The Kilo-Degree Survey (KiDS)

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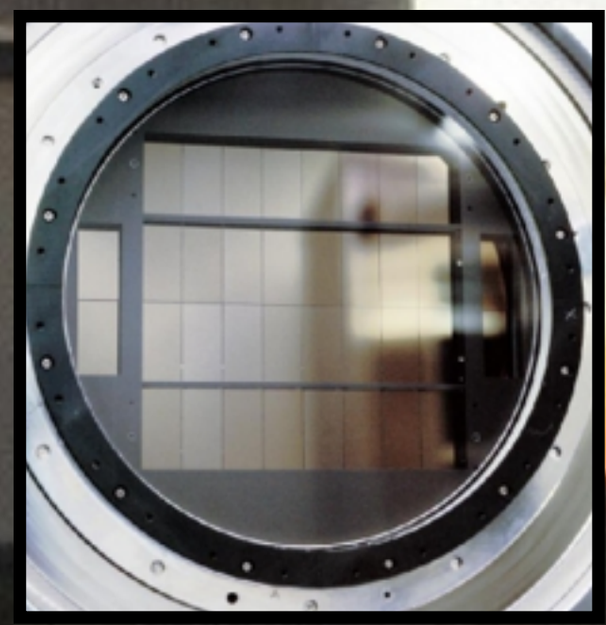
KiDS:

- 1500 sq. deg. survey
- VLT Survey Telescope (VST)
- four bands: ugri
- superb image quality
- same footprint as VIKING
- overlap with 2dF, GAMA, SDSS



The KiDS Team

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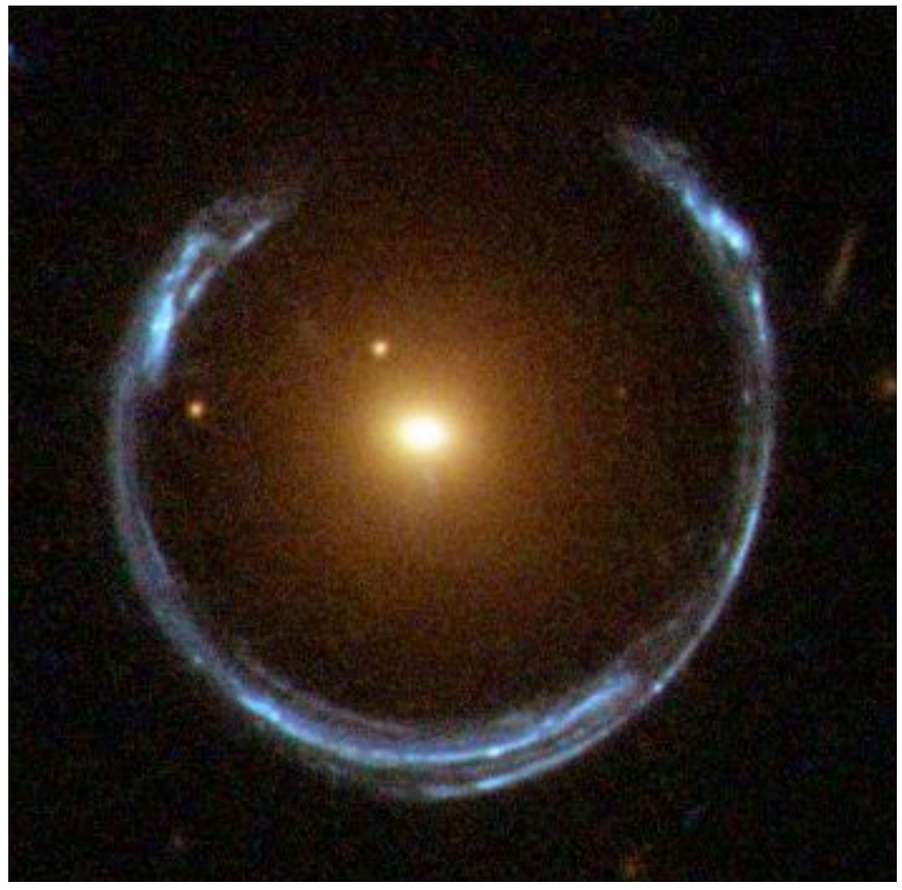
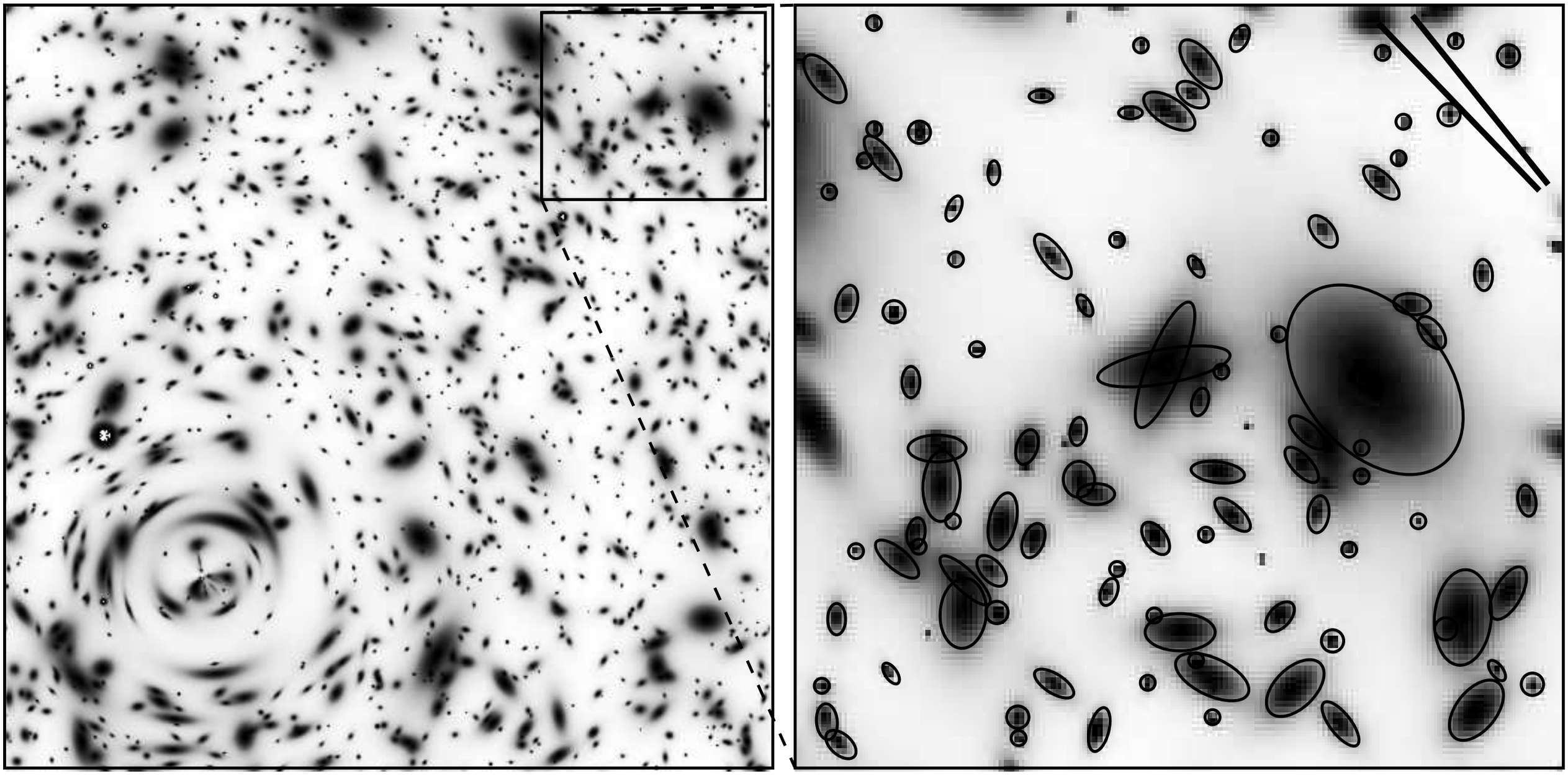


Credit: ESA/Hubble & NASA

Credit: M. Sachs

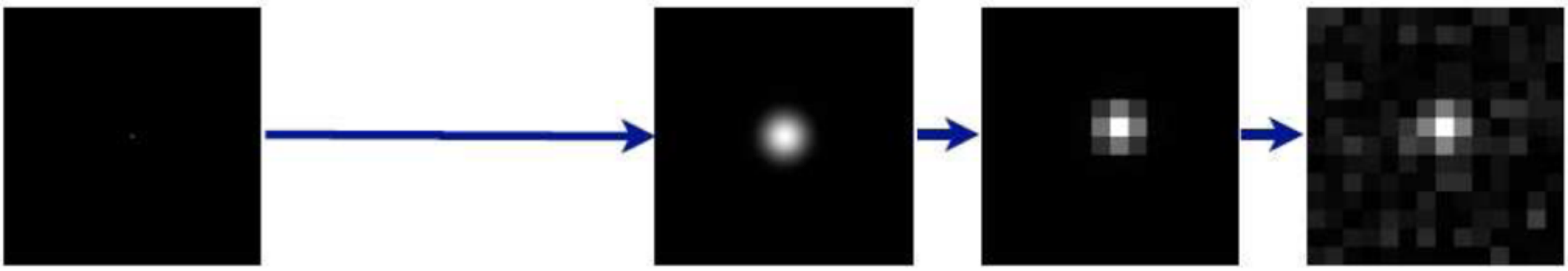


Mellier (1999)

Galaxies: Intrinsic galaxy shapes to measured image:

Intrinsic galaxy (shape unknown) | Gravitational lensing causes a ***shear (g)*** | Atmosphere and telescope cause a convolution | Detectors measure a pixelated image | Image also contains noise

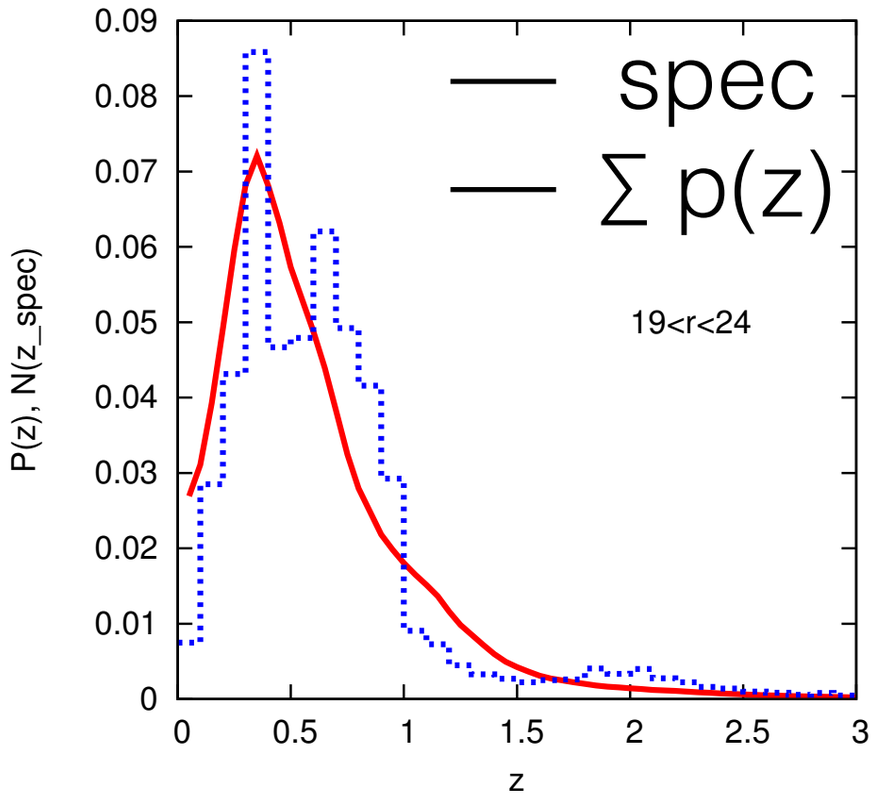
Stars: Point sources to star images:



