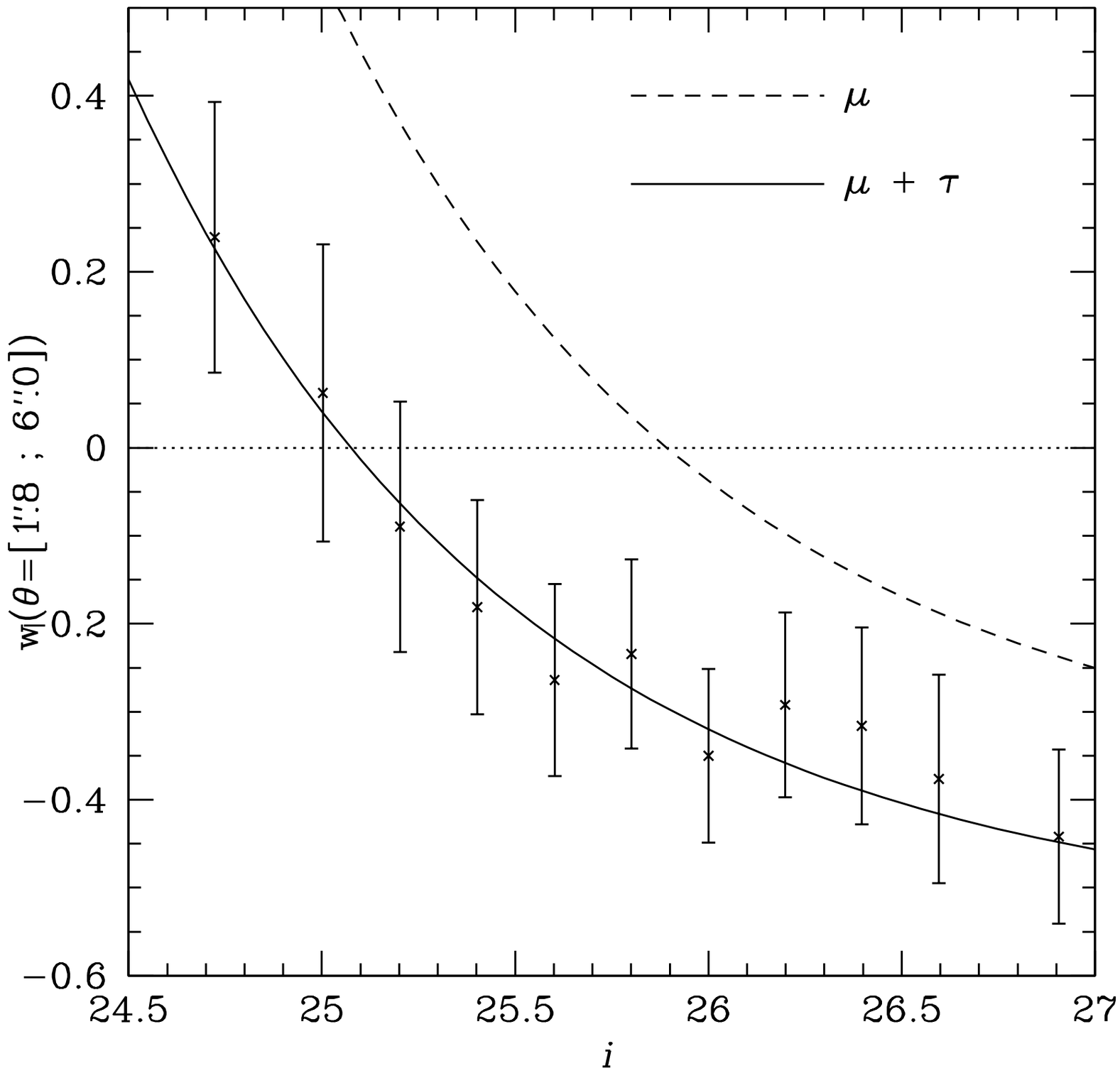
Disadvantages

- lower signal-to-noise per galaxy
- theoretically less clean **BUT: astrophysics**
- less mature, i.e. systematics less well understood
- might require higher order moments of the light distribution for full potential



