

Stellar Population Analyses

Andrea Gibilaro & Susana Carneiro



Universiteit
Leiden
The Netherlands



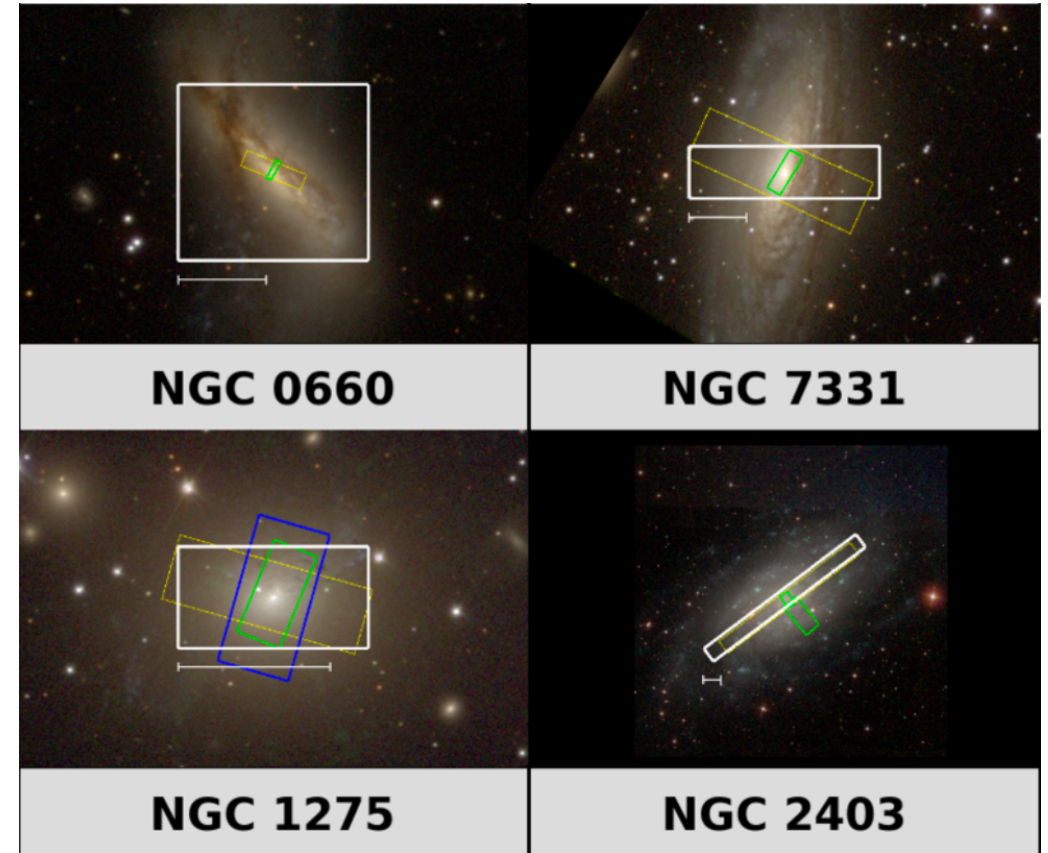
Deriving Physical Properties from Broadband Photometry with Prospector: Description of the Model and a Demonstration of its Accuracy Using 129 Galaxies in the Local Universe

J. Leja , B. D. Johnson , C. Conroy , P. G. van Dokkum , N. Byler



Scientific Question and Methods

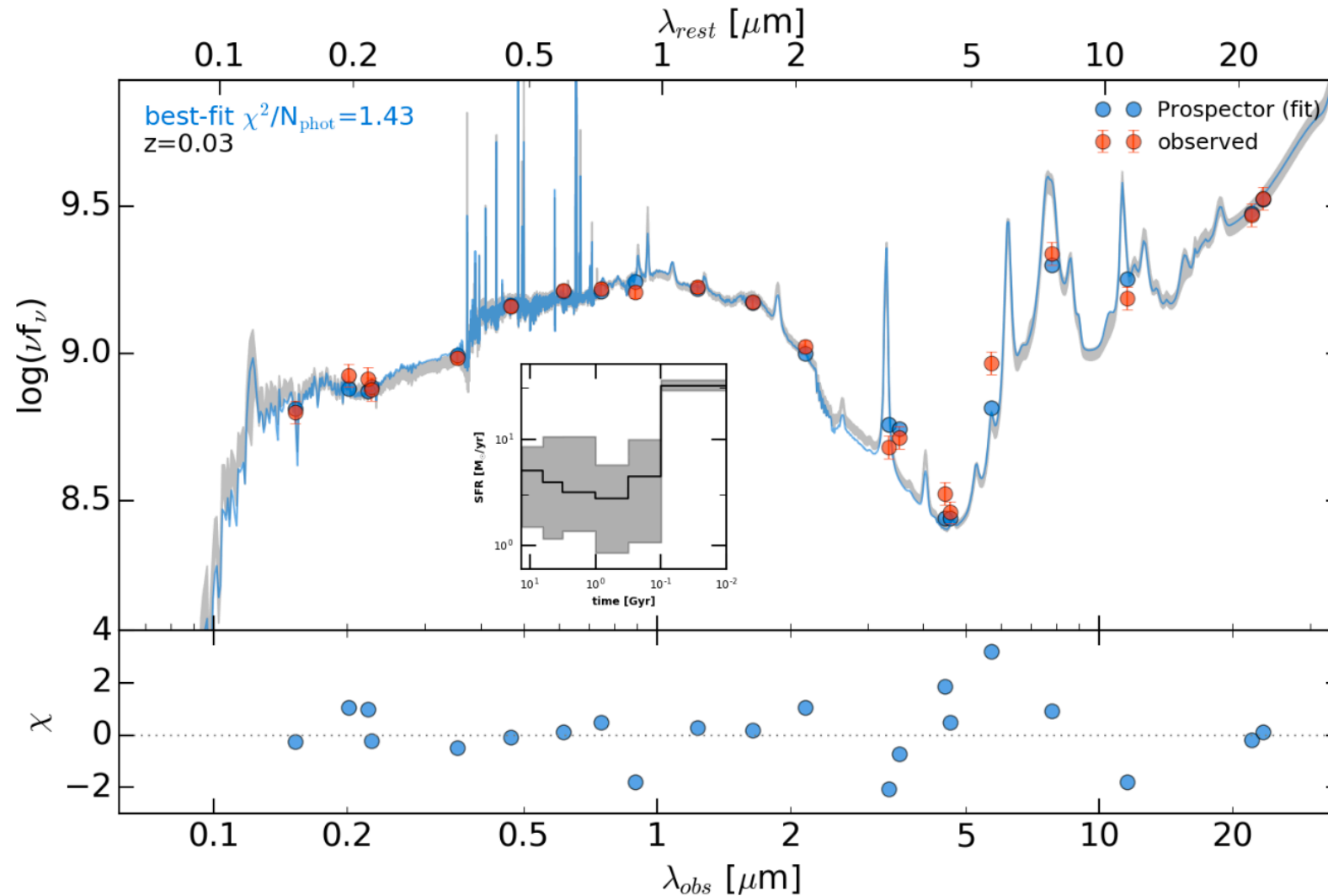
- Test a model fit to broadband photometry with observed spectroscopic features
- 129 galaxies from Brown et al. (2014) atlas
- 26 photometric bands from the far UV to middle IR
- Spectra: ground based telescopes (optical), Spitzer and Akari (IR)



