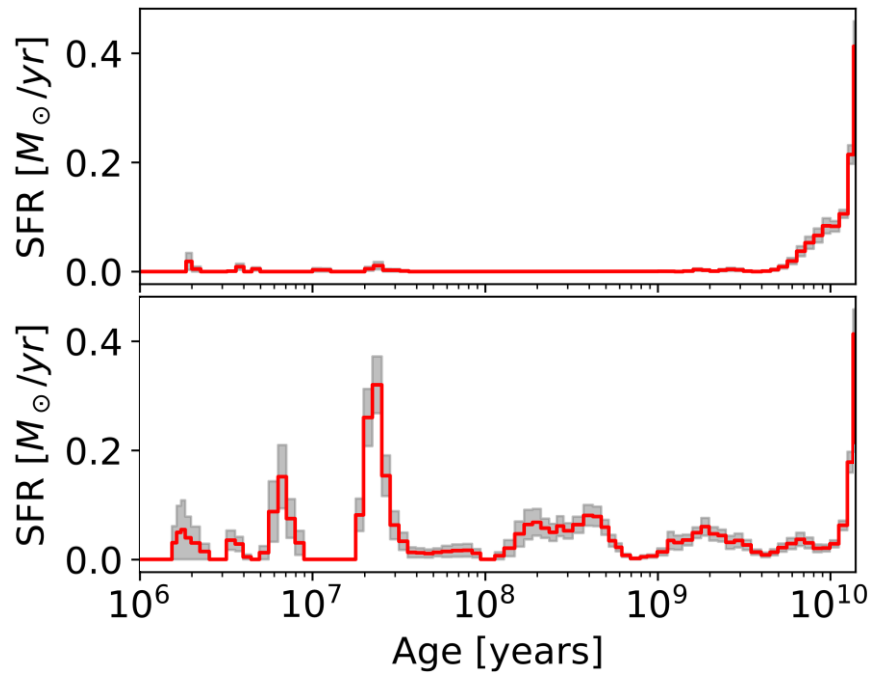


Credit: pngall.com



RUB



RUHR-UNIVERSITÄT BOCHUM

THE "ENVIRONMENTAL IMPACT" ON THE STAR FORMATION HISTORY OF DWARF GALAXIES

Malte Przybyl – 08.09.2026 – Annual Meeting of the German Astronomical Society

Motivation

Field galaxies ↔ Group galaxies
Dwarf galaxies ↔ Larger galaxies

Is this visible in the Star Formation History (SFH) of galaxies?

Steps to go

- I. Sample Selection
- II. Galaxy Group Catalog
- III. Spectral Analysis
- IV. Results
- V. Conclusion
- VI. Outlook

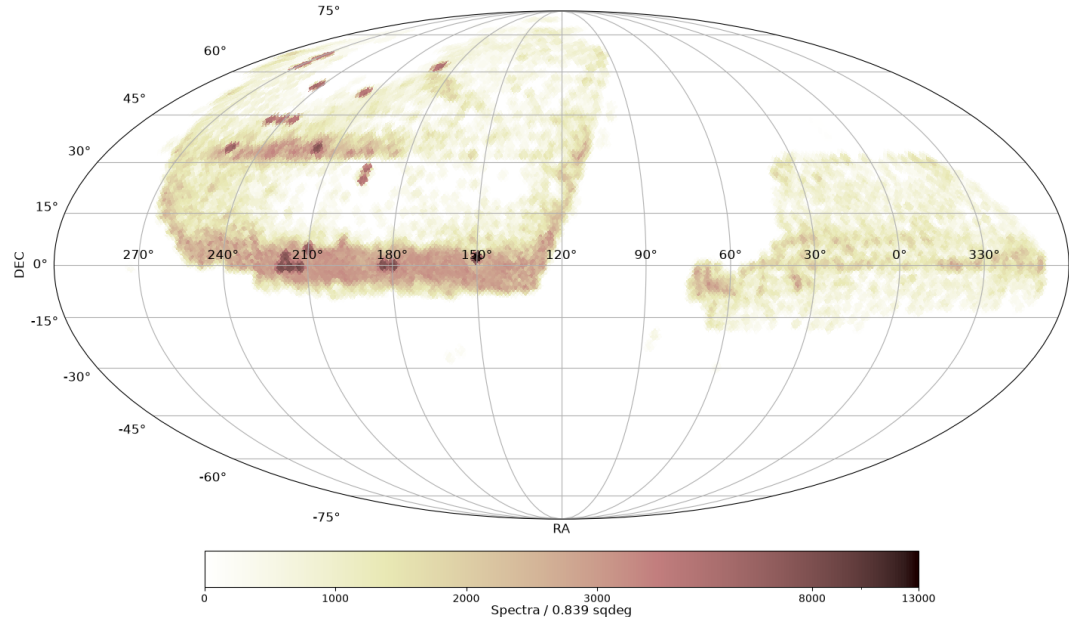
Chapter I

Sample Selection

Sample Selection

- Expectations:

- Large Redshift Survey
- High Completeness
- Availability of Spectra

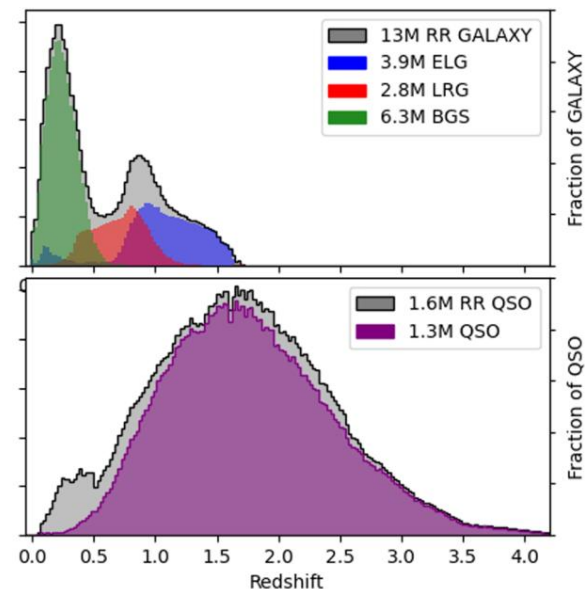


- DESI DR1 (DESI Collaboration et al. 2026)

- “FastSpecFit Spectral Synthesis and Emission-Line Catalog” (VAC, Value Added Catalog, Moustakas et al. in prep., Moustakas et al. 2023)

Sample Selection

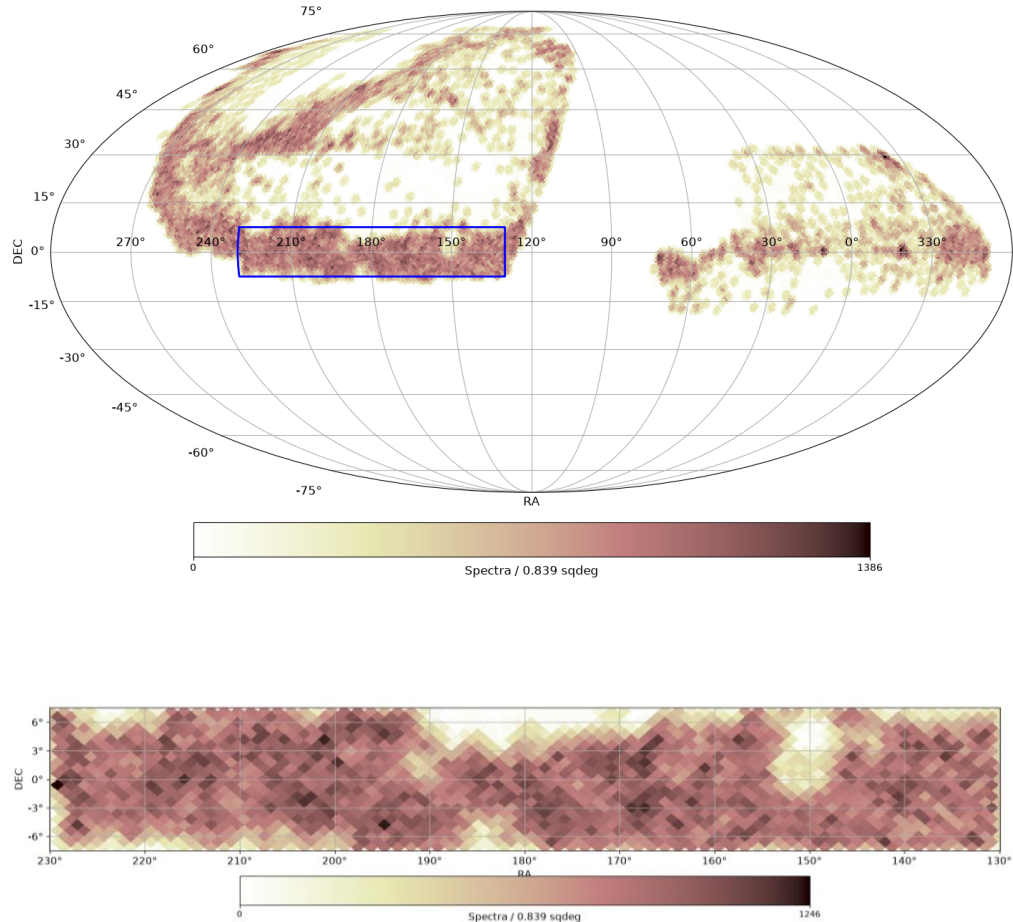
- DR1 consists of Bright Galaxy Survey (**BGS**), Emission Line Galaxies (**ELGs**), Luminous Red Galaxies (**LRGs**) and **QSOs**
- For a coherent catalog, I only use **BGS** objects (Hahn et al. 2023)
 - $z < 0.6$
 - $r_{\text{mag}} < 20.175$
 - Excludes a lot of low- z , low- $M_{\star}$ objects



Credit: Desi Collaboration et al. 2026

Sample Selection

- Use region of high completeness
- Remove stars and objects with redshift warnings
- Full Sample:
 - 17,995,820 $\rightarrow$ 1,374,121 spectra
 - $\approx 1500 \text{ deg}^2$



Chapter II

Galaxy Group Catalog

Galaxy Group Catalog

- Nessie (Lambert et al. 2026) is a friends-of-friends group finding algorithm
 - Requires only R.A., Dec., redshift
- Group membership is based on distances between galaxies $i = 1$ and $i = 2$:



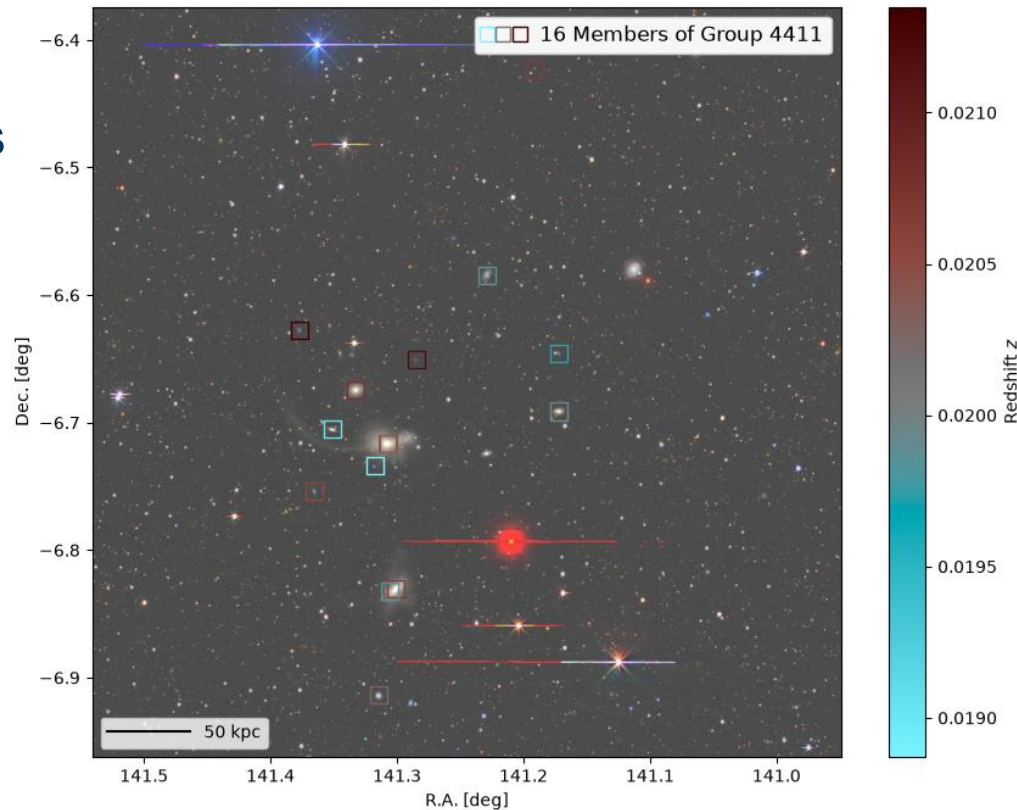
NESSIE

Credit: github.com/TrystanScottLambert/nessie_py

- Distance proj. on sky: $\tan(\theta_{12}) \sum_i d_i^{\text{com.}} \leq b_0 \sum_i (\rho(z_i) c_i)^{-1/3}$
- Distance along line-of-sight: $|d_1^{\text{com.}} - d_2^{\text{com.}}| \leq \frac{b_0 R_0}{2} \sum_i (\rho(z_i) c_i)^{-1/3}$
 - $b_0, R_0 \equiv$ free parameters to be chosen ($b_0 = 0.054, R_0 = 26$ in my case)
 - $d_i^{\text{com.}} \equiv$ comoving distance, $\rho(z_i) \equiv$ average local galaxy density
 - $c_i \equiv$ completeness, $\theta_{12} \equiv$ angular separation

