Morphology and Luminosity Bias of Galaxy Clustering

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The morphology and luminosity bias of galaxy clustering have been examined by using SSRS2 Catalog which has 5426 galaxies with morphological types through the redshift-space power spectrum. We have found the clustering of galaxies depends on their morphological types in the sense that early types are more clustered than late types. The power spectrum of early types is higher than that of the combined sample by 20~50% while that of late types is lower than that of the combined one by 15~20%. The morphology bias of galaxy clustering depends on scales. On scales 0.07 h Mpc^{-1} < k <0.17 h Mpc^{-1}, the bias factor of early types relative to the combined sample ($B_E = P_E(k)/P_{E+S}(k)$) is approximately constant at the level of 1.25, and the bias factor of late types ($B_S = P_S(k)/P_{E+S}(k)$) is approximately 0.85. On scales 0.17 h Mpc^{-1} < k < 0.50 h Mpc^{-1}, however, the degree of bias and anti-bias become stronger towards smaller scales ($B_E = 1.25 \rightarrow 1.5$, $B_S = 0.85 \rightarrow 0.77$).

To understand the scale dependence of morphology bias, we also calculated the power spectra from mock-survey samples in two cosmological models: the open CDM model (OCDM; $\Omega h=0.2$) and the flat CDM model with non-zero cosmological constant (ΛCDM; $\Omega h=0.24$, $\Lambda=0.6$, b=1.3). We have found that the morphology bias of galaxy clustering depends on the peculiar velocity of galaxies, the relation between galaxy morphology and local density, and the bias factor of mass and galaxy density fluctuations. The peculiar velocity and galaxy biasing with respect to the mass lower the strength of morphology bias on all scales explored and for both types of galaxies. Although the morphology-density relation also changes the strength, it appears in different manner for early and late types of galaxies. We have found based on the strength of morphology bias that the ΛCDM model is preferred over OCDM.

The clustering of galaxies also depends on the luminosity of galaxies. For both early and late types, the luminosity bias occurs in the region, M<-19.0. But the trends are discriminated between early and late types. While early type galaxies are more clustered as they go brighter, late type galaxies make a trough at M~-19.5.