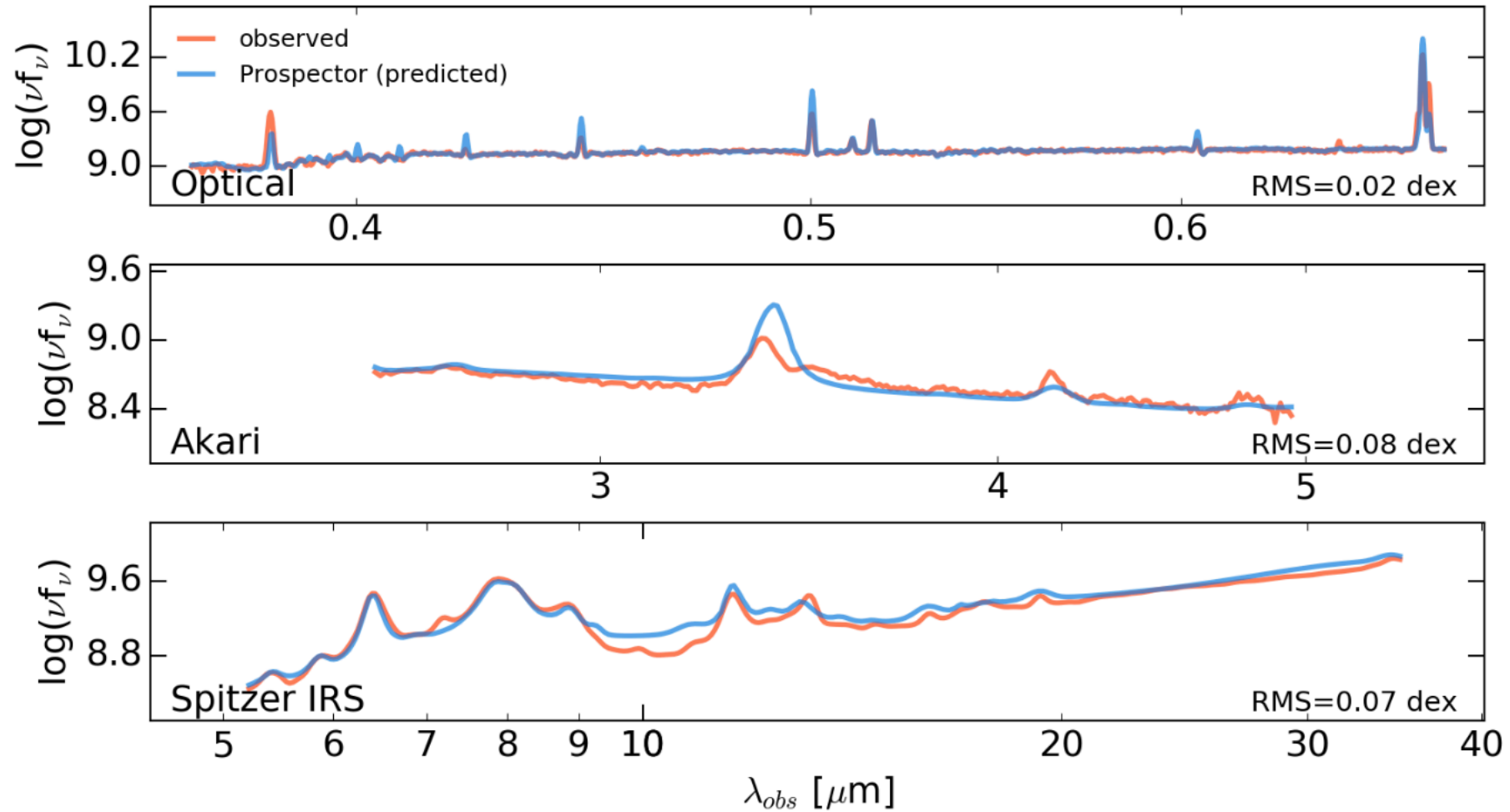
Parameters

1. Stellar mass and Star Formation History
 - Division between Star forming and quiescent galaxies
2. Stellar metallicity
3. Dust attenuation and emission
 - Separate description for birth cloud and diffuse dust screening
 - Silicate-graphic-PAH emission model
4. Nebular emission
 - Fixed ionization parameter