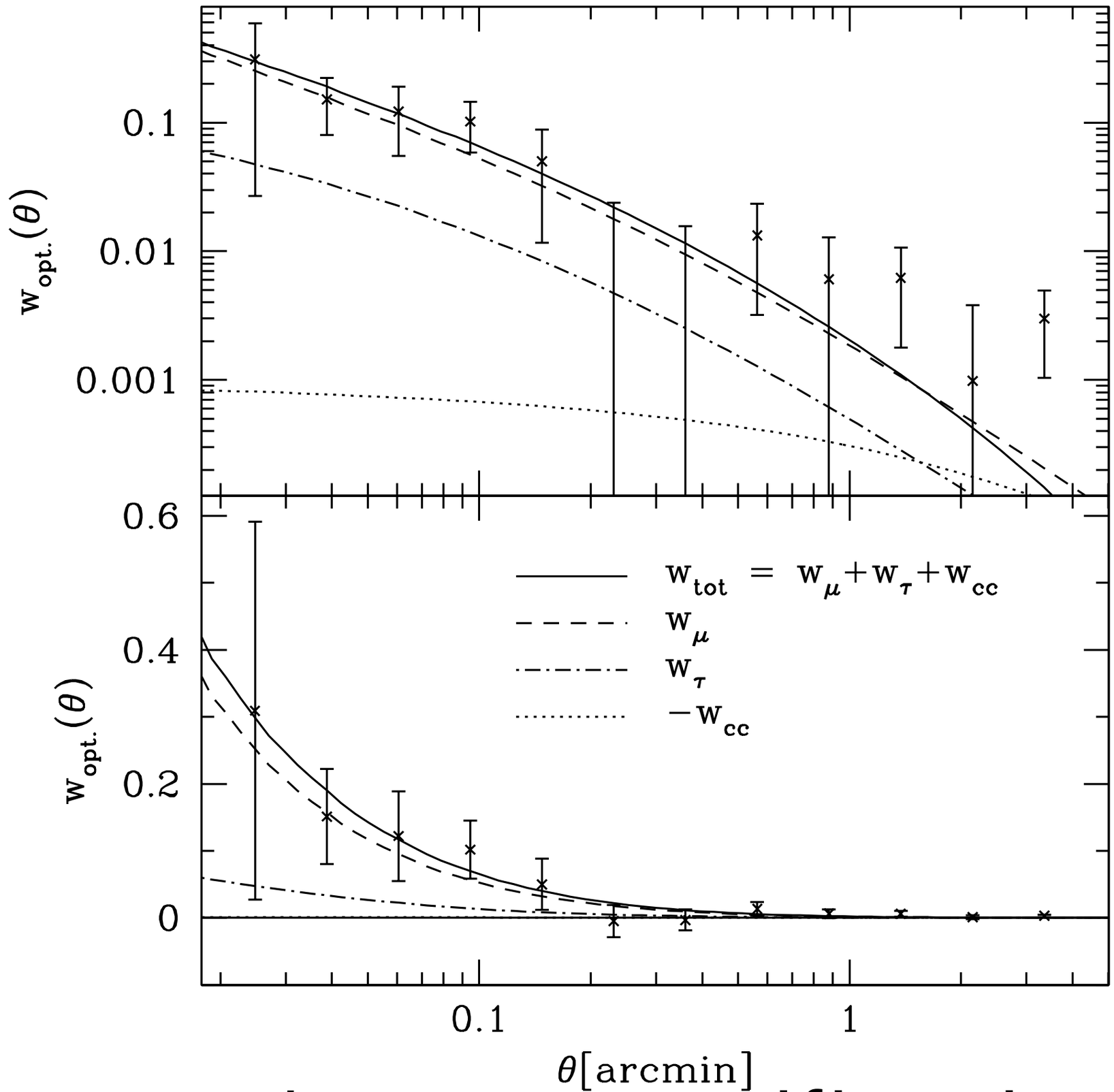
Sub-mm galaxy lenses

Hildebrandt et al. (2013)