Galaxy Group Catalog

- The final group catalog contains $> 200,000$ groups up to 350 members
- A medium-size example group with 15 galaxies



Chapter III

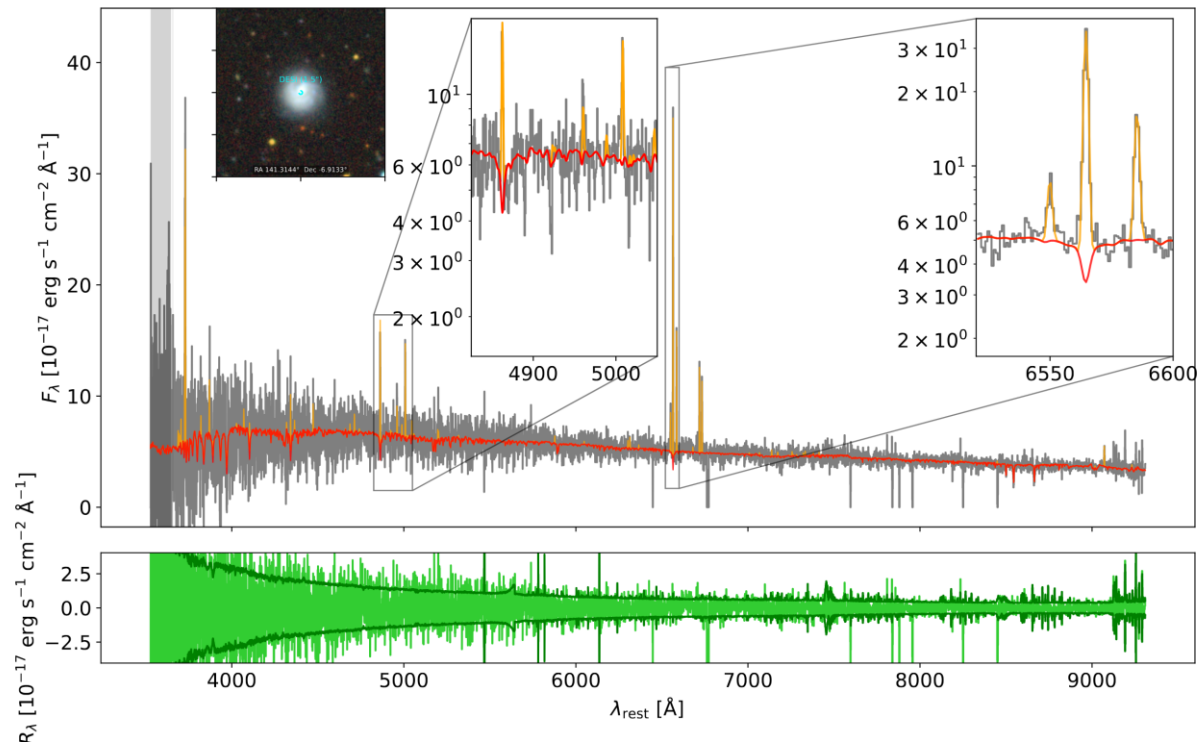
Spectral Analysis

Spectral Analysis

- Done using a spectral synthesis software developed by Pascal Vennedey (Vennedey et al. in prep.) based on pPXF (Cappellari 2023)
 - Extraction of SFH from spectra based on empirical models
 - Certain strong emission lines ($H\alpha$, [O III]) → Recent Starburst
 - High continuum flux in blue / UV → High-mass stars → Recent SF
 - High continuum flux in red / IR → Low-mass stars → SF in the past

