Eclipsing Variable Star NSVS 3792718

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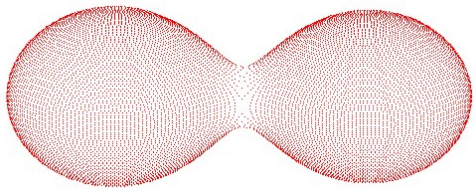
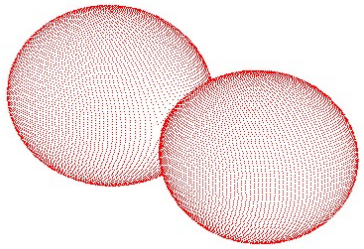
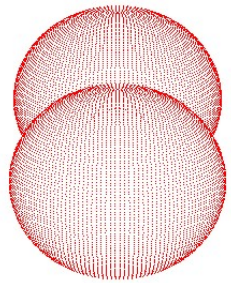
Introduction

- Binary star systems are two stars which are gravitationally bound to one another.
- Eclipsing binaries
  - Variable brightness: Min when eclipsing, max when not.
- Values which can be determined: orbital period, surface temperature, color, mass, radius, metallicity, etc.







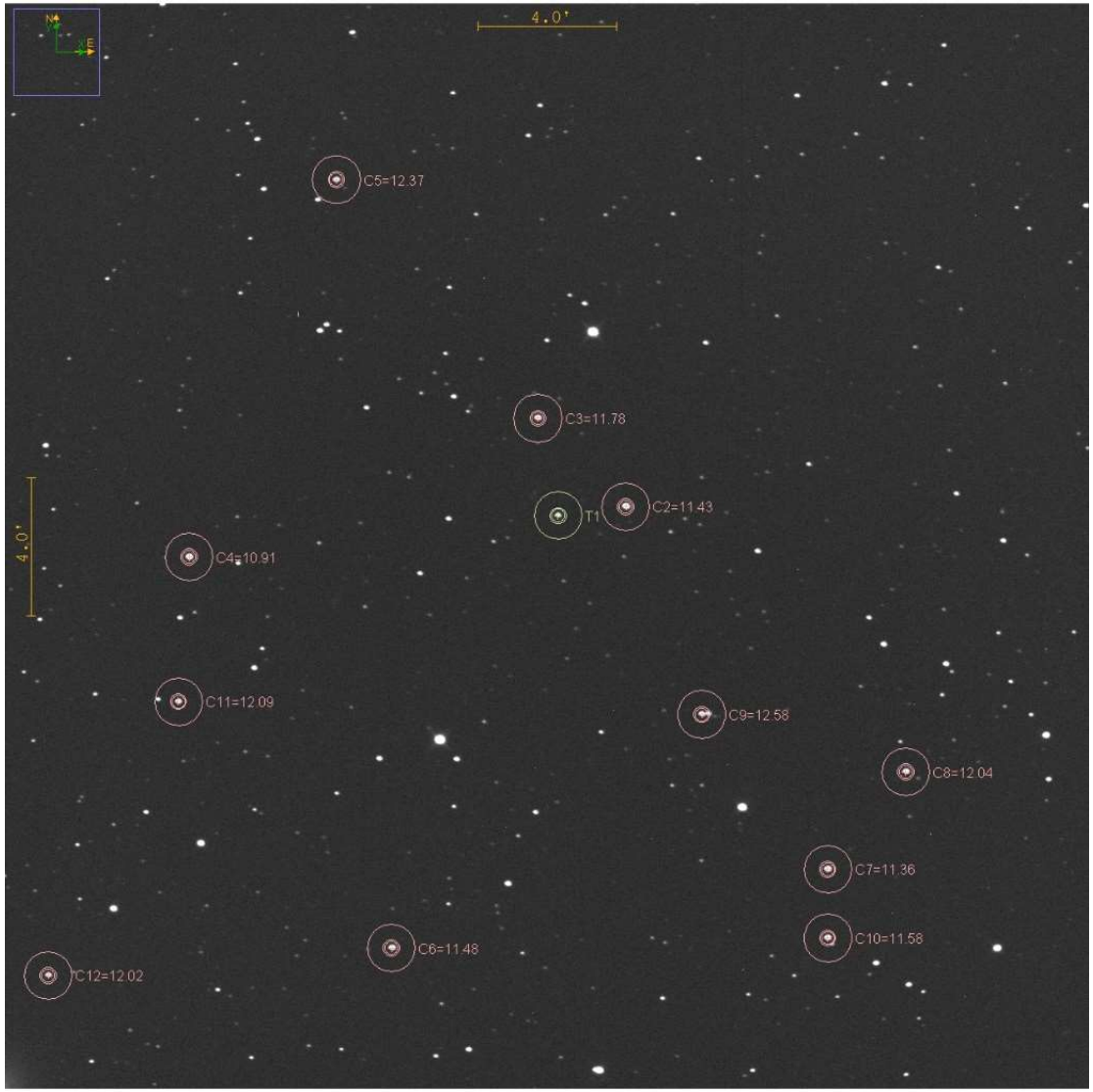
Process

- Obtain data for NSVS 3792718
  - Nights of September 22, 23, 25, October 17, 18, 21, November 25, 2015
  - 200 images from V filter
  - 214 from B
  - 230 from R
  - 644 total
- Reduce images, plate solve
- Photometry
  - Find comparison stars
  - AstroImageJ
