Update on kSZ related activities

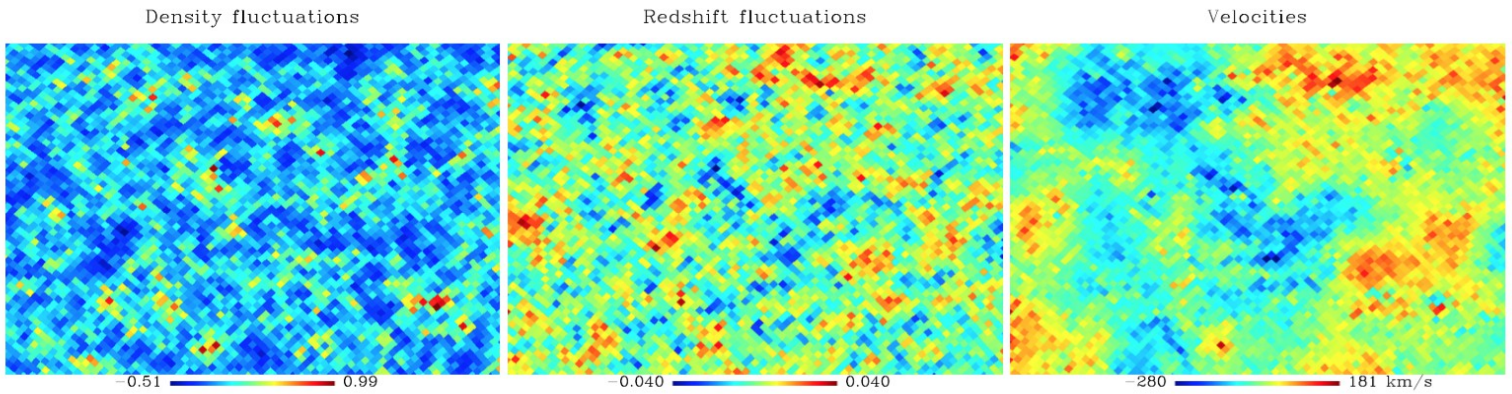

Figure 1. Cartesian projection of density fluctuations, ARF, and radial peculiar velocities on left, middle, and right panel, respectively. The size of each maps is 35x25 deg^2 and they show data from one of our lightcone simulations. Even by eye, we can see that ARF and peculiar velocities are correlated on scales of the order of a few degrees.

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[CEFCA]

Orsay, March 22nd 2019

OUTLINE

- Exploring the correlation between kSZ and Angular Redshift Fluctuations (ARF). Current results for 6dF, SDSS Galaxies and QSOs (thanks to Jonás Chaves-Montero)
- Activities ongoing at Cornell University by Rachel Bean and Victoria Calafut

Angular redshift fluctuations (ARF)

- ARF are sensitive to the line-of-sight peculiar velocities of the matter probes (galaxies, QSOs, HI, etc)
- ARF are also sensitive to the radial gradient of the matter density field under the Gaussian redshift shell
- ARF are particularly robust against systematics impacting the number density of galaxies such as stellar background light, airmasses, or dust extinction

$$\bar{z} + \delta z(\hat{\mathbf{n}}) = \frac{\sum_{j\in p} W_j z_j}{\sum_{j\in p} W_j} = \bar{z} + \frac{\sum_{j\in p} W_j (z_j - \bar{z})}{\sum_{j\in p} W_j}$$

