Multidark Lightcones Status

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Lensing and galaxy mocks in the same lightcone

Based on BigMultidark simulation

- DM only with Planck cosmology ($\Omega_m = 0.31$)
- 2.5 Gpc/h periodic box and 3840^3 particles
- 80 snapshots from z = 10 to z = 0 (69 below z = 1)
- Mass range of halos 4.7×10^{11} to 6×10^{15} Msun/h
- Force resolution 10 kpc/h (lowz) and 30 kpc/h (highz)
- Halo catalogs extracted with BDM and FoF

Box remapping code (Carlson&White2010)

## Lensing ray tracing with GLAMER (Metcalf et al. 2013, Petkova et al. 2013)

HOD Galaxy clustering with peculiar velocities (de la Torre & Peacock 2013)

$\Rightarrow$ Overlapping Lensing and Clustering mocks:

$\Rightarrow$ 54 LC of area 7x4 deg^2 up to z=2.3

$\Rightarrow$ 99 LC of area 5.5x1.6 deg^2 up to z=2.3

$\Rightarrow$ 4 LC of area 87x2.6 deg2 up to z=2
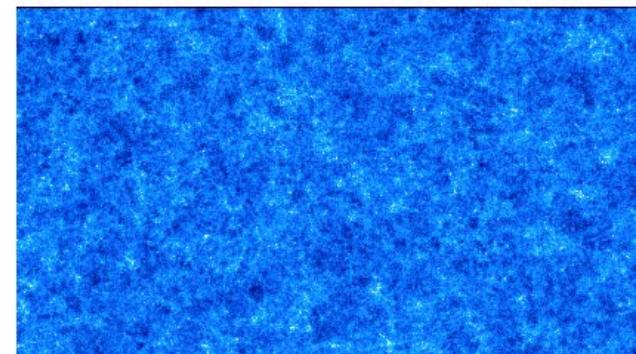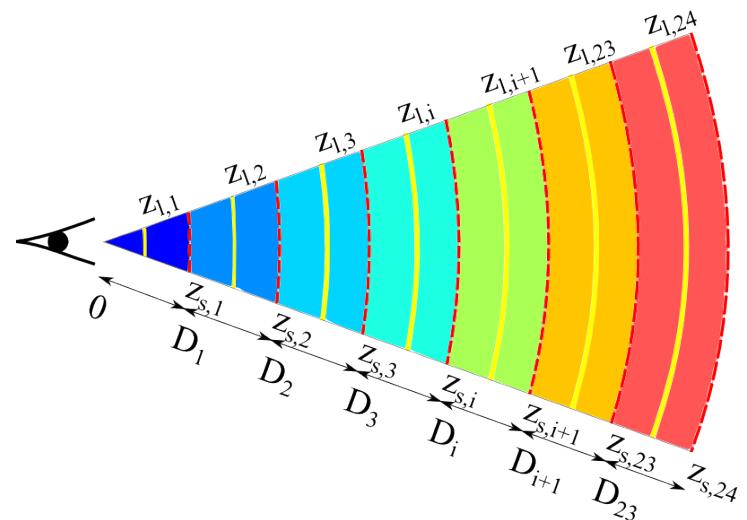
Lensing power spectrum
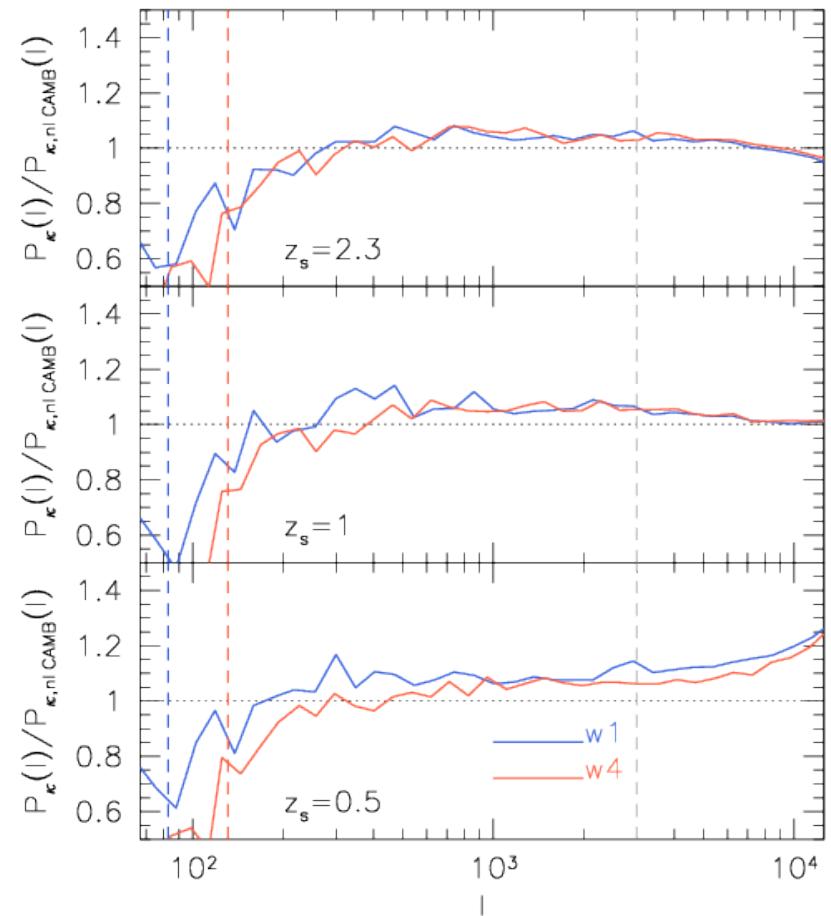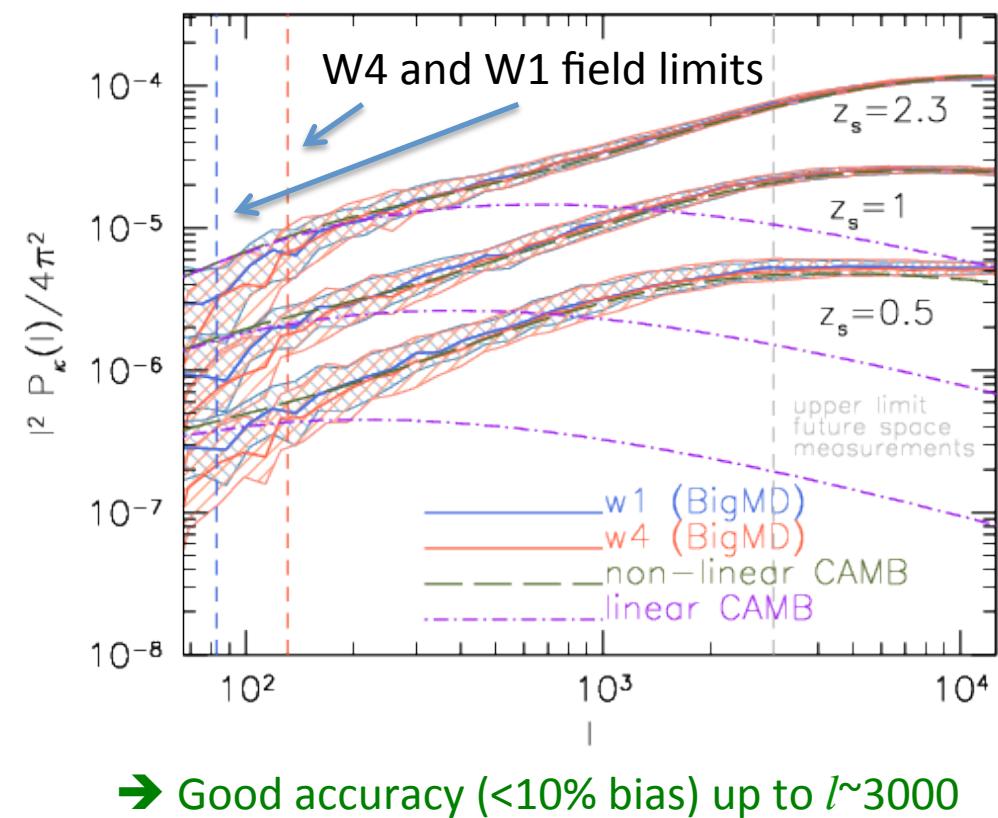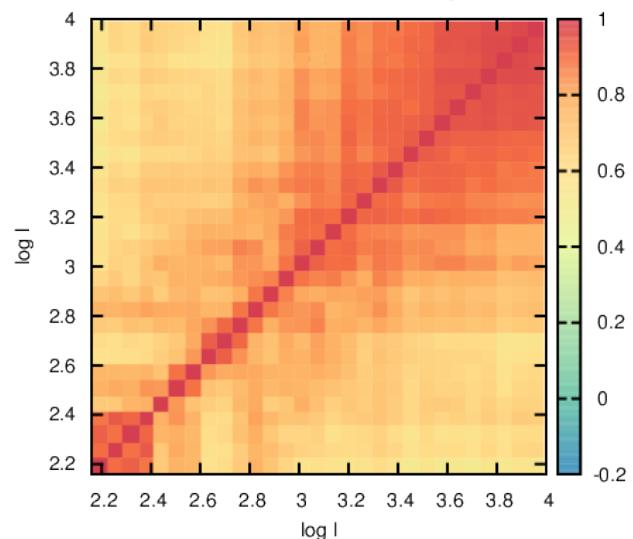
W4 and W1 field limits

