Homogeneity and isotropy in the 2MPZ photometric redshift catalogue

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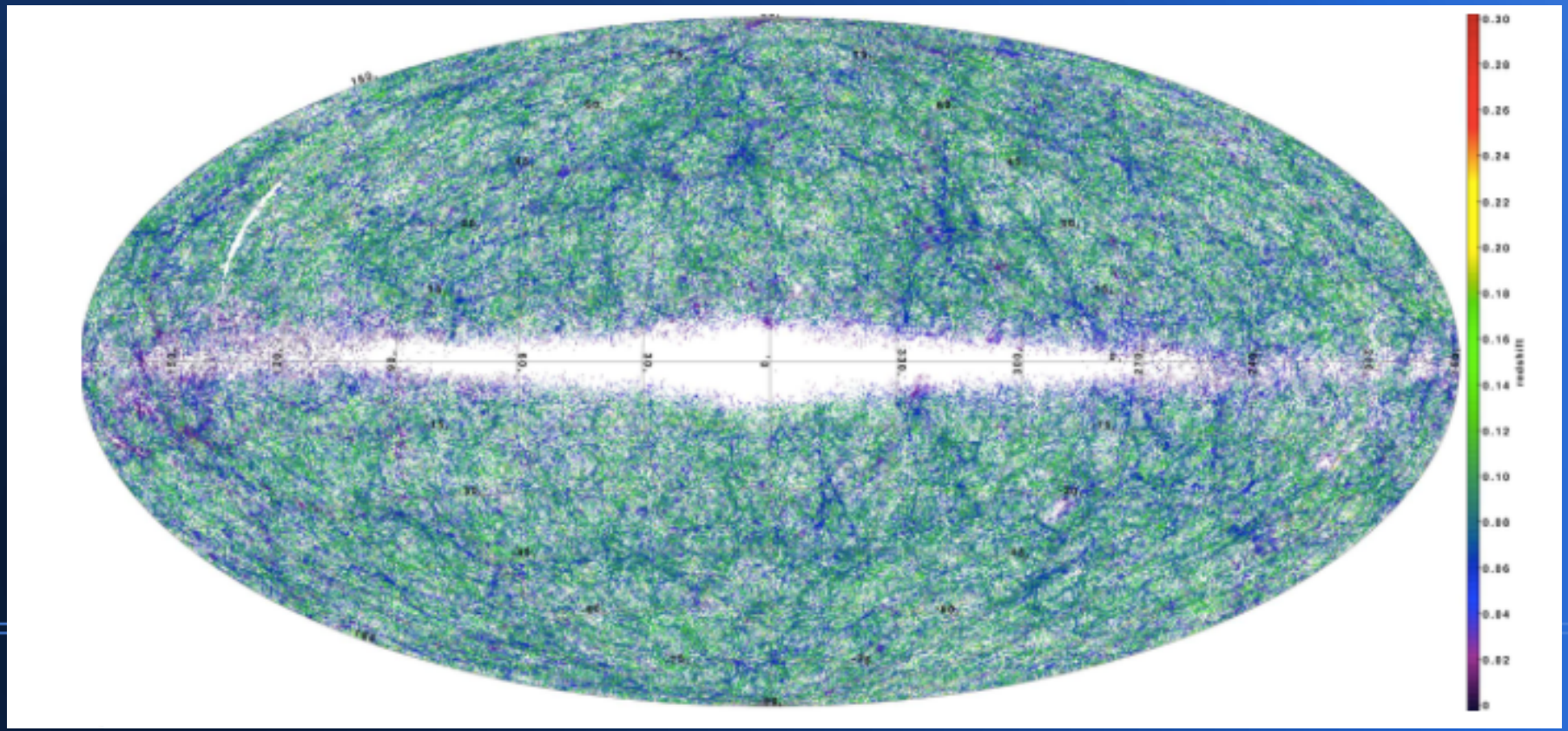
Introduction

- The standard model of cosmology is based on the Cosmological Principle
- Model independent technique to test it in photometric catalogs (Alonso et al., 2014, MNRAS 440, 10)
- 2MPZ good candidate to use this technique since big volume is needed