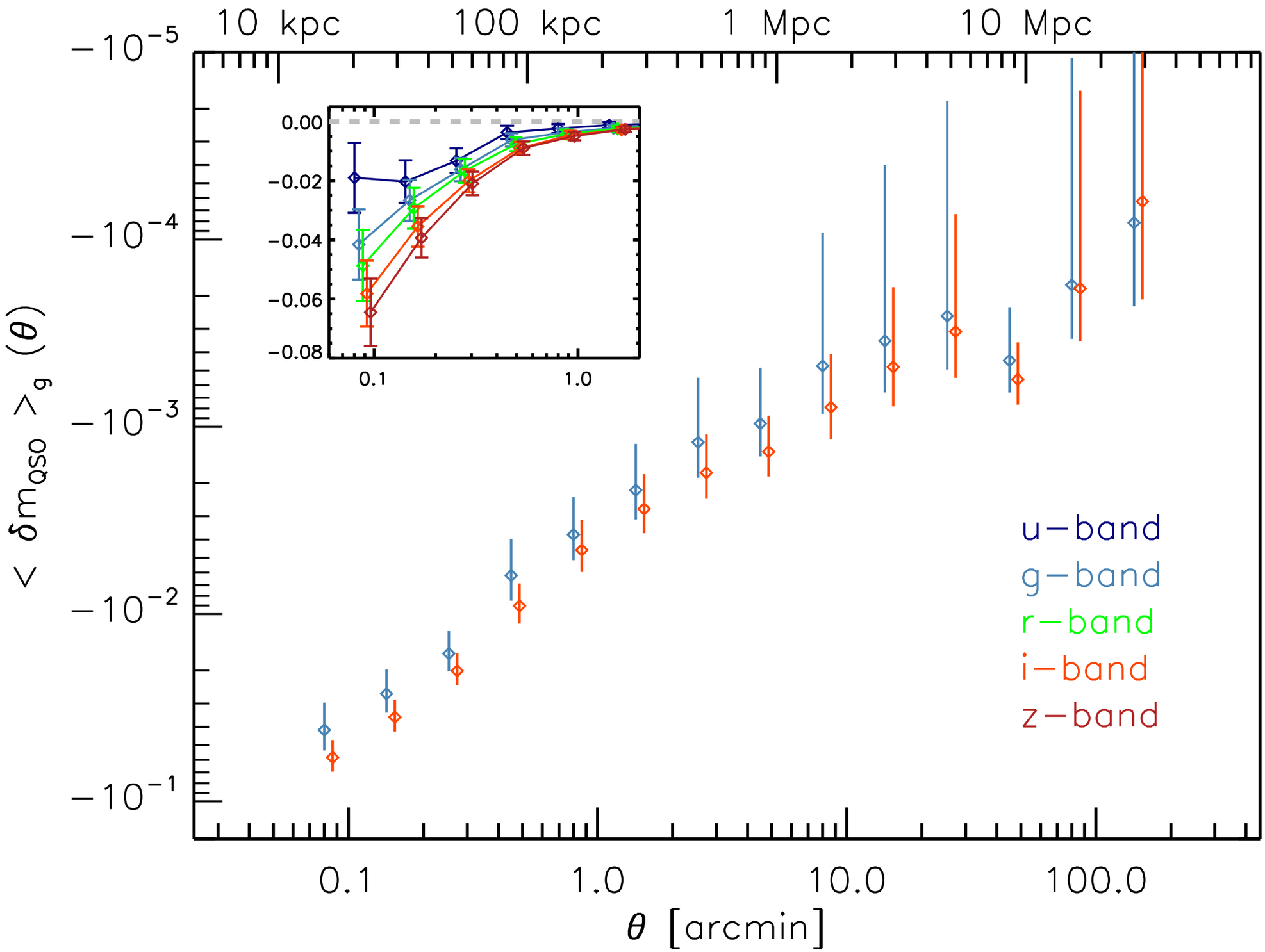
Dusty sub-mm galaxies

Hildebrandt et al. (2013)



Sub-mm galaxy magnification signal

Hildebrandt et al. (2013)

