

Calibrating the infrared camera Clio

Or how I needed 4 months to generate 1 graph

BY CHRIS BOHLMAN

MENTOR: DR. KATIE MORZINSKI

STEWARD OBSERVATORY, UA



Adaptive Optics 101

- ▶ Adaptive optics correct for disturbances of the atmosphere in astronomical image taking
- ▶ Although it serves as an improvement to raw data, it's still not precise enough alone
- ▶ Using Python, I got to calibrate the images taken by Clio

Magellan AO System



Photo by Yuri Beletsky, Las Campanas Observatory

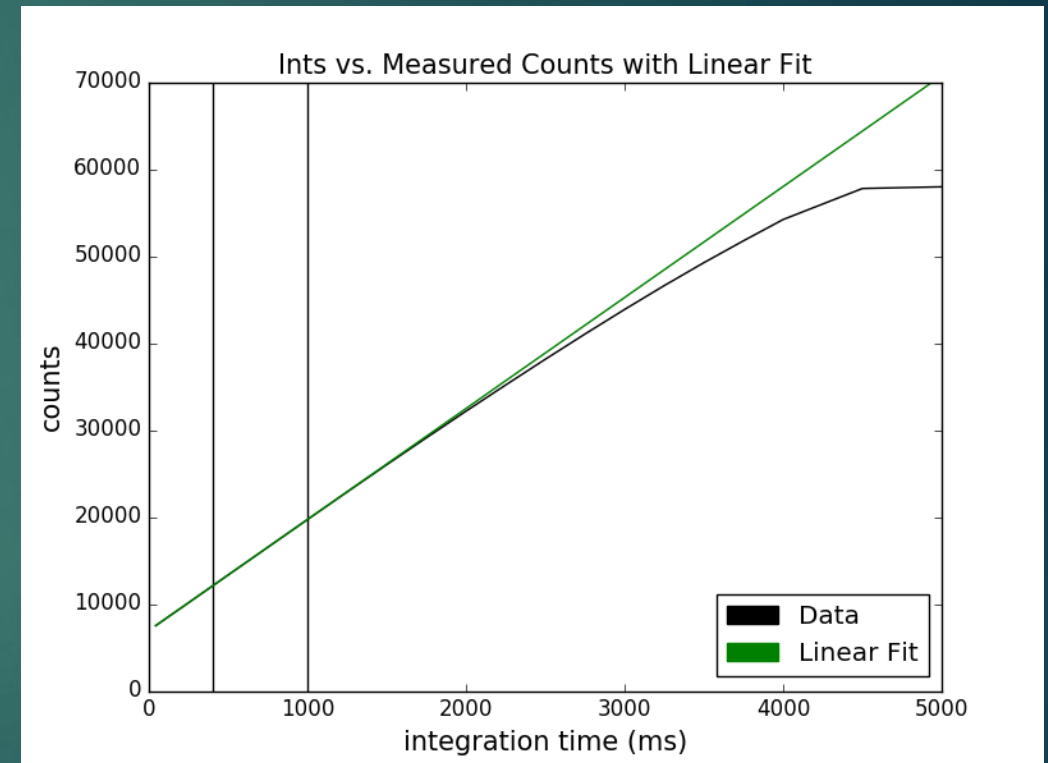


Overview of Internship

- ▶ Corrected images taken by the Clio instrument
- ▶ Calibrated one data set, took coefficients from those, applied them to another data set.
- ▶ Hands on applications of my work