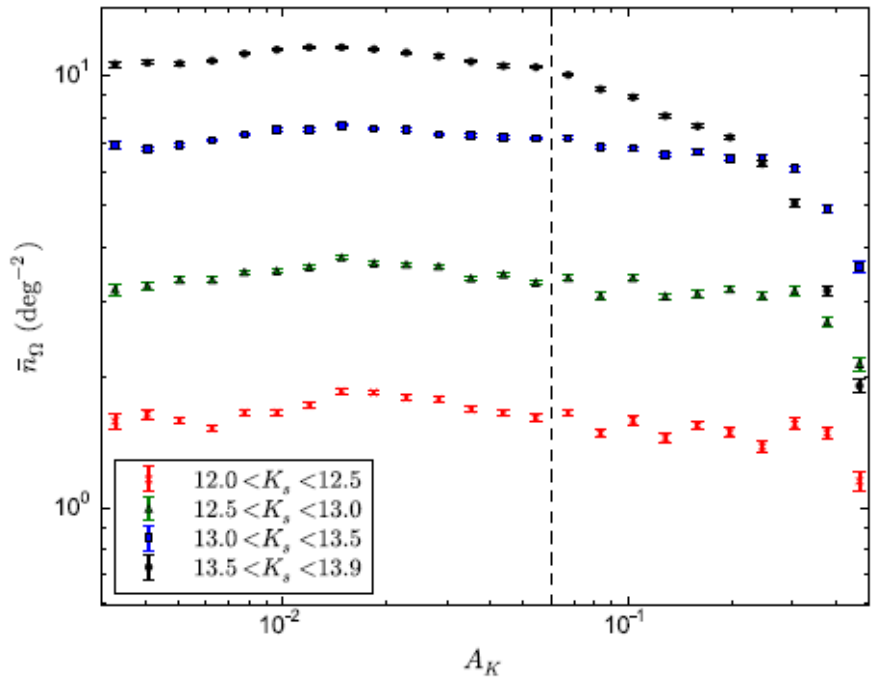
The data

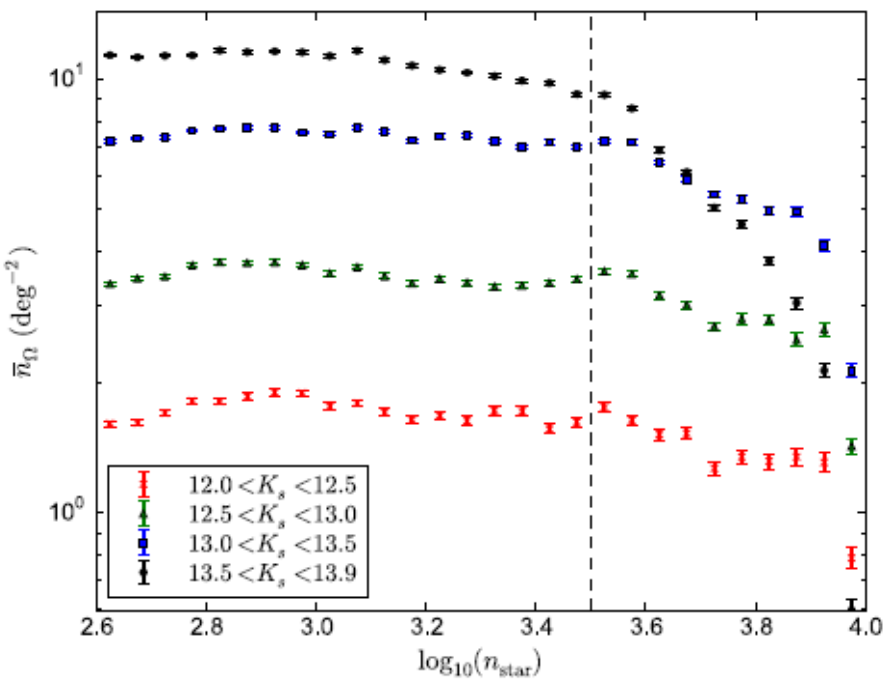
- 2MPZ (Bilicki et al 2013): First public all-sky photometric catalog
- 1 million galaxies K<13.9



The data

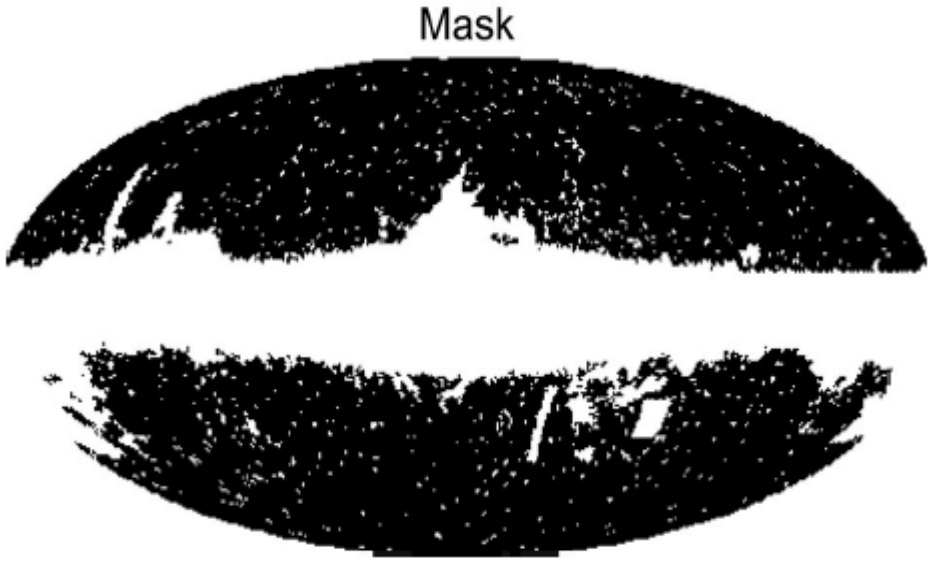
- 2MPZ: First public all-sky photometric catalog
- 1 million galaxies K<13.9
- Masking: Ak>0.6, log(ns)>3.5

