How star formation is shut down depends on environment, but the properties of galaxies in transition do not

Benedetta Vulcani
Star formation - mass relation

(e.g. Brinchmann et al. 2004, Noeske et al. 2007a, Elbaz et al. 2007, Daddi et al. 2007 and many others)

Peng et al. 2010
Star formation - mass relation

(e.g. Brinchmann et al. 2004, Noeske et al. 2007a, Elbaz et al. 2007, Daddi et al. 2007 and many others)

INDEPENDENT OF THE ENVIRONMENT

Peng et al. 2010
Star formation - mass relation

(e.g. Brinchmann et al. 2004, Noeske et al. 2007a, Elbaz et al. 2007, Daddi et al. 2007 and many others)

Independent of the environment

Peng et al. 2010
Star formation - mass relation

(e.g. Brinchmann et al. 2004, Noeske et al. 2007, Elbaz et al. 2007, Daddi et al. 2007 and many others)

INDEPENDENT OF THE ENVIRONMENT

Peng et al. 2010
Star formation - mass relation in different environments at low z

in collaboration with Angela Paccagnella, Bianca Poggianti & the WINGS team
The sample

WINGS + OMEGAWINGS surveys
31 clusters at 0.04 < z < 0.07
mass complete sample
galaxies within 2 R_200 from the cluster center
fore/background galaxies for the field sample
SFR and masses from spectrophotometric model (Fritz et al. 2007, 2011)
The sample

WINGS + OMEGA WINGS surveys
31 clusters at 0.04 < z < 0.07
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fore/background galaxies for the field sample
SFR and masses from spectrophotometric model

Paccagnella, BV et al.
ApJL to be submitted
The sample

WINGS+OMEGAWINGS surveys
31 clusters at 0.04<z<0.07
mass complete sample

Paccagnella, BV et al.
ApJL to be submitted
THE INCIDENCE OF GALAXIES IN TRANSITION DEPENDS ON ENVIRONMENT

As galaxies leave the main sequence, they become redder and older

→ GRADUAL SHUT DOWN OF STAR FORMATION, ONLY CLUSTER CORES STRONGLY QUENCH GALAXIES
Star formation - mass relation in different environments at higher $z$

in collaboration with Bianca Poggianti & the EDiSCS team
The sample

Eso Distant Cluster Survey
17 clusters and 10 groups at 0.4<z<0.8
mass complete sample
field sample from Noeske et al. 2007 (AEGIS)
stellar masses from the relation between $L_B$ and B-V color (Bell & De Jong 2001)
SFRs from OII and IR luminosity
AGN contamination?
The sample

Eso Distant Cluster Survey
17 clusters and 10 groups at 0.4 < z < 0.8
mass complete sample
field sample from Noeske et al. 2007 (AEGIS)
stellar masses from the relation between L_B and B-V color (Bell & De Jong 2001)

SFR
AGN

clusters + groups
field

▲ 24 μm detection + OII
■ only OII

BV et al. (2010)
The sample

Eso Distant Cluster Survey
17 clusters and 10 groups at $0.4 < z < 0.8$
mass complete sample
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field

\[ \Delta \text{ 24 $\mu$m detection + OII} \]
\[ \text{  only OII} \]

\[ \text{ red galaxies} \]

BV et al. (2010)
The sample

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stellar masses from the relation between L_B and B-V color (Bell & De Jong 2001)

SFR
AGN

similar trends at z~0.5

clusters+groups
field

▲ 24 μm detection + OII
■ only OII

red galaxies

BV et al. (2010)
24 μm detection + OII
only OII
BV et al. (2010)
clusters

field

groups

24 μm detection + OII

only OII

red galaxies

BV et al. (2010)
Star formation in clusters deviate from the trend of the field
Groups follow the SFR-Mass relation of the field

NO STRANGULATION    NO PREPROCESSING

BV et al. (2010)
Star formation - mass relation
Star formation - mass relation
Star formation - mass relation
Star formation - mass relation
Star formation - mass relation
Spatial distribution of star formation in cluster galaxies at $z \sim 0.5$

in collaboration with Tommaso Treu, Kasper Schmidt, Bianca Poggianti and the GLASS team
The Grism Lens-Amplified Survey from Space (PI T. Treu, UCLA)

