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By

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# Abstract

Fuck you I'm smart

# Acknowledgments

Thanks to my parents, who let me drag the old telescope out ot the driveway, and then didn't laugh at me when I decided I wanted to take pictures of the sky for a living; to Joe and Grandma Sue, who demand a one-sentence answer but get a ten-minute diatribe; to Brianna, whose unwavering support has made the last 2 years much more fun that would have been otherwise possible.

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Galaxies are cool i guess

# Chapter 1

# Resolved and Integrated Stellar Masses in the SDSS-IV/MaNGA Survey, Paper I: PCA spectral fitting & stellar mass-to-light ratio estimates

*A version of this chapter has previously appeared in the* Astrophysical Journal

Pace, et al. 2019, ApJ, 883, 82

and is notated P19a throughout this dissertation

## Abstract

We present a method of fitting optical spectra of galaxies using a basis set of six vectors obtained from principal component analysis (PCA) of a library of synthetic spectra of 40000 star formation histories (SFHs). Using this library, we provide estimates of resolved effective stellar mass-to-light ratio ($\Upsilon^*$) for thousands of galaxies from the SDSS-IV/MaNGA integral-field spectroscopic survey. Using a testing framework built on additional synthetic SFHs, we show that the estimates of $\log \Upsilon^*_i$ are reliable (as are their uncertainties) at a variety of signal-to-noise ratios, stellar metallicities, and dust attenuation conditions. Finally, we describe the future release of the resolved stellar mass-to-light ratios as a SDSS-IV/MaNGA Value-Added Catalog (VAC) and provide a link to the software used to conduct this analysis[1]


[1]The software can be found at `https://github.com/zpace/pcay`.

# Chapter 2

# Resolved and Integrated Stellar Masses in the SDSS-IV/MaNGA Survey, Paper II: Applications of PCA-based stellar mass estimates

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## Abstract

A galaxy's stellar mass is one of its most fundamental properties, but it remains challenging to measure reliably. With the advent of very large optical spectroscopic surveys, efficient methods that can make use of low signal-to-noise spectra are needed. With this in mind, we created a new software package for estimating effective stellar mass-to-light ratios $\Upsilon^*$ that uses principal component analysis (PCA) basis set to optimize the comparison between observed spectra and a large library of stellar population synthesis models. In Pace et al. (2019a), we showed that a with a set of six PCA basis vectors we could faithfully represent most optical spectra from the Mapping Nearby Galaxies at APO (MaNGA) survey; and we tested the accuracy of our M/L estimates using synthetic spectra. Here, we explore sources of systematic error in our mass measurements by comparing our new measurements to data from the literature. We compare our stellar mass surface density estimates to kinematics-derived dynamical mass surface density measurements from the DiskMass Survey and find some tension between the two which could be resolved if the disk scale-heights used in the kinematic analysis were overestimated by a factor of $\sim 1.5$. We formulate an aperture-corrected stellar mass catalog for the MaNGA survey, and compare to previous stellar mass estimates based on multi-band optical photometry, finding typical discrepancies of 0.1 dex. Using the spatially resolved MaNGA data, we evaluate the impact of estimating total stellar masses from spatially unresolved spectra, and we explore how the biases that result from unresolved spectra depend upon the galaxys dust extinction and star formation rate. Finally, we describe a SDSS Value-Added Catalog which will include both spatially resolved and total (aperture-corrected) stellar masses for MaNGA galaxies.

# Chapter 3

# Paper 3 Long Title

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and is notated P20 throughout this dissertation

## Abstract