Quiescent galaxy populations at 1 < z < 1.5 : GOGREEN survey

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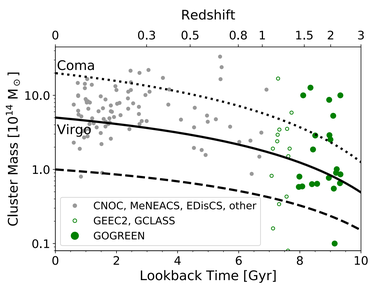
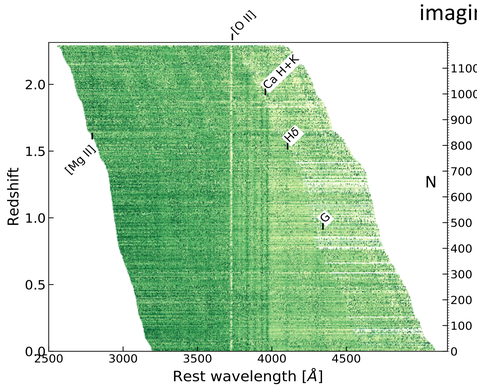
GOGREEN survey



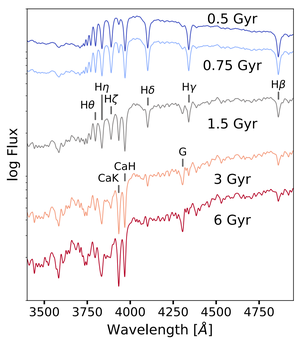
Gemini **O**bservations of **G**alaxies in **R**ich **E**arly **EN**vironments

- 12 clusters + 9 groups selected as progenitors of local clusters
- Gemini spectroscopy + deep optical (ugriz, AB~26) and NIR (YJK, AB~24) imaging



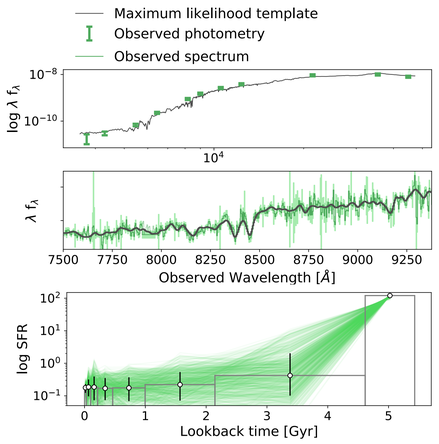
- 1146 galaxies observed within 1 < z < 1.5 with spectroscopy
- 479 quiescent galaxies: 124 field galaxies and 253 cluster members

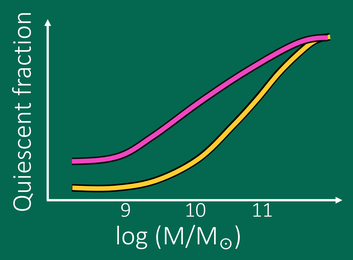
Galaxy star formation histories

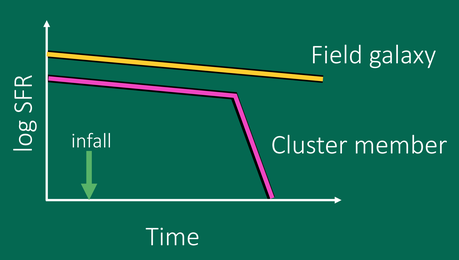


- Spectral features change as a galaxy evolves, indicate age of stellar populations
- We can use these features to measure the age of a galaxy, and broadly trace the star formation history
- Quiescent galaxies are selected by UVJ colour, D_n4000 break, or [O II] emission

- We use the Bayesian MCMC fitting code Prospector[1] to fit SPS templates to the spectroscopy and photometry
- We use non-parametric models with eight age bins which can capture complex star formation histories

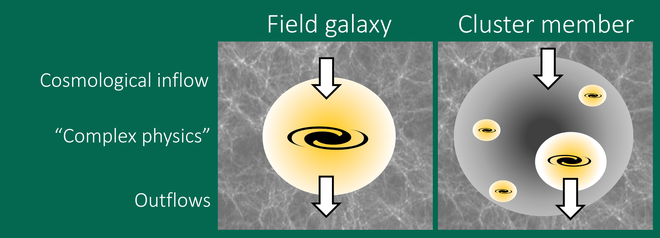






- Galaxies in clusters are more likely to be quiescent, i.e. not actively forming stars, regardless of mass.
- Whatever mechanism that transforms galaxies from star forming to quiescent is either stronger in clusters, and/or there are additional mechanisms.
- *Environmental-quenching* mechanisms suppress star formation sometime after a galaxy enters a cluster.