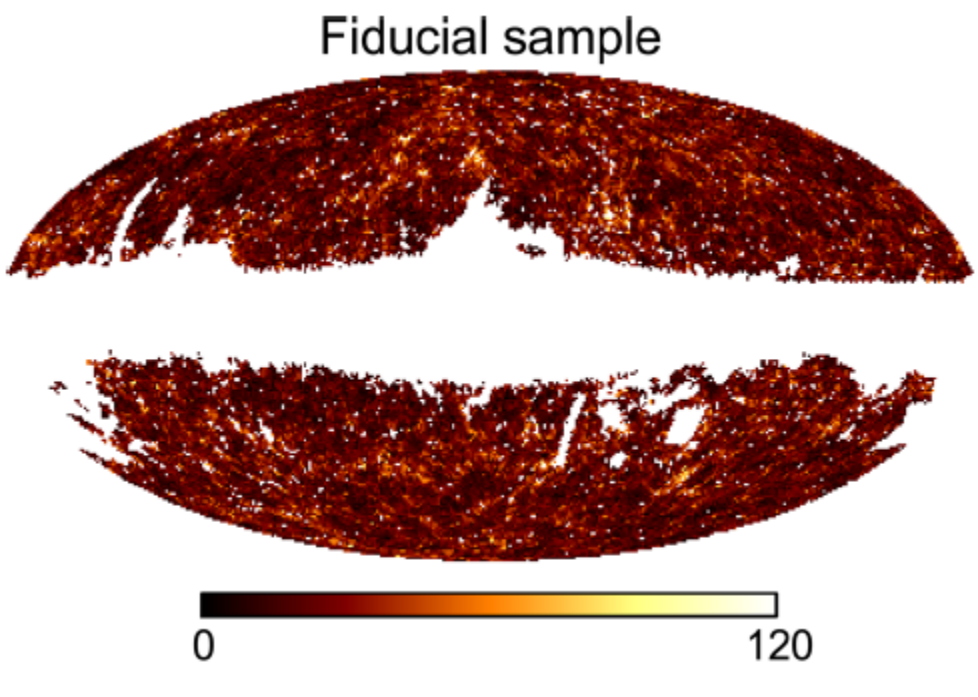




The data

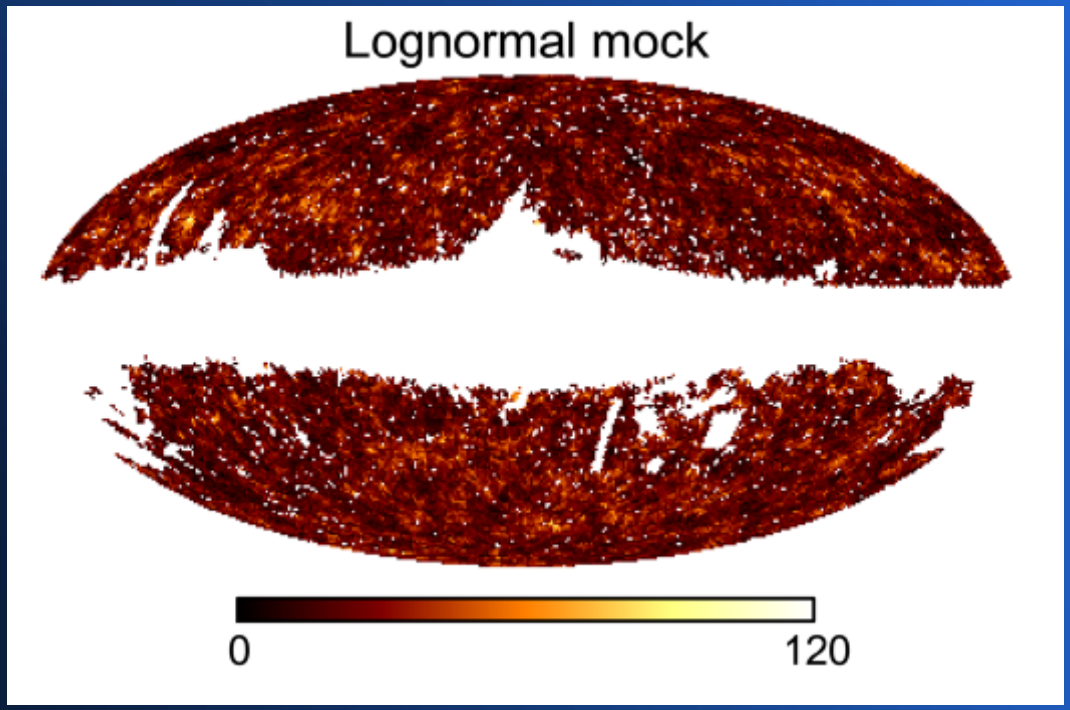
- 12 < K < 13.9. fsky=0.647. 628 kGals
- 2 redshift bins $0.03 \leq z < 0.08$, $0.08 \leq z \leq 0,3$





