

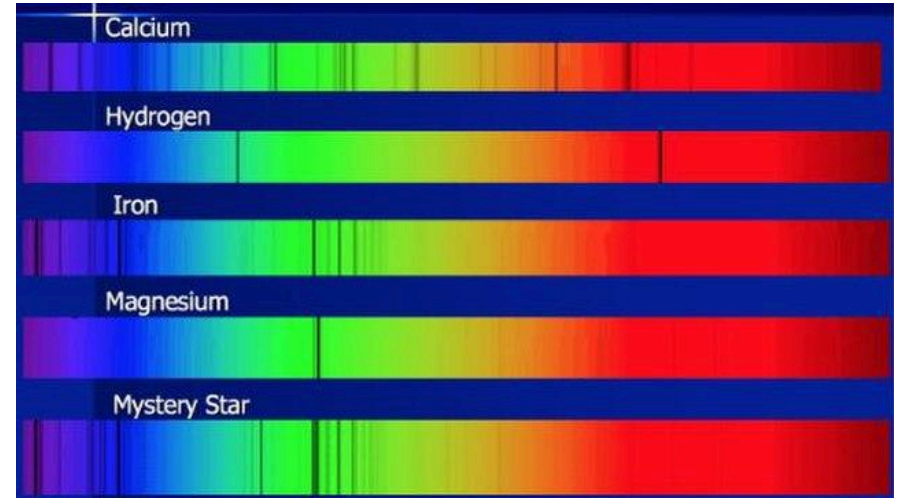
Stellar Spectroscopy

Carl Crum
Independent Inquiry
First Semester

What is spectroscopy? Why does it matter?

- Using a prism or grating, star light can be broken up into a rainbow (spectrum)
- Different types of stars have different spectra → OBAFGKM system
- Absorption and emission lines reveal chemical elements
- Spectrum shape (Planck Profile) reveals the effective surface temperature
- Other traits: radial velocity, mass

Elements and stars have unique spectra



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The Equipment

- 5 most important items
 - Telescope
 - Spectroscope
 - Mount
 - Camera
 - Computer
- Star Analyser 100: diffraction grating, low-resolution, as easy as it gets!
- Monochrome camera: higher sensitivity, more scientific



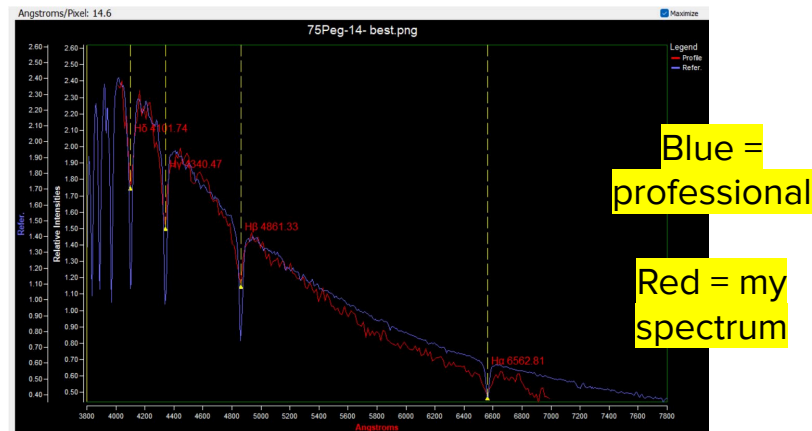
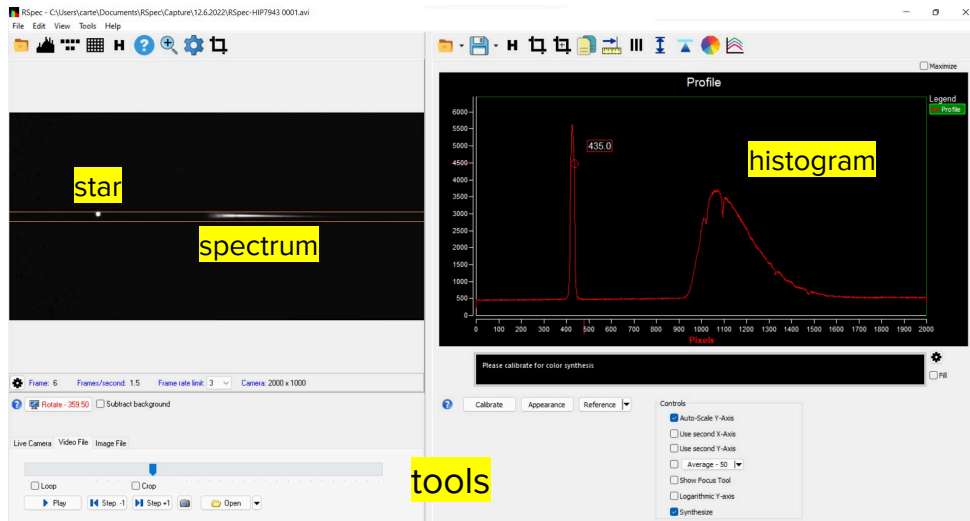
StarAnalyzer100 attached to the camera