$z_s = 2.3$

$z_s = 1$

$z_s = 0.5$

upper limit
future space
measurements

w1 (BigMD)
w4 (BigMD)
non−linear CAMB
linear CAMB

➔ Good accuracy (<10% bias) up to l~3000

$l^2 P_\kappa(l)/4\pi^2$

$P_\kappa(l)/P_{\kappa, nl\ CAMB}(l)$

$z_s = 2.3$

$z_s = 1$

$z_s = 0.5$

w1
w4
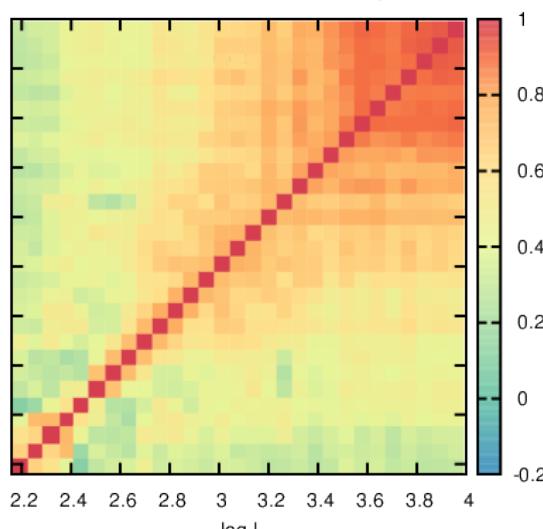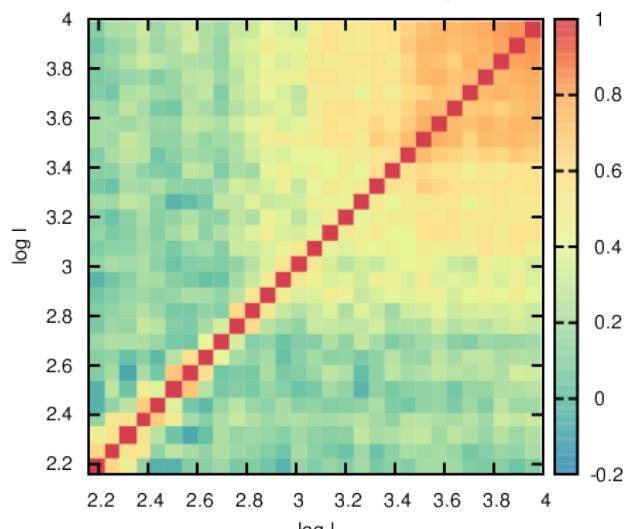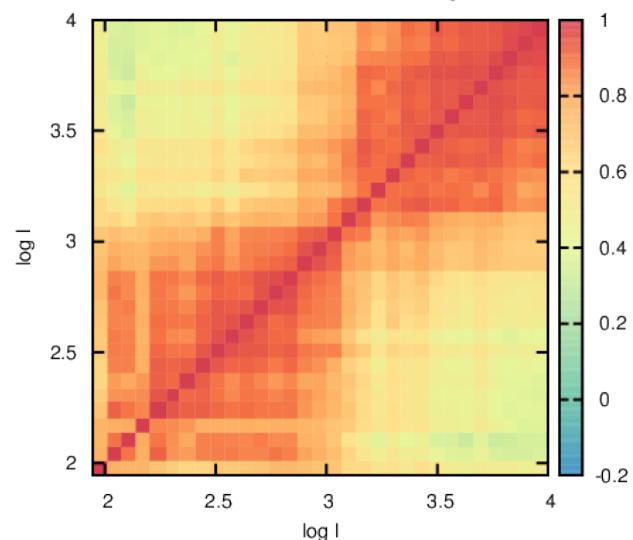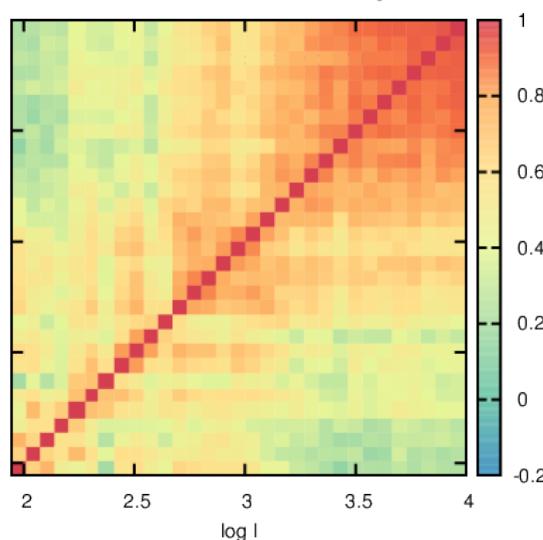
Covariance matrices on $P_\kappa(l)$
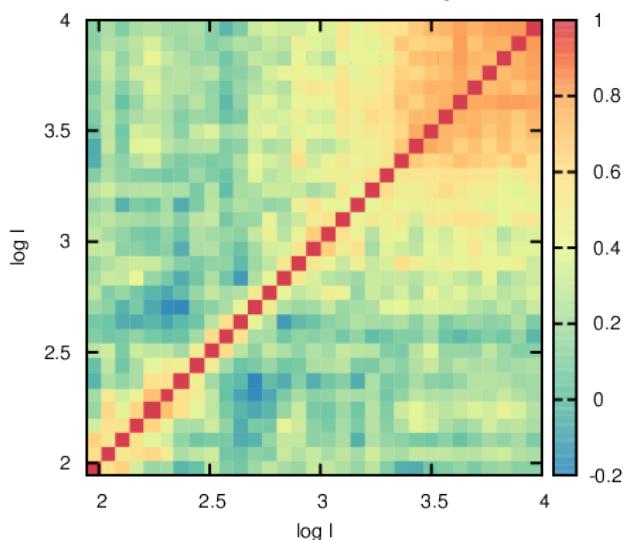
Lensing statistics checks

