Things that spark in the dark: when stars are formed while galaxies collide

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Overview

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Overview

- Why we care about galaxy mergers

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- Getting merger time

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- Why we care about galaxy mergers
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- Change in star-formation rate

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Why we care about galaxy mergers

- Galaxy mergers underpin our current understanding of galaxy evolution

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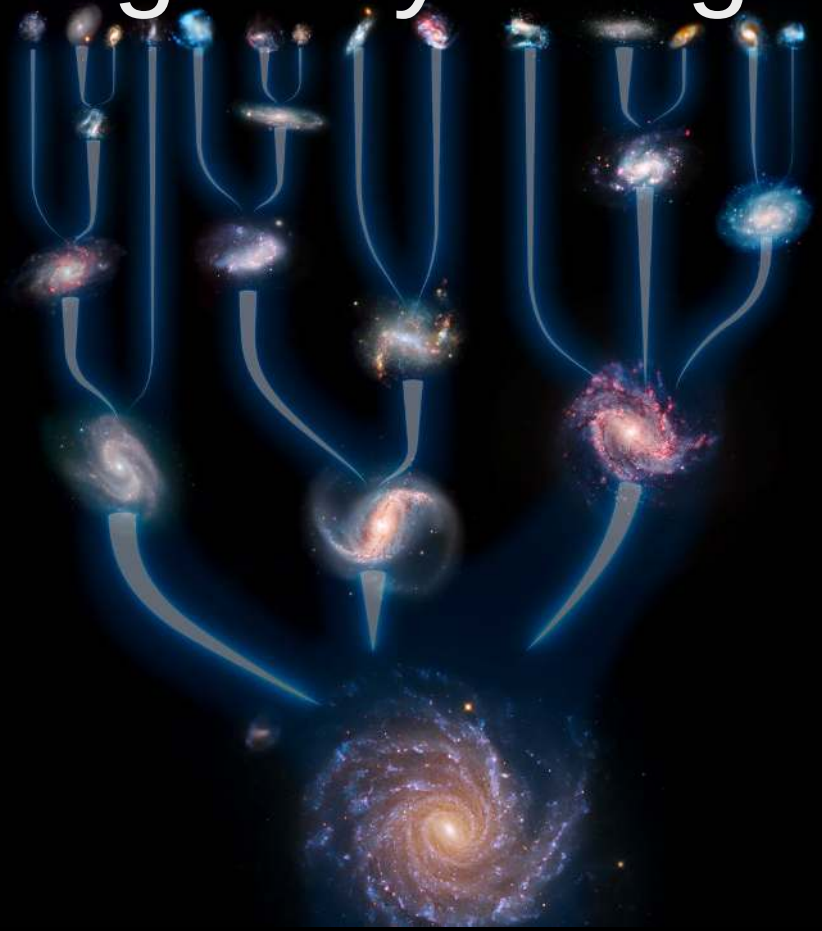
Why we care about galaxy mergers

- Galaxy mergers underpin our current understanding of galaxy evolution
- All galaxies have, or will have, mergers at some point



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ESO/L. Calçada

Why we care about galaxy mergers

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NASA, ESA, and the Hubble Heritage Team (STScI/AURA)-ESA/Hubble Collaboration

Why we care about galaxy mergers

- Change in morphology

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Why we care about galaxy mergers

- Change in morphology
- Change in active galactic nuclei (AGN) activity

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Why we care about galaxy mergers

- Change in morphology
- Change in active galactic nuclei (AGN) activity
- Change in star-formation rate (SFR)

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Why we care about galaxy mergers

