Spatially Resolved Properties of Post-Merger Galaxies with MaNGA and ALMA

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Image Credit:
ESA/NASA
Hubble

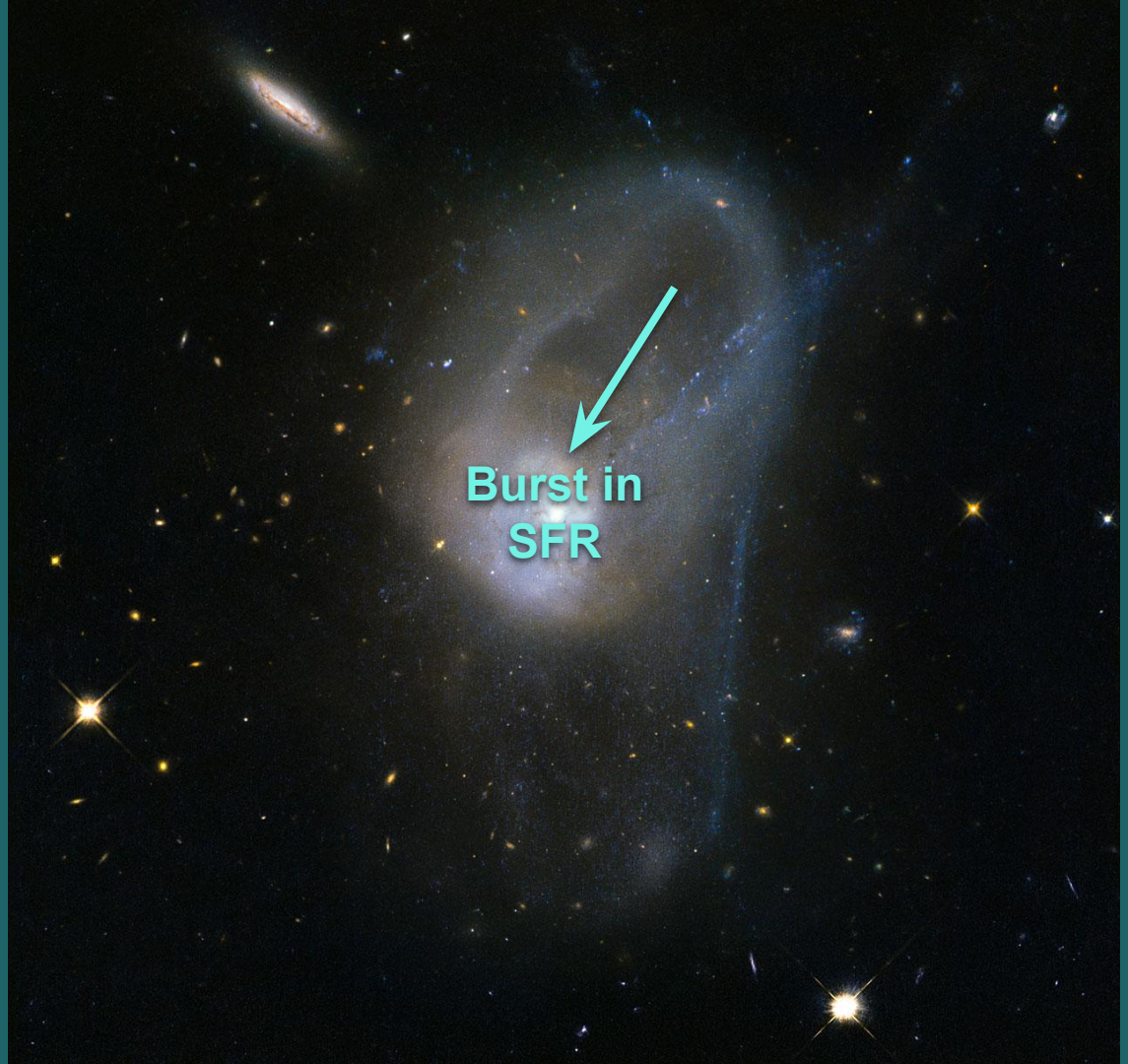

Image Credit:
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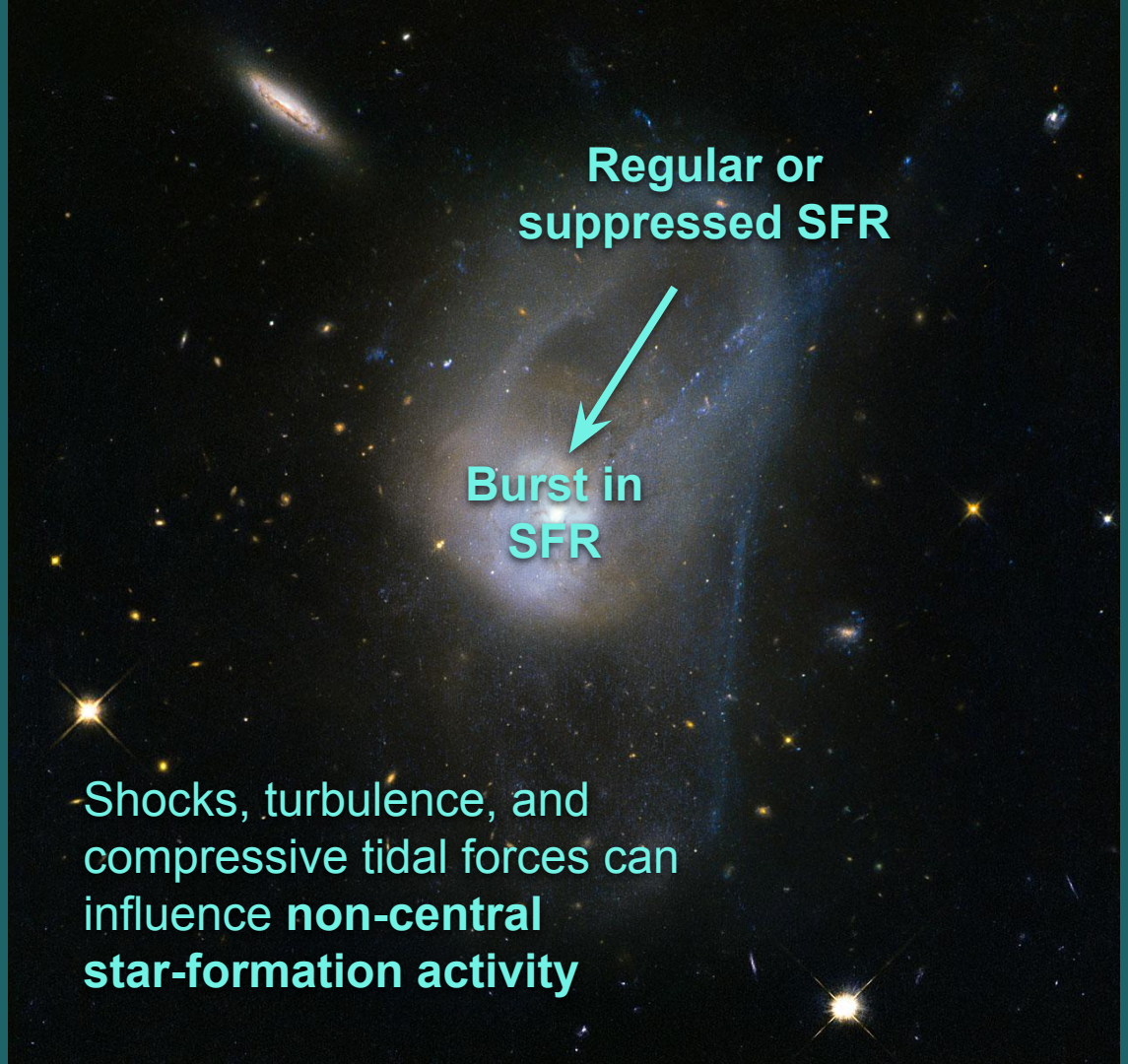

Image Credit:
