

SDSS-IV MANGA: THE RADIAL PROFILE OF ENHANCED STAR FORMATION IN CLOSE GALAXY PAIRS

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ABSTRACT

We compare the radial profiles of the specific star formation rate (sSFR) in a sample of 169 star-forming galaxies in close pairs with those of mass-matched control galaxies in the SDSS-IV MaNGA survey. We find that the sSFR is centrally enhanced (within one effective radius) in interacting galaxies by ~ 0.3 dex and that there is a weak sSFR suppression in the outskirts of the galaxies of ~ 0.1 dex. We stack the difference profiles for galaxies in five stellar mass bins between $\log(M/M_{\odot}) = 9.0$ – 11.5 and find that the sSFR enhancement has no dependence on the stellar mass. The same result is obtained when the comparison galaxies are matched to each paired galaxy in both stellar mass and redshift. In addition, we find that the sSFR enhancement is elevated in pairs with nearly equal masses and closer projected separations, in agreement with previous work based on single-fiber spectroscopy. We also find that the sSFR offsets in the outskirts of the paired galaxies are dependent on whether the galaxy is the more massive or less massive companion in the pair. The more massive companion experiences zero to a positive sSFR enhancement while the less massive companion experiences sSFR suppression in their outskirts. Our results illustrate the complex tidal effects on star formation in closely paired galaxies.

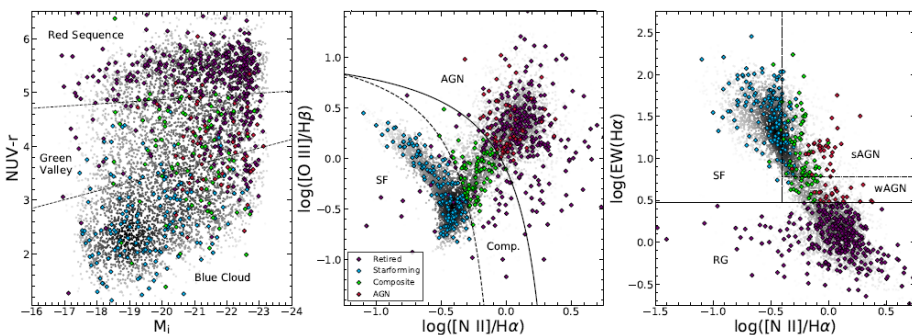
Previous study on SDSS-IV MaNGA data:

Pan+19: The paired galaxies as a function of merger stage, a strong enhancement of sSFR in their centers and a moderate enhancement in their outskirts

This study: the radial profile as a function of the stellar mass, projected separation, and mass ratio

Data: MPL-8 (6142 unique galaxies); Fitting code: SPFIT

Sample selection: CM + BPT + WHAN diagram



Inside-IFU sample (covered by a single IFU): 54 targets

Outside-IFU sample (NSA catalog): 115 targets with pairs

($\Delta v < 500 \text{ km/s}$)

Analysis methods:

sSFR:

Cardelli+89,

A_v from $H\alpha/H\beta$

$$\frac{\text{SFR}}{M_{\odot} \text{ yr}^{-1}} = \frac{L_{H\alpha}}{1.86 \times 10^{41} \text{ erg s}^{-1}}$$

Radial profile:

$0.0 - 2.6 R_{\text{eff}}$

Control sample:

