COMMISSION 27 OF THE I. A. U.
INFORMATION BULLETIN ON VARIABLE STARS

Number 1944

Konkoly Observatory
Budapest
1981 March 31

HU ISSN 0374-0676

THE SHOCK RADIATION EFFECT ON THE PULSATING VARIABLE STARS' LIGHT AND COLOUR CURVES

As is known several lines of spectroscopic evidence point to the existence of shock fronts in the atmospheres of pulsating variable stars. The correlation between the maximum width of the loop L_{U-B} in the U-B, B-V plane and strength of the hydrogen emission lines, which we revealed (Batyushkova and Erleksova, 1980), may be one more argument for the explanation of these peculiarities using the shock model. The calculation of shock radiation is essential for the radius determination by Wesselink's method. The task of removing of the excess radiation from the light and colour curves must be solved before the Wesselink's method may be used (Klimishin, 1972).

We have calculated the excess radiation from the shock in U,B,V-bands and the changes in colour indices $\Delta(U-B)$ and $\Delta(B-V)$ because of this shock. The propagation of the shock has been regarded in the atmosphere of W Vir type star with a velocity D=80km/sec, which is in accordance with the observable velocities on the level where $\tau = 0.1$ and $\rho = 2.5 \times 10^{-9} g/cm^3$. We have supposed that the atmosphere consists of pure hydrogen and the radiation is due to the free-bound and free-free transitions. The necessary values of electron concentration and temperature have been obtained from shock structure calculations by Whitney and Skalafuris' (1963) method. The numerical results indicate that the shock wave has no effect on the colour index B-V within $0^m.01$ and the relation between the amount of the V-band radiation and $\Delta(U-B)$ colour excess may be represented as

$$\Delta V = 0.66\Delta(U-B) \qquad (1)$$

that is different from Abt's result for RR Lyr (Abt, 1959).

Our results were applied to BL Her ($P=1^{d}.31$). The normal light curve was obtained by combination of Abt and Hardie's (1960) and also Gavrilova and Kiselyov's (1979) observations. Then ΔV was calculated and the light curve was corrected on the radiation from the shock (Fig.1) by using of the U-B, B-V diagram (Fig.2) and supposing that the relation (1) is performed on all phases of ascending branch of the light curve.

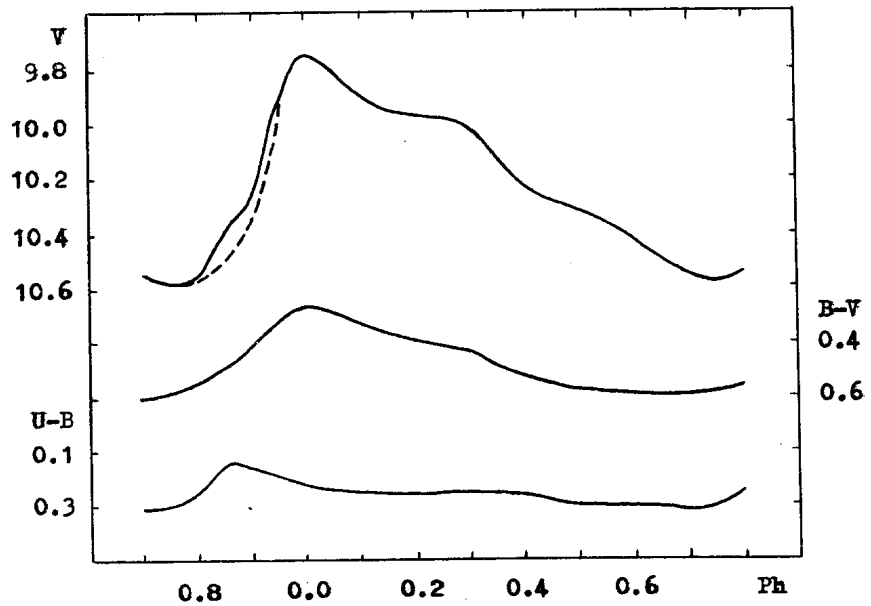

Figure 1. The normal V,B-V, U-B light and colour curves of BL Her. The minimum value of the colour index U-B exactly corresponds to the phase of the hump on the ascending branch of the light curve. The dashed line represents the light curve corrected on the shock radiation effect.

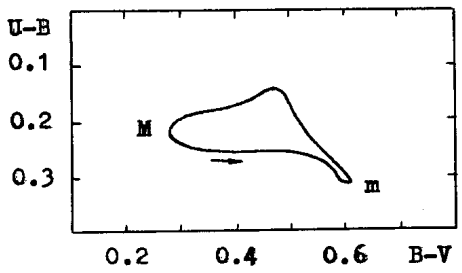

Figure 2. The observed colours of BL Her as a function of phase. The letters M and m indicate the phases of maximum and minimum light, respectively. The maximum width of the loop corresponds to the phase of a hump on the ascending branch. The arrow points the trend in which the loop is described.

Further on the radius was calculated by Wesselink's method. The radial velocity curve, which was presented by Abt and Hardie (1960), was used. Taking into account the phase lag between the light and radial velocity curves by Frolov's (1966) method, we have received $R=(4.99\pm0.18)\times10^6$km for 14 phase pairs instead of $R=(6.7\pm1.3)\times10^6$km with uncorrected light curve.

As is seen the removing of the shock radiation effect from the light and colour curves led us not only to a smaller mean radius, but it decreased significantly the mean relative error of its determination. We obtained the absolute magnitude of BL Her $M_V=-0^m.21$ according to our value of radius, and this is in full accord with the existing period-luminosity relations.

It is proposed to publish the results of the work in the Tajik Bulletin in more details.

The author would like to thank Professor I.A. Klimishin for continued encouragement and helpful discussion of the results obtained.

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