The Star Formation Properties of Merging Galaxies at 0.3<z<2.5

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Silva et al. 2018, ApJ 868 46S

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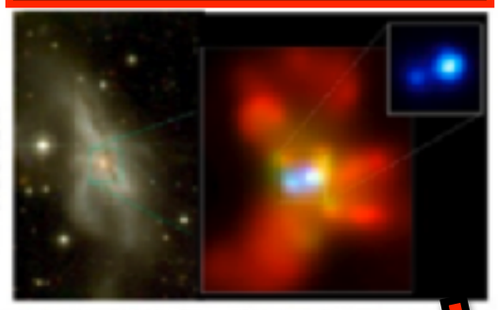
Why study high-z galaxy mergers?

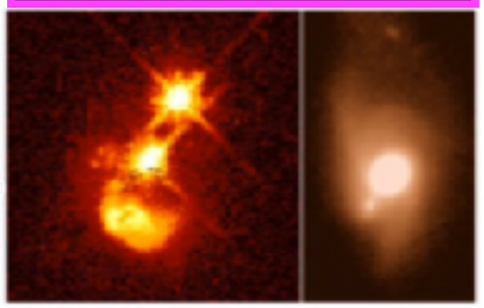
- The merging of two galaxies with similar mass (major mergers) can make profound changes in the morphology and the properties of galaxies

c) Interaction

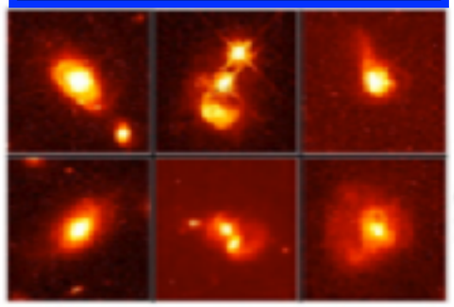
d) Coalescence



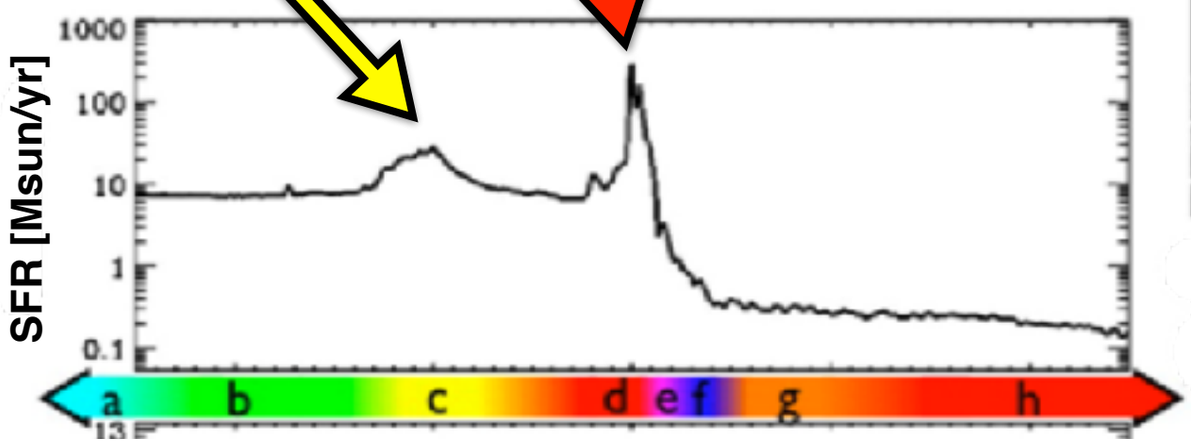
e) Blowout



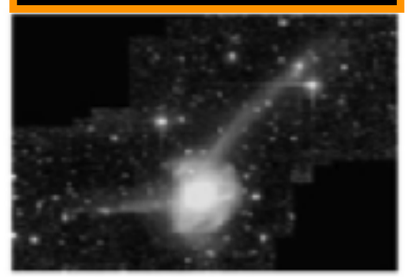
f) Quasar



b) Early-stage

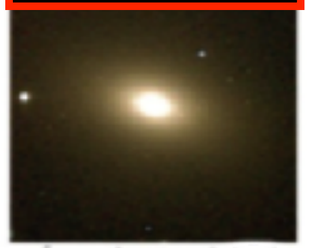


g) Decay



a) Isolated Disk

h) Dead Elliptical



Hopkins+08

Why study high-z galaxy mergers?

- The merging of two galaxies with similar mass (major mergers) can make profound changes in the morphology and the properties of galaxies

- Their fraction seem to increase with redshift

Most of studies of major mergers at z>1 have focus on global statistics (e.g. merger rate) and not impact on properties

Major mergers have been studied in depth in local Universe:

Local mergers show higher Star Formation activity than non-merging galaxies (Darg+10, Jogee+09, Robaina+09, Ellison+13, Kampczyk+13)

Is the same at high redshift?

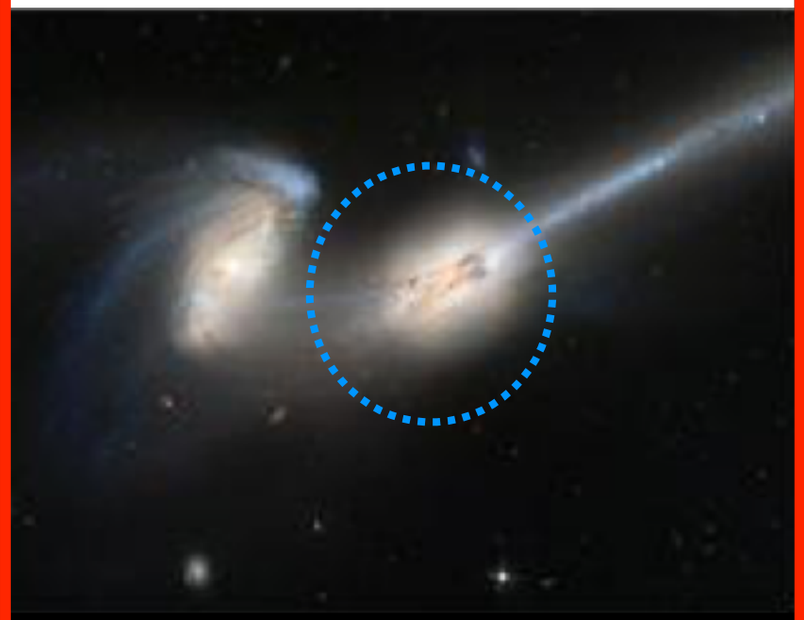
Method to Select Mergers

Lackner et al. 2014

A. Early-Stage

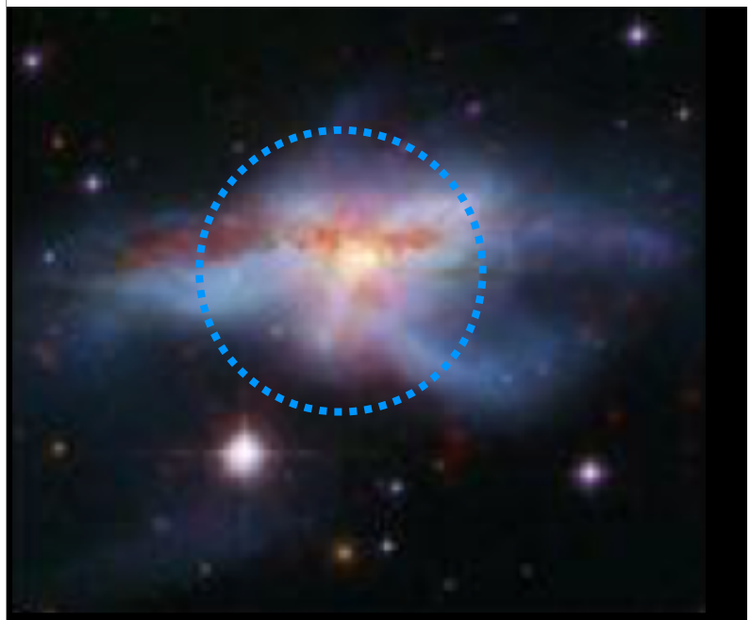
Selection of galaxy pairs with separations <100 kpc

B. Pre-coalescence

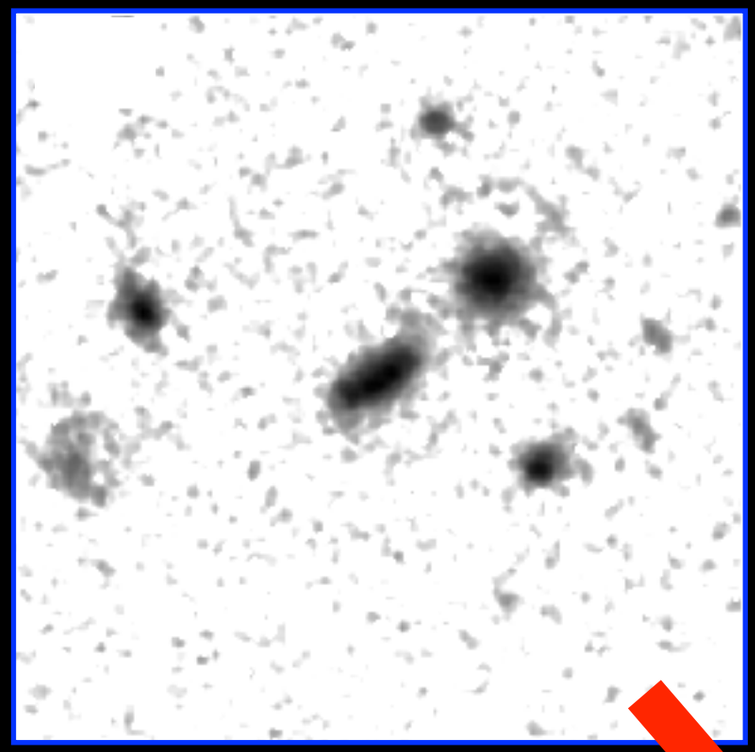


We select galaxies with two intact nuclei separated by few kpc (just before coalescence).

