Morphological Transformation of Red Sequence Galaxies in High Redshift Galaxy Clusters

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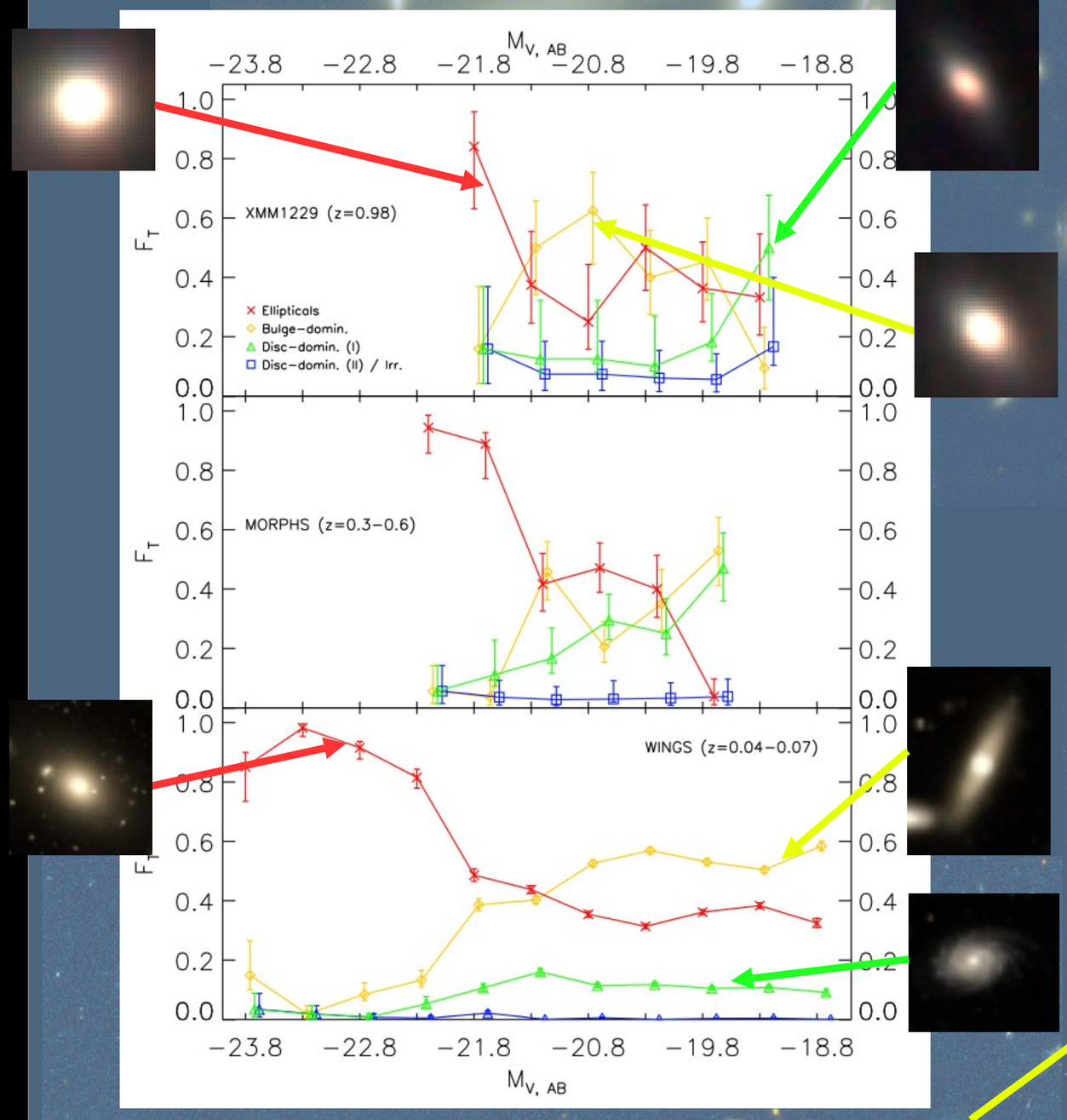
Galaxy clusters are the most massive virialised large scale structures in the universe and therefore they constitute optimal laboratories for the study of the environmental drivers of galaxy evolution. We use a sample of nine galaxy clusters at 0.8 < z < 1.5 from the HAWK-I cluster survey (HCS, Lidman et al. 2013) to study the build-up of the red sequence in clusters at epochs when most processes responsible for star-formation quenching were likely to take place. Here we present the results of the investigation of the morphological properties of red sequence galaxies in the cluster XMMU J1229+0151 (top panel), at z=0.98, as well as the study of the build-up of the red sequence in four more HCS clusters at 0.8 < z < 1.04 (bottm panel).