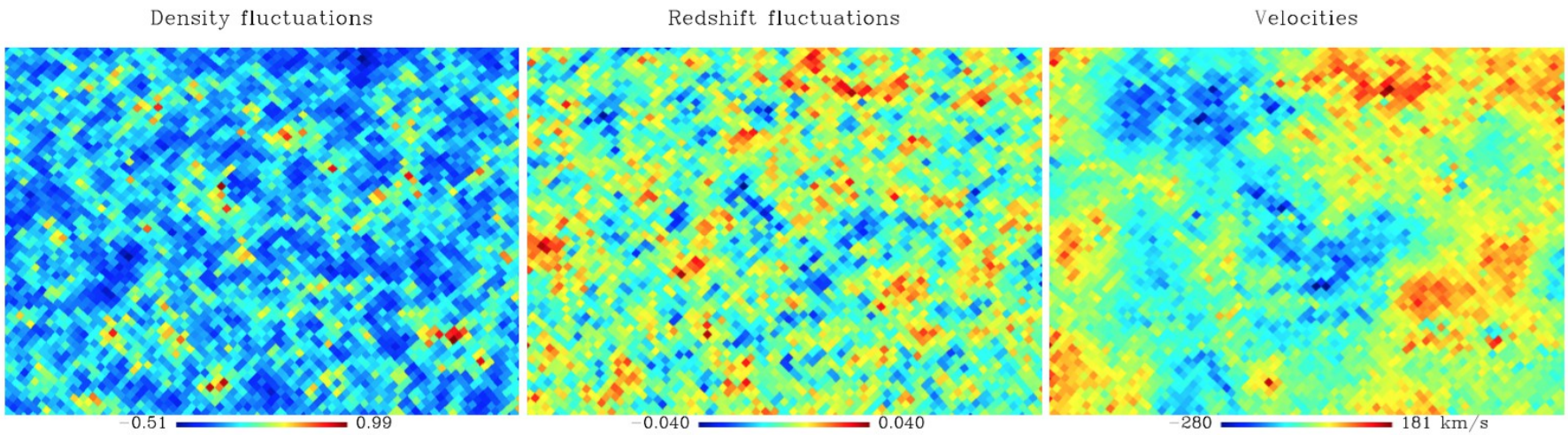
$$W_j = W(z_j;\sigma_z) \equiv \exp -\{(z_{\rm obs} - z_j)^2/(2\sigma_z^2)\}$$

CHM + (submitted)

Angular Density Fluctuations (ADF)

$$1 + \delta_g(\hat{\mathbf{n}}) = \frac{\sum_{j\in p} W_j}{\langle \sum_{j\in p} W_j \rangle_{\hat{\mathbf{n}}}}$$

Chaves-Montero + (in prep)