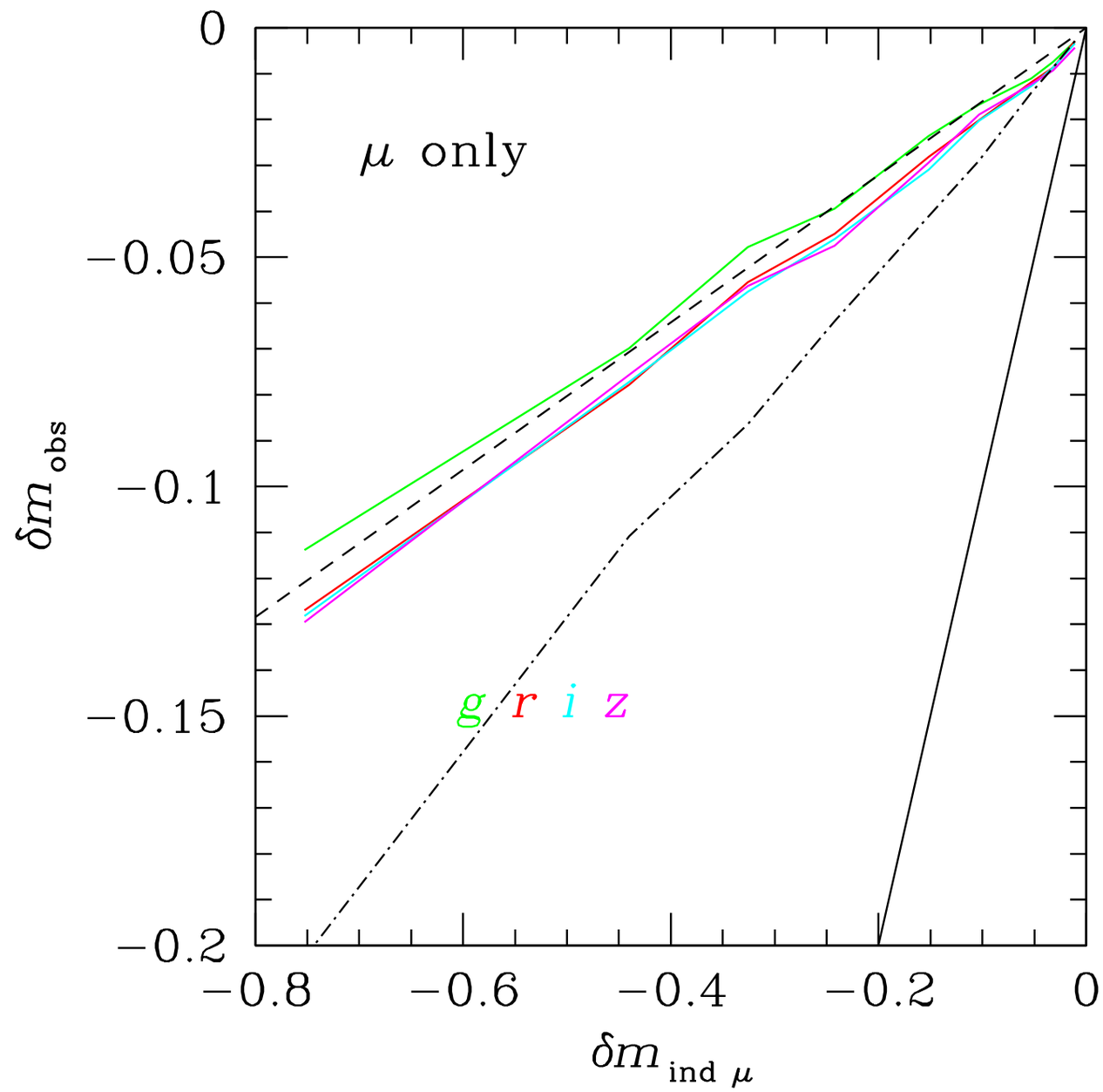


Magnitude shift

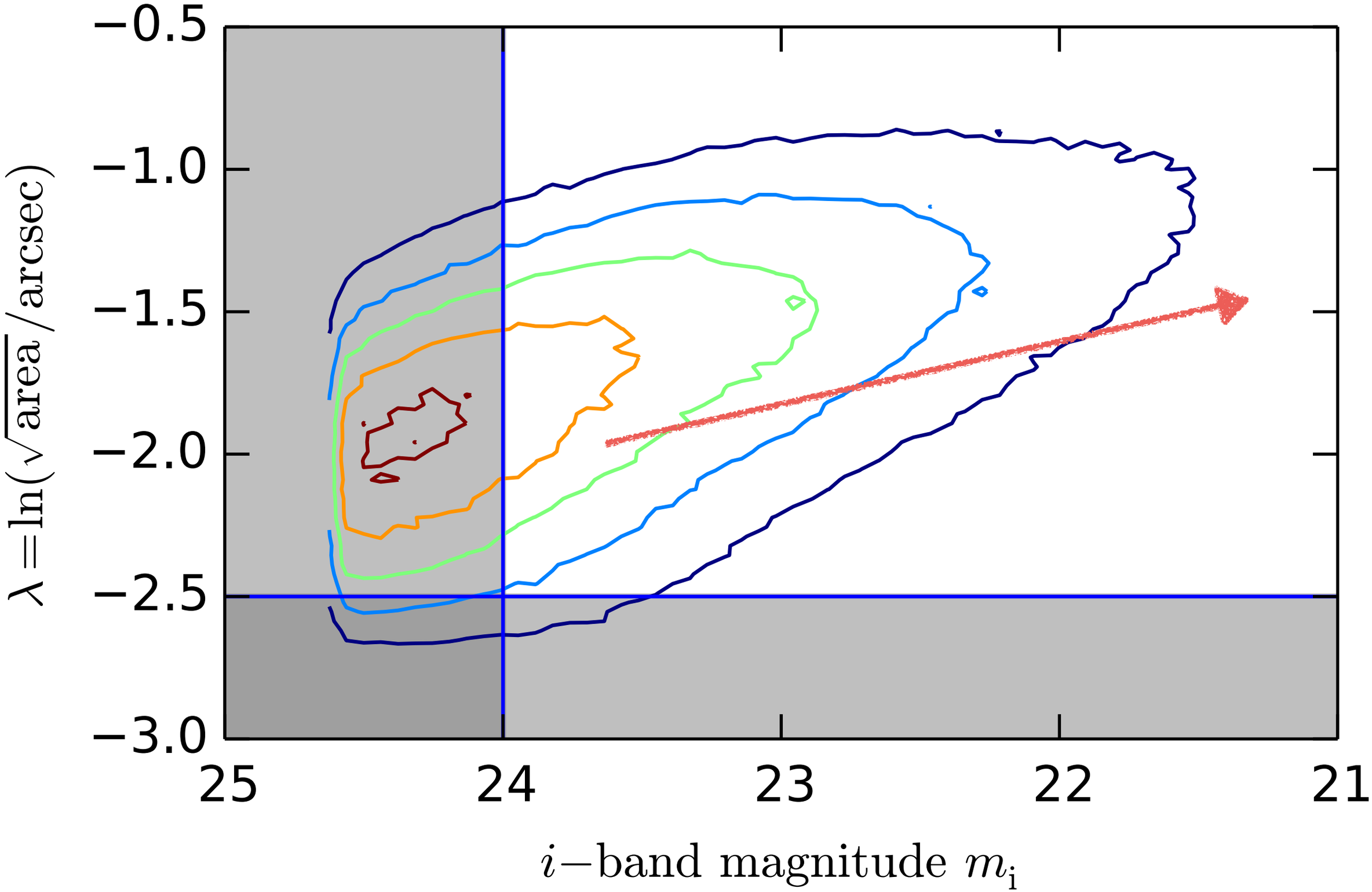
Ménard et al. (2011)

Magnitude shift, μ only, real

- Not fully achromatic!
- Chromaticity depends on colour selection.
- WL prediction holds.
- Observed number-counts useless.