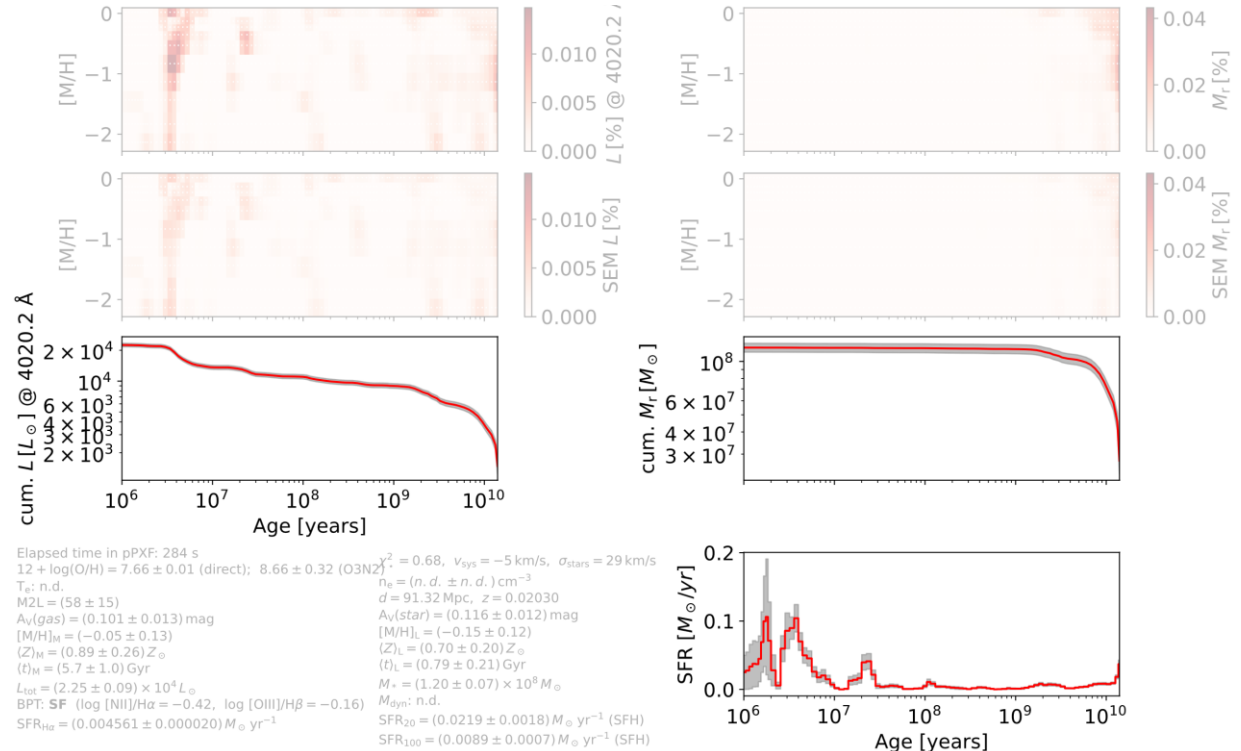
Spectral Analysis

- Continuum and line fitting



Spectral Analysis

- Continuum and line fitting
- Extraction of luminosity, mass and SF history

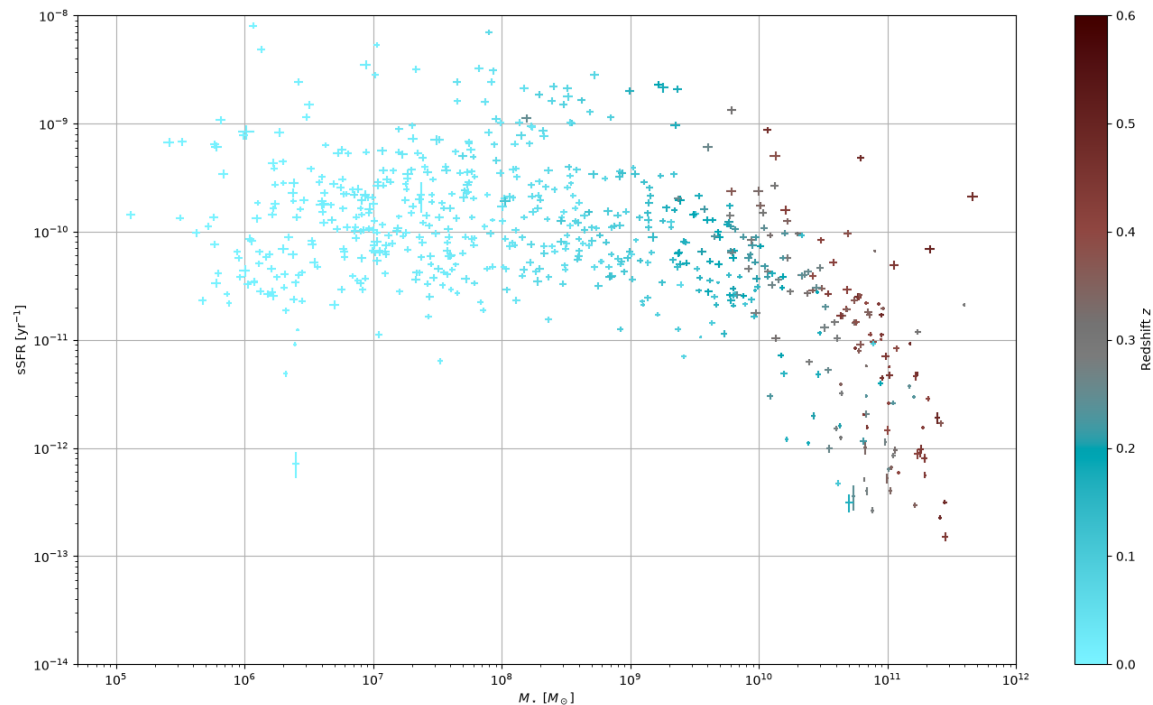


Chapter IV

Results

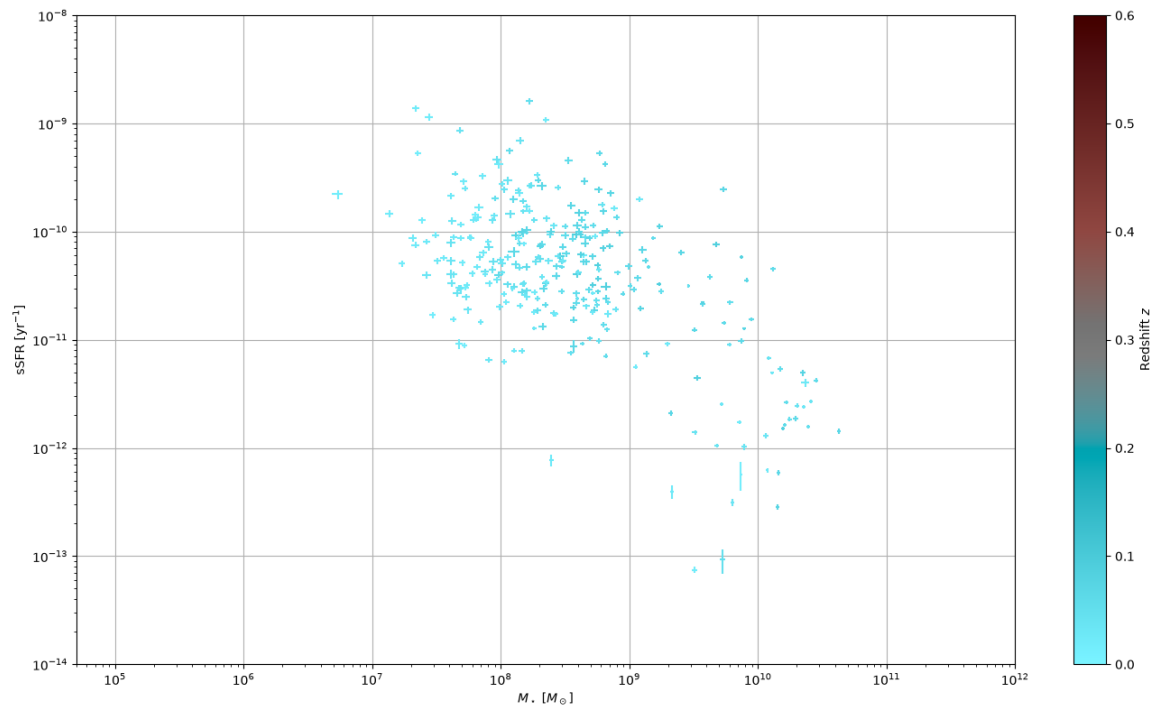
Results

- sSFR
- Isolated Galaxies



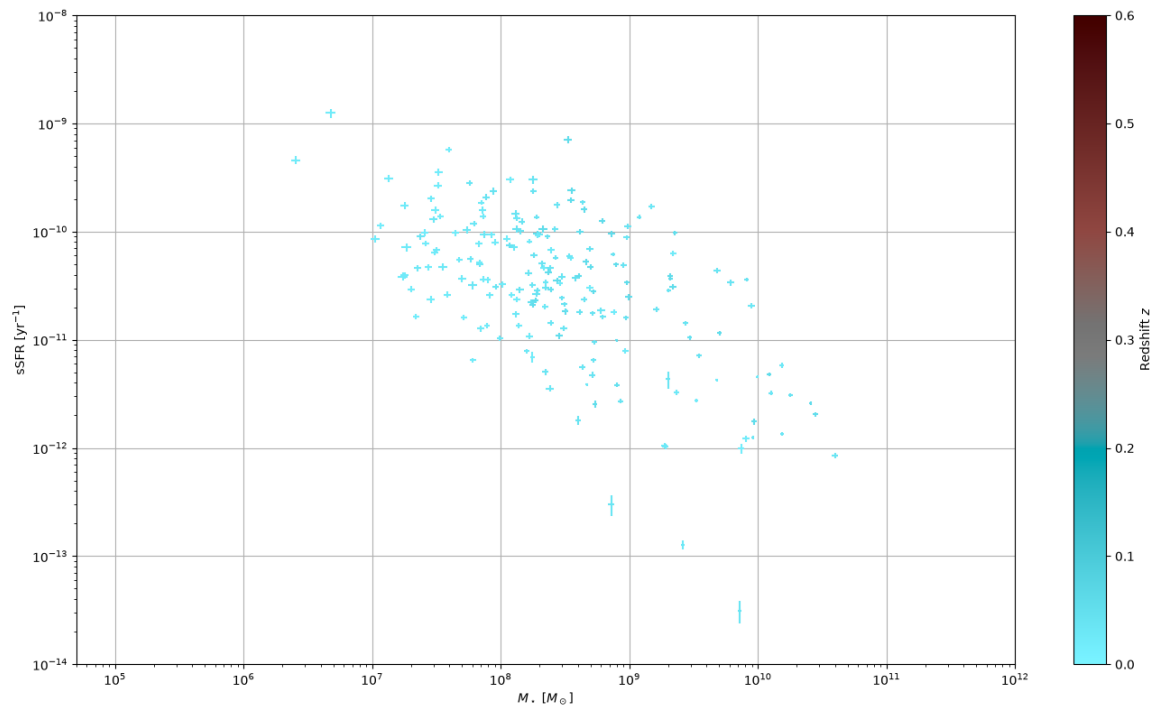
Results

- sSFR
 - Isolated Galaxies
 - Galaxies in groups of 5



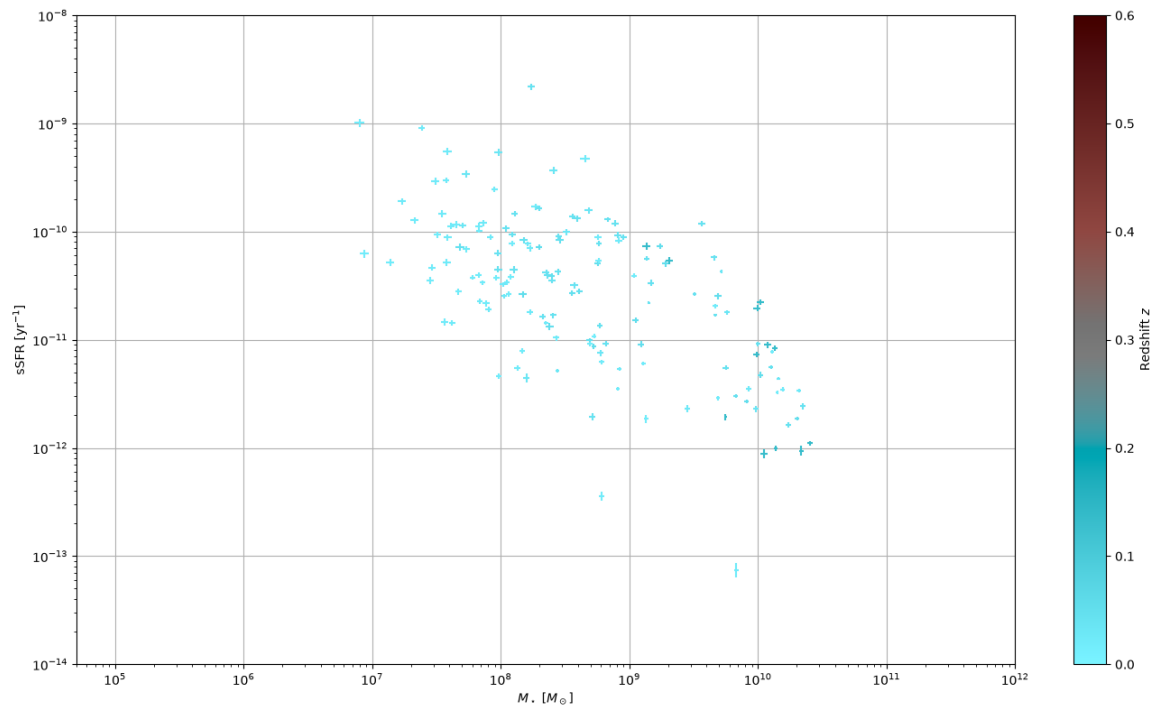
Results

- sSFR
 - Isolated Galaxies
 - Galaxies in groups of 5
 - Galaxies in groups of 10



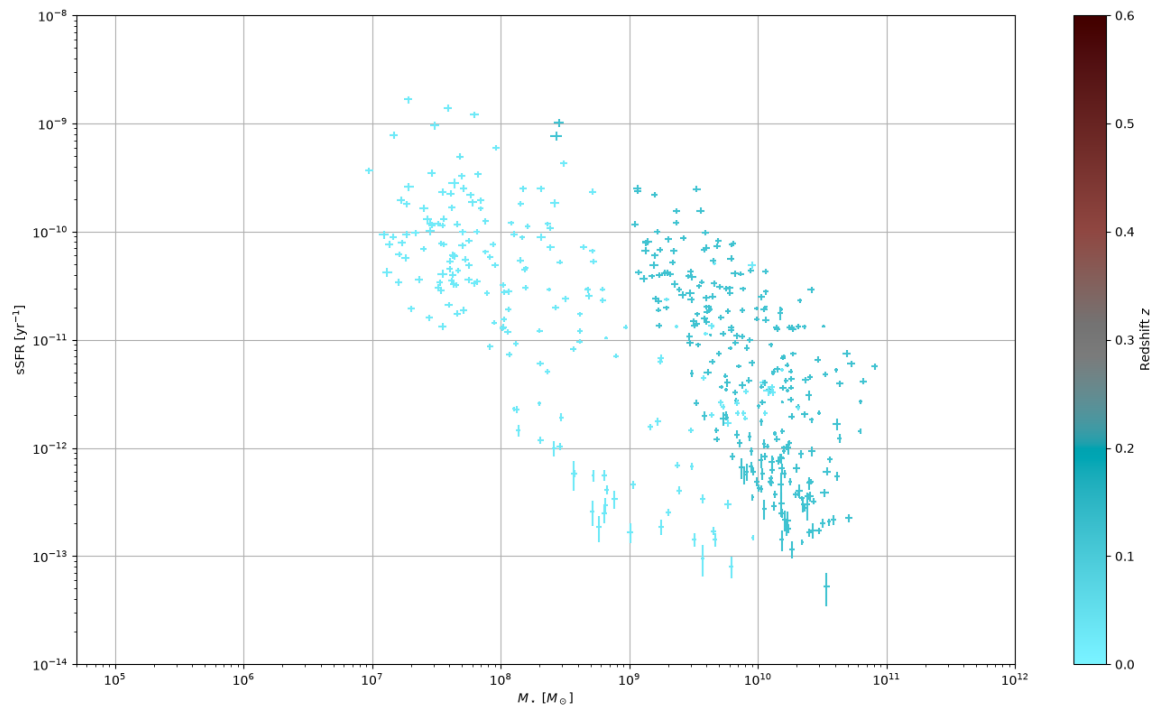
Results

- sSFR
 - Isolated Galaxies
 - Galaxies in groups of 5
 - Galaxies in groups of 10
 - Galaxies in groups of 15



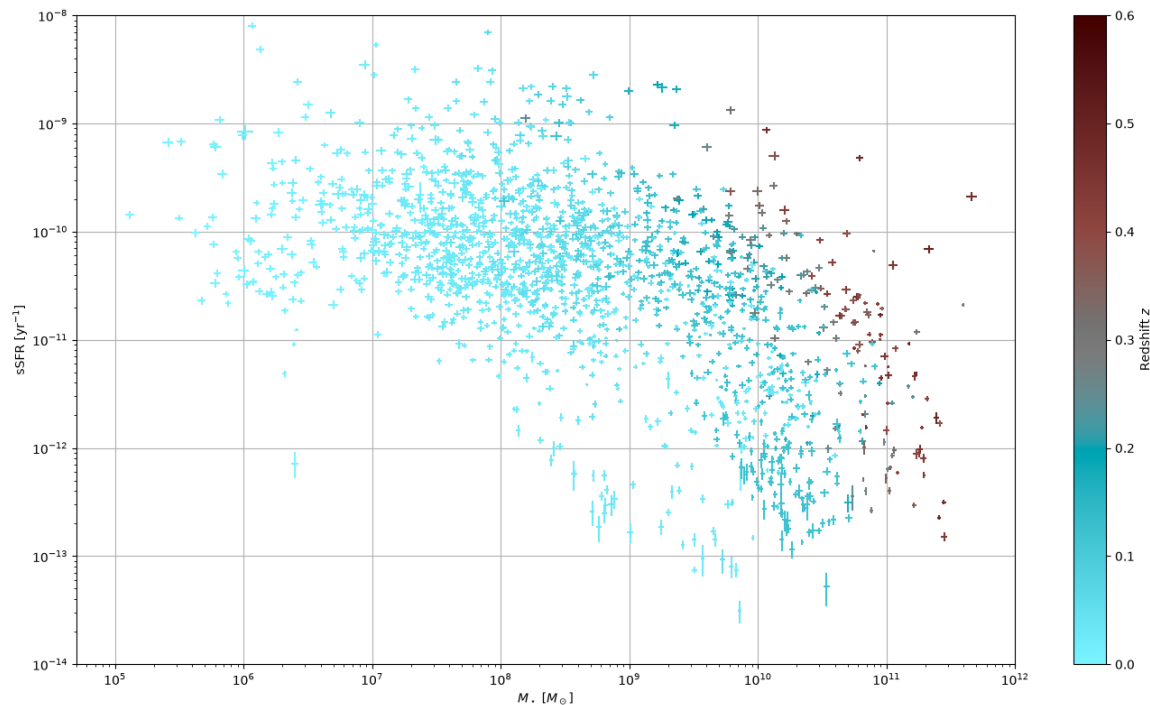
Results

- sSFR
 - Isolated Galaxies
 - Galaxies in groups of 5
 - Galaxies in groups of 10
 - Galaxies in groups of 15
 - Some Clusters



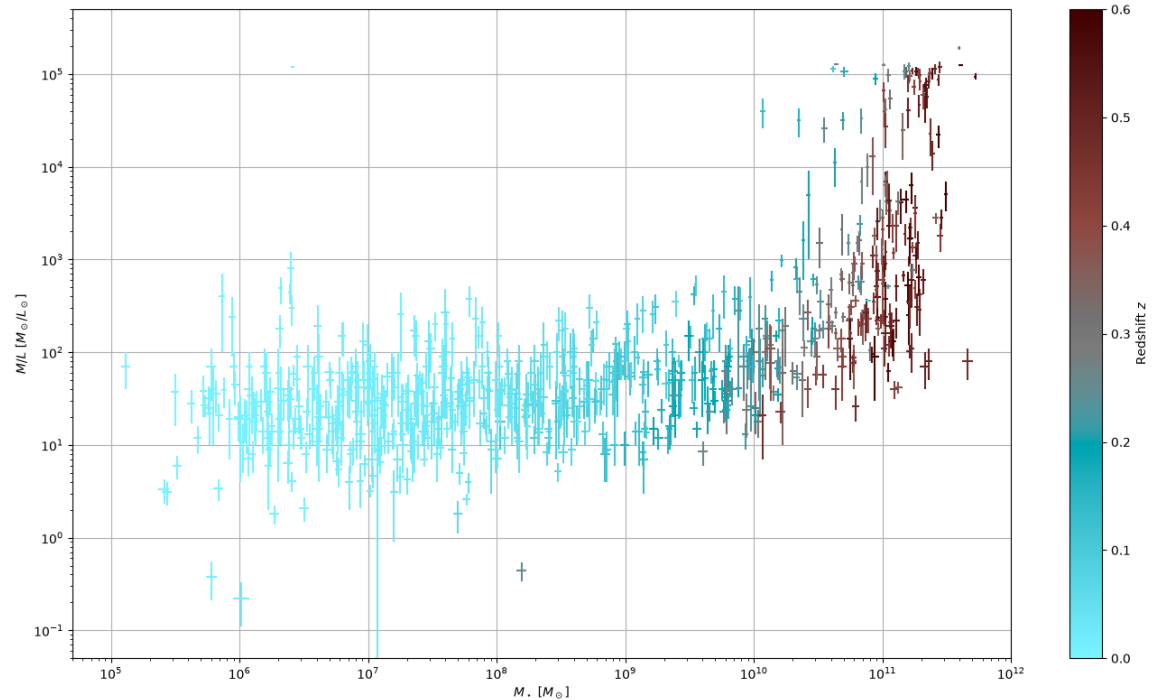
Results

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 - Galaxies in groups of 5
 - Galaxies in groups of 10
 - Galaxies in groups of 15
 - Some Clusters