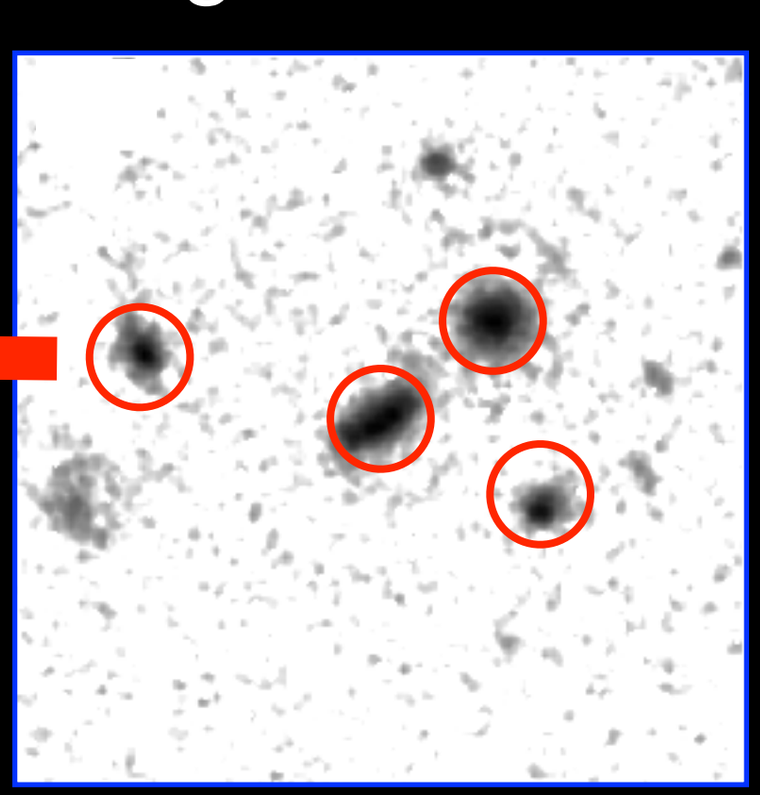
C. Post-Merger



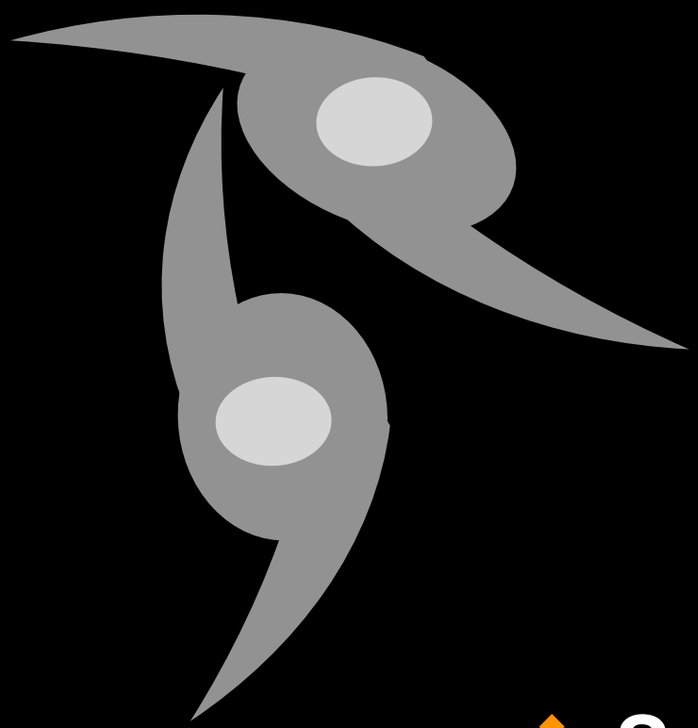
Selection of galaxies with disturbed morphologies



