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Measuring Unbiased Star Formation Histories: Correcting Model Imposed Priors

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ABSTRACT

Models for galaxy star formation histories (SFHs), both parametric and non-parametric, impose strong priors on the physical properties of galaxies. These priors significantly bias galaxy stellar mass, star formation rate, and metalicities inferred from fitting galaxy spectral energy distributions (SED) and therefore impact all of the main summary statistics used to investigate galaxy populations (*e.g.* stellar mass function, star formation rate-density, star-forming sequence). In this work, we present a method that can correct for these biases by imposing uniform, or uninformative, priors, on the physical properties. The method imposes a maximum-entropy transformation on the probability distributions of the SED model parameters to force the physical properties into any specified distribution. We demonstrate, using simulated galaxy spectra constructed from the IllustrisTNG hydrodynamical simulation, that with this method we can accurately recover the input SFHs with SED modeling. Lastly, we use the method to infer the SFHs of galaxies in a low-redshift, volume-complete sample from the Galaxy and Mass Assembly (GAMA) Survey. The cosmic star formation rate-density we derive from the inferred SFHs are in good agreement with direct observations.

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APPENDIX

REFERENCES

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