Intrinsic star (point source) | Atmosphere and telescope cause a convolution | Detectors measure a pixelated image | Image also contains noise

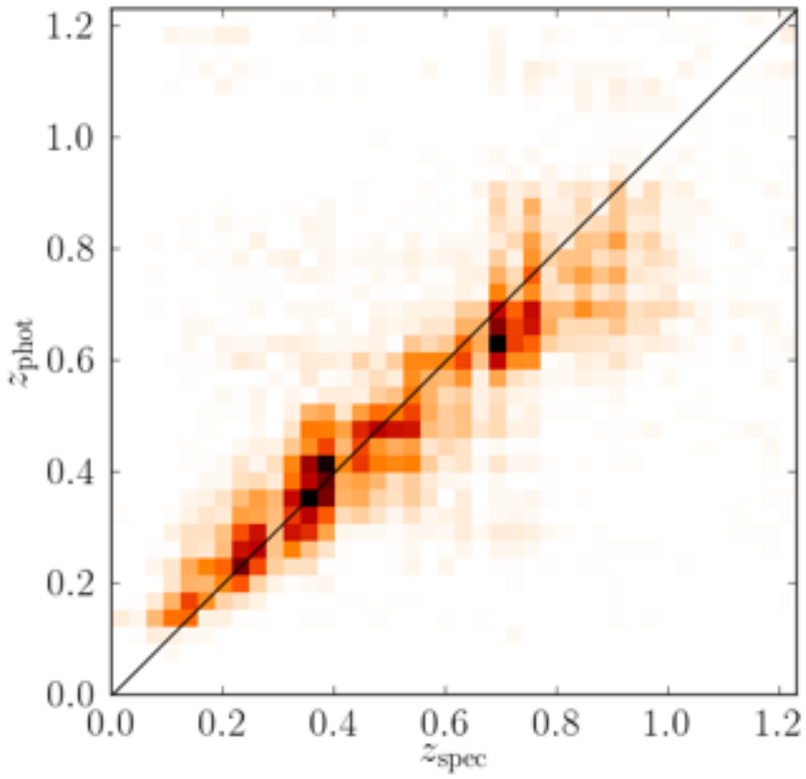
Bridle et al. (2008)

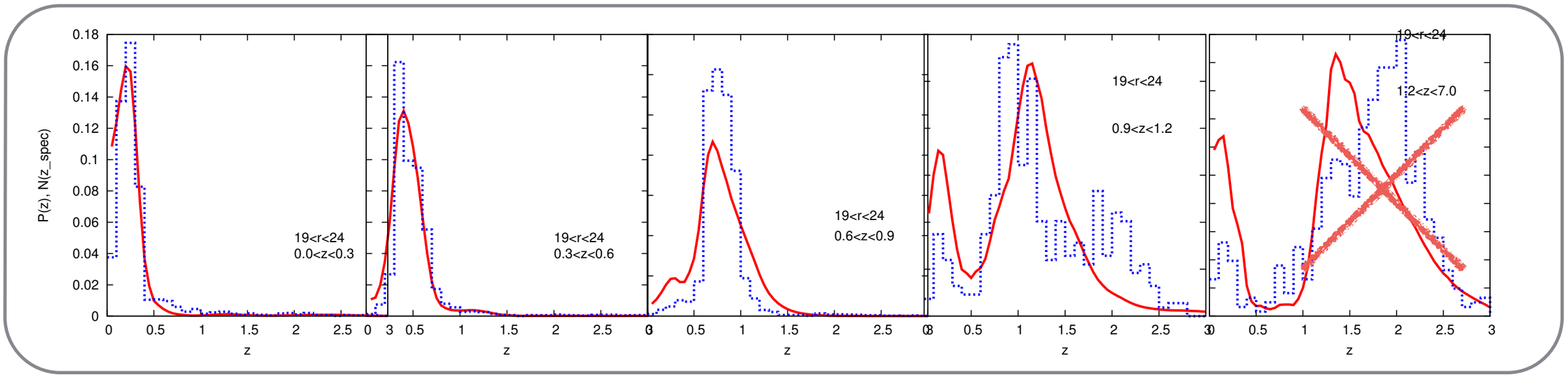
KiDS photometric redshifts



COSMOS
CDFS

(VST data from VOICE programme —thanks!)





Kuijken et al. (2015)

KiDS features

- Telescope built with weak lensing in mind.
  Very well controlled PSF.

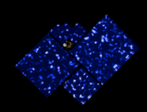
- Survey delayed a lot. Team was very well prepared!!

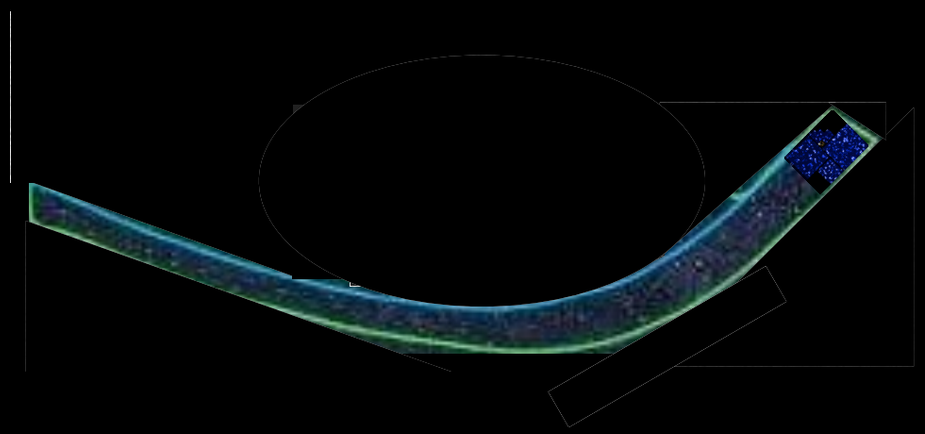
- Small, experienced (CFHTLenS) team working on the lensing science.

- Overlap with VIKING
  -> only wide, deep, and well-matched optical+NIR survey
  Preparation for Euclid and WFIRST.

- KiDS + CFHTLenS + RCSLenS + some smaller CFHT projects
  = **~3000 sq. deg. of very high quality lensing data**.