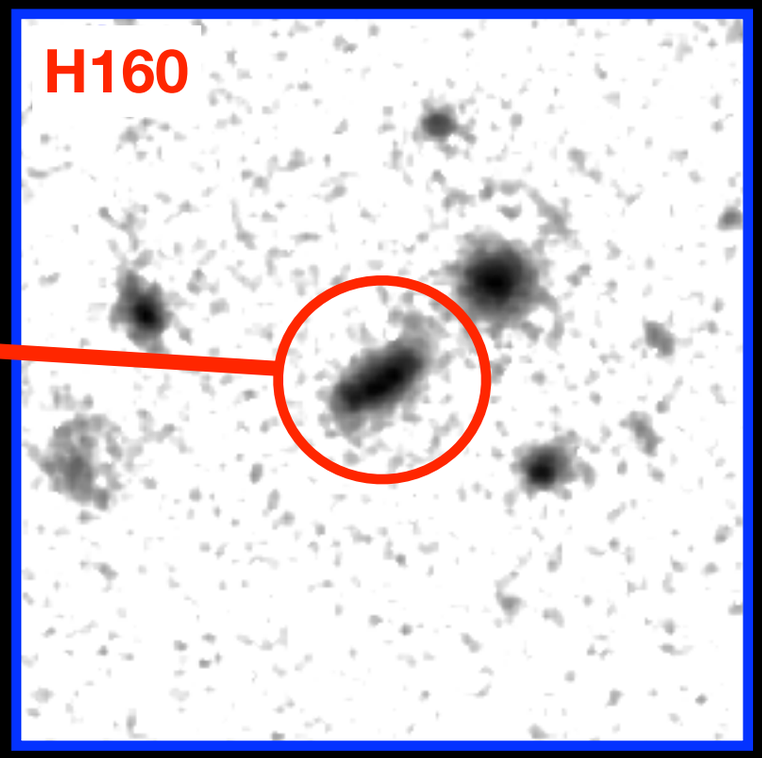
Bright regions in an image



Restrictions on properties to select mergers



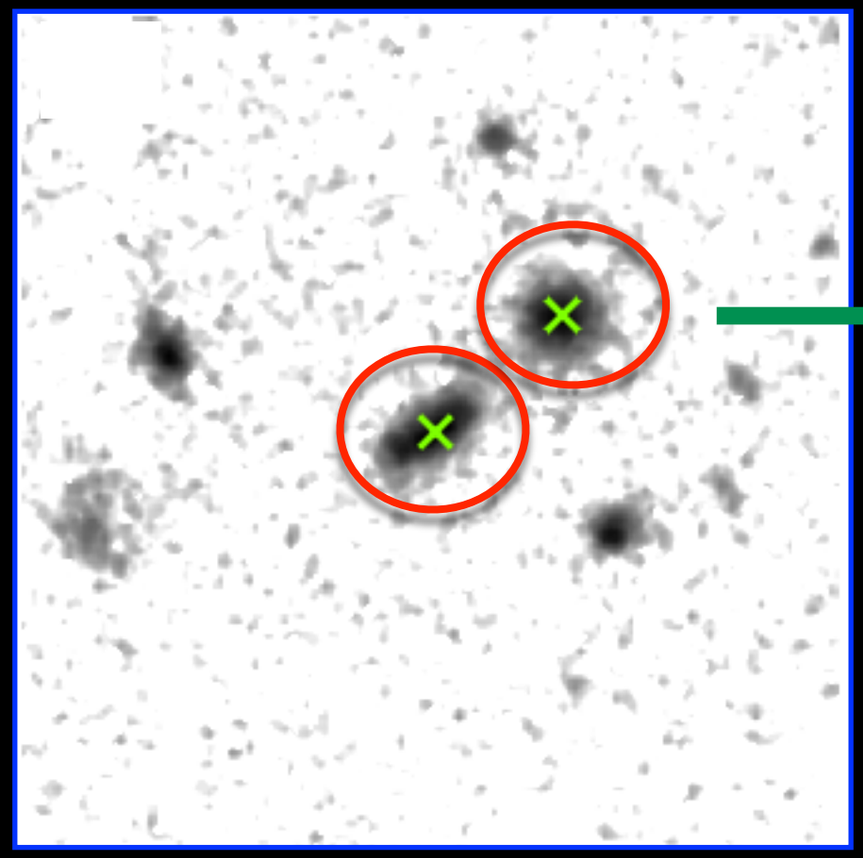
$M_{star}>10^{10}M_{sun}$



Apply method to near-IR HST/F160W images

- Selection of mergers in rest-frame optical out to z=2.5

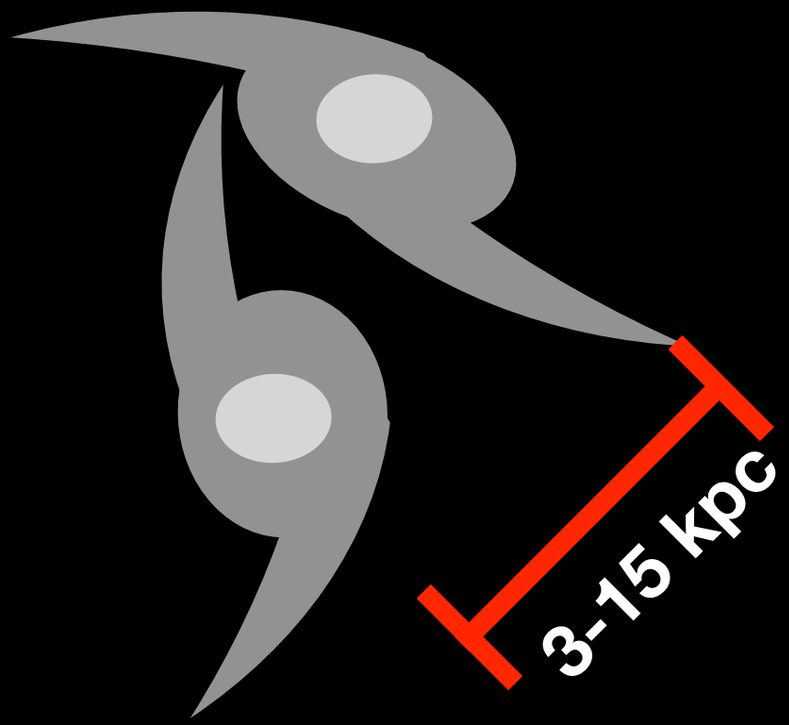
- Centered on ~5700 galaxies with $M_{star}>10^{10}M_{sun}$ and $0.3<z_{best}<2.5$ in CANDELS (COSMOS, AEGIS, GOODS-N, GOODS-S, UDS) fields



Match selected regions with 3D-HST catalogs to find properties

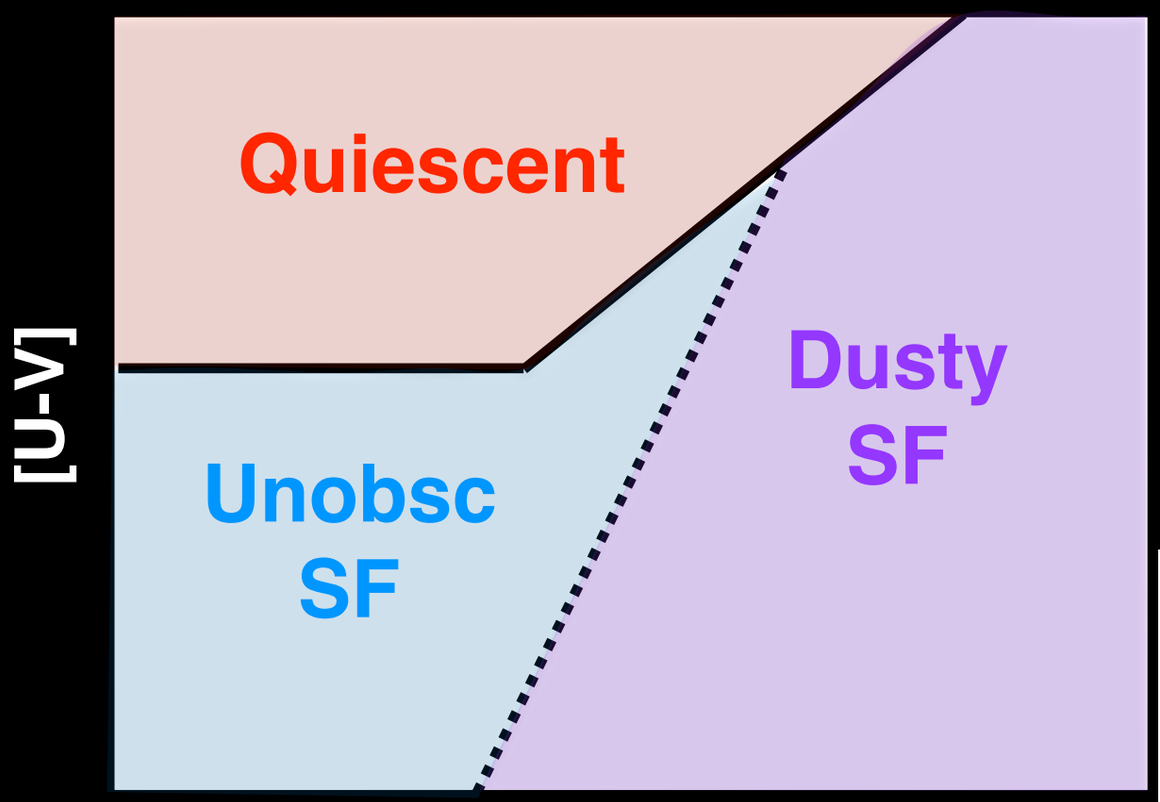
Separate mergers from line of sight contaminants

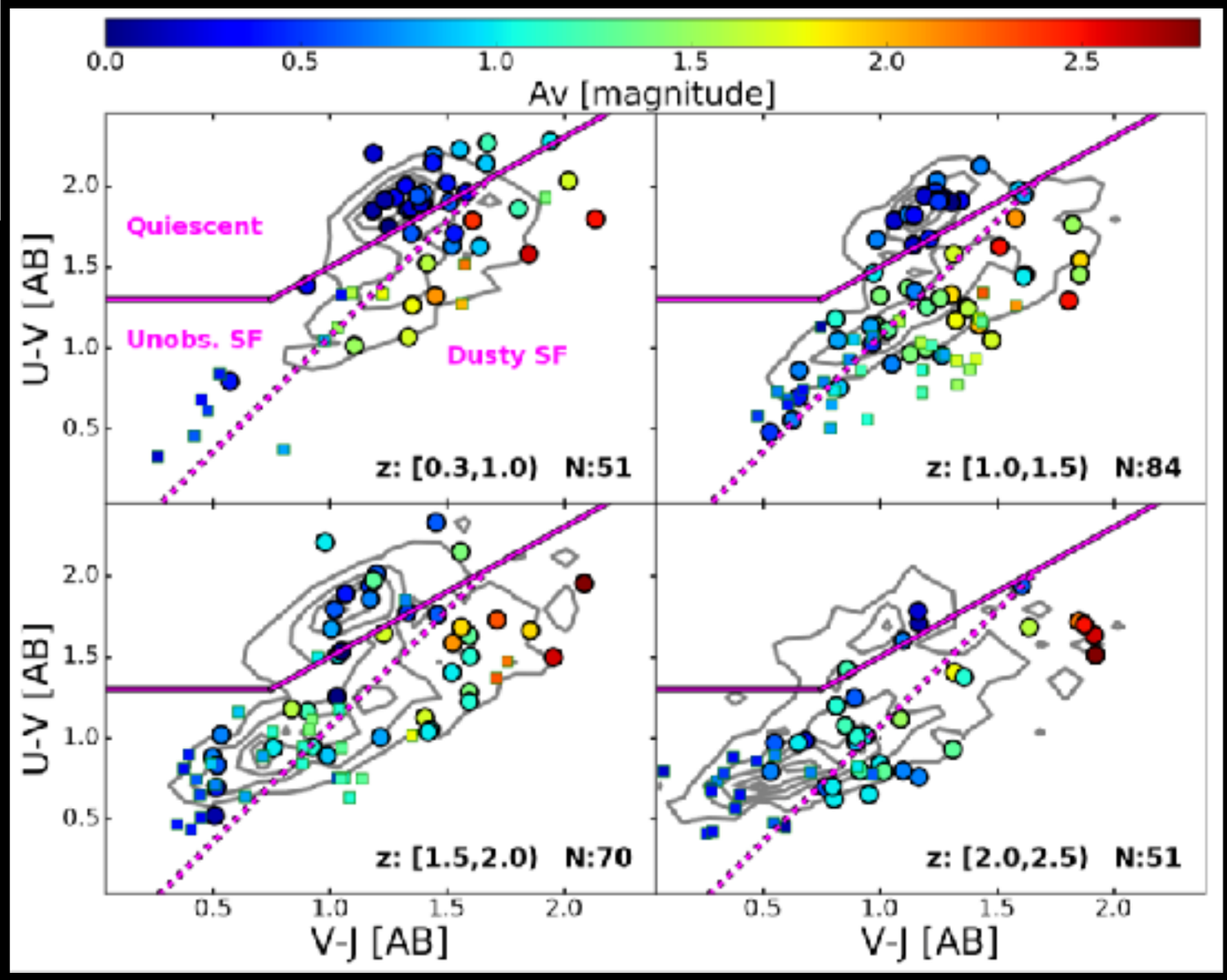
Final Sample of Mergers



- **Sample:** 130 merging systems
- Projected distance 3-15 kpc
- Major Mergers constructed using a cut in stellar mass ratio
- 0.3<z<2.5