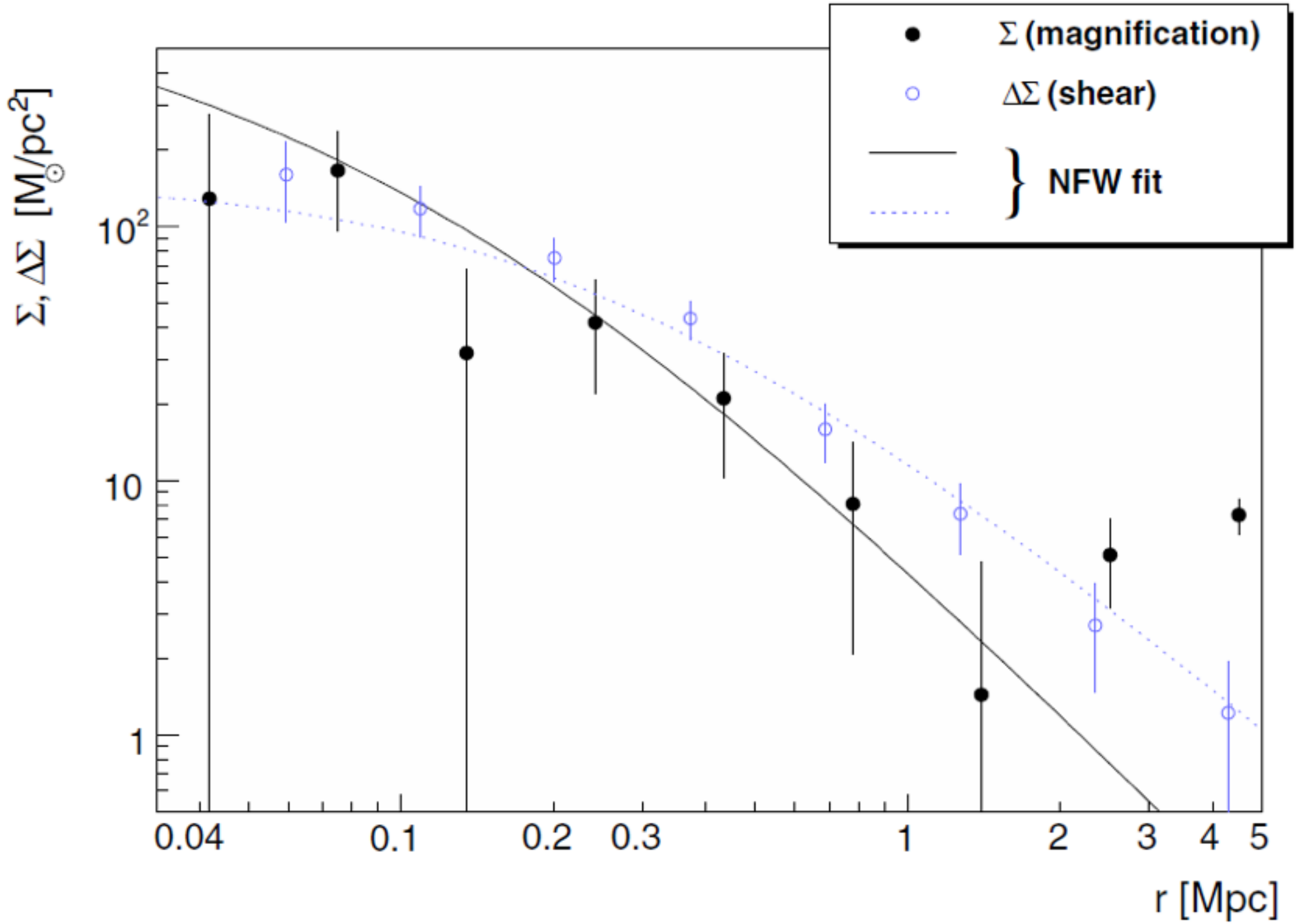


Hildebrandt (2015 in prep.)