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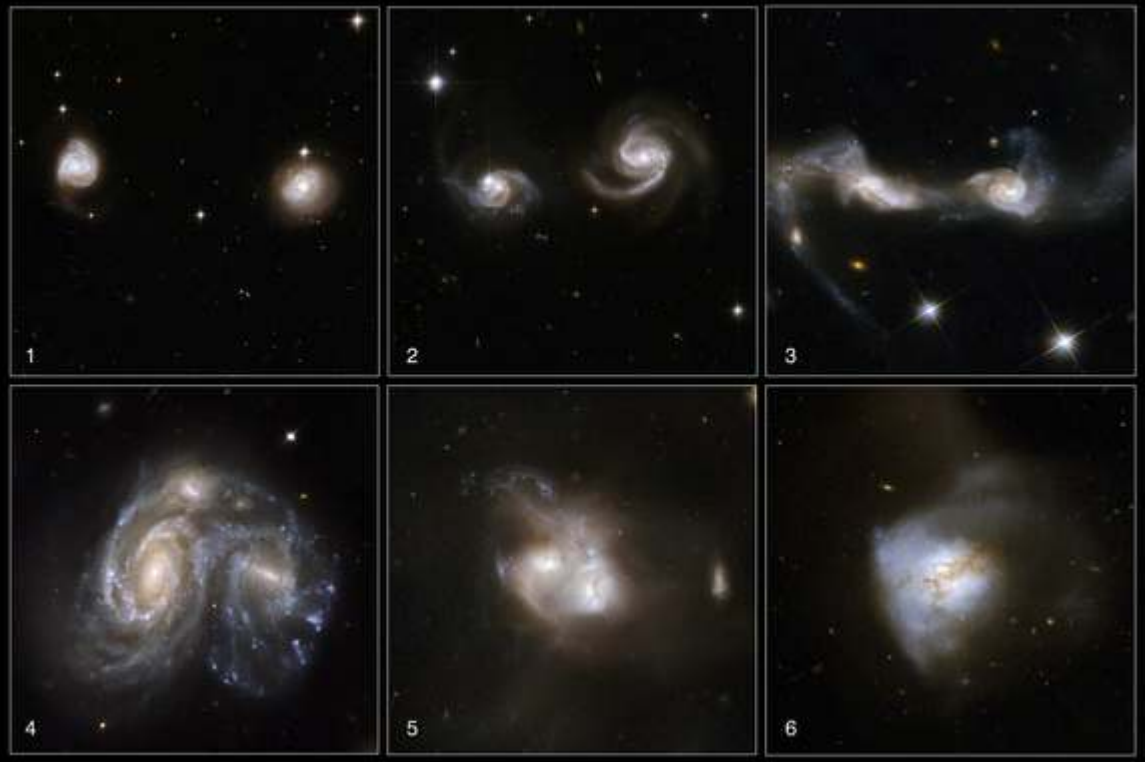
Adam Evans

What we know



NASA, ESA, the Hubble Heritage Team (STScI/AURA)
ESA/Hubble Collaboration and A. Evans (University of Virginia, Charlottesville/NRAO/Stony Brook University), K. Noll (STScI), and J. Westphal (Caltech)

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What we know

- Mergers change morphology
- Mergers increase AGN activity
- Mergers increase SFR

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Merger Time

- Train a CNN with images from IllustrisTNG

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Merger Time

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  - Will merge in next 500 Myr or have merged in last 500 Myr

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  - Major mergers: mass ratio 1:4 or closer

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- Apply to 5897 merging KiDS galaxies