Me working in my backyard

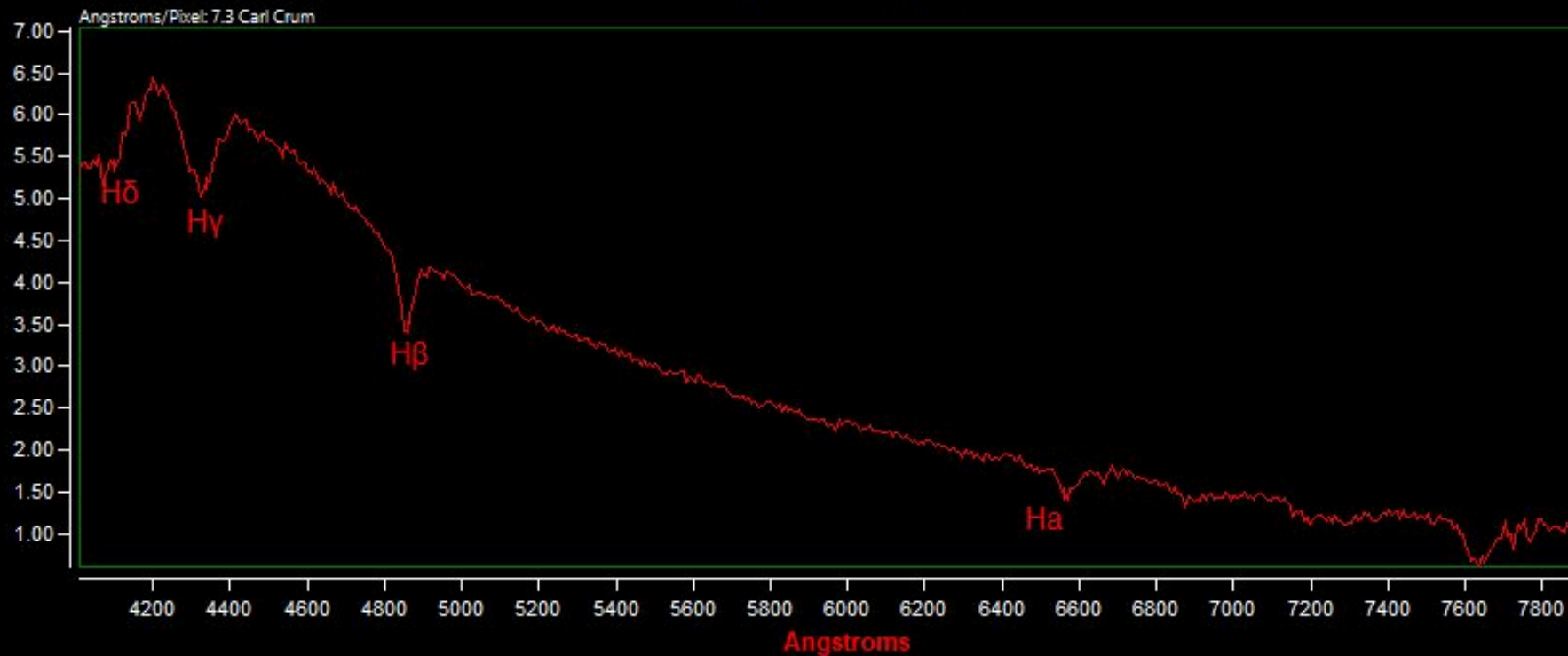


The Software

- RSpec does it all: focus, capture, and process data
- Left panel: the live view of the star and its spectrum
- Right panel: 1D histogram of the spectrum
- Two most important steps:
 - Wavelength Calibration
 - Instrument Response Curve
- Compare your results with the pros!