- Condense data to analyze for future steps

Comparison stars

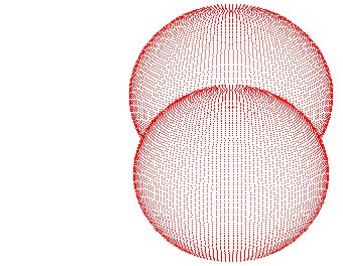
1. TYC 2806-966-1	5. TYC 2806-26-1	9. TYC 2806-691-1
2. TYC 2806-586-1	6. TYC 2806-260-1	10. TYC 2805-38-1
3. TYC 2805-916-1	7. TYC 2806-742-1	11. TYC 2805-1503-1
4. TYC 2806-852-1	8. TYC 2806-150-1	

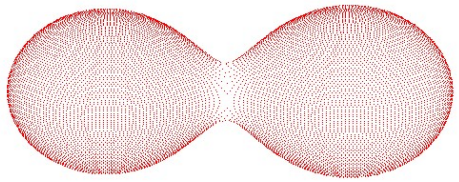
V filter image taken with the 20-inch parallax telescope at Ball State on September 23, 2015. Red circles indicate comparison stars. The number next to that is the magnitude with the V filter. The green circle is the target star.



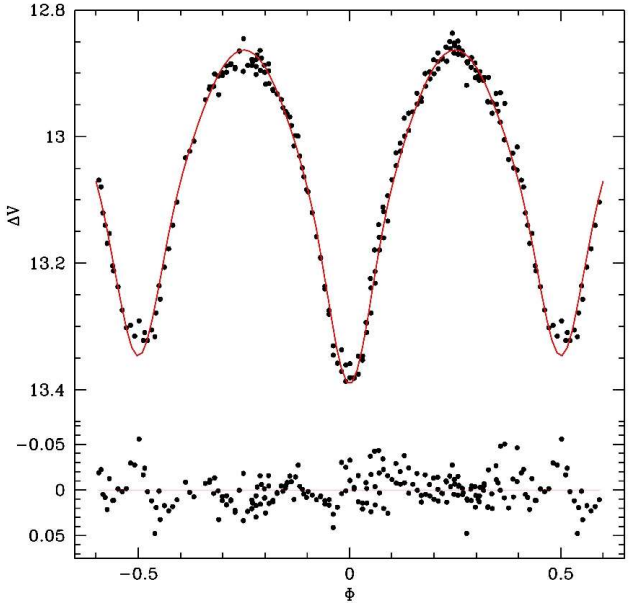
Data Analysis

- PERANSO
  - Determine orbital period and light curve plot
- PHOEBE (PHysics Of Eclipsing BinariEs)
  - Stellar modelling
  - Light curve and synthetic light curve
  - Residuals
  - Star-spots (not in this analysis)