140 orbits HST grism spectroscopy of 10 massive clusters (Cycle 21) COMPLETED

Clusters are selected from CLASH and Frontier Field (z=0.3-0.6)

Spectra for ~20,000 objects (~10,000 down to $m_{F140} \sim 24$)

Spatial information to create maps of emission lines

e.g. Schmidt+2013, Nelson+2012,2013

Credit: K. Schmidt
The Grism Lens-Amplified Survey from Space (PI T.Treu, UCLA)

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Spatial information to create maps of emission lines
e.g. Schmidt+2013, Nelson+2012,2013

Credit: K. Schmidt
The sample

2 clusters: MACS0717.5+3745 z=0.548 (merging)
  MACS1423.8+2404 z=0.545 (relaxed)
All galaxies with reliable z estimate and detected Hα in emission (in G102)
25 galaxies with z within ± 0.03 the z_{cl}: CLUSTER MEMBER sample
17 galaxies with z outside ± 0.03 the z_{cl}: FIELD sample
Stellar masses from SED fitting (CLASH photometry)
sizes from the second order moment of the light distribution
Maps of Hα and continuum emission

- $r(\text{H}\alpha) > r(\text{cont})$
- $r(\text{H}\alpha) = r(\text{cont})$

$\sim 60\%$ both in clusters and field

$\sim 30\%$ in clusters

$\sim 20\%$ in the field
SIZE RATIO

OFFSET BETWEEN THE EMISSION IN THE CONTINUUM AND THE Hα EMISSION
Maps of Hα and position within the clusters

LOCAL GAS DENSITY (X ray emission)

$\text{MACS}1423 \quad \text{MACS}07\text{17}$

$r(\text{H} \alpha) > r(\text{cont})$

$r(\text{H} \alpha) = r(\text{cont})$

$r(\text{H} \alpha) < r(\text{cont})$

similar results when using LOCAL MASS DENSITY (gravitational lens model)
Star formation - mass relation

![Graph showing the relationship between log(SFR) and log(M_\star[M_\odot])]
Summary

Environmental processes are expected to act on cluster galaxies, leaving a recognizable signature.

Galaxies in clusters are as star forming as galaxies in the field, both at $z=0$ and at $z=0.5$.

In clusters a population of galaxies in transition from being star forming to passive is evident.

Both in clusters and field 60% of the galaxies have $r(H\alpha)$ larger than $r(\text{continuum})$ → SF occurring in galaxy outskirts.

In clusters some examples of $r(H\alpha) >> r(\text{continuum})$ → sign of ongoing stripping?

Both in clusters and field the $H\alpha$ emission is offset with respect of the continuum emission → bulk of SF not occurring in galaxy cores.

In clusters offset correlate with X-ray emission → sign of ongoing stripping?

MACS1423 is more relaxed than MACS0717 and all but one galaxies have $H\alpha$ disk larger than continuum.
FROM BLUE STAR-FORMING TO RED PASSIVE: GALAXIES IN TRANSITION IN DIFFERENT ENVIRONMENTS

Benedetta Vulcani, Bianca M. Poggianti, Jacopo Fritz, Giovanni Fasano, Alessia Moretti, Rosa Calvi, and Angela Paccagnella

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Abstract

We use the $(U-B)_{AB}$ color and morphologies to characterize galaxies, in ongoing or recent transformation of their star formation activity and/or late types, and blue star-forming early types. Color fractions depend on environment. The incidence of red galaxies increases with increasing masses toward the group outskirts and in binary and single galaxies. The galaxies are independent of environment, and increases monotonically with structural parameters, star formation properties, histories, and ages for the different subpopulations. Color transformations are due to a bulges and disks which does not noticeably affect galaxy structure. The enhanced bulge-to-disk ratio due to the remission of the disk, not to suggest that green colors might be due to star formation histories for the classical “quenching” processes. Our results and formation activity and morphology depend neither on environment of galaxy of a halo. The only environmental dependence we find is

- **Keywords:** galaxies: general – galaxies: formation – galaxies: evolution – galaxies: morphologies
Mergers and star formation: the environment and stellar mass growth of ultra-v luminous galaxies since z = 2.

UltraVISTA

AB


thank you for the attention