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Comparing stellar properties of cluster galaxies from z = 1 until today

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The observed properties of galaxies are strongly dependent on both their total stellar mass and their morphology. Furthermore, the environment is known to play a strong role in shaping them. The galaxy population in the local universe that is located in virialized clusters is found to be red, poorly star-forming, and mostly composed of early morphological types (Pérez-Millán et al., 2023).

Towards a holistic understanding of the mechanisms that drive galaxy evolution, we exploit the data from the WIde-field Nearby Galaxy-cluster Survey (WINGS; $0.04 < z < 0.07$; Fasano et al. (2006)), and its extension OmegaWINGS (Gullieuszik et al., 2015). We also use the spectrophotometric code `SINOPSIS` (Fritz et al., 2007) to obtain galaxy properties such as stellar mass, Star Formation Rate (SFR) and Star Formation Histories (SFH), with the end to study the role of both the local and global environments affecting stellar properties at fixed morphology.

Using data from the ESO Distant Cluster Survey (EDisCS; $0.4 < z < 1.0$; White et al. (2005)), we compare our main results at low-z with those at intermediate-high redshift. We define our galaxy sample as cluster members with stellar mass $\log \mathcal{M}_*/M_\odot > 10$, and a good spectral fit obtained with `SINOPSIS` ($\chi^2 < 5$). The number of galaxies in the sample is 2,925 in WINGS/OmegaWINGS and 161 in EDisCS.

In Figure 1, we show the Main Sequence (MS) for star-forming galaxies in both low- and high-z samples. We observe the clear evolution of MS with redshift: the sSFR (SFR over stellar mass) of low-mass galaxies is about 1 dex higher in EDisCS than in WINGS/OmegaWINGS. According to Noeske et al. (2007), this reduction of sSFR for all stellar masses seems to be gradual, with gas exhaustion as the main candidate cause. Another important result is that the MS at high-z presents a steeper slope than at low-z, as also reported by, e.g., Karim et al. (2011), for the same redshift range we explore.

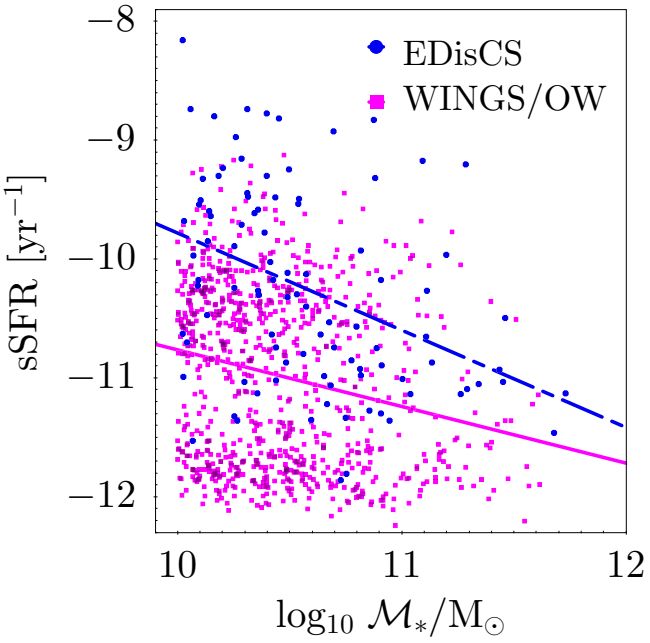

Figure 1. sSFR *versus* stellar mass. *Blue circles* and *short-long dashed line*: EDisCS; *magenta squares* and *solid line:* WINGS/OmegaWINGS. Lines represent the best linear fit. The main sequence of high-z galaxies is above the low-z main sequence at all stellar masses.

Among other results, we confirm some known findings, such as the morphological evolution through cosmic time and larger SFR at earlier epochs. We also determine that clusters may have been more efficient in quenching star formation in the past, and we propose that the general higher star formation activity in galaxies at these redshifts may explain the Butcher-Oemler effect. The paper with the full results will be published as Pérez-Millán (in prep.).

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