MNRAS **000**, 1–2 (2020) Preprint 11 March 2020 Compiled using MNRAS LaTeX style file v3.0

Spectral resolution is not important for modeling galaxy growth

Louis E. Abramson[1]★ and Daniel D. Kelson[1]

[1] *Carnegie Observatories, 813 Santa Barbara Street, Pasadena, CA 91101, USA*

Accepted XXX. Received YYY; in original form ZZZ

ABSTRACT

Key words: galaxies: surveys — galaxies: spectroscopy — spectroscopy: techniques

1 INTRODUCTION

A central ambition of the study of galaxy evolution is understanding stellar mass growth; i.e., galaxy star formation histories (SFHs). Spectral energy distributions (SEDs) are the key data in this work because they can be decomposed into combinations of distinct stellar populations of known ages. The resulting coefficients yield the amount of stellar mass a galaxy is inferred to have formed at the lookback time corresponding to each population's age.

Stellar populations have different but not orthogonal SEDs. As such, the above decompositions are usually degenerate. Such degeneracies are compounded by age-independent effects like metallicity and dust reddening.

To alleviate those degeneracies, high resolution spectra ($R \sim 1000$s) are often used in addition to galaxy broadband colors in the model fitting. The hope is that the details of absorption lines will potentially increase the contrast between stellar subpopulations, constrain metallicity, and so yield more accurate age/mass coefficients. The utility of these data is usually taken as axiomatic, but it is also readily testable.

This paper presents an experiment that shows there is very little information in high resolution spectra that enhance constraints on galaxy SFHs compared to inferences based on a combination of photometry and very low resolution ($R \lesssim 100$s) prism spectra.[1] We perform this experiment by using precomputed SFH inferences based on low resolution SEDs for a set of **XXX** systems at $\langle z \rangle =$ **ZZZ** to produce predictions of each galaxy's high-resolution spectrum, and comparing these predictions to actual high resolution observations taken post-facto. With the exception of the Balmer lines—whose divergence from predictions is readily ascribable to emission line infilling—we find differences to be of order **whatever they are**, suggesting **whatever we say they do**.

Below, Section 2 describes the data on which our experiment is based, Section 3 shows the comparisons between our high resolution spectral predictions and the high resolution data, and Section 4 describes the implications of these results. We use AB magnitudes and assume a Chabrier (2003) stellar initial mass function (IMF) with $(H_0, \Omega_M, \Omega_\Lambda) = (70\ \mathrm{km\ s^{-1}\ Mpc^{-1}}, 0.3, 0.7)$ throughout.

2 DATA

2.1 Master sample

This experiment is based on the *Carnegie Spitzer IMACS Survey* (CSI; Kelson et al. 2014). CSI provides Magellan-IMACS Low- and Uniform-Dispersion Prism spectroscopy for objects with *Spitzer* [3.5] $\leq$ 21 in **XXX sq. deg.** from **THESE FIELDS**. Combined with supplemental $ugrizJK_s$ photometry from the NEWFIRM archive (**CITE**) and Canada-France-Hawai‘i Telescope Legacy Survey (CFHTLS; **CITE**), these data were used to derive flexible SFHs for each galaxy as part of the redshift estimation process. The sample is complete to $\log M_* \sim 10.3$ at $z \sim 0.7$. The spectral resolution of the prisms varies from $R \sim$ **XXX** to $R \sim$ **YYY** at **wavelengths**, about **THIS MUCH WORSE** than the Sloan Digital Sky Survey (York et al. 2000).

Dressler et al. (2016, 2018) examine the CSI SFHs in detail. Dressler et al. (2018) provides a thorough treatment of SFH inference quality in its Appendix as assessed via simulations and comparisons of objects with repeat observations. We defer the reader to those texts for that information, but briefly review the SFH inference process here. *None of these details are important in the context of the experiment we detail below*, which should be repeated using other approaches.

2.2 High-resolution spectroscopy

3 COMPARING PREDICTIONS TO HIGH RESOLUTION DATA

4 DISCUSSION

5 SUMMARY

Foo.

Facilities: Magellan/IMACS

★ E-mail: labramson@carnegiescience.edu

[1] A future paper will extend this statement to photometry based inferences alone.

Software: IDL (Coyote libraries; `http://www.idlcoyote.com/`), python (`CarPy`).

ACKNOWLEDGEMENTS

REFERENCES

Chabrier G., 2003, PASP, 115, 763
Dressler A., et al., 2016, ApJ, 833, 251
Dressler A., Kelson D. D., Abramson L. E., 2018, ApJ, 869, 152
Kelson D. D., et al., 2014, ApJ, 783, 110
York D. G., et al., 2000, AJ, 120, 1579

This paper has been typeset from a TEX/LATEX file prepared by the author.