

## Preliminary Model of the Close Binary System GSC 4383.0384 = ES UMa

### Generalized Data Systems management team (G.D.S.)

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The variability of ES UMa was found on the basis of visual observations carried out by J. Kysely, and K. Hornoch and confirmed by D. Hanžl, in 1993 [1]. The star is listed on the Guide Star Catalogue with the number 4383.0384 and the following equatorial coordinates:

$$\text{R.A.} = 9^{\text{h}} 54^{\text{m}} 28^{\text{s}}.9 \quad \text{DEC.} = +69^{\circ} 13' 22'' \text{ (2000.0)}$$

On the basis of many photoelectrical observations, Z. Mikulášek and D. Hanžl [2] published the first light elements for ES UMa, suggesting a period of 0.528904 days, a mean B-V index of  $0.482 \pm 0.004$  mag. and variability of W UMa type. The star was catalogued as ES UMa in the 72nd name-list of variable stars [3] with a variation between 10.99 - 11.38 mag (V).

Using the normal points coming from the V photoelectrical measurements carried out by Mikulášek et al. [4], a preliminary model for ES UMa was computed making use of the Binary Maker 2.0 [5] computer code.

A spectral type F7 and a mean surface temperature  $T_1 = 6320$  K for the convective model, gravity exponent  $g_1 = g_2 = 0.32$ , bolometric albedos  $A_1 = A_2 = 0.5$  and limb darkening coefficients  $x_1 = x_2 = 0.6$  were assumed on the basis of the observed (B-V) on the ground of the tables of Browsers et al. adopted from Binary Maker. A preliminary solution was obtained with the SNIFFER code [6] and served as the input set of parameters to refine with Binary Maker. The non-spot model was not able to represent the features of ES UMa's light curve satisfactory, therefore we were forced to add a dark spot on the surface of the secondary component.

The best fit solution is shown in table 1, while the spot parameters are listed in table 2. In figure 1 we can see the synthetic light curve computed with Binary Maker, plotted among to the observed data-points. In figure 2 we have shown the system configuration at the phase 0.25.

**Table 1.** Orbital parameters for ES UMa

$q = 0.267 \pm 0.012$
$f = 0.167 \pm 0.024$
$i = 72^{\circ}.5 \pm 0.3$
$T_2/T_1 = 0.918$
Mean $R_1 = 0.505 \pm 0.007$
Mean $R_2 = 0.280 \pm 0.004$
$L_1 = 0.819 \pm 0.010$
$L_2 = 0.181 \pm 0.010$

**Table 2.** Spot Parameters

Co-Latitude $90^{\circ}$
Longitude $291^{\circ}$
Spot Radius $12^{\circ}$
Temp. Factor 0.9

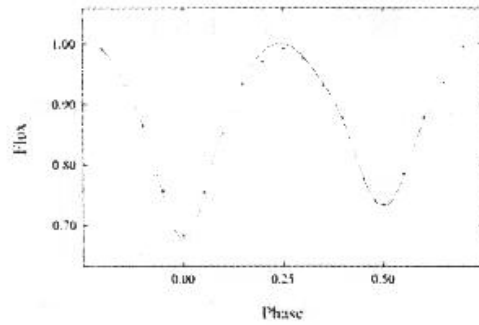


Figure 1. Synthetic light curve plotted among the observed data-points for ES UMA.

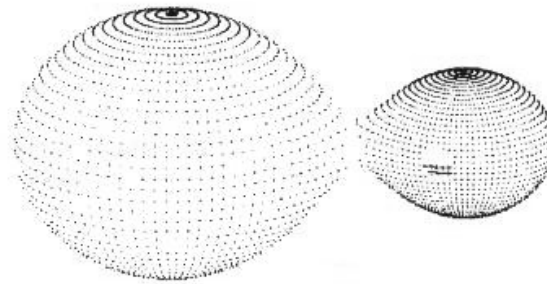


Figure 2. System configuration at the phase 0.25

## References

- [1] - Hanžl D., Kyselý J., Hornoch K., 1993, IBVS 3879
- [2] - Mikulášek Z., Hanžl D., 1993, IBVS 3914
- [3] - Kazarovets E. V., Samus N. N., 1995, IBVS 4140
- [4] - Mikulášek Z., Hanžl D., Hornoch K., 1995, Contributions of the Nicholas Copernicus Observatory and Planetarium in Brno No. 31
- [5] - Bradstreet D. H., 1993, Binary Maker 2.0 User Manual, Contact Software
- [6] - Gaspari A., 1996, private communication