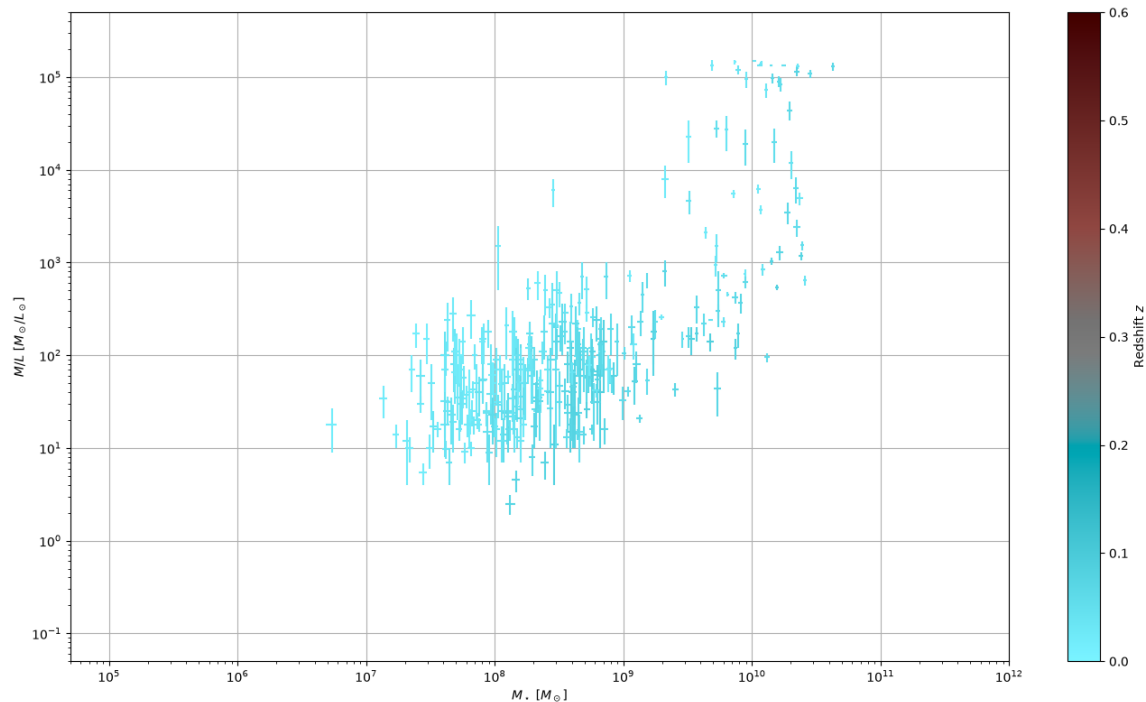
Results

- M/L
- Isolated Galaxies



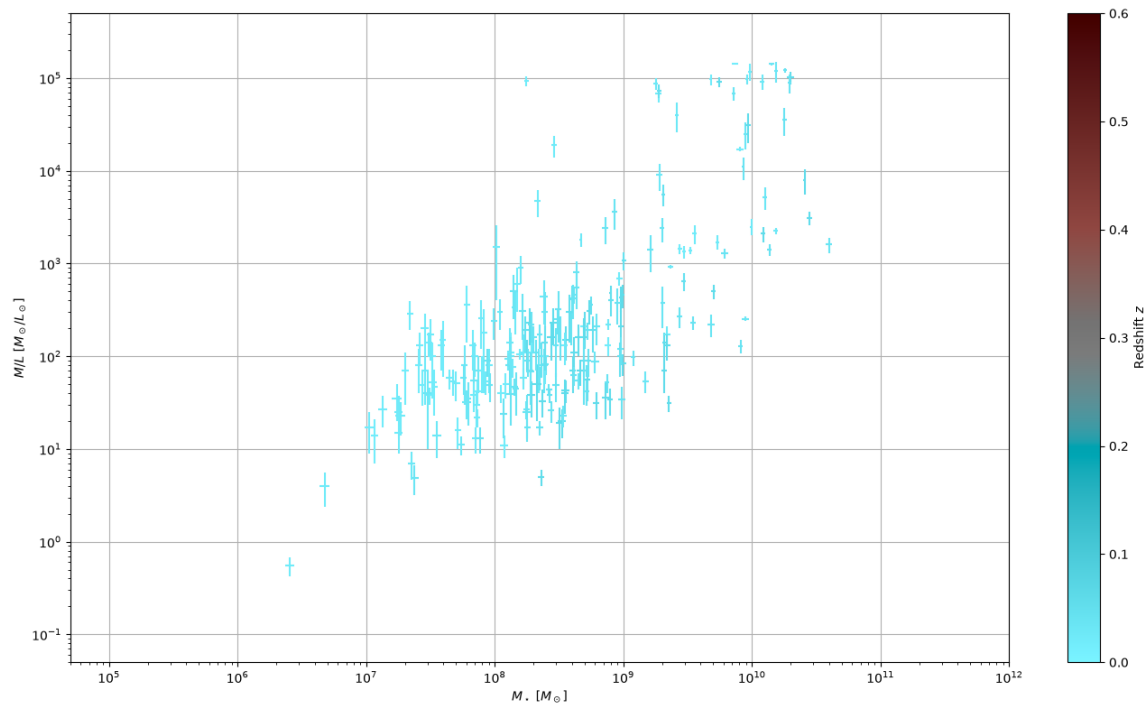
Results

- M/L
 - Isolated Galaxies
 - Galaxies in groups of 5



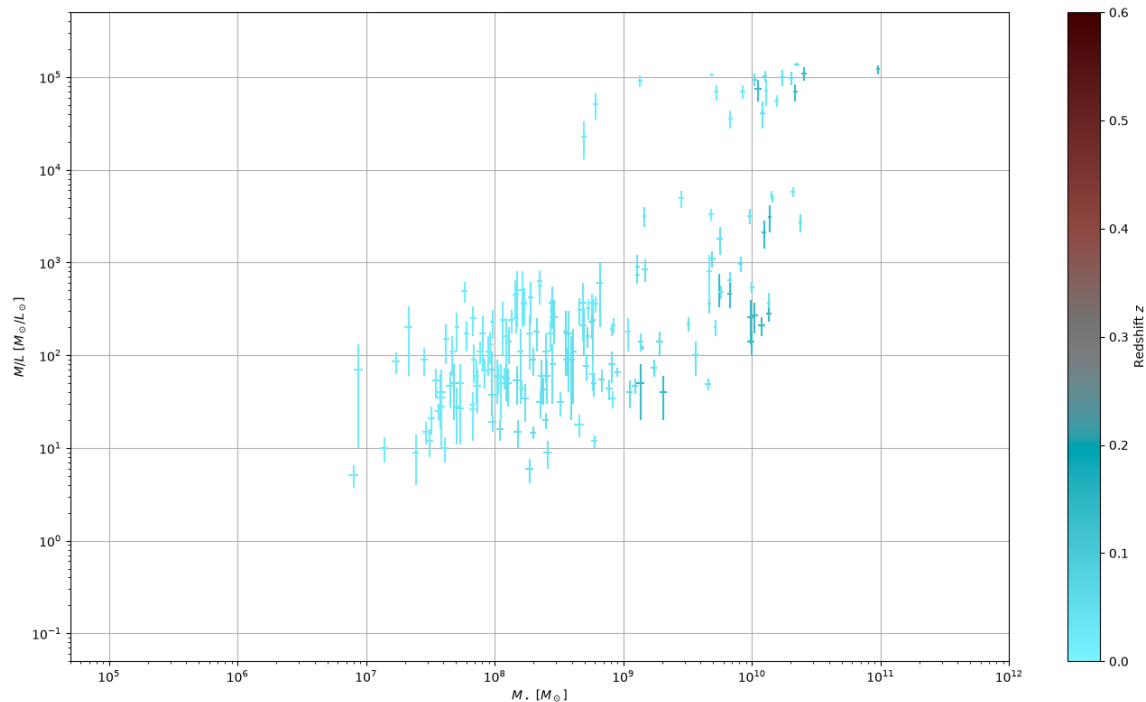
Results

- M/L
 - Isolated Galaxies
 - Galaxies in groups of 5
 - Galaxies in groups of 10



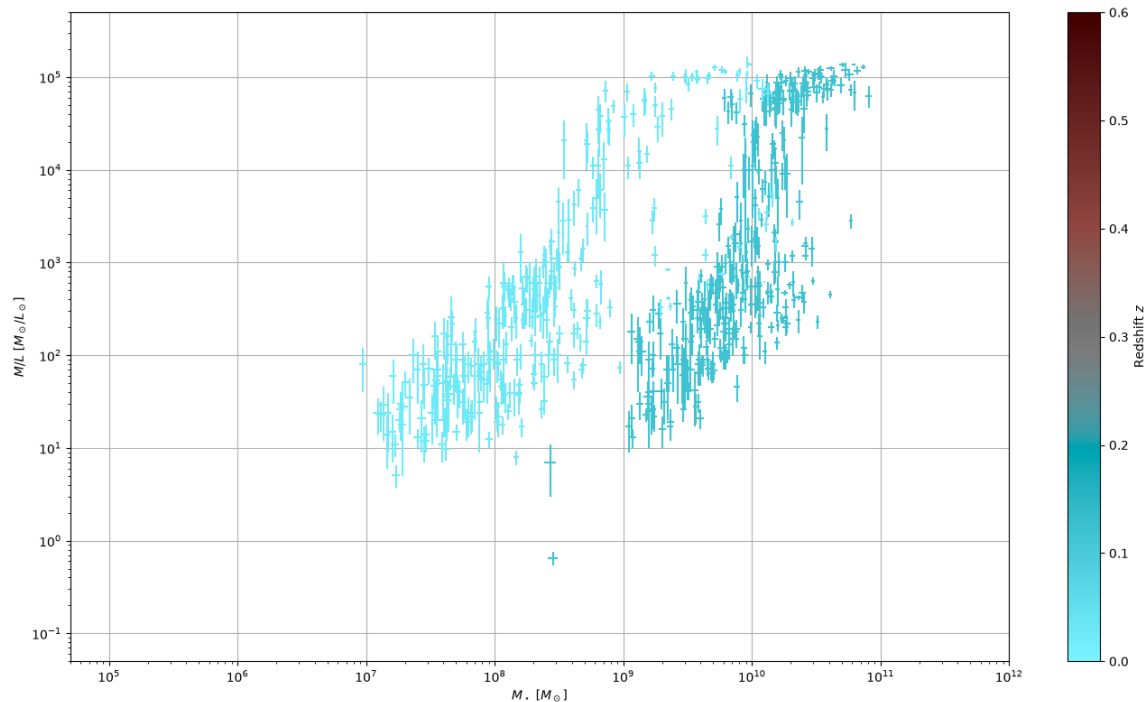
Results

- M/L
 - Isolated Galaxies
 - Galaxies in groups of 5
 - Galaxies in groups of 10
 - Galaxies in groups of 15



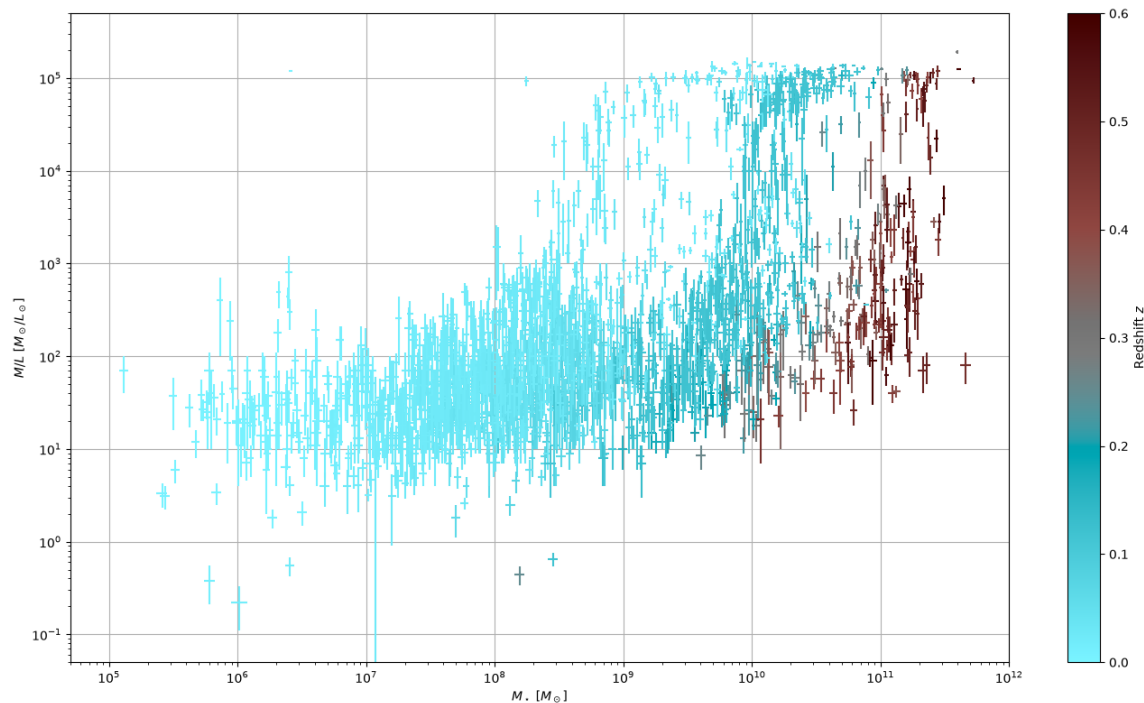
Results

- M/L
 - Isolated Galaxies
 - Galaxies in groups of 5
 - Galaxies in groups of 10
 - Galaxies in groups of 15
 - Some Clusters



