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The growth of the red-sequence in clusters since $\simeq$ 1

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Abstract. We use deep nIR imaging of 15 galaxy clusters at $z \simeq 1$ to study the build-up of the red-sequence in rich clusters since the Universe was half its present age. We measured, for the first time, the luminous-to-faint ratio of red-sequence galaxies at z=1 from a large ensemble of clusters, and found an increase of 100% in the ratio of luminous-to-faint red-sequence galaxies from z=0.45 to 1.0. The measured change in this ratio as function of redshift is well-reproduced by a simple evolutionary model developed in this work, that consists in an early truncation of the star formation for bright cluster galaxies and a delayed truncation for faint cluster galaxies.

Keywords. galaxies: clusters: general, galaxies: evolution, galaxies: formation

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Galaxy clusters are gravitationally bounded structures in the Universe which are inhabited by several thousands of galaxies and filled by a hot X-ray emitting gas. The central megaparsec of clusters is dominated by early type galaxies, which are observed to obey tight empirical scaling relations as the Fundamental plane (FP) and the Color-magnitud relation (CMR). In this work, we present deep J_s and K_s-band imaging of 15 galaxy clusters at $z \simeq 1$, which were discovered in the Red-Sequence Cluster Survey (RCS-1) (Gladders & Yee (2005)) and followed up using the VLT/ISAAC instrument. We built the K_s-band luminosity function (LF) and the color-magnitude diagram (CMD) for the combined cluster sample at z=1 through the application of the B+Z method developed by Muñoz, Padilla & Barrientos (2009). We found that our K_s-band LF is well described by a Schechter function with $K_s{}^* = 18.82$ and $\alpha = -0.42$, and that the CMD shows a qualitatively deficit of red-sequence (RS) galaxies with $M_V > -20$. We computed the ratio between the number of luminous and faint RS galaxies (L/F ratio) within the magnitude limits defined by De Lucia *et al.* (2007) and found the value of 1.07 ± 0.28 at $z = 1$. We concluded that our value of $K_s{}^*$ at $z = 1$ favors a passive evolution model with formation redshift $z_f = 3$, and that the increase of the L/F ratio towards higher redshifts can be explained if progenitors of present-day $M_V > -20$ early-type galaxies have undergone a recent burst of star formation at $z = 1$.

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