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LIGHT CURVE CHANGES IN THE ECLIPSING BINARY V719 Her

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The General Catalogue of Variable Stars (Kholopov 1985) lists V719 Her as a probable type c RR Lyrae star with a period of 0.336 days. In the remarks, it is noted that another possibility is that V719 Her is a W UMa eclipsing binary with a period of .67 days. Schmidt (1991; 1993) obtained 15 light curve points in 1989-91 and concluded that V719 Her is indeed a W UMa star but with a period of .400995 days. Goderya, Leung and Schmidt (1996; 1997) subsequently obtained extensive photometry in 1993 which provided timings for five minima over an interval of 78 days. Combining these data with the 1989-91 observations yielded a period of 0.400983 days. However, the resulting O−C plot showed a systematic trend in the 1993 data which suggested a shorter period. Goderya *et al.* interpreted this in terms of a period decrease of 0.54 seconds per year which is unusually large for a W UMa star.

In an attempt to verify the large period change, further VR photometry was conducted on four nights in 1995 and 16 nights in 1997. The observations were all obtained with the CCD camera on the Behlen Observatory 0.76-m telescope. The observation and reduction techniques were the same as described by Schmidt (1991). We used the same comparison stars as Goderya, Leung and Schmidt (1996) but redetermined the mean magnitudes and colors using a total of twelve photometric nights. The values are given in Table 1 and are accurate to better than 0.01 magnitudes.

Table 1. Photometric Indices for V719 Her and its Comparison Stars

Star	V	R	$V-R$
V719 Her	12.51	12.12	0.40
C1	14.03	13.51	0.52
C2	14.48	14.13	0.35

More than 200 new light curve points were obtained. The individual observations have been placed in the IAU Archives of Unpublished Variable Star Observations (file number 333E) or they can be obtained from the author.

When the new observations were plotted it was apparent that they did not fit the elements derived by Goderya *et al.* with a decreasing period. Therefore, all of the observations were used to redetermine the period with the data corrected discrete Fourier method (Ferraz-Mello, 1981). Although this method is not well suited to eclipsing stars in general, it will produce useful periods for W UMa stars where the maxima are rounded. The period obtained in that way was then doubled (since there are two minima per cycle while the DCDF method searches for one) and adjusted to minimize scatter in the light curve. The resulting period was 0.400928 ± 0.0000015 days.

All of the data is plotted in Figure 1 with this period. It is immediately obvious that a single period is valid over the entire interval from 1989 to 1997. Thus, the period variation suggested by Goderya *et al.* was spurious. Since the depths of the minima vary (see below) it is possible the erroneous period was due in part to difficulties in distinguishing between the two minima. With the current expanded data set, the ambiguity is resolved.

In examining Figure 1, it can be seen that there is a range of 0.10 to 0.15 magnitudes in the brightness throughout the light curve. Most of this range arises because the object was brighter in 1997 than earlier. However, even during one season the scatter at some phases is larger than observational error. We can eliminate difficulties with comparison stars as the source of the scatter since there are two comparison stars which agree at the level of 0.012 in V and 0.013 in R both during one season and over the longer term.