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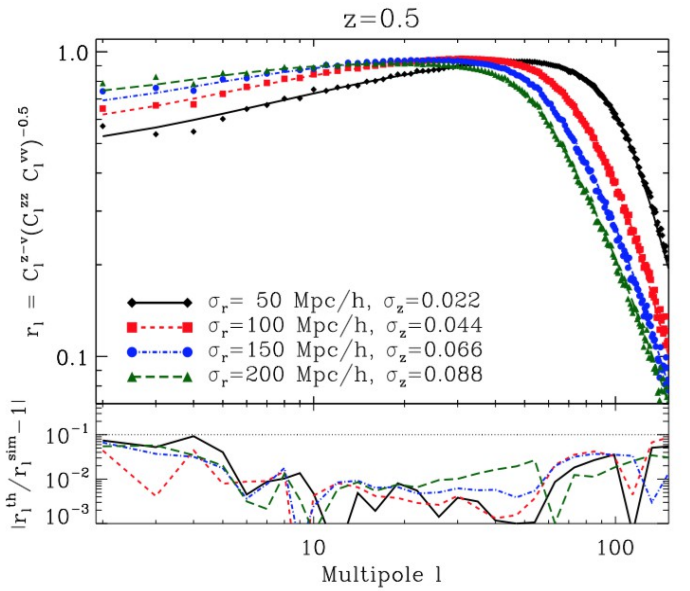
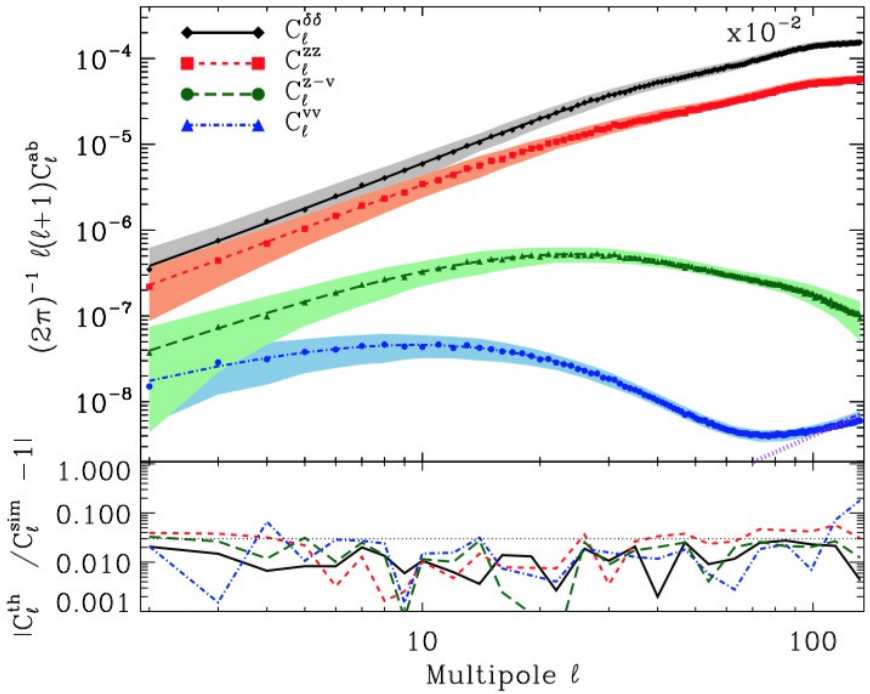
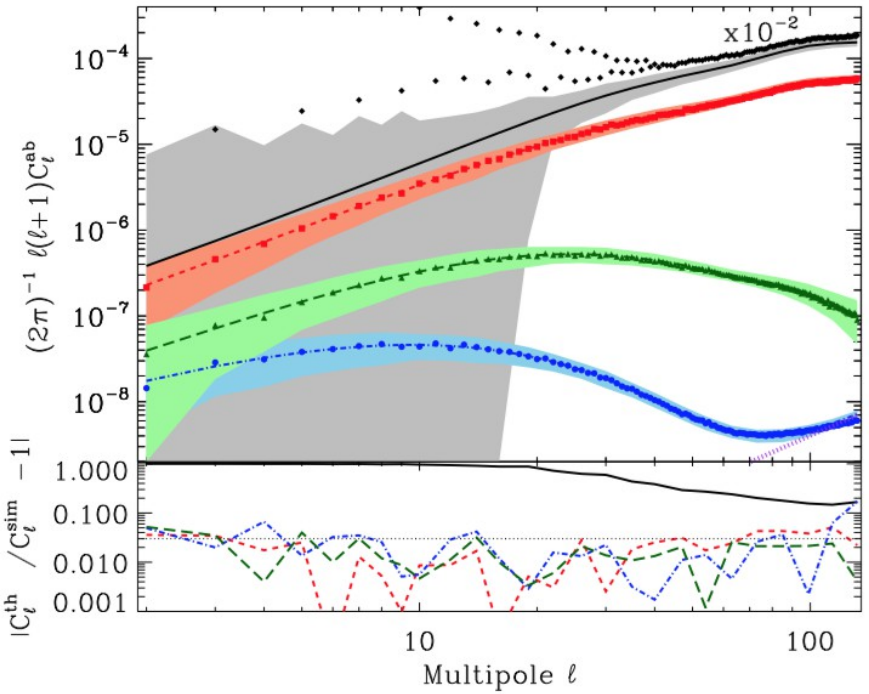


