An Unusual Brightening of the Eclipsing Binary RZ Cassiopeiae

Wayne M. Lowder*
511 Grasslands Road, Valhalla, NY 10595

Abstract The eclipsing binary RZ Cassiopeiae showed an unusual brightening between JD 2450415 and 2450490. I discuss the possible meaning of this brightening, and suggest further monitoring of this fascinating star.

1. Introduction

The bright eclipsing variable RZ Cas is well suited to binocular observation by amateurs, exhibiting a range of 6.2 to 7.7 (visual) and a period of 1.195 days. In a recent review paper, Narusawa *et al.* (1994) summarized available information on its behavior. The long-term O–C diagram indicates complex period variations. The brightness of the system was found to be nearly constant outside of eclipses, but the light curves through eclipse have shown significant instabilities. The descent and ascent are sometimes not symmetrical, and the minima are sometimes flat. Olson (1982) included RZ Cas in a list of five semi-detached eclipsing binaries showing photometric disturbances that he interpreted as indicating the presence of an accretion disk and/or hot spot and significant mass transfer. In addition, peculiarities in the radial velocity curve and variations in the photon flux from x-ray to radio wavelengths have been observed. A definitive interpretation of all these anomalies has yet to be made.

2. Observations

Since 1986, the author has made nearly 2,000 visual observations of RZ Cas at all phases of its light curve. Prior to JD 2450415 (November 27, 1996), the star was observed at maximum between 6.1 and 6.4, with some indication that small-amplitude variations were taking place. During eclipses, the star faded to 7.7, consistent with the range published in the *General Catalogue of Variable Stars* (GCVS, Kholopov *et al.* 1985), and asymmetries in the descent and ascent were sometimes noted. However, between JD 2450415 and 2450490, the star exhibited the unusual behavior shown in Figure 1. The uncertainty associated with the data points, many of which combine several observations, is estimated to be less than 0.1 magnitude. On JD 2450415, the system brightened from 6.2 to 5.7 in less than two hours and then faded to 6.15 over several days. There followed a more gradual rise of at least 0.2 magnitude, lasting until about JD 2450490. Observations of six eclipses during this time interval (JD 2450443.5, 2450449.5, 2450455.5, 2450461.5, 2450474.6, and 2450486.6) all showed normal minima of 7.7, with O–C = +0.026

*deceased January 31, 2003

day relative to the GCVS elements. Since JD 2450490, the behavior of the system has been as it was prior to JD 2450415.

No similar brightenings have been noted in any of the approximately 25 bright eclipsing binaries observed in a similar manner, including three on the list of "active" stars given by Olson (1982), i.e., U Cep, U CrB, and U Sge. However, mention should be made of the anomalous fadings of EI Cep outside of eclipse noted by the author (Lowder 1986, 1989).

RZ Cas is clearly a fascinating and complex system, possibly quite important astrophysically. Narusawa *et al.* (1994) have shown that the primary eclipses are likely to be partial ones. If so, the brightening reported here can be interpreted as a major mass transfer event, producing a highly luminous hot spot on the surface of the primary component that was eclipsed during primary minima. However, much more data are needed to clarify the behavior of this system. Intensive monitoring, particularly using photoelectric techniques, is highly desirable for all phases of its light curve. Observations brighter than 6.1 should be reported immediately to AAVSO Headquarters.

References

Kholopov, P. N., *et al.* 1985, *General Catalogue of Variable Stars*, 4th ed., Moscow.
Lowder, W. M. 1986, *J. Amer. Assoc. Var. Star Obs.*, **15**, 279.
Lowder, W. M. 1989, *J. Amer. Assoc. Var. Star Obs.*, **18**, 116.
Narusawa, S., Nakamura, Y., and Yamasaki, A. 1994, *Astron. J.*, **107**, 1141.
Olson, E. C. 1982, *Astrophys. J.*, **259**, 702.

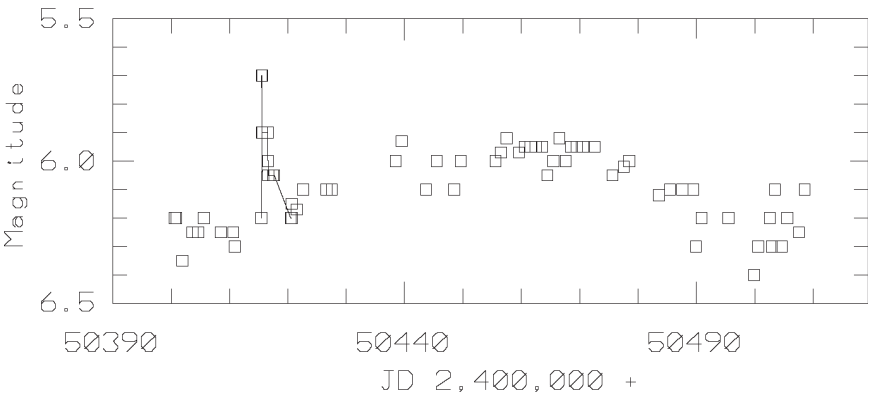

Figure 1. Visual data from the author for RZ Cas.