Star-forming galaxy fit



Star-forming galaxy fit

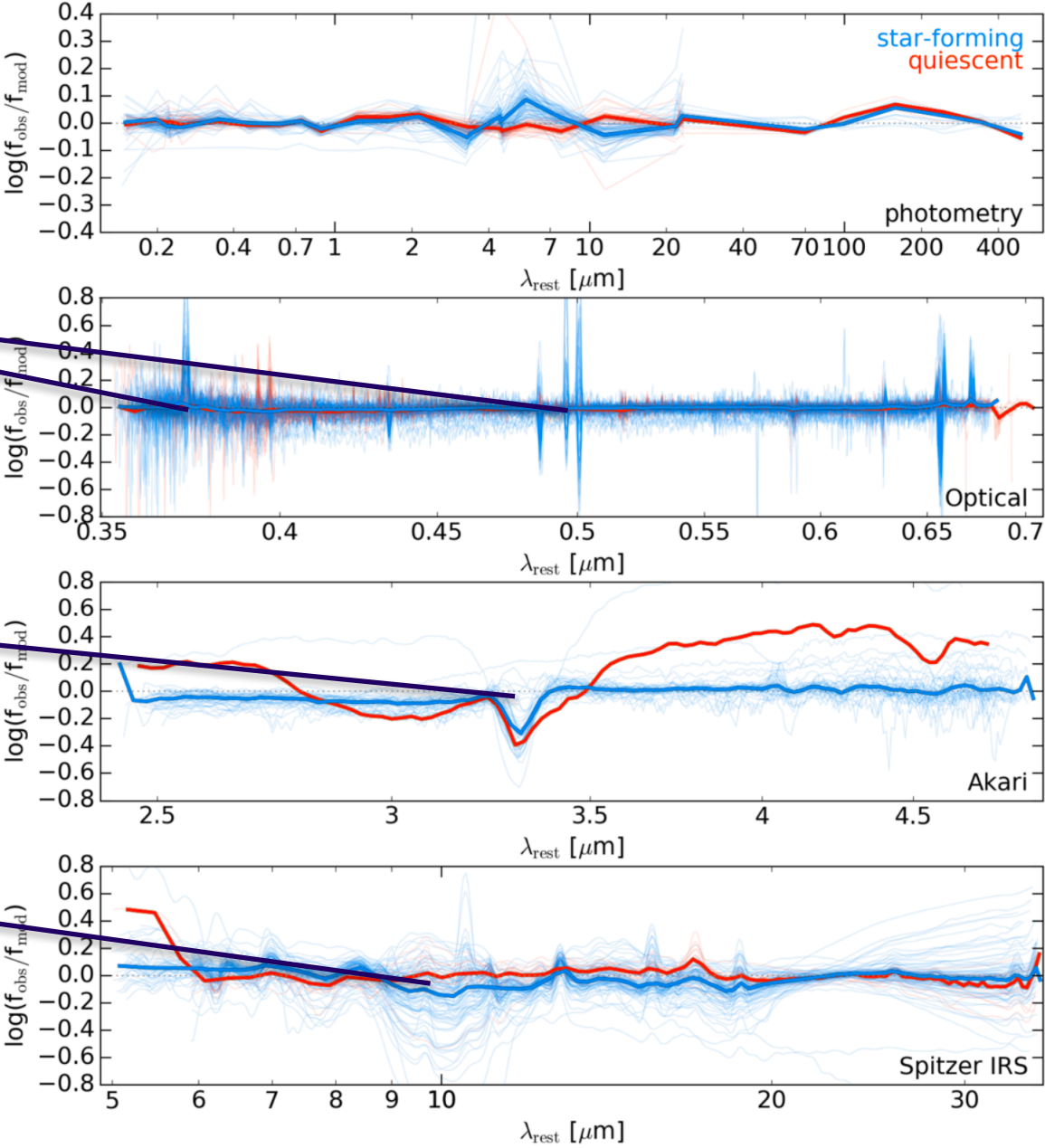


Residuals

