



Identifying unusual quiescent galaxies using deep rest-frame UV imaging with GOGREEN observations



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The Survey and Terminology

The GOGREEN (Gemini Observations of Galaxies in Rich Early Environments) survey uses Gemini North and South to obtain deep spectroscopy and imaging for 21 groups and clusters in the redshift range $1 < z < 1.5$.^[1]

Focusing specifically on the clusters in our sample, we define the following terminology:

- Quiescent Galaxies: UVJ selected red-sequence galaxies, non-starforming.
- Blue Quiescent Galaxies (BQG): UVJ defined as occupying the blue end of the red sequence.
- FUV-bright Quiescents (FUVQ): detected* in rest-frame FUV.
- B-bright Quiescents (BQ): detected* in observed B band.
- V-bright Quiescents (VQ): detected* in observed V band.

By selecting these subsets of the quiescents, we are trying to find unusual quiescents, that are no longer forming stars, but show evidence of recent star formation.

*non-zero flux within 5σ

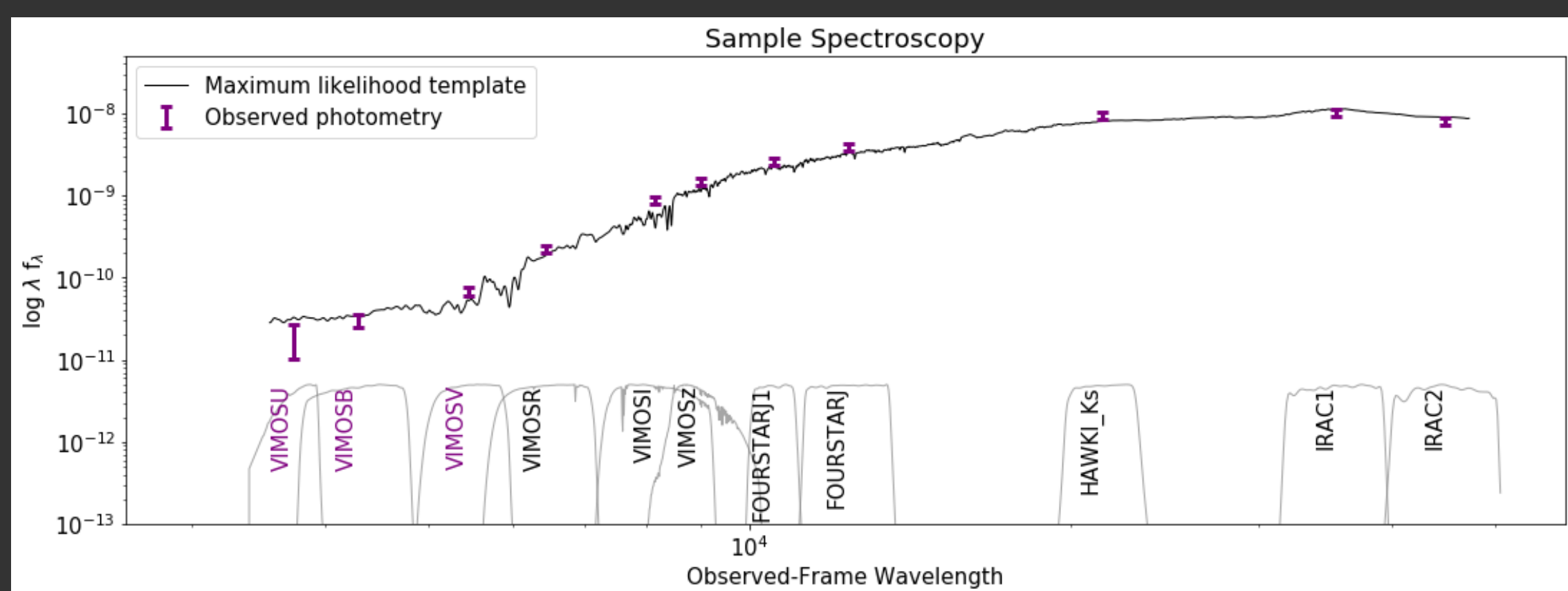


Figure 1. The maximum likelihood template of the spectra along with the observed photometry. The filters considered in this paper are shown in purple, corresponding to the blue end of the spectrum.

Targeting Galaxies Detected in Rest-Frame NUV/FUV

Star formation appears as emission in the rest-frame NUV/FUV (which in the observed frame are the U, V and B bands). Quiescent galaxies, on average are old enough that these signatures aren't detected anymore. Targeting based on these detections allows us to select young quiescents, which may overlap with the population of post-starburst galaxies, that undergo star formation

BQGs were selected to be anything within the blue end of the quiescent population, defined by a box best encompassing galaxies of ages between 300 Myr and 800 Myr.^[2]

The different bands (FUV, B, V) used to categorize detections of quiescents chosen such that typical red sequence galaxies wouldn't show detections since they lack star formation.

