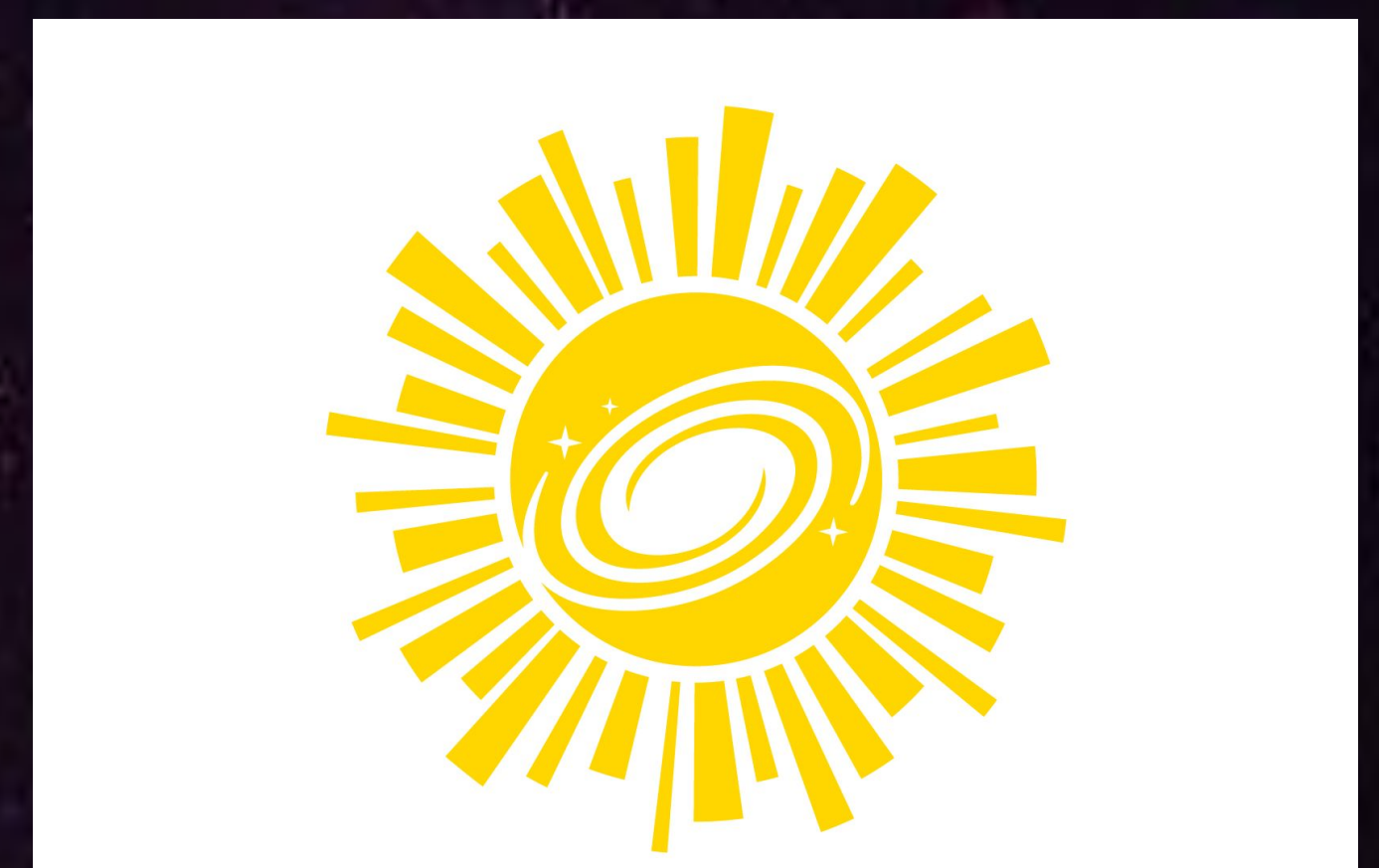# Explore the Universe

Name: Aaron Marsh
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Research Question/Goal:

To have a hands on experience in the observatory and to learn how to use other resources to observe objects, collect data, and analyze data

What are the properties of the celestial object in question, and why is this information useful?

Research Context:

The understanding of the nature of variable stars and exoplanets is in high demand in the astronomy community, because these types of celestial objects can help answer a lot of scientifically interesting questions.

- Variable stars must be monitored over a long period of time due to the nature of their variability

- It is especially important to continuously collect data for variable stars, because they can be used as 'standard candles'

- It is important to know the period and luminosity, as well as other properties of these variable stars, which is why such thorough data must be collected

I chose to observe/collect data for a variable star in the Hydra constellation, called VX-Hydra.

Instruments/Resources:

Physical Instruments:

The University of Maryland observatory is equipped with a 14" Celestron telescope, as well as 7" and 6" telescopes. The data for the star of interest, VX-Hydra, was taken with the 14" telescope. These instruments utilize CCD technology.