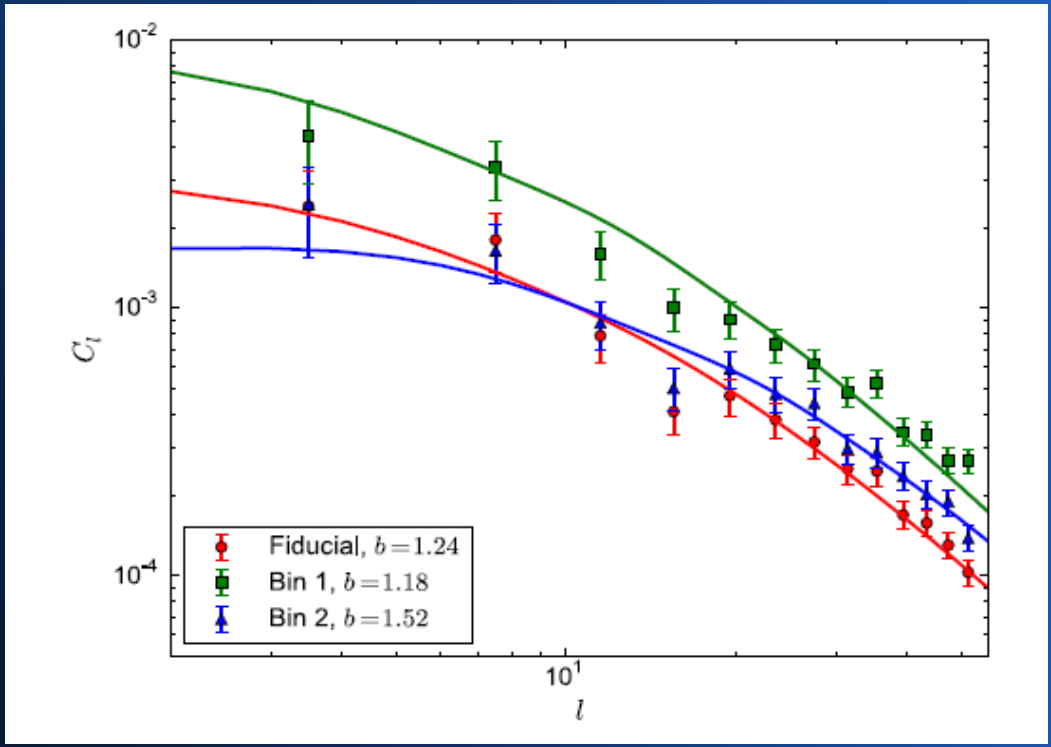
Creating mocks

- Generated 10000 lognormal catalogs with the same redshift distribution



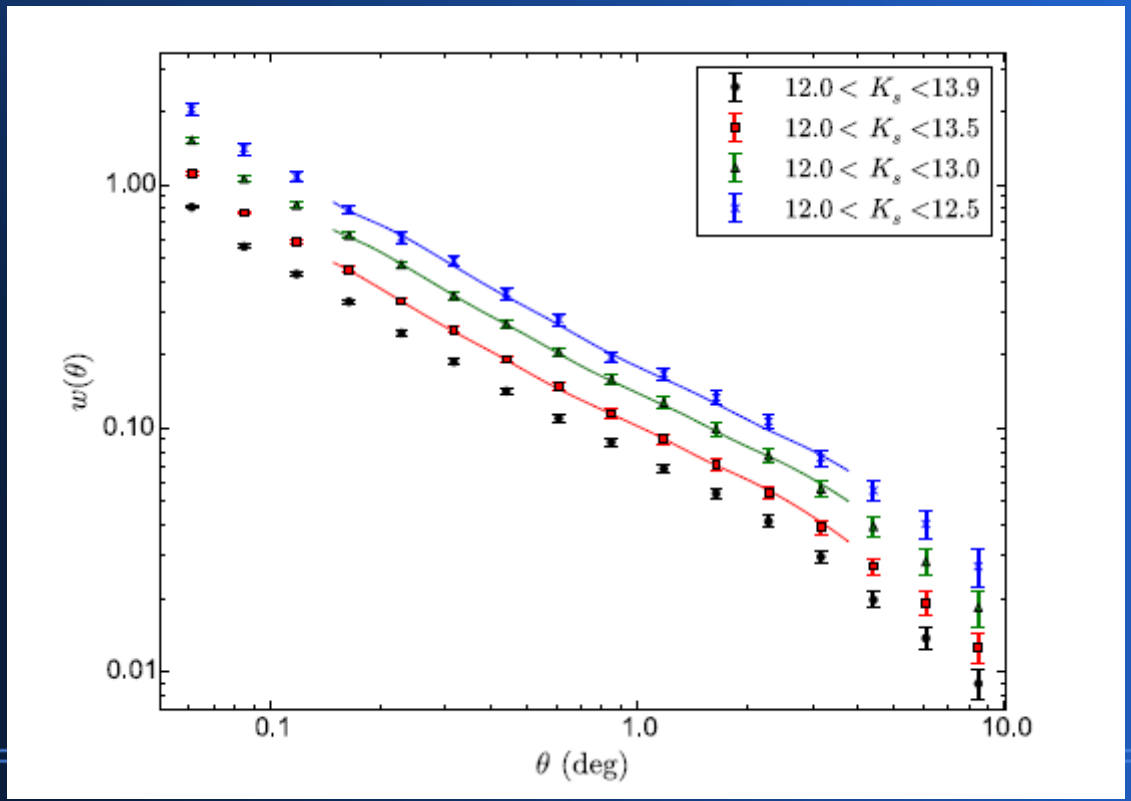
Creating mocks and estimating bias

- We estimate the bias and luminosity function to generate the mocks



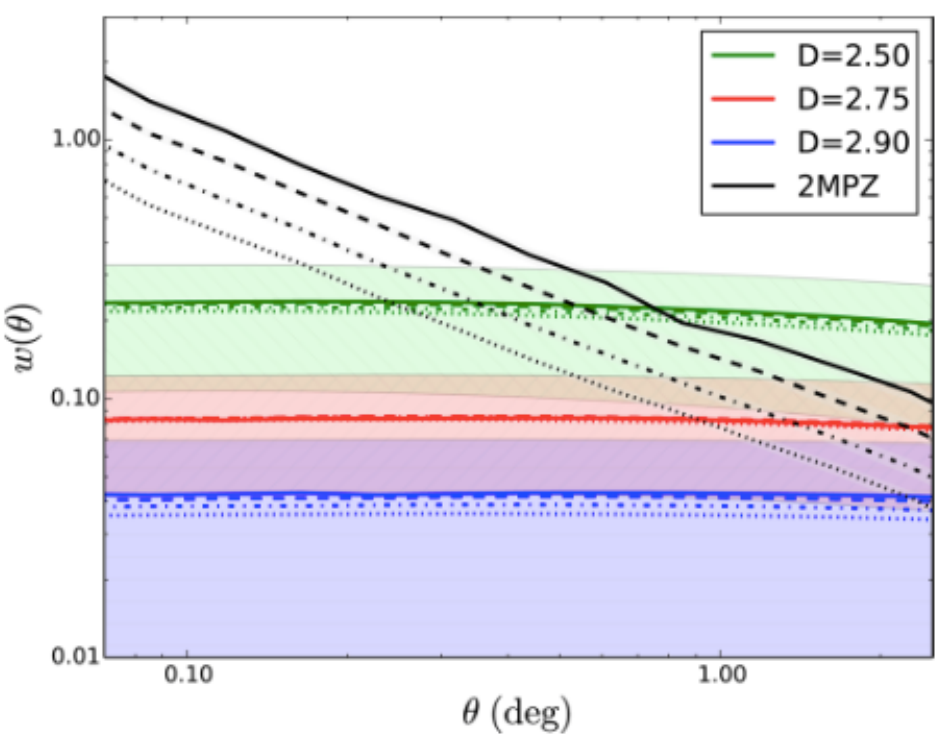
