GALAXY CLUSTERING AND SYSTEMATICS WITH THE DARK ENERGY SURVEY YEAR 3 DATA

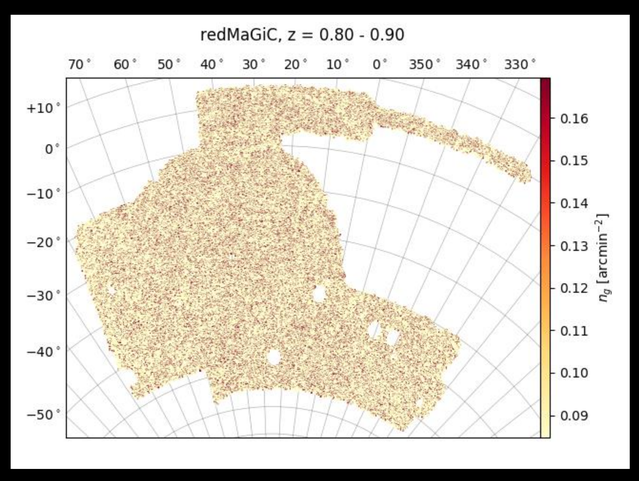
Martín Rodríguez Monroy, on behalf of the DES Collaboration....

THE DARK ENERGY SURVEY

INTRODUCTION

The Dark Energy Survey is an international collaboration whose main goal is to understand THE NATURE OF THE DARK ENERGY. To achieve this, it has performed a *6-year photometric survey from Cerro Tololo (Chile), covering around* 5000 square degrees of the southern sky up to magnitude i = 23.7 or redshifts of about 1.2. *One of the main probes for the Large-Scale Structure (LSS)* of the Universe is the GALAXY CLUSTERING, described by the two-point correlation function. Its *combination with weak lensing measurements has proven to provide* tight constraints on cosmological parameters.

The main sources of SYSTEMATIC ERROR for galaxy clustering are photometric redshift errors, observing conditions and astrophysical sources of contamination. In *order to obtain reliable cosmological information it is necessary to* perform a systematics mitigation and to validate the impact of these corrections....

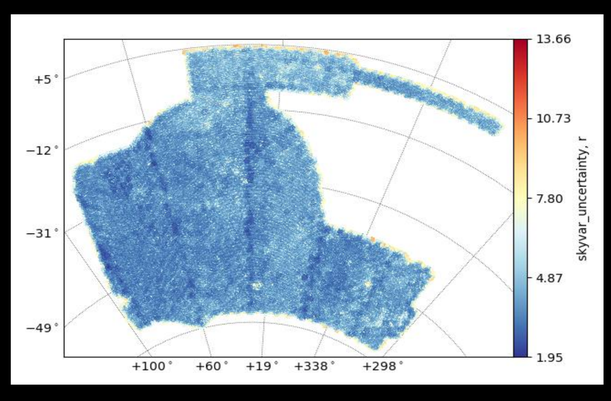


SAMPLES

- REDMAGIC: sample of Luminous Red Galaxies (LRGs) selected by the redMaGiC algorithm (E. Rozo, *et al.*, arXiv:150705460). This sample has HIGH QUALITY photo-z's. We analyze it in the redshift range z = 0.15 – 0.90
- MAGLIM: magnitude limited sample. Optimization of the lens galaxy selection and alternative to LRG samples. INCREASED DENSITY with reliable photo-z. Redshift range z = 0.20 – 1.05
- BAO SAMPLE: red galaxy sample optimized for the detection of the BARYONIC ACOUSTIC SCALE. Balance between density and photo-z precission. Redshift range z = 0.60 – 1.10
- MOCK CATALOGS: log-normal mock realizations. We created 1000 of them for each galaxy sample. These mocks help us to identify the main contaminants and to perform validation tests

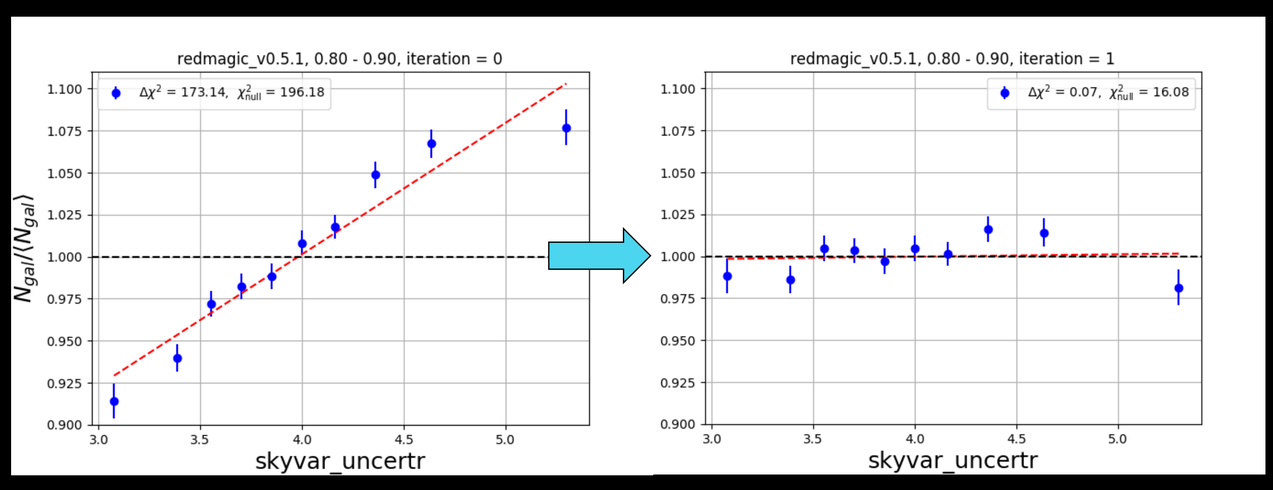
SURVEY PROPERTY MAPS

- SURVEY PROPERTY (SP) MAPS: healpix maps that track the spatial variations of a certain statistic concerning the IMAGING CONDITIONS of the survey across the sky
- For each observing condition there are different statistics that characterize them. We also consider a galactic extinction and a stellar density map, making 102 MAPS in total!
- Many of them are correlated, so we reduce their number using correlation matrices
- We go from 102 maps to 34 representative SP maps