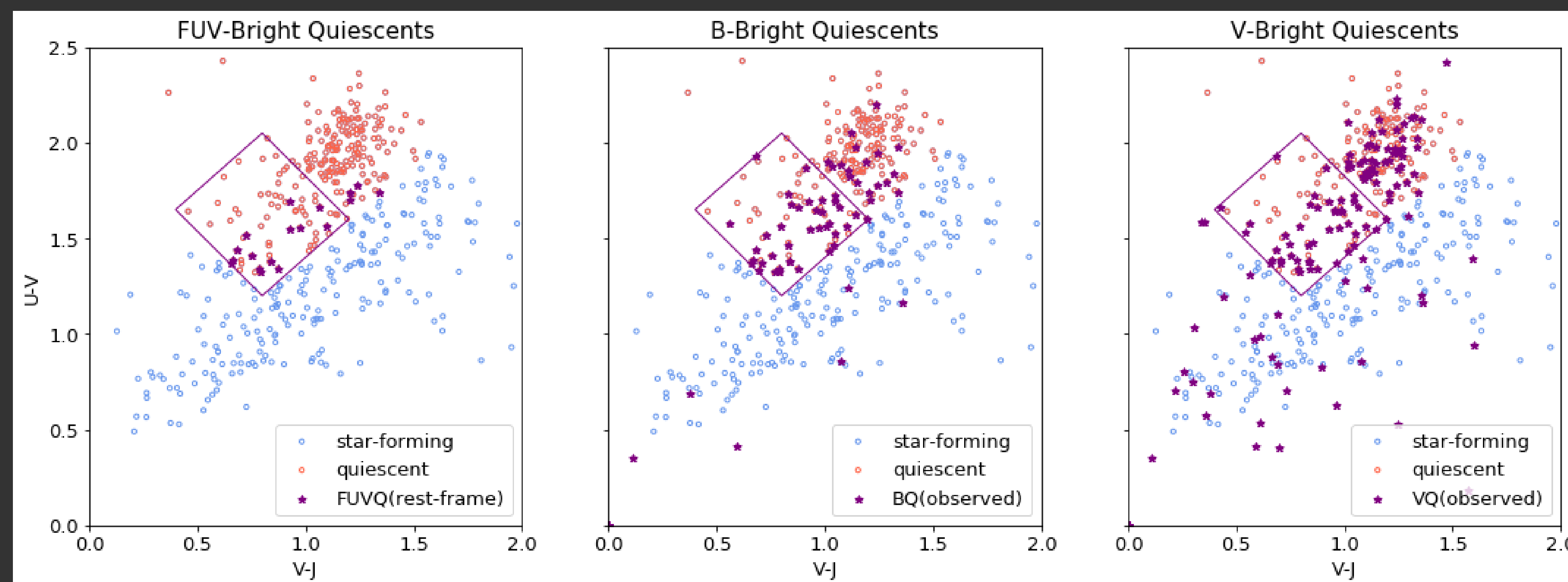


Figure 2. The UVJ colour-colour diagram, showing the different populations, here in a single cluster. Only sampling the quiescent population and those quiescent galaxies which show unusual detection in the rest-frame NUV/FUV shows that there is a large population (purple) that lie on the red sequence (red) but have evidence of star formation in their colour (detections in the FUV, B, V bands).

No Apparent Cluster Dependence

- The galaxies defined as FUVQ, BQ, VQ, trace the quiescent population.
- Their spatial distribution is not related to cluster centric radius
- They show evidence of recent star formation in the form of detections in these bands, yet lie on the red sequence.

Next:

- Compare with spectroscopically identified post-starburst galaxies to see if there's a relation between the two populations
- Simulate the evolution of these galaxies to track their position on a UVJ diagram
- Compare SEDs of these galaxies to typical quiescents of similar masses.