Impact of systematics (extinction) biasing the number density of galaxies/QSOs

Without extinction

With extinction given by *Planck's* map

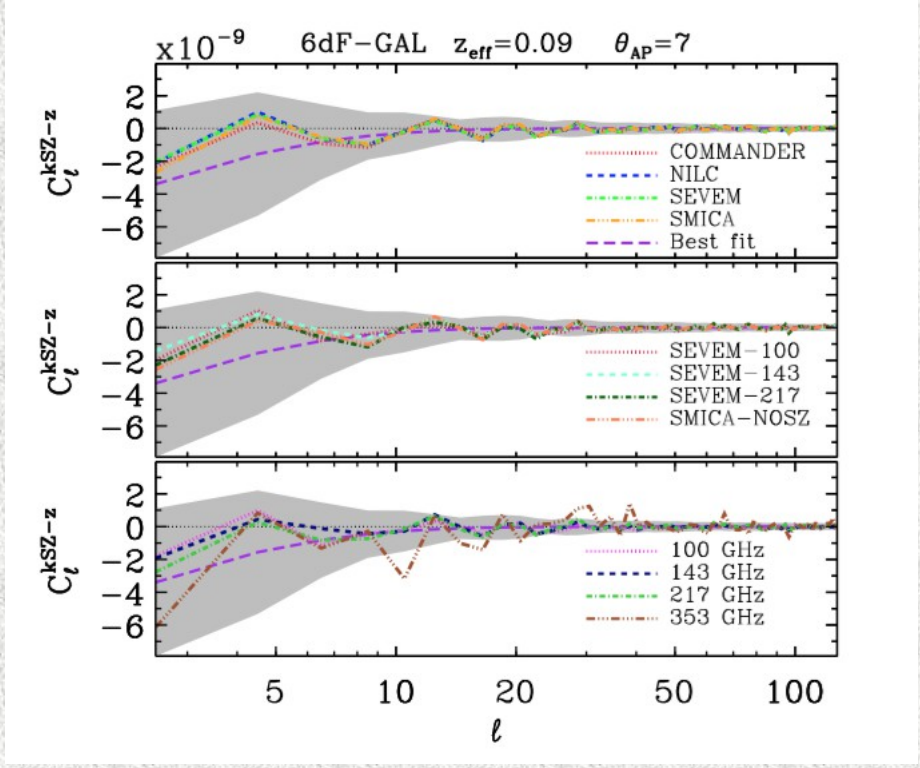




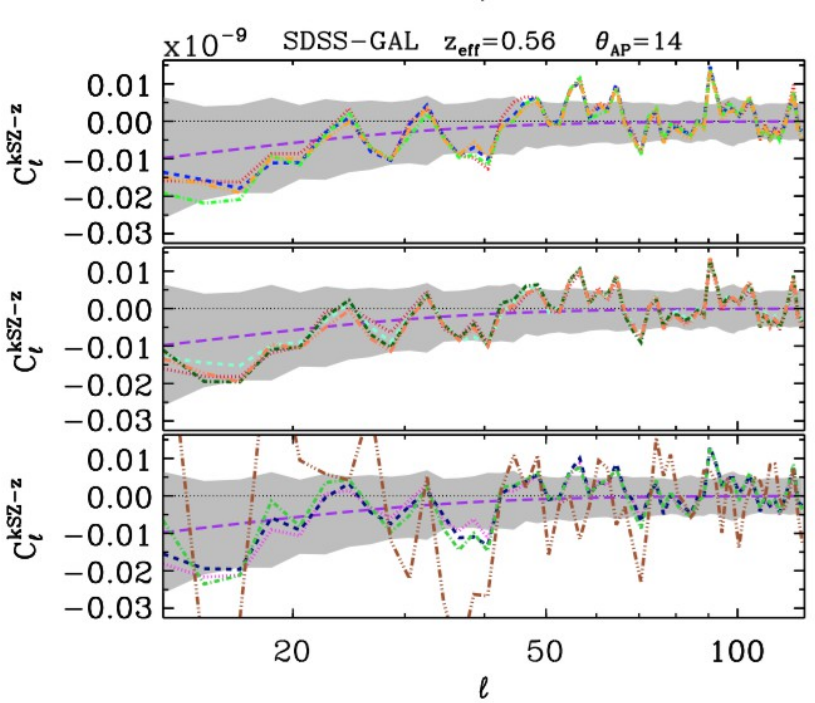
Chaves-Montero + (in prep)

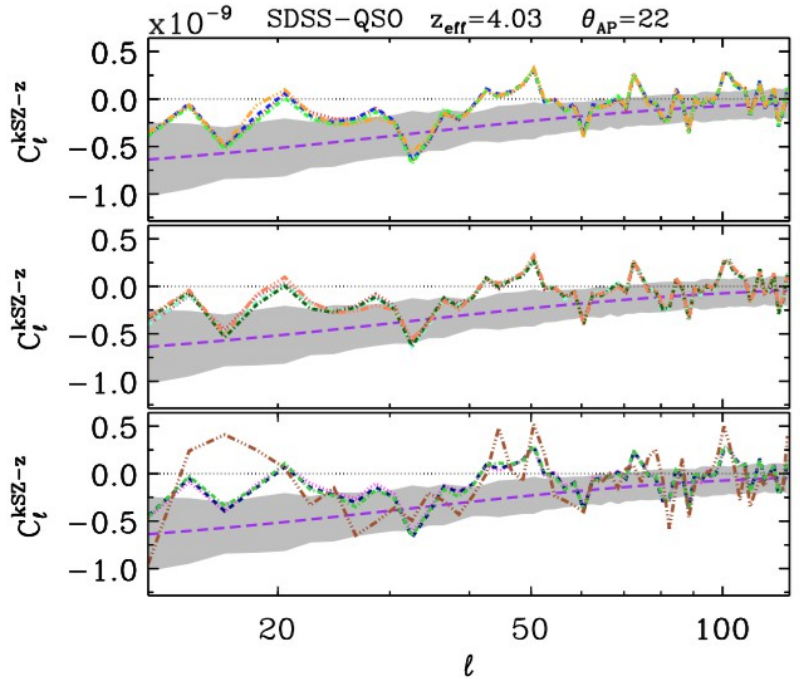
Angular redshift fluctuations (ARF)

