

Introduction

The demonstration of real-time photometry to amateur astronomers and the public offers a powerful and seldom-seen, outreach opportunity. This poster describes the equipment and software used to provide such a demonstration at the Julian StarFest, Julian, CA, in August 2022. It was hoped that outreach of this type would not only appeal to the general public but would also encourage astrophotographers and those practicing Electronically Assisted Astronomy (EAA) to expand their interest into photometry. Photometric measurements can be usefully done with their existing equipment with little or no modification. This possibility significantly lowers the barrier to entry for those wishing to experiment with this branch of science, ideally attracting a new generation of much-needed citizen scientists.

Equipment and Software

An optical tube assembly (OTA) based on a color CMOS camera, or monochrome CMOS camera with RGB filters, is just fine for beginning your photometric journey. Why spend money on something when you don't know it is a good fit? Further, there are many excellent, free photometry software packages like AstrolmageJ (AIJ) and ASTAP to do the post-processing.

I came into photometry from an EAA background using a CMOS color camera. All I needed to add was a UV/IR cut filter to constrain the spectral response of the camera to the visual range. My main equipment consists of a Celestron C8 SCT, f/6.3 focal reducer, UV/IR cut filter, and a ZWO ASI533MC color camera.

For the real-time photometry demonstration, SharpCap Pro was used for image acquisition, with on-the-fly application of master darks and flats. Images were saved to a separate folder which was polled by AIJ to perform differential photometry. Since no RA/Dec information was available in the FITS header of the image, AIJ uses a centroiding algorithm to keep the apertures accurately on the target and comparison stars. Measurement results can be graphically displayed in real-time if M-Plot is checked in the Multi-Aperture Measurements window. The polling and centroiding functions are user selectable within AIJ – further details are provided in a YouTube video [1]. Sixty-second exposures, collected at the same cadence, proved ideal for live viewing. PHD2 was utilized for guiding.

Target Star

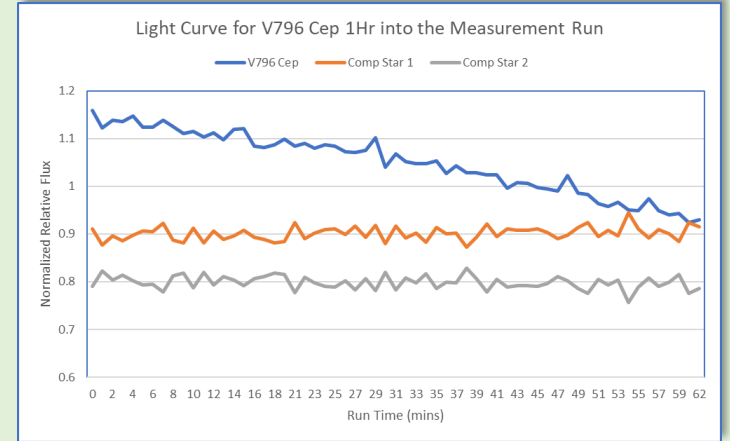
The star chosen for this demonstration was the eclipsing binary, V796 Cep. Real-time light curve plots were displayed on a large-screen monitor of this EW variable. With a period of 9.43119 hours, it was hoped the divergence between the light curve of V796 Cep and the comparison stars could be seen in relatively short order. Gaia EDR3 reports the distance of this 12th magnitude star as 501 pc or 1633 light years.

Support Presentation

When doing this type of outreach, I recommend cutting between the developing real-time light curve and a presentation. This presentation should ideally contain information on the basics of photometry, equipment and software used, characteristics of the target star, and how this data will be used within the astronomical community. This additional information keeps the audience engaged and aids with the visualization of the target being measured. A sample presentation can be found in [1].

Results

A little to my surprise, the viewing public was fascinated by the concept of two stars orbiting around a common gravitational center known as a barycenter. They were also thrilled to hear amateur astronomers could provide meaningful data to the scientific community, supporting the operation of telescopes like Hubble and James Webb, and providing data for analysis on exoplanets and binary stars. The event and subsequent YouTube video [1] has generated interest from fellow astronomers wishing to perform this type of outreach.



Results cont.

Nearly thirteen hours of data was collected over two nights at the Julian StarFest. This data was subsequently post-processed with ASTAP and AIJ, and tri-color green (TG) measurements were formatted and uploaded to the AAVSO International Database – picture middle below. A simulated snapshot from the live view just one hour into the first night's run clearly shows the divergence between the target and comparison stars light curves. [1] shows the entire light curve for the same evening sped up sixty times.

Summary

Real-time photometry was successfully demonstrated over two nights at the Julian StarFest to amateur astronomers and the public. The slowly changing light curve of an eclipsing binary star system captured the imagination of many of those viewing it, greatly exceeding the author's expectations of this outreach opportunity. The author hopes this demonstration and accompanying YouTube video [1] will encourage amateur astronomers to try photometry and begin their journey into citizen science.

Acknowledgements

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1. Karen Collins and her team for developing AstrolmageJ;
2. Robin Glover, the developer of SharpCap and SharpCap Pro;
3. The developers of ASTAP and PHD2;
4. Kevin Alton for his encouragement through the AAVSO mentorship program.

References

[1] <https://youtu.be/uSz5n2b6QR4>.



Photo Credit:
Woody Schlom