Use UVJ colors to separate galaxies by type





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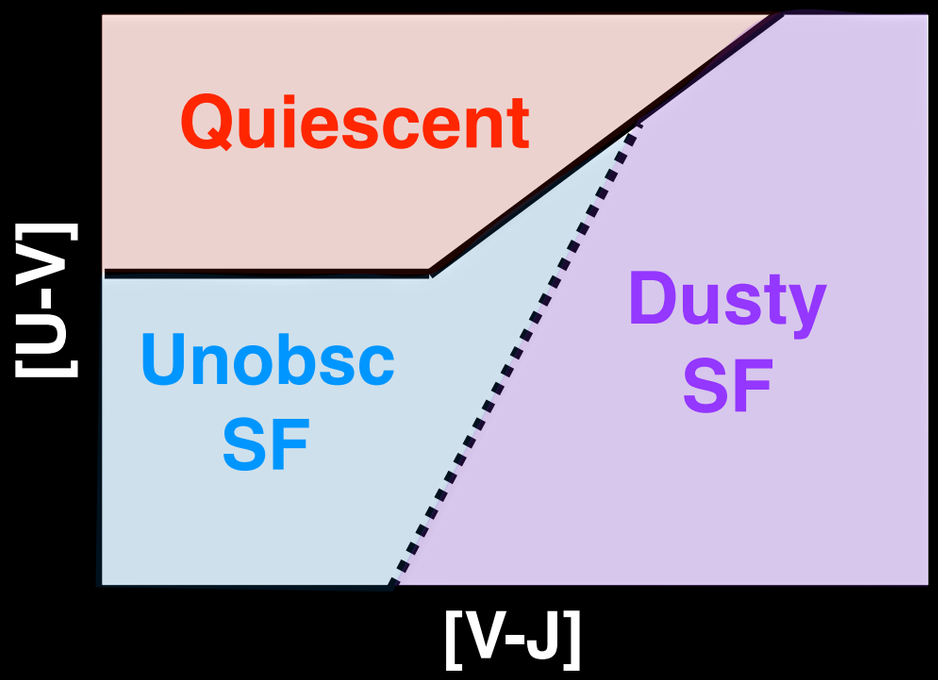


Separate Galaxies

Quiescent (36%)

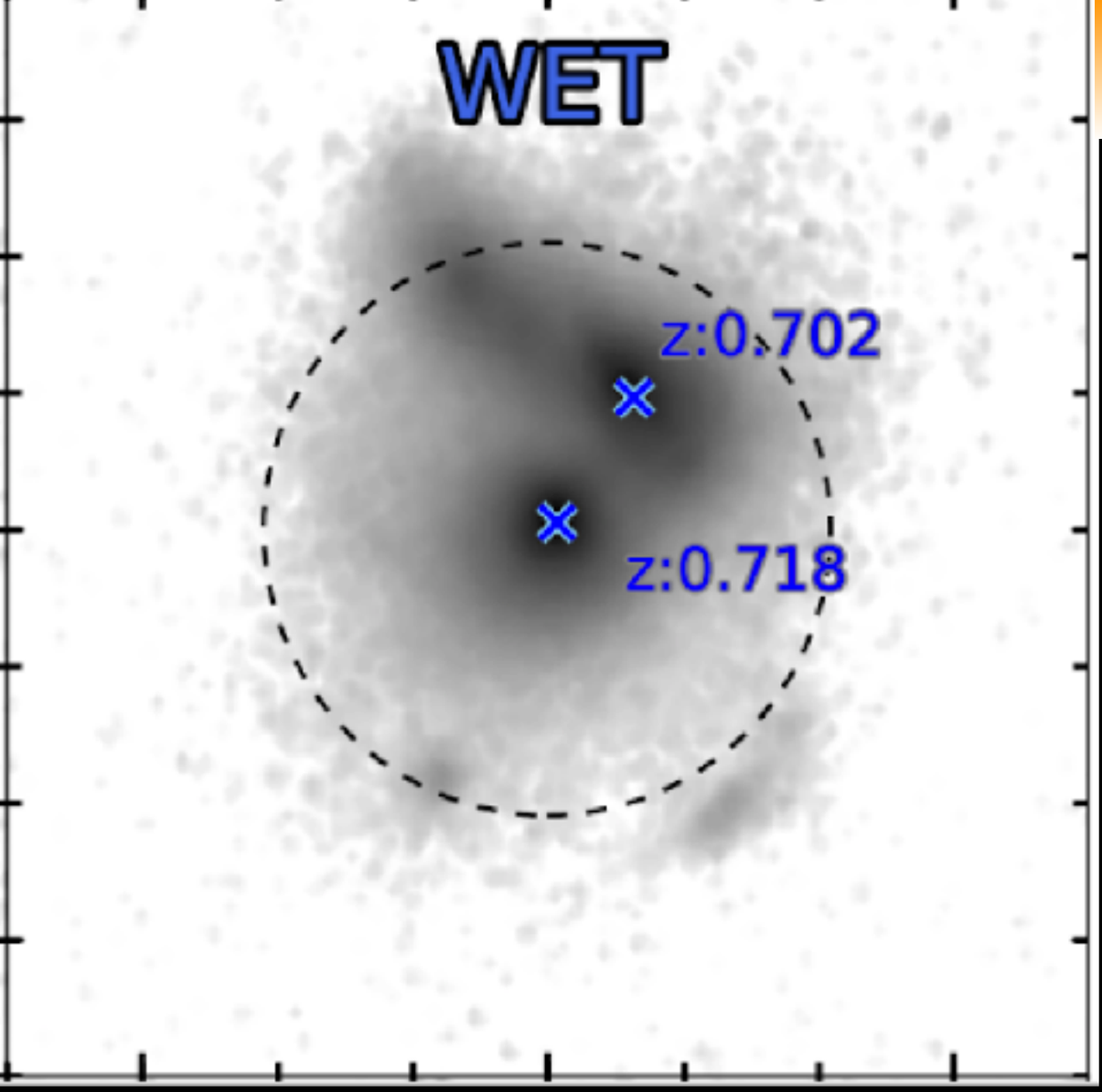
Star-forming dusty (42%) or unobscured (22%)

Separate Mergers

Wet (53%)

Mixed (22%)

Dry (25%)



Examples of Merger Types

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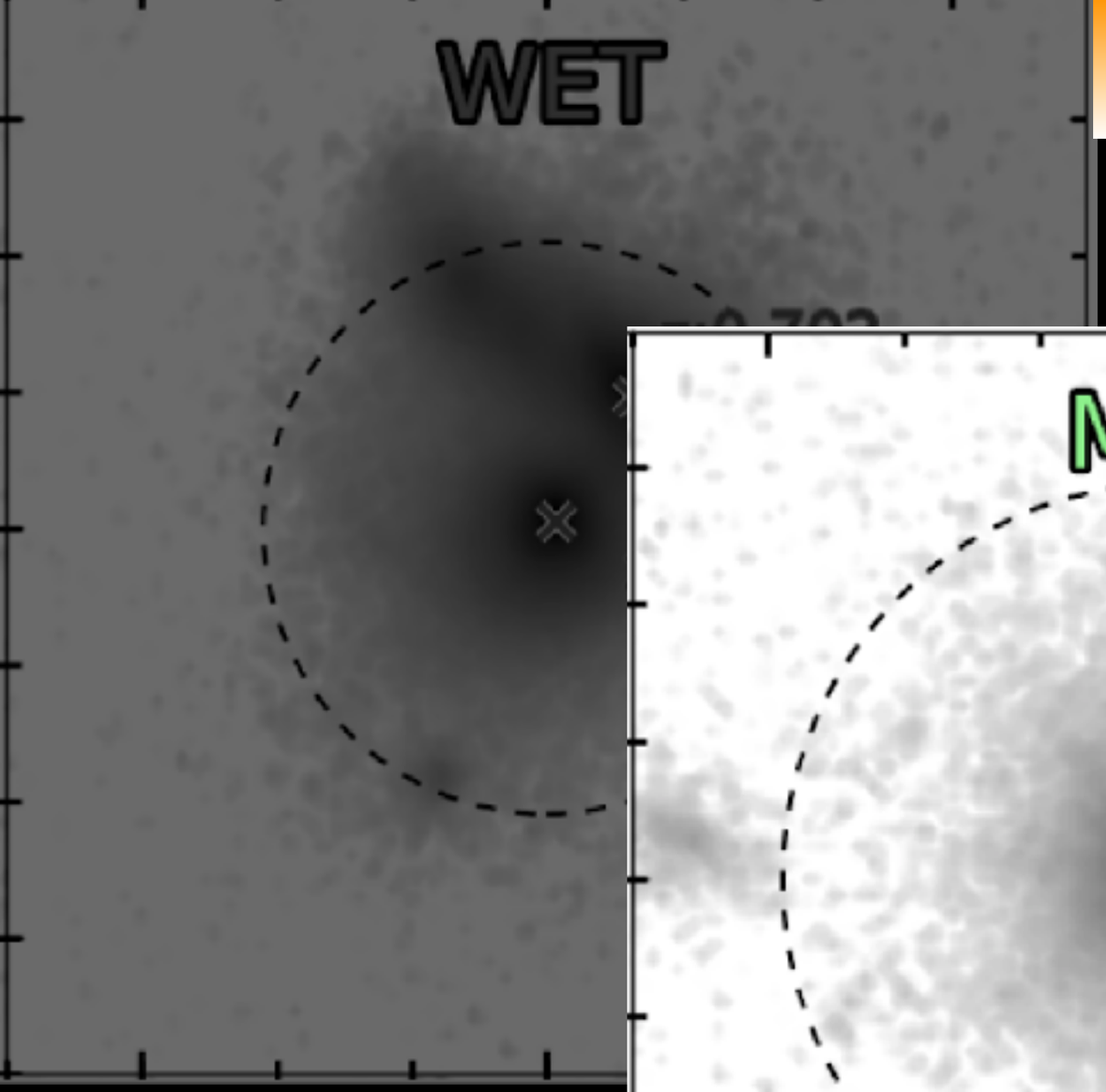

