

Evidence for a third body perturbing the spectroscopic binary 57 Cygni

Poster (Friday, April 20, 2018)

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Abstract: We present evidence from five observing seasons confirming repetitive Doppler-shifts in the double-line spectroscopic binary 57 Cygni. Our spectroscopy is limited to a range encompassing H-alpha and the helium 667.8 nm line; the Doppler-shifts were well-resolved in the helium line but less so in H-alpha. Although radial velocities derived from both lines were reasonably consistent, we retained only the helium-line derived velocities for sinusoidal curve-fits to the orbital dependence. The fit-amplitudes specify the ratio of the stellar masses as 1.03 ± 0.05 , in agreement with previous assessments. We find an eccentricity of 0.028 ± 0.024 and a longitude of periastron of $163.5 \pm 2.5^\circ$; the former is significantly lower than that previously reported while the latter is in agreement but calls into question the apsidal motion projected from the last published studies four decades ago. Our modeling suggests the presence of an external third body was implicit in the previously observed apsidal motion, as well as the most likely mechanism for our observed variation in eccentricity. Based upon the spectral type, the near-circular orbit and the established mass ratio, we can place restrictions on the orbital inclination from 51.5 -to- 53.0° , in reasonable agreement with previous estimates.

Amplitudes, Periodicities, and Secular Brightness Trends of Long-Period Variable Stars in the Field of Open Cluster M23

Poster (Friday, April 20, 2018)

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More than 500,000 images of Open Star Cluster M23 have been obtained at Luther College since 2005. Of the approximately 1,600 stars detected in these images, approximately 80 have been identified as long-period variable stars (LPVs) via statistical tests developed at Luther. LPVs pulsate with periods of tens to hundreds of days, and their amplitudes of variation, periodicities, and long-term brightness trends warrant analysis. Recent developments have allowed for an improvement in the analysis of these LPV properties done in the past at Luther. These developments include the discovery of more LPVs allowed by an improved normalization method, the increase in photometric resolution resulting from a modified method of photometry, and the addition of five more years of data to the data set. The advantages and disadvantages of various methods of determining LPV amplitudes of variation will be discussed, and it will be shown how the change to a new telescope in the middle of the data set has complicated the analysis of LPV long-term brightness trends. Efforts made to remedy this instrument-induced artifact via modified photometric methods will be described.

Professional Development, Astronomy Education, and Traffic: Reflections on Experiencing the Great American Eclipse

Oral (Saturday, April 21, 2018)

Jeffrey Butikofer

Upper Iowa University

On August 21, 2017 all of the contiguous United States had an opportunity to view a solar eclipse: a partial eclipse for most, but a total eclipse for a thin swath of the country from coast-to-coast. I traveled from Fayette, Iowa to just south of Casper, Wyoming so I could experience totality during what has been dubbed the Great American Eclipse. In this presentation, I will reflect on the journey and share photographs from the event. I have incorporated some of these photographs into my Introduction to Astronomy course to demonstrate the ability to obtain relatively high-quality images with modest equipment and experience. The photographic techniques learned are applicable to our Introduction to Astronomy laboratory, which is usually only taken by education majors at Upper Iowa University. Telescope and astrophotography projects during the lab are geared towards providing hands-on experience with the equipment.