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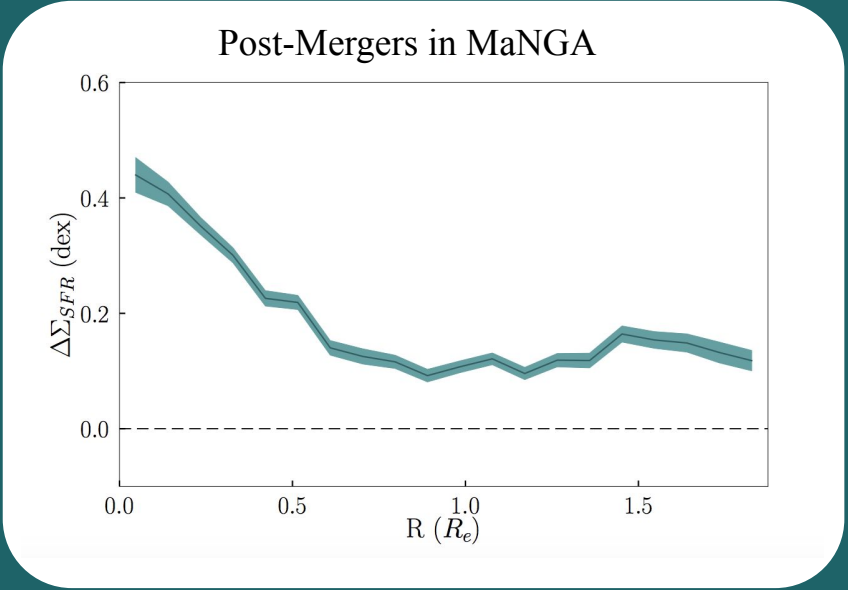
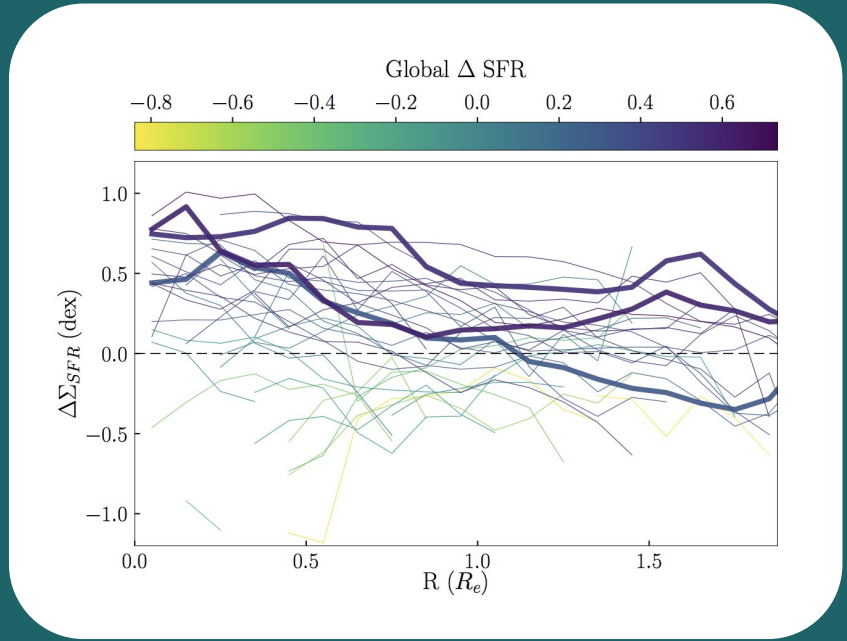
Spatial distribution of star-formation in post-merger galaxies in MaNGA (Thorp et al. 2019)

Generally, post-merger galaxies have enhanced star-formation across the galaxy, with the greatest enhancement at the center.