Scaling of the 2p-acf

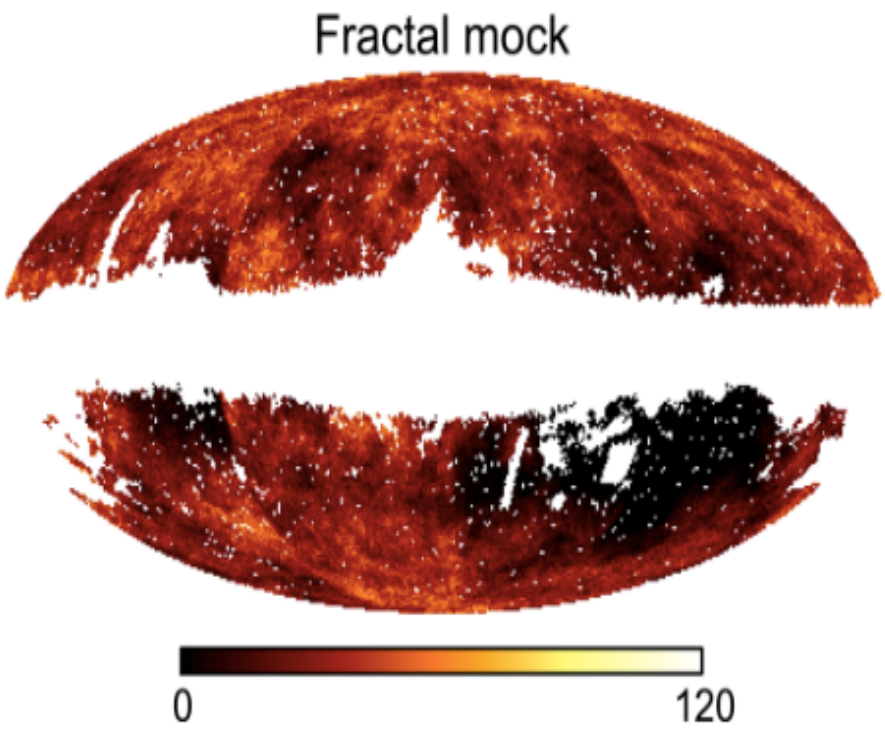
$$\omega(\theta, B) = \frac{W(B\theta)}{B}$$



Correlation function of fractal models

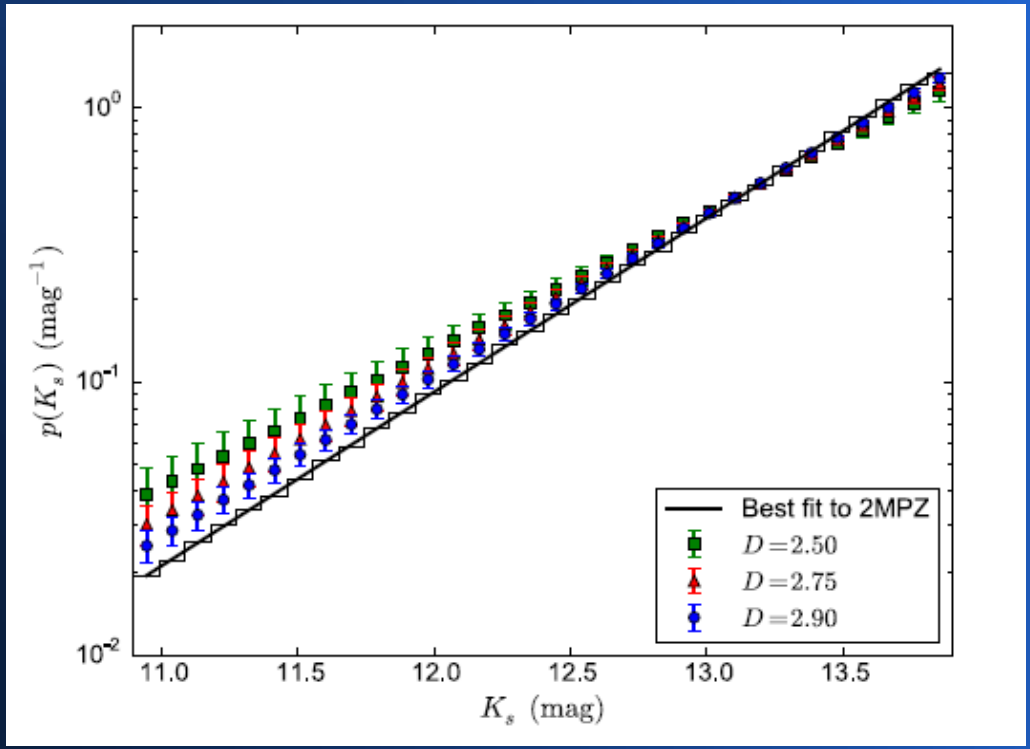
- We generated a suite of 100 mock catalogs with D=2.5, 2.75 and 2.9





Scaling relations

- β = 0.63 (Δβ=0.015) (β = 0.2D, D fractal dim)



