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THE ENVIRONMENT DEPENDENCE OF THE GREEN VALLEY

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To shed light on the impact of internal and external quenching mechanisms upon galaxies, in this paper we compare properties of star forming, passive and transition galaxies in three discrete environments: field, groups as representative of intermediate mass systems, and the most massive virialised systems in the Universe, X-ray clusters. We classify galaxies into three sequences: passive (PS), green valley (GV) and star forming (SFS), by means of their UV-optical colour $^{0.1}(NUV - r)$. We study a number of galaxy properties: UV-optical colour, stellar mass, morphology, specific star formation rate and the history of star formation.

In this work we select galaxies from the Main Galaxy Sample (MGS, Strauss et al. 2002) of the Sloan Digital Sky Survey's (SDSS, York et al. 2000). We draw our sample of galaxies in groups from the sample of groups identified by Zandivarez & Martínez 2011. Finally, our sample of galaxies in X-ray clusters has been drawn from two sources: the C-P04-I sample of Coenda et al. 2009, and the C-B00-I sample of Muriel et al. 2014.

Our main findings can be summarised as:

1. Regarding the morphological classification, as it is well established in the literature, GV galaxies have intermediate morphologies. We find that this appears to be independent of the environment.

2. When comparing stellar masses, we find that, GV and PS late-type galaxies have similar mass distributions, while early-types in PS are more massive than their GV counterparts. This difference becomes almost negligible in the central regions of clusters. Regarding GV galaxies alone, field galaxies are typically the most massive, particularly when considering late-types. The environment that has the largest fraction of low mass GV galaxies is the outskirt of clusters.

3. We find a growing (decaying) trend of the abundance of PS (SFS) galaxies as a function of stellar mass, seen in all environments. The abundance of GV galaxies as a function of stellar mass is almost constant, with the exception of the field. On average, GV galaxies account for $\sim 20\%$ of all galaxies in groups and X-ray clusters. The field differs from the other environments in that it has a clear lack of $\sim 10^{10} M_\odot$ GV galaxies.

4. When analysing the relationship between the specific star formation rate and the stellar mass, we find that GV galaxies lie far off the main sequence, and closer to PS galaxies. In the inner regions of clusters this effect is maximum.

5. We find that the star formation history of galaxies depends on stellar mass, sequence and environment. GV galaxies have star formation histories intermediate between SFS and PS galaxies. As denser environments are considered, the history of star formation of GV galaxies becomes more similar to that of PS galaxies.

6. Using a simple model to describe the star formation history of galaxies, we estimate quenching times as a function of stellar mass, sequence and environment. GV and PS galaxies have quenching times that are roughly independent of stellar mass, whereas SFS galaxies' quenching time decreases with mass. We find that GV galaxies more massive than $\sim 10^{10.5} M_\odot$ have quenching times that decrease with increasing environmental density. Another result worth mentioning is that below $\sim 10^{10.5} M_\odot$, SFS galaxies in the field have quenching times ~ 1.8 times larger than in other environments.

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