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υ^1 Ori A - A NEW ECLIPSING BINARY IN THE TRAPEZIUM*

A UBV photometry of the eclipsing binary BM Ori = υ^1Ori B has been made during the 1973/74 season on La Silla (Chile), using a Rakoš area scanner (Rakoš 1970) attached to the ESO 50 cm reflector. The amplitude and the direction of the scans were chosen to include all four brighter Trapezium stars in order to use three of them as comparison stars for the variable. The daily means of the magnitude differences between the Trapezium stars show a rms scatter of $0^m.013$ in all three filters for A-C and $0^m.023$, $0^m.028$, and $0^m.034$ in ΔV, ΔB, and ΔU for D-C. The scatter is caused by systematic errors due to irregular slit motion, imperfections of the telescope, and nebular background. The rms scatter of the colour indices is considerably smaller because usually corresponding profiles were obtained without changing the telescope setting:

$\sigma(\Delta(B-V)) = 0^m.008$ for A-C and $0^m.011$ for D-C

$\sigma(\Delta(U-B)) = 0^m.008$ for A-C and $0^m.015$ for D-C.

Within the expected precision, the averages of the scanner observations do agree well with those obtained with normal photometers (Table 1). The observations labeled "60 cm Tel" were made in 1974 Nov. on La Silla using the excellent 60 cm reflector of the Astronomical Institute of the Ruhr-University Bochum with an 8 sec of arc diaphragm. No significant variation of the magnitude differences has been detected during the observing period of several months.

On 1973 Oct. 10/11, however, υ^1Ori A (= HD 37020, the preceding star) was about one magnitude fainter than usual. The change was very obvious to the direct view through the control eyepiece and from the CRT display of the intensity profile, since normally υ^1Ori A and D are almost equal in brightness. Although a constant phase in the minimum was suspected from the first reduction of the observations, from a new analysis a continuous light variation seems

*Based on observations made at the European Southern Observatory to be a little more probable (Fig.1). In Table 1 the V difference of $2\overset{m}{.}676$ corresponds only to the central part of the minimum, whereas the colour indices are averages of all observations of that night. The changes in the colour indices are only marginal, they do not exceed two times the mean error of one daily mean and could be due to systematic errors.

On 1974 Nov. 07/08 the very last part of another minimum was detected visually and confirmed with the scanner on La Silla. As the star was normal the night before, the total duration of the eclipse must have been less than one day. On 1974 Apr. 25/26-i.e. exactly in the middle between the two other events - an additional minimum was suspected from visual observations with the 60 cm refractor in Hamburg-Bergedorf under very unfavourable conditions.

These three minima lead to a first estimate of the period of $P_1 = 196.25 \pm 0.1$ days or an integer fraction thereof. Although the relatively short duration of the minimum ($D \lesssim 24$ h) suggests a shorter period, 49.06 d ($=P_1/4$) and all periods shorter than 39.25 d ($=P_1/5$) can be excluded because they would have been detected during my observations. A longer period would explain the fact of the late discovery and the absence of significant RV variations in the observations of Struve and Titus (1944) which cover a time span of 6 weeks.

The amplitude of the minimum is too large to be explained by an eclipse of stars of almost equal luminosity and size. Probably, the secondary is a pre-main-sequence star with a low surface brightness. As it is possibly an object similar to the secondary of BM Ori (see Huang 1975 for further references), detailed observations are highly desirable. The long period and the duration of the minimum require observations from different longitudes in order to get a complete light curve of the next event. Assuming a period of 196.25 days, the next minimum will occur on 1975 May 23.0, but will hardly be visible. The next observable minimum will be on 1975 Dec. 05.3.

Table 1

Magnitude differences υ^1Ori A minus C

Reference/Instrument	ΔV	$\Delta(B-V)$	$\Delta(U-B)$
Sharpless 1952	1.61	0.00	+0.05
Johnson+Borgmann 1962	1.59	+0.01	+0.07
Walker 1969	1.597	+0.042	+0.085
60 cm Tel	1.628	+0.010	+0.055
scanner (mean of 24 nights)	1.638	-0.007	+0.069
scanner 1973 Oct. 10/11	2.676	+0.009	+0.082