There is more variability on a galaxy-per-galaxy basis, particularly in the galaxy's outskirts.

Enhanced SFR



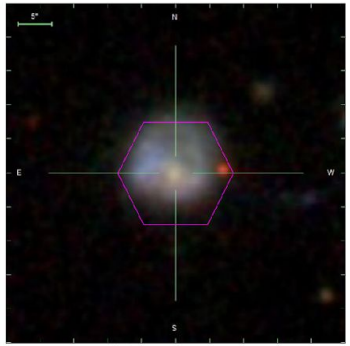


ALMaQUEST

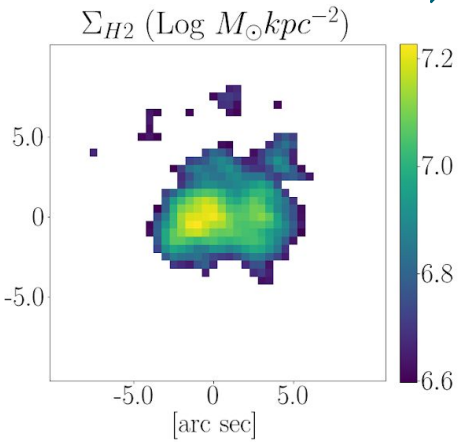
Molecular gas maps from ALMA

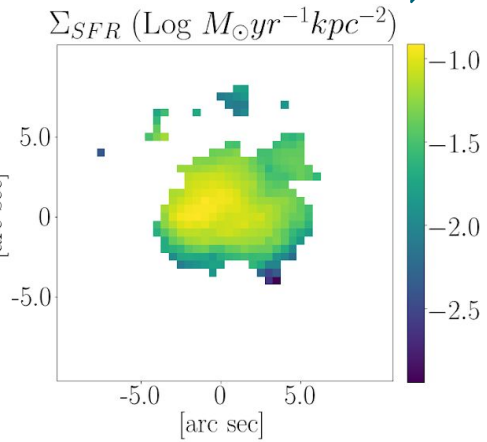
Matched to MaNGA resolution

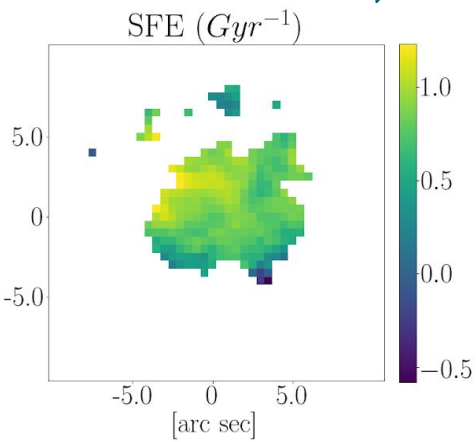
To combine optical & radio dataproducts.



MaNGA ID: 8156-3701







ALMaQUEST

Focus on Mergers

An ALMA cycle 7 program to augment ALMaQUEST with a set of observations of galaxy pairs and post-mergers. PI: Hsi-An Pan

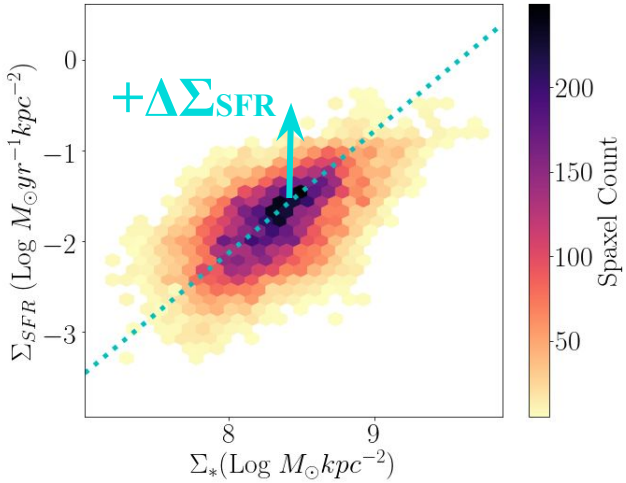
What drives the changes in star-formation surface density for post-mergers?