Halo lensing

Simulated n(z) from CFHTLens for the sources

Lensing measurements
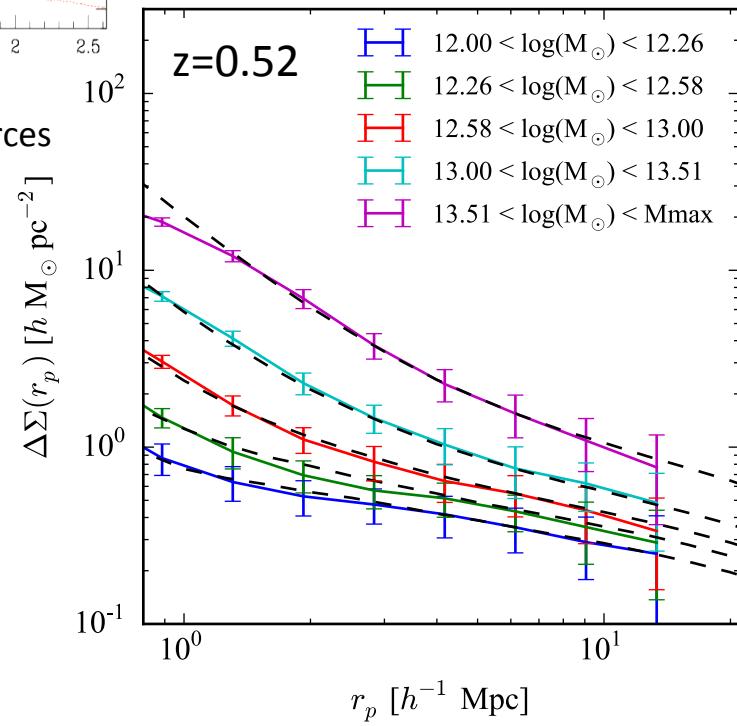
Equivalent density projection
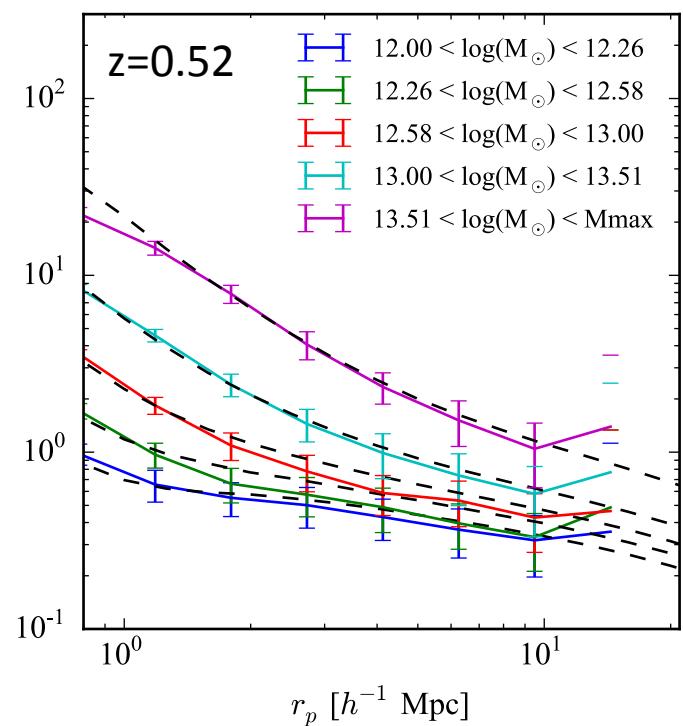
➜ Well reproduced with standard HOD model (van den Bosch 2013)
➜ We verify that our lensing measurements are unbiased estimators of the underlying matter density