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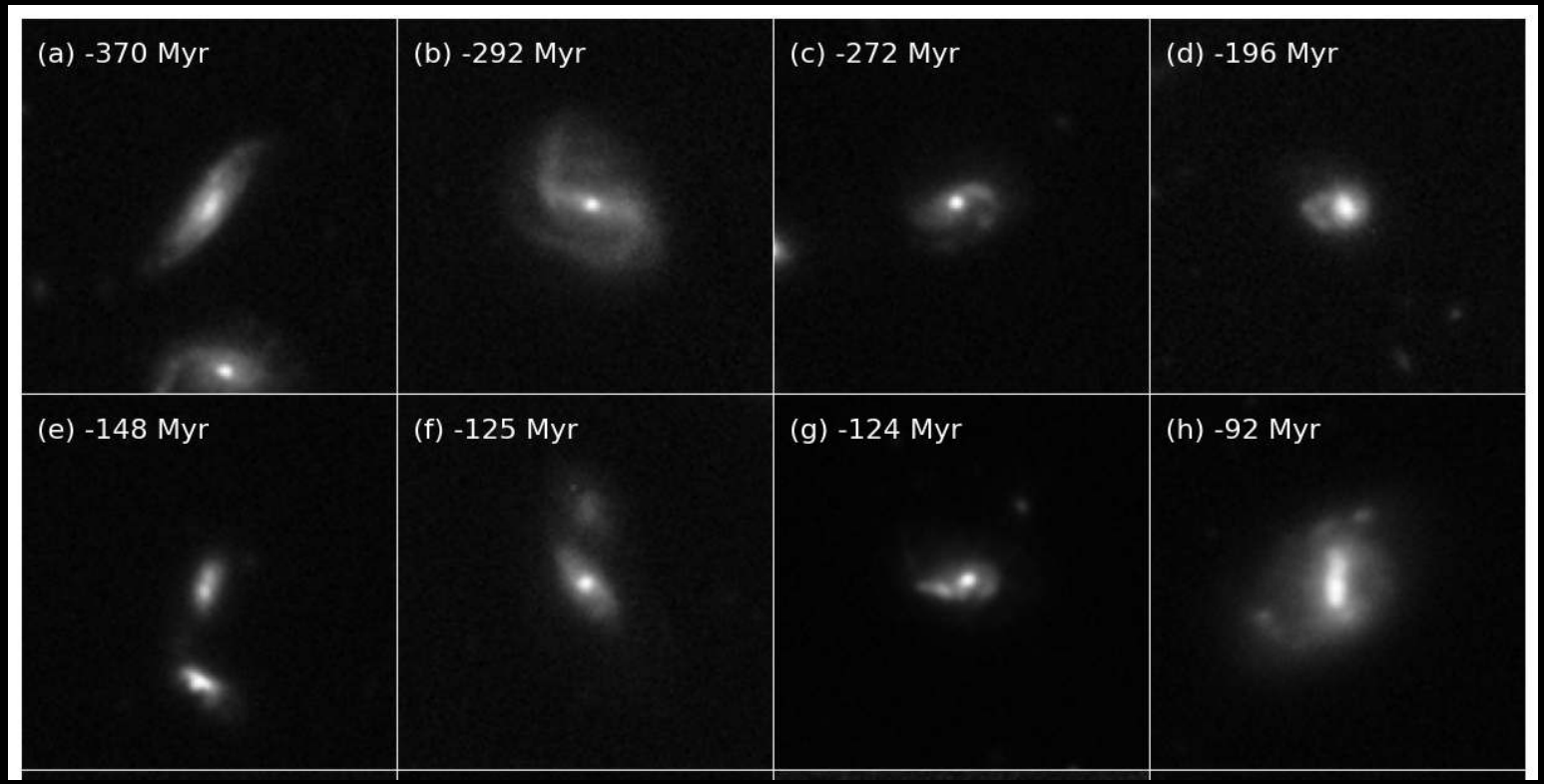
Merger Time