CFHTLenS collaboration





CFHTLenS

KIDS-N

ATLAS-N

KIDS-W2

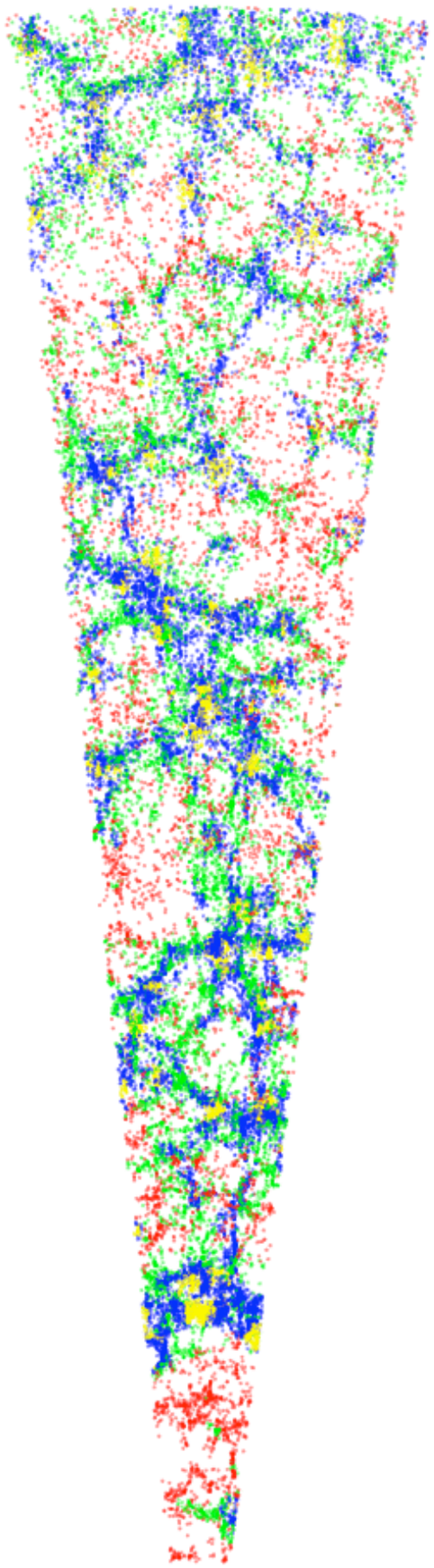
VPHAS+

ATLAS-S

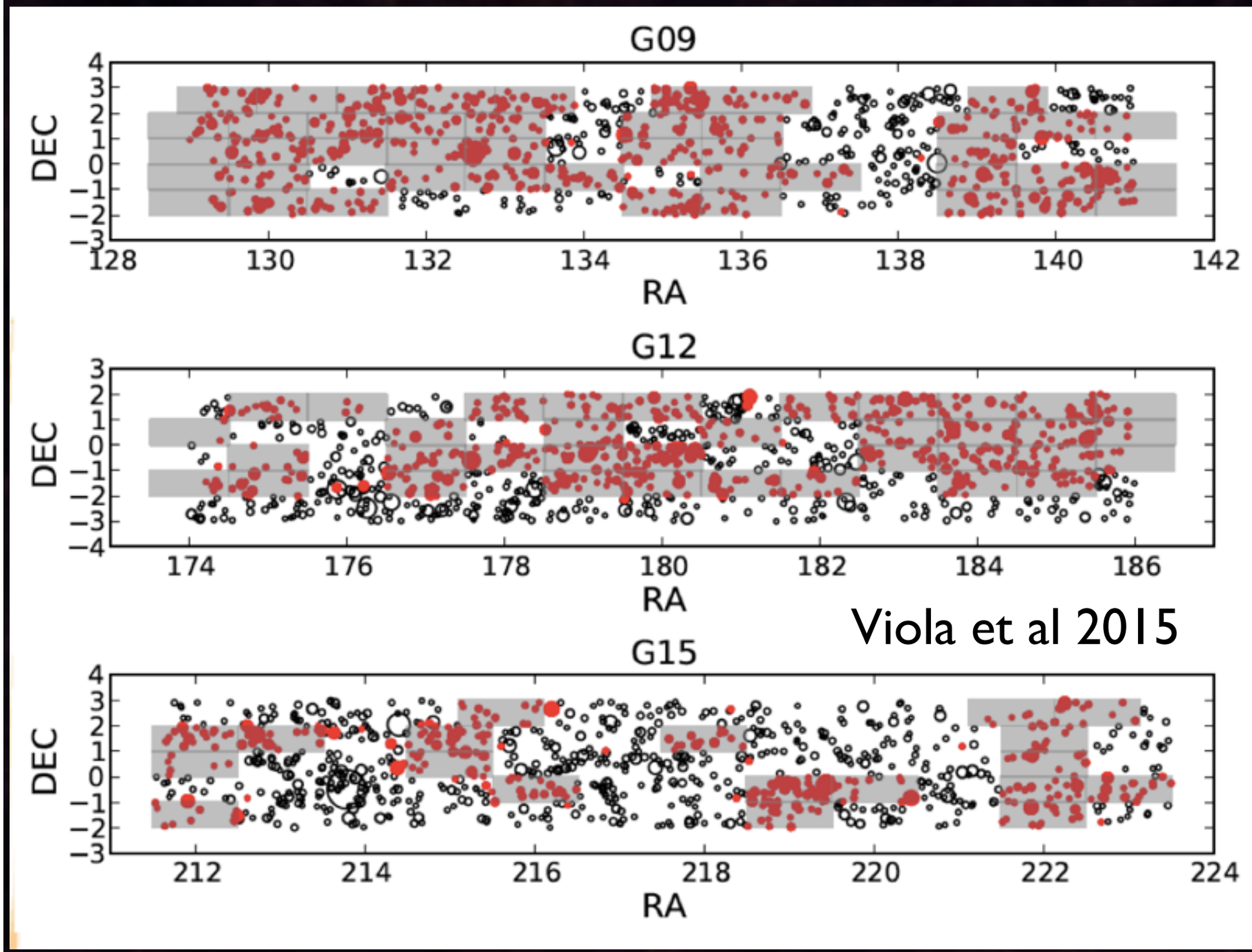
KIDS-S

10^2 sqdeg	CFHTLenS	17 gal/arcmin^2	zm=0.75	Completed
	RCS2	6 gal/arcmin^2	zm = 0.6	
10^3 sqdeg	KiDS	9 gal/arcmin^2	zm=0.7	Now
	DES	8 gal/arcmin^2	zm=0.65	Now
	HSC	20 gal/arcmin^2	zm=1.0	Now
10^4 sqdeg	Euclid	30 gal/arcmin^2	zm=0.9	2020-….
	LSST	31 gal/arcmin^2	zm=1.0	2022-….

KiDS-GAMA (DR2)



Eardley et al 2015



Viola et al 2015

KiDS early science

- Using KiDS DR2 data with GAMA overlap (~110 sq. deg.)

- Concentrate on DM - baryon connection with GGL-like measurements.

- Measure average shear signal around
  - GAMA galaxies
  - GAMA groups
  - Satellite galaxies in GAMA groups

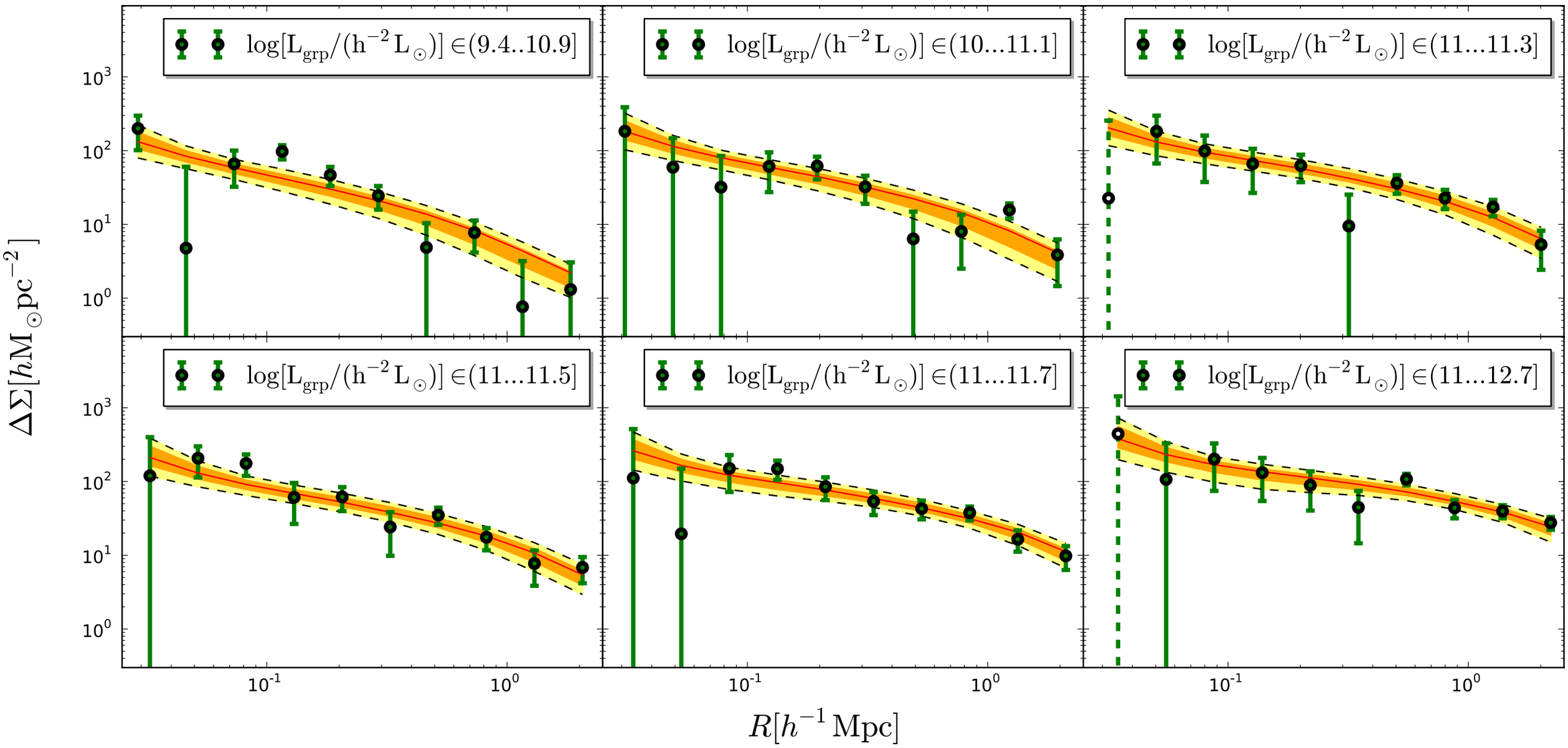
GAMA group (spectroscopic redshift)

Sources:

Tangential shear
+
Photometric redshift

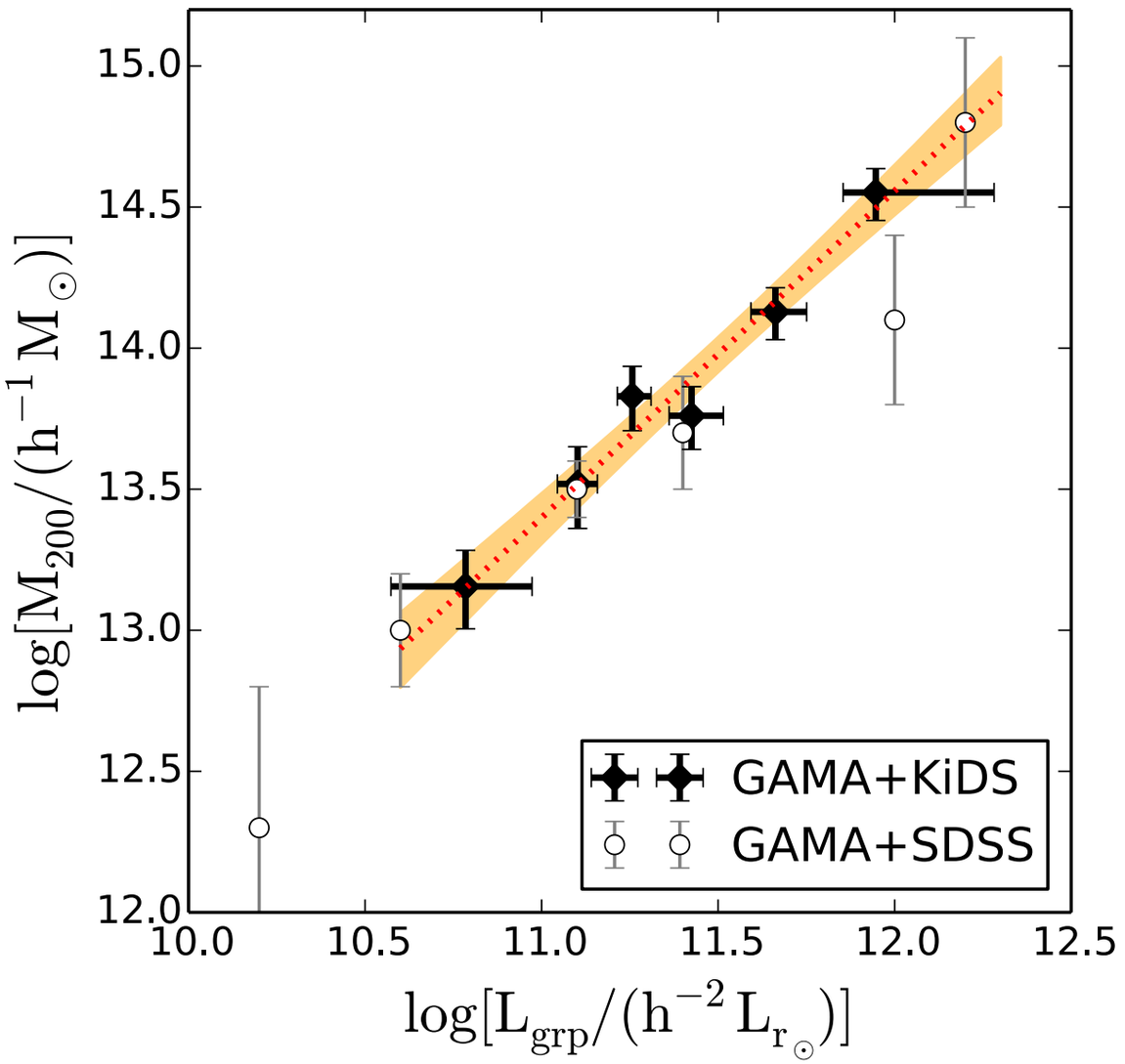
KiDS optical data

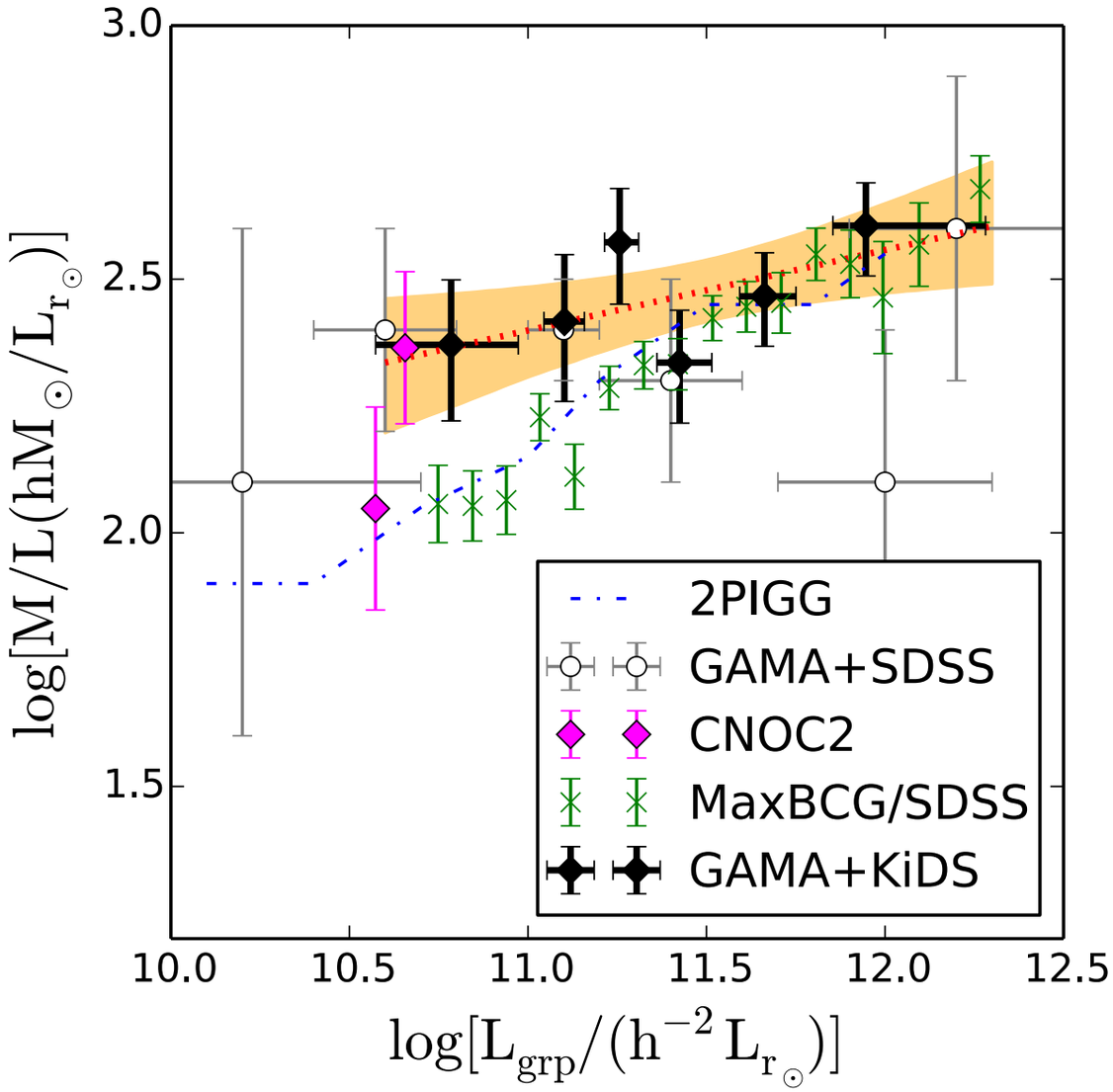
credit: Alex Tudorica, Massimo Viola



KiDS early science - group lensing

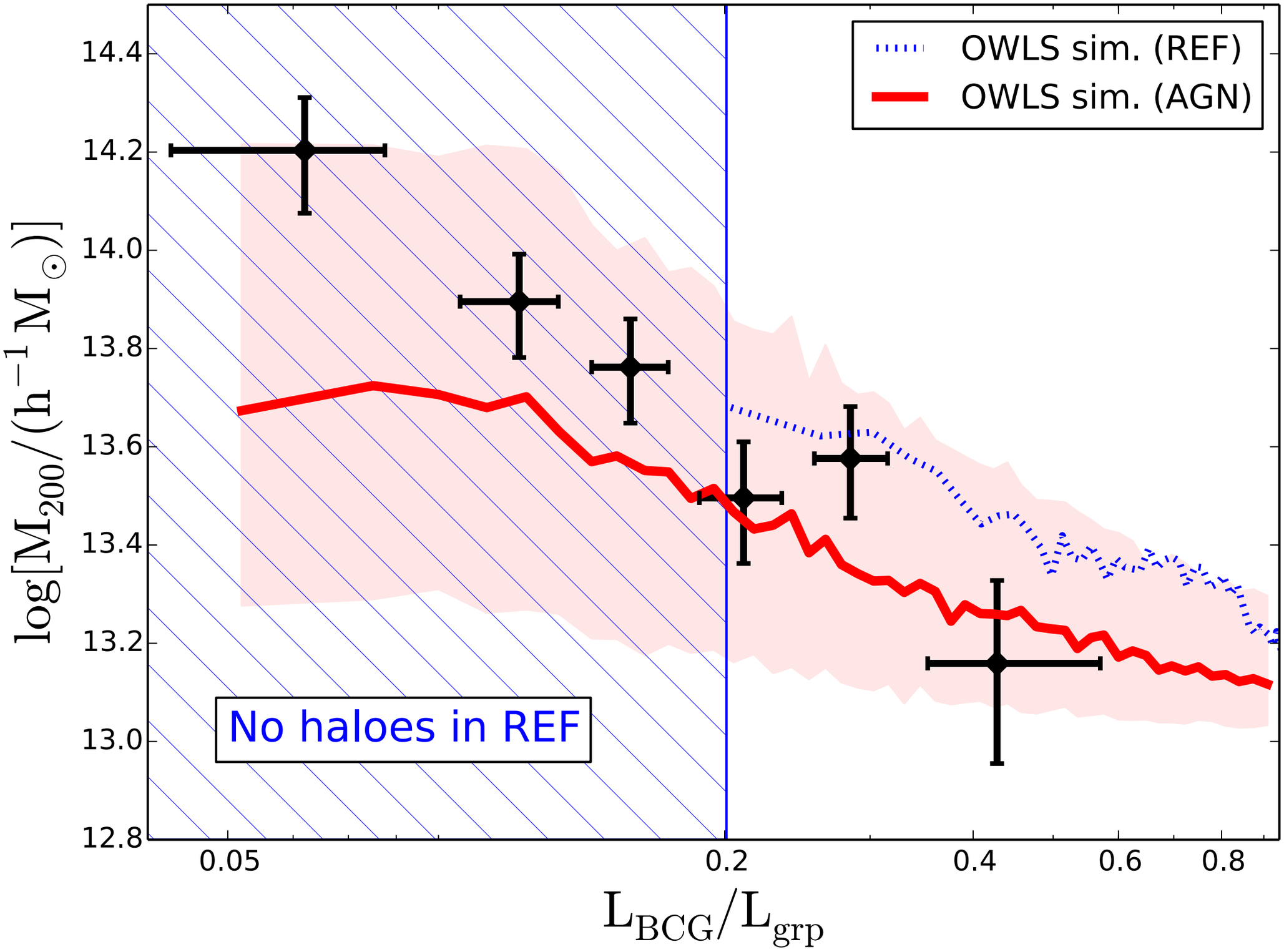
Viola et al. (2015)





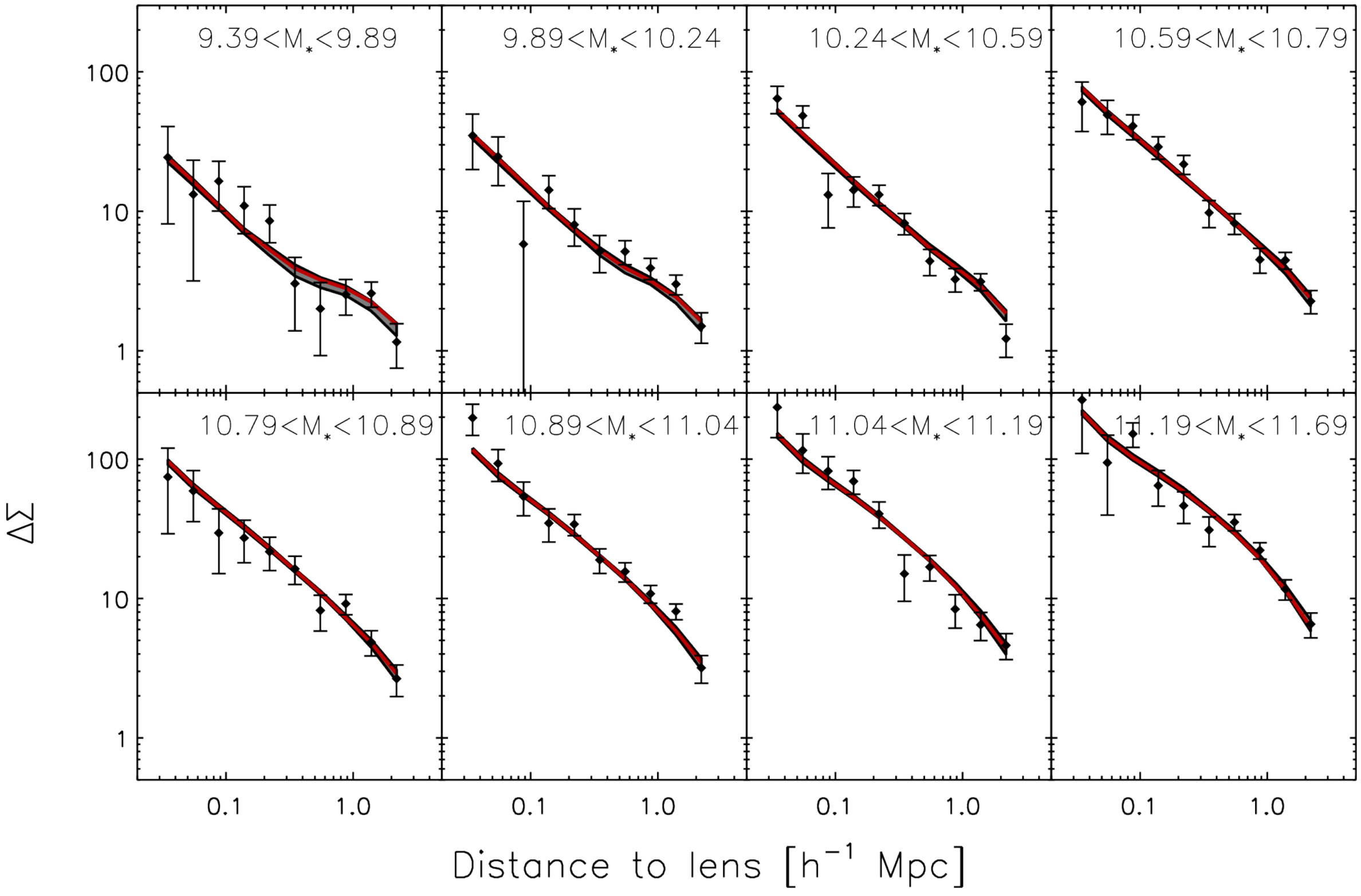
KiDS early science - group lensing

Viola et al. (2015)