Impact of the map resolution
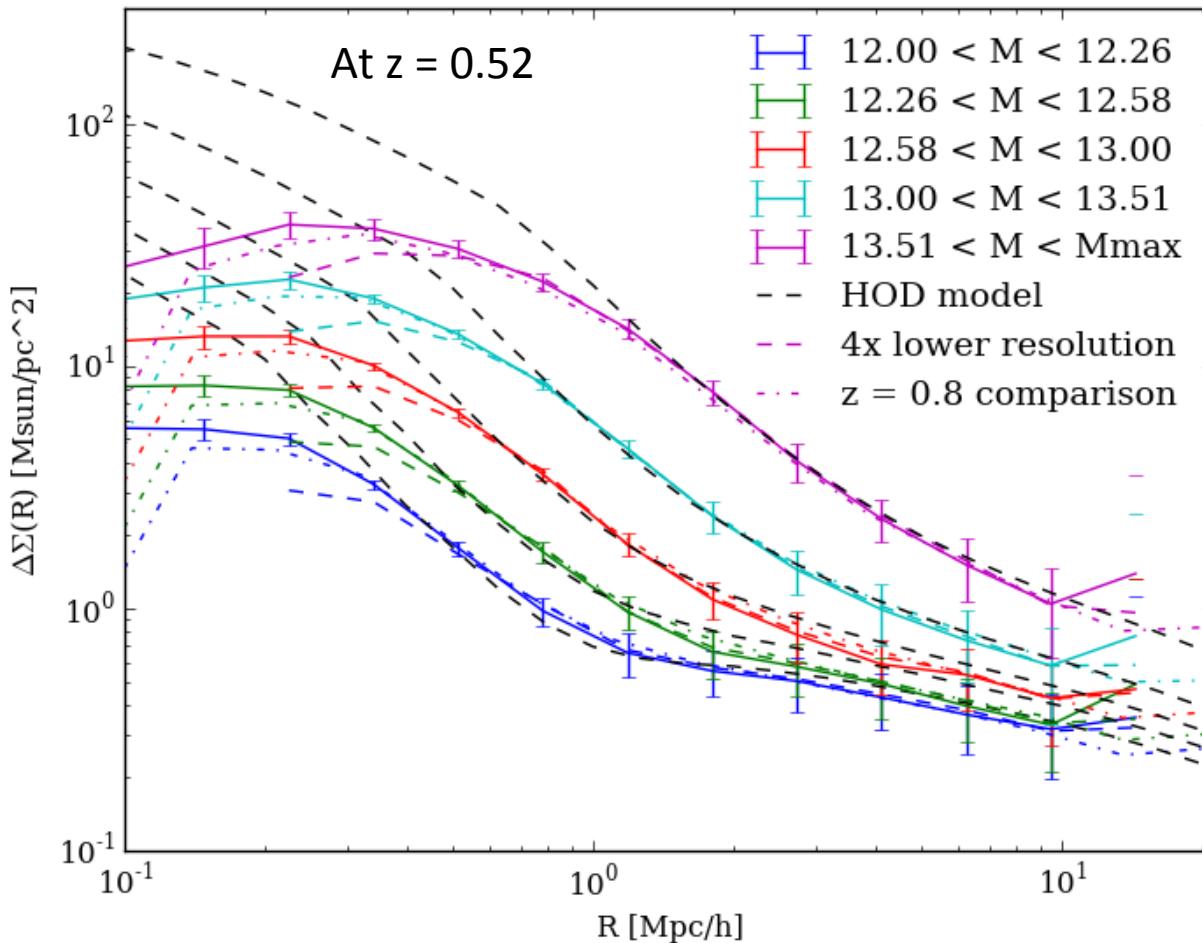

→ Map resolution effect starting below R~0.3Mpc/h
→ Halo mass dependent mismatch with theory

Halo lensing covariance matrices


Low mass halos

