A Light Curve of Theta-1 Orionis A

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Abstract

Theta-1 Orionis A (V1016 Ori), a member of the Trapezium, was only discovered to be an eclipsing binary system in 1974. The study of this system has been recently summarized by Strickland and Lloyd (The Observatory, 120, 2000, pp. 141-149).
We are obtaining a complete light curve in VBRI using a CCD on the 18-inch telescope at Appalachian State University's Dark Sky Observatory. We have obtained new times of primary minimum and are searching for the undiscovered secondary eclipse as well. A status report is presented here.

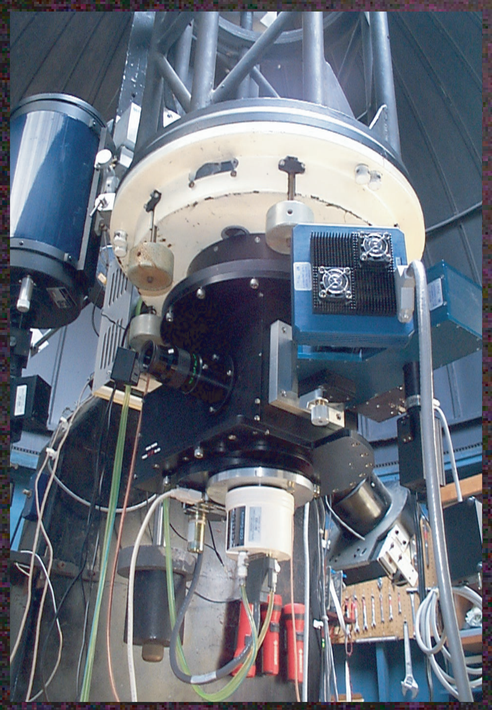
Introduction

Theta-1 Orionis A, a member of the Trapezium in the Orion Nebula, was only discovered to be an eclipsing binary about 30 years ago. The 65.4 day period offers few chances at observing an eclipse each season, and the secondary eclipse has not been found.
We started a search for the secondary after obtaining a primary eclipse lin November of 2001. We are also filling in the light curve between eclipses. The analysis of the images is difficult do to the proximity of the stars and the background nebulosity.

Observations

The images are being obtained using the 18-inch telescope at Appalachian's Dark Sky Observatory. The Roper CH350 CCD camera has a SITe 1024-square chip that provides a few pixels per FWHM at typical 2-3 arc-sec seeing. A DFM-Engineering filter wheel contains Bessell set BVRI filters from Omega Optical.

Exposures are one-second long, preventing saturation but thus so short that they are noisy due to transparency and seeing variations. On most nights BVRI images are taken; we have several nights of only R images due to equipment problems. Dusk sky flats are also taken, and are 1-second exposures as well.

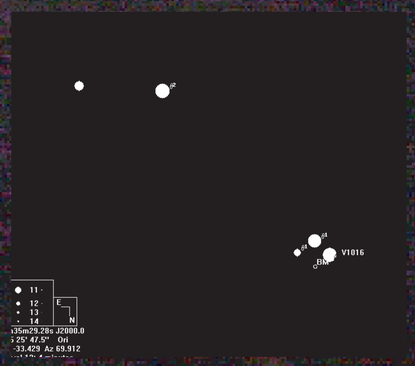


18-inch Telescope Instrumentation

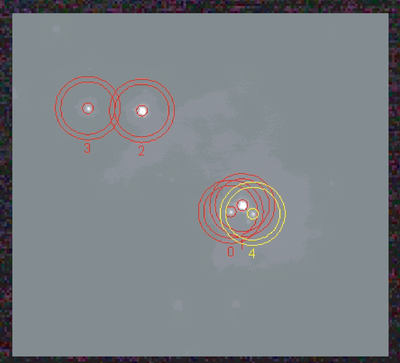
John and Craig in the 18-inch Control Room

Data Analysis

The images are being analyzed using Axiom Research's Mira-AP software. The comparison stars for the field are shown in the chart below, produced with Project Pluto's Guide software. These stars are of similar spectral type (~B0) to the hotter star comprising our target binary. The other known eclipsing binary in the Trapezium, BM Ori, is not used.

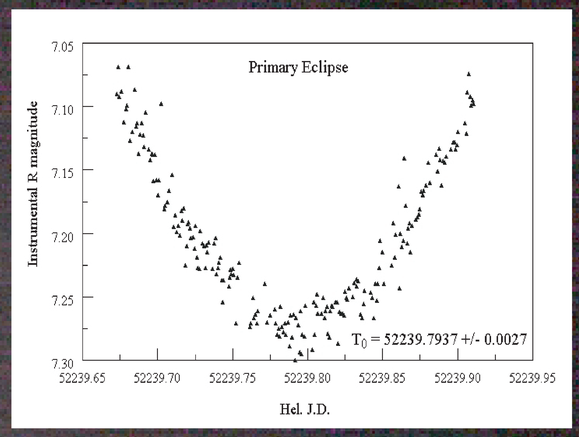


The data image below shows the measurement apertures used for the stars and their respective background annuli.

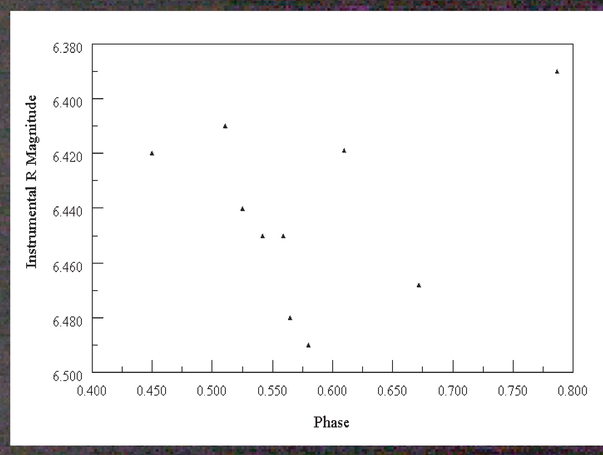


Status and Early Results

This project began when we noted an opportunity to observe a primary eclipse on 11/25-26/01. That attempt was successful (see R filter light curve below), and led us to start the search for the secondary.



While we have dozens of individual nights' images spread across the entire light curve, we have been concentrating on reducing the data around phase 0.5 to find the secondary. The graph below shows some of those points, each one representing a night's average.



Conclusions

While the data show a possible drop in brightness near phases 0.56, this drop is not significantly larger than the error bars in the data (~0.02 mag). It could be that the event is too shallow to detect with this technique. However, we have not covered all of the phases where a secondary could occur (~0.3 - 0.7). Also, there are gaps where the expected 20-hour long event (the length of the observed primary eclipse), could have occurred but were not observed due to daylight or clouds. We are continuing to fill in these gaps with observations currently under way.

Acknowledgments

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