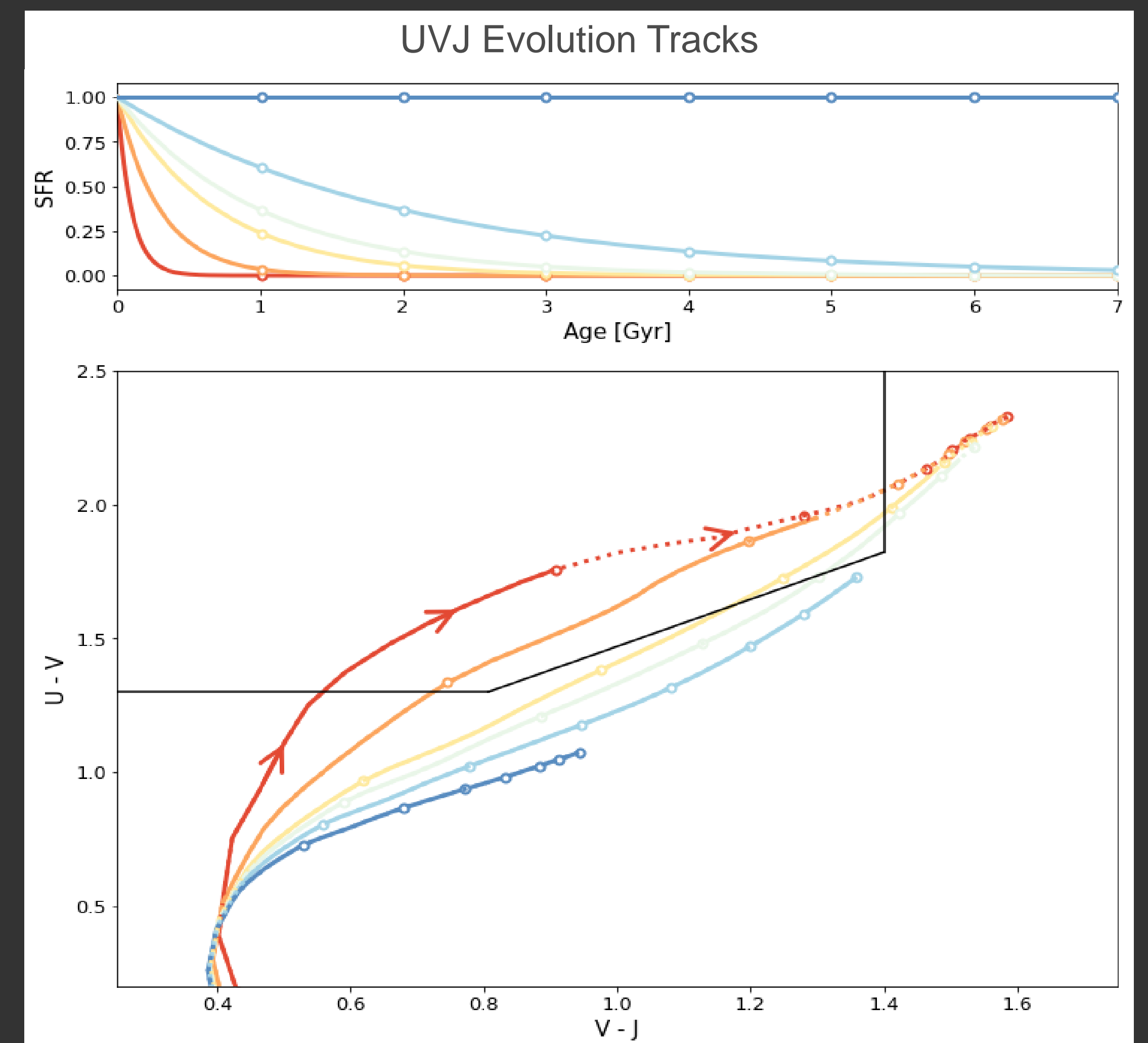


Figure 4. Simulated evolutionary paths for galaxies of different quenching timescales. Galaxies undergoing rapid quenching (red and orange) fill in the lower part of the red sequence, while those with slow quenching only touch the upper red sequence. The unusual quiescents discussed here likely underwent fast quenching. Dotted lines indicate where the galaxies become undetected in FUV.

