

The role of environment for quenching star formation in observed low-redshift galaxies: Analysis of SDSS data (DR8)

1. Plot a histogram for sSFR at different stellar mass bins (e.g., 9.5-10, 10-10.5, 10.5-11, 11-12). What do you find? Interpret your result.
2. Distinguish star-forming from quiescent galaxies by using sSFR as a discriminant. Looking at the plot of Fig. 1, what could be a good choice for the critical sSFR?
3. Plot the fraction of quiescent galaxies vs galaxy stellar mass, what do you observe and why?

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4. Split your galaxy sample into different stellar mass bins, and plot the quiescent galaxy fractions versus different density estimates (Neighbour number count within a cylinder of 0.5, 1 and 2 Mpc). Interpret your results.
5. What are potential caveats of the analysis above? If you want to better isolate environmental effects on SF quenching, what would be needed?
6. The analysis has been done for low redshift ($z < 0.1$) galaxies. How would you expect the quiescent galaxy fractions at a given galaxy mass and density to evolve towards higher redshifts and why? [DeLucia, Hirschmann & Fontanot 2019 may provide some helpful insights].

Information for Exercises — 5

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The SDSS catalogues has the following format:

ssfr, errlow_ssfr, errup_ssfr, mass, errlow_mass, errup_mass, density_05Mpc, density_1Mpc, dens_2Mpc, dens_3_o, annu_1_o, annu_2_o, annu_3_o, annu_5_o, dummy1, dummy2, dummy3, r_a, Dec, redshift, Mag_r, max, distmax, dens_01_o, dens_02_o

SSFR: specific SFR = SFR/Mstellar; units: $\log(1/\text{yr})$

MASS: stellar mass; units: $\log(M_{\text{sun}})$

density_05Mpc, density_1Mpc, dens_2Mpc: number counts of neighbour galaxies within a projected cylinder of 0.5, 1, and 2 Mpc (not in log!)

Note that details on projected density are given in Wilman+10 (see also Hirschmann+14)

Mag_r: absolute r-band magnitude

For the following analysis, select only galaxies brighter than $M_r = -18$ (to be complete in the considered redshift space).