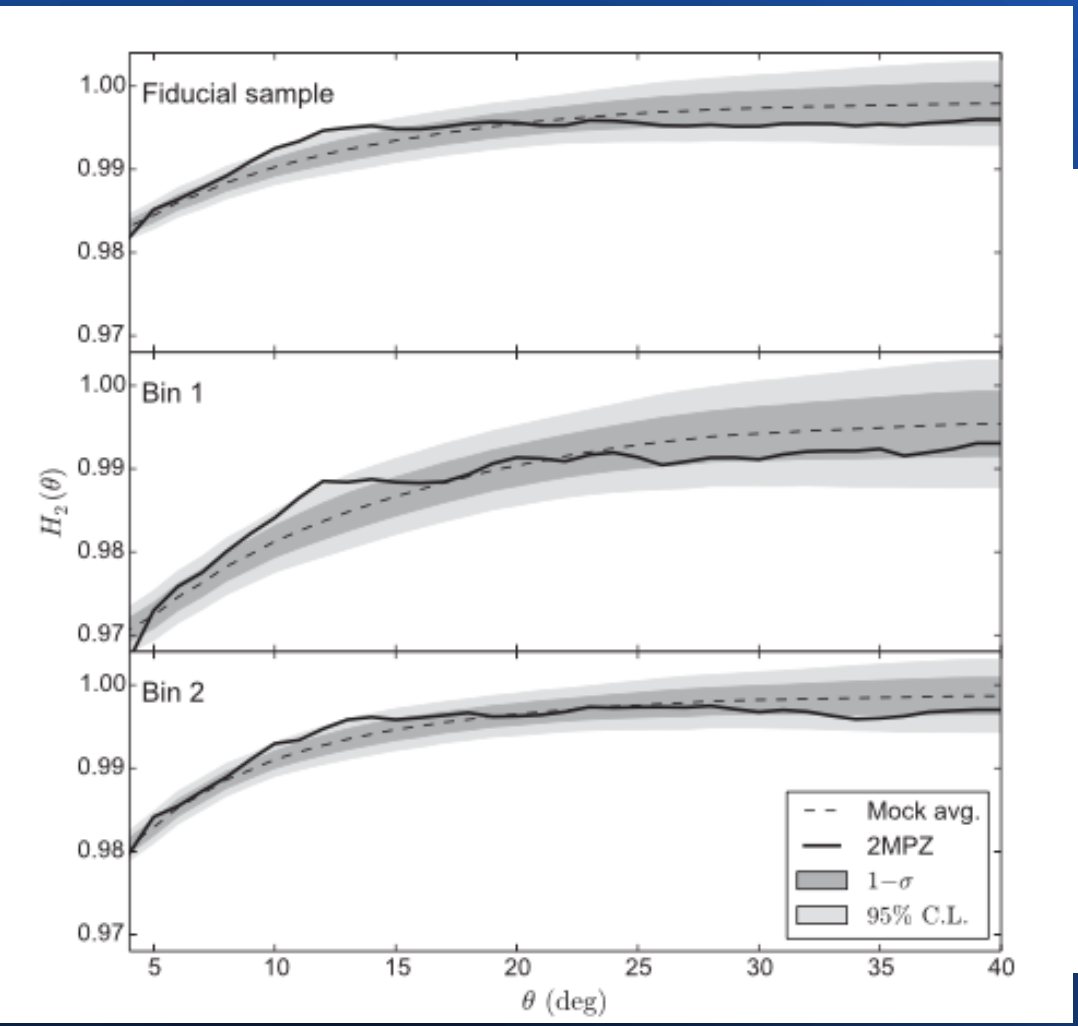
The angular homogeneity index

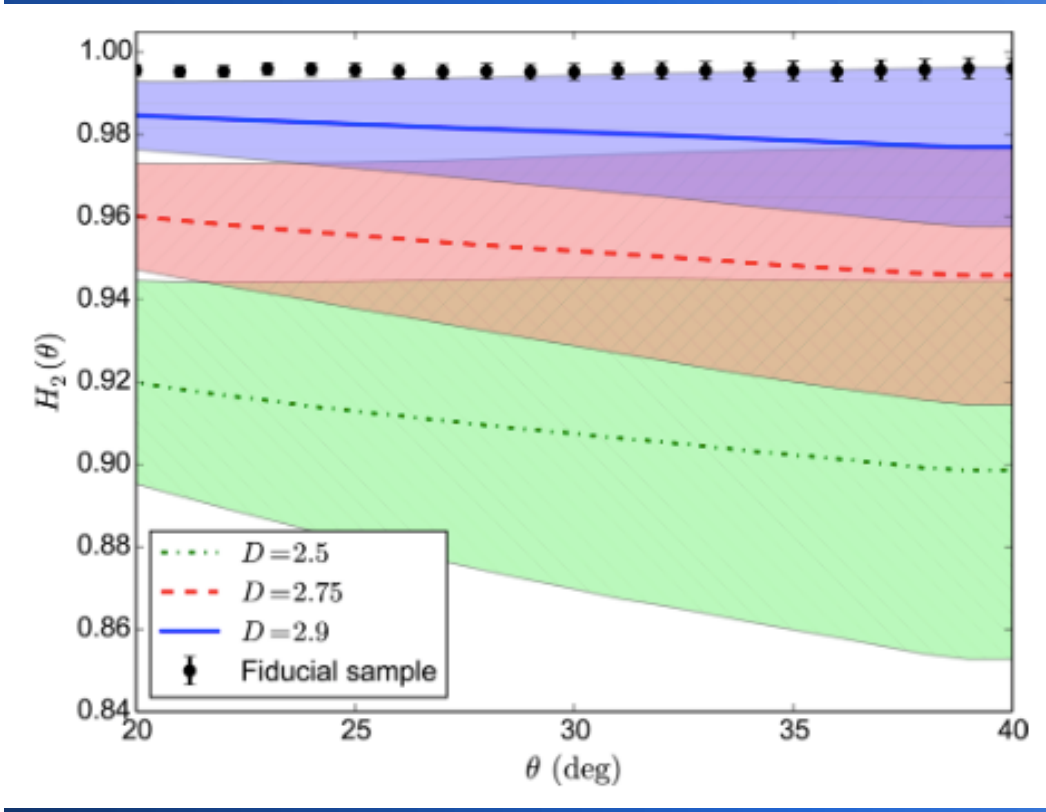
- We use the method presented in Alonso et al., 2014, MNRAS 440, 10
- Counts-in-spheres using a random catalog

