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THE DEPENDENCE OF THE FABER-JACKSON RELATION ON THE MAGNITUDE RANGE

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Using three samples of early-type galaxies in a magnitude range of ∼5.5 mag, we analyse the behaviour of the Faber-Jackson relation coefficients as a function of the magnitude range where galaxies are selected. The coefficients depend on the brightness of galaxies and on the width of the magnitude range. These dependencies are due to selection effects and intrinsic galaxy properties. The intrinsic dispersion of the Faber-Jackson relation changes progressively with luminosity, with bright(relative to faint) galaxies having a significantly smaller dispersion.

We use a sample of ETGs from the Sloan Digital Sky Survey (SDSS) in filters g^*, r^*, i^* and z^* (Bernardi et al. 2003). This sample contains 8666 galaxies, distributed in a redshift interval $0.01 < z < 0.3$ and within a magnitude range $\Delta M \sim 6.0$ mag. We have defined a subsample from the SDSS in the redshift interval $0.04 \leq z \leq 0.08$. This subsample has 1670 galaxies in each filter, covers a magnitude range $\Delta M \sim 4.4$ mag ($-18.5 \geq M_{g^*} > -22.9$) and is complete for $M_{g^*} \lesssim -20$. We also use a sample of 116 ETGs from the Coma cluster (Milvang-Jensen 1997, Jørgensen et al. 1999) in the Gunn r filter ($\Delta M \sim 4.5$ mag) and a sample of 44 ETGs from the Hydra cluster (Milvang-Jensen 1997) also in the Gunn r filter ($\Delta M \sim 5.6$ mag). Figure 1 shows the variation of the B coefficient as function of the upper magnitude cut-off. Both the intrinsic dispersion and the FJR coefficient-values change systematically as we increase the width of the magnitude interval.

A first study of the intrinsic dispersion of galaxies as a function of luminosity reveals that for bright galaxies it is smaller than for faint galaxies. We show in Figure 2 the behaviour of the intrinsic dispersion value in very narrow magnitude ranges (0.25 mag wide intervals) for the homogeneous and total samples from the SDSS in filter g^*. Figure 2 shows the data for the homogeneous sample (diamonds) and total SDSS sample (circles). It is clear that the intrinsic dispersion value changes systematically as we consider brighter galaxies, and that brighter galaxies present a lower value for the intrinsic dispersion than the value for fainter galaxies. For the total SDSS sample (circles), we observe the same behaviour. When we apply the run test to these data, we find that there are reasons to affirm, with a 99% level of confidence, that there is an underlying trend of the values of the intrinsic dispersion as a function of luminosity.

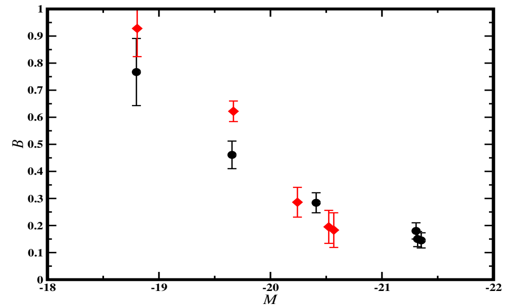

Fig. 1. Variation of the FJR slope (B) in increasing-magnitude-intervals (filter g^*). Total SDSS sample (circles). Homogeneous SDSS sample (diamonds).

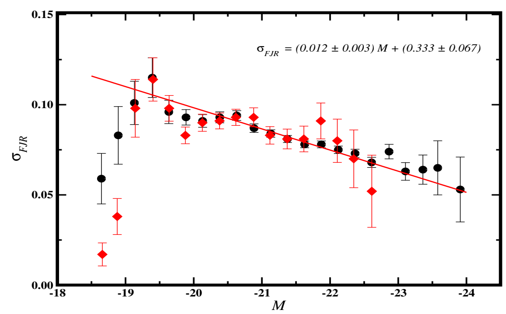

Fig. 2. Variation of the FJR intrinsic dispersion ($\sigma_{\rm FJR}$) in 0.25 mag wide intervals (filter g^*). Total SDSS sample (circles). Homogeneous SDSS sample (diamonds). Fit equation: $\sigma_{\rm FJR} = (0.012 \pm 0.003)M + (0.333 \pm 0.067)$.

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