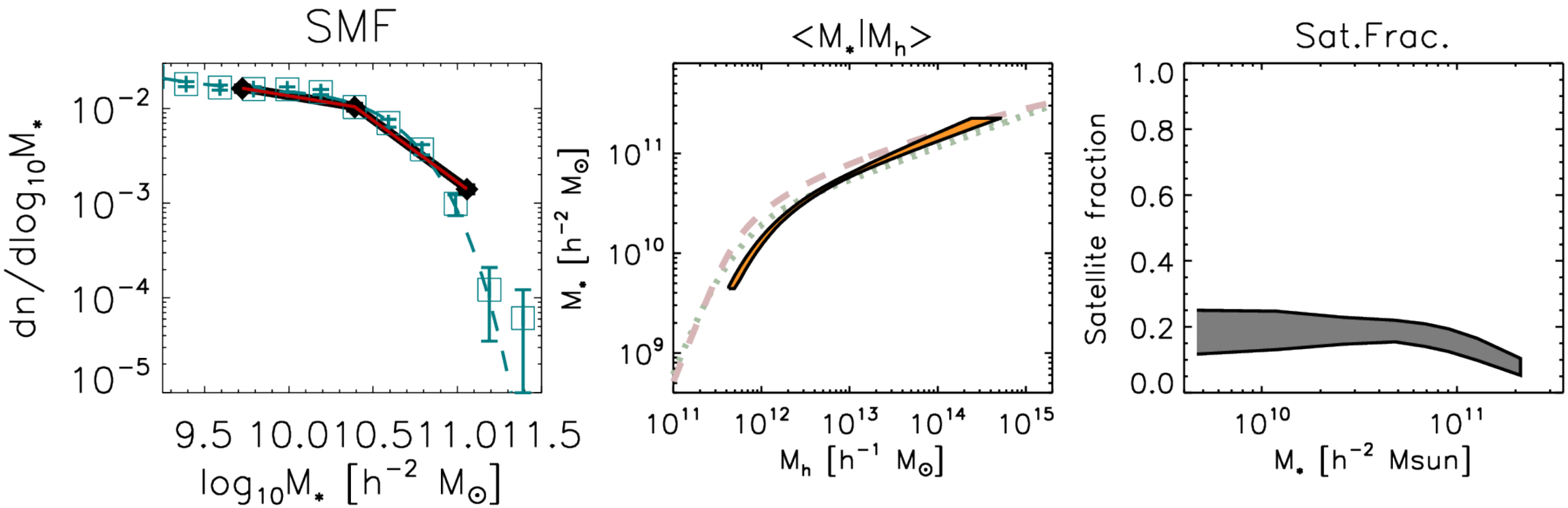


KiDS early science - group lensing

Viola et al. (2015)



van Uitert et al. (2015, in prep.)



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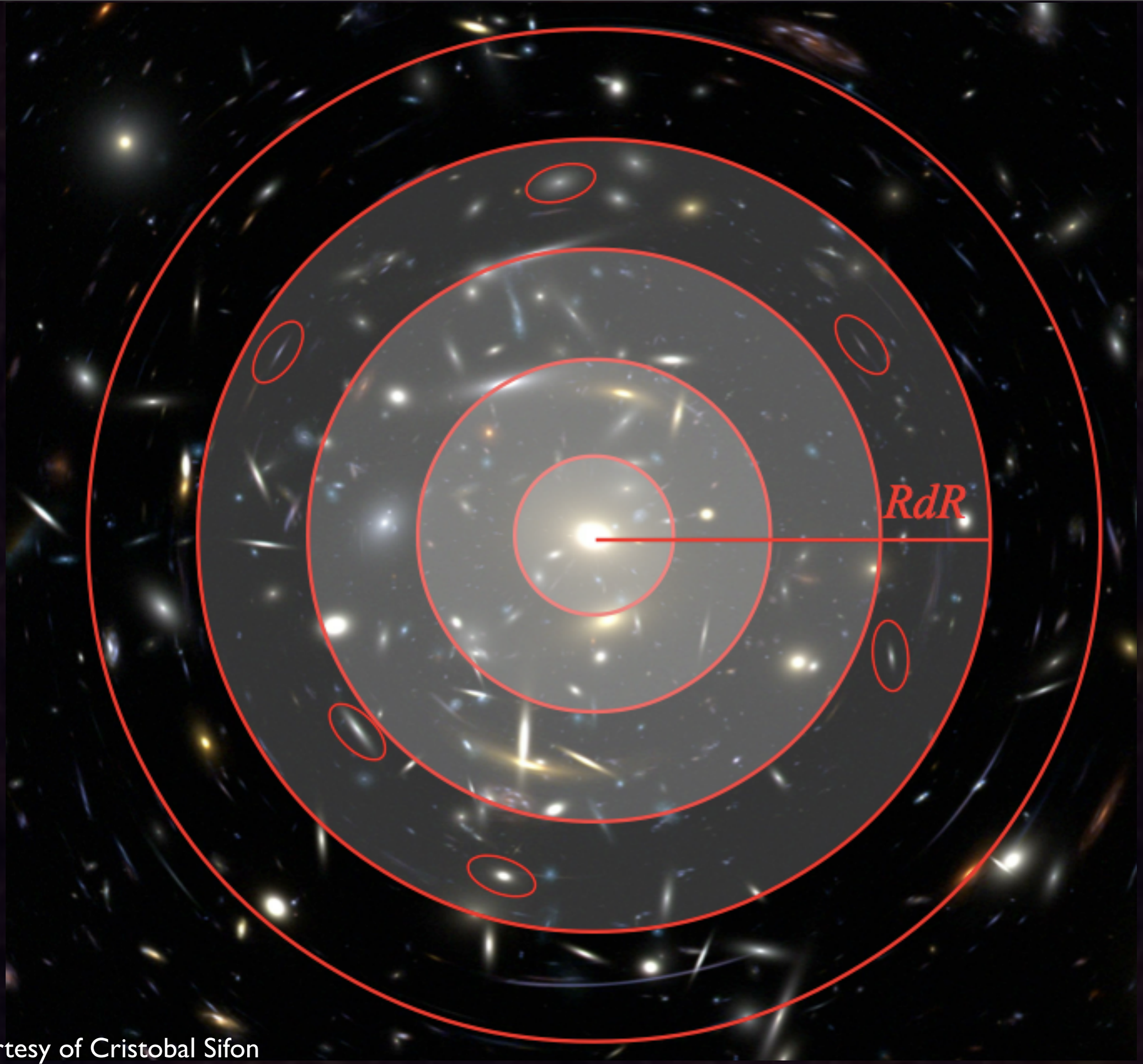
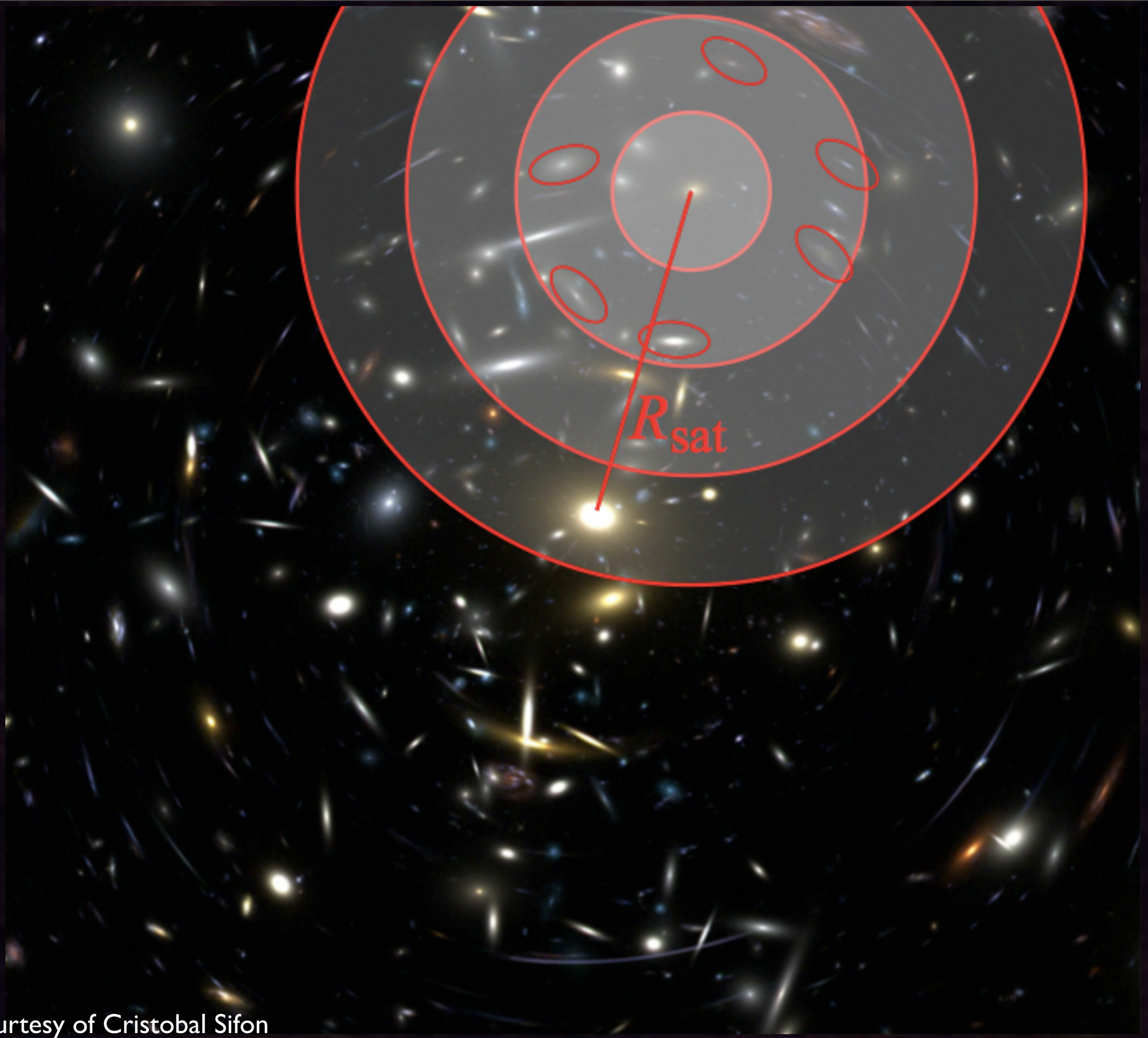


