Galaxy Evolution across the Hubble Time
Proceedings IAU Symposium No. 235, 2006
F. Combes & J. Palouš, eds.

doi:10.1017/S1743921306005977

Enviromental Effects on Internal Color Gradients of Early-Type Galaxies

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Abstract. We use g and r band imaging from the Palomar Abell Cluster Survey (Gal et al. 2000, AJ 120, 540) in order to estimate internal color gradients, measured as the logarithmic slope of galaxy radial color profiles, for a sample of 4000 early-type galaxies in $N = 162$ Abell clusters, spanning a wide richness range, from poor groups to rich clusters, and a redshift range of z=0.05 to z=0.25. Color gradients are estimated from the galaxy structural parameters (namely, the effective radius, r_e, and the Sersic index, n) in the g and r bands. These parameters are derived by fitting galaxy images with 2D PSF convolved Sersic models (La Barbera *et al.* 2002, ApJ, 571, 790). We select as early-type cluster galaxies those objects with Sersic index $n > 2$, that lie on the color magnitude relation of each cluster. Only objects with S/N ratio high enough to derive reliable structural parameters are included in the analysis (La Barbera *et al.* 2005, ApJL, 626, 19). Field contamination amounts to $\sim 10\%$ in our sample and is corrected for by using 32 blank fields observed with the same setup and analyzed in the same way as the cluster images. We find that color gradients follow two distinct redshift trends, with

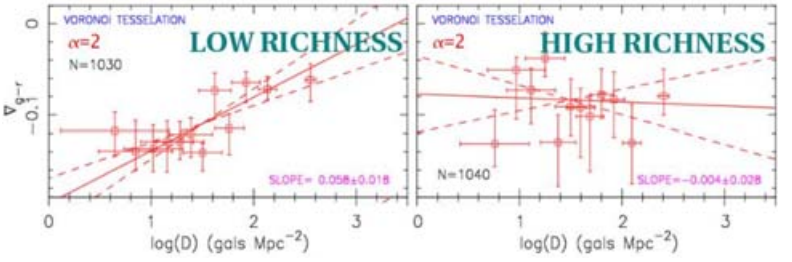

Figure 1. Dependence of color gradients on local galaxy density.

color gradients being less steep for richer rather than poor clusters (La Barbera et al. 2005, ApJL, 626, 19). Fig. 1 plots the mean internal color gradient of galaxies as a function of local galaxy density, which is estimated by using the Voronoi tessellation method. We find that color gradients are strongly dependent on local environment, with color gradients being less steep in higher rather than in lower density regions. However, this environmental trend only holds for poor clusters, with galaxies in rich clusters not showing any significant trend. These results support a picture whereby some interaction mechanism, such as galaxy-galaxy merging, flattens the internal color gradient of galaxies, producing the observed correlation with local density in low richness clusters. If rich clusters form through the merging of groups of galaxies, this process would wash out any correlation between local density and the past merging history of galaxies.

Keywords. galaxies: evolution, galaxies: luminosity function, galaxies: colors