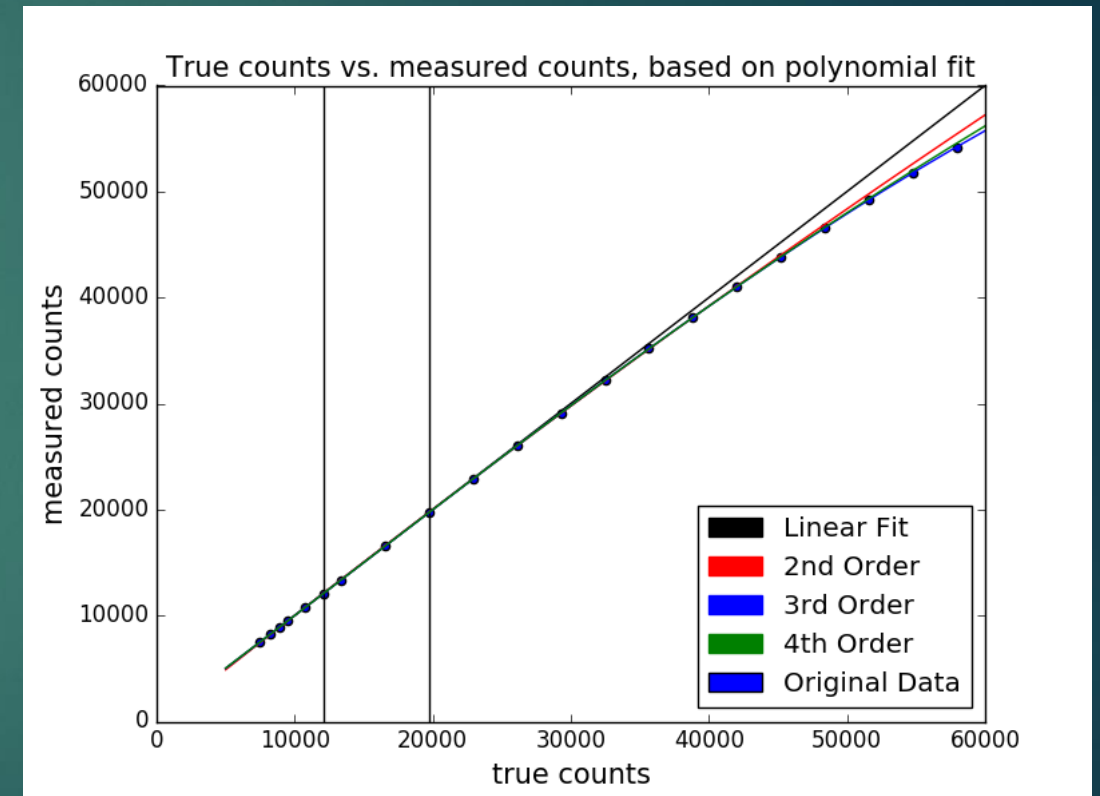
Relevant Terms and Information

- ▶ Ints & Counts?
- ▶ Linearity?
- ▶ Python: Coding language of choice



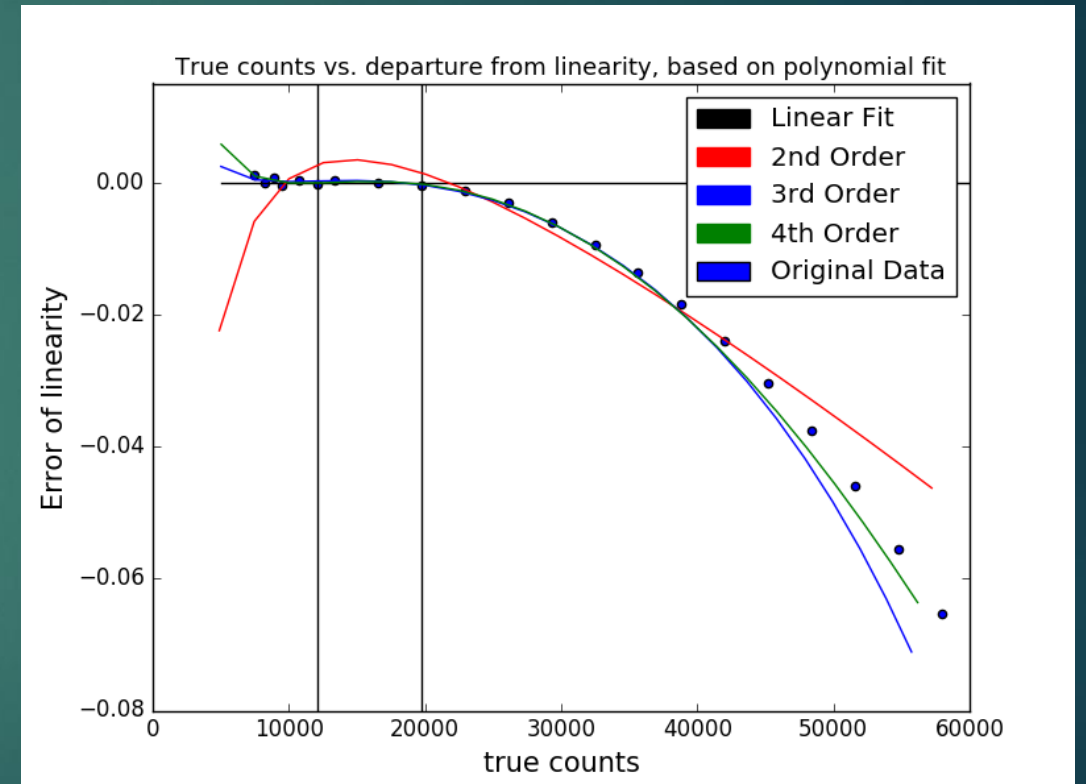
Explanation of Code (All 400 lines!)

