A STATISTICAL STUDY OF ENVIROMENT EFFECTS ON GALAXY PROPERTIES

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We perform statistical analyses in the CfA and SRC 2 catalogs regarding the dependences of galaxy morphology and galaxy circular velocity on enviroment.

The morphological index t is found a continuous decreasing function of the galaxy density measured in shells (radial width 2 Mpc) at different radii in the range 1Mpc < r < 10 Mpc. Figure 1 shows the average normalized inner density (r < 1.5 Mpc), Di, versus the morphological index t, where the galaxies with index t<0 have been added in the bin t = -1.

At a given value of the inner galaxy density we find that the morphological index of the central object is more negative when larger is the galaxy density in the external shells (5Mpc < r < 10Mpc). This effect is present only if both early and late types are considered (positive and negative values of t).
We find that the galaxy density at external shells is not related to variations of morphology neither within early types nor within late types. These results may be explained in terms of a higher merger rate of spirals in global galaxy density enhancements originating early type objects. On the other hand, disk-bulge ratios of late types and ellipticities of early types are found to depend only locally on density.
All galaxies are binned according to Di. For each bin we compute the average difference delta t = t(high) - t(low) where high (low) referes to 1/3 the galaxies with the highest (lowest) external densities (3-5 Mpc). The histogram of the differences delta t is shown in figure 2-a (all types) and figure 2-b (t > 0). If the morphology-density relationship is of local character it would be expected this histogram to be centered in zero. As seen in these figures this ocurrs in case 2-b but not in case 2-a. We conclude that the abundance of elliptical galaxies requires of a global high density environment.

We find that the mean circular velocity of galaxies has an approxmately linear increase with shell density as expected in the linear regime of a hierarchical clustering scenario like the CDM model. This effect is shown in figure 3 which displays Di as a function of the circular velocity Vc.

Applying the previously described method we find that at a given Di the circular velocities of galaxies are ~10% smaller than the average for the sub sample with the largest external densities. This may be regarded as evidence for the stripping of halo material driven by encounters.
Figure 4-a displays the average difference in Vc between high and low external densities (3Mpc < r < 5Mpc) for galaxies with the same value of Di. In igure 4-b is shown the histogram corresponding to figure 4-a.

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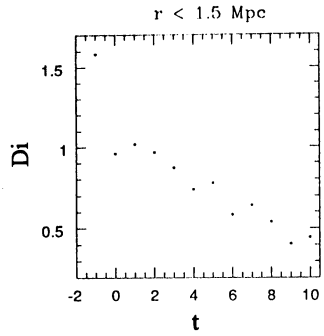

Figure 1

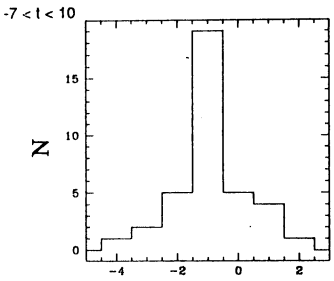

Figure 2-a

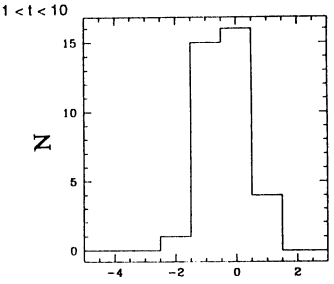

Figure 2-b

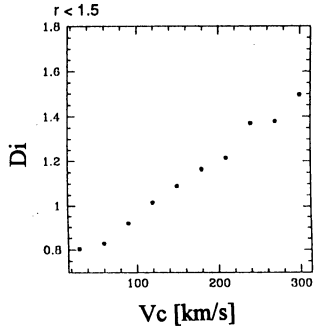

Figure 3

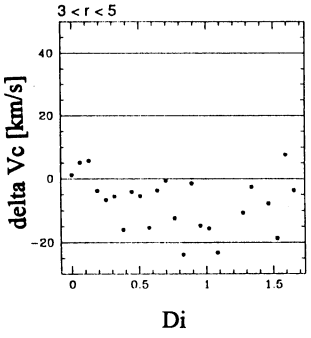

Figure 4-a

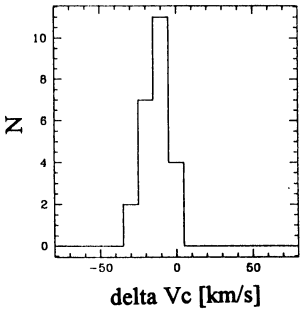

Figure 4-b

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