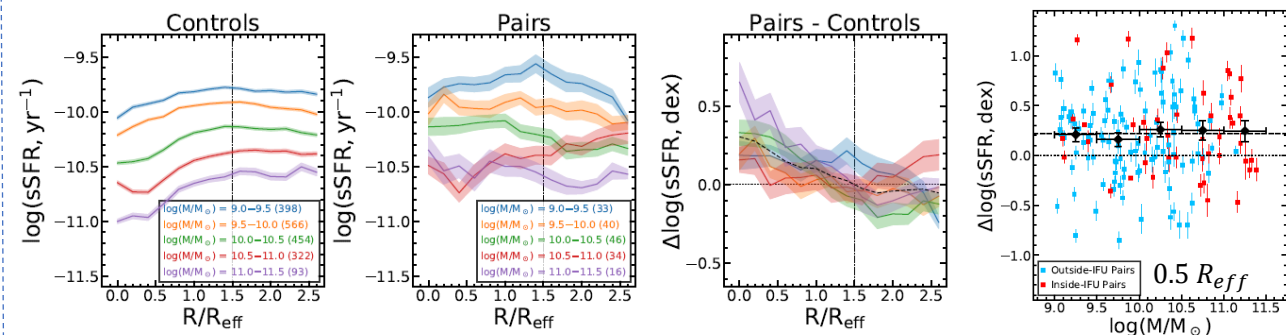
Stellar mass (< 0.1 dex)

Redshift (< 0.025)

$R_{\text{eff}} (< 20\%)$

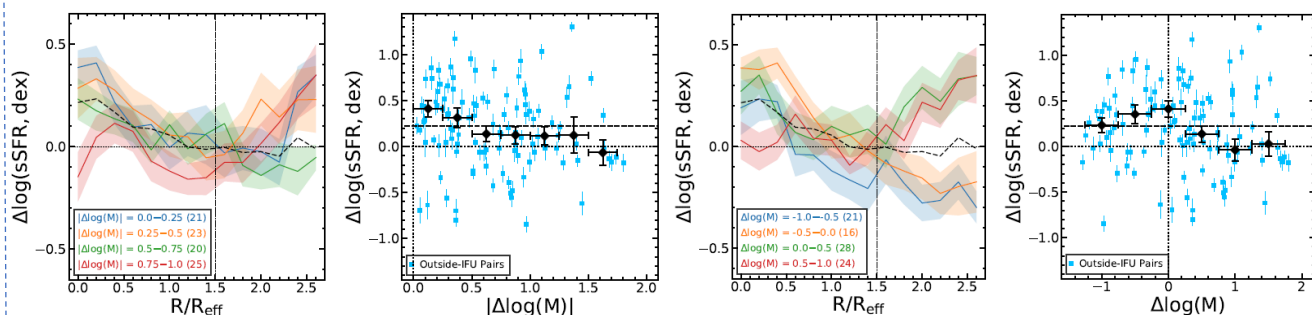
Results:

Star formation: Central enhancement: $\sim 0.3 \pm 0.1$ dex; Outskirts suppression: $0.0 - 0.1$ dex



The $\log(\text{sSFR})$ profile is independent of the total stellar mass of the galaxies

→ Compare with mass ratio (exclude Inside-IFU): $\Delta \log(M) = \log(M_{\text{target}}) - \log(M_{\text{comp}})$,

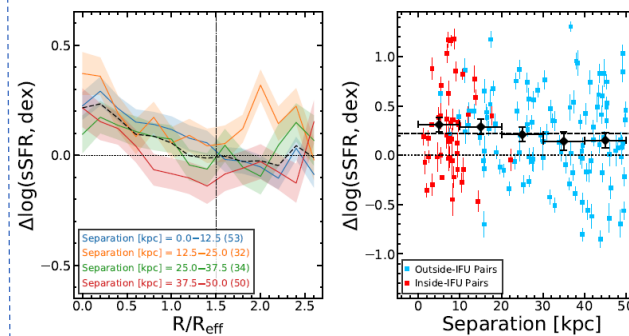


Major mergers: $|\Delta \log(M)| \leq 0.5$

Minor mergers: $|\Delta \log(M)| \geq 0.5$

1. The central \uparrow is strongest for pairs with 1:1 mass
2. Secondary have higher levels of sSFR \uparrow in their centers and sSFR \downarrow in their disks.
3. Primary companions have sSFR \uparrow at wide radii.
4. Secondary shows a higher sSFR \uparrow than primary

→ Compare with separation



Discussion:

1. This paper's sample is lack of post-merger galaxies compare with Pan+19.

[Post-merger have higher $\Delta \log(\text{SFR})$]

2. Compare with hydrodynamical simulations (Patton+20)

Consistent

