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# PHOTOELECTRIC OBSERVATIONS OF THE ALGOL-TYPE BINARY STAR RZ Oph

RZ Oph ( BD +7°3832 ) is a long period ( P=262 days ) Algol-type binary star. Its components have been classified as F5Ib + K5Ib ( Knee et al. 1986 ). Baldwin ( 1978 ) showed that the observed hydrogen emission lines originate in a flattened disk surrounding the F component and derived a model of the system with component masses of about 3.5 and 1.3 solar masses for the primary and secondary, respectively ( while assuming the system inclination close to 90 degrees ). The most controversial was his conclusion that the secondary component did not fill its critical Roche lobe. An alternative model, also on the basis of Baldwin observations, was worked out by Smak (1981) who assumed semidetached configuration of the system which led to i = 75. During the campaign suggested by Smak in 1981 several investigators obtained photometric observations of RZ Oph ( Papousek and Vetesnik 1982, van Paradijs et al. 1982, Forbes and Scarfe 1984, Knee et al. 1986 ) The most recent model of RZ Oph was worked out by Knee et al. from their photometric and spectroscopic observations. They obtained a new radial velocity curve solution and derived the mass ratio of the system to be about 0.12. Their solution also supports the model with the secondary star being inside its critical Roche lobe. Olson (1987) summarized his efforts to obtain a complete uvbyI light curve of RZ Oph. He estimated the disk parameters by analyzing the eclipses of the F component by the disk and found the disk to be very large, filling or even overflowing the Roche lobe of the gainer. The disk temperature runs from 5600K to about 4400K at the edge of the disk. The light curve published by Olson is the most complete ever obtained but it is based on observations collected from 1981 to 1986 so the scatter due to long-term disk variations is very large. Since the light curve outside the eclipses should provide some information about the secondary star I decided to reobserve RZ Oph.In order to minimize the intrinsic variations of the light curve due to disc variations my attempt was to get a complete light curve of the system in the shortest possible time which for RZ Oph means one observing season. All observations were made with 0.6 m Cassegrain telescope equipped with a double-beam photometer ( Szymanski and Udalski 1989 ) at the Mt.Suhora observatory, using a set of B and V filters close to the UBV Johnson-Morgan system. BD +6 3917 was used as a comparison star. Observations begun in September 1988 in order to cover the primary minimum which was predicted in October 1988 and were continued throughout 1989 to collect a complete light curve. Observations obtained in 1988 are presented in Fig. 1a and 1b, those collected in 1989 in Fig. 2a and 2b. The time of primary minimum determined from the observations made in 1988 is:

$$\text{Min I} = \text{JDhel} \quad 2447442.70 \pm 0.5$$

As one can see, in 1989 it was possible to obtain almost complete light curve of RZ Oph. Unfortunately, it is not possible to combine the observations made in 1988 and 1989 due to different depths of the primary minimum, observed in both filters ( see Fig. 1 and 2 ). I have found no instrumental reasons which could account for these differences. Similar effect was reported by Olson and Hickey ( 1983 ). They found that the system observed in 1982 was dimmed by 0.03 to 0.1 magnitude in comparison with observations obtained by Baldwin, and it returned to the previous brightness level in only one orbital cycle.The light curve of RZ Oph exhibits light variations from night to night, but the most striking feature of the light curve, particularly if one compares it with the light curve of KU Cyg, another Algol-type binary with similar components F4I + K5III ( Olson 1988 ), is the fact that the primary minimum is rather shallow. It might suggest that part of light constant with phase is present during all the period, also in the primary minimum. This would be either a third light in the system or, what seems to be more plausible, a considerable part of the disk light is still visible in the primary minimum. In 1989 the dips near the primary minimum were not as visible as in earlier observations reported by Olson, which implies that disk effects were less prominent in 1989. Spectroscopic observations made in 1989 (Olson 1989) show the double-peaked structure of

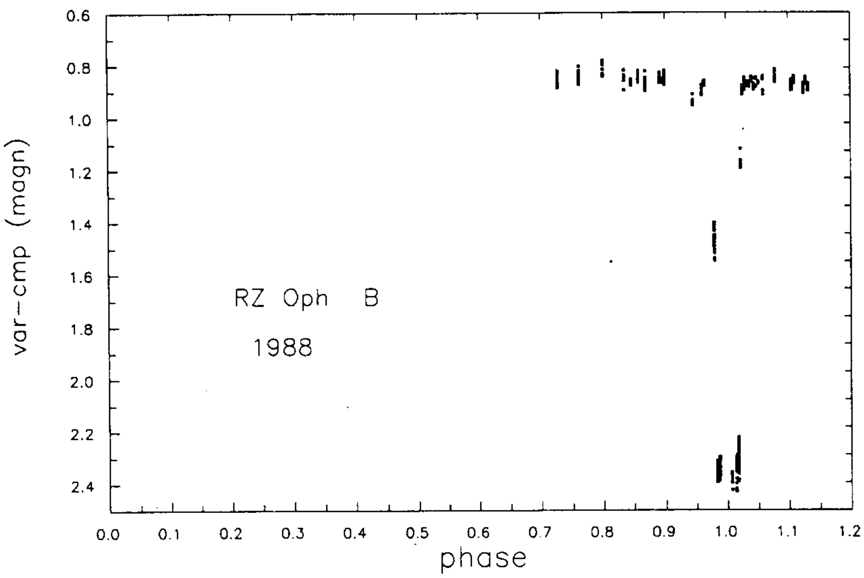


Figure 1a Observations of RZ Oph in B filter obtained in 1988.

