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Photoelectric photometry of eclipses of the symbiotic binary EG Andromedae

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Two recent photoelectric minima of the eclipsing symbiotic binary EG Andromedae taken at the observatories Scalnaté Pleso and Crimea in the 1985-1987 period are compared. Some comments about the orbital period and circumstellar matter in the system are given.

Key words: symbiotic stars, individual, EG And.

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1. Introduction

EG Andromedae is a symbiotic binary system. The cool component is a M3 III star, the hot component is a subdwarf of temperature 60250K and luminosity 1,45 $L_\odot$ (B o y a r c h u k, 1985). S m i t h (1980) found an orbital period of 470 days from variations of H_α emission line. UV spectroscopy, taken by O l i v e r s e n et al. (1985) argues in favour of the existence of a rapidly rotating disk surrounding the hot component. They explained the behaviour of the emission lines as an indication that the hot component with surrounding nebula suffers a partial eclipse by the cool M giant. The eclipsing nature of the system was confirmed photometrically by C h o c h o l et al. (1986), who determined the following ephemeris:

$$JD_{min} = 2\,446\,336{,}7 + 474^d E. \quad (1)$$

The period 474 days was estimated by a comparison of line profiles of Balmer lines on spectra, taken in 1967-1969 and 1982-1984. The light curve of the eclipsing binary can be influenced by semiregular fluctuations discovered by J a r z e b o w s k i (1964) with the mean period of 40 days and amplitude of $\approx 0{,}1$ mag. The fluctuations were larger at λ420 nm than at λ560 nm, suggesting a variable blue component. The variability was confirmed by T e m p e s t i (1977) from photoelectric observations, taken in 1968-1970. The amplitude of semiregular fluctuations reached 0,27 mag. in Oct. 1969 - Feb. 1970.

Observational material and results

The UBV photometry of EG And was obtained in the years 1985-1987 by the single channel photoelectric photometer, installed in the Cassegrain focus of the 0,6 m telescope at the Skalnaté Pleso (SP) Observatory. The measurements were carried out with a 10 seconds integration time and reduced to the international UBV system. The star HD 3914 (V=7,0, B-V=0,44) was used as a comparison star. The differential photometry $\Delta m = m(EG\ And) - m(HD\ 3914)$ is presented in Table 1

Table 1

Photoelectric Observations of EG And

JD_{hel} 2446000+	ΔV	ΔB	ΔU±σ	Number of observations	Observatory
281,528	0,131	1,598	3,202±0,010	6	SP
281,555	0,132	1,599	3,218±0,007	7	SP
282,547	0,137	1,606	3,230±0,009	7	SP
301,505	0,154	1,634	3,254±0,006	6	SP
332,405	0,166	—	3,385±0,002	175	Crimea
341,542	0,222	1,700	3,403±0,006	11	SP
341,567	0,216	1,704	3,404±0,006	12	SP
342,352	0,216	—	3,459±0,005	8	Crimea
342,604	0,209	1,682	3,379±0,009	16	SP
344,328	0,186	—	3,399±0,006	8	Crimea
344,612	0,201	1,675	3,369±0,011	8	SP
344,628	0,207	1,669	3,382±0,008	8	SP
346,363	0,222	—	3,466±0,005	8	Crimea
346,619	0,218	1,687	3,378±0,005	12	SP
368,360	0,207	1,684	3,279±0,17	2	SP
368,451	0,202	1,680	3,292±0,009	12	SP
422,348	0,162	1,628	3,124±0,004	6	SP
422,373	0,170	1,629	3,088±0,004	5	SP
422,397	0,161	1,612	3,083±0,017	7	SP
430,339	0,220	1,694	3,074±0,006	12	SP
431,373	0,219	1,682	3,066±0,011	12	SP
431,403	0,210	1,668	3,054±0,005	8	SP
436,334	0,189	1,672	3,101±0,008	7	SP
468,302	0,165	1,577	3,025±0,020	4	SP
484,270	0,080	1,510	2,947±0,014	11	SP
486,262	0,082	1,510	2,881±0,008	16	SP
685,594	0,022	1,470	2,904±0,006	16	SP
693,590	0,093	1,532	2,947±0,004	30	SP
714,617	0,025	1,447	2,672±0,008	15	SP
718,538	0,062	1,514	2,823±0,010	12	SP
720,523	0,072	1,519	2,940±0,050	7	SP
733,478	0,228	1,696	2,850±0,007	15	SP
738,610	0,165	1,609	2,657±0,007	10	SP
748,442	0,130	1,614	2,808±0,014	13	SP
749,559	0,171	1,586	2,785±0,017	25	SP
750,487	0,142	1,619	2,875±0,009	28	SP
756,518	0,289	1,774	3,112±0,006	15	SP
775,509	0,199	1,643	3,023±0,005	13	SP
816,392	0,331	1,814	3,253±0,006	9	SP
823,371	0,268	1,743	3,322±0,005	6	SP
830,345	0,108	1,590	3,256±0,007	6	SP
831,360	0,110	1,560	3,232±0,008	7	SP
832,357	0,221	1,575	3,214±0,004	10	SP
851,281	0,303	1,789	3,276±0,005	22	SP
853,275	0,262	1,740	3,243±0,008	14	SP

and Fig. 1. Standard errors are given only for ΔU observations. A few observations in 1985 were obtained with the five channel photometer-polarimeter of the 1,25 m telescope AZT 11 at the Crimean Observatory. The star HD 4143 was used as a comparison star. The observations were reduced to the above mentioned dif-