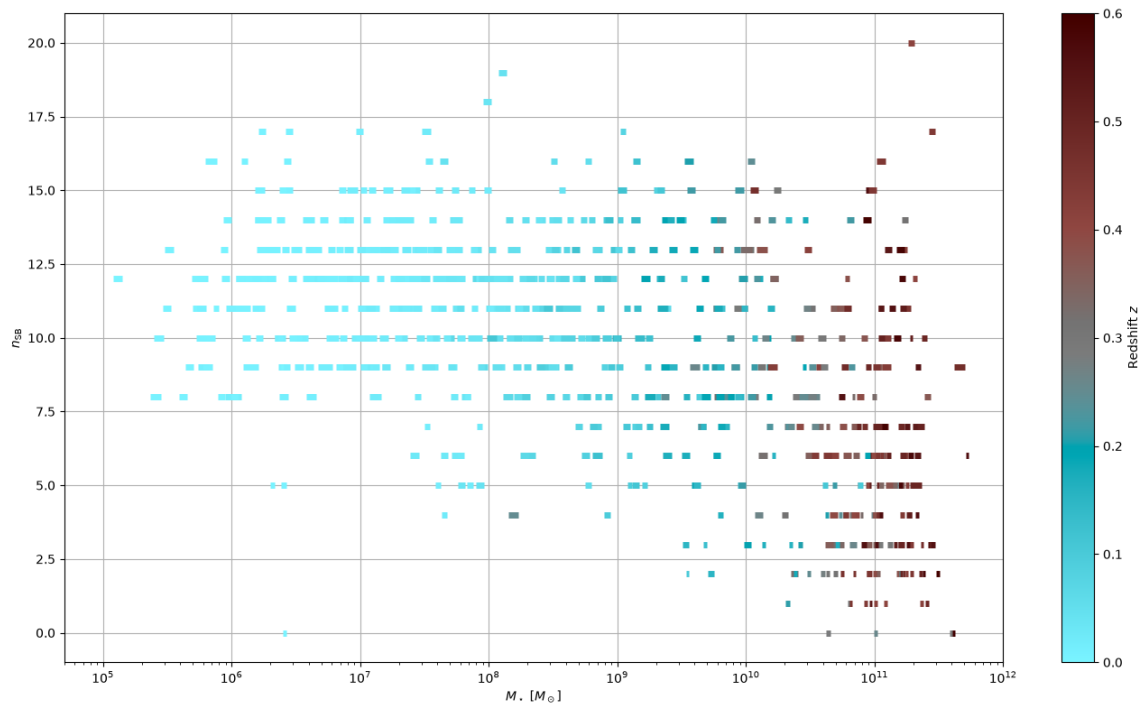
Results

- M/L
- Isolated Galaxies
 - Galaxies in groups of 5
 - Galaxies in groups of 10
 - Galaxies in groups of 15
 - Some Clusters



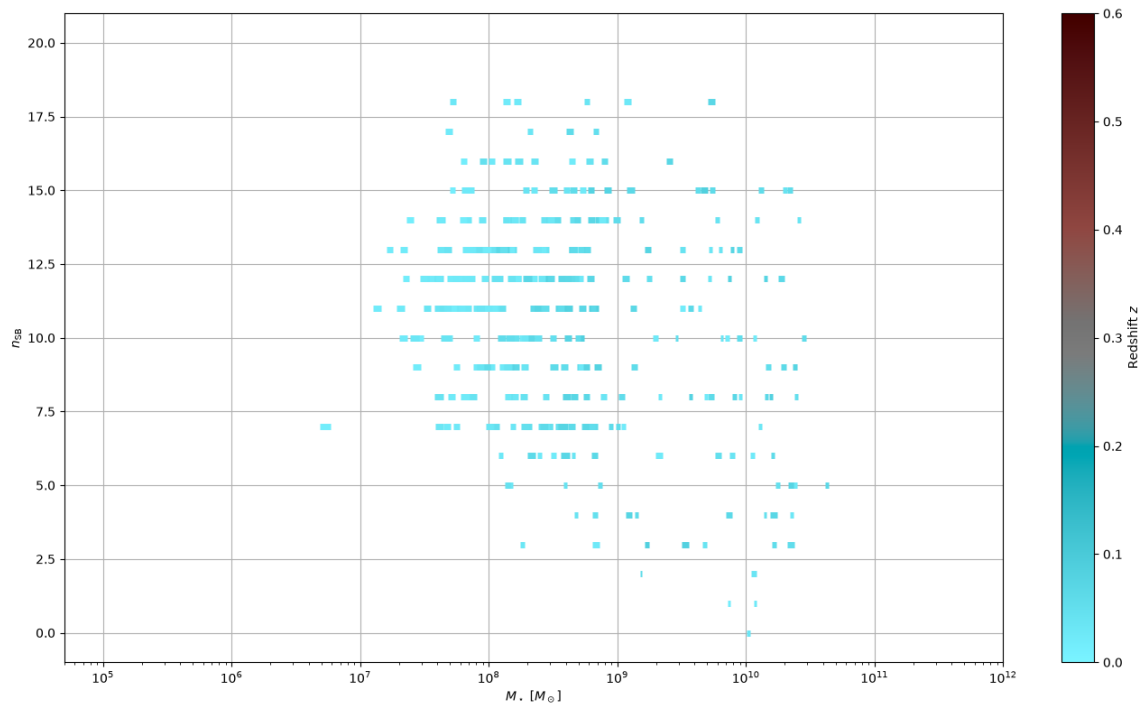
Results

- # Bursts
- Isolated Galaxies



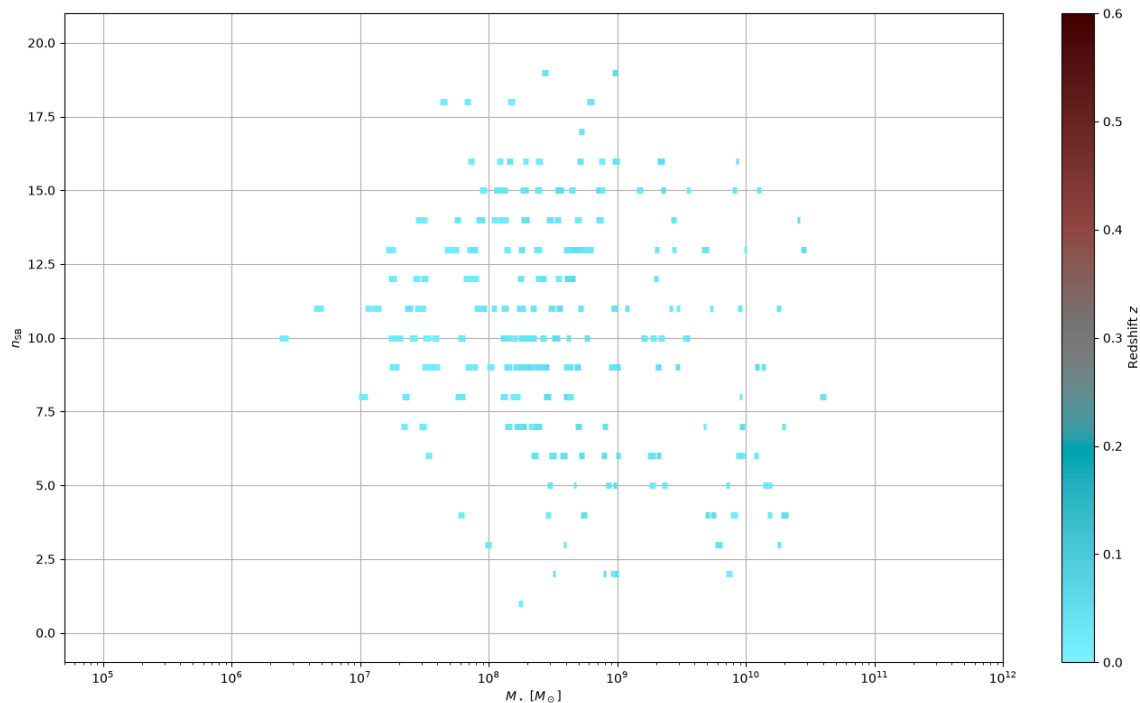
Results

- # Bursts
- Isolated Galaxies
- Galaxies in groups of 5



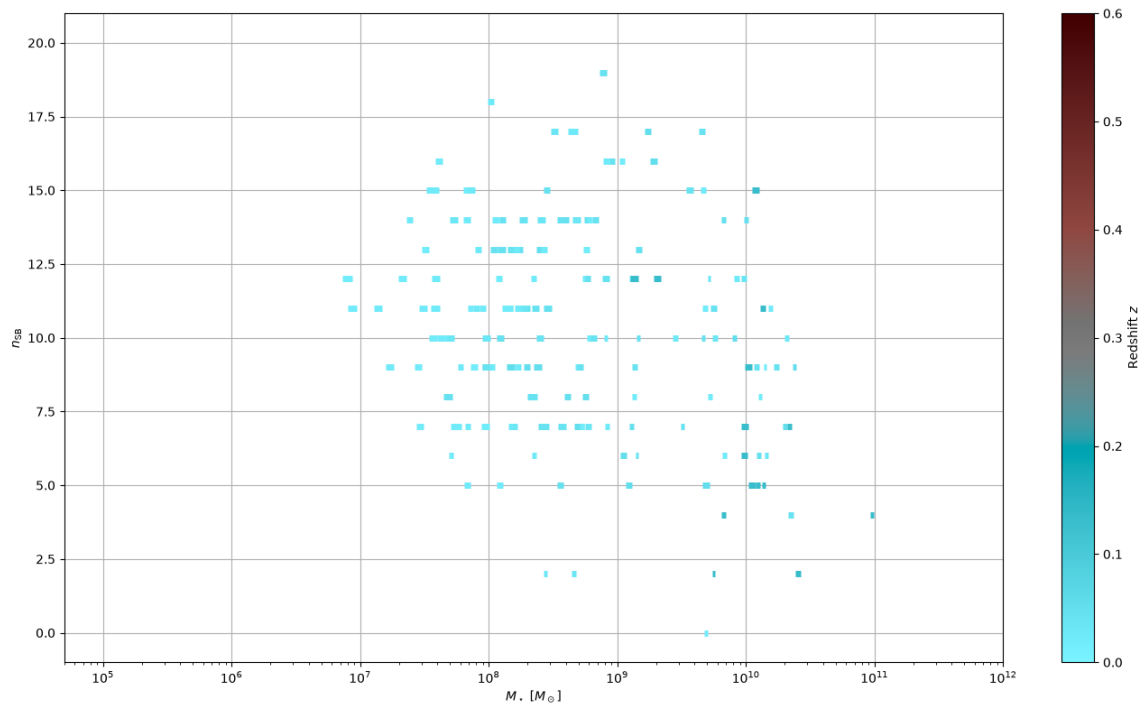
Results

- # Bursts
 - Isolated Galaxies
 - Galaxies in groups of 5
 - Galaxies in groups of 10



