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PHOTOELECTRIC UBV OBSERVATIONS OF EG ANDROMEDAE

One of the patterns of the photometric variability of symbiotic binary systems is that, caused by the orbital motion. Orbital variability is observed in the EG And system, consisting of an M2 III giant and a hot subdwarf. The period is about 480^d and UBV measurements have been obtained practically at all orbital phases. According to the observations during the last years (Hric et al. 1991, Hric et al. 1993, 1994, Skopal et al. 1995) two minima are present in the orbital photometric variations — a primary, when the giant is towards the observer and a secondary one, remote from the primary approximately at the half orbital period. The data scattering is a sign of light fluctuations, which become most apparent in the area of the secondary minimum in U band (Skopal et al. 1995).

Two different models are proposed for an explanation of the variations. According to the first of them, a reflection effect has place in this system and the primary minimum occurs when the unheated part of the giant's atmosphere is oriented towards the observer (Munari 1993). The hot component of EG And, however, has a low luminosity (Murset et al. 1991) which is insufficient (see Belyakina 1970) for the heating of the giant. Moreover, the Lyman luminosity is spent entirely for ionization of a portion of the wind of the giant and according to the approach of Taylor and Seaquist (1984) the boundary between the ionized and the neutral portions is far away from its photosphere. Skopal (1995) has critically considered the possibility for reflection effect and has shown that the light variations of many symbiotic systems with low luminosity hot components require an explanation of principle.

According to the second model (Skopal et al. 1993, Skopal 1995) a common envelope, having geometry of the equipotential surface containing the Lagrangian point L_2, is responsible for the existence of the two minima in the orbital light curve. In this model, however, the giant's continuum, which is dominant in the BV region (Kenyon 1986), is not taken into account. This model meets, also, the next difficulty. In accordance with Kenyon's (1986) colour – colour diagnostic the UV continuum of EG And does not indicate the presence of an optically thick accretion disk, such as that formed as a result of mass transfer via L_1. That is why the view that the giant in this system does not fill its Roche lobe and loses mass by means of stellar wind is widely accepted (Oliversen et al. 1985, Vogel 1991, Vogel et al. 1992, Vogel 1993, Munari 1993, Tomov 1995). The existence of the envelope described is not compatible with the existence of the giant's wind, expected in accordance with the theory of stellar evolution. Having in mind the difficulties of the interpretation as well as the light fluctuations pointed we consider that a large amount of observational data is required for comparison with the future models.

Table 1. Differential photometry of EG And against HD 3914, in magnitudes

Julian day	Δ V	Δ B	Δ U		Julian day	Δ V	Δ B	Δ U
2448582.354	0.07	1.25	2.79		2449971.395	0.13	1.34	2.70
2448609.229	0.02	1.26	2.77		2449973.390	0.14	1.37	2.87
2448636.260	0.08	1.26	2.86		2449988.450	0.19	1.45	3.06
2449046.240	0.11	—	—		2449993.401	0.12	1.37	3.00
2449173.561	0.11	1.33	3.11		2449996.393	0.11	1.34	2.92
2449178.572	0.14	1.37	3.19		2450012.291	0.16	1.40	3.02
2449248.454	0.16	1.41	3.32		2450024.301	0.09	1.29	2.95
2449340.196	0.10	1.32	3.12		2450049.326	0.09	1.31	2.95
2449573.512	0.07	1.26	2.84		2450092.210	0.05	1.27	2.96
2449598.500	0.12	1.34	2.81					

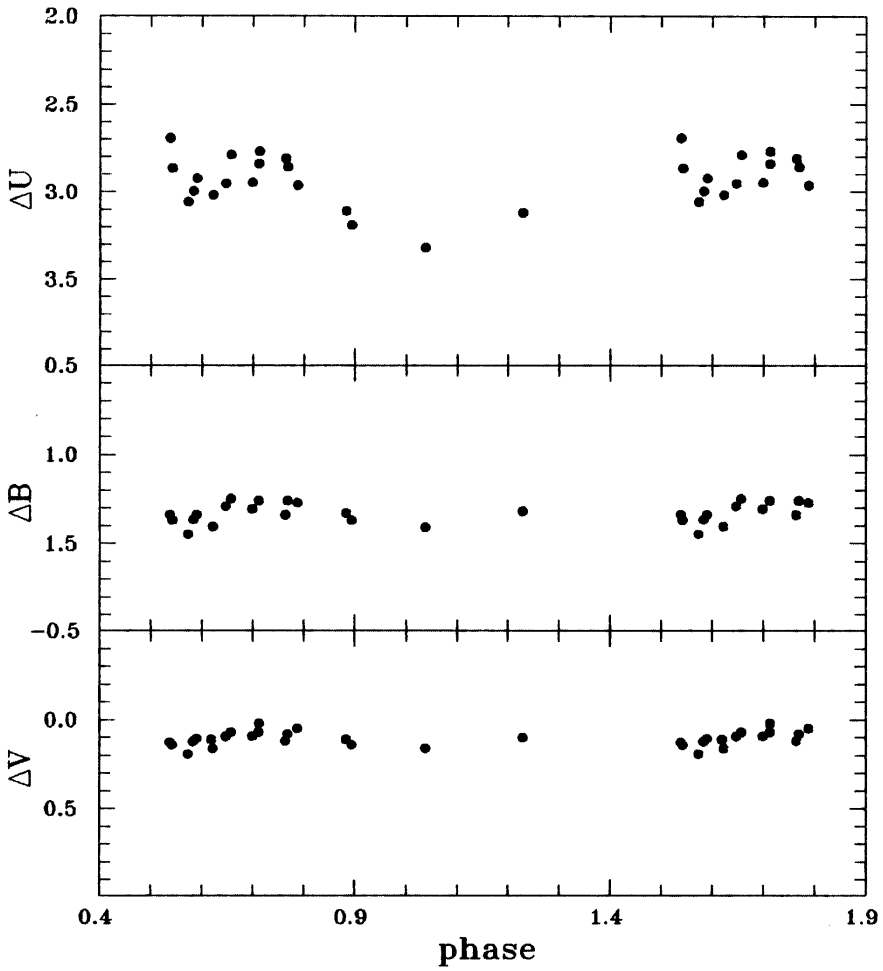

Figure 1. Orbital UBV light variations of the EG And system

Here we present nineteen photoelectric estimates in the three colour UBV system, obtained after November 1991. They were carried out with a single channel photoelectric photometer, mounted at the Cassegrain focus of the 0.6 m telescope of the National Astronomical Observatory "Rozhen". The data on JD 2450012.291 have been taken using the similar telescope and equipment of the Astronomical Observatory Belogradtchik. The star HD 3914 (V = 7.0, B − V = 0.44) has been used as the comparison star. The data derived has been processed by means of a photoelectric data software (Kirov et al., 1991), using the reduction coefficients (Zamanov, private communication) for both atmospheric extinction and standard UBV system. The differential photometry $\Delta m = m(\mathrm{EG\,And}) - m(\mathrm{HD\,3914})$ in the three colours is presented in Table 1.

Our photometric data indicate orbital variations (Figure 1). The phases have been reckoned using the elements $\mathrm{JD_{min}} = 2446336.7 + 482.2 \times \mathrm{E}$ where the zero phase is at the epoch of the primary minimum (Skopal et al., 1993). The kind of the variations detected as well as the amplitudes in the different bands are in agreement with the results of the other observers (Hric et al. 1991, 1993, 1994, Skopal et al. 1992, 1995), although the phase range of the secondary minimum has not well been covered.

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