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Variability of star-forming galaxies around the SFMS and MZR

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Abstract

The star-formation main sequence (SFMS) and the mass-metallicity relation (MZR) are two tight, fundamental relations that govern galaxy evolution. Their intrinsic scatter originates from some galaxies having above- or below-average SFR and metallicity, which leads to the question of whether galaxies which are offset from the relations stay there for long periods of time or whether they frequently cross the relations such as with bursts of star-formation. This has been widely studied in simulations but observational evidence is scarce and typically limited to indirect proxies of variability.

In this poster, I will show a novel approach in which we directly measure the number of times currently star-forming galaxies in the MaNGA sample have crossed each relation in the past Gyr using stellar populations. The stellar MZR is crossed much less than the SFMS and the average number of crossings for both relations grows for lower stellar masses, fitting well with expectations as does the fact that currently star-forming galaxies show significantly more crossings than retired ones. We analyse how well these results fit with predictions of halo virialisation shutting off gas accretion. The deviation from the relation in dex and duration of the bursts is fairly constant regardless of the stellar mass except for the deviation of the MZR which becomes smaller at higher masses, supporting lower outflow efficiency in these galaxies.

We also measure the percentage of time that galaxies currently on one side of the relations spend at the same location showing that, despite how common crossings are, galaxies tend to spend most of their time on one side of the relation. As such, the scatter of the SFMS is a combination of halo-level differentiation and short-term stochastic fluctuations which contribute similarly to it, while the scatter in the stellar MZR is mainly due to halo-level differentiation.

My poster in zenodo.org can be found here