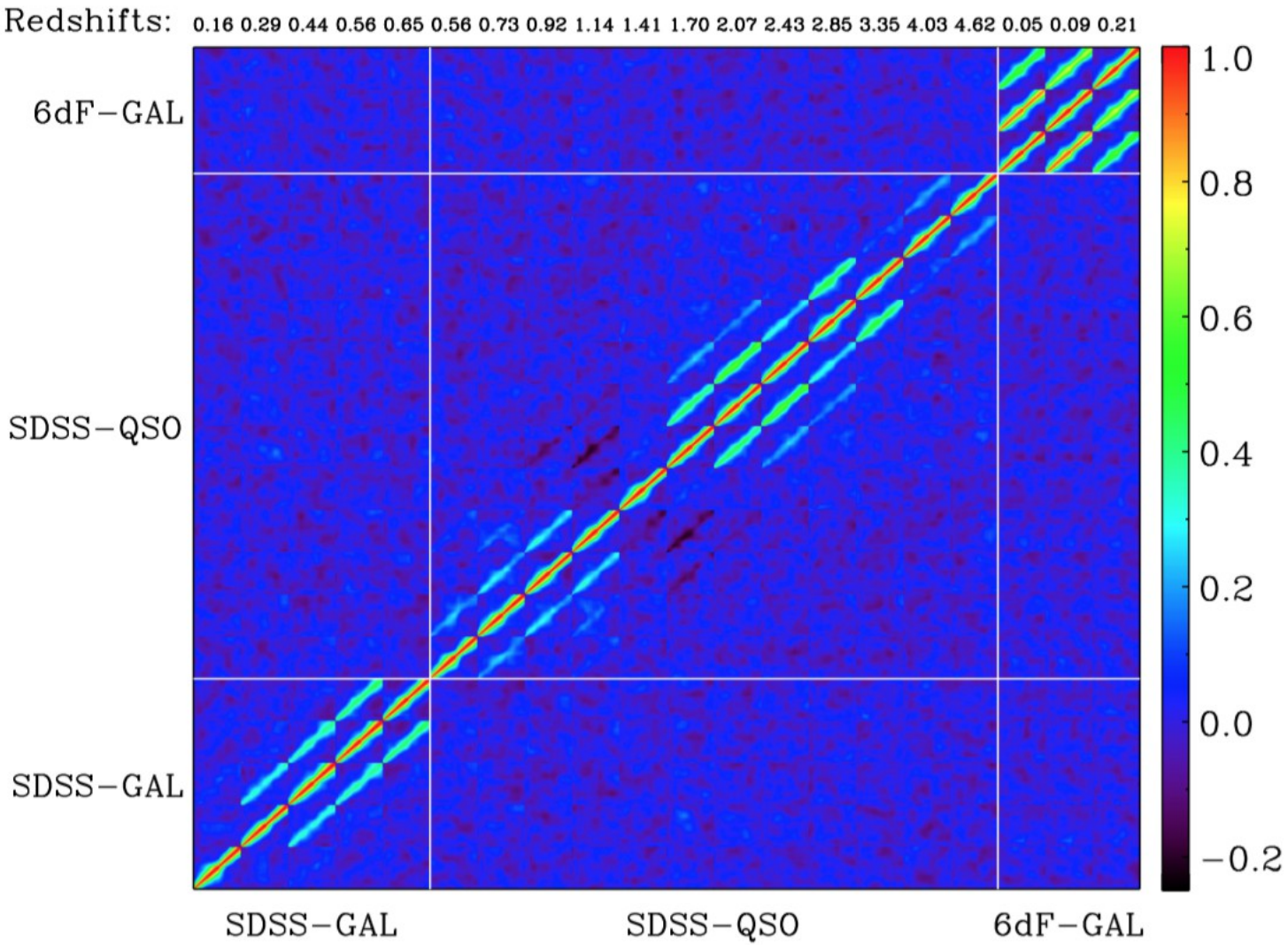
- Our analyses on Planck CMB data and 6dF and SDSS galaxies and QSOs are proving the highest significance kSZ detection …