High mass halos

z=0.8
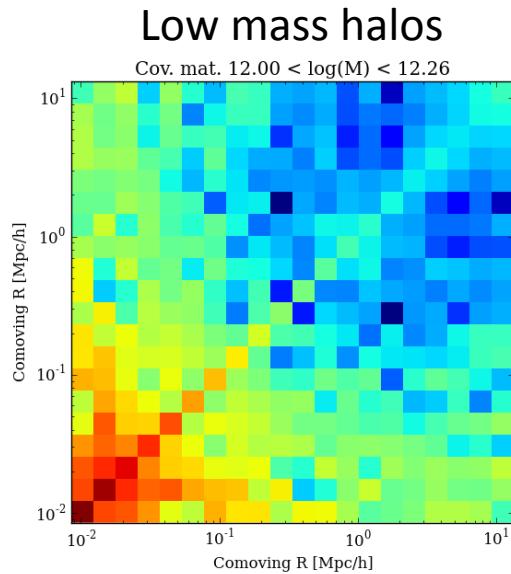
z=0.52
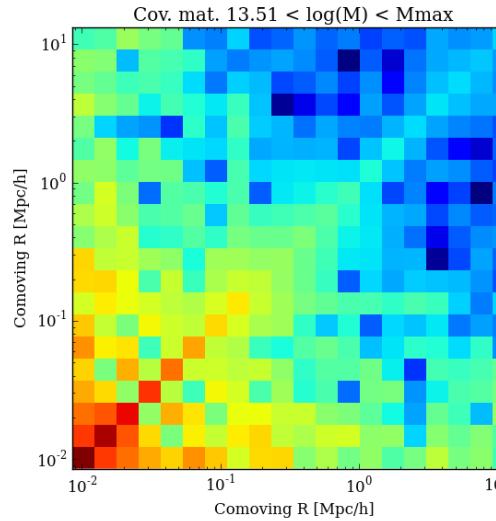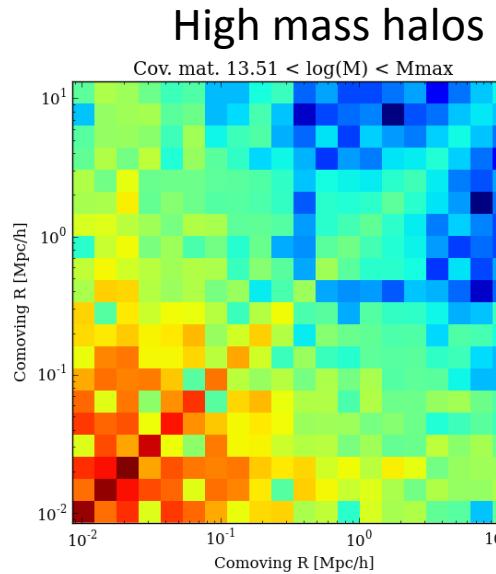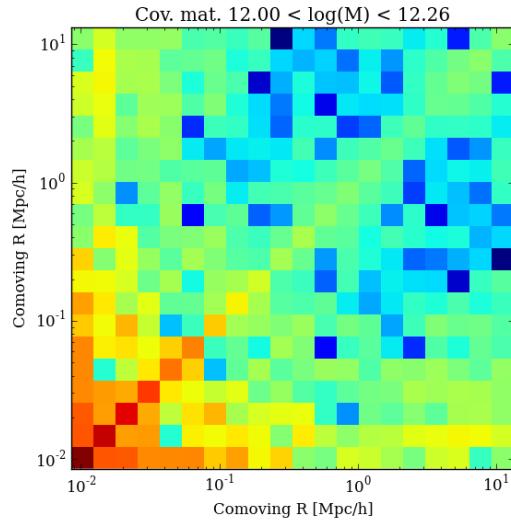
VIPERS covariance matrices