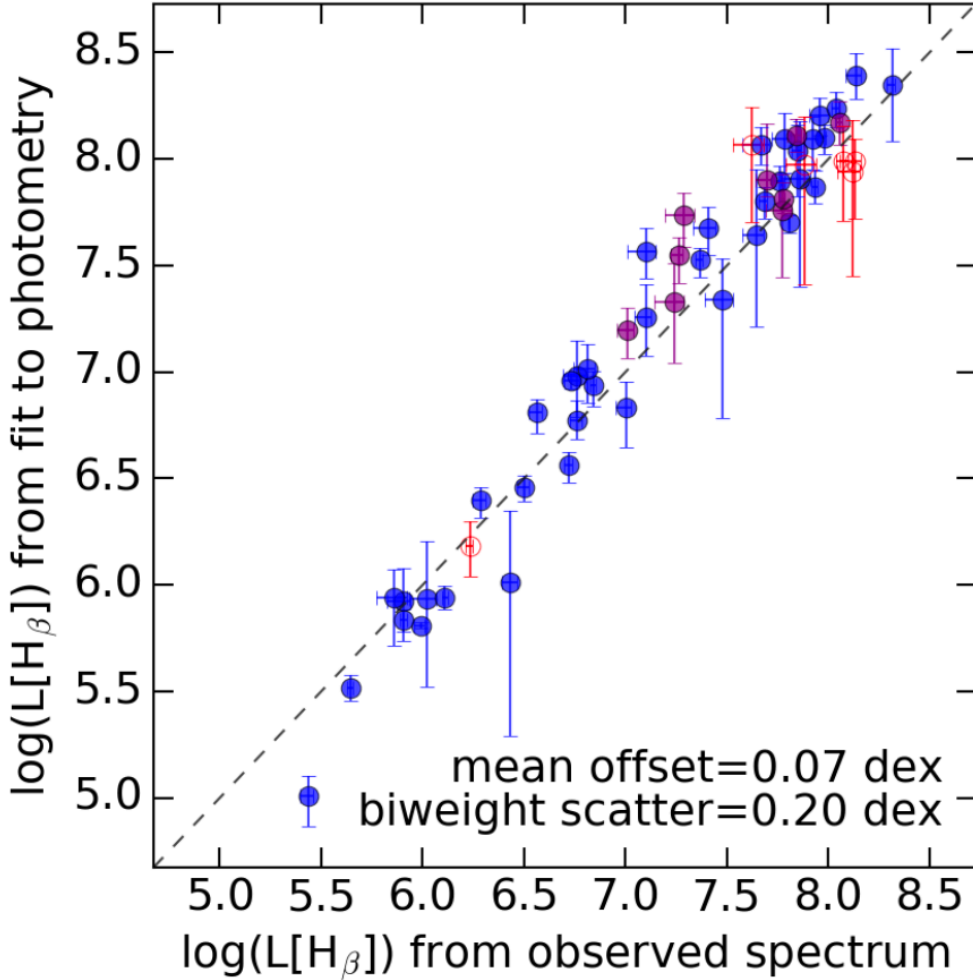
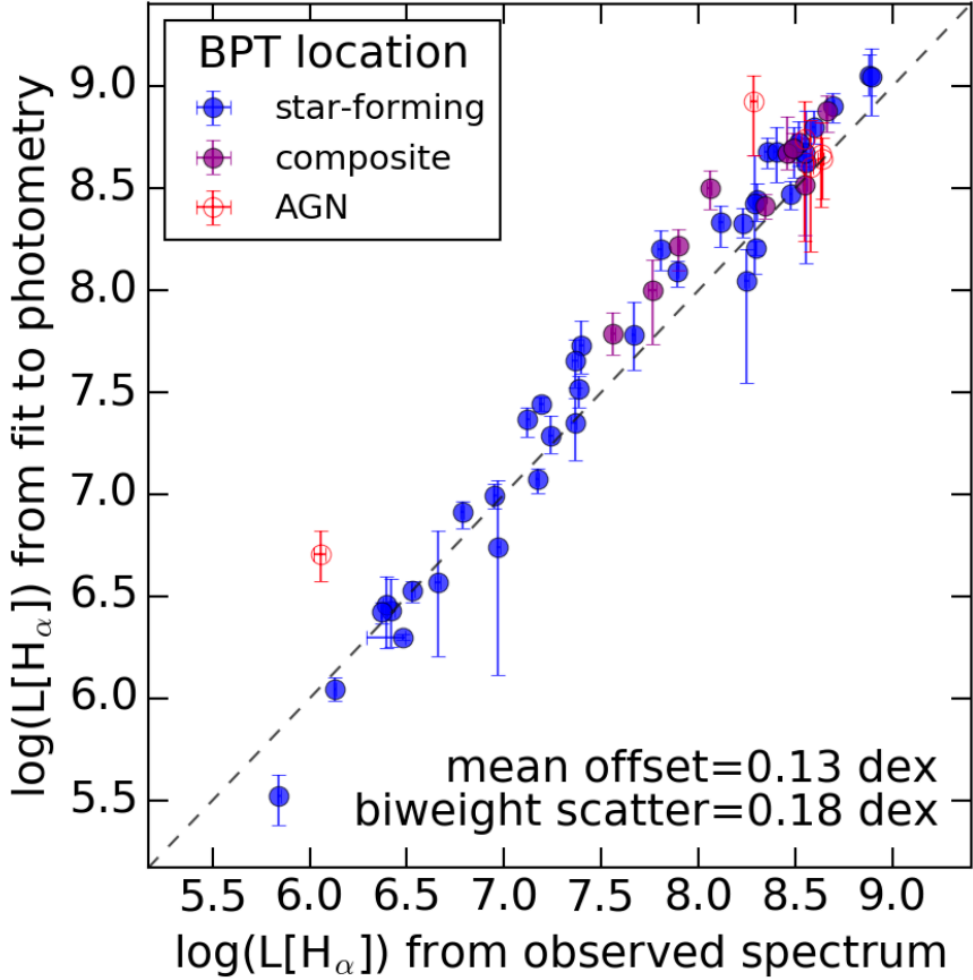
[OII] and [OIII] lines

