THE OPTICAL LIGHT CURVE OF BE UMA

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BE UMa is a classical example of an eclipsing binary system with a strong reflection effect (Margon & Downes, 1981; Ando *et al.*, 1982; Ferguson *et al.*, 1987). A hot star looks like the central star of a planetary nebula, and illuminates the faced-on surface of the cool component. However, no planetary nebula around BE UMa was discovered. The hot star has a temperature of 1-2$\times10^5 K$, so that spectral maximum of its proper radiation falls in the far ultraviolet thus contributing unsignificantly to the optical brightness of the system. On the other hand, a hot spot on the surface of the cooler component produced by the reflection effect has a central temperature of about $1.5\times10^4 K$ giving maximal radiation output in the near ultraviolet. Changing of the visible area of the spot leads to sinusoidal brightness variations of the whole system.

We measured the star on 544 plates obtained at Crimean laboratory of Sternberg Astronomical Institute with the 40cm astrograph and the 50cm Maksutov telescope. In addition, we performed 121 *UBV* electrophotometrical observations of BE UMa at the 60cm and 125cm reflectors.

The B-observations were reduced jointly with Harvard photographic observations (Ferguson *et al.*, 1987). As result, a centennial series of observations were obtained to derive an improved ephemeris:

$$HJD_{\min} = 47628.5381 + 2.^{d}2911667\,E$$

The light curve folded with new elements is shown in Fig.1. No significant orbital period changes were noticed. The light curve amplitude is different in different photometric systems: $\Delta U = 5^m$, $\Delta V = 2^m$. This difference

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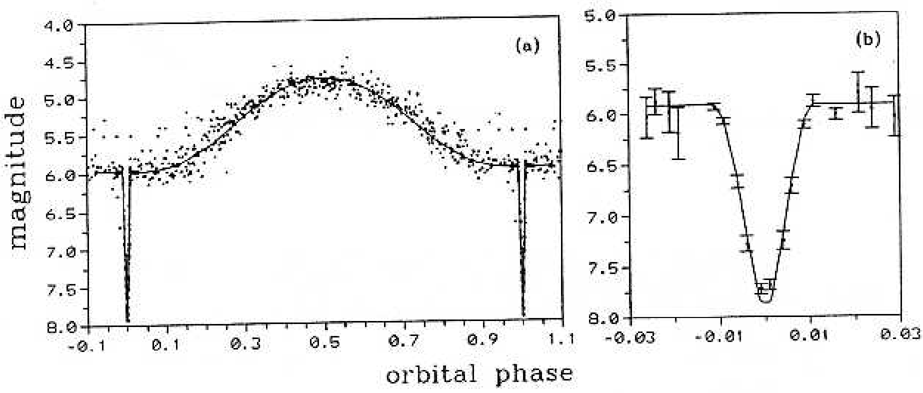

Figure 1. The observed and synthesized *B*-light curves of BE UMa: (a) total; (b) only in the eclipse.

enabled us to determine temperatures of both components of the binary. Similar results were obtained by other authors (e.g. Ando *et al.* (1982)).

Using light curve synthesis method, we found some parameters of BE UMa – orbital inclination i, radius of the primary R_{wd} and of the cool star R_o, and temperatures of both components T_{wd}, T_o:

i	$82.^{\circ}9 \pm 0.^{\circ}8$
R_{wd}	$1.18 \pm 0.10 R_{\odot}$
T_{wd}	$5.40 \pm 0.45 \times 10^3 K$
R_o	$0.090 \pm 0.007 R_{\odot}$
T_o	$1.25 \pm 0.13 \times 10^5 K$

A few stars are known to show similar characteristics. However, they all have lower temperatures of the degenerate component. For example, temperature of the nucleus of V477 Lyr and of UU Sge is $4 \times 10^4 K$ and $5 \times 10^4 K$, respectively.

A separation between the components of BE UMa was estimated from the third Kepler's law. The mass of the hot planetary nebula nucleus ranges from 0.6 to 1.2 $M_{\odot}$. If the cool component is a G-K star, then its mass is 0.6-$0.8 M_{\odot}$and the components are separated by $6.0 \pm 0.5 \times 10^6 km$ ($8.7 \pm 0.7 R_{\odot}$).

References

Ando H., Okazaki A., Nishimura Sh. //*PASP*, 1982, **34**, 141.
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