$$G_2(\theta) = \bar{N}(\theta)\mathcal{N}(\theta) - 1$$

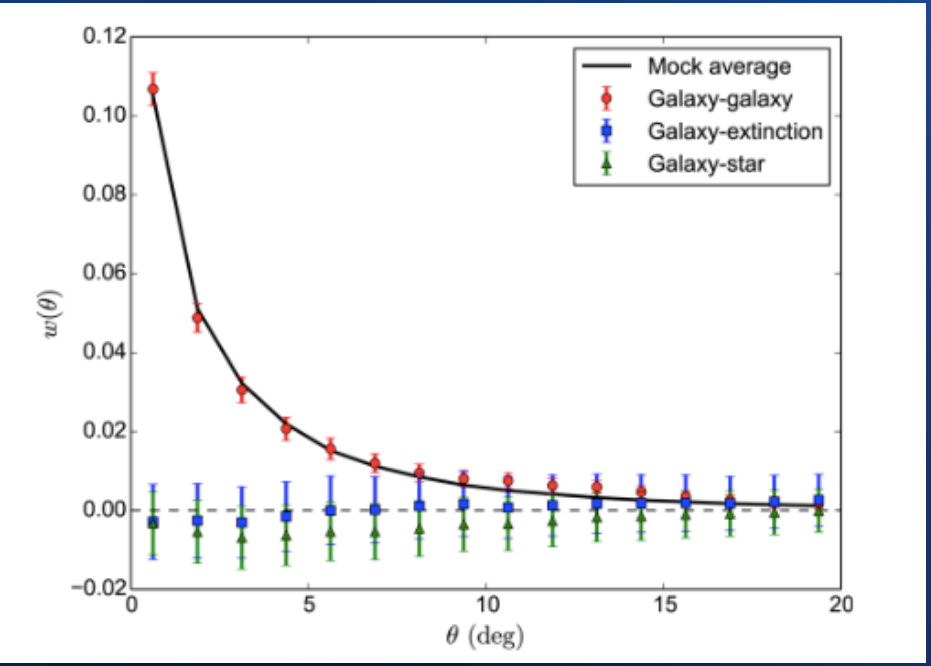
$$H_2(\theta) = \frac{d\log G_2(\theta)}{d\log V}$$