Overprediction of PAH emission

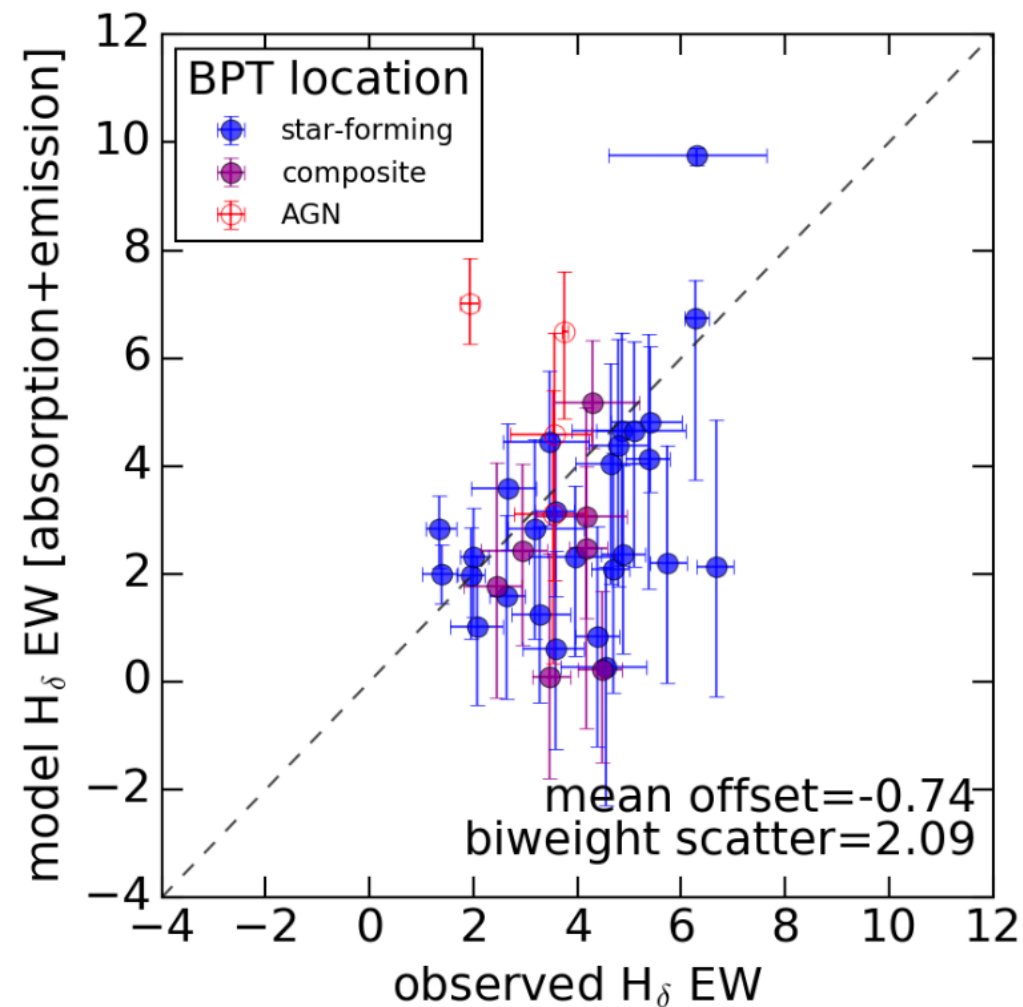
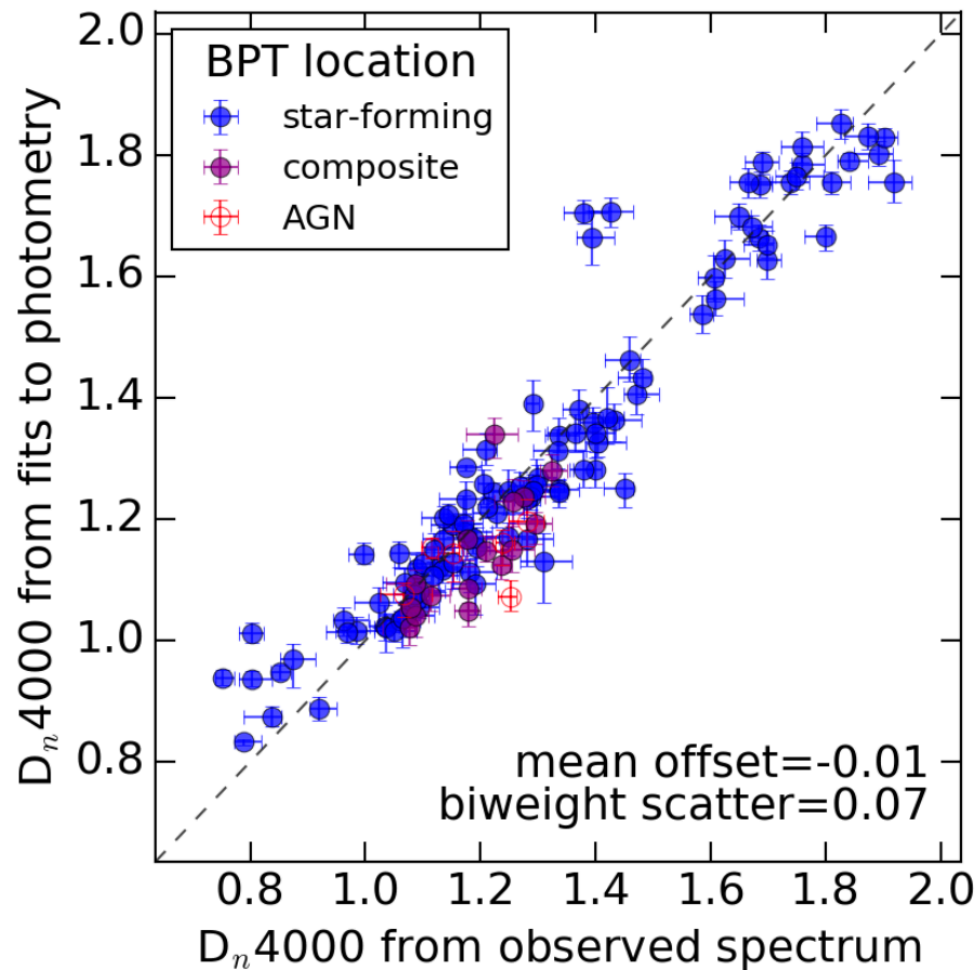
AGN activity in star-forming galaxies



H α and H β predictions



SFH parameters



Conclusion

- Good agreement with SFH parameters
- Robust H α luminosity estimation from broadband photometry
- Well-predicted reddening curve from H α and H β lines
- Only photometric measurements are needed to estimate SFR changes with metallicity, stellar mass and PAH content.