HOD model taken from de la Torre et al. 2013

Without WL shape noise
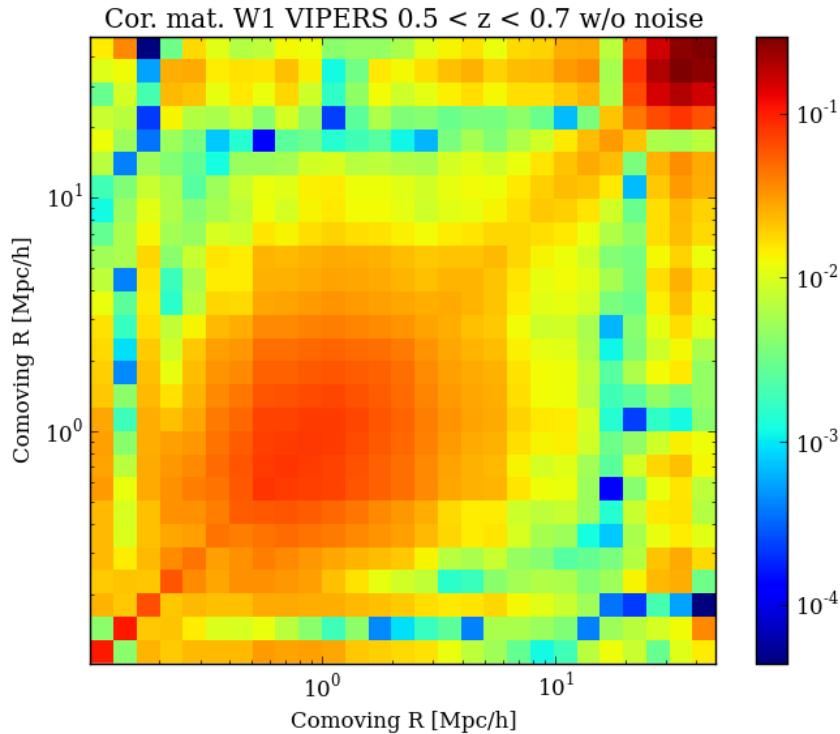
With WL shape noise
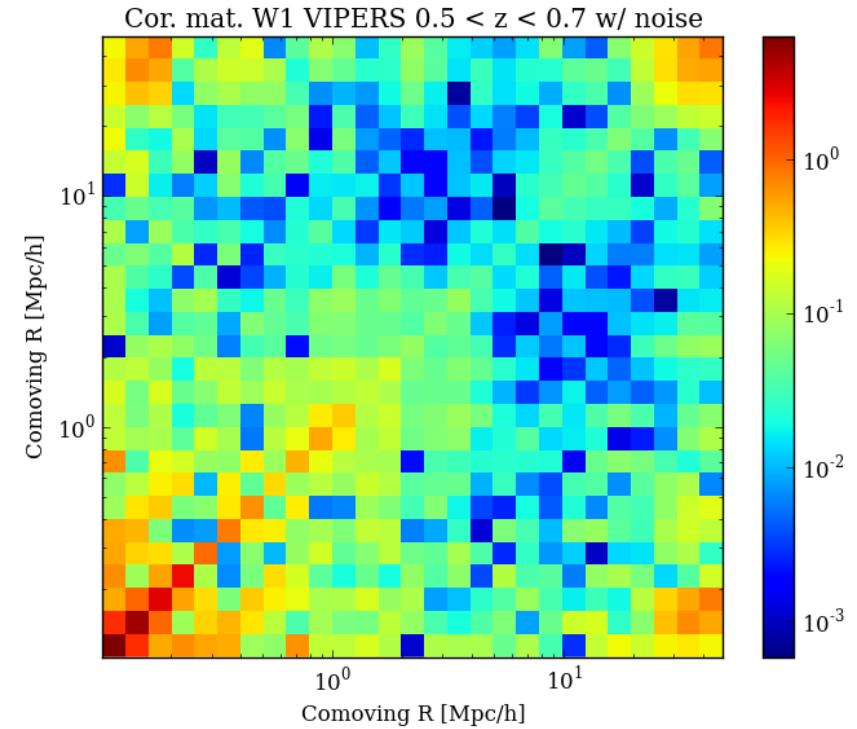
➜ We need more mocks to decrease the noise