Two Possible Solutions:

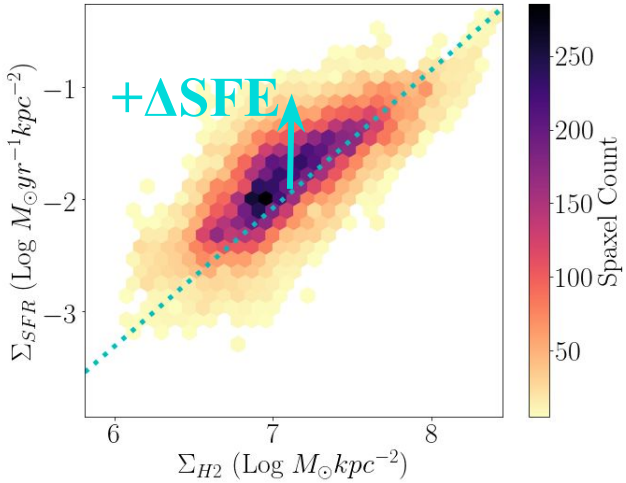
1.) An enhanced efficiency at which gas is converted to stars.

2.) An excess of molecular gas to fuel star formation

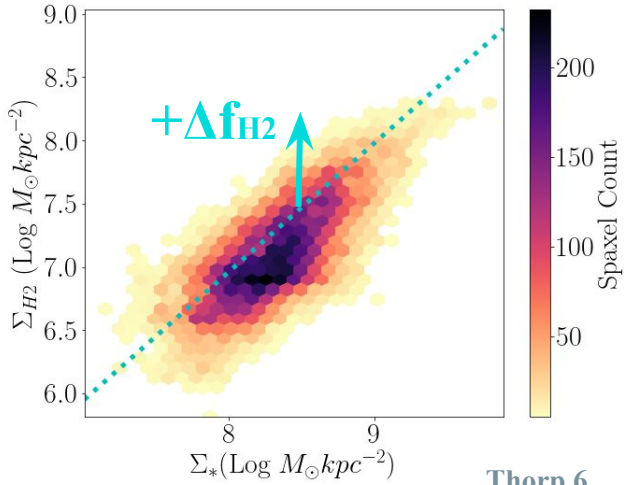
Resolved Star-Forming Main Sequence



Resolved Schmidt-Kennicutt



Resolved Molecular Gas Main Sequence



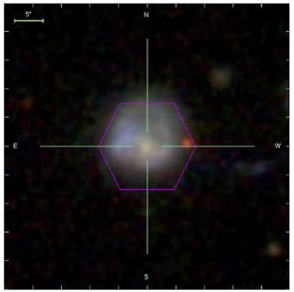
What drives the changes in star-formation surface density for post-mergers?

Two Possible Solutions:

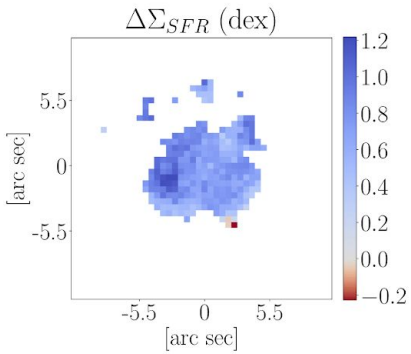
1.) *An enhanced efficiency at which gas is converted to stars.*

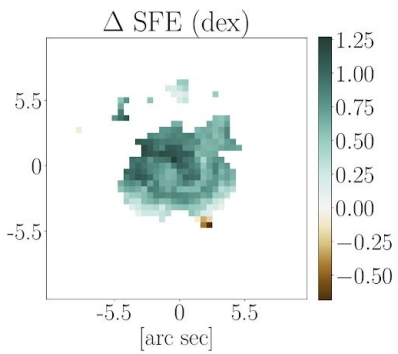
2.) An excess of molecular gas to fuel star formation

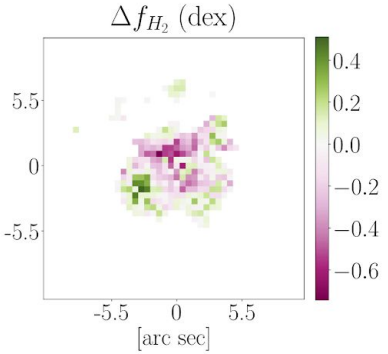
For this galaxy, the enhanced star-formation is created by an enhanced star-formation efficiency.