Problematics

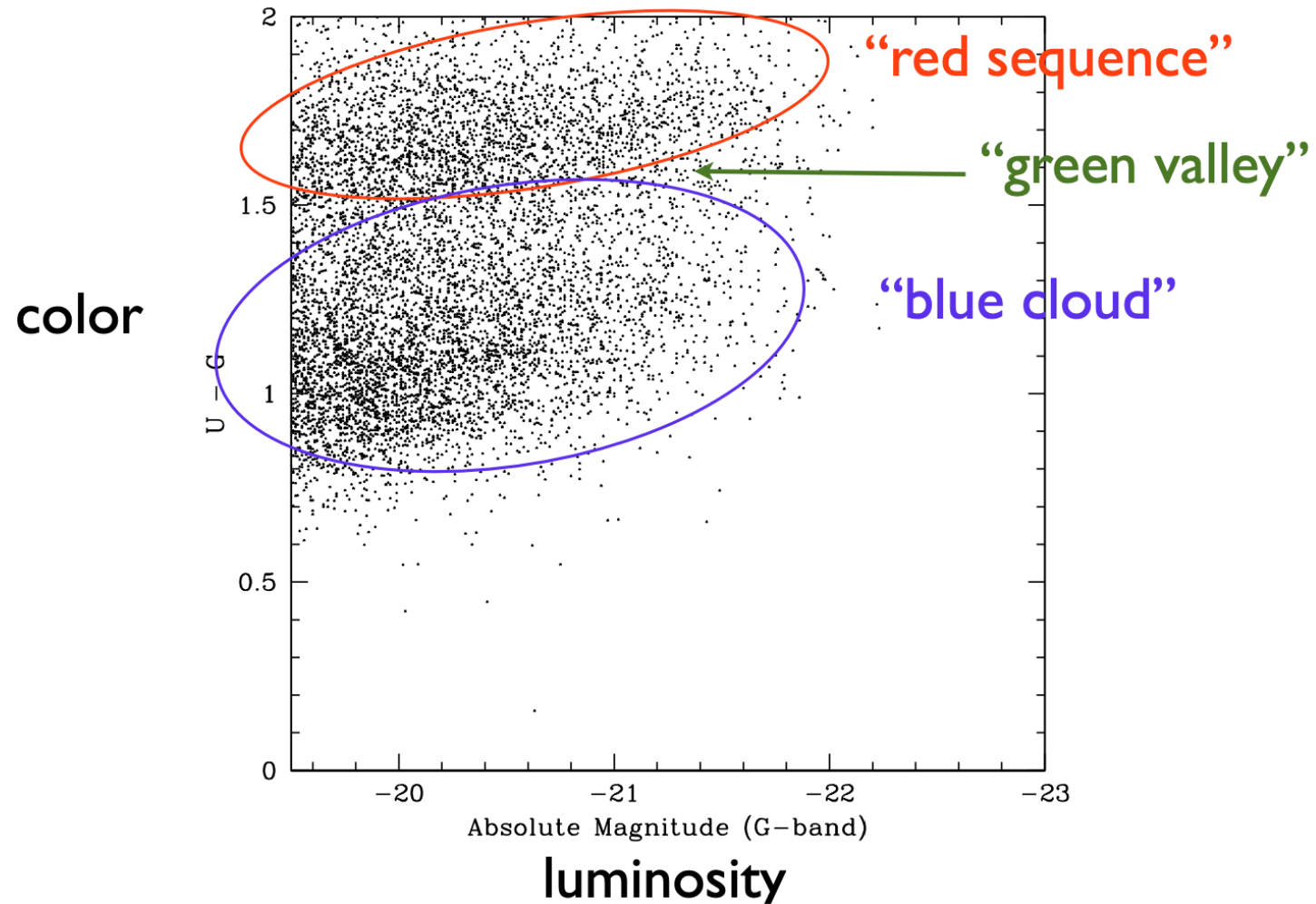
- Degeneracy with complex SFH models
- Not tested at high redshift
- Issues in galaxies hosting strong AGN
- No age-metallicity relation implemented

Inferring the star-formation histories of massive quiescent galaxies with BAGPIPES: Evidence for multiple quenching mechanisms