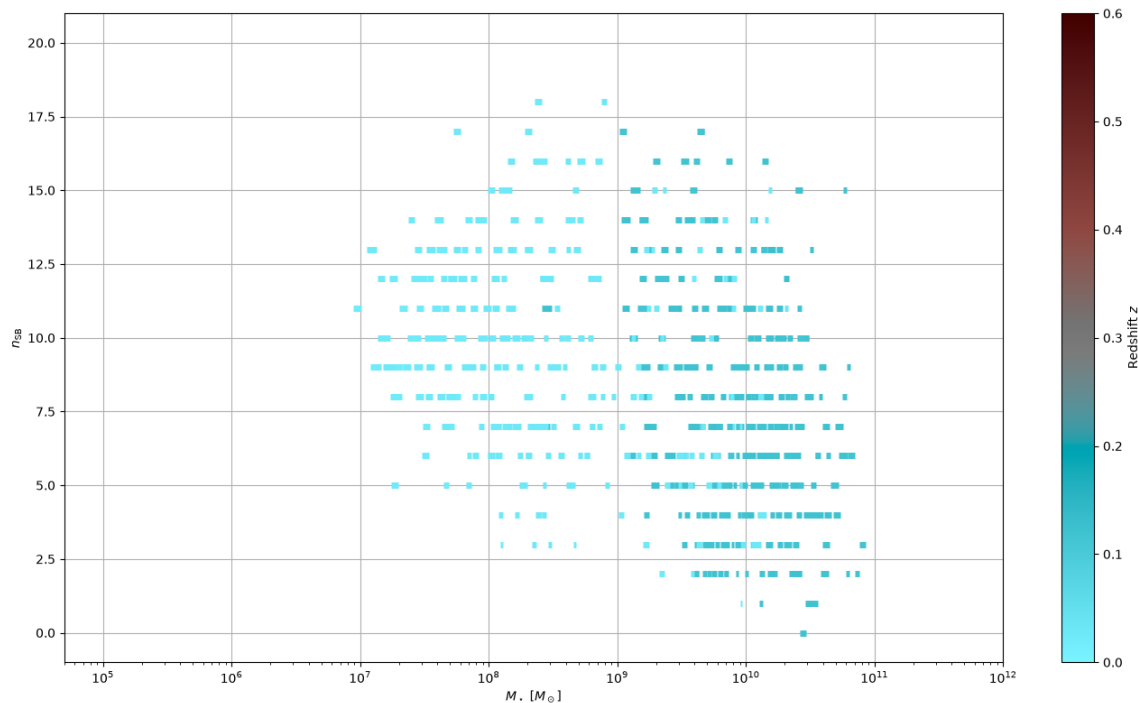
Results

- # Bursts
 - Isolated Galaxies
 - Galaxies in groups of 5
 - Galaxies in groups of 10
 - Galaxies in groups of 15



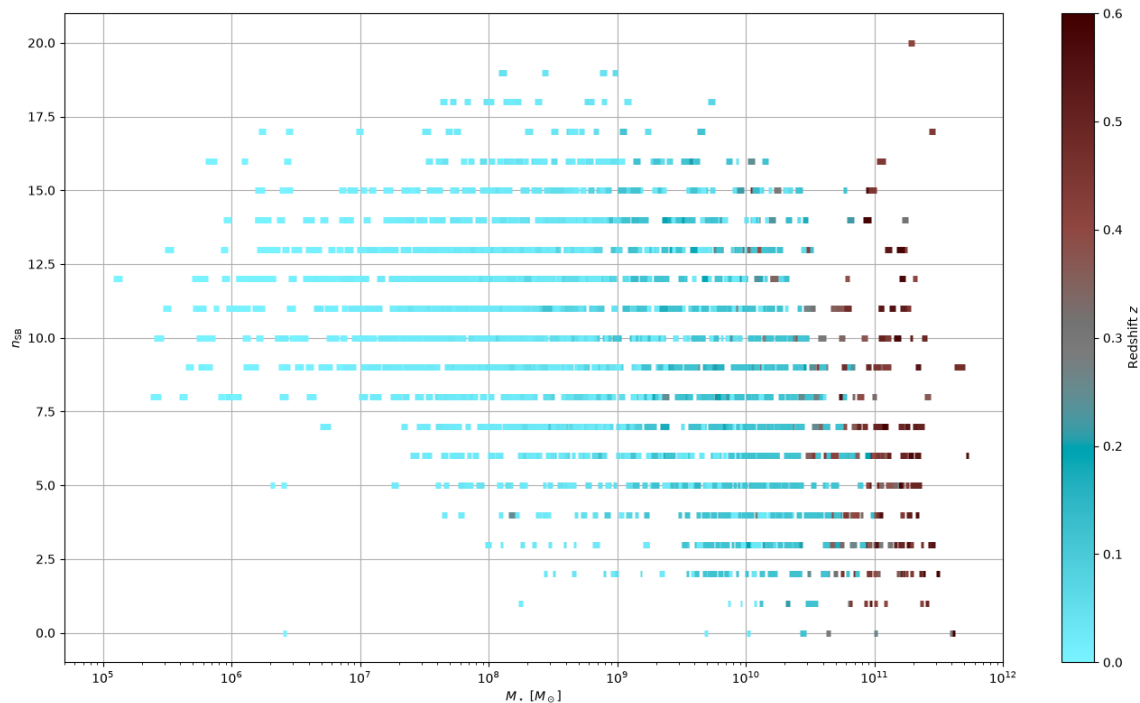
Results

- # Bursts
 - Isolated Galaxies
 - Galaxies in groups of 5
 - Galaxies in groups of 10
 - Galaxies in groups of 15
 - Some Clusters



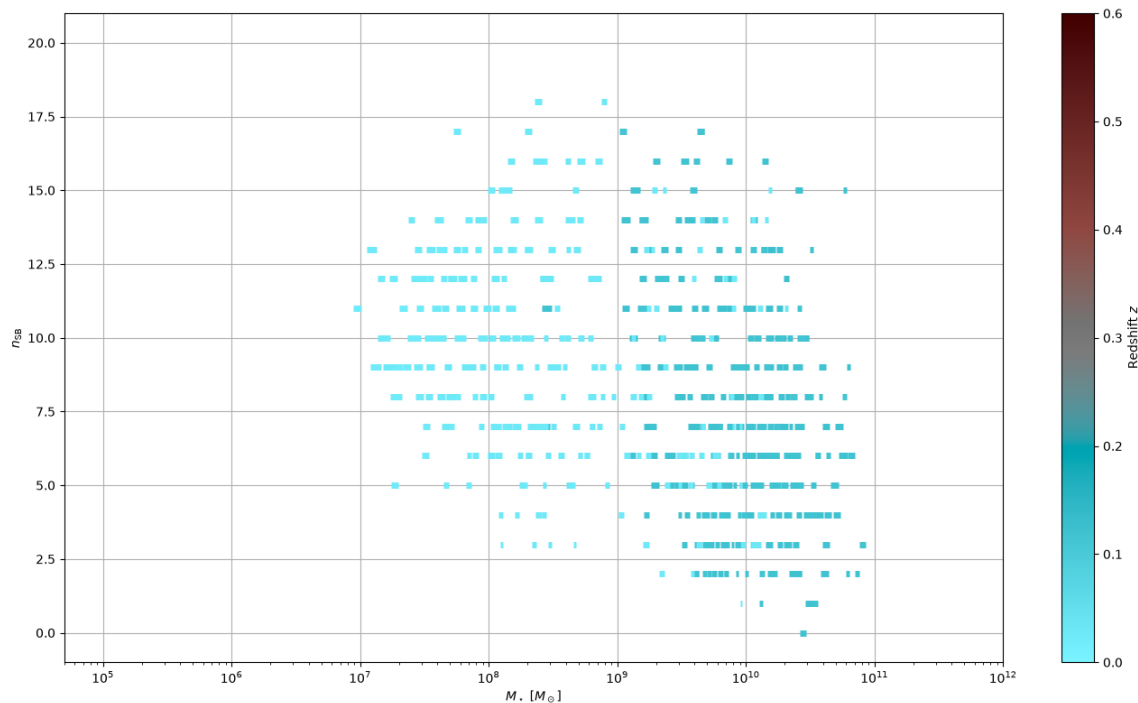
Results

- # Bursts
- Isolated Galaxies
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- Galaxies in groups of 10
- Galaxies in groups of 15
- Some Clusters



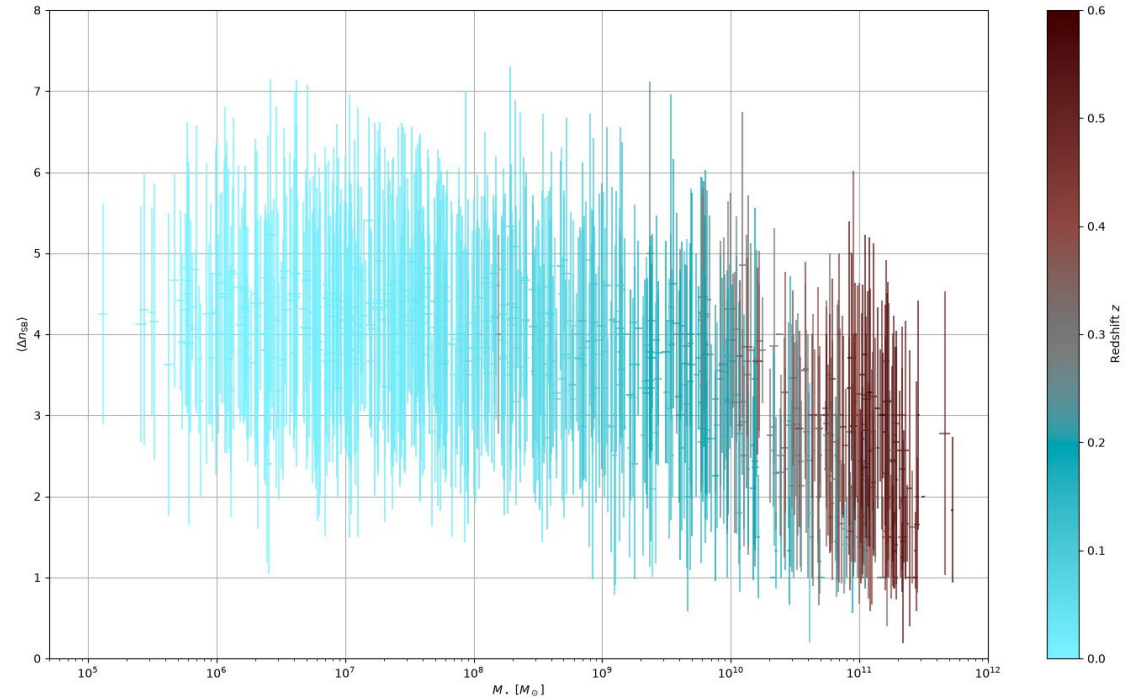
Results

- For one of the clusters, the average number of bursts is $n_{\text{SB}} = 9.0 \pm 3.4$
- For a comparable fraction of the isolated galaxies, it is $n_{\text{SB}} = 9.2 \pm 3.5$



