AEGIS: The Morphologies of Green Galaxies at 0.4<z<1.2

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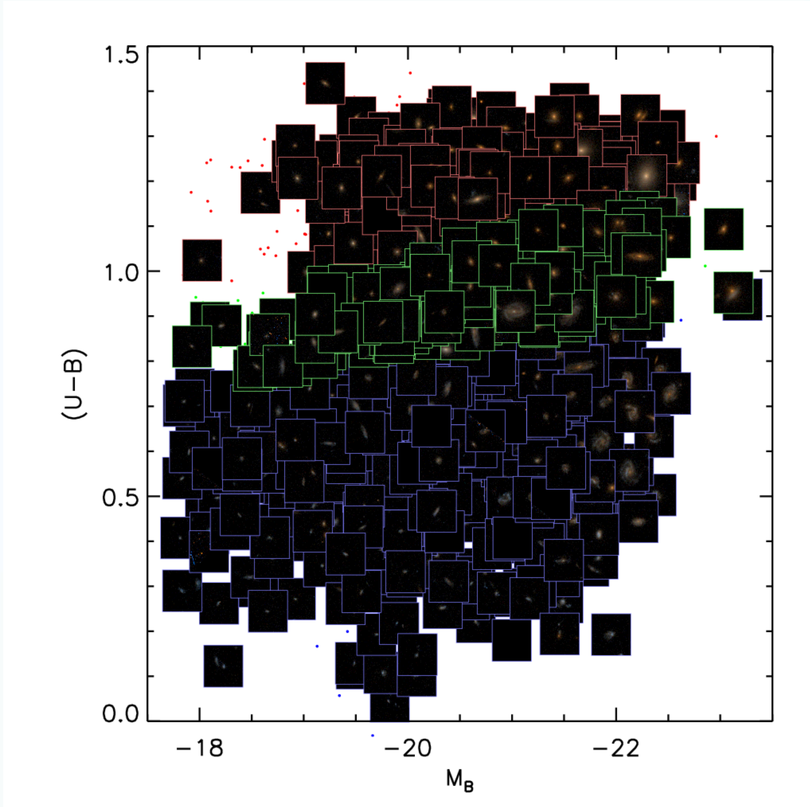
Abstract

We present quantitative morphologies of ~300 galaxies in the optically-defined green valley at 0.4 < z < 1.2, in order to constrain the mechanism(s) responsible for quenching star formation in this population. The sample is selected from galaxies in the All-Wavelength Extended Growth Strip (~0.2 deg^2) International Survey (AEGIS) with DEEP2 spectroscopic and CFHTLS Photometric redshifts. Using *HST*/ACS imaging, we study several quantitative morphological parameters including CAS, B/T from GIM2D, and Gini/M_{20}.

We find that the green galaxy population is intermediate between the red and blue galaxy populations in terms of concentration, asymmetry, morphological type and merger fraction. We find that most green galaxies are not classified as mergers; in fact, the merger fraction in the green valley is lower than in the blue cloud. We show that at a given stellar mass, green galaxies have higher concentration values than blue galaxies and lower concentration values than red galaxies. Additionally, we find that 12% of green galaxies are bulge-less with B/T = 0. Our results show that green galaxies are generally massive ($M_* \sim 10^{10.5}\ M_\odot$) disk galaxies with high concentrations. We conclude that major mergers are likely not the sole mechanism responsible for quenching star formation in this population and that either other external processes or internal secular processes play an important role both in driving gas towards the center of these galaxies and in quenching star formation.