A. C. Carnall, R. J. McLure, J. S. Dunlop, R. Davé, 2024



Introduction



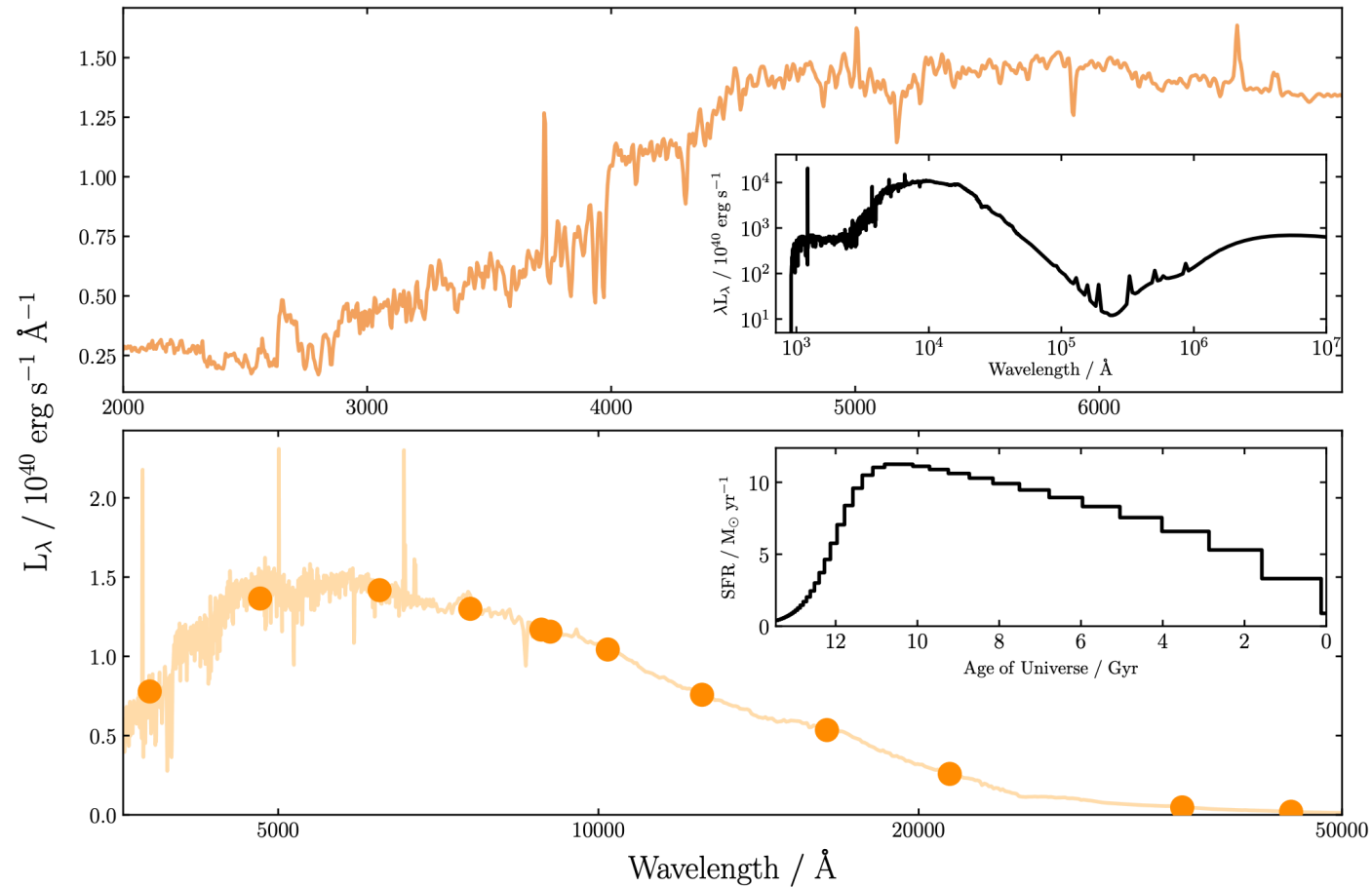
Lecture Slide, R. Bouwens

Scientific Questions

1. When did quenched galaxies form their stellar mass?
2. How long did the process of quenching take?

BAGPIPES

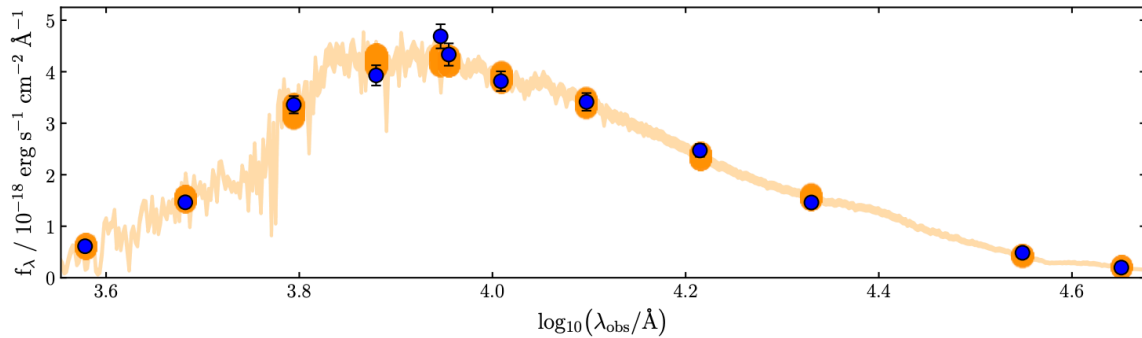
Bayesian Analysis of Galaxies for Physical Inference and Parameter EStimation