Online Resources:

I utilized the the AAVSO target tool in order to narrow down a list of potential targets

This online resource let me filter through different criteria, helping me ultimately find an ideal target

VX-Hydra was the best choice, because:

    -It was visible in this part of the sky during nighttime
    -It's period had an ideal length of time (around 3 hours)
   -It was bright enough that our telescopes could measure it

We also tracked weather in order to determine ideal nights for visibility for measuring the star - some of the factors we looked for included:

    -Temperature
    -Seeing
    -Humidity
    -Cloud coverage

Data/Analysis
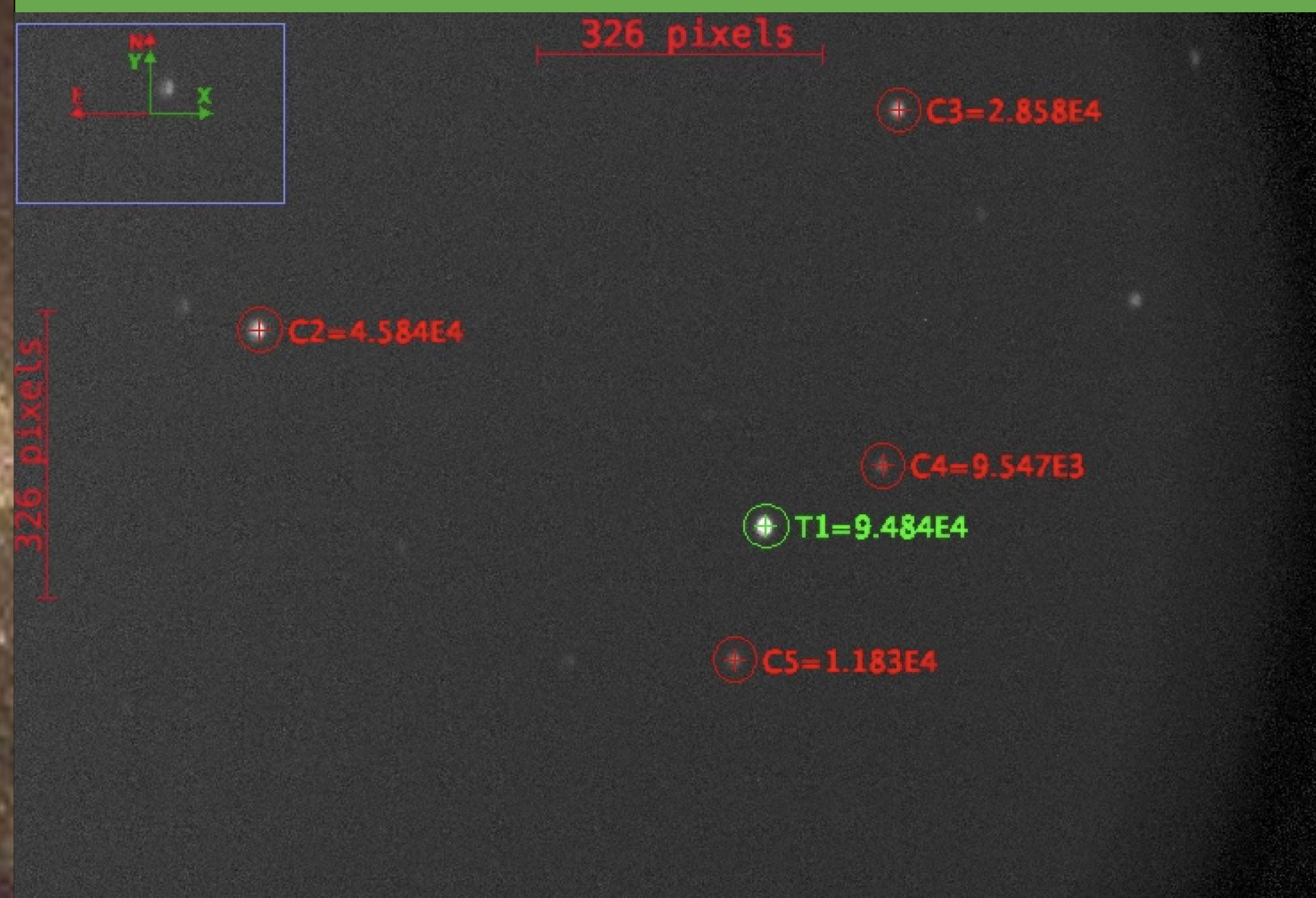
Calibrated Image of VX-Hydra with apertures of the target star (green), and apertures of reference stars (red)
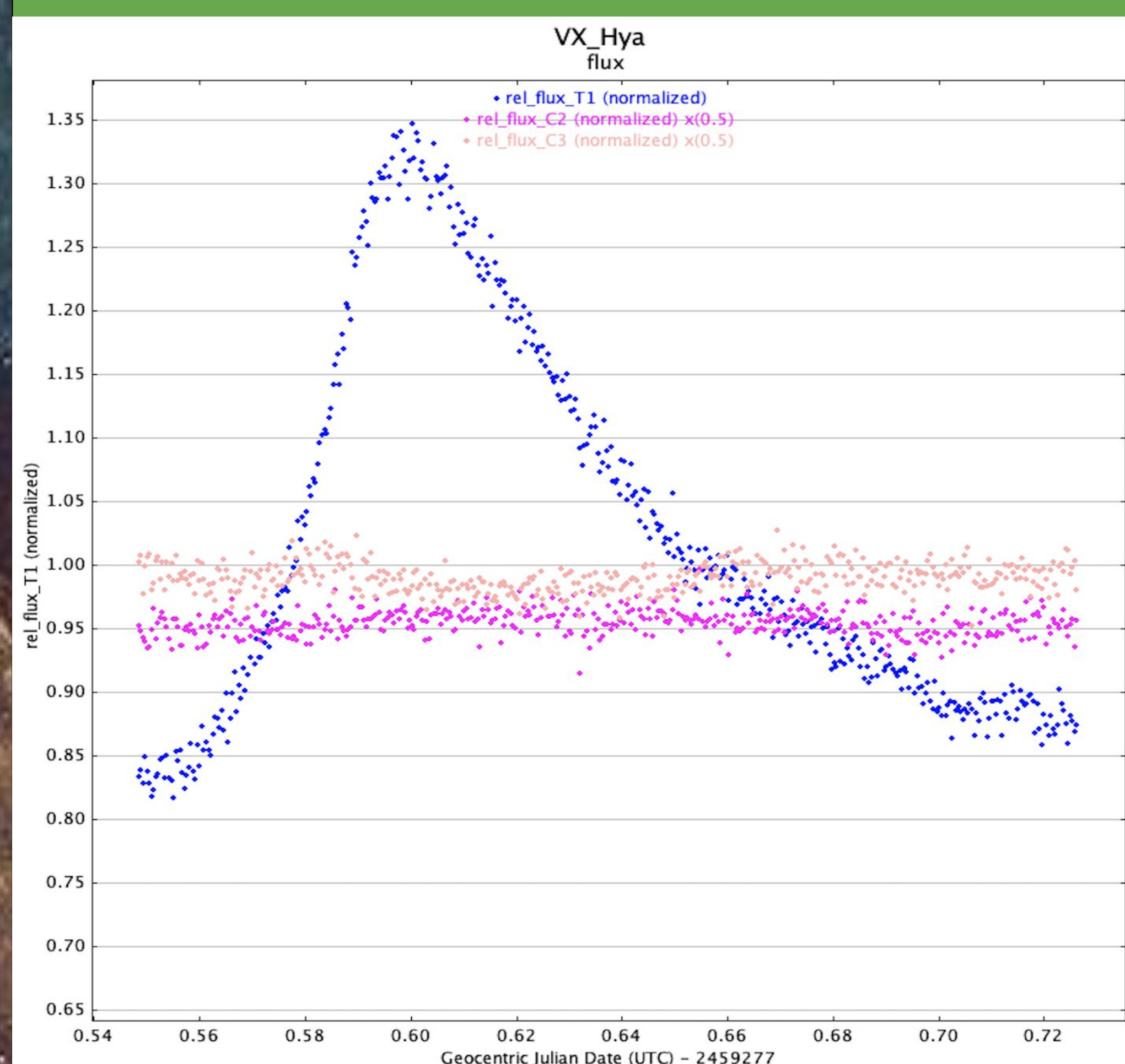
The light curve of VX-Hydra (blue) compared with light curves of reference stars (other)