Magnitude-size distribution

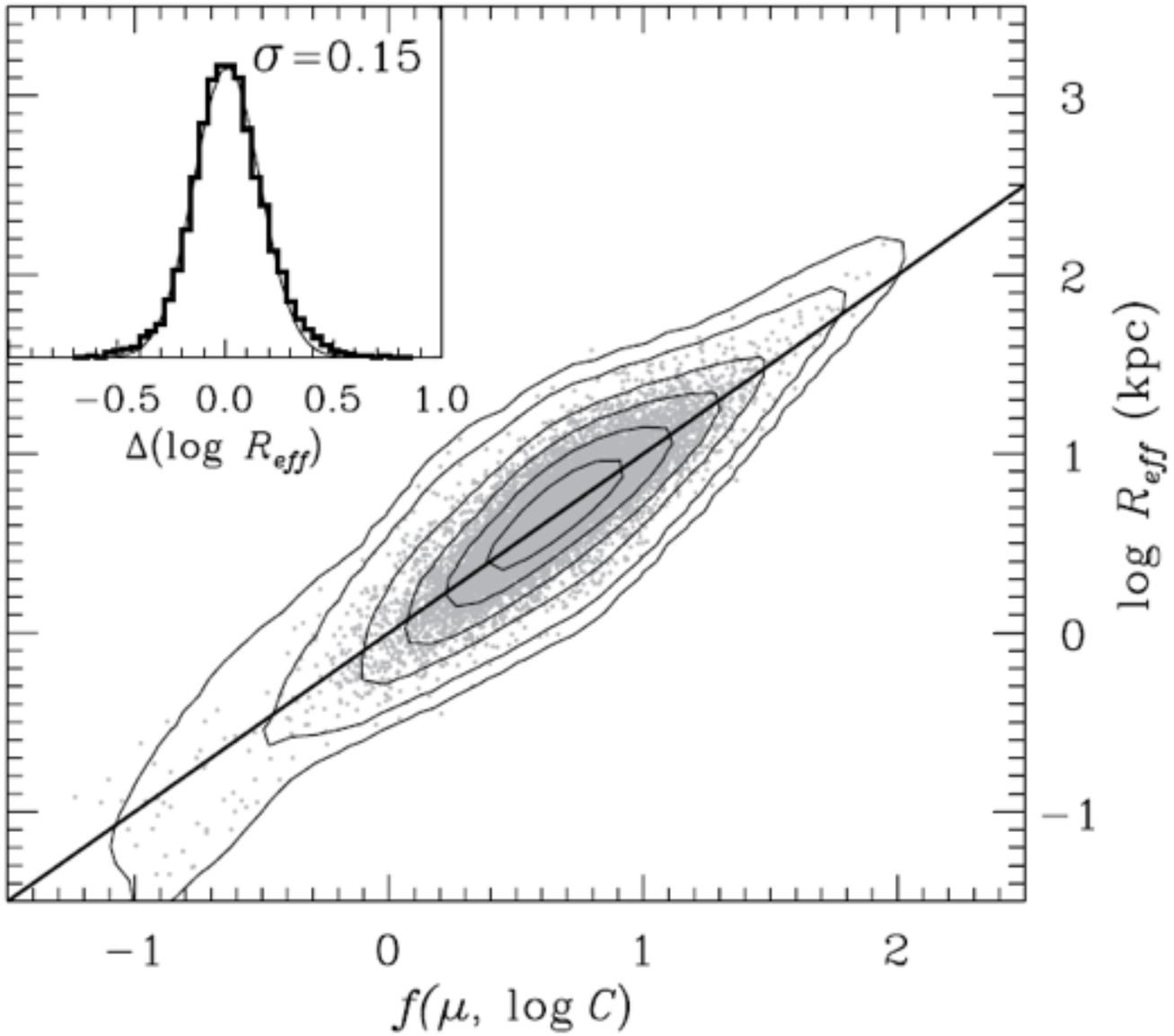
Alsing et al. (2014)