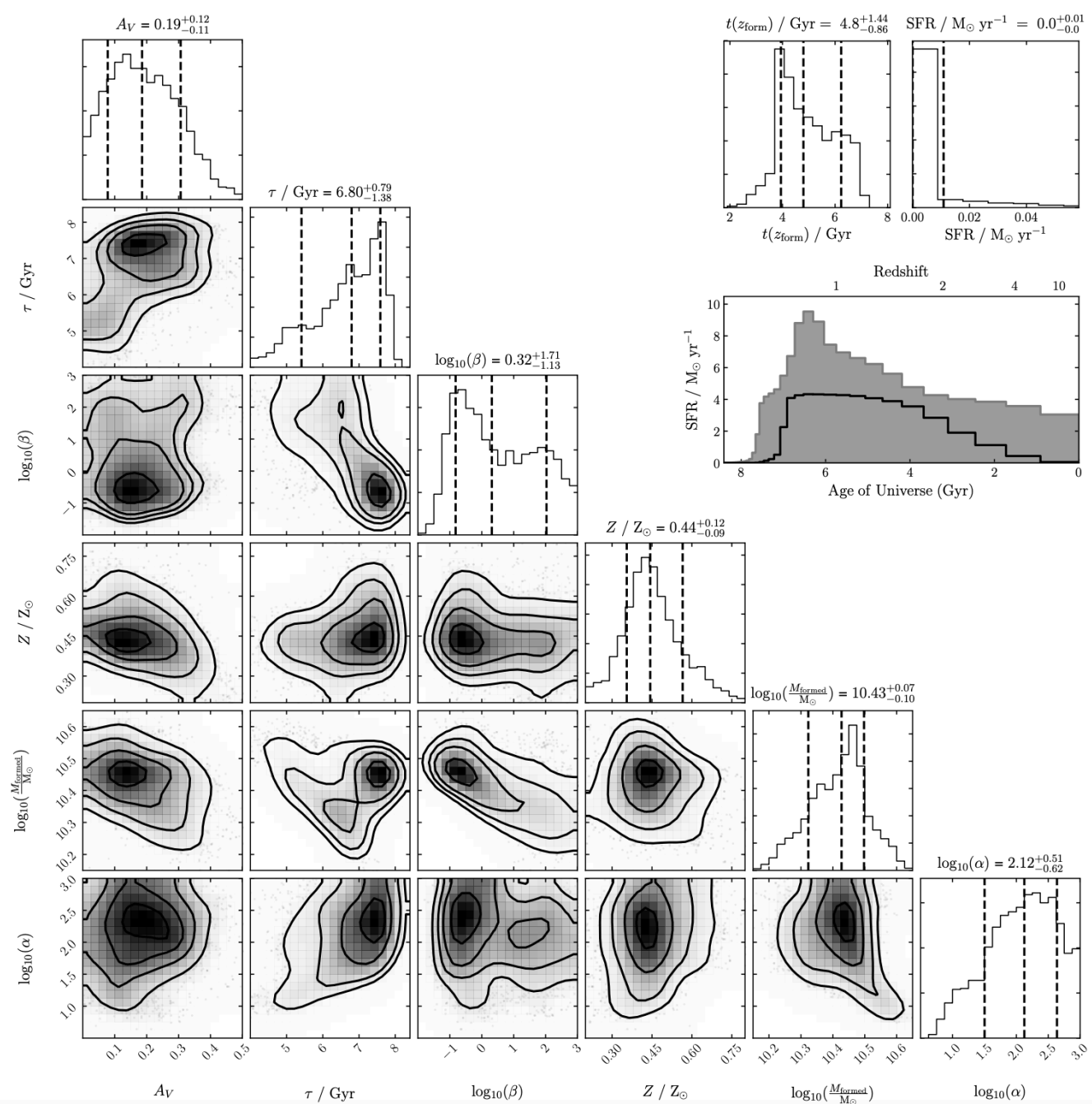
A. C. Carnall+2024

BAGPIPES

Bayesian Analysis of Galaxies for Physical Inference and Parameter Estimation



A. C. Carnall+2024

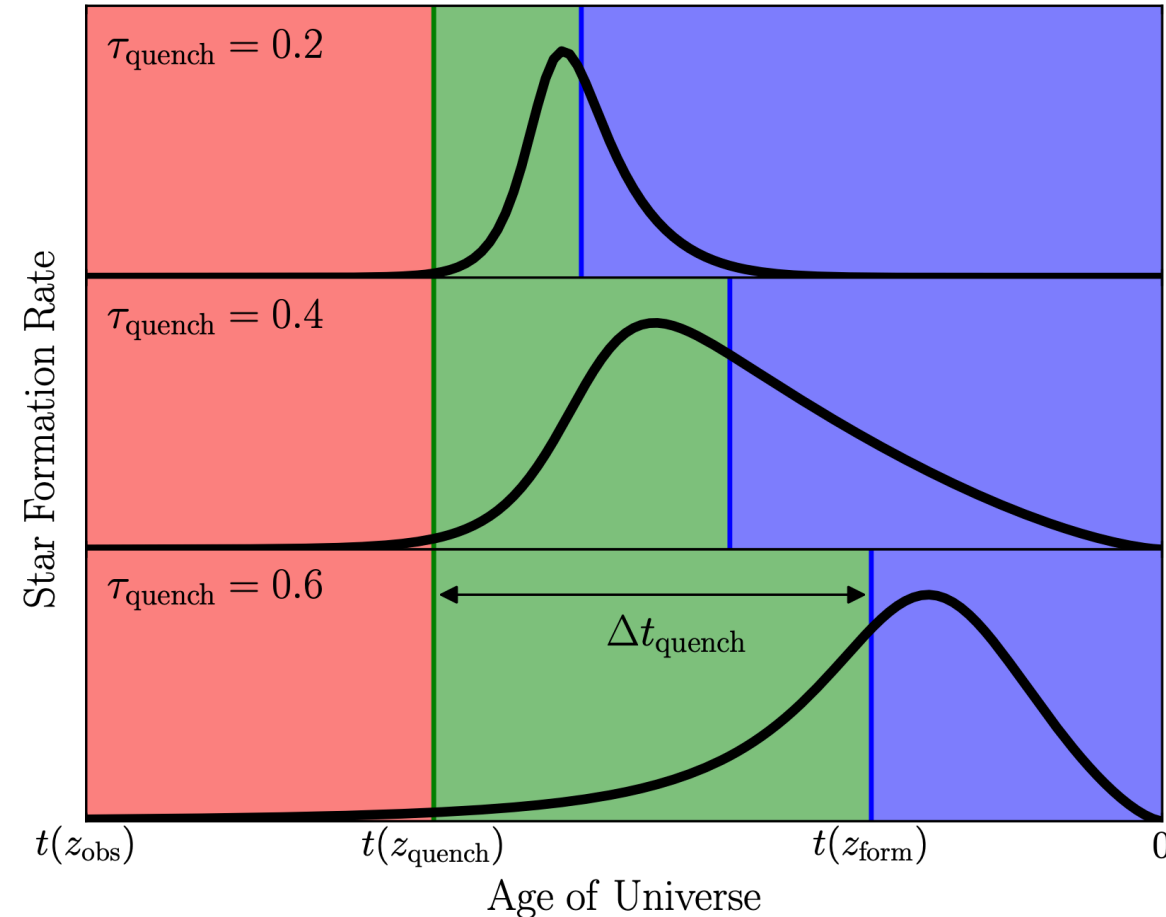


Results and Discussion

A. C. Carnall+2024

Three main types of star formation histories:

- A. Fast growth and very fast quenching, under 1 billion years. Likely caused by powerful black hole activity
- B. Gradual growth, then fast quenching over 1-2 billion years. Likely caused by AGN feedback
- C. Fast growth but very slow quenching, over 3 billion years. Likely due to galaxies running out of gas



Conclusion

- Models + Data → Galaxy Histories
- AGN feedback is the main mechanism driving quenching
- Massive galaxies form and quench earlier
- Quenching timescales depend on redshift (fast at high z , slow at low z)