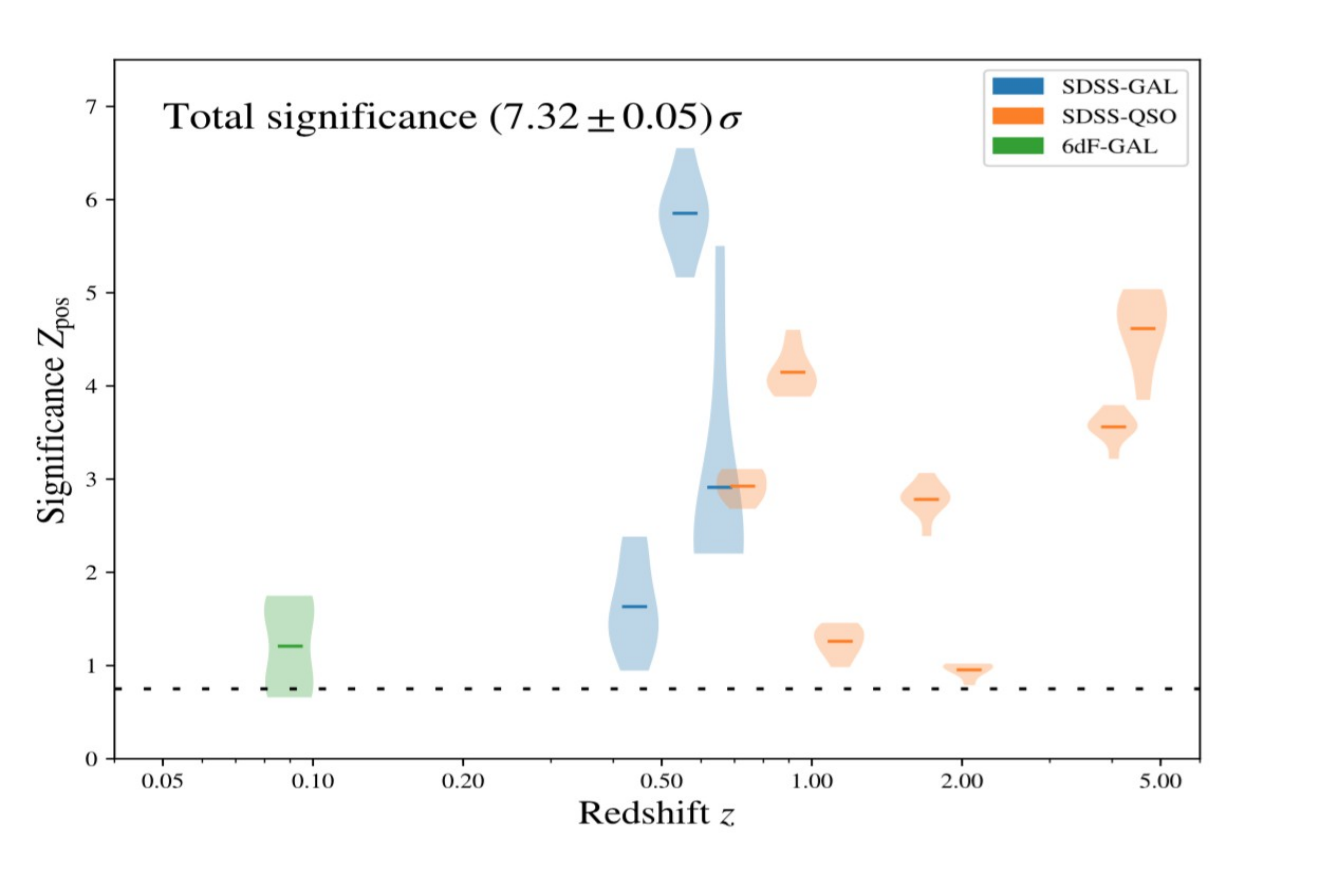
Chaves-Montero + (in prep)







Chaves-Montero + (in prep)



Chaves-Montero + (in prep)