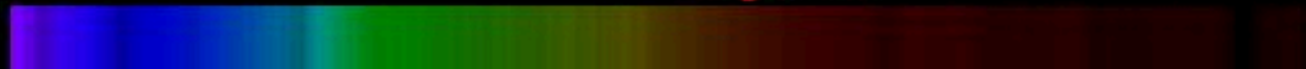
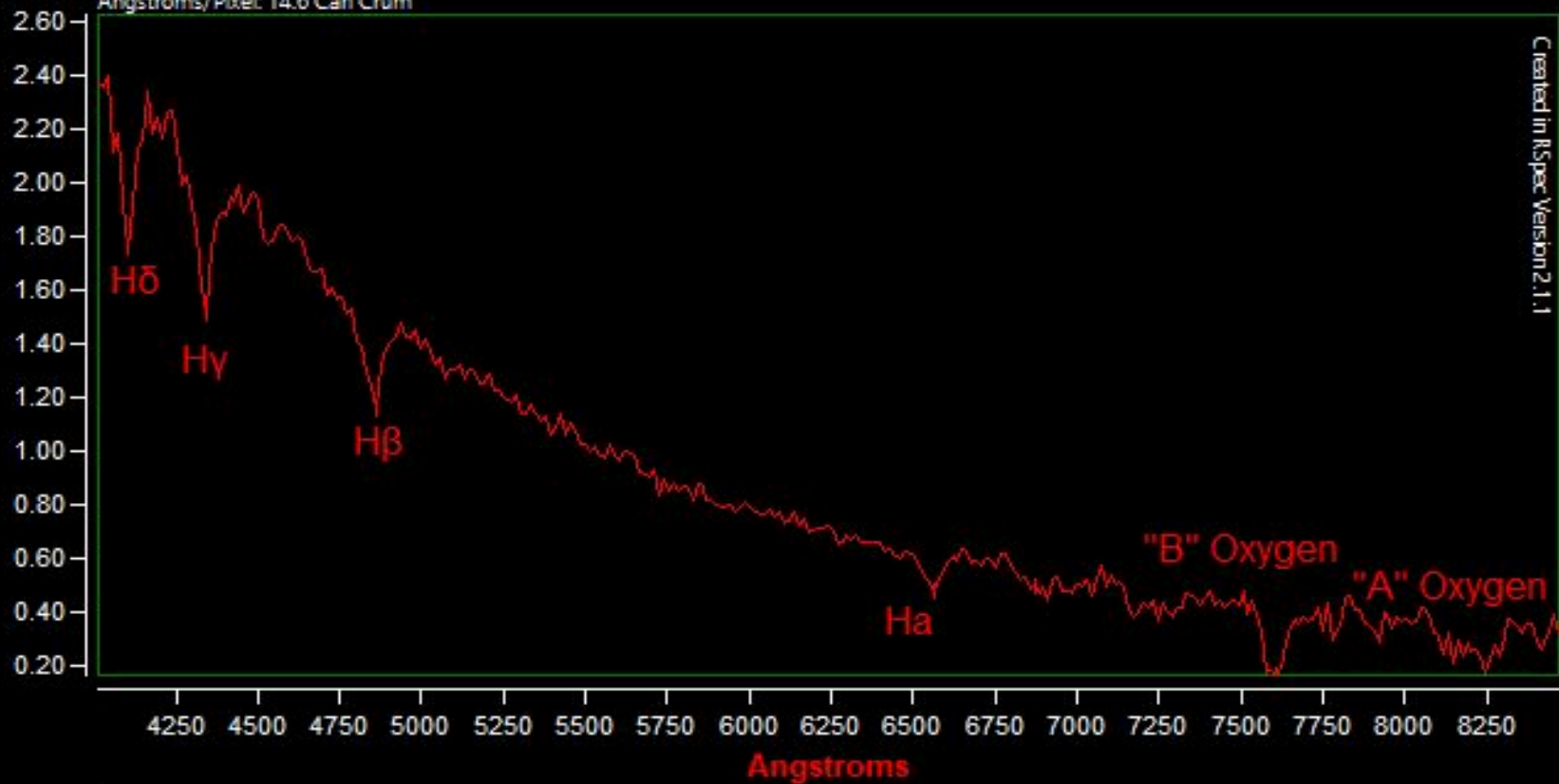