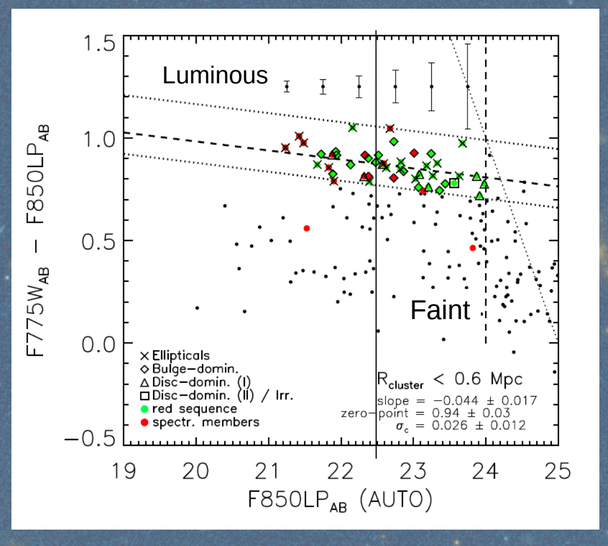


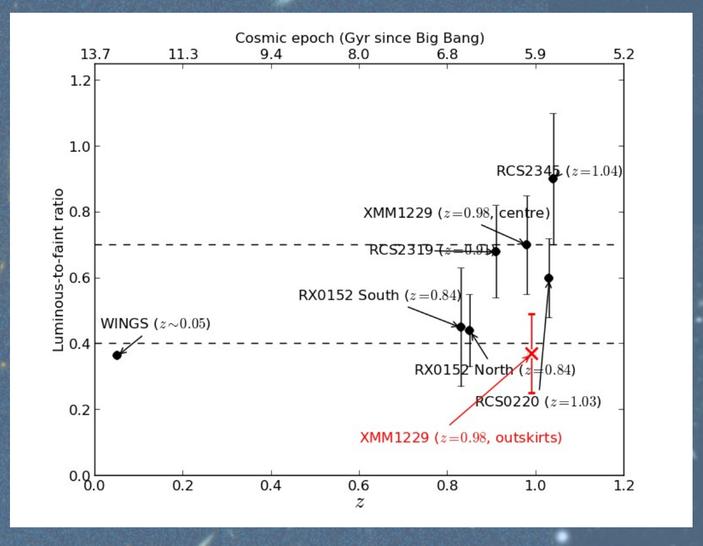
Left: We compare the behaviour of red sequence galaxies with different morphologies in XMM1229 (figure below) and two low-redshift composite cluster samples: MORPHS (z~0.4) and WINGS (z~0.05).

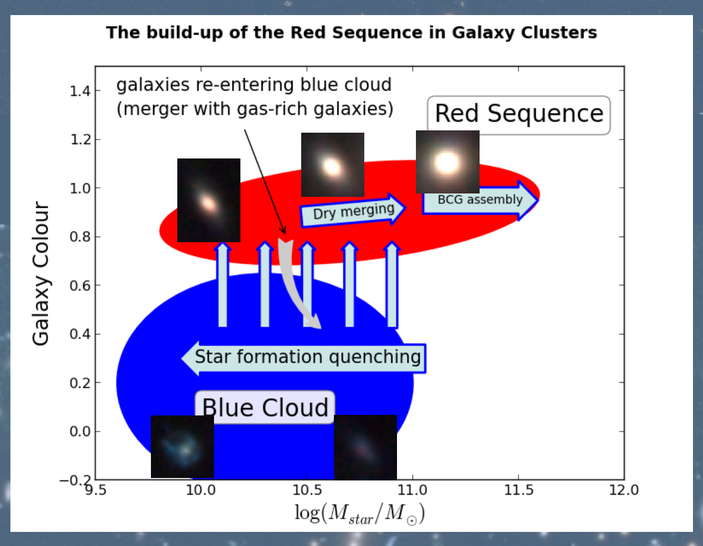
- The fraction of S0 galaxies in XMM1229 decreases at faint luminosities, where disc-dominated systems tend to become more frequent. At low redshift the fractions of discs is overall lower. This suggests that the faint red disc galaxies seen at z~1 may be the progenitors of faint S0s seen in local clusters.

- The bright end of the red sequence shows significant evolution, with a population of massive elliptical galaxies not detected at least up to z=0.3. These galaxies were likely originated via dry merging, although some of them show bluer colours suggesting the presence of younger or metal-poor stellar populations (Crawford et al. 1999, Jiménez et al. 2011).

XMMU J1229+0151 (z=0.98)







HCS clusters at z~1 show a deficit of galaxies at the faint end of the red sequence (see left-hand panel) in their inner regions (R < 0.54 R_{200}). This deficit, parametrised by the higher ratio between the numbers of luminous and faint galaxies (L/F) at high redshift, indicates that the red sequence is building up at low masses because lower-mass galaxies cease star formation at later times settling later on to the red sequence (downsizing, central panel). This result is consistent with most authors in the recent literature (e.g.: De Lucia et al. 2007, Capozzi et al. 2010, Rudnick et al. 2012). However, the large uncertainties on the measurements of L/F and the difficulties in determining cluster membership at high redshift do not allow to exclude that the deficit could be only a selection effect (see Andreon 2008 and Crawford et al 2009). We do not detect deficit in the cluster RX J0152.7-1357 at z=0.84 and in the outskirts (i.e. R > 0.54 R_{200}) of XMM1229 (red point in central panel). The picture we draw for the build-up of the red sequence and the morphological evolution in the HCS clusters can be summarised by the cartoon in the right-hand panel.

References:

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The results presented in this poster are part of Cerulo P. et al. (2013), submitted to MNRAS.