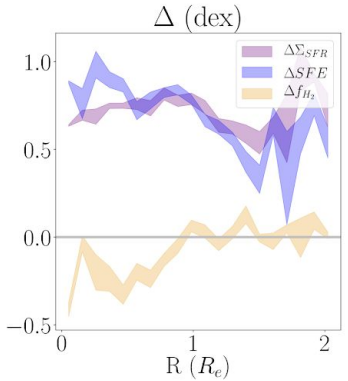


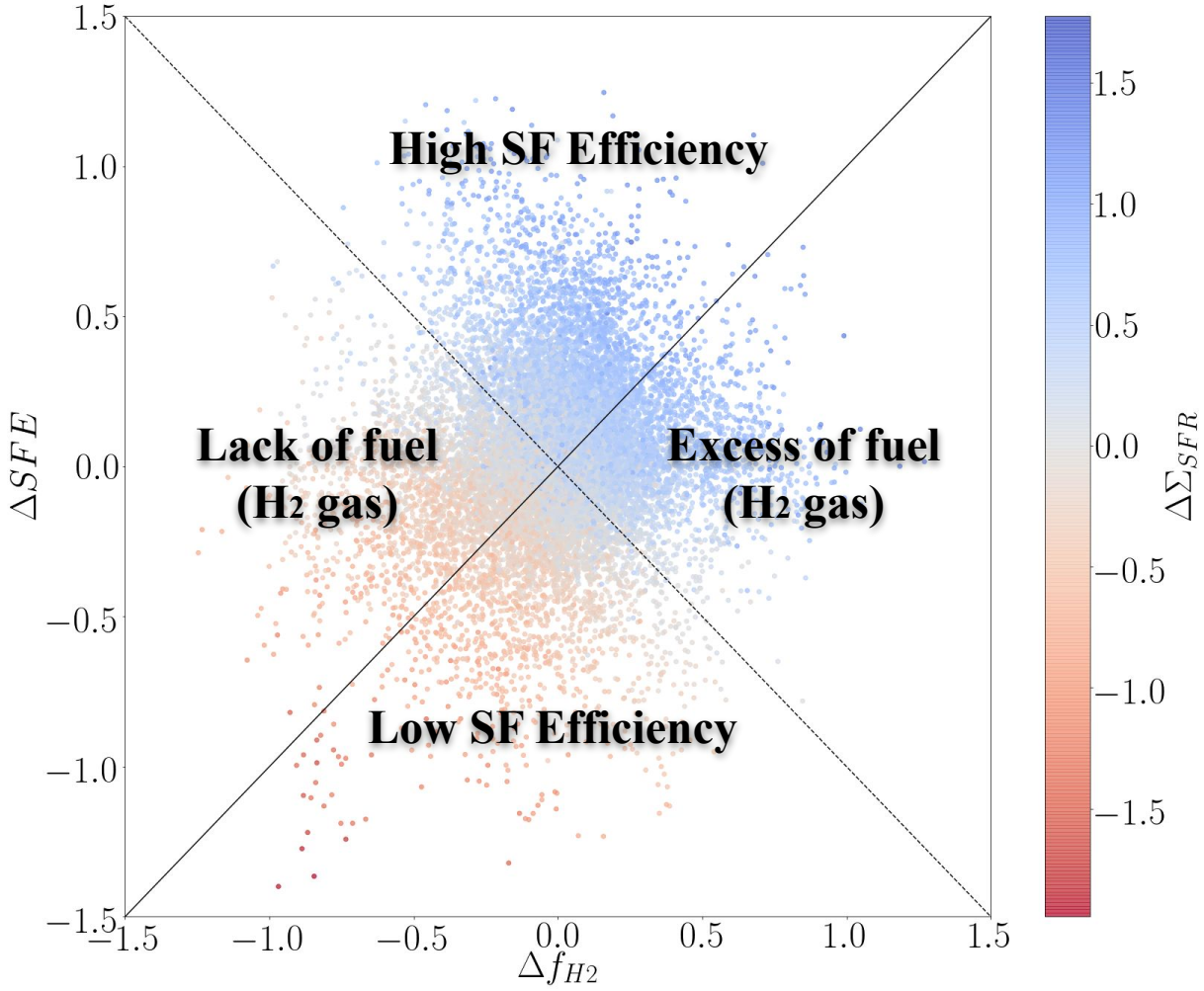
MaNGA ID: 8156-3701

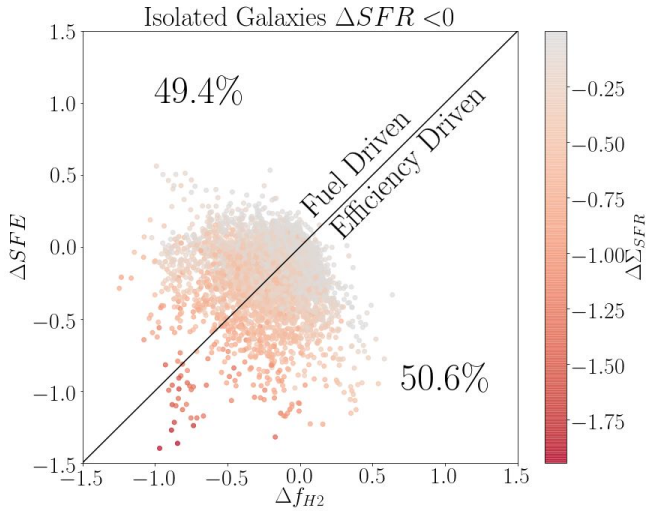


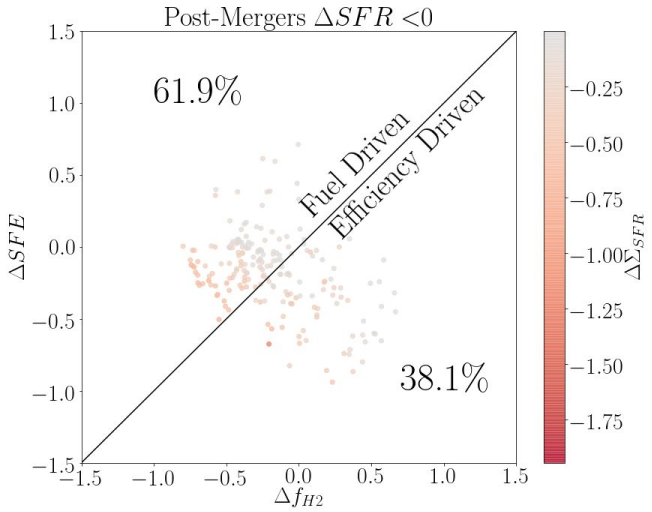


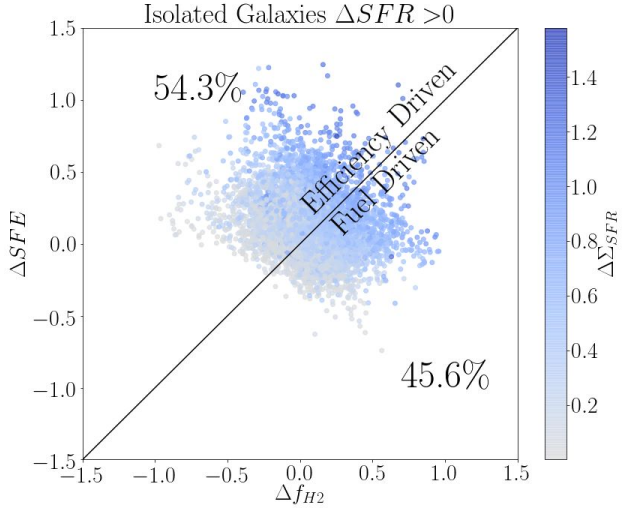


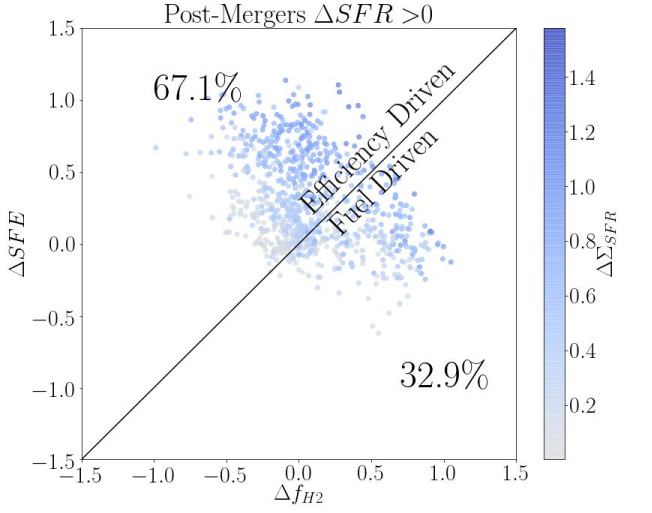


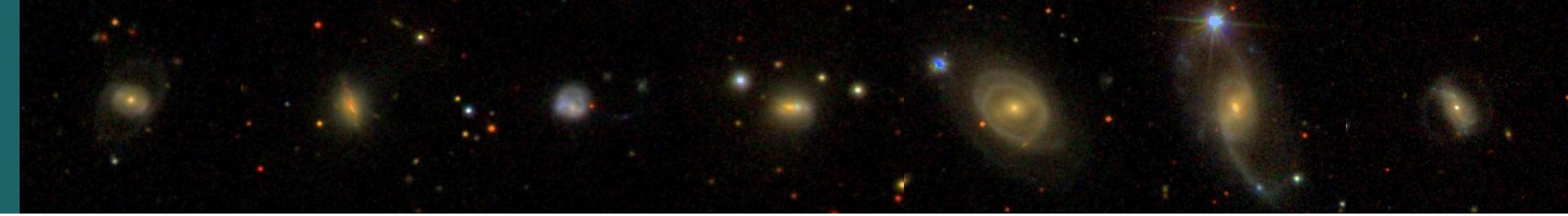

High SF Efficiency
Lack of fuel
(H2 gas)
