Correlation Functions of the Abell, APM, and X-ray Clusters of Galaxies

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We have measured the correlation functions of the optically selected clusters of galaxies in the Abell and the APM catalogs, and of the X-ray clusters in the XBACs and BCS catalogs using the same method of calculation. We have found that the amplitude of the correlation function of the APM clusters is much higher than what has been previously claimed, in particular for richer subsamples. The correlation length of the APM clusters with the richness class $R \geq 70$ as defined by the APM team is found to be $r_0 \simeq 24\ h^{-1}$Mpc. This amplitude of correlation function is 2.2 times higher than that of Croft et al. (1997) at the same separation r. We have also found that the correlation length of the Abell clusters with the richness class $RC \geq 1$ is $r_0 \simeq 24h^{-1}$Mpc, which is consistent with our results for the APM sample. The richness dependence of cluster correlations is given by $r_0 = 0.39d_c + 5.1$, which is stronger than the weak dependence of Croft et al. (1997), but is consistent in slope with the Bahcall-Soneira estimate.

The X-ray bright Abell clusters in the XBACs catalog and the clusters in the BCS catalog selected purely by the X-ray fluxes, in general, show strong clustering. The correlation length of the most X-ray luminous XBACs clusters with $L_x \geq 1.0\times 10^{44}\ h^{-2}$erg s^{-1} is 37.7 h^{-1}Mpc, and that of the BCS clusters with $L_x \geq 0.7\times 10^{44}\ h^{-2}$erg s^{-1} is 36.0 h^{-1}Mpc. These results are consistent with the strong richness dependence obtained from our optical cluster samples.