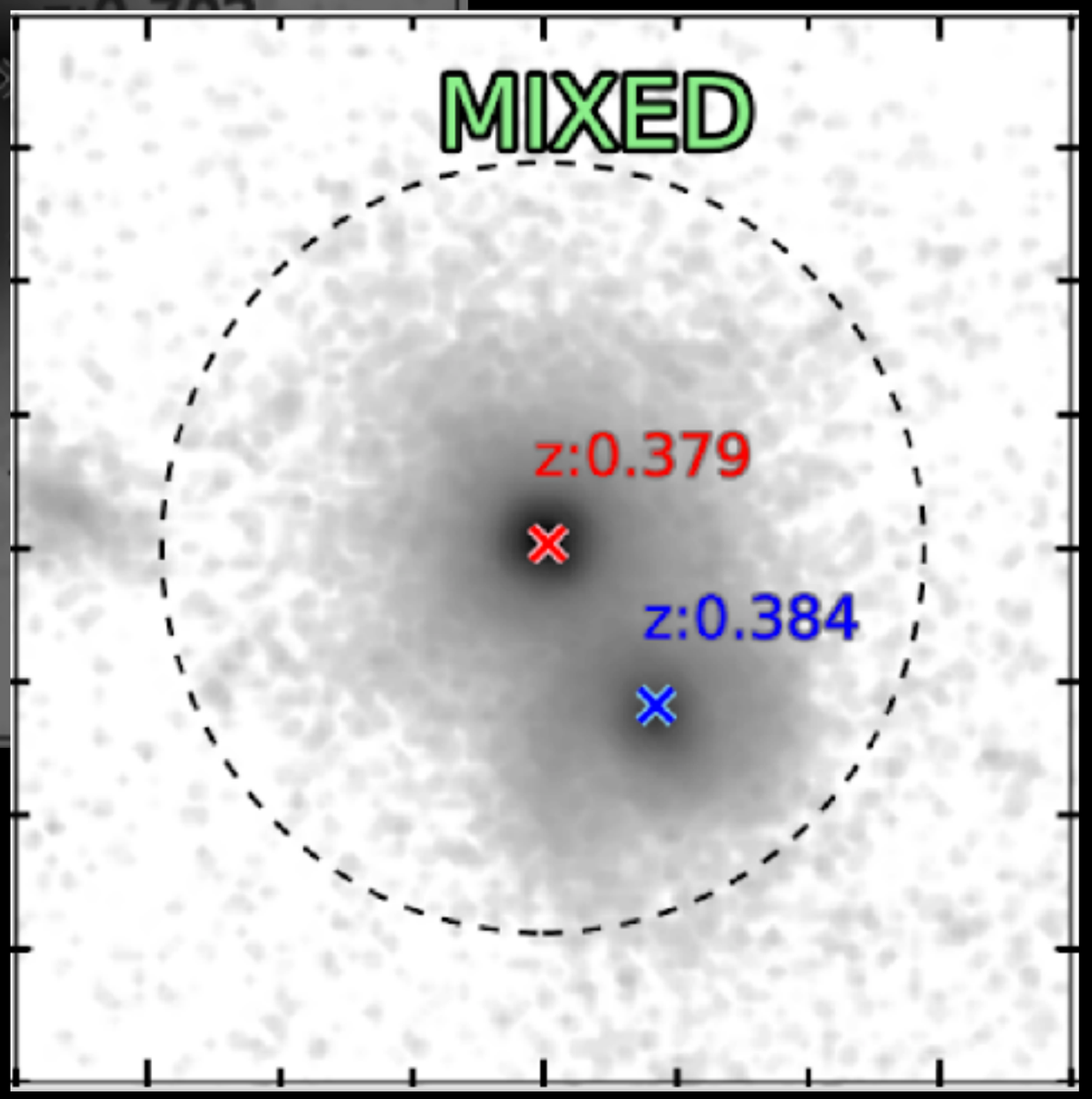

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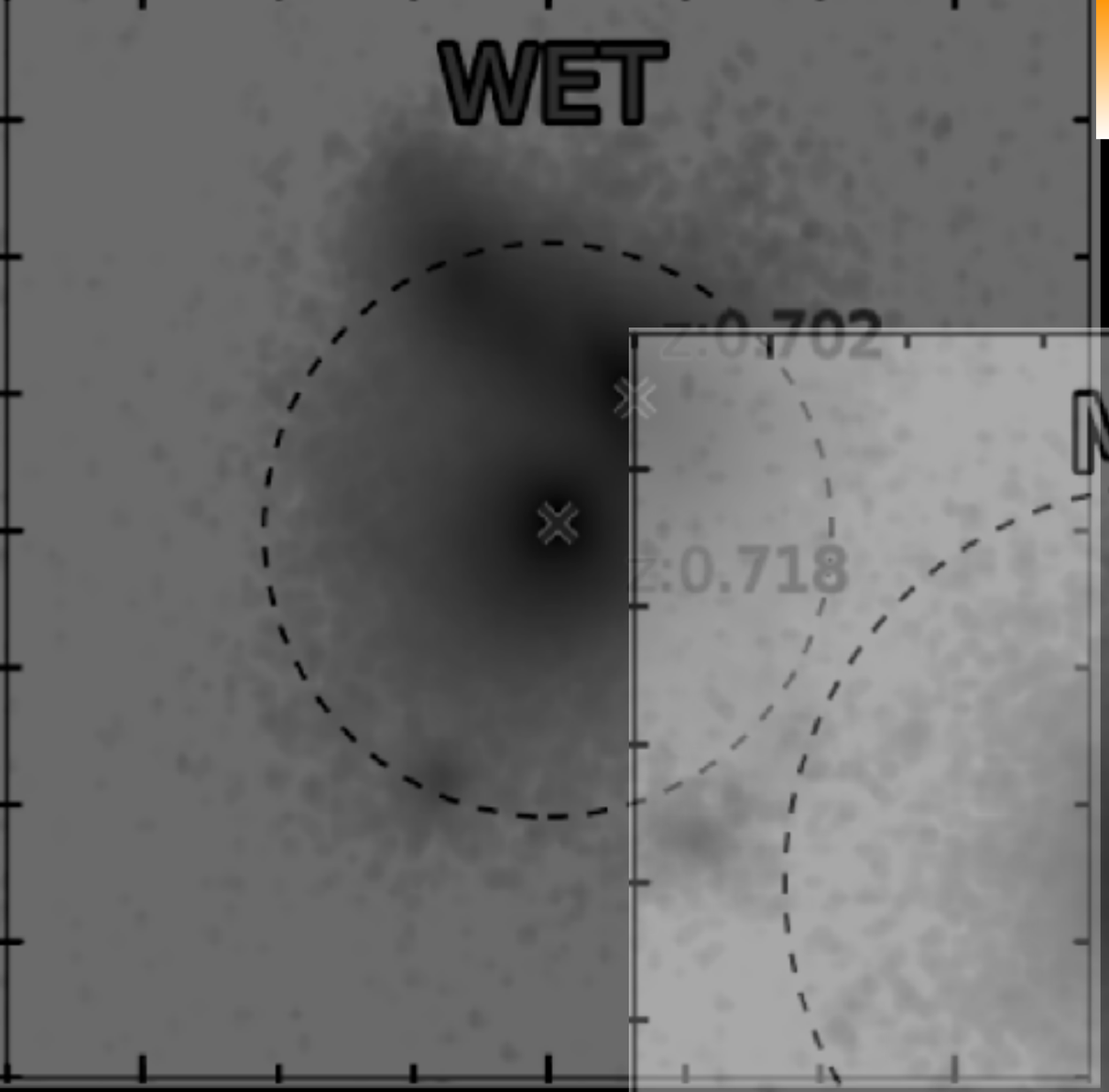