- The light curve maps the luminosity, or flux, of the star over time (UTC)
- We can see VX-Hydra has a more varied light curve than the reference stars, because it is a known variable star, while the others are not

Methodology/Procedure:

Step 1: Use the AAVSO online target tool to find a target star

Step 2: Determine what night is best to take measurements given the weather conditions

Step 3: Set up telescopes and log all necessary information beforehand

Step 4: Use reference stars to help line up the telescope with the target star. Since VX-Hydra is near Betelgeuse, I used Betelgeuse as a reference star

Step 5: Collect raw data of the star and then take calibration frames.

There are three types of calibration images that must be taken: Bias, flat, and dark. These images correct for natural imperfections in the original images.

Step 6: Calibrate, align and process the data

- After these calibration images are taken into account, using software called AstroImageJ, the images can be processed.

- If the target drifted throughout the observation, the images may have to be aligned.

- Using the software carefully, one can then generate a light curve, with detailed information about the star.

Suggestions for Future Research:

- Variable stars that are similar to VX-Hya could be analyzed in a similar way
- We could compare and contrast the analysis to look for patterns specific to these types of variable stars
- If you would like to learn more about VX-Hya, and see more light curves, feel free to email me

Limitations:

- Because of the Covid-19 Pandemic, we only were able to make it to the observatory once
- We were able to use data from several different nights of observing, but we only had one data set from a night where we carried out the observations

Acknowledgements:

Citations:

https://www.aavso.org/