Dependence of Barred Galaxy Fraction on Galaxy Properties and Environment

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We investigate the dependence of the occurrence of bars in galaxies on galaxy properties and environment. We use a volume-limited sample of 33,391 galaxies brighter than $M_r = -19.5 + 5\log h$ at $0.02 \leq z \leq 0.05489$, drawn from the Sloan Digital Sky Survey Data Release 7. We classify the galaxies into early and late types, and identify bars by visual inspection. Among 10,674 late-type galaxies with axis ratio $b/a > 0.60$, we find 3240 barred galaxies ($f_{\rm bar} = 30.4\%$) which divide into 2542 strong bars ($f_{\rm SB} = 23.8\%$) and 698 weak bars ($f_{\rm WB} = 6.5\%$). We find that $f_{\rm SB}$ increases as $u - r$ color becomes redder and that it has a maximum value at intermediate velocity dispersion ($\sigma \simeq$150 km s^{-1}). This trend suggests that strong bars are dominantly hosted by intermediate-mass systems. Weak bars prefer bluer galaxies with lower mass and lower concentration. In the case of strong bars, their dependence on the concentration index appears only for massive galaxies with $\sigma > 150$ km s^{-1}. We also find that $f_{\rm bar}$ does not directly depend on the large-scale background density when other physical parameters ($u-r$ color or σ) are fixed. We discover that $f_{\rm SB}$ decreases as the separation to the nearest neighbor galaxy becomes smaller than 0.1 times the virial radius of the neighbor regardless of neighbor's morphology. These results imply that strong bars are likely to be destroyed during strong tidal interactions and that the mechanism for this phenomenon is gravitational and not hydrodynamical. The fraction of weak bars has no correlation with environmental parameters. We do not find any direct evidence for environmental stimulation of bar formation.