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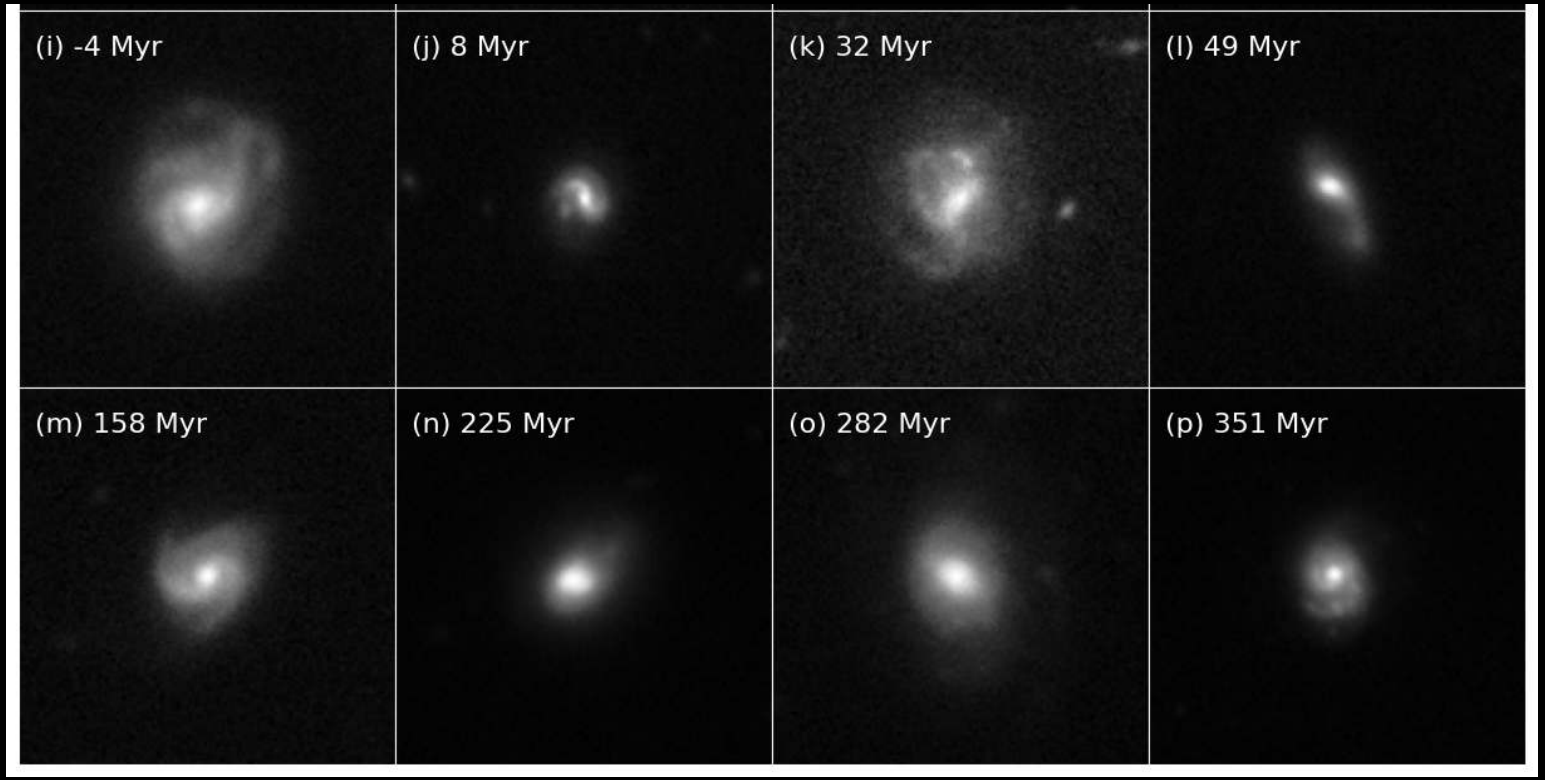

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Merger Time

Predicted merger time range	Mean error (Myr)	Median error (Myr)
-500 Myr ≤ t < 500 Myr	182	145
-500 Myr ≤ t < -300 Myr	140	60
-300 Myr ≤ t < -100 Myr	165	145
-100 Myr ≤ t < 100 Myr	190	160
100 Myr ≤ t < 300 Myr	179	154
300 Myr ≤ t < 500 Myr	214	154

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Change in SFR

- Match merging galaxies to 10 non-mergers

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  - Same M_*
  - Same local density
  - Same redshift

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Change in SFR

- Match merging galaxies to 10 non-mergers
  - Same M_*
  - Same local density
  - Same redshift
- Change in SFR (ΔSFR)
  - $\Delta SFR = \log(SFR_{mgr}) - \text{median}[\log(SFR_{ctrl})]$

