Contribution ID: **174** Type: **Talk**

An iterative reconstruction of cosmological initial density fields

Tuesday, 3 September 2019 15:20 (25 minutes)

We present an iterative method to reconstruct the linear-theory initial conditions from the late-time cosmological matter density field, with the intent of improving the recovery of the cosmic distance scale from the baryon acoustic oscillations (BAOs) and making the distance measurements more reliable in upcoming redshift surveys, e.g., PFS, DESI and Euclid. We apply the iterative method to the dark matter density field and galaxy mocks, in both real and redshift space, generated from N-body simulations and then compute the two-point correlation function and the power spectrum for the reconstructed density field. Comparing with the standard reconstruction method, which has been widely used in previous BAO distance measurements, we find that our iterative method can reconstruct the initial linear density field more precisely, especially on small scales (< 40 Mpc/h). Furthermore, we measure the distance scale by fitting for the position of the acoustic signature in the correlation function and evaluate the performance of the iterative reconstruction method. We also discuss the effects of number density, smoothing filtering, and galaxy bias on the reconstruction process.

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Session Classification: Parallel Sessions: Large Scale Structure (C.A.R.L., H09)

Track Classification: Large Scale Structure