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Percolation analysis for cosmic web with discrete points JIAJUN ZHANG, Department of Physics, The Chinese University of Hong Kong, DALONG CHENG, Center of Astronomy and Astrophysics, Shanghai Jiao Tong University, MING-CHUNG CHU, Department of Physics, The Chinese University of Hong Kong
— Percolation analysis has long been used to quantify the connectivity of the cosmic web. Unlike most of the previous works using density field on grids, we have studied percolation analysis based on discrete points. Using a Friends-of-Friends (FoF) algorithm, we generate the S-bb relation, between the fractional mass of the largest connected group (S) and the FoF linking length (bb). We propose a new model, the Probability Cloud Cluster Expansion Theory (PCCET) to relate the S-bb relation with correlation functions. We show that the S-bb relation reflects a combination of all orders of correlation functions. We have studied the S-bb relation with simulation and find that the S-bb relation is robust against redshift distortion and incompleteness in observation. From the Bolshoi simulation, with Halo Abundance Matching (HAM), we have generated a mock galaxy catalogue. Good matching of the projected two-point correlation function with observation is confirmed. However, comparing the mock catalogue with the latest galaxy catalogue from SDSS DR12, we have found significant differences in their S-bb relations. This indicates that the mock catalogue cannot accurately recover higher order correlation functions than the two-point correlation function, which reveals the limit of HAM method.

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