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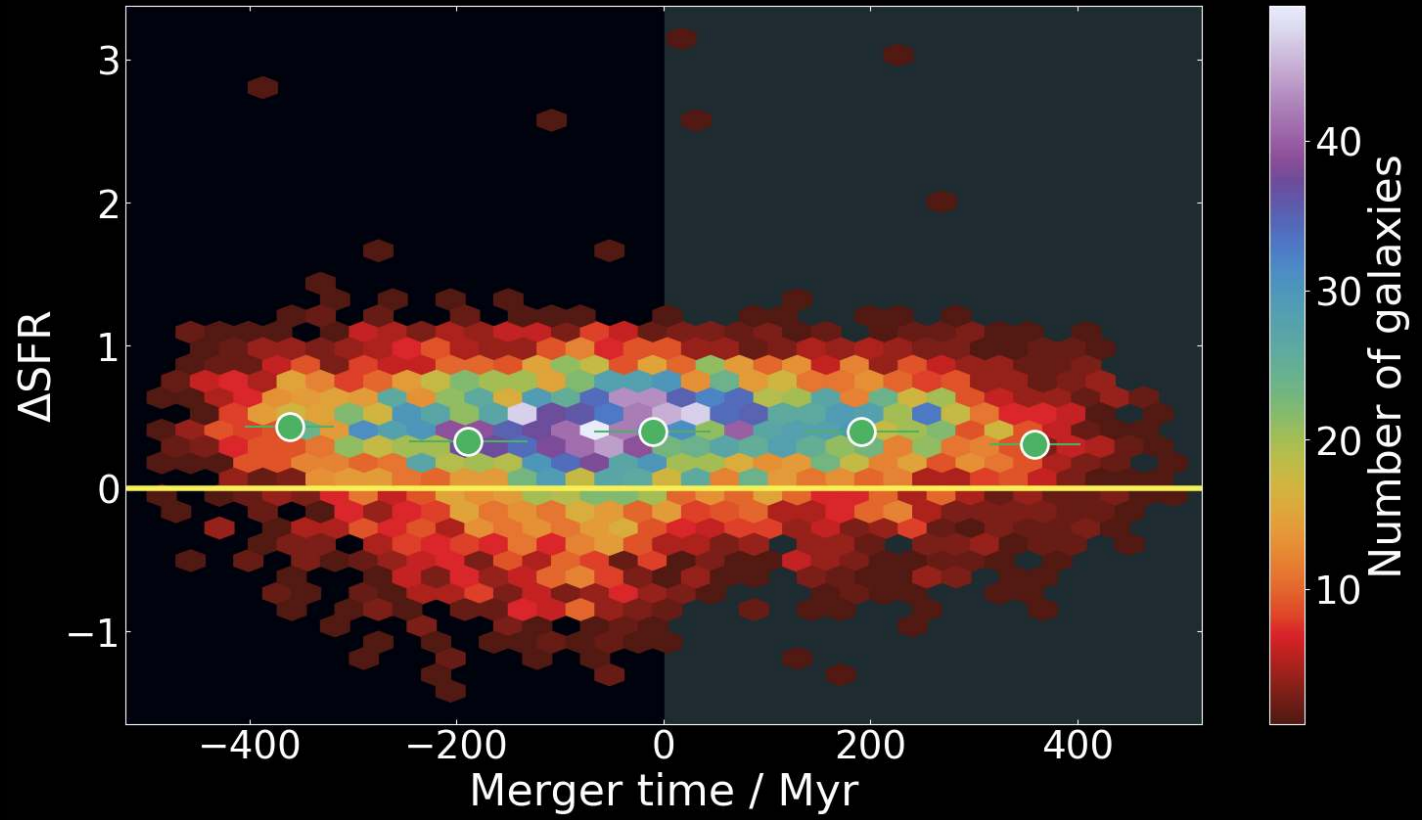
Change in SFR



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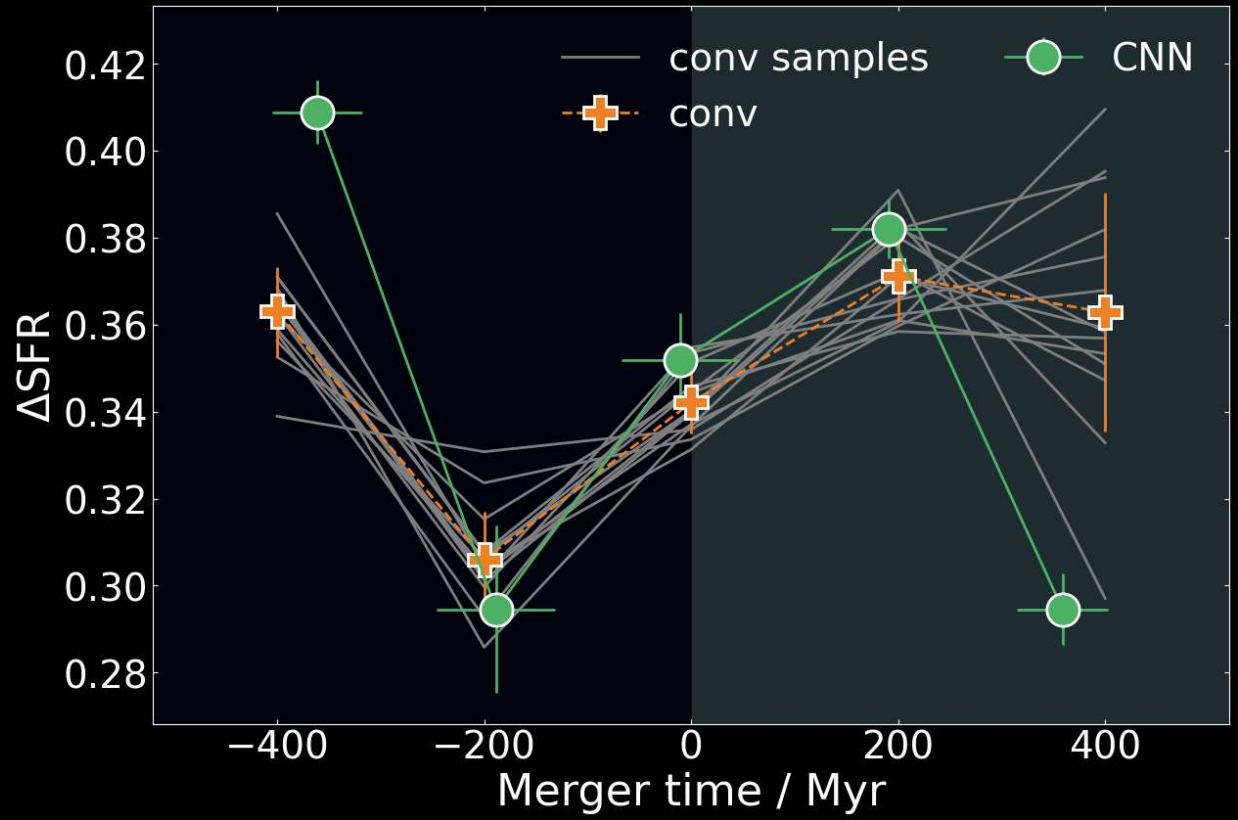