Excess of fuel
(H2 gas)
Low SF Efficiency
ΔSFE
Δf_{H2}
$\Delta\Sigma_{SFR}$
1.5
1.0
0.5
0.0
−0.5
−1.0
−1.5

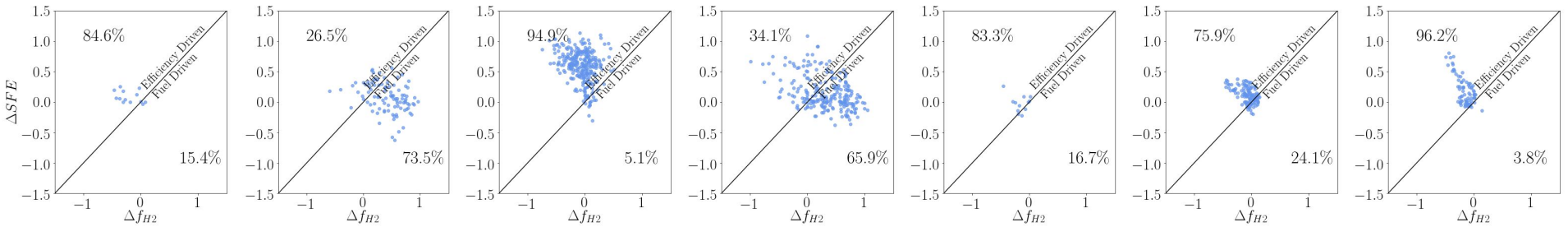

Isolated Galaxies ΔSFR <0
49.4%
50.6%
Fuel Driven
Efficiency Driven
ΔSFE
Δf_{H2}
$\Delta\Sigma_{SFR}$


Post-Mergers ΔSFR <0
61.9%
38.1%
Fuel Driven
Efficiency Driven
ΔSFE
Δf_{H2}
$\Delta\Sigma_{SFR}$