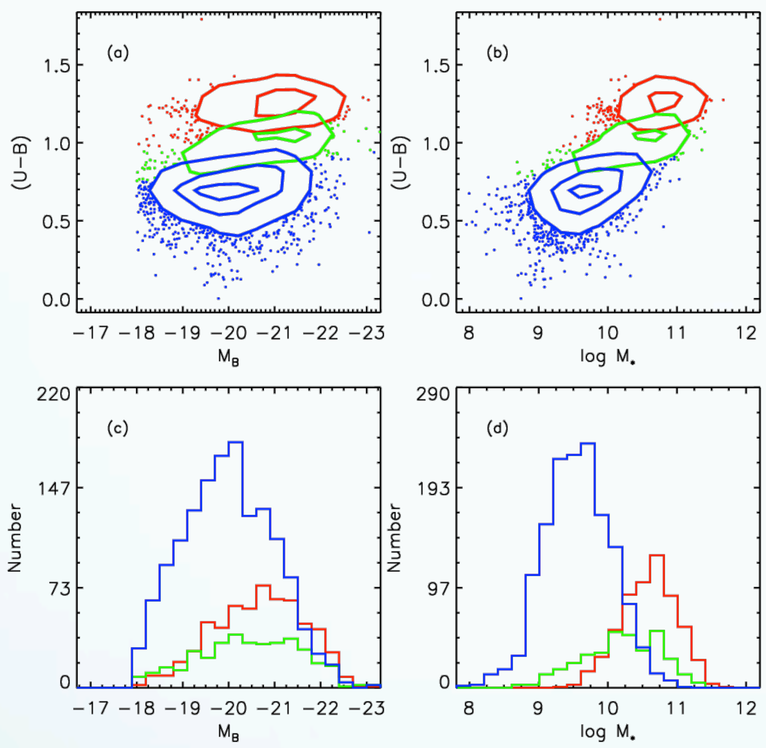


Figure 1. We show the color magnitude diagram (a), the color stellar mass diagram (b), the one dimensional magnitude distribution (c) and stellar mass distributions (d).

Green galaxies have intermediate stellar masses between blue cloud and red sequence galaxy populations. To limit differences in color we consider morphology dependent on stellar mass distributions at a given stellar mass.

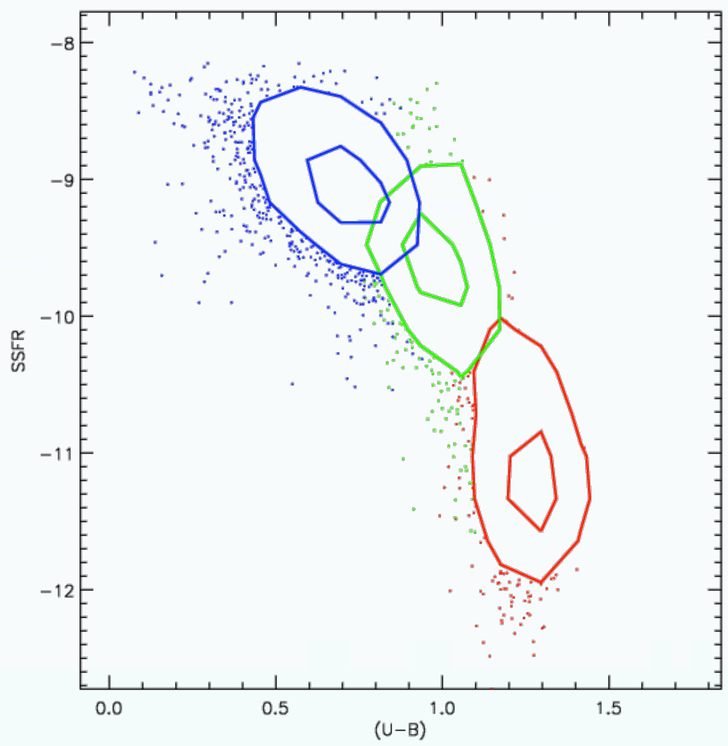


Figure 2. In the (U-B) color versus specific star formation rate space, we find that green galaxies have lower star formation per unit mass than blue galaxies. Galaxies with optical colors affected by dust will be scattered into the upper right corner of this plot. Most are not green due to dust, but are green due to lower SFR.

We repeat all red, green and blue after removing dust obscured star forming galaxies and we find the same results.