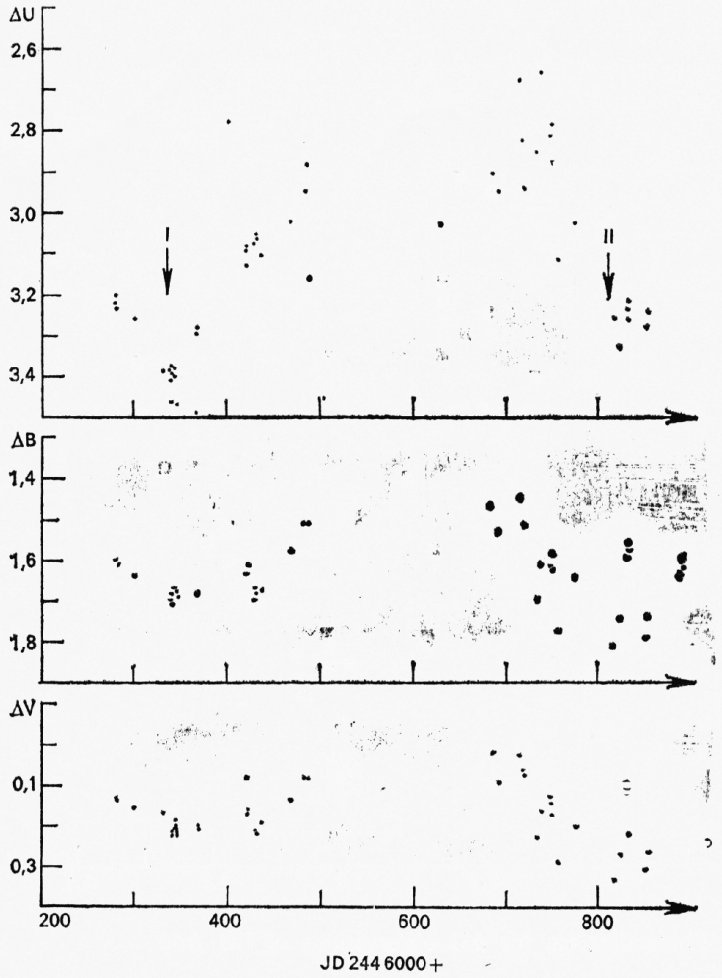

Fig. 1. Differential UBV photometry of EG And

ferential photometry using the observations of HD 4143 at the SP Observatory Arrows in Fig. 1 indicate JD_{min} according to ephemeris (1).

As seen on Fig. 1 there are remarkable differences between the minima in 1985 (minimum I) and 1986-1987 (minimum II): 1) The descending branch of minimum II is steeper than the descending branch of minimum I, especially in filter B and V.2) The depths of the minima differ and depend on the colour. 3) The observations in minimum II show much larger fluctuations than those in minimum I (standard errors are the same for both sets of observations).

These changes obviously reflect activity of the hot component and can be caused by highly variable circumstellar plasma in the system.

The observed centre of minimum II seems to be shifted in comparison with computed one according to ephemeris (1). The arrow is located on the descending

branch of minimum II so the orbital period could be even larger than 474 days, approximately 480 days. We used this period to draw the phase diagram for ΔU observations (Fig. 2). The minima are distinguished by different symbols. The descending branch of the minimum is steeper than the ascending branch. It could be caused by elliptical orbit.

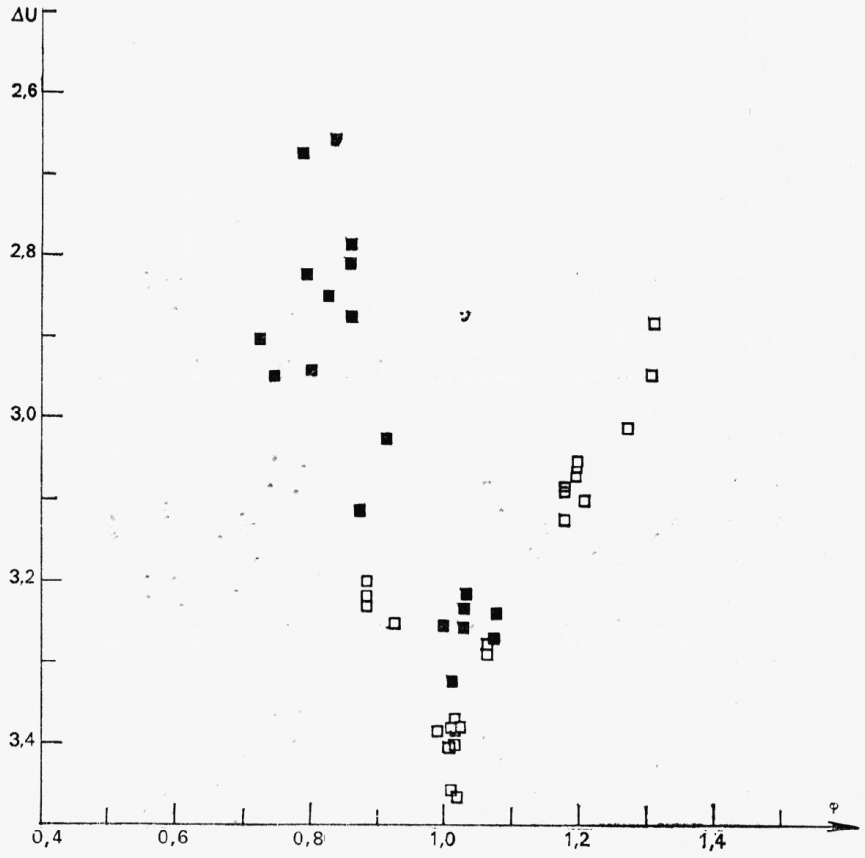

Fig. 2. Phase diagram for ΔU observations of EG And

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