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A 3-parameter SHAM for BOSS, eBOSS and DESI tracers

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SubHalo Abundance Matching (SHAM) is an empirical method for constructing galaxy catalogues based on high-resolution N-body simulations. We apply SHAM on the UNIT simulation to simulate SDSS BOSS/eBOSS Luminous Red Galaxies (LRGs) within a wide redshift range of 0.2 < z < 1.0. Besides the typical SHAM scatter parameter σ, we include v smear and Vceil to take into account the redshift uncertainty and the galaxy incompleteness respectively. These two additional parameters are critical for reproducing the observed 2PCF multipoles on 5–25 h^-1 Mpc. The redshift uncertainties obtained from the best-fitting Vsmear agree with those measured from repeat observations for all SDSS LRGs except for the LOWZ sample. We explore several potential systematics but none of them can explain the discrepancy found in LOWZ. Our explanation is that the LOWZ galaxies might contain another type of galaxies which needs to be treated differently. The evolution of the measured σ and Vceil also reveals that the incompleteness of eBOSS galaxies decreases with the redshift. This is the consequence of the magnitude lower limit applied in eBOSS LRG target selection. The projected 2PCFs of our SHAM galaxies also agree with the observational ones on the 2PCF fitting range.

For DESI, we apply this method to the latest LRG and ELG SV3 data. Since the redshift uncertainty distribution obtained from repeats are Lorentzian instead of Gaussian, we changed the format of Vsmear. The clustering prediction is satisfactory and Vsmear is also consistent with the results measured from the repeat observations.

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