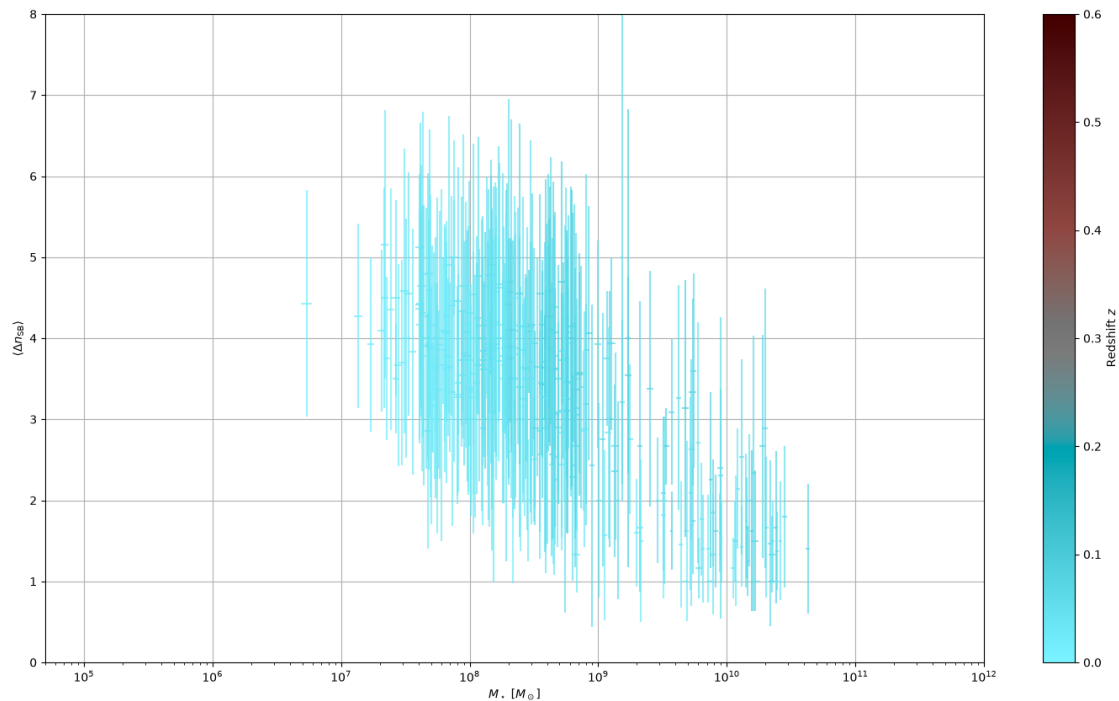
Results

- Δ Bursts
- Isolated Galaxies



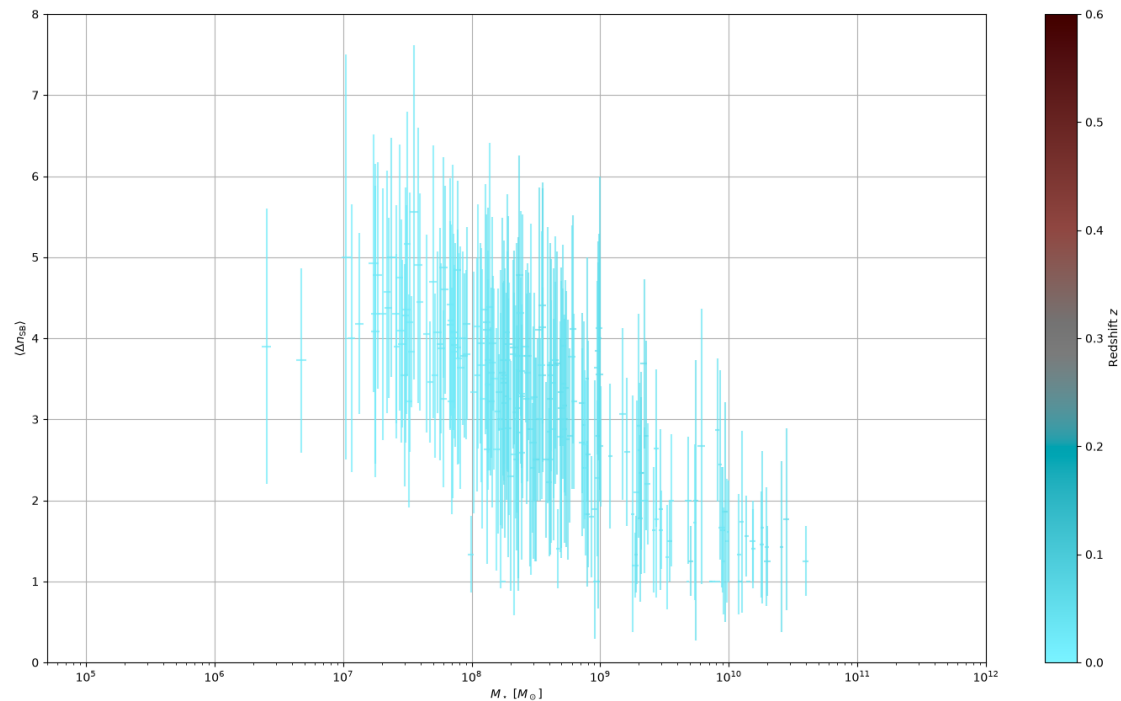
Results

- Δ Bursts
- Isolated Galaxies
- Galaxies in groups of 5



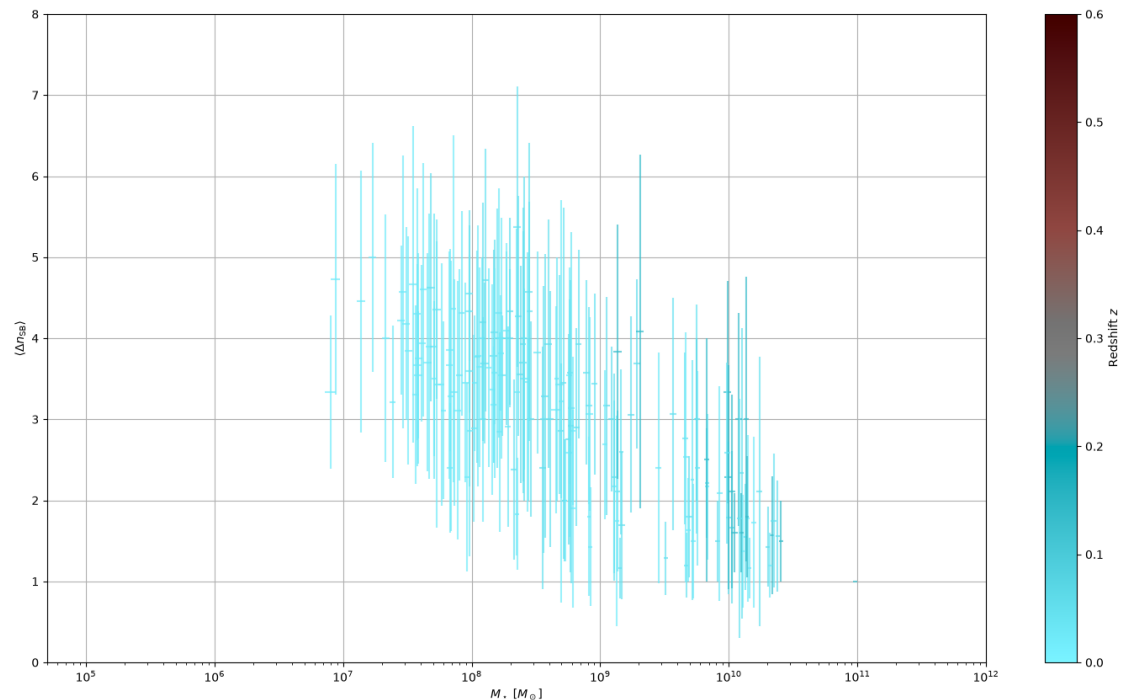
Results

- Δ Bursts
 - Isolated Galaxies
 - Galaxies in groups of 5
 - Galaxies in groups of 10



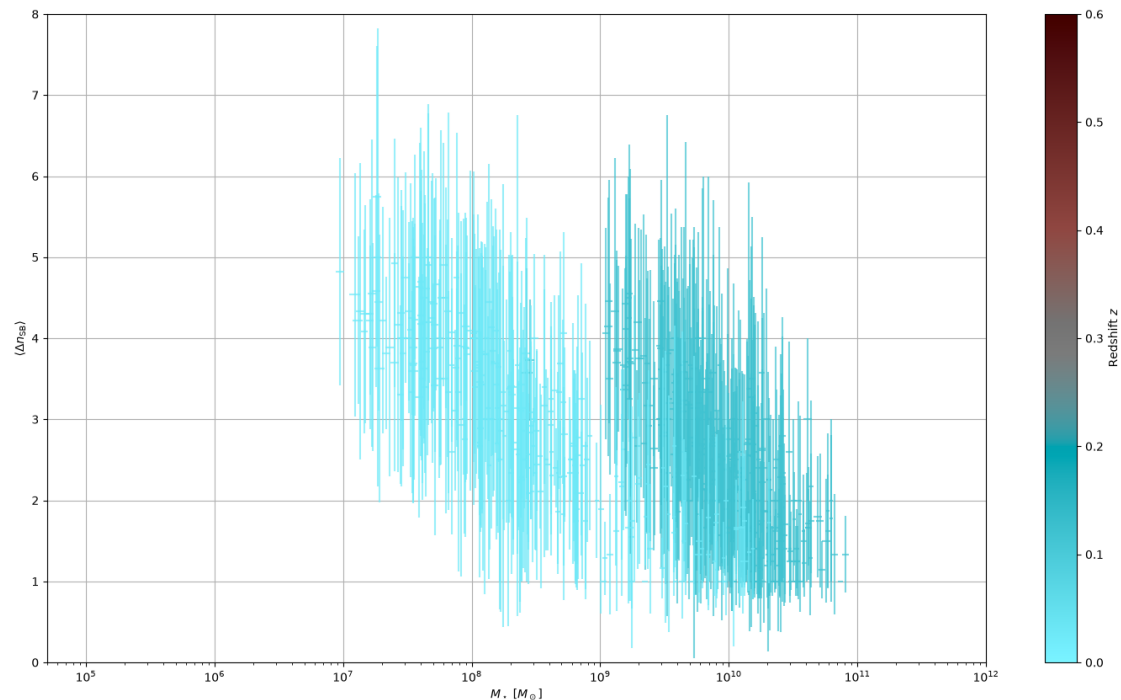
Results

- Δ Bursts
 - Isolated Galaxies
 - Galaxies in groups of 5
 - Galaxies in groups of 10
 - Galaxies in groups of 15



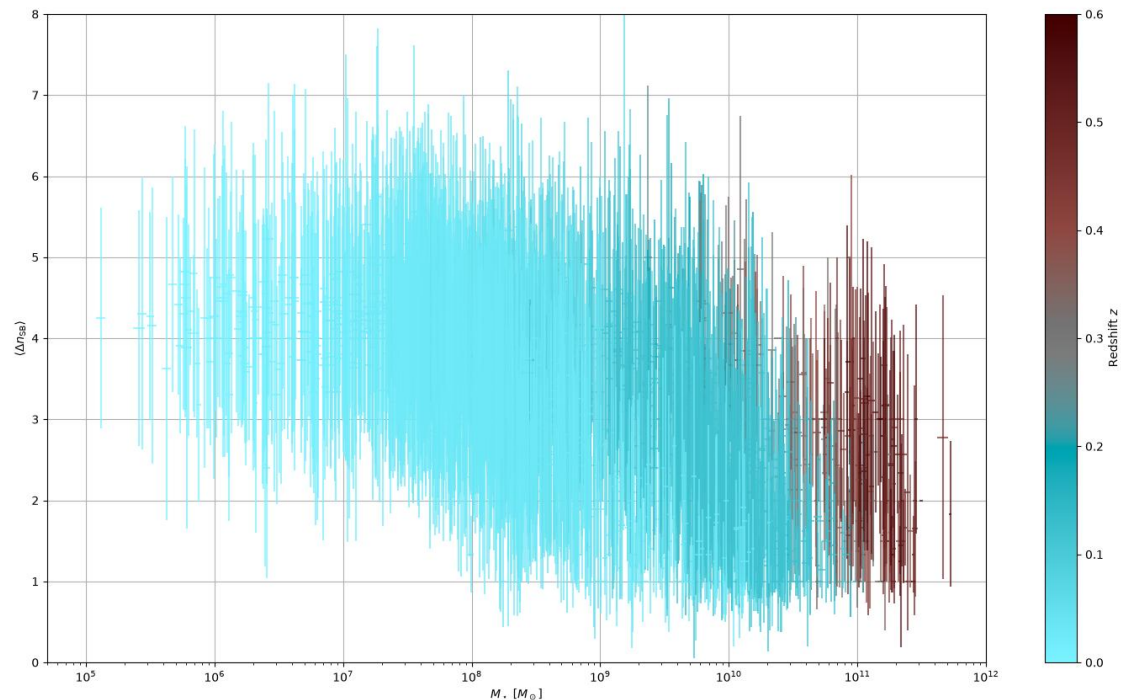
Results

- Δ Bursts
 - Isolated Galaxies
 - Galaxies in groups of 5
 - Galaxies in groups of 10
 - Galaxies in groups of 15
 - Some Clusters



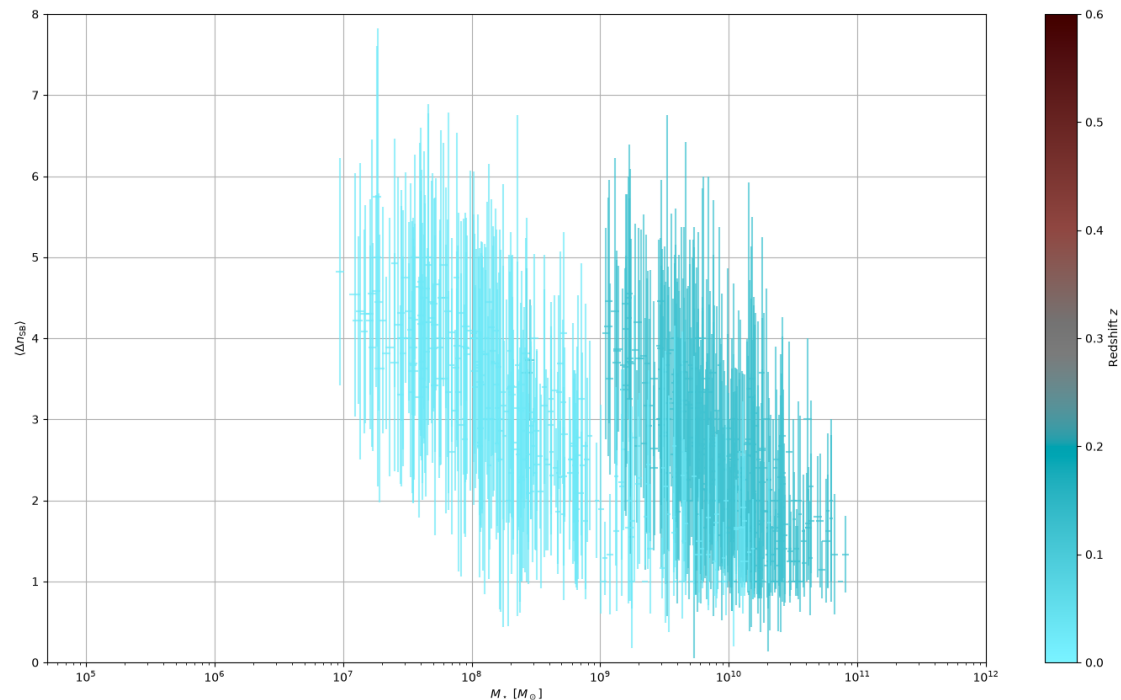
Results

- Δ Bursts
 - Isolated Galaxies
 - Galaxies in groups of 5
 - Galaxies in groups of 10
 - Galaxies in groups of 15
 - Some Clusters