HIP 7943 - B9V



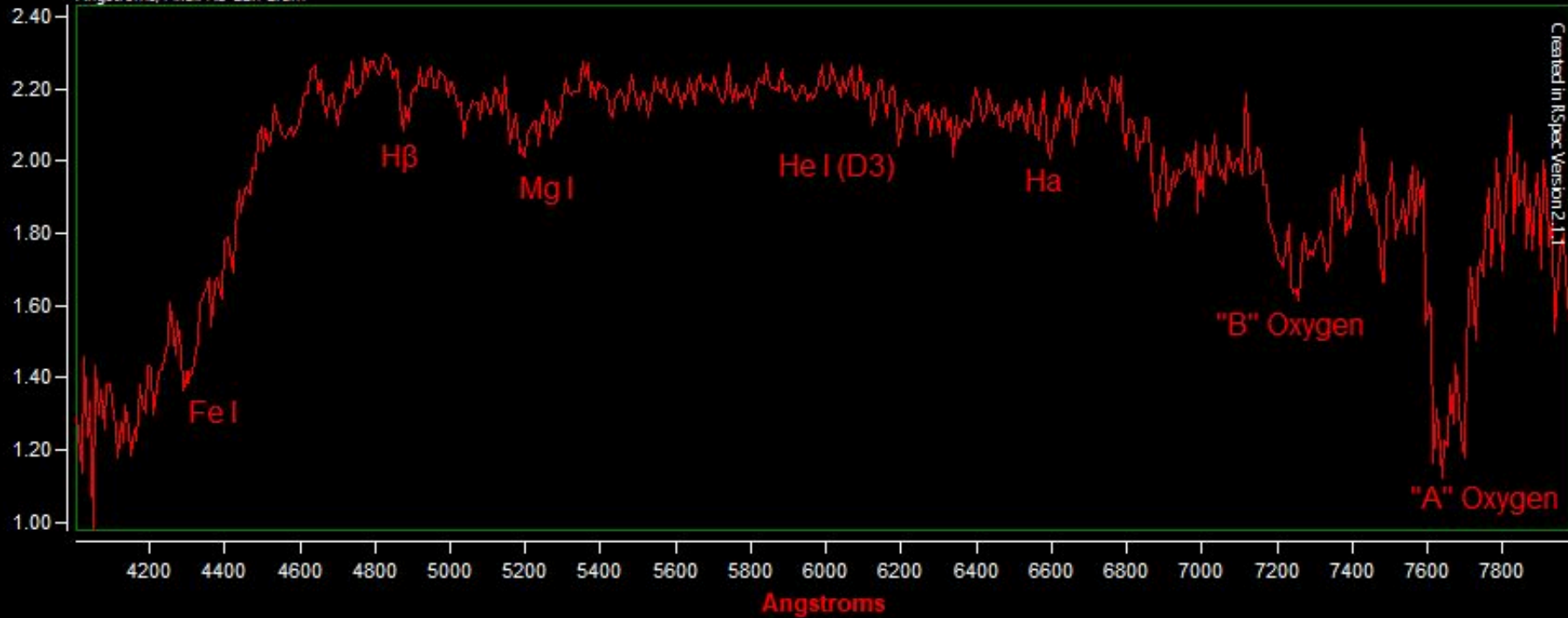
75 Pegasi - A1V

Angstroms/Pixel: 14.6 Carl Crum



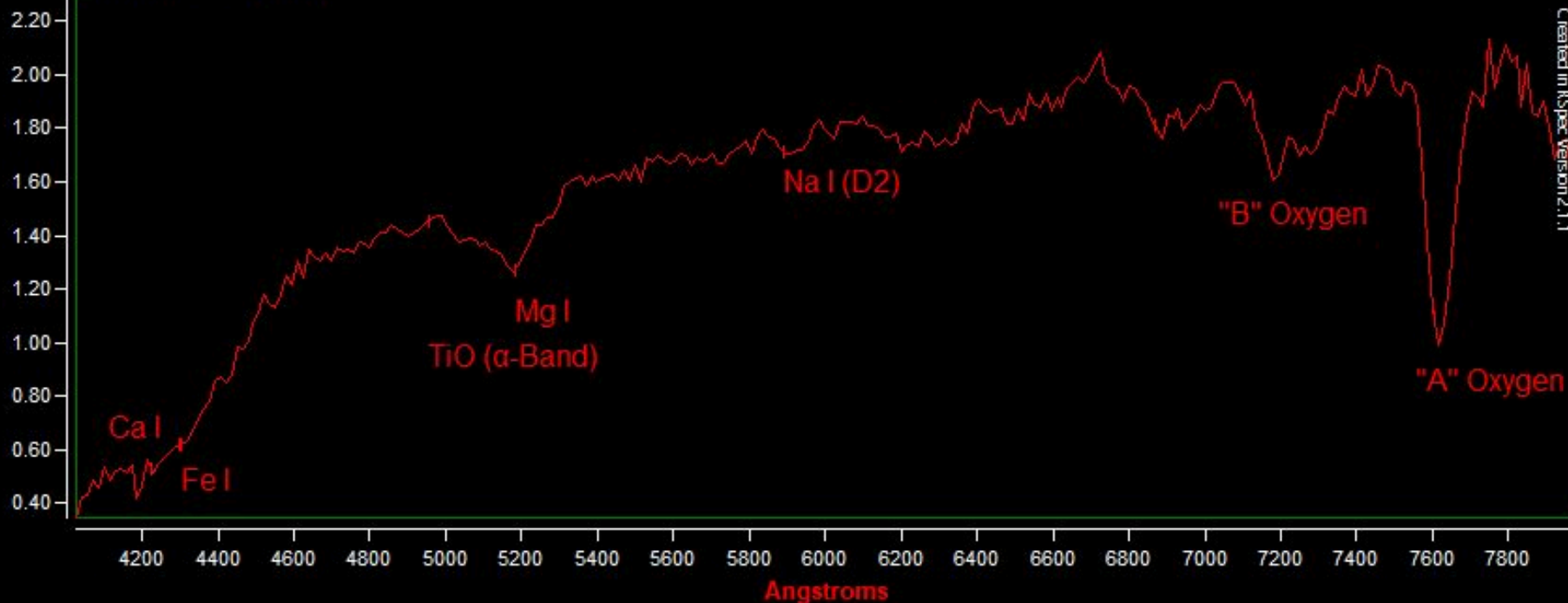
HIP 27335 - G5III

Angstroms/Pixel: 7.3 Carl Crum



HIP 114449 - K3III

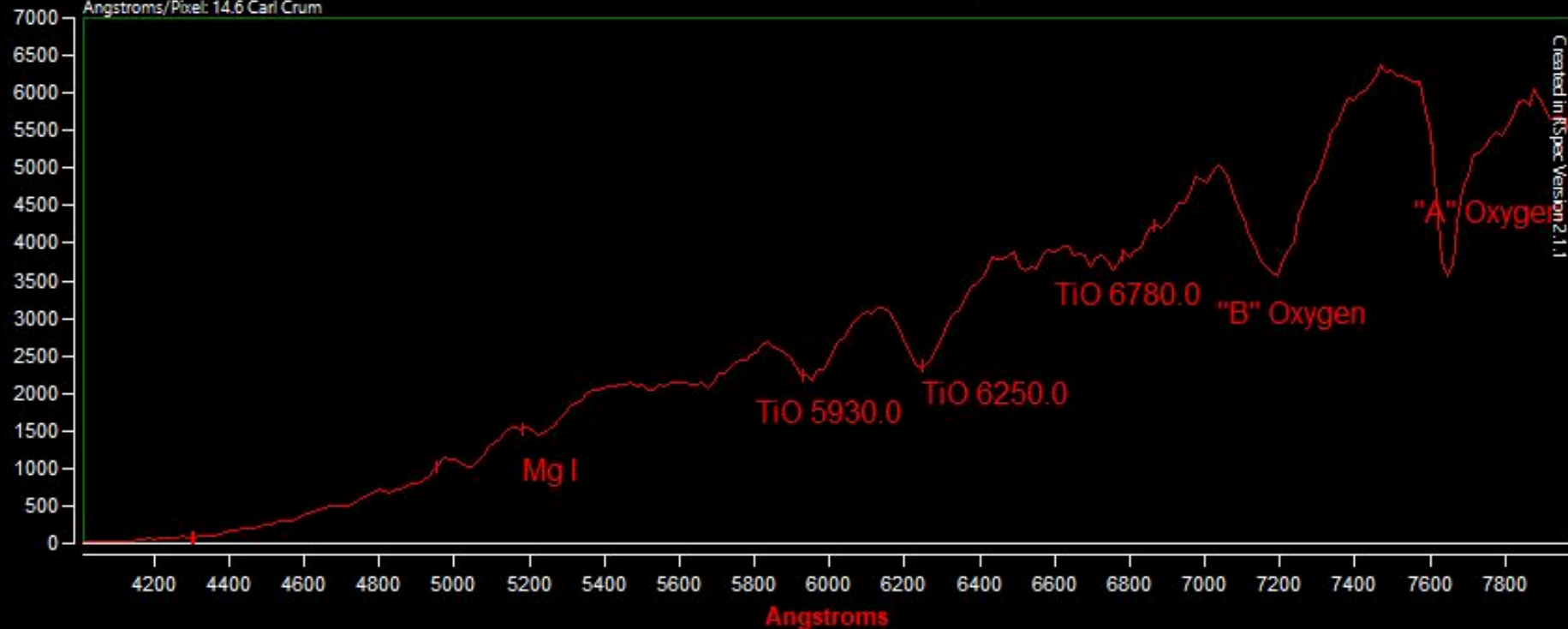
Angstroms/Pixel: 14.6 Carl Crum



Created in IRSpec Version 2.1.1

HIP113131 - M3Ib

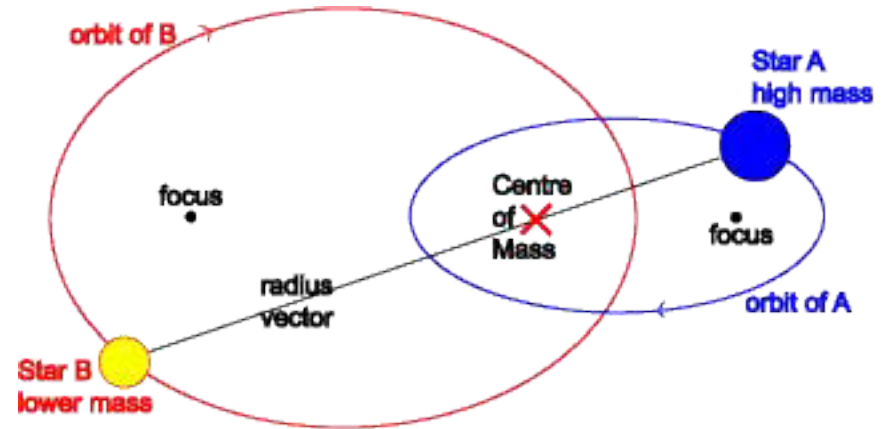
Angstroms/Pixel: 14.6 Carl Crum



Future Projects

- Determine the orbital period, masses, and spectral types of a binary star system
- Compare the emission lines of M(e) and B(e) stars
- Record the dimming and brightening of a variable star
- Calculate the redshifts of stars and galaxies using high-resolution spectroscopy

Using Kepler's 3rd Law, the mass of a binary system can be calculated



Orbits of Stars In a Binary System

"Introduction to Binary Stars." *Australia Telescope National Facility*, CSIRO, 20 July 2022,
https://www.atnf.csiro.au/outreach/education/senior/astrophysics/binary_intro.html.

Want to learn more? Check out these resources!

- [Cochard, François, *Successfully Starting in Astronomical Spectroscopy: A Practical Guide*, EDP Sciences, 2018](#)
- [Walker, Richard, *Spectral Atlas for Amateur Astronomers*, Cambridge University Press, 2017](#)
- RSpec: rspec-astro.com
- AAVSO 2020 Spectroscopy Workshop: https://www.youtube.com/playlist?list=PLnZ_rvnR35rdopw2GSKFo_VYyAG9P6jDB