SYSTEMATICS MITIGATION

I. Fix a significance THRESHOLD for the contamination
II. Identify the MOST SIGNIFICANT SP map
III. Fit the relation n_{obs} = F(SP)
IV. Derive a WEIGHT MAP as w = 1/F(SP)
V. Apply the weight map to the data
VI. Re-evaluate the significance of the SP maps
VII. Repeat iteratively until convergence is achieved
VIII. FINAL WEIGHT MAP = product of individual weight maps
IX. Apply this final weight map to the data

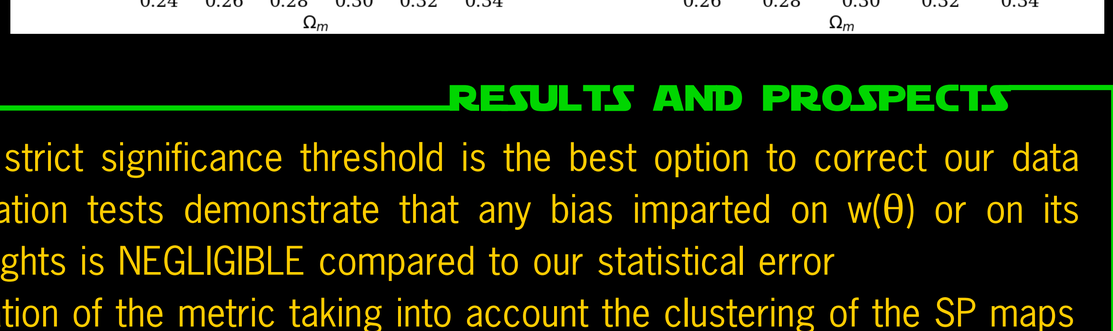


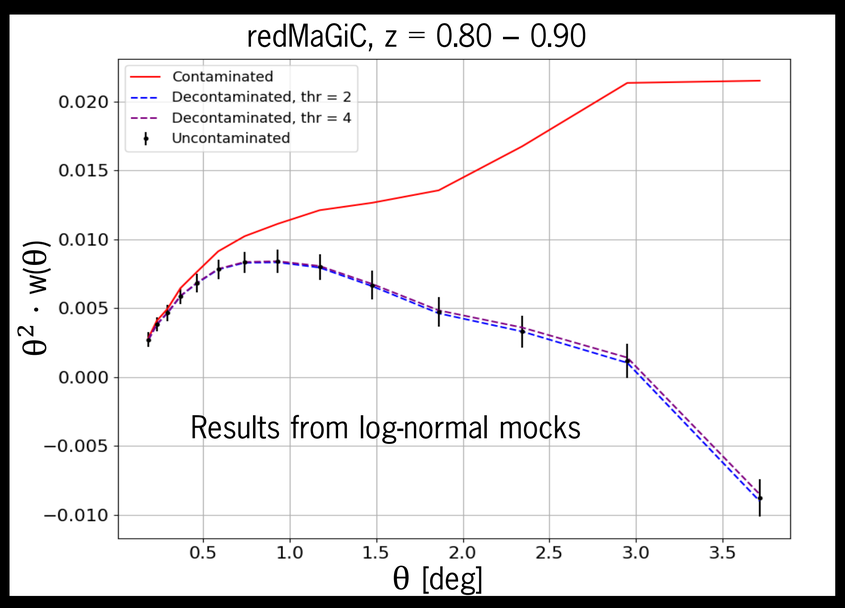
ROBUSTNESS OF THE WEIGHTS

In order to ensure that our correction method does not induce BIASES neither on w(θ) nor on its covariance, we performed VALIDATION tests:

- ESTIMATOR bias: do weights combined with w(θ) introduce a bias?
- FALSE CORRECTION bias: do we correct for some SP maps just by chance?
- RESIDUAL SYSTEMATIC bias: do we leave some contamination uncorrected?
- Impact on COVARIANCE: do weights impact the covariance of w(θ)?

redMaGiC, z = 0.80 – 0.90 MagLim, z = 0.95 – 0.15





RESULTS AND PROSPECTS

- We determine that a strict significance threshold is the best option to correct our data completely. Our validation tests demonstrate that any bias imparted on w(θ) or on its covariance by the weights is NEGLIGIBLE compared to our statistical error
- We study a generalization of the metric taking into account the clustering of the SP maps
- IN SUMMARY, we have validated the weights, the methodology and the metric itself, showing that our results are ROBUST and that the systematic uncertainty is smaller than the statistical error
- Covering larger areas reduces the statistical uncertainty, so the characterization and MITIGATION OF SYSTEMATIC ERRORS are becoming an increasingly important task for DES and for the coming surveys

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The 9th KIAS Workshop on Cosmology and Structure Formation
November 2nd-6th, 2020

Contact: martin.rodriguez@ciemat.es / monroy.ciemat@gmail.com