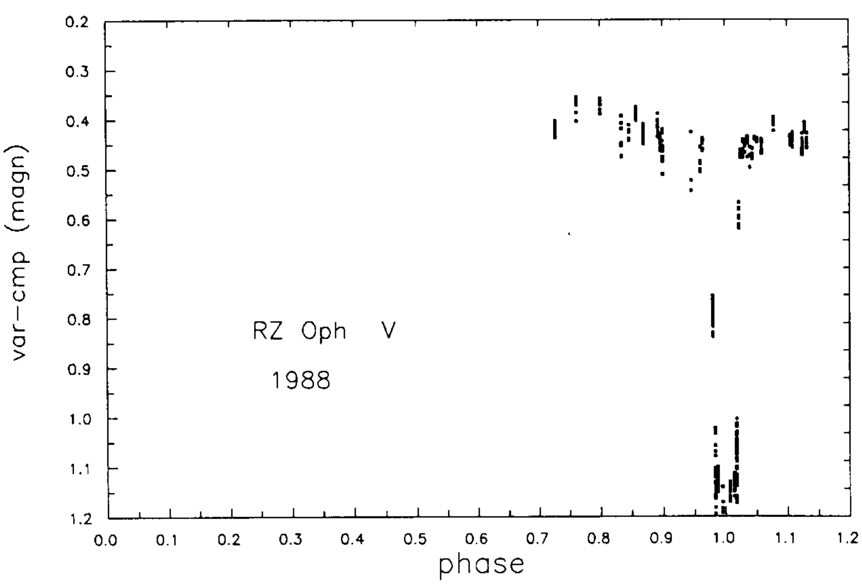


Figure 1b Observations of RZ Oph in V filter obtained in 1988.

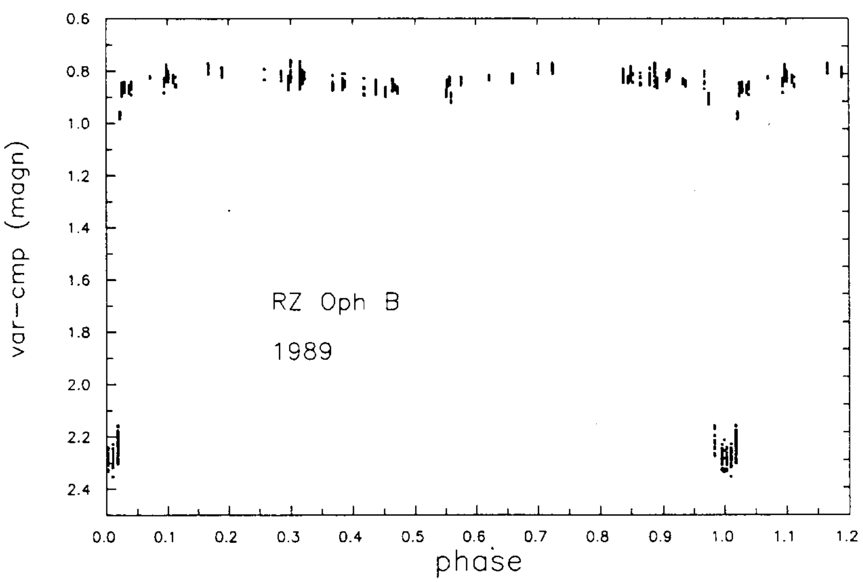


Figure 2a  Observations of RZ Oph in B filter obtained in 1989.

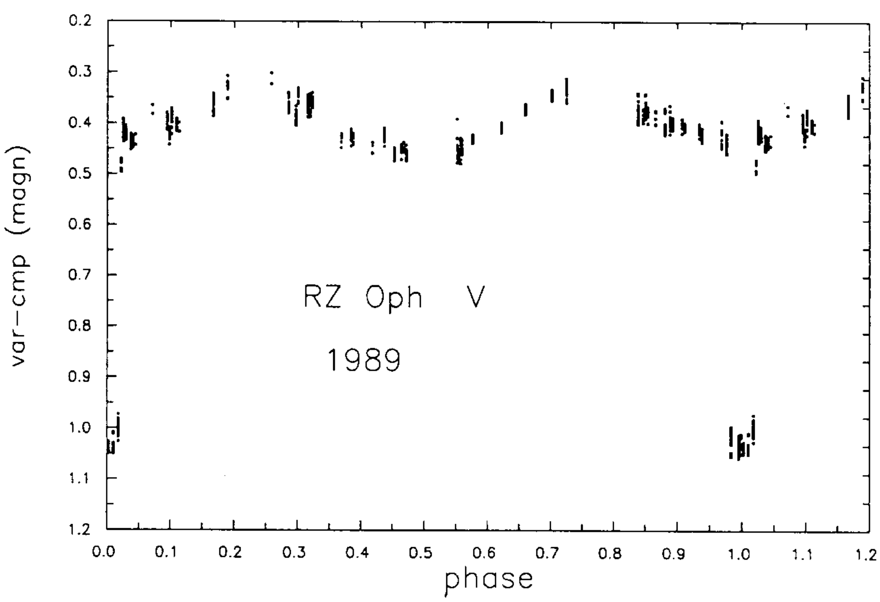


Figure 2b  Observations of RZ Oph in V filter obtained in 1989.

hydrogen emission lines, evidently arising in a flattened disk around the primary component. The ellipticity effect is clearly visible in both filters what suggests that the secondary star can not be so deep inside its Roche lobe as it was obtained in the model of Knee et al., but rather fills or almost fills its critical Roche. This would also agree with conclusions obtained from the IUE observations reported by Plavec and Scarfe (1989) implying that the secondary must be distorted. A complete analysis together with parameters of a new model of RZ Oph obtained on the basis of the presented observations and those reported by Olson will be published in Acta Astronomica.

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