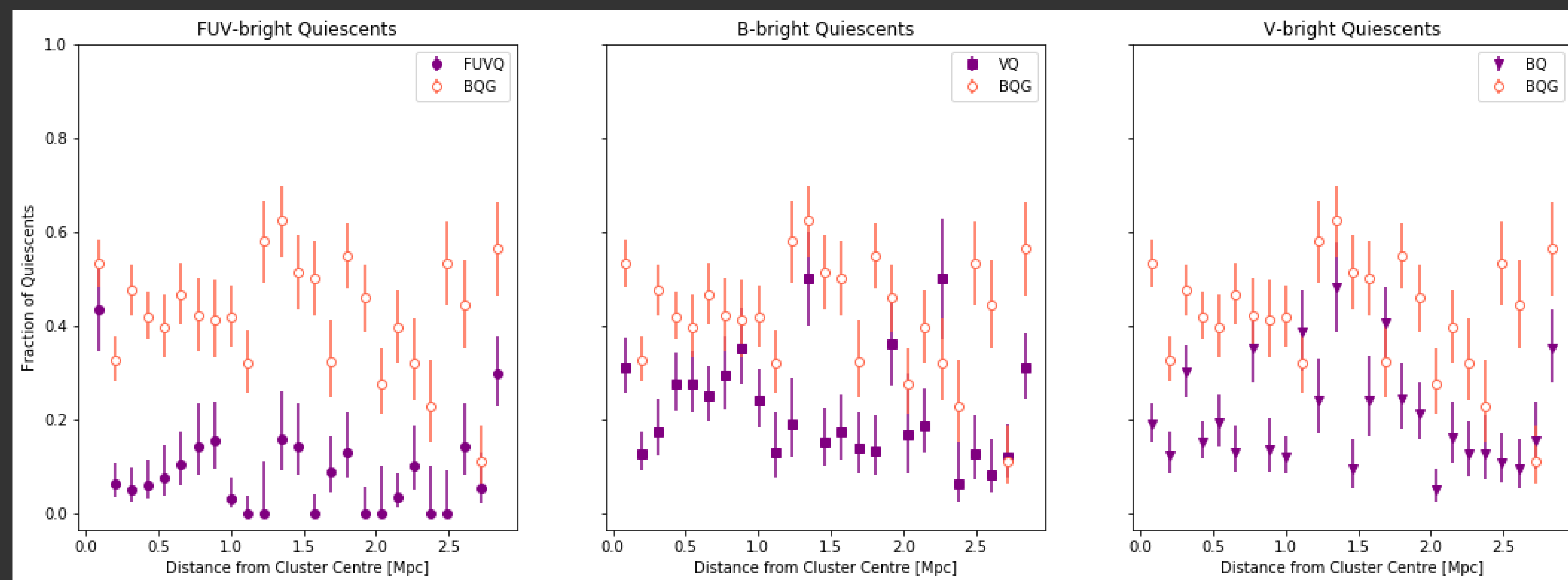
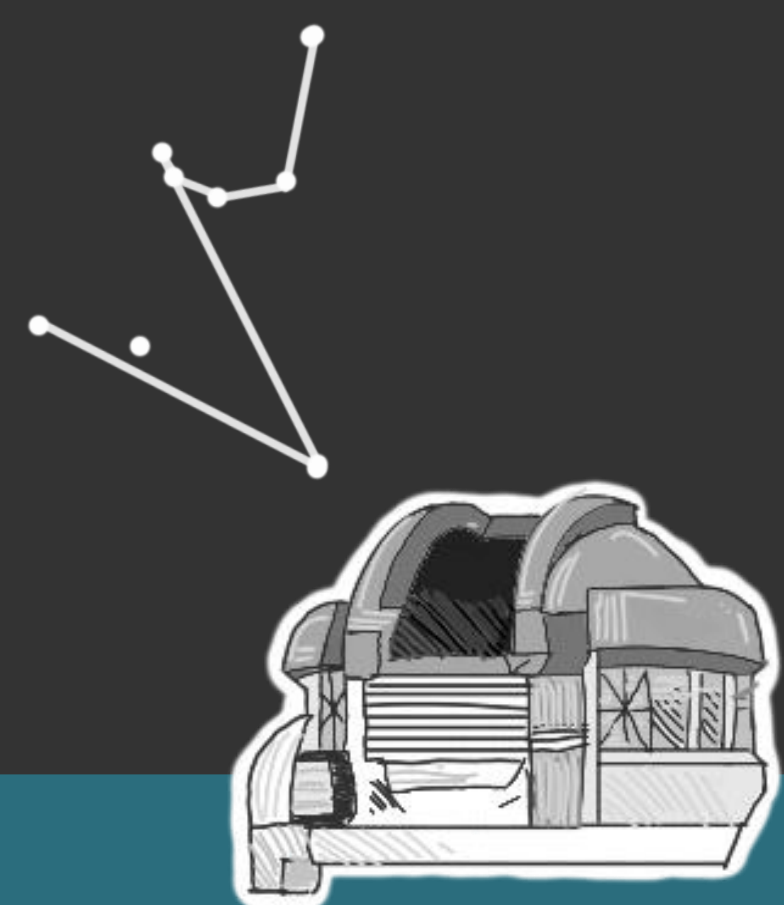


Figure 3. The red points in all three plots show the (same) BQG population defined by UVJ colour. The purple shows each of the three subclasses of unusual quiescents. The scatter in both populations show no correlation with cluster centric radius, and show about the same fraction within the clusters ($r \lesssim 1$ Mpc) as there is outside of them ($r \gtrsim 1$ Mpc)

GOGREEN info and this poster: gogreensurvey.ca



The GOGREEN TEAM

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* CASCA 2019 Poster ** CASCA 2019 Talk (Wed 1:30)

Literature

- [1] Balogh, Michael L., et al. "Gemini Observations of Galaxies in Rich Early Environments (GOGREEN) I: survey description." Monthly Notices of the Royal Astronomical Society 470.4 (2017): 4168-4185.
- [2] Belli, Sirio, Andrew B. Newman, and Richard S. Ellis. "MOSFIRE Spectroscopy of Quiescent Galaxies at $1.5 < z < 2.5$. II. Star Formation Histories and Galaxy Quenching." The Astrophysical Journal 874.1 (2019): 17.