

[GC07] Environmental Dependence of Properties of Galaxies in the Sloan Digital Sky Survey

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We investigate the dependence of physical properties of galaxies brighter than  $M_r = -18.0 + 5 \log h$  in the Sloan Digital Sky Survey (SDSS) on environment, as measured by local density using an adaptive smoothing kernel. We find that variations of galaxy properties with environment are almost entirely due to the dependence of morphology and luminosity on environment. When morphology and luminosity are fixed, other physical properties are nearly independent of local density, without any break or feature. Weak residual dependences on environment include that of the color of late-types (bluer at lower density) and of the  $L-\sigma$  relation of early-types (larger dispersion at higher density for bright galaxies). The fraction of galaxies with early morphological type is a monotonically increasing function of local density and luminosity. The morphology-density-luminosity relation, as measured in this work, should be a key constraint on galaxy formation models. We demonstrate that the morphology of galaxies is originated from physics at scales much smaller than  $7 h^{-1} \text{Mpc}$  Gaussian smoothing scale. It is also shown that the galaxy morphology depends on both  $3h^{-1} \text{Mpc}$  scale density and the distance to the nearest companion galaxy.

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