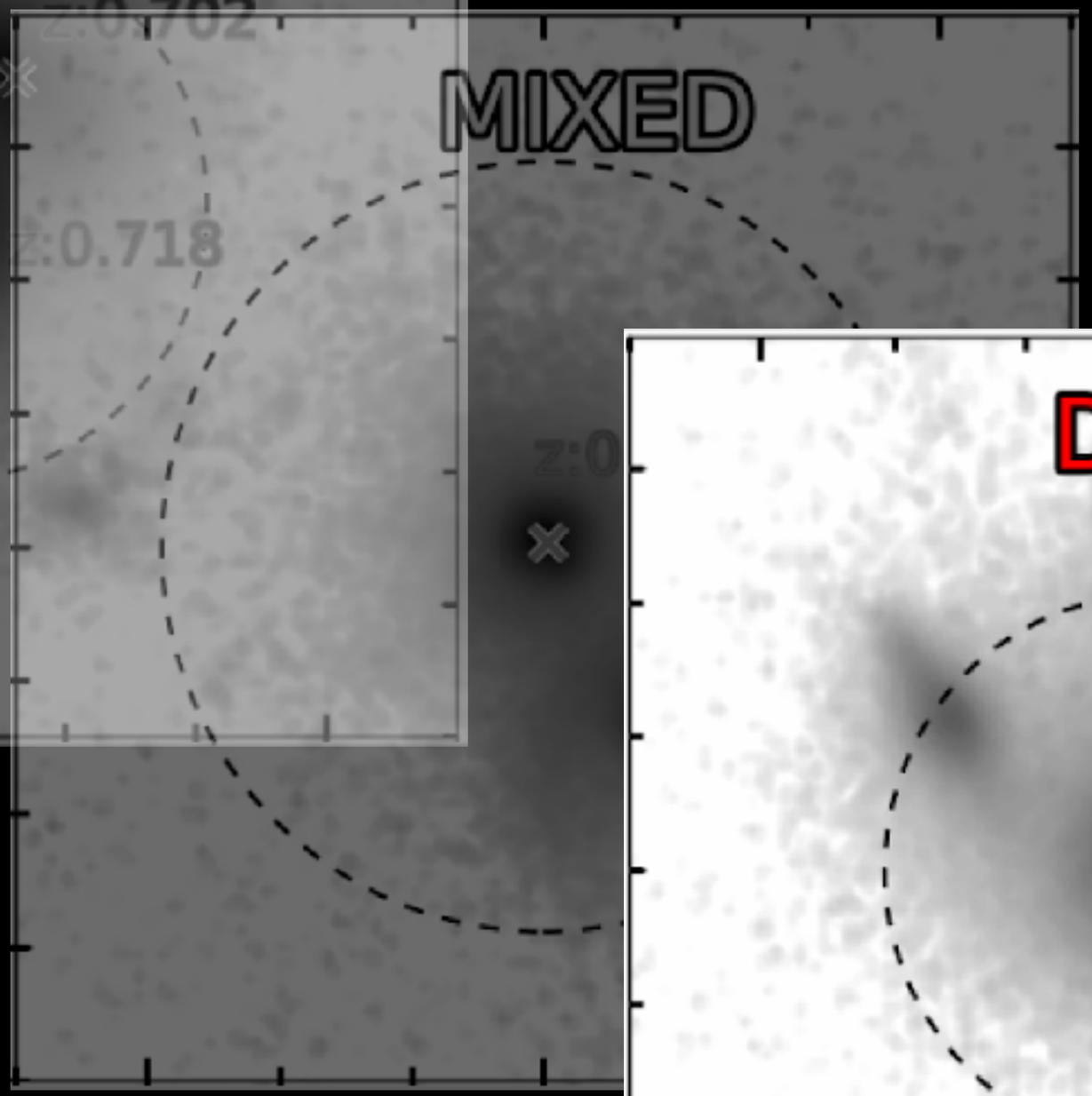
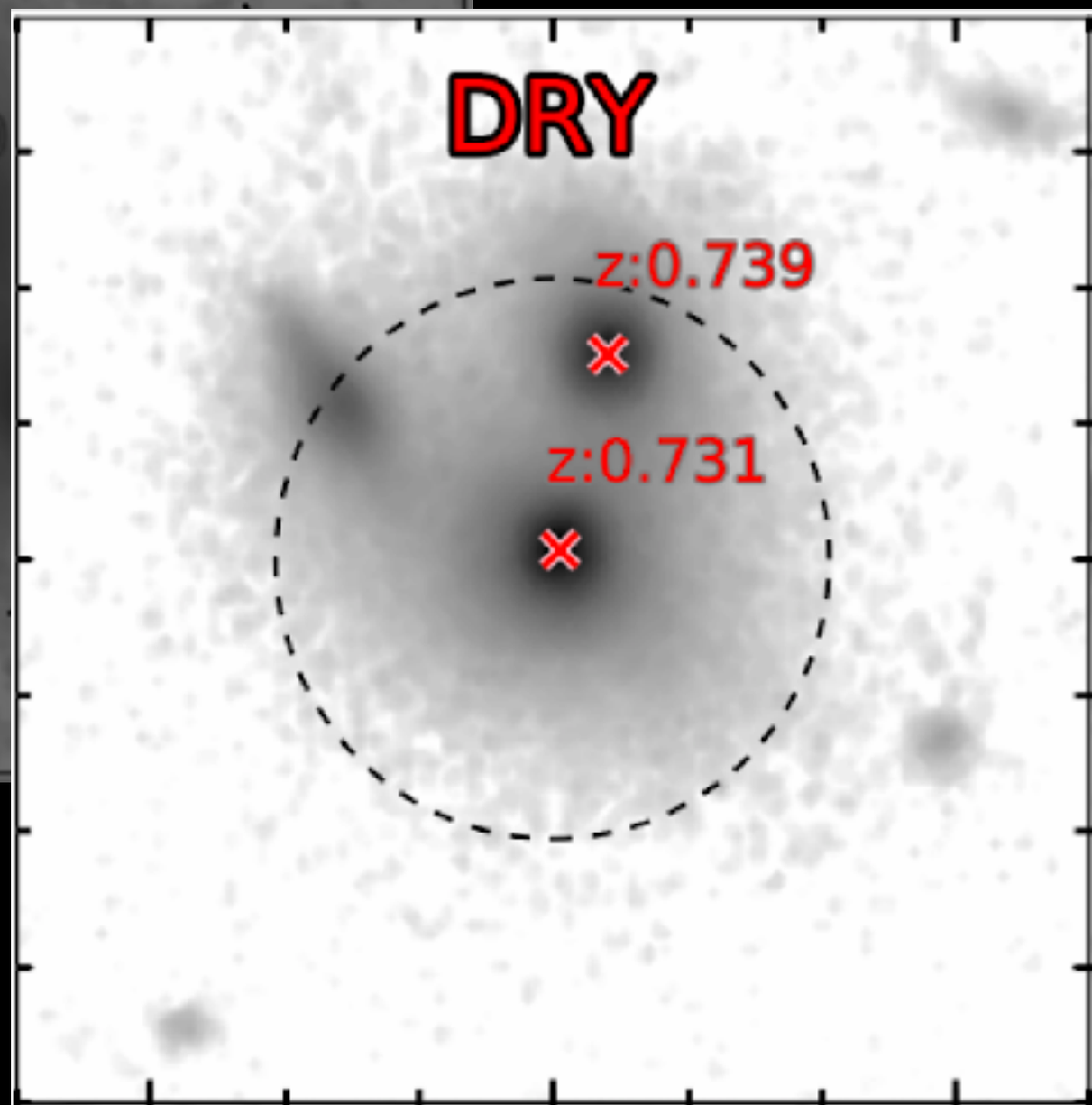
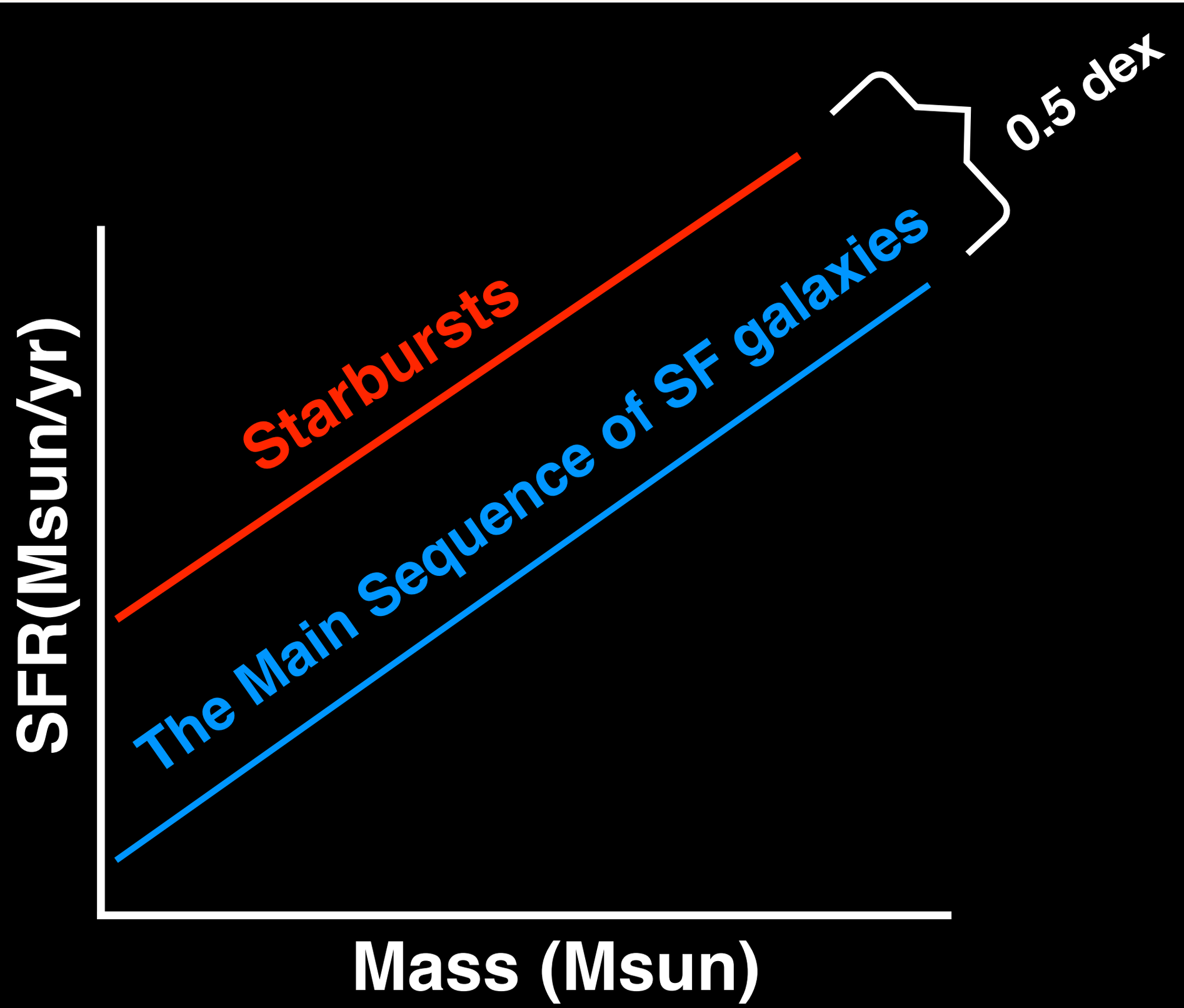






