Mathematical Image Analysis on Galaxies

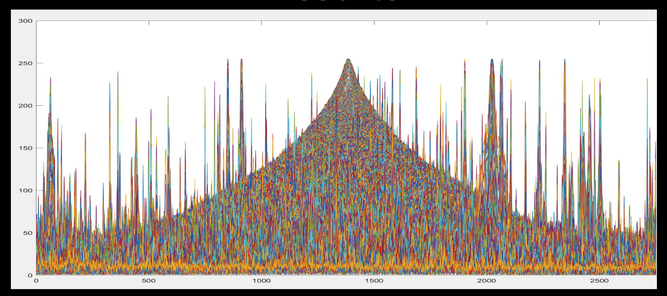
Kohl James, Victoria Morado, Andy Ponce; Advisors: Dr. JungHa An, Dr. Brian Morsony

California State University Stanislaus, Dept. of Mathematics, 1 University Cir., Turlock, CA 95380

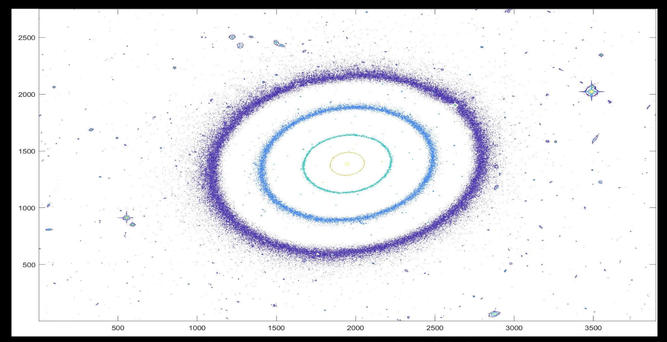
Introduction

- We aim to establish a relationship between intensity and distance within images of galaxies
- This is useful in developing rotation plots which can measure many useful quantities.

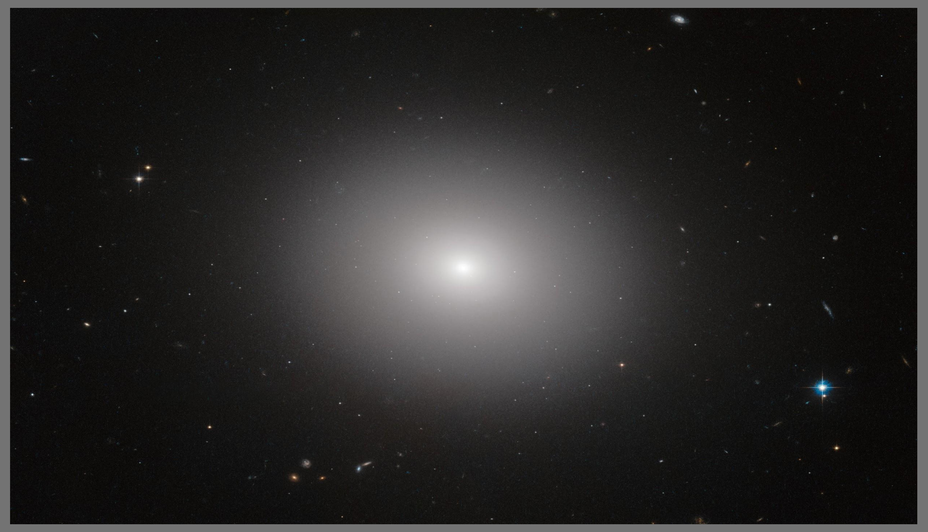
Results



Plot of Intensities in IC-2006



Contour Map of IC-2006



Methods

The materials used to date include:

- MATLAB: Numerical-analysis-oriented programming language
- NASA's Image Catalog: to obtain suitable images of roughly elliptical galaxies

We use MATLAB to generate a histogram of intensities along the x-axis of our image. This is evidence that the center of the galaxy is quantitatively brighter than the rest of the galaxy. We then generate a contour map of the image's intensity to verify that the center is the brightest.

Next, we develop a linear map to be able to relate distance between any two points in the galaxy. Finally, we experimentally determine the center of the galaxy and use our linear map to find these distances.

Conclusions

- The center of the galaxy can be quantitatively shown as the brightest point of IC2006
- The center of IC2006 (in this image) is the point (1363,1947).
- The distance between an object within IC2006 and IC2006's center can be found through linear mapping.
- Our methods have been applied to another galaxy, NGC3610 and IC1101 [images omitted], and its center was found to be at (645,632) and (246,288) respectively.

Future Direction

We hope to develop a Fourier series to model the intensity of the image. We then aim to use this series to implement a noise-reduction process that can be applied, generally, to other images.

We also wish to solve the inverse problem. That is, we want to generate a solution region of all points with a given intensity. We are currently experimenting with a circle, ellipse, and annulus-shaped solution set.

Acknowledgments

- We thank Dr. JungHa An for her invaluable advice and contribution
- We thank Dr. Brian Morsony for his support and flexibility.
- We thank the RISE and LSAMP programs for providing funding for this research.

STEM Success — Students Transitioning to Engaged and Motivated Success

RISE — Research and Immersion for STEM Excellence