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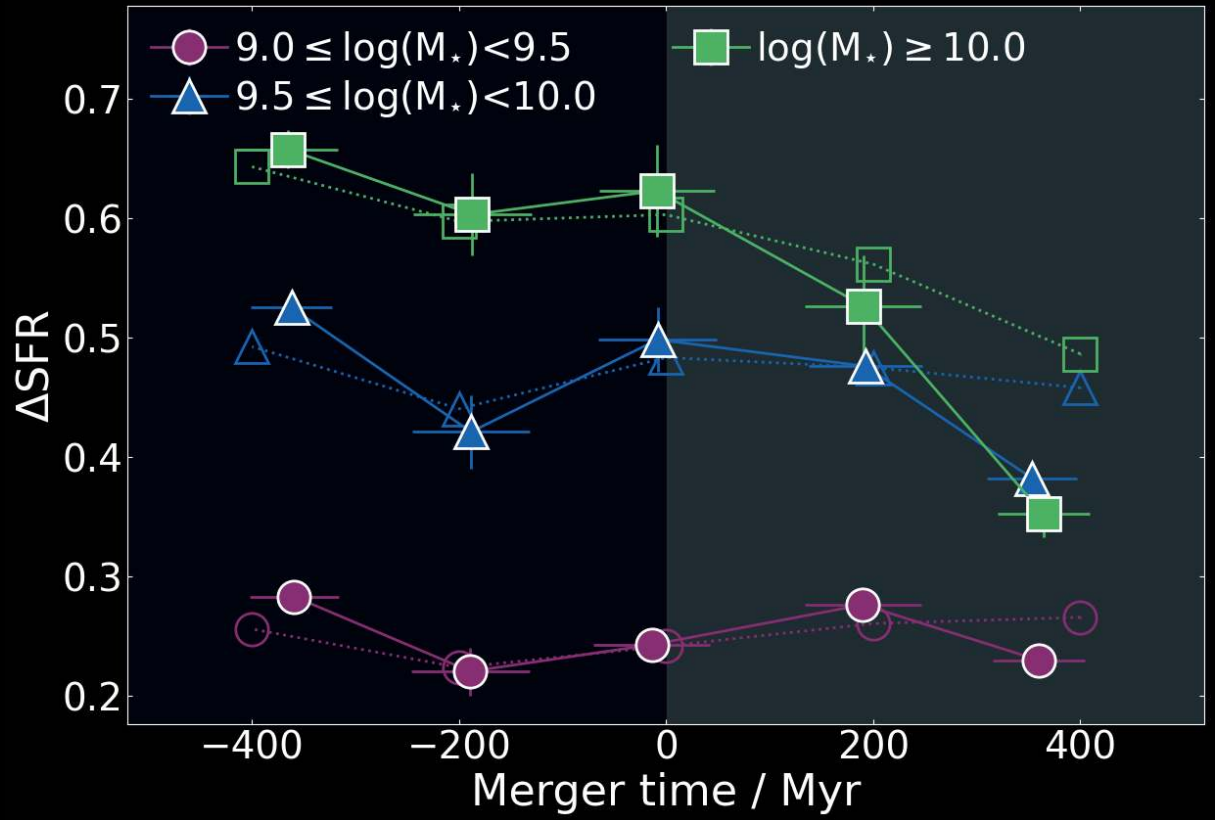
Change in SFR - M_*