Galaxy evolution is influenced by environment



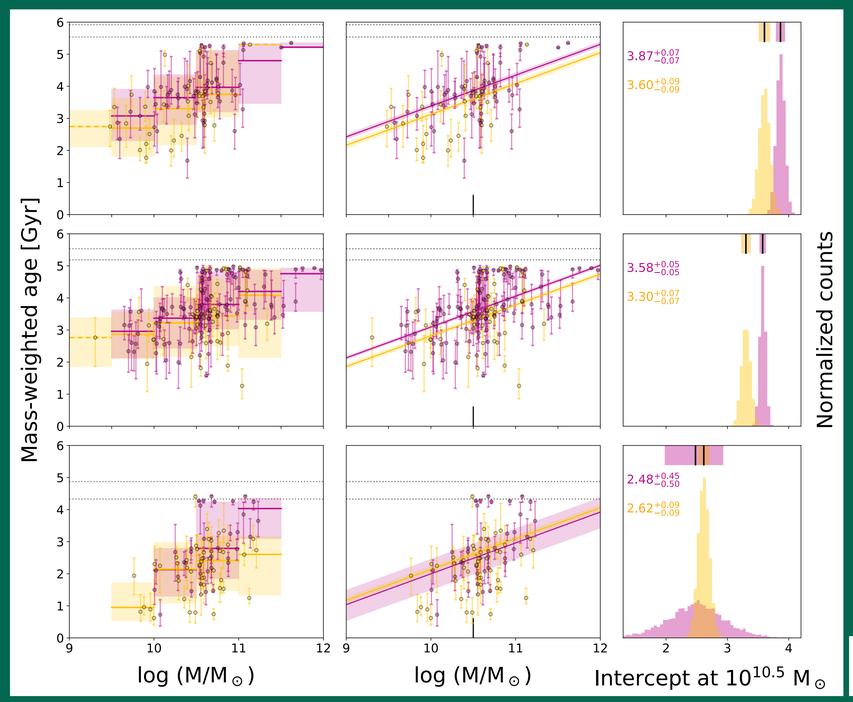
- 'Field' galaxies have gas reservoirs replenished by infalling gas, while 'cluster galaxies' do not – it instead accretes onto the cluster halo.
- Clusters host many galaxies, allowing for many gravitational interactions and mergers.

No significant age difference between quiescent cluster and field galaxies at 1 < z < 1.5

We compare differences in the star formation histories (measured as stellar ages) of field galaxies and cluster members as a function of environment, mass, and redshift.

In isolated mass bins, there is little difference in mass-weighted age

The age–mass trend is the same between field and cluster galaxies within 2σ at 1 < z < 1.5



1 < z < 1.1

1.1 < z < 1.2

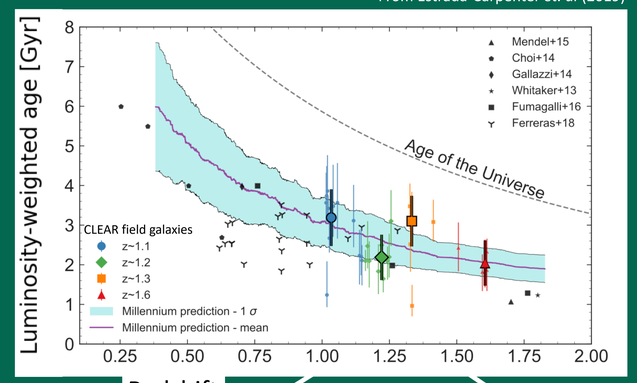
1.3 < z < 1.5

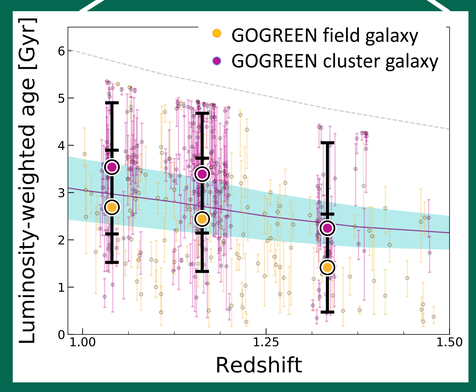
- GOGREEN field galaxy
- GOGREEN cluster galaxy

We compare our results to predictions of the field population age-redshift trend from the Millennium simulation, lower redshift samples, and a population of field galaxies from a deep HST WFC3/G102 grism survey of CANDELS (CLEAR survey[2]).

- Our measurements agree well with this data, with cluster galaxies having slightly older ages.

From Estrada-Carpenter *et. al* (2019)





Future work:

- Proposed environmental quenching mechanisms predict differences in the ages of cluster and field populations given the timescale of the process. Given the similarities we find in our data, we may exclude some models.
- There are a number of very old cluster galaxies, and a few very old field galaxies. We will explore differences between these galaxies and the rest of the population w.r.t. cluster-centric distance, morphology, α-abundance, etc.

Poster available at: **gogreensurvey.ca**

✱ Balogh *et. el*, 2017 (2017MNRAS.470.4168B),
[1] Leja *et. al*, 2017 (2017ApJ...837..170L),
[2] Estrada-Capenter *et. al*, 2019 (2019ApJ...870...133E)

See also: poster by Karen McNab ( ), and talk by Andrew Reeves (Wed., Clusters/Groups)