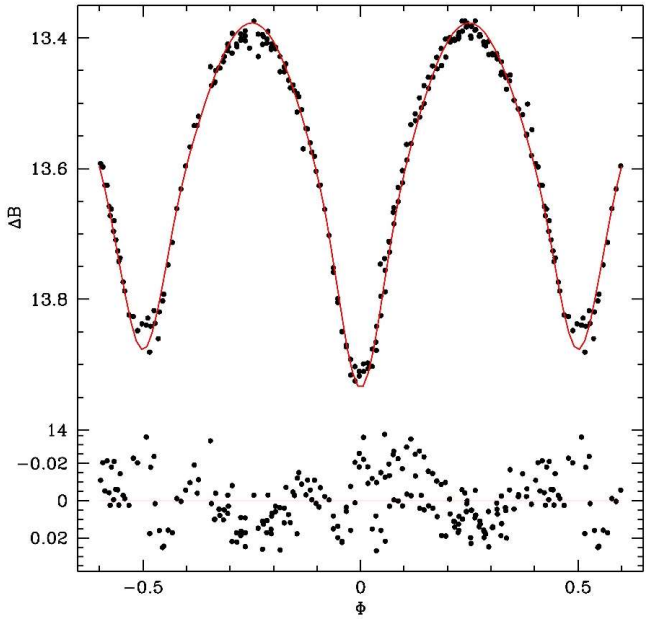




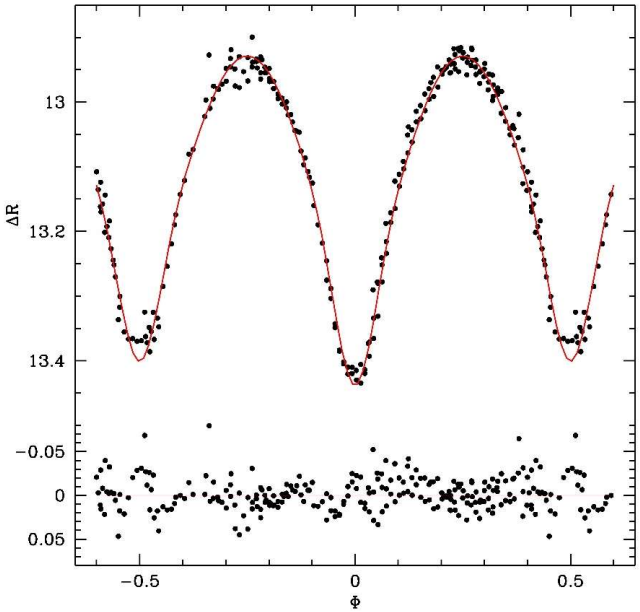
Light curves



V filter light curve (top) and the residuals (bottom). The solid red line is the synthetic light curve.