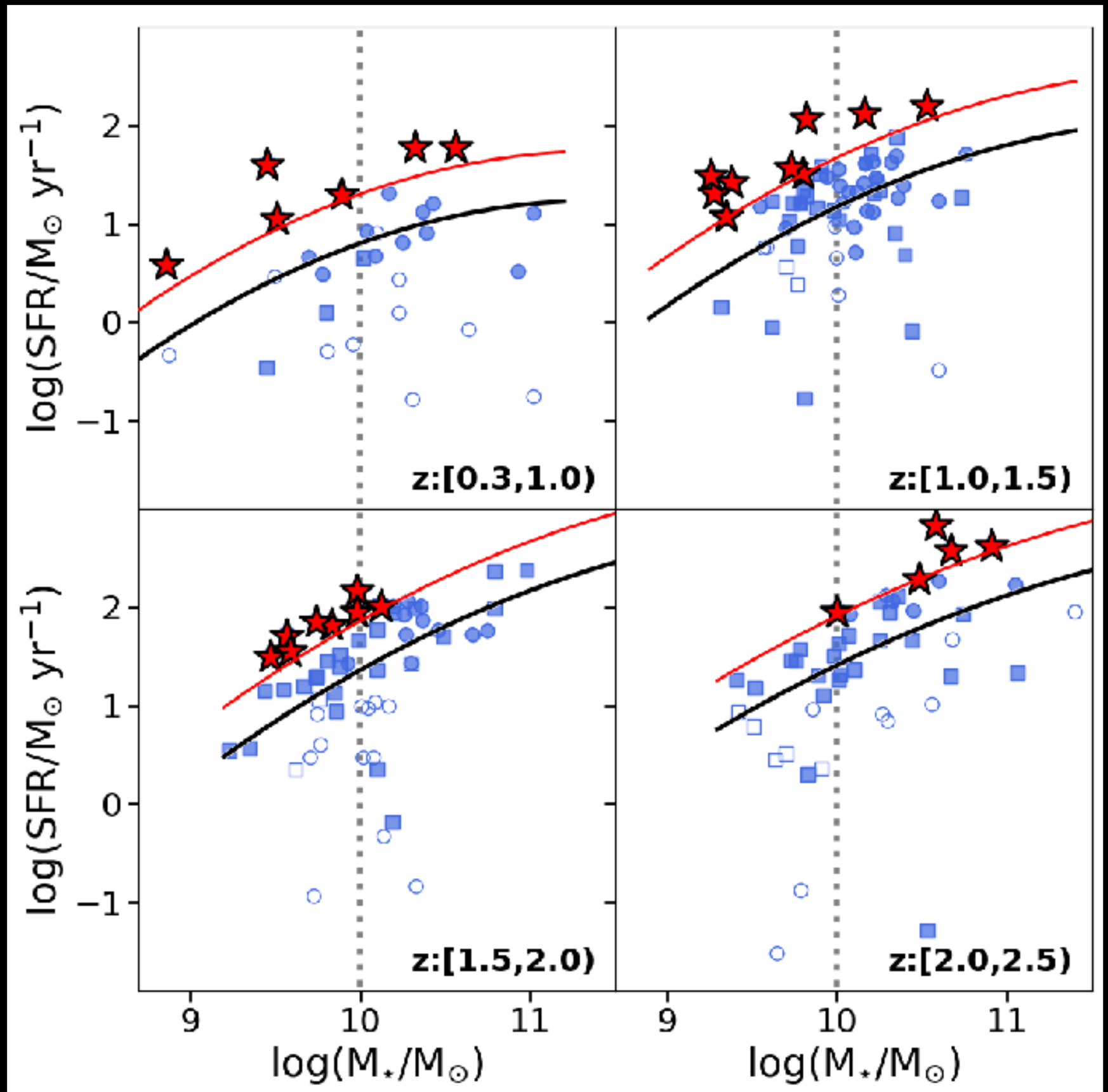
Definition of Starburst



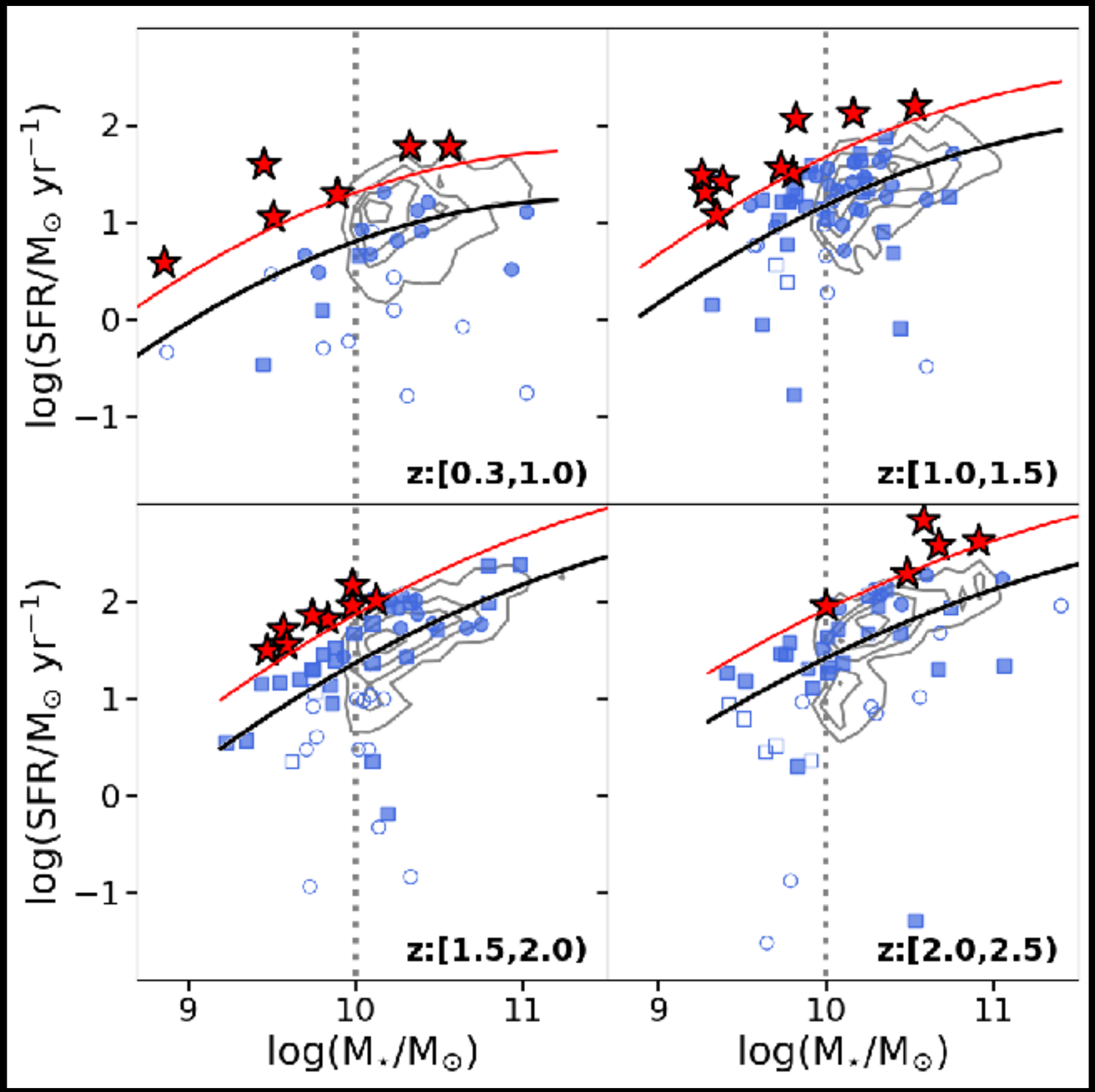
★ *Starbursts*

● *Star-forming merging galaxies*

—— *MS fit Whitaker+14*



Comparison SF activity in Mergers & non mergers



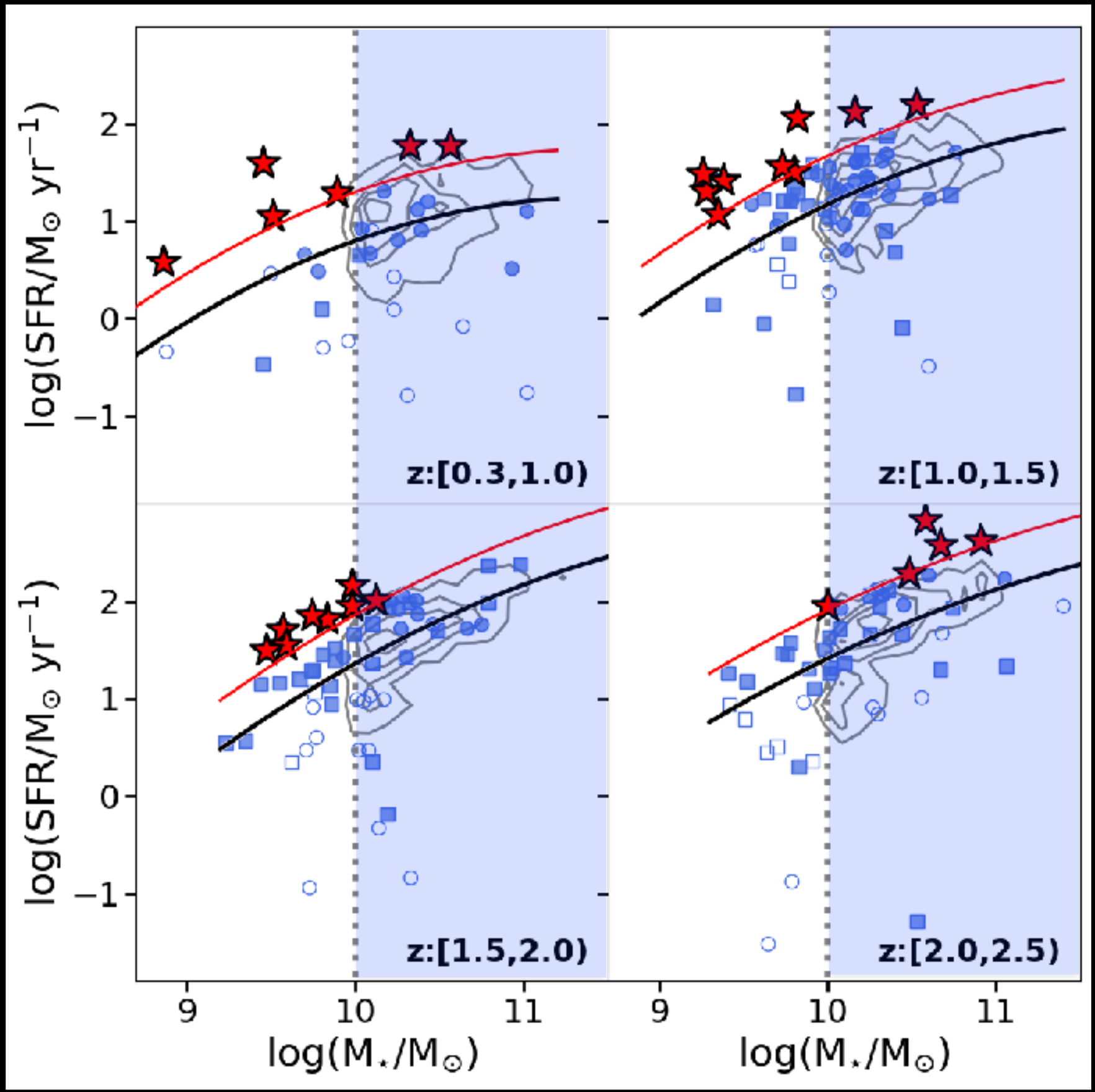
At masses log(M⋆/M⊙)>10

KS test: No difference

12% of the merger sample are starbursts

All the starbursts are dusty SF galaxies and are in wet mergers

High fgas?

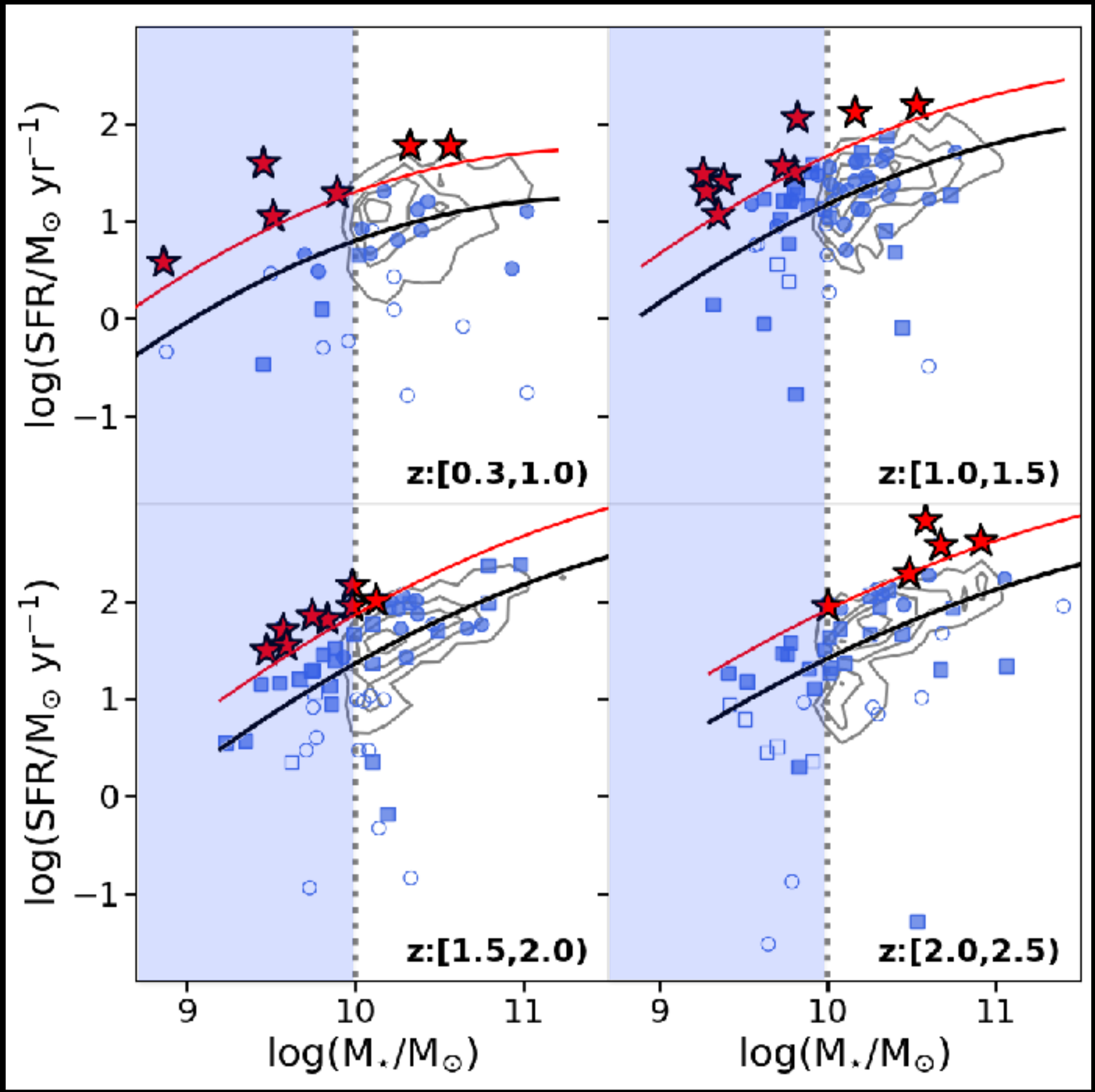


At masses log(M⋆/M⊙)<10

KS test: Different population

Higher fraction of starbursts (20%) in merging galaxies

Higher enhancement in SF activity in low mass merging galaxies



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Local mergers show higher Star Formation activity than non-merging galaxies (Darg+10, Jogee+09, Robaina+09, Ellison+13, Kampczyk+13)

Is the same at high redshift?

Depends

Conclusions

Star formation enhancement might depend on properties of merging galaxies

Galaxies with higher gas/dust content and those with lower masses might increase their SF activity even before coalescence

Silva et al. 2018, ApJ 868