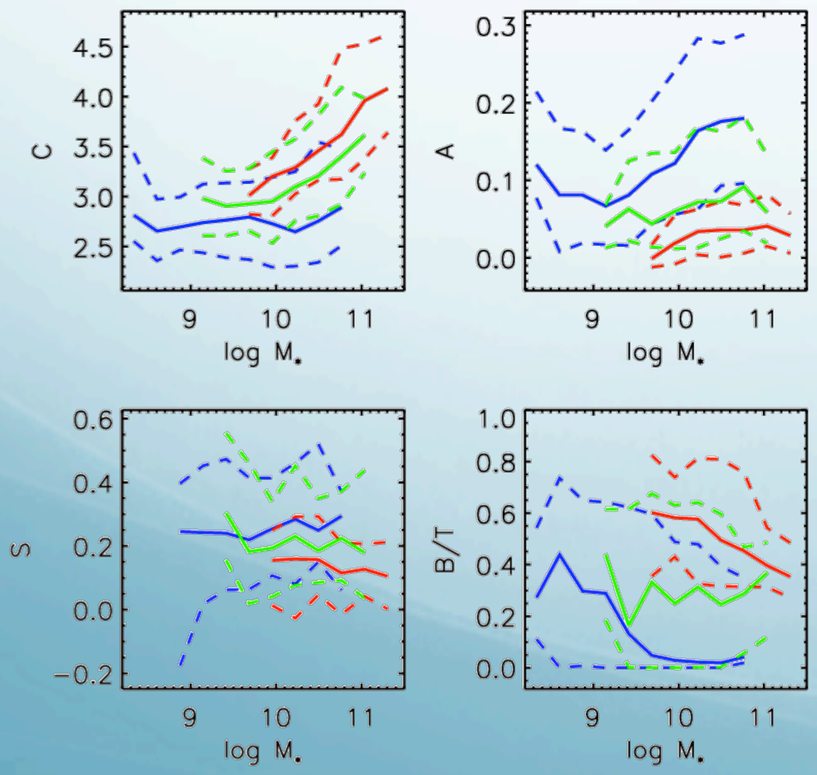


Figure 3. Conditional distribution plots which show the median and 68% range for the red, green and blue galaxies. The four subplot show concentration, asymmetry, smoothness, and bulge to total fraction values at a given mass.

Compared to blue galaxies at a fixed stellar mass green galaxies:

- have higher B/T
- are more smooth (less clumpy)
- are less asymmetric
- are more concentrated

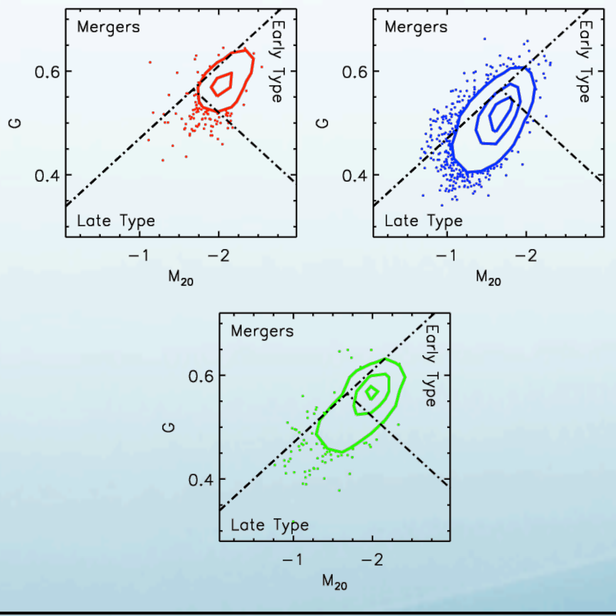


Figure 4. Using the cuts defined in Lotz+04, we can divide the space into early (E/S0/Sa) and late (Sb/Sc/Ir) types, and mergers. We find fewer mergers in the green galaxy population compared to the blue galaxy population. Half of the green galaxy population is late-type, so they are not likely to be recent merger.

These fractions are measured over a wide redshift range in samples that are not volume-limited and thus should not be taken as the global fractions for red, green and blue galaxies.

	Red	Green	Blue
Mergers	11.9 ± 1.1 %	14.1 ± 1.1 %	19.1 ± 1.2 %
Early Type	66.4 ± 3.3 %	34.0 ± 1.9 %	7.8 ± 0.7 %
Late Type	21.7 ± 1.6 %	51.9 ± 2.5 %	73.1 ± 2.9 %