Slide courtesy of Cristobal Sifon



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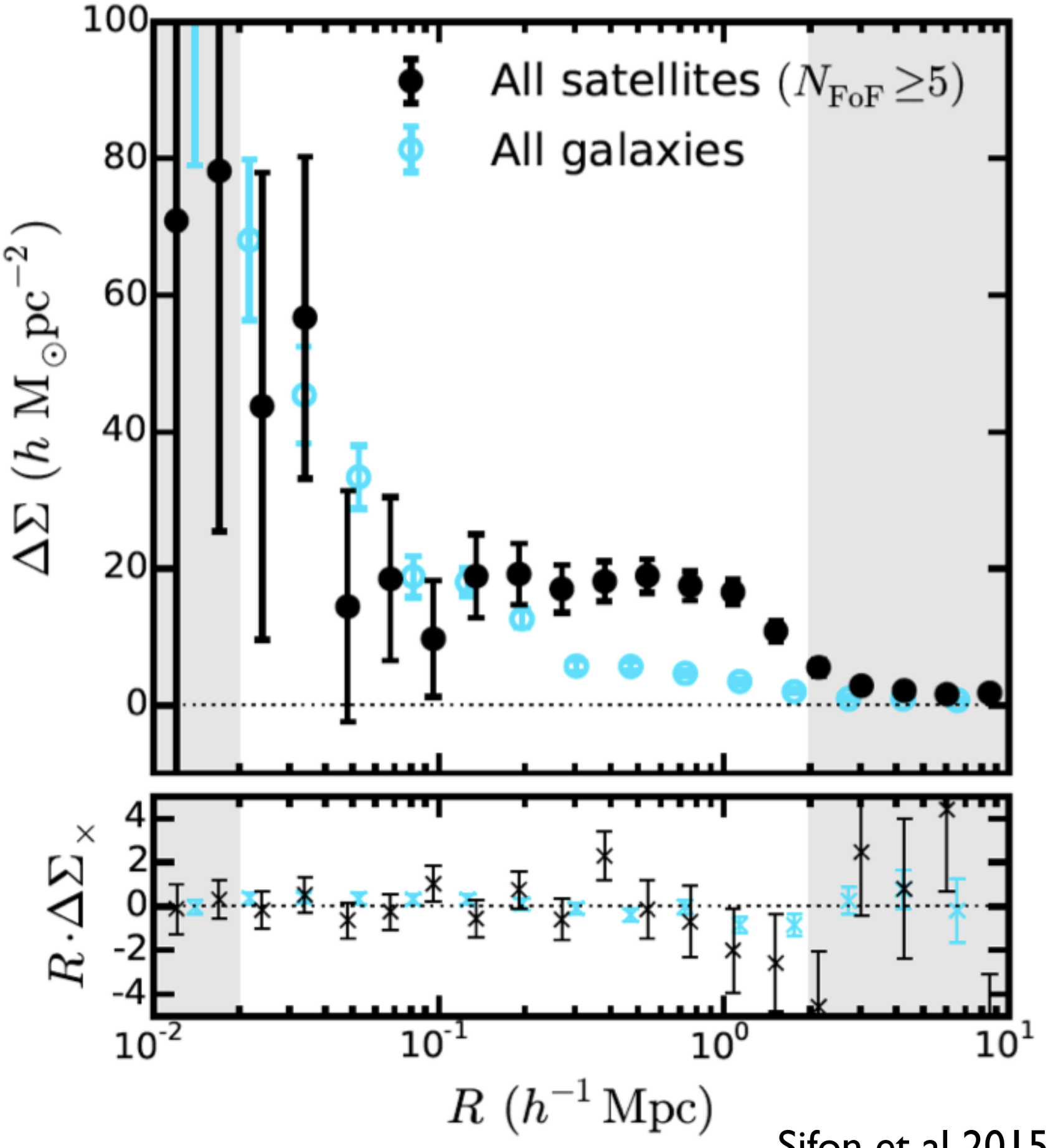
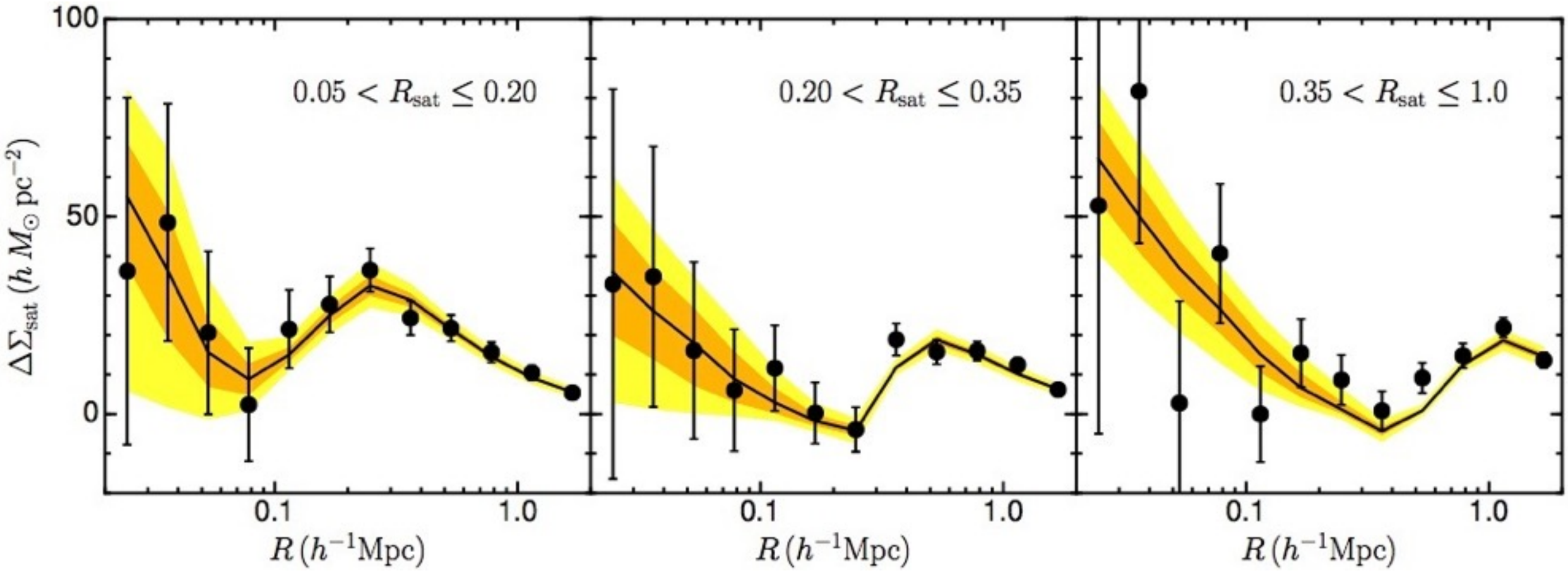


