



CALIFORNIA STATE SCIENCE FAIR 2012 PROJECT SUMMARY

Name(s) Shashank Dholakia; Shishir Dholakia	Project Number J1806
Project Title The Sky Is No Limit: A Photometric Comparison of the Variable Stars Beta Lyrae and Delta Cephei	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals In this project, we asked the question "How do the light curves of different types of variable stars differ and is it possible to identify a variable star type by its light curve?" We also wanted to know if a digital camera in a light polluted environment can obtain accurate photometric results and if variable star photometry can expand our understanding of the universe.</p> <p>Methods/Materials We chose two types of variable stars, Beta Lyrae, an eclipsing binary and Delta Cephei, a Cepheid variable. We used a digital camera to perform photometry and record the variation in brightness and plot their light curves. We took a series of images of the variable star and a few calibration stars of known and fixed brightness. We stacked the images using the software DeepSkyStacker to obtain a single image. Iris was then used to obtain the pixel value of the variable and calibration stars. By comparing this pixel value of the calibration stars with their actual brightness, we derived brightness of the variable star. This entire process gave us one data point on the light curve. We repeated this process for 73 and 23 nights for Beta Lyrae and Delta Cephei respectively to plot their light curves.</p> <p>Results We found that Beta Lyrae had an irregular light curve with two minima and two maxima, while Delta Cephei showed a simple periodic light curve. Delta Cephei's light curve was far more regular than Beta Lyrae, however the brightness ascended faster than it dimmed, resulting in a saw tooth shape light curve.</p> <p>Conclusions/Discussion Our hypothesis that an eclipsing binary has two minima was supported. Our hypothesis for Delta Cephei was partially supported. Its light curve was regular but had a saw tooth shape instead of a sine wave. The study of variable stars can help us understand many things about our universe. Exoplanet systems can be detected because they change in brightness in similar ways to eclipsing binaries. Cepheid variables are standard candles. By measuring their magnitude, we can measure the distance of the galaxy they are in. Our experiments also showed that photometry using a digital camera, even in a light polluted environment can provide accurate measurements of variable stars. This is important since it shows that amateur astronomers can significantly contribute to our understanding of the universe in ways such as discovering supernovae and exoplanet systems.</p>	
Summary Statement This project analyzes two variable stars over a period of time and demonstrates how accurate variable star photometry can help us understand more about the universe.	
Help Received Mrs. Fohner and Mr. Asekomeh for providing support and advise; Father for encouragement; Dave Majors for introduction to variable stars; Dr. Aaron Price for information on photometry	