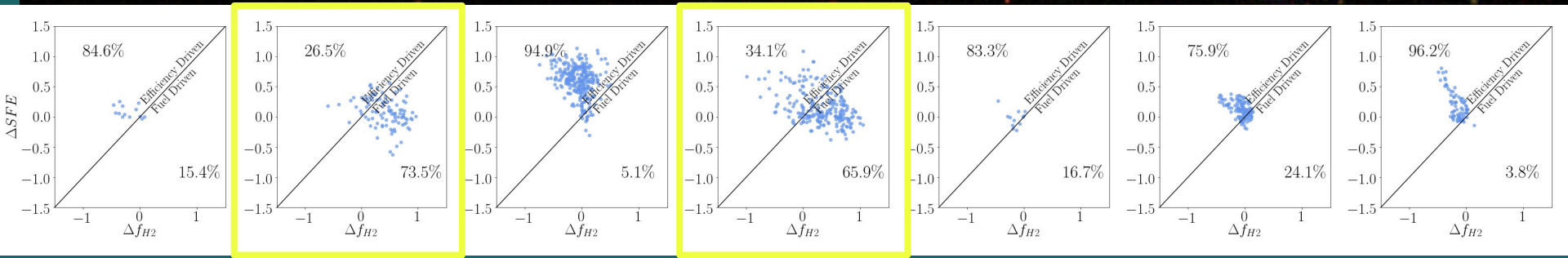

Isolated Galaxies ΔSFR >0
54.3%
45.6%
Efficiency Driven
Fuel Driven
ΔSFE
Δf_{H2}
$\Delta\Sigma_{SFR}$


Post-Mergers ΔSFR >0
67.1%
32.9%
Efficiency Driven
Fuel Driven
ΔSFE
Δf_{H2}
$\Delta\Sigma_{SFR}$

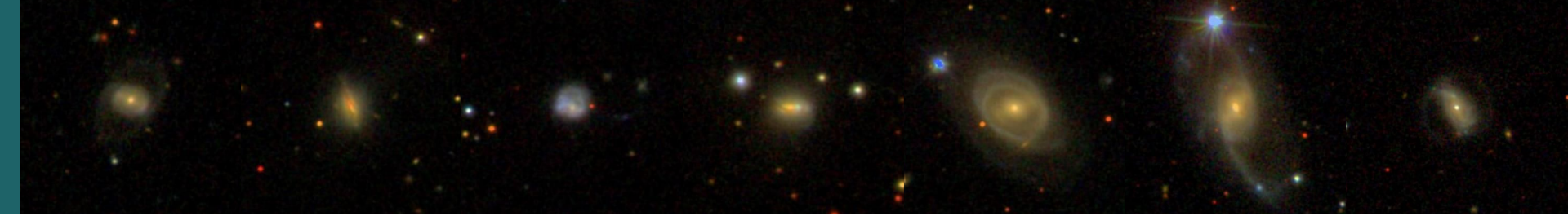


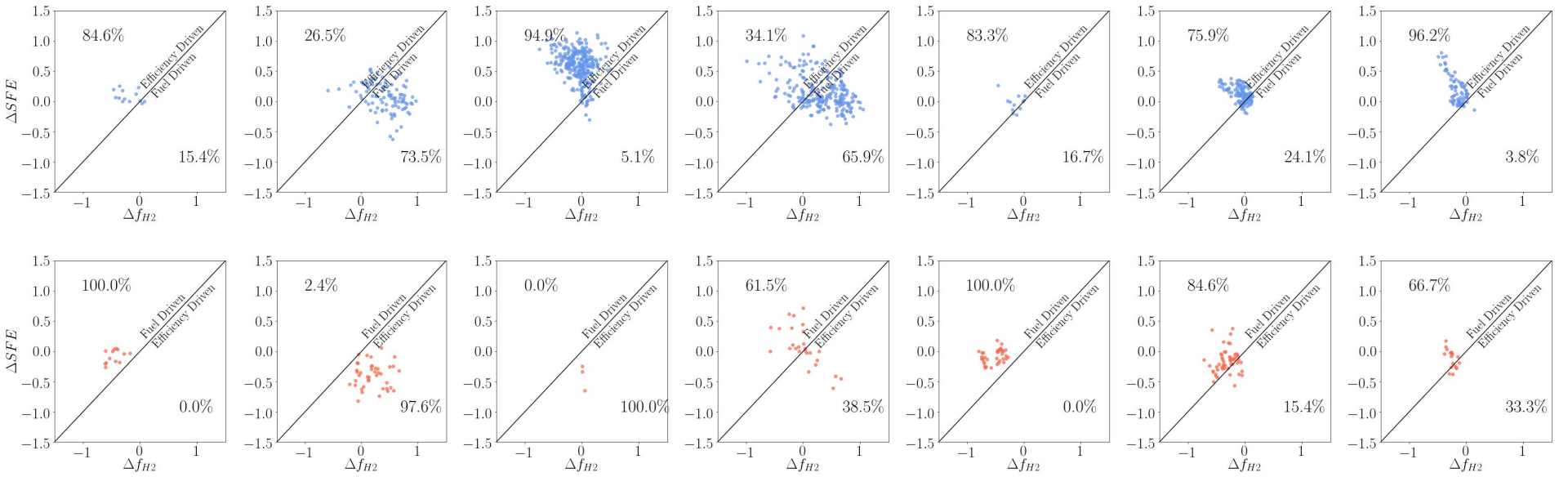


The majority of galaxies have enhanced star formation, fueled by an enhanced SFE.

