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Publications

First author: 6 accepted, 5 submitted. **Second author**: 3 accepted.

[14] **Slepian Z**, Eisenstein DJ et al., **Constraining the Baryon-Dark Matter Relative Velocity with the Large-Scale 3-Point Correlation Function of SDSS BOSS DR12 CMASS Galaxies**, MNRAS submitted, 7 pages; arXiv: —.

- Using the 3PCF of $\sim 800,000$ galaxies, we constrain the bias with which the baryon-dark matter modulates galaxy formation to be less than 1%. This bias is an important possible systematic of the BAO method as used in the 2PCF and can shift the inferred distance scale. Our constraint is strong enough to ensure that any systematic shift in the distance scale is less than $\sim 0.3\%$, and thus greatly sub-dominant to the statistical error bars of BOSS. This constraint suggests our 3PCF technique can be used in DESI to self-protect from any potential shift in the distance scale due to the relative velocity.

[13] **Slepian Z**, Eisenstein DJ et al., **Detection of Baryon Acoustic Oscillation Features in the Large-Scale 3-Point Correlation Function of SDSS BOSS DR12 CMASS Galaxies**, MNRAS submitted, 16 pages; arXiv: —.

- We present the first high-confidence ($\sim 4.5\sigma$) detection of the BAO in the 3PCF using $\sim 800,000$ galaxies. This detection significance is robust to bias model choice; we fit two models, one with only linear and non-linear bias and one also including tidal tensor bias. We make the first application of the BAO method to the 3PCF to measure the distance to redshift 0.57 with 1.7% precision, comparable to the precision available from the 2PCF prior to reconstruction. We also find a high-precision constraint on the linear bias and a 2.6σ preference for non-zero tidal tensor bias.

[12] **Slepian Z** & Eisenstein DJ, **Modeling the large-scale redshift-space 3-point correlation function of galaxies**, MNRAS submitted, 23 pages; arXiv:1607.03109.

- We present a model of the redshift-space 3PCF based on linear perturbation theory that casts the 3PCF as 1 and 2-D integral transforms of the linear power spectrum. We show that the pre-cyclic dipole of the 3PCF is the strongest source of BAO features, which ultimately stem from density and velocity gradients generated by growth of structure. We find that RSD result in a roughly scale and multipole-independent rescaling of the real space 3PCF and we also present an extremely fast 3PCF prediction scheme useful for cosmological parameter studies.

[11] **Slepian Z**, Eisenstein DJ et al., **The large-scale 3-point correlation function of the SDSS BOSS DR12 CMASS galaxies**, MNRAS submitted, 16 pages; arXiv:1512.02231.

- We measure the 3PCF for $\sim 800,000$ galaxies using all triangles and on scales up to 180 Mpc$/h$. Fitting using the full covariance matrix we find a 2.8σ BAO feature and a $\sim 2.5\%$-precision constraint on the linear bias.

[10] **Slepian Z** & Eisenstein DJ, **A new look at lines of sight: using Fourier methods for the wide-angle anisotropic 2-point correlation function**, MNRAS submitted, 7 pages; arXiv:1510.04809.

- We show how to use Fourier transforms for the pair count while retaining the essentially exact line of sight to each galaxy pair and including wide-angle corrections. We also present perturbation theory predictions for measurements done in this framework.

[9] **Slepian Z** & Eisenstein DJ, **A Simple Analytic Treatment of Linear Growth of Structure including Baryon Acoustic Oscillations**, MNRAS 457, 24-37, 2016.

- For the first time we show how linear regime growth of structure on the intermediate scales relevant for the BAO can be treated largely analytically, connecting previously known large-scale and small-scale results. This work offers a unified, simple (though approximate) picture of growth of structure on all scales including BAO.

[8] **Slepian Z** & Eisenstein DJ, **Accelerating the 2-point and 3-point galaxy correlation functions using Fourier transforms**, MNRAS Letters, 455, 1, L31-L35, 2016.

- We show how the 3PCF algorithm of [7] can be cast as a convolution and evaluated by Fourier transforms. We use a similar mathematical approach to show how Fourier transforms can be used with an approximate line of sight to each galaxy pair for anisotropic 2-point clustering (as opposed to a single line of sight to the entire survey).

[7] **Slepian Z** & Eisenstein DJ, **Computing the Three-Point Correlation Function of Galaxies in $\mathcal{O}(N^2)$ Time**, MNRAS, 454, 4, 4142-4158, 2015.

- We present a novel 3PCF algorithm allowing computation of the 3PCF's multipole moments in N^2 time, N the number of objects. We show how to handle edge correction and the covariance matrix in this framework and demonstrate the algorithm on SDSS DR7 mock catalogs.

[6] **Slepian Z** & Eisenstein DJ, **On the signature of the baryon-dark matter relative velocity in the two and three point galaxy correlation functions**, MNRAS, 448, 1, 9-26, 2015.

- We present a configuration-space picture of the relative velocity, showing how its shift to the BAO scale in the 2PCF stems from the causal structure of its Green's function. We show that the relative velocity has a unique signature in the 3PCF and present a compression scheme to maximize the possible signal.

[5] **Slepian Z**, Gott JR & Zinn J, **A one-parameter formula for testing slow-roll dark energy**, MNRAS, 438, 3, 1948-1970, 2014.

- We show that for all models of dark energy as a scalar field slowly rolling down its potential and with equation of state close to -1 today, the Hubble parameter has the same functional form. We consider the effects of cosmological parameter uncertainties on detection prospects. This work's formula has been used to constrain slow-roll dark energy by BOSS (Aubourg et al. 2014, arXiv:1411.1074) and Planck (2015, Paper XIV).

[4] **Slepian Z** & Goodman J, **Ruling Out Bosonic Repulsive Dark Matter in Thermal Equilibrium**, MNRAS, 427, 1, 839-849, 2012.

- We show that these DM models can be ruled out by combining cross-section constraints from the Bullet Cluster with predicted and observed rotation curves.

[3] Gott JR & **Slepian Z**, **Dark energy as double N-flation – observational predictions**, MNRAS, 416, 2, 907-916, 2011.

- By analogy with inflation, we develop a model of dark energy as a scalar field in slow-roll, and use our knowledge of inflation to make probabilistic predictions for the dark energy equation of state by assuming both fields' initial amplitudes are drawn from Gaussians.

[2] Goodman J & **Slepian Z**, **Chance and Chandra (and repulsive dark matter)**, Pramana, 77, 1, 107-118, 2011.

[1] Rafikov R & **Slepian Z**, **Dynamical Evolution of Thin Dispersion-Dominated Planetesimal Disks**, The Astronomical Journal, 139, 2, 565-579, 2010.