Future projects

- With

VIPERS – W1 fields

Realization 1 (shear and convergence maps)

All realizations (54) (shear and convergence maps):
1-9 10-19 20-29 30-39 40-49 50-54

Lensing Catalogue for the realization 1 (8 random samples of the field of view)

Lensing Catalogues for all realizations (54 x 8) — each field of view and source redshift distribution are randomly sampled 8 times
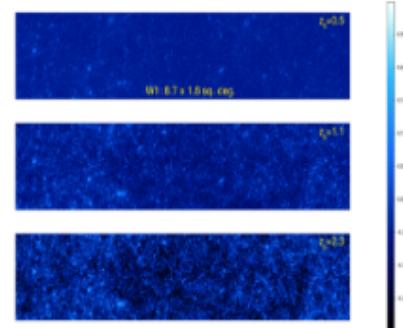
Power Spectra all source redshifts and realizations

Halo Catalogs

VIPERS – W4 fields

Realization 1 (shear and convergence maps)

All realizations (99) (shear and convergence maps):
1-9 10-19 20-29 30-39 40-49 50-59 60-69 70-79 80-89 90-99

Lensing Catalogue for the realization 1 (8 random samples of the field of view)

Lensing Catalogues for all realizations (99 x 8) — each field of view and source redshift distribution are randomly sampled 8 times
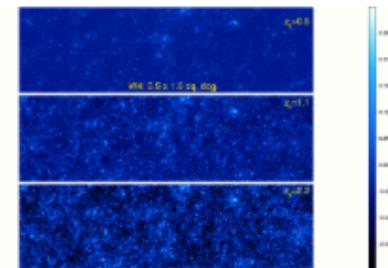
Power Spectra all source redshifts and realizations

Halo Catalogs

Stripe82 – coming soon

- Lightcones uploaded on the Bologna lens Factory website for public access

https://bolognalensfactory.wordpress.com/home-2/multdarklens/

- Acknowledgement to Giocoli et al. 2015

Future project

- CESAM is developing a web-service hosted by LAM to automatically produce lensing and clustering catalogs from a given redshift distribution
- We are working on producing catalogs for any field size without an N-body simulation (much faster and less resource intensive)

Conclusion

- We produced lensing lightcones from the BigMultidark cosmological boxes

- We extensively tested the lensing catalogs and found our measurements to be reliable down to scale R ~ 300 kpc/h

- We computed covariance matrices for halos, and we are also preparing for galaxy mocks (VIPERS, CMASS, etc)

- Covariance matrices are still noisy and we need to increase the number of lightcones