Results

- For the same cluster as before, the average length per burst is $\Delta_{\text{SB}} = 2.8 \pm 1.0$
- For the similar fraction of the isolated galaxies, it is $\Delta_{\text{SB}} = 3.5 \pm 0.9$



Chapter V

Conclusion

Conclusion

Field galaxies $\leftrightarrow$ Group galaxies

- No difference in # of starbursts visible
- Shorter starbursts in group galaxies
 - May be due to galaxy-galaxy interactions quenching starbursts in groups

Dwarf galaxies $\leftrightarrow$ Larger galaxies

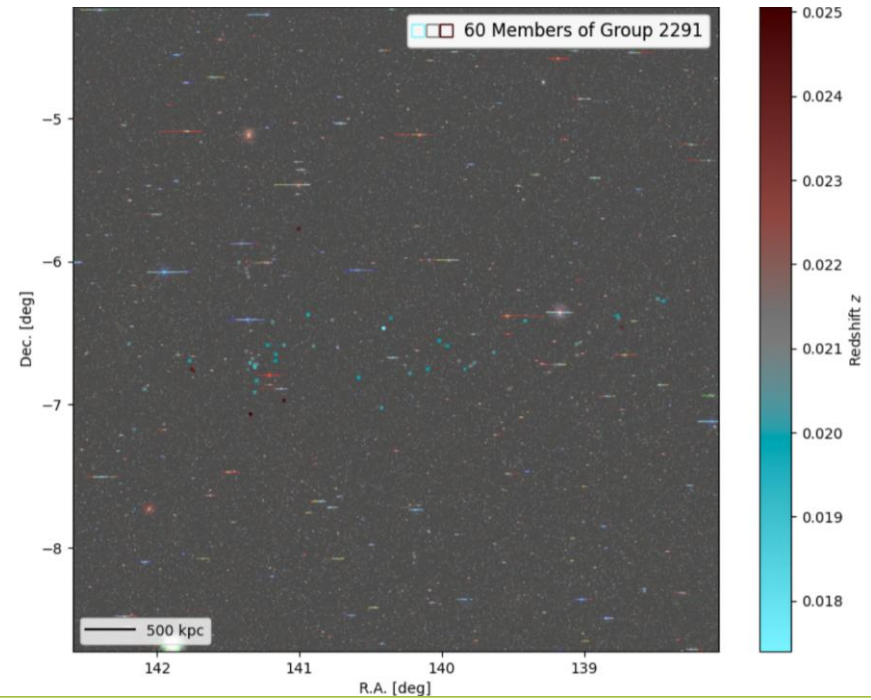
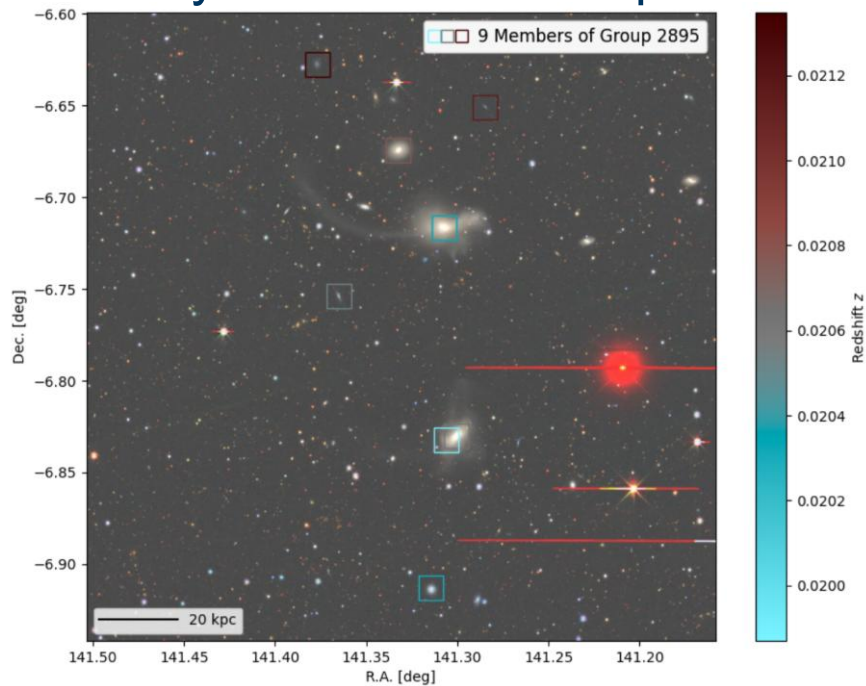
- Across all environments, dwarfs show more sSFR, more starbursts, longer starbursts and lower mass-to-light ratios

Chapter VI

Outlook

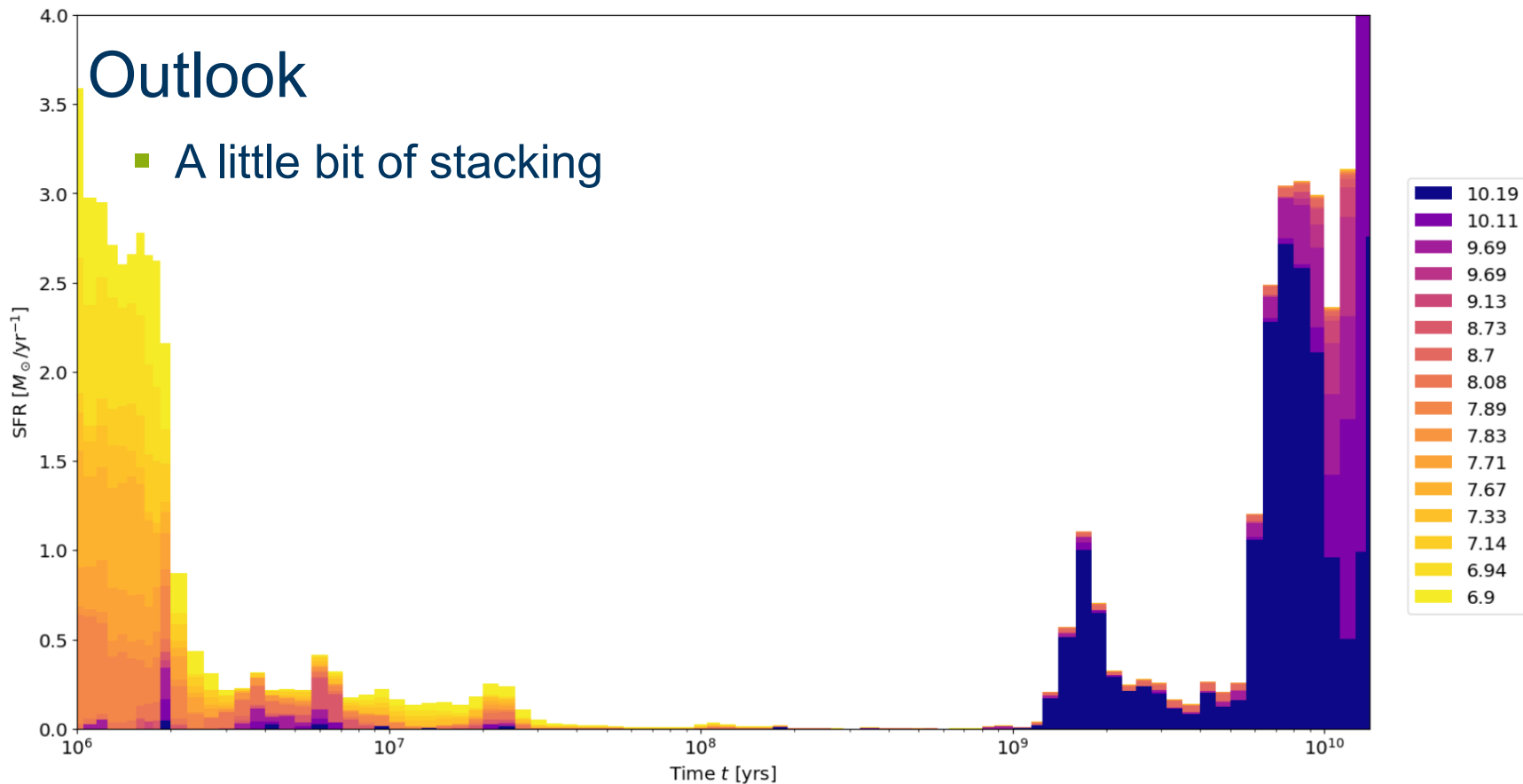
Outlook

■ Analysis of sub- and superstructure



Outlook

■ A little bit of stacking

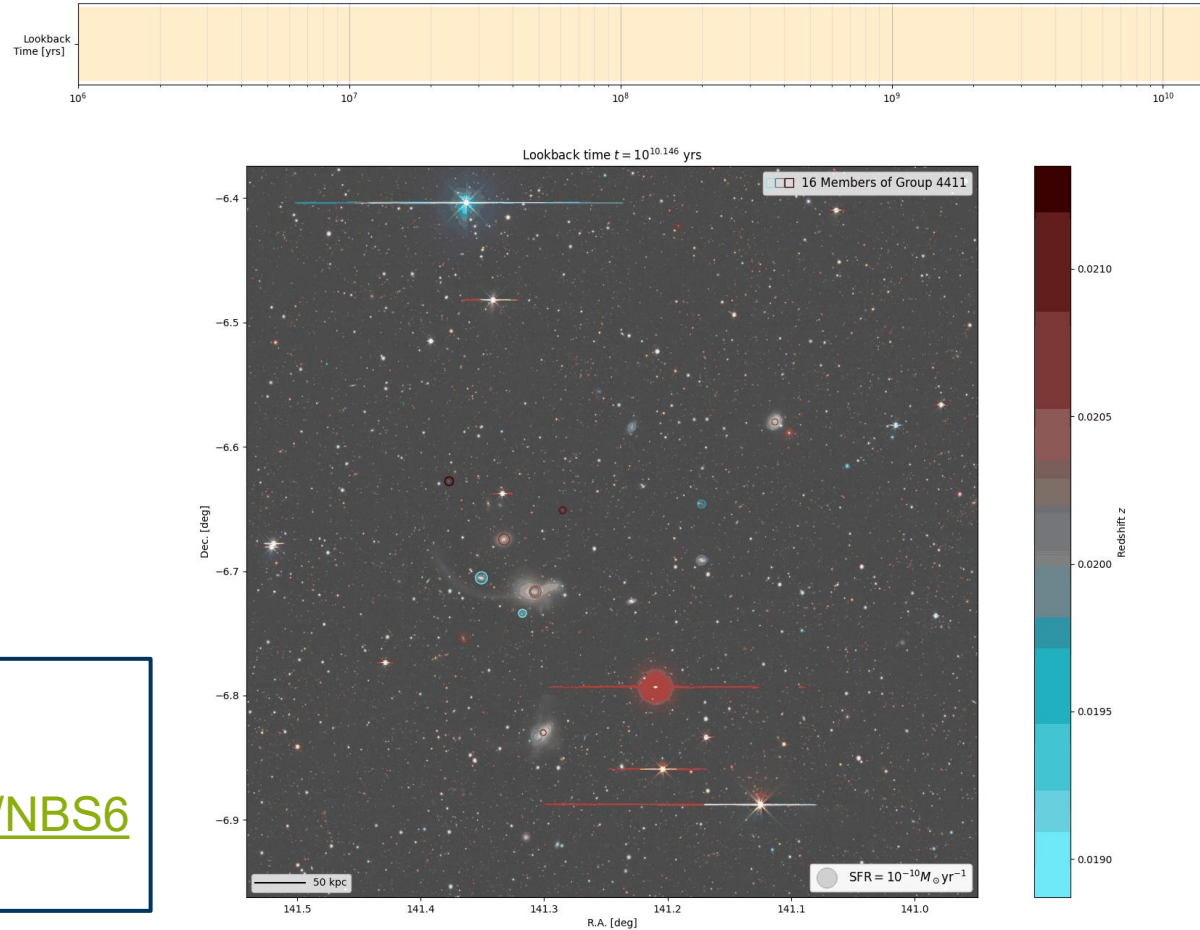


Outlook

■ sSFR(t)

Link to GIF:

<https://ruhr-uni-bochum.sciebo.de/s/NBS693tR7WwKBEH>



Finally...
The End

References

- **Cappellari, M. (2023).** 'Full spectrum fitting with photometry in PPXF: stellar population versus dynamical masses, non-parametric star formation history and metallicity for 3200 LEGA-C galaxies at redshift $z \approx 0.8$ '. In: MNRAS 526.3, pp. 3273–3300.
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References

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- **Hahn, C. et al. (2015).** 'The DESI Bright Galaxy Survey: Final Target Selection, Design, and Validation'. In: AJ 165.6, 253, p. 253.
- **Lambert, T. S. et al. (2026).** 'Messier: A fast, powered, fast, flexible, and generalized friends-of-friends galaxy-group finder in R and Python'. In: Astronomy and Computing 54, 101011, p. 101011.
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