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THE VARIABLE STAR BD +41°2447

The variability of BD +41°2447 (R.A.$_{1950}$ = $13^h57^m03^s$, Decl.$_{1950}$ = +41°03!7) was discovered by chance in connection with photoelectric UBV observations of stars in the North Galactic Pole region (Oja, 1985) in March 1980.

The star was put on the observing programme of the 40 cm Cassegrain reflector of the Kvistaberg Observatory. The nearby F5 star BD +41°2450 was selected as comparison star (V = $8^m.495$, B-V = $0^m.461$, U-B = $-0^m.011$) and quite a number of observations were obtained in the autumn of 1980 and the winter and spring of 1981. The observations showed that the V magnitude varied between 9.5 and 10.0, while the colours remained almost constant at B-V = $0^m.30$, U-B = $0^m.00$. The magnitude changed considerably during a few hours, so the period was not likely to exceed a fraction of the day, but a conclusive result as to the length of the period could not be arrived at. More measurements were made in the springs of 1983 and 1987. Altogether 267 observations were obtained.

From the observations in three seasons altogether eleven more or less well-determined epochs of minimum could be derived. To these dates a linear relation

$$\text{Min.} = A + nxP \quad (n = \text{integer}) \qquad (1)$$

was adjusted by trial and error; this process was greatly facilitated by the existence of two well-determined minima on two consecutive nights in April 1987. A period of 0.258 73 days satisfied the data quite well, and a light-curve was constructed from all available observations. It was, however, obvious that different minima were different in shape; the double period was tried, the result being a much better fit. A period around $0^d.517\ 46$ thus seemed more probable. All data were now used with a period-searching programme (Oja, 1987); the search was made with 0.5x(B+V), and the resulting best period is

$$\text{Prim. min.} = 2\ 446\ 895.455 + nx0.517\ 459\ 7. \qquad (2)$$

Defining phase as the decimal part of (J.D. - 2 440 000)/P, the phase of

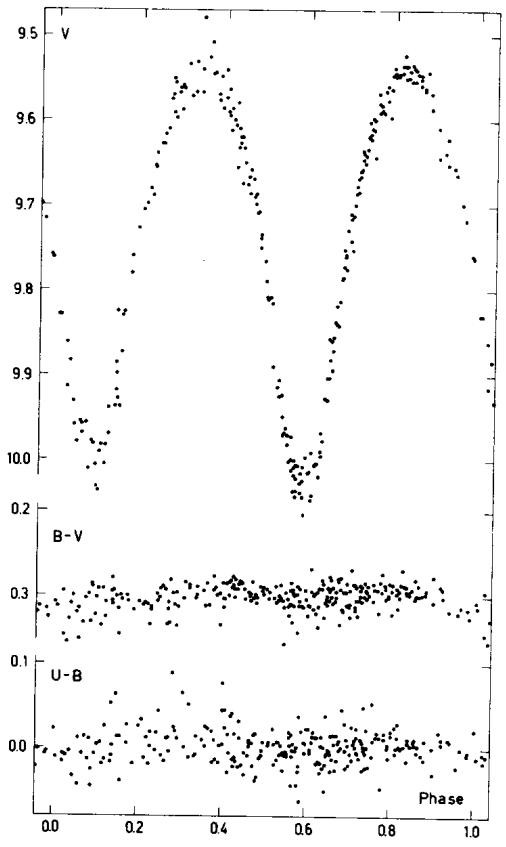

Figure 1. The light-curve of BD $+41^{\circ}2447$

primary minimum is 0.588 and that of secondary minimum 0.092. The primary minimum is only $0^{m}.02$ deeper than the secondary minimum and the phase difference between primary and secondary minima is very close to 0.5. A period half as long as the adopted value perhaps cannot be ruled out completely, although in that case the light-curve certainly is not constant. With the longer period the minimum dispersion resulting from the period-search corresponds to a mean error of $0^{m}.017$ in one determination of magnitude. This is slightly lower than the mean error of a magnitude determination of a field star in the North Galactic Pole region (Oja, 1985, Table I), a consequence of the differential character of the measurements. It does not leave very much room for a variation of the light-curve.

The light-curve is shown in Figure 1. It is obvious that the colours change very little. The star is slightly redder at minimum, though. During

a quarter of a period around primary minimum <B-V> = $0^m.302$, around secondary minimum <B-V> = $0^m.313$, around maxima <B-V> = $0^m.299$; <U-B> = $-0^m.002$ for all phases. The dispersion in U-B is quite large; This is probably due to the fact that many observations were made rather low in the sky, especially so in the autumn and early winter 1979-1980. The amplitude of the light variation is $0^m.5$. The individual observational data (more than 250 observations in each colour) have been deposited as file No. 163 in the archives of unpublished data of IAU Commission 27. The star is present on one of the objective prism plates taken for the survey of the North Galactic Pole region with the 100/135/300 cm Kvistaberg Schmidt telescope. The hydrogen and K line intensities in the Uppsala system (Ljunggren and Oja, 1961) are Hγ = 43, Hδ = 56, K = 57, corresponding to the spectral type F0 and the intrinsic colour $(B-V)_o = 0^m.27$. The K line is only insignificantly fainter than for "mean" stars; the values yield ΔS = 1 in the sense Sp(H) - Sp(K) (Preston, 1959). The high amplitude combined with the very small colour variation excludes pulsation as a cause of the light variation. Remain eclipses; indeed, the properties of BD $+41^\circ 2447$ fit very well into the definition of the EW eclipsing variables (Kholopov, 1985). The conclusion thus is that BD $+41^\circ 2447$ is a quite typical EW eclipsing variable.

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