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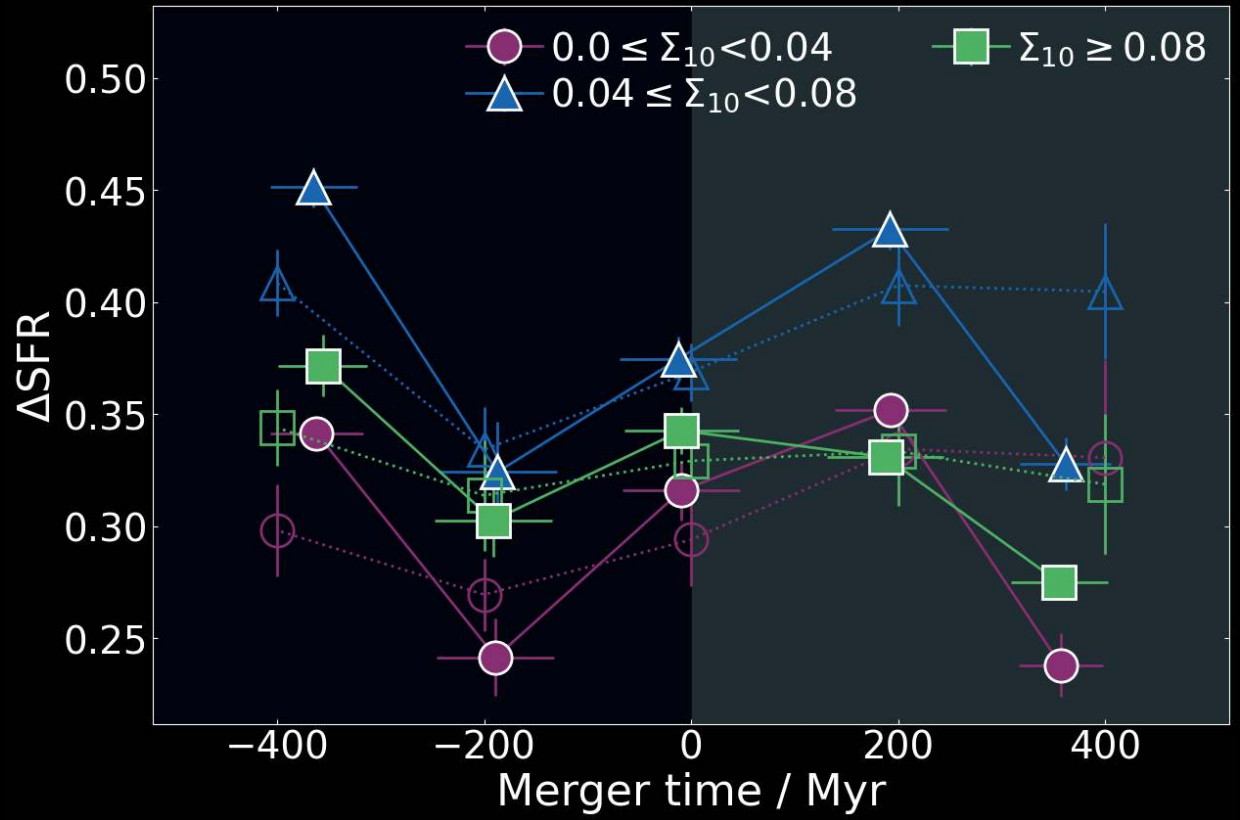
Change in SFR - Density



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Summary

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Summary

- Created the first ever catalogue of mergers times for observed galaxies
- SFR increases as galaxies approach coalescence, then quenches at later stages
- More massive galaxies have higher ΔSFR but quench sooner
- Local density has no direct impact on SFR in mergers

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