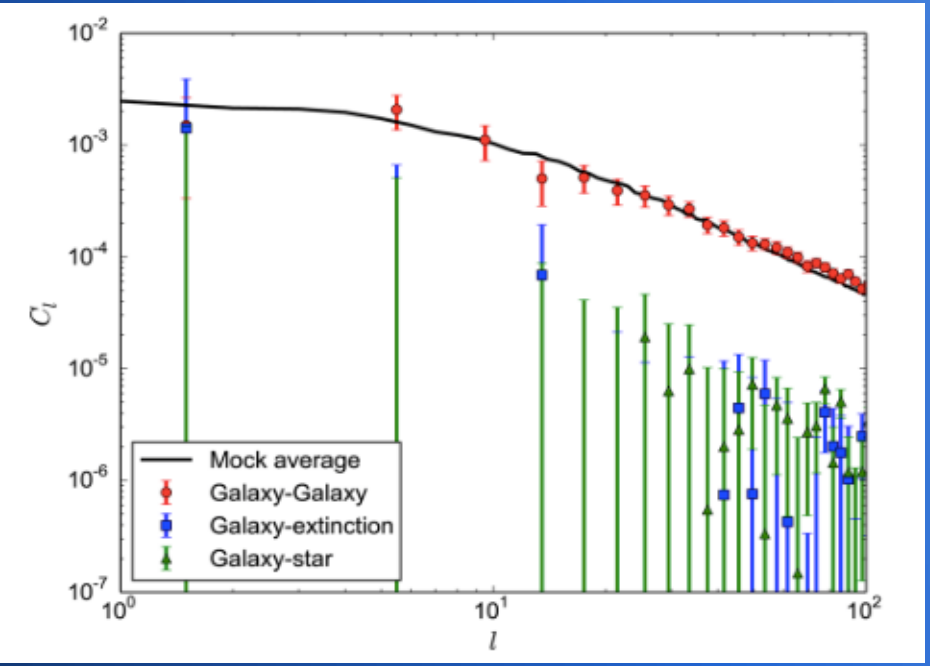
The angular homogeneity index



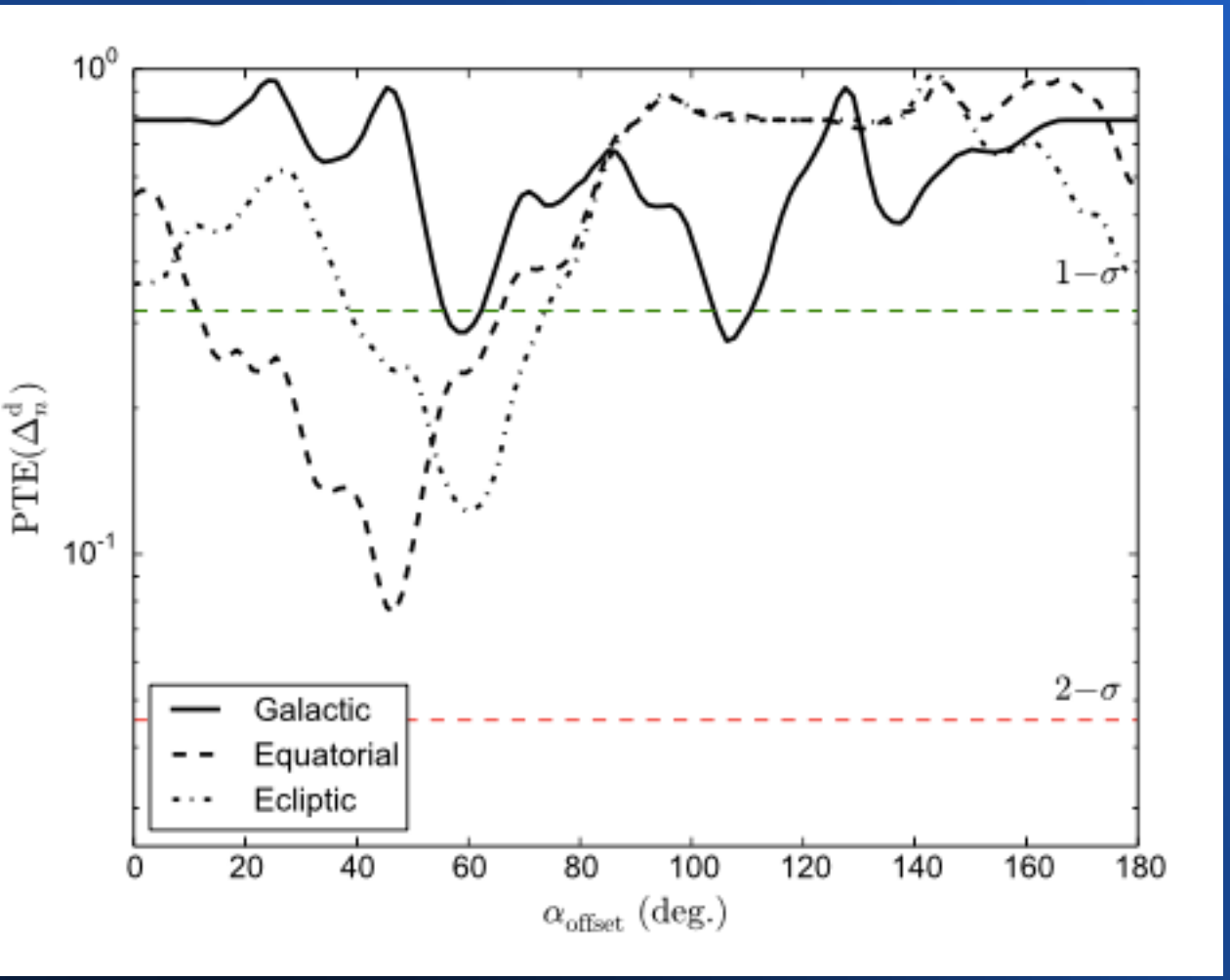


Clustering systematics



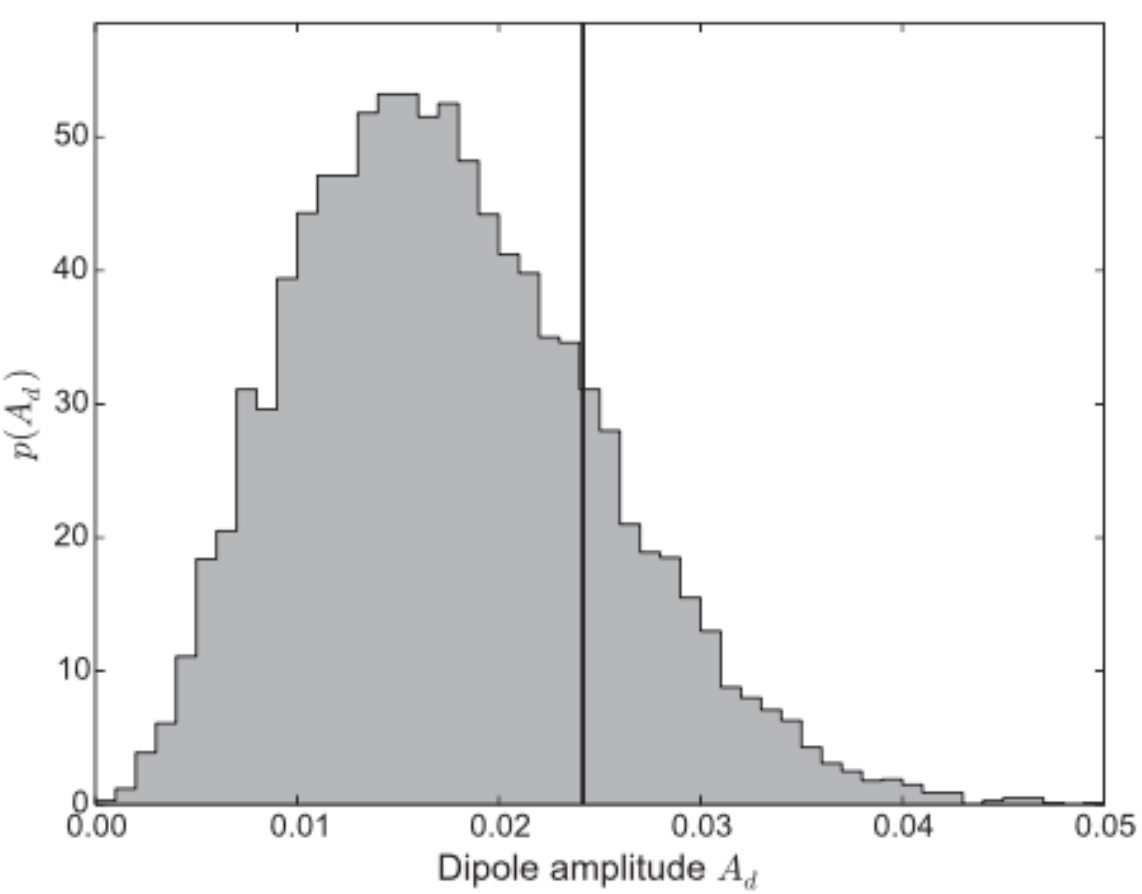


Hemispherical differences



$$\Delta_n = \frac{2|\bar{n}_\Omega^N - \bar{n}_\Omega^S|}{\bar{n}_\Omega^N + \bar{n}_\Omega^S}$$

Power of assymetries



We compute the variance of the overdensity field inside discs of 10º and 20º, subtract mean and fit the dipole. Repeat the process for 10000 lognormal mocks and compare. (1.5-sigma)

Conclusions

- Presented analysis of homogeneity using a model independent, unbiased estimator in a photometric catalog.
- Measurements of homogeneity in good agreement with the standard cosmological model (and in tension with D<2.75)
- Scaling laws for number counts and correlation function closely follow statistically homogeneous cosmology (tension for D<2.75)
- Dipole in the clustering variance of the data in the same direction [(l, b) ~ (310º, 5º)] as previous studies. But perfect agreement with the variance expected within L  CDM.
- Next steps: apply this methodology to WISE and DES