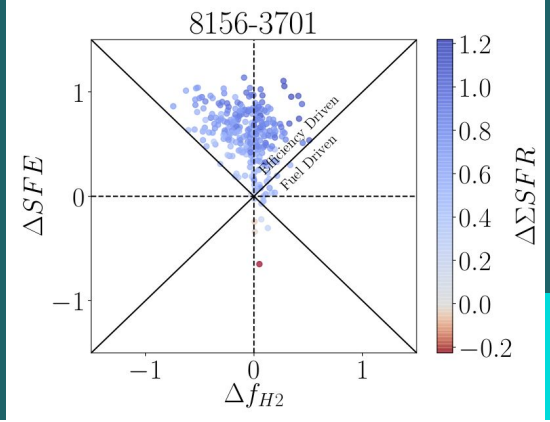


The majority of galaxies have enhanced star formation, fueled by an enhanced SFE. There are some exceptions of fuel driven starbursts.

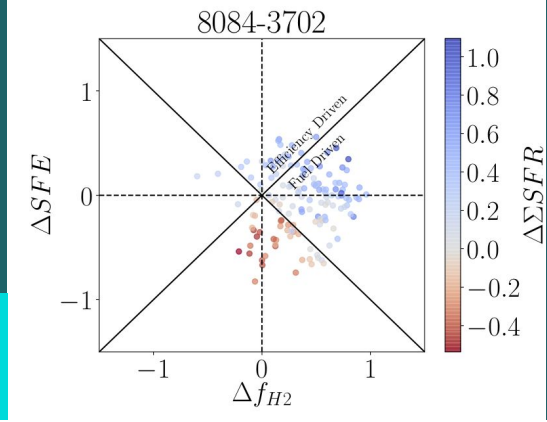


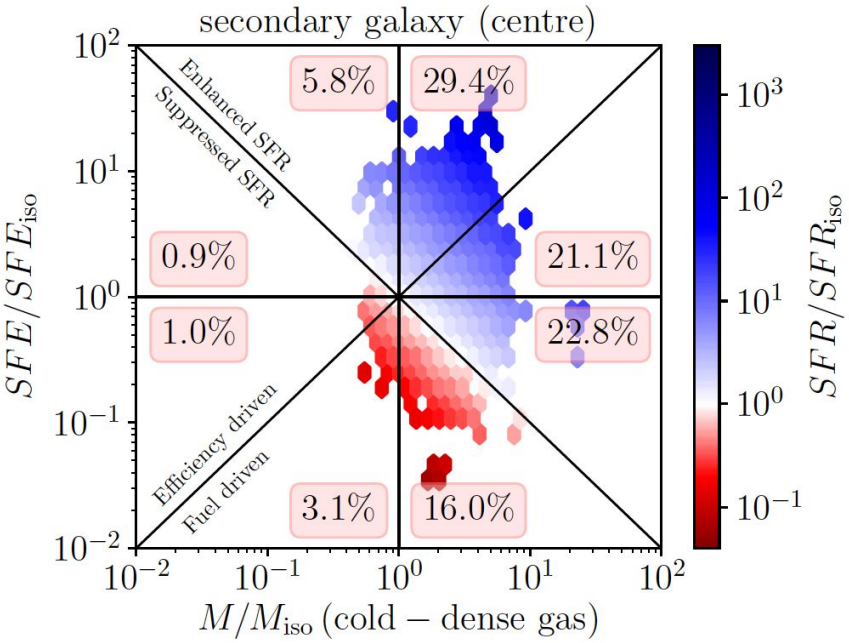


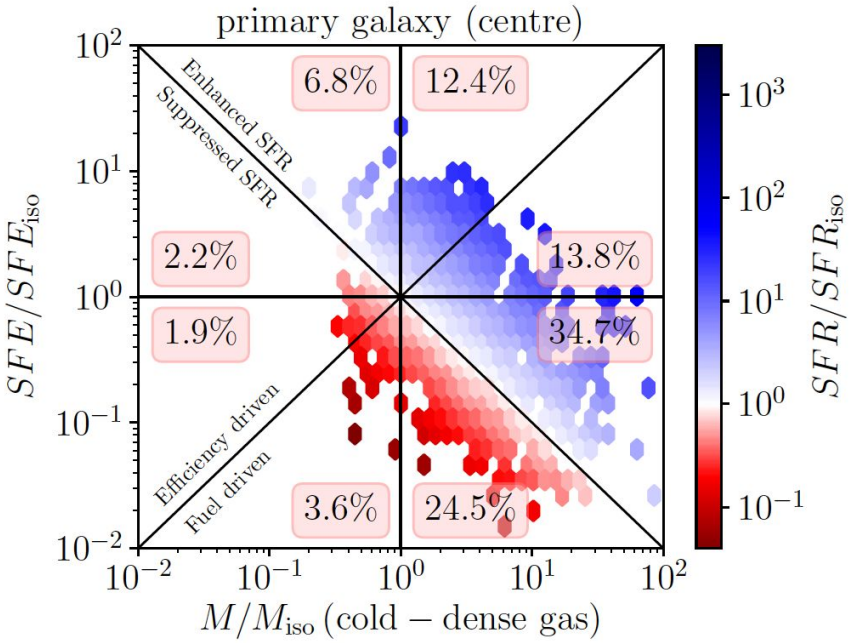
Galaxies with efficiency driven star-formation enhancements often also have SFR deficits driven by a suppressed gas fraction.



Moreno et al. 2020 (submitted)







Summary

- The star-formation enhancement in post-mergers is more likely to be driven by a greater star-formation efficiency, compared to isolated galaxies.
- There are exceptions where SFR enhancements is driven by an excess of molecular gas.
  - These galaxies are not distinct from other post-mergers in global mass and SFR, so this deviation is the direct result of the interaction's progenitor qualities.