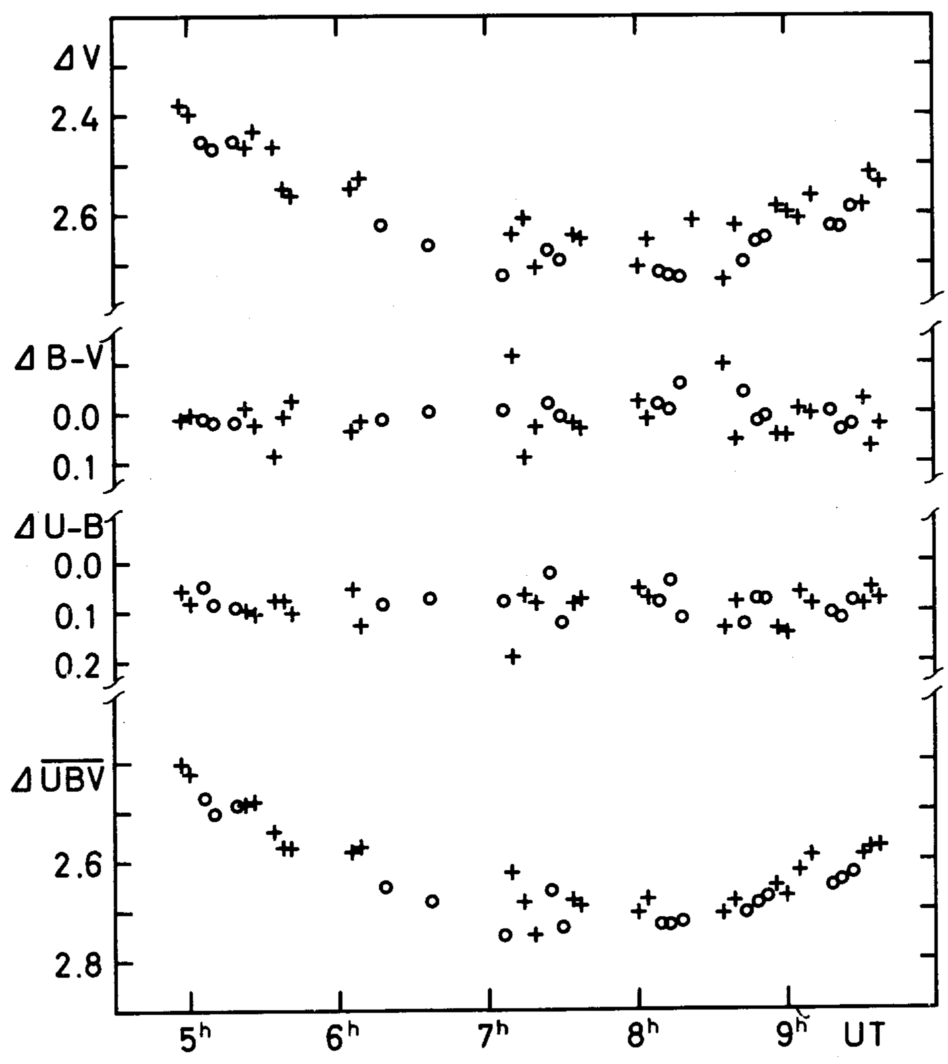

Fig. 1: Magnitude and colour differences ϑ^1 Ori A-C on 1973 Oct 11. $\Delta\overline{UBV} = (\Delta U + \Delta B + \Delta V)/3$. Position angle of scanning direction: ∘ 170° + 350°.

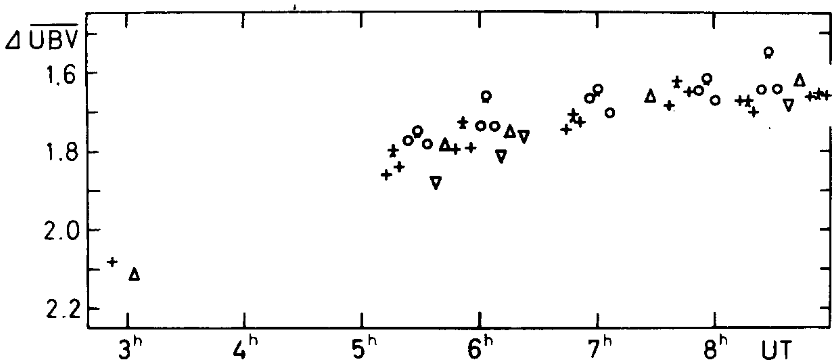

Fig. 2: Magnitude differences ϑ^1 Ori A-C on 1974 Nov 08
Position angle of scanning direction: ∘ 170° ♀ 175°
+ 350° ∔ 355° ▿ 90° ▵ 270°.

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