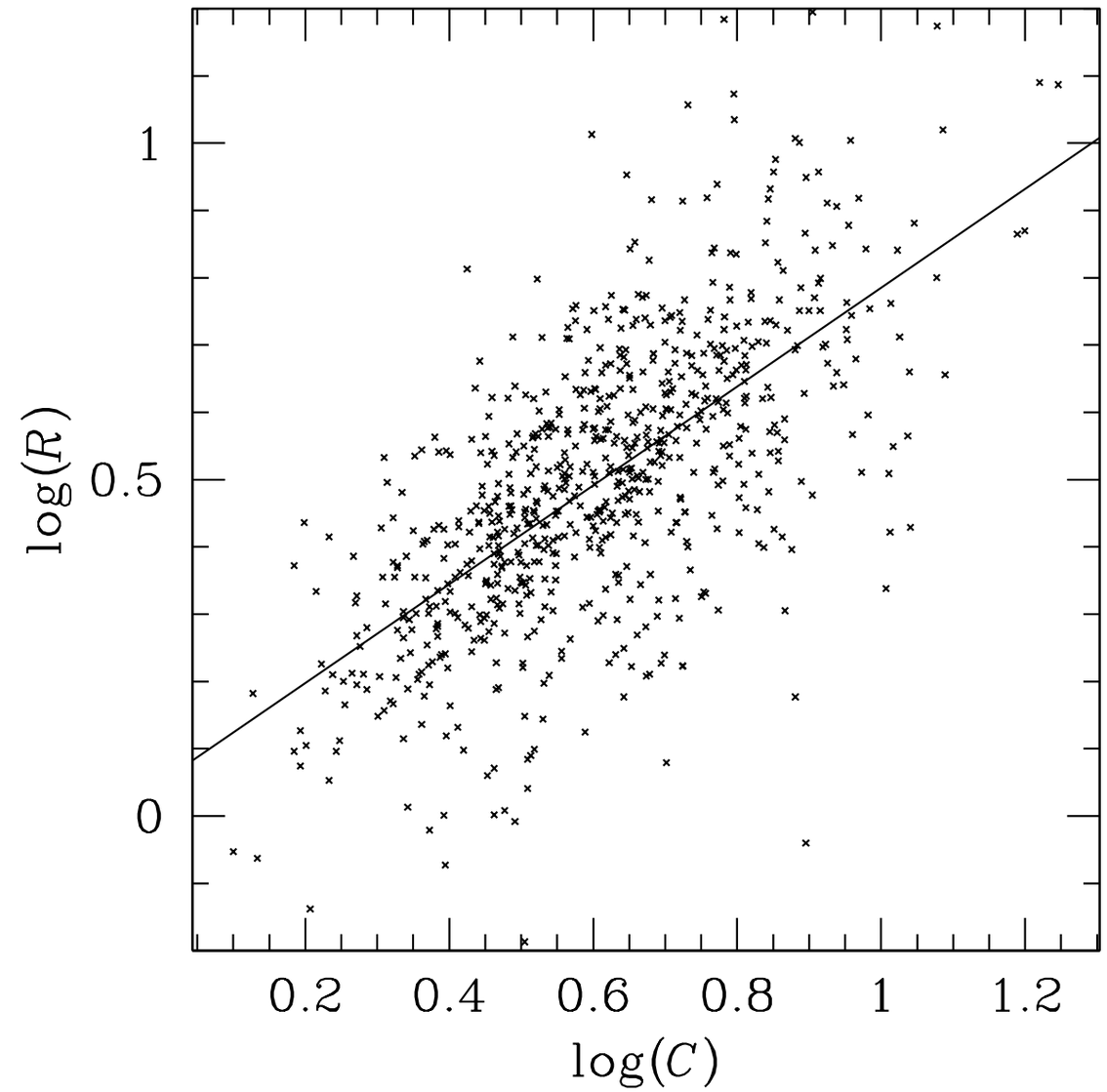
Size-flux magnification

Schmidt et al. (2012)