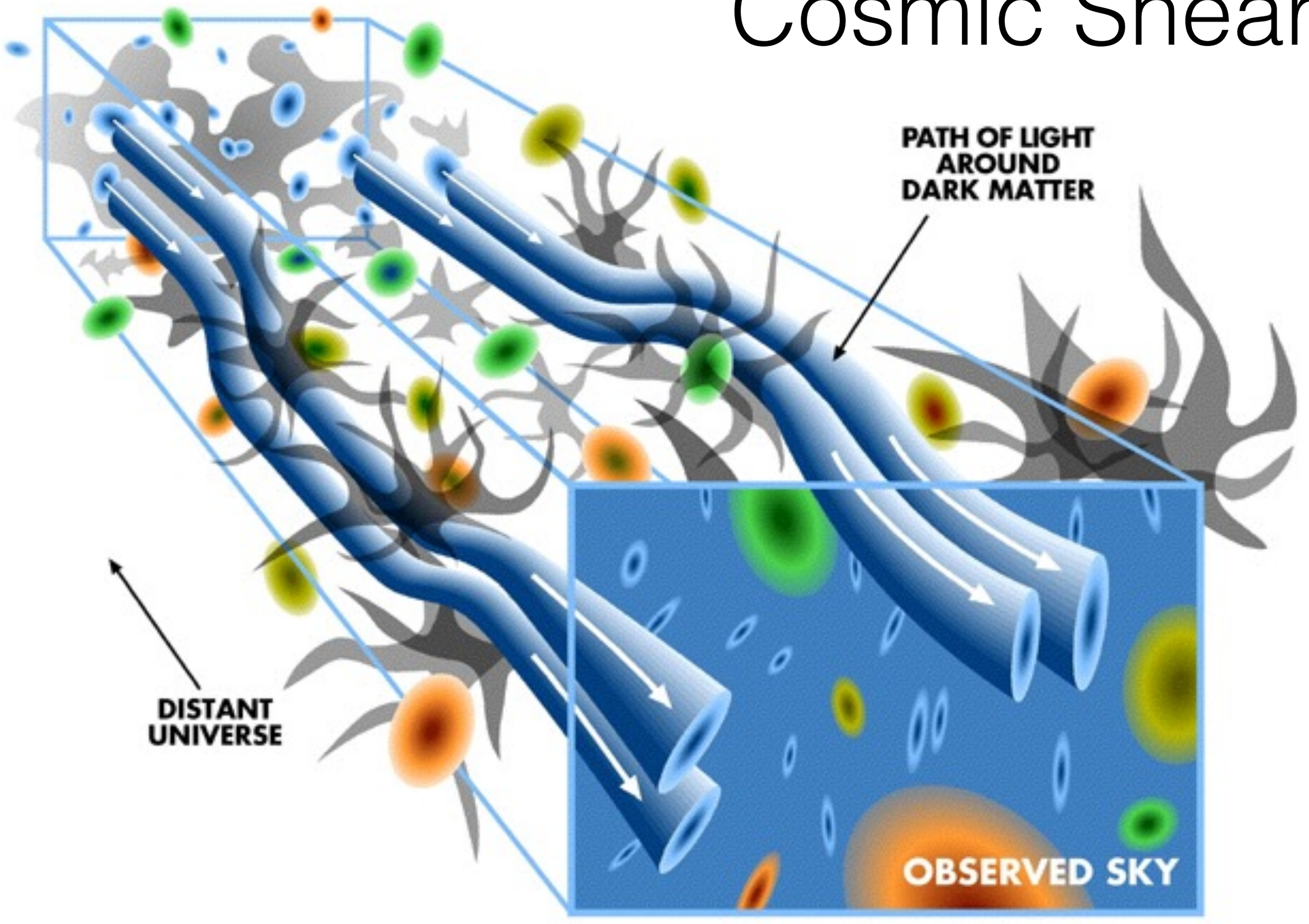
Sifon et al 2015



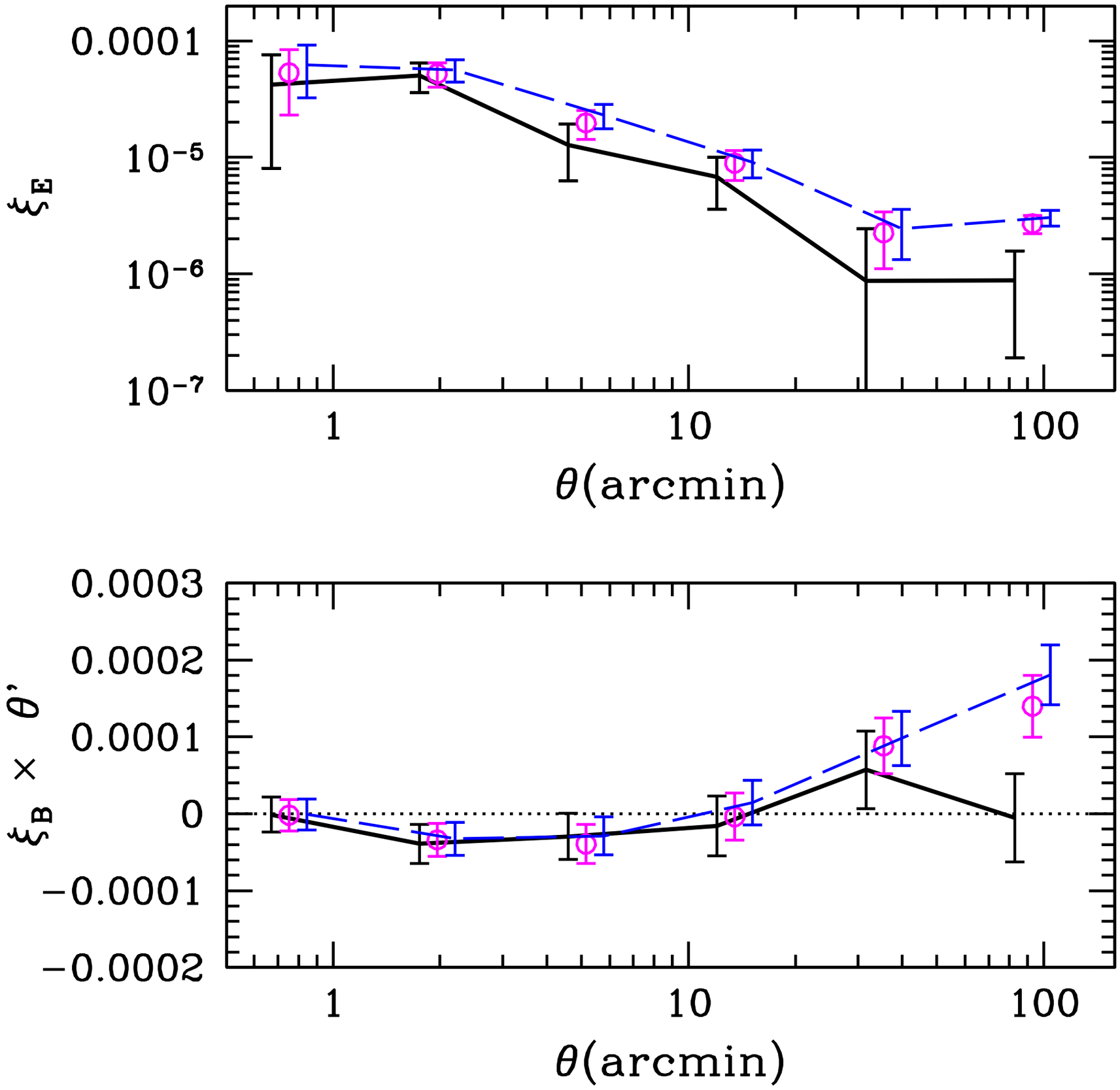
KiDS early science - satellite lensing

Sifon et al. (2015)

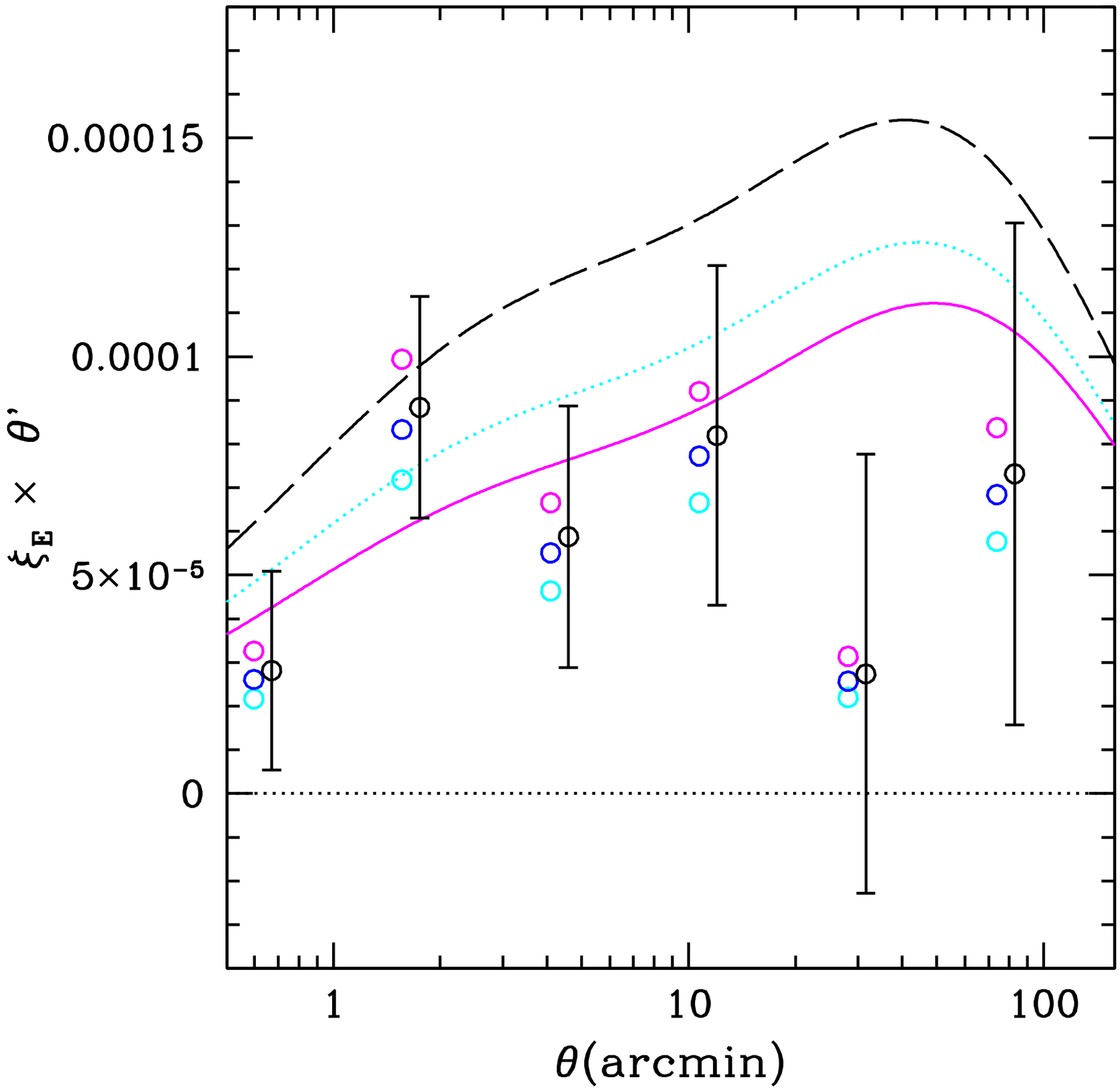
Cosmic Shear



Credit: http://www.lsst.org



Kuijken et al. (2015)



Kuijken et al. (2015)

KiDS cosmic shear

- ~500 sq. deg. are being analysed.
- New version of lensfit (self-calibrating) with a large dedicated suite of image simulations.
- Careful photo-z calibration and marginalisation over photo-z errors.
- Advanced theoretical modelling including IA, baryons, neutrinos, super-sample covariance, etc.