- ▶ Had to read in every image's exposure and brightness count, and devised a way to linearize the images and correct them through an equation.
- ▶ Tested second, third, and fourth order equations to see which fit the data the best



Explanation of Code Part 2

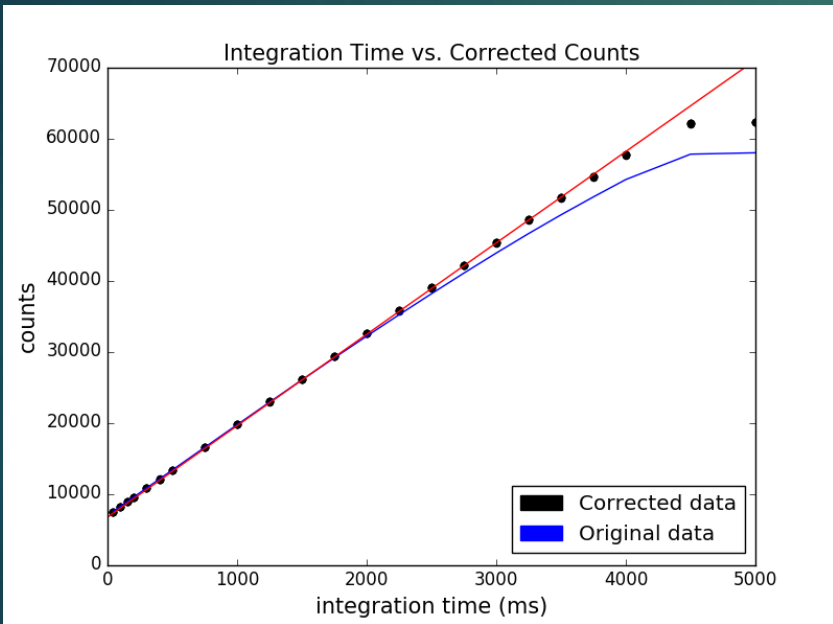
- ▶ Devised error plots as well to view where fits diverged
- ▶ Combination of plots demonstrated which fit turned out to be the best



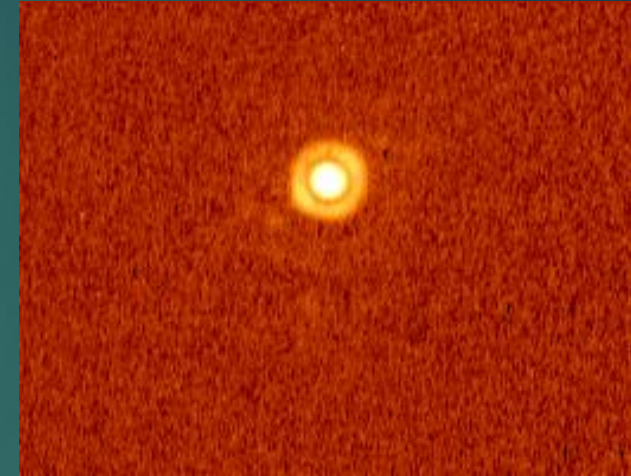
Results of Correction

- ▶ Calibrated the counts to the fourth order
- ▶ Took coefficients from that and applied them to another data set
- ▶ Therefore, multiple data sets can be calibrated through this method.

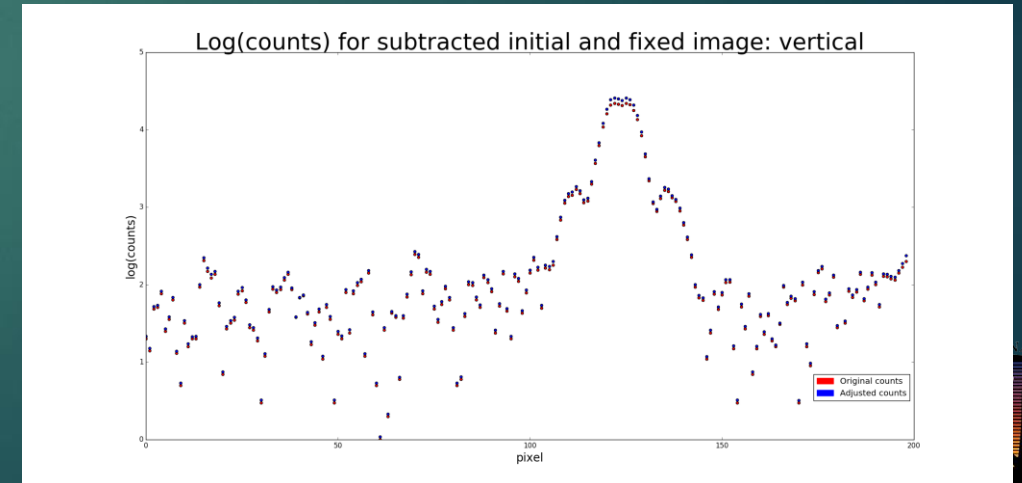
Corrected Data Visualization



Corrected picture:



Graph of a Vertical Slice:



Impact on Modern Astronomy

- ▶ Exoplanet luminosity has to be measured with the linearity correction applied, due to low counts
- ▶ Can accurately measure the brightness of planets and stars with calibrated data
- ▶ Leads to energy measurements through luminosity, distance, habitable planets.

Acknowledgements and Questions

- ▶ Katie Morzinski, my mentor
- ▶ The Entire MagAO staff
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