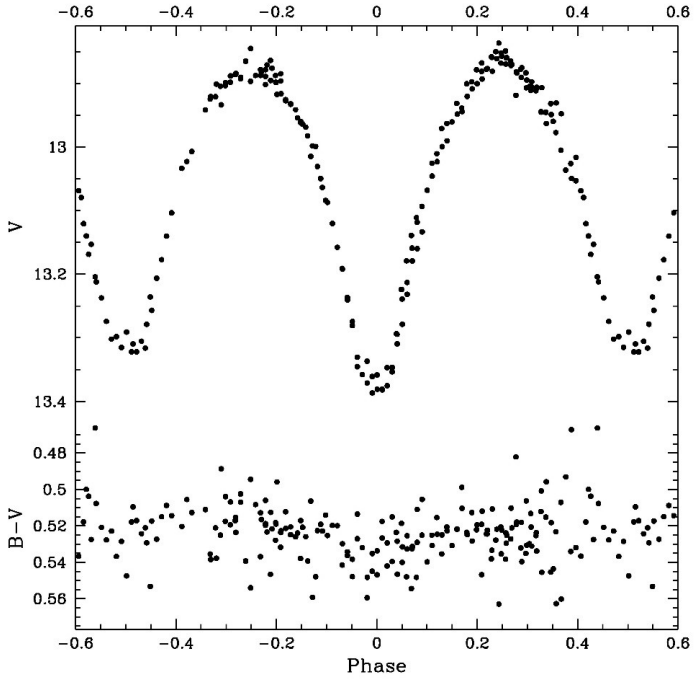
B filter



R filter

Surface Temperature

- Analysis of B-V plot and residuals (pictured right)
- $(B-V)-E(B-V)=(B-V)_0$ (1)
  - $(B\text{-}V)_0$: intrinsic color
  - (B-V): observed color
- $E(B-V)=\frac{A_V}{R}$ (2)
  - A_V: Exinction, drop in brightness from dust. (E. Schlafly 2011)
  - R = 3.1
- Use E(B-V) to find temperature from P. Flower 1996



Times of minima and O-C

Minimum	HJD	E	E_{round}	O-C
Epoch (1st primary)	2457288.8089776 ± 0.00023562	0	0	0 ± 0.00023562
(1st secondary)	2457287.7147415 ± 0.00021880	-2.497	-2.5	0.001236 ± 0.00033695
(2nd primary)	2457313.7843660 ± 0.00024087	56.997	57	-0.001385 ± 0.000321544

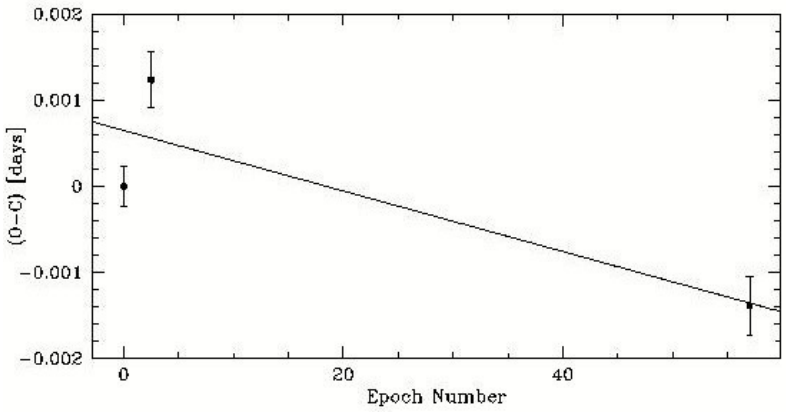


Table Key

- HJD: Heliocentric Julian Date of minimum
- E: # of orbits since Epoch
- E_{round}: Rounded E, to the nearest whole/half orbit
- O-C: Observed minus calculated minimum ($E-E_{round}$)

System Information

Parameter	Symbol [unit]	Value
Period	P [days]	0.43819 ± 0.000706
Epoch	T_0 [HJD]	$2457288.8089776 \pm 0.00023562$
Surface temperature	T_{eff} [K]	6440 ± 290
Individual stellar mass (estimate)†	M [$M_\odot$]	1.309 ± 0.021
Indv. stellar radius (estimate)†	R [$R_\odot$]	1.382 ± 0.019

†These estimates assume the system is a main sequence star, which isn't the case, so they are estimates. (Harmanec 1988)

Future

- Finish up NSVS 3792718
  - Spectroscopy
  - Paper
- Continue work on NSVS 2854398
  - Finish PHOEBE modelling
  - Calculations

References

- Astronomy and Astrophysics, volume 355, L27-30 (2000/3-2)
- E. Schlafly, 2011, ApJ, 737, 103S
- Fitzgerald, M. P. 1970, A&A, 4, 234
- Flower, P. J. 1996, ApJ, 469, 355
- Harmanec, P. 1988, Bulletin of the Astronomical Institutes of Czechoslovakia, 39, 329
- Vanmunster, T. Light Curve and Period Analysis Software, PERANSO. CBA Belgium Observatory 2011

Questions