Ellipticals



Spirals

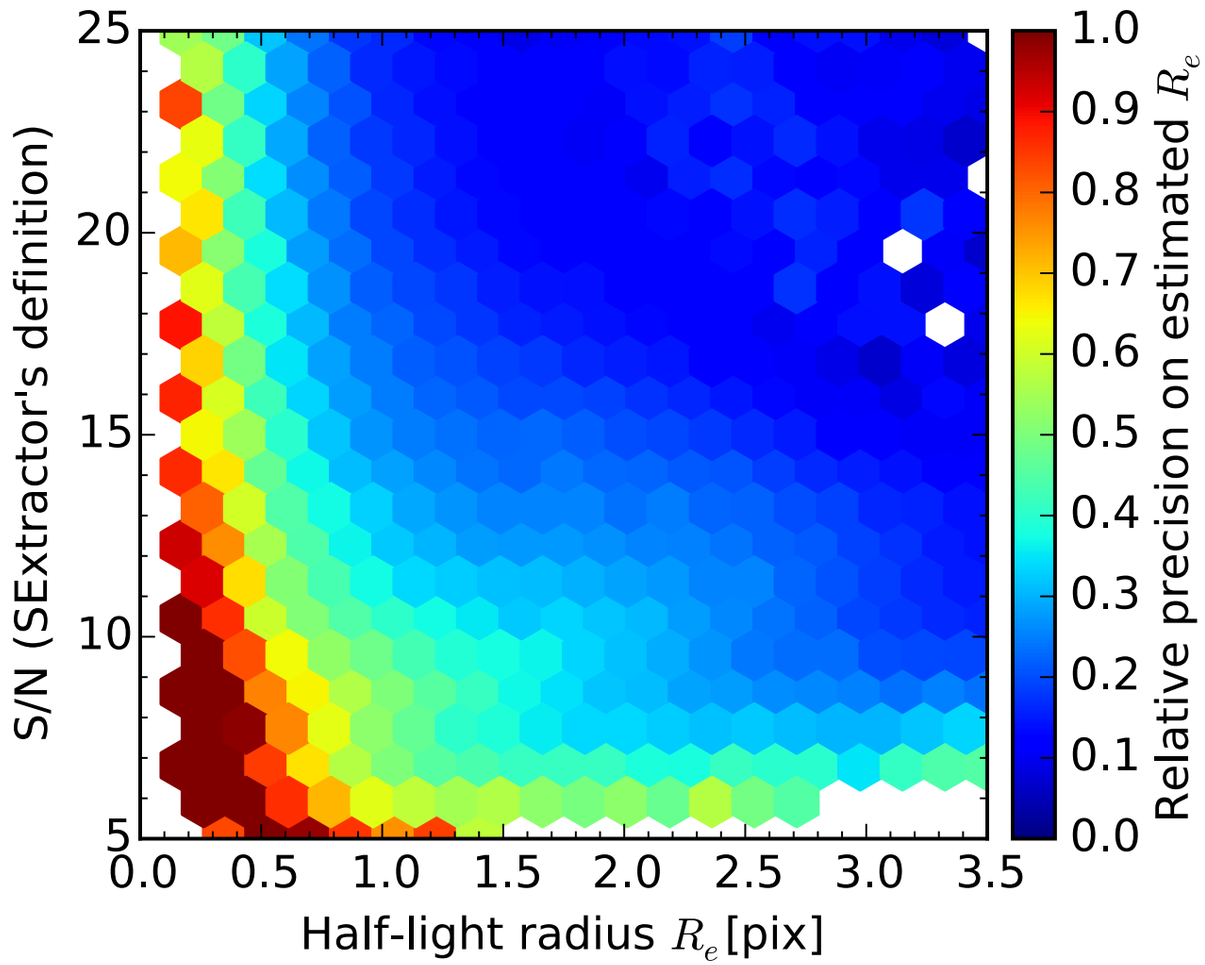


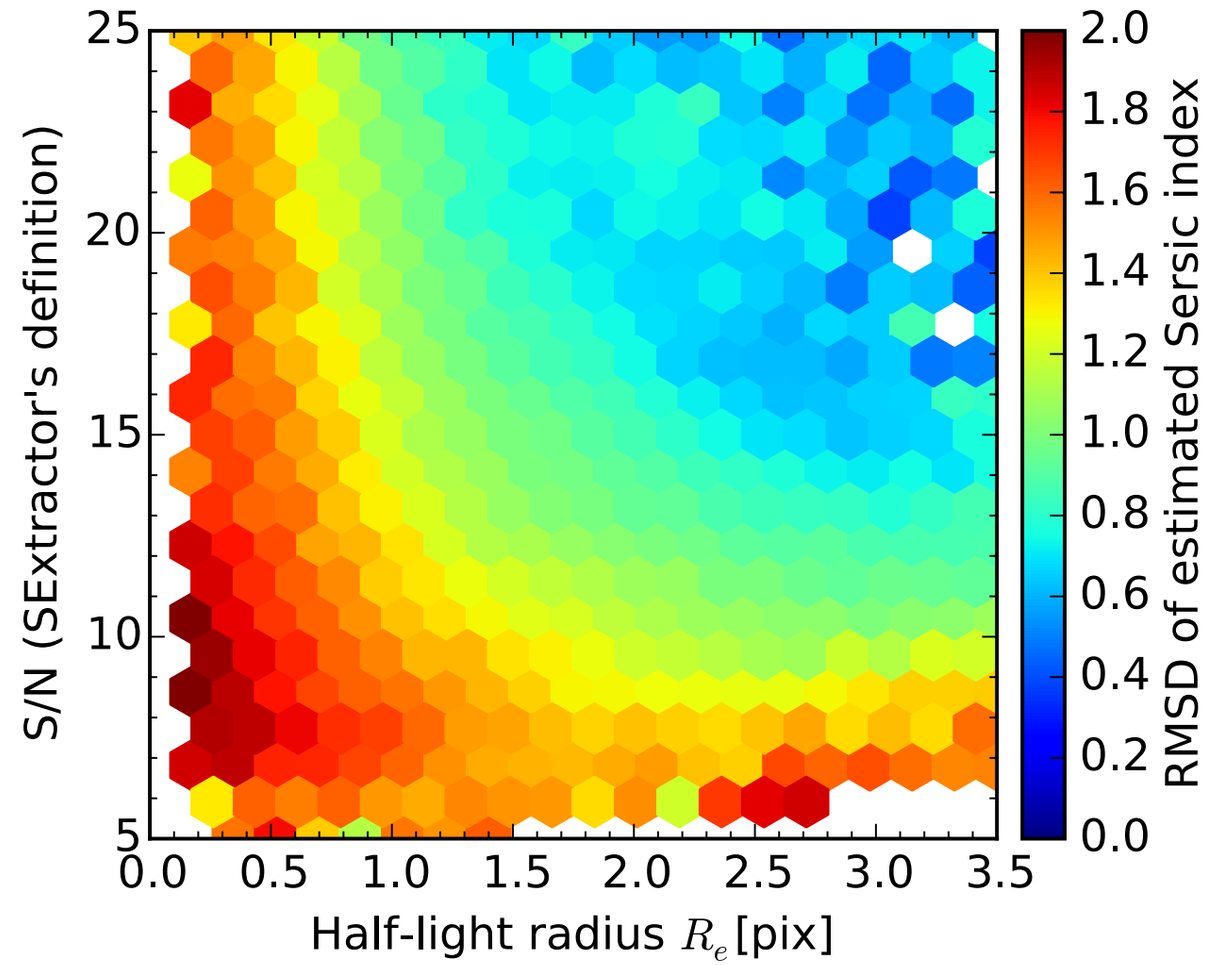
Galaxy scaling relations

Huff et al. (2014)

Hildebrandt et al. (in prep.)

BUT: intrinsic size density correlations (Joachimi et al. 2015)





Measuring sizes and concentrations

Tewes et al. (2015 in prep.)

Summary

- RCSLenS takes cosmological weak lensing to the next stage. Public data release by the end of the year.

- First GGL-like measurements are finished.
  Confirm GR (E_G test) and introduce optimised observables.

- Cosmic shear over ~1000deg^2 as well as cross-correlations between mass maps and other probes are coming soon.

- Shear-based weak lensing will soon be complemented by size magnification (using scaling relations).

- We're using galaxies as sources. Need to know those extremely well!