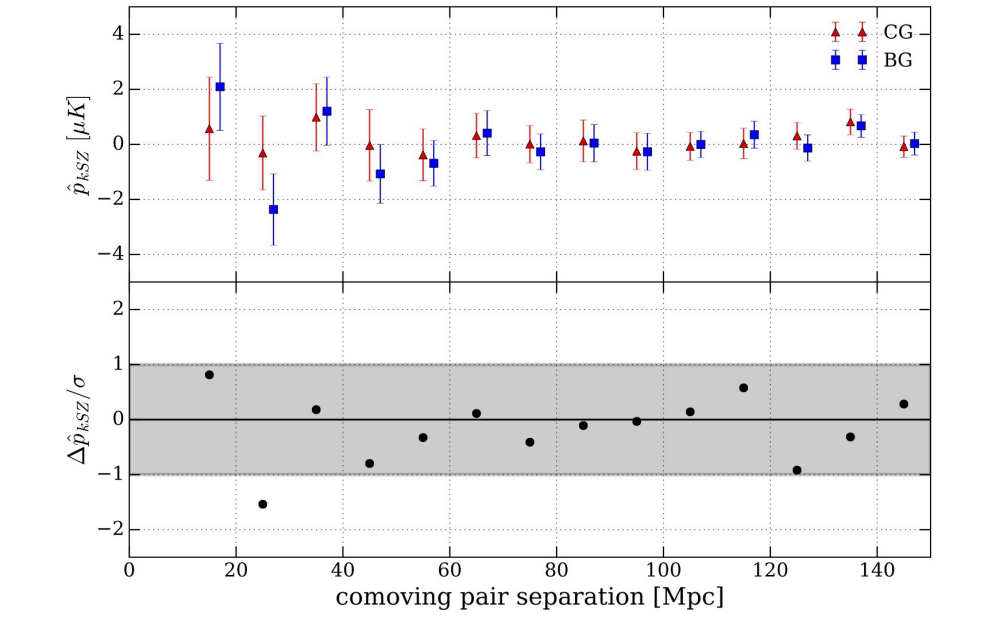
Angular redshift fluctuations (ARF)

- Once we are done with this analysis we shall compute realistic forecasts for Euclid for the spectroscopic sample.
- We should explore the possible combination of photometric Euclid + JPAS catalogues, and the use of high-quality photo-redshifts (photo-*z* error < 0.05) to set constraints on kSZ & missing baryons: in our analyses, has used typical widths of the Gaussian shell of \sigma_z ~0.05

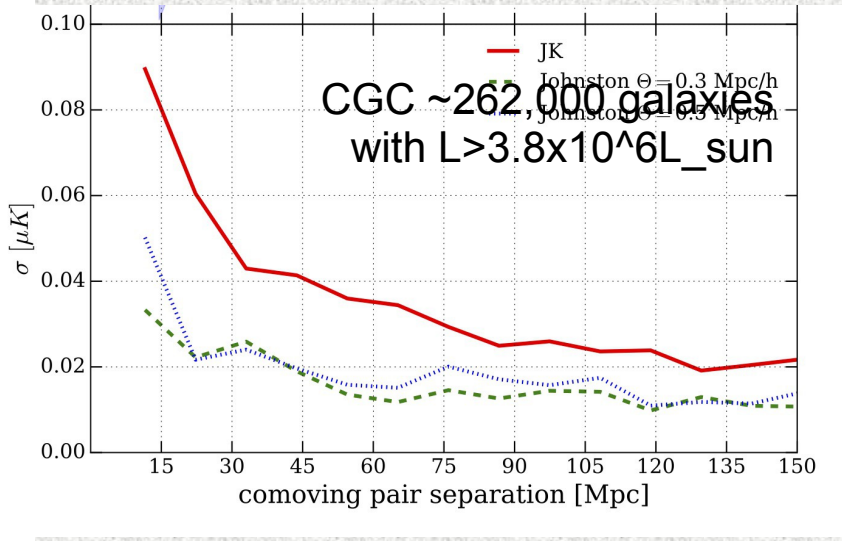
Activities at Cornell University

- Sensitivity of kSZ pairwise extraction to methods & assumptions e.g. minimizing cluster mis-centering from proxy galaxy offset systematic errors by utilizing spectroscopic and photometric data in tandem
- Currently focused on pairwise kSZ pipeline development that will enable Euclid x ACT and Euclid x Simons Observatory pairwise kSZ analyses

Comparison of pairwise kSZ momentum for Planck x SDSS redMaPPer data when one uses the Most Likely Central Galaxy (CG) vs Brightest Central Galaxy (BC) as proxy for cluster center



Comparison of statistical JK vs systematic errors due to proxy galaxy offsets from cluster center using the Johnston analytic model for Planck x SDSS CGC data



V. Calafut, R. Bean & B. Yu, Phys. Rev. D 96, 123529 (2017) arxiv: 1710.01755.