KiDS−N region

RCS1111

KiDS−N

CFHTW2

5
0
−5
−10

240
220
200
180
160
140

KiDS−S region

RCS0357

CFHTW1

RCS0320

KiDS−S

2dFLenS
Still to observe
<50% completeness
BOSS DR10

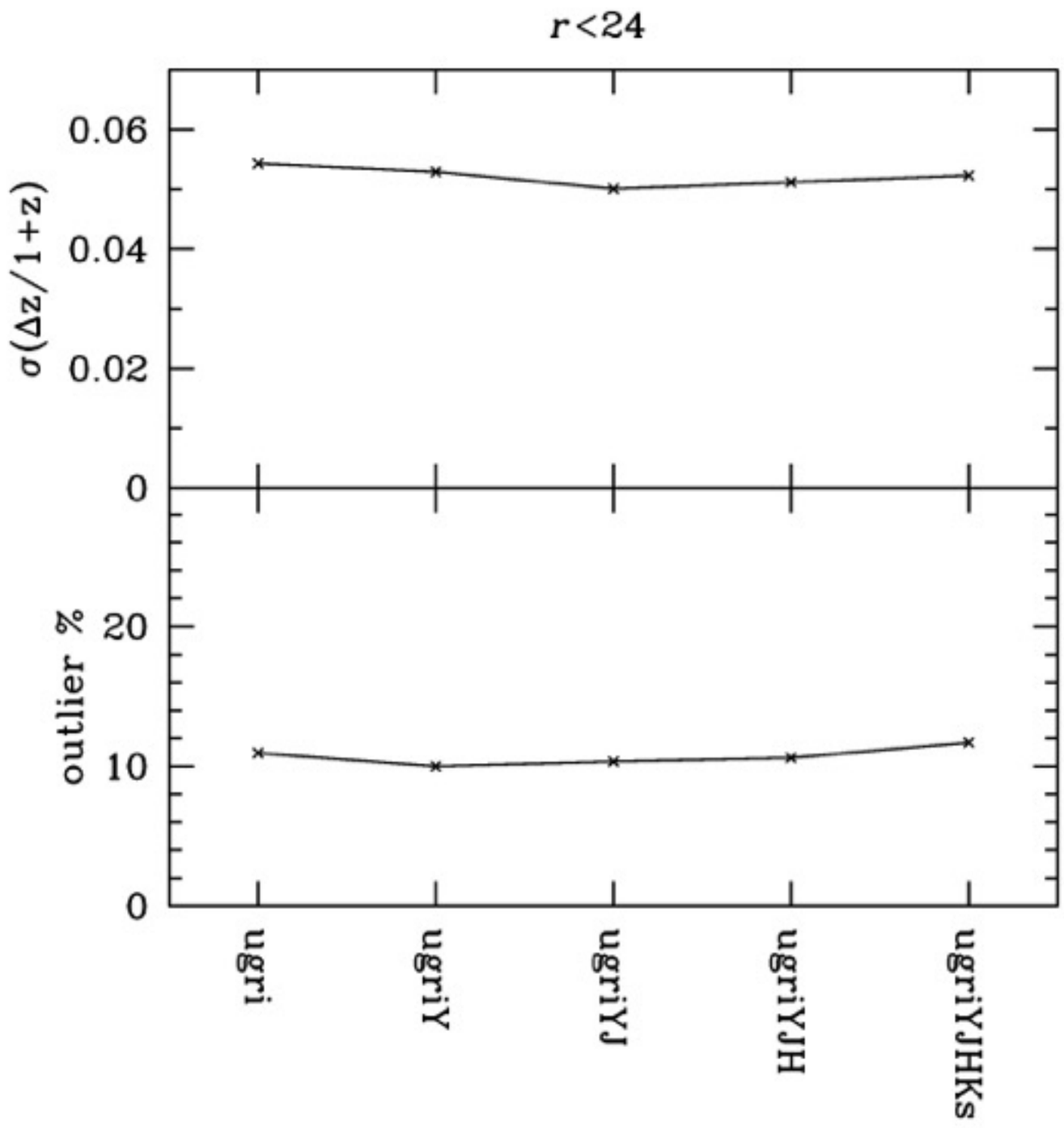
−10
−20
−30

60
40
20
0
−20

Credit : C. Blake

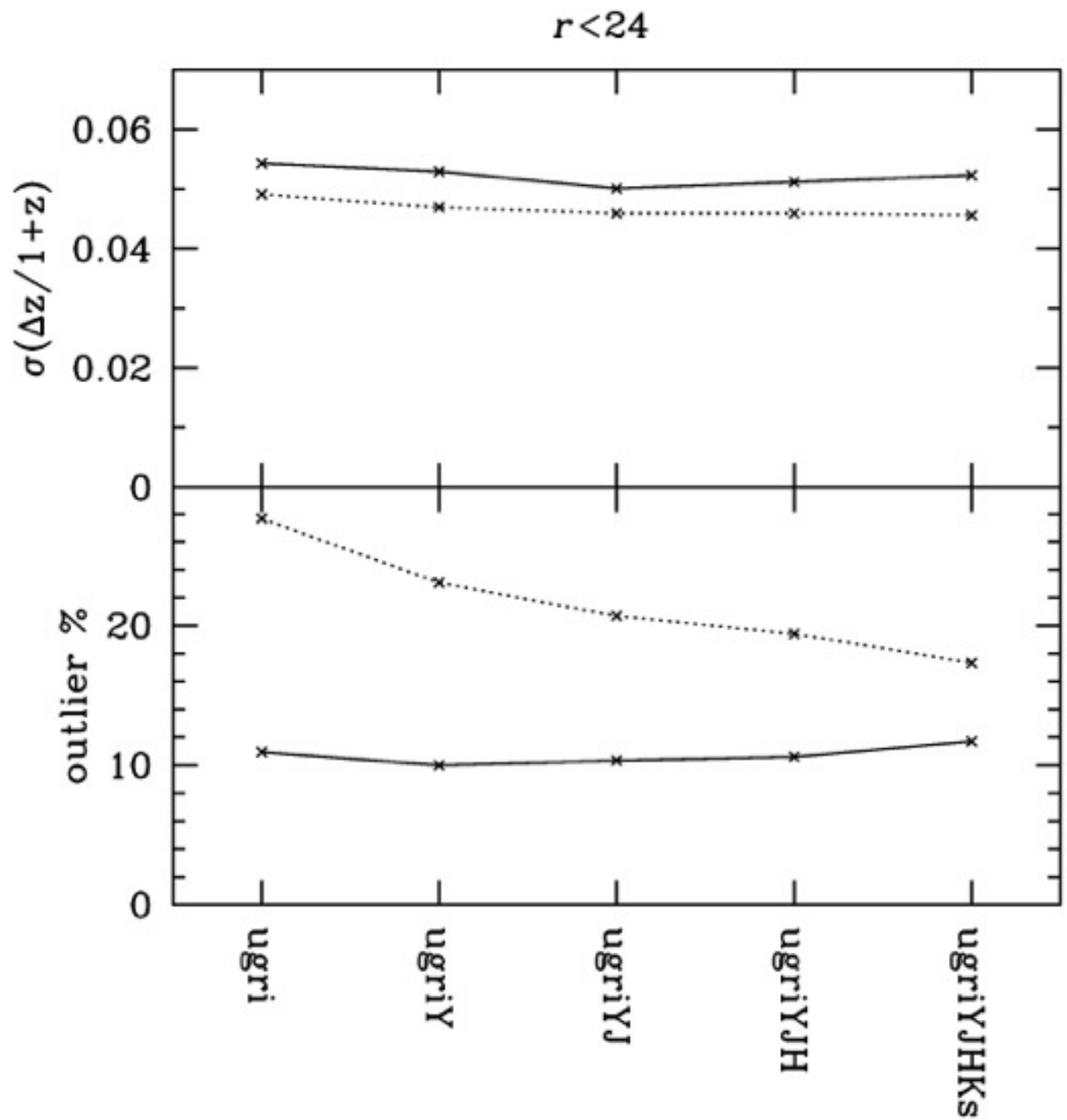
Results from KiDS+VIKING

- solid: data



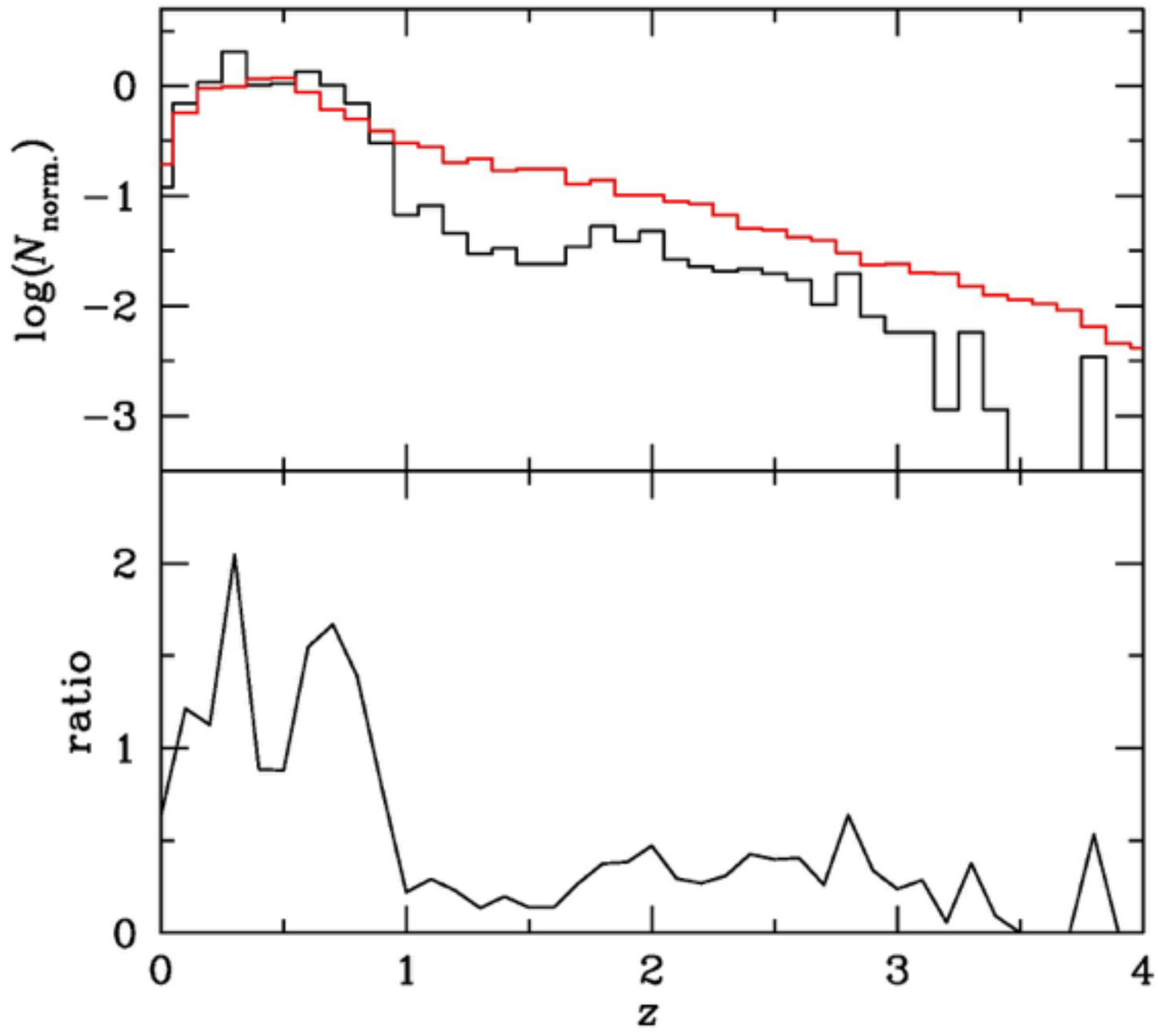
Results from KiDS+VIKING

- solid: data
- dotted: simulations



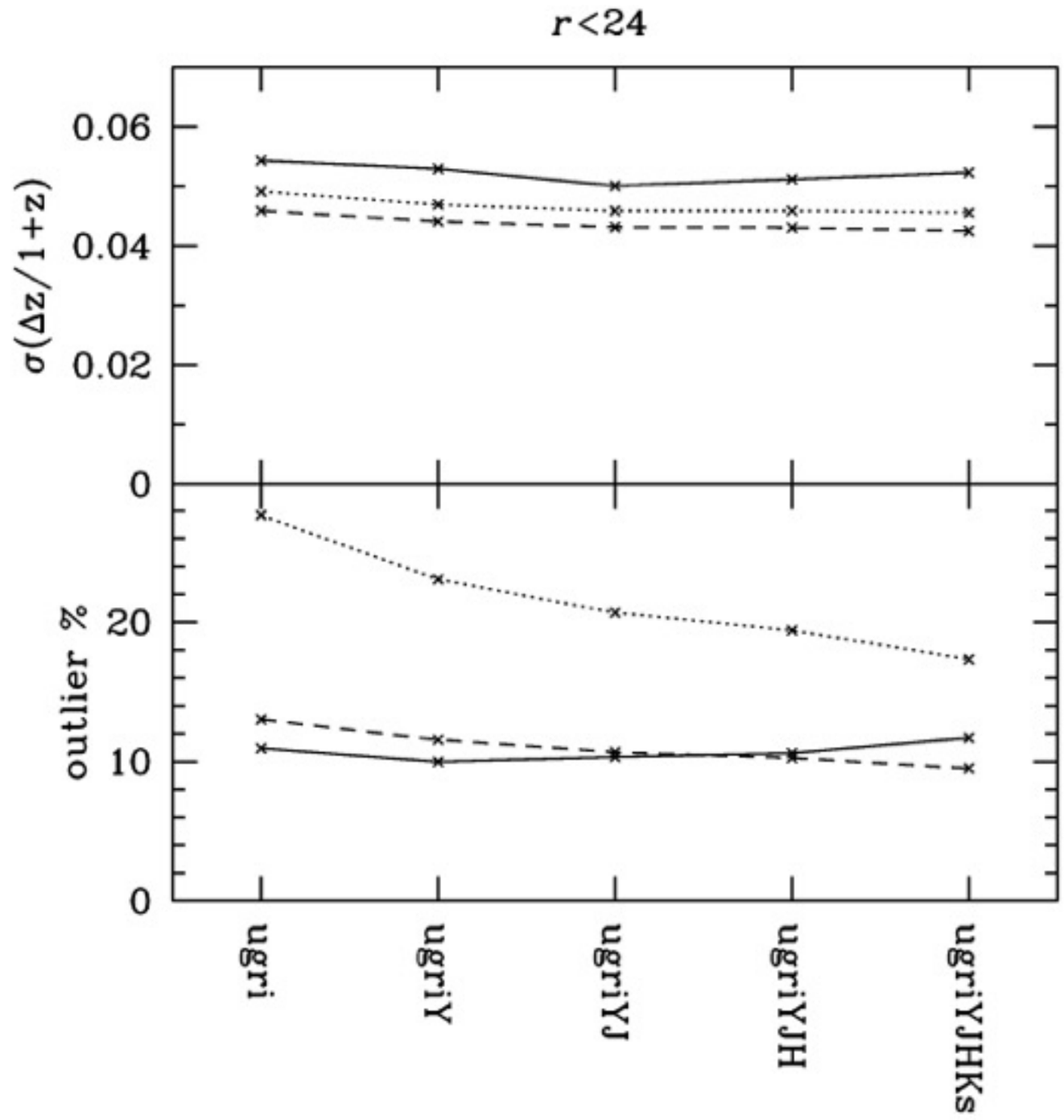
Redshift distributions

- Red: Simulation
- Black: zCOSMOS



Results from KiDS+VIKING

- solid: data
- dotted: simulations
- dashed: weighted simulations



Other science with KiDS

- High-z QSO
- Strong lensing
- Cluster finding
- Stellar density in the MW
- MW halo satellites
- …

Summary

- KiDS is a weak lensing survey with **very high-quality data** => **systematics well-controlled**.
- Early science exploiting the KiDS-GAMA overlap.
- Cosmic shear becoming interesting with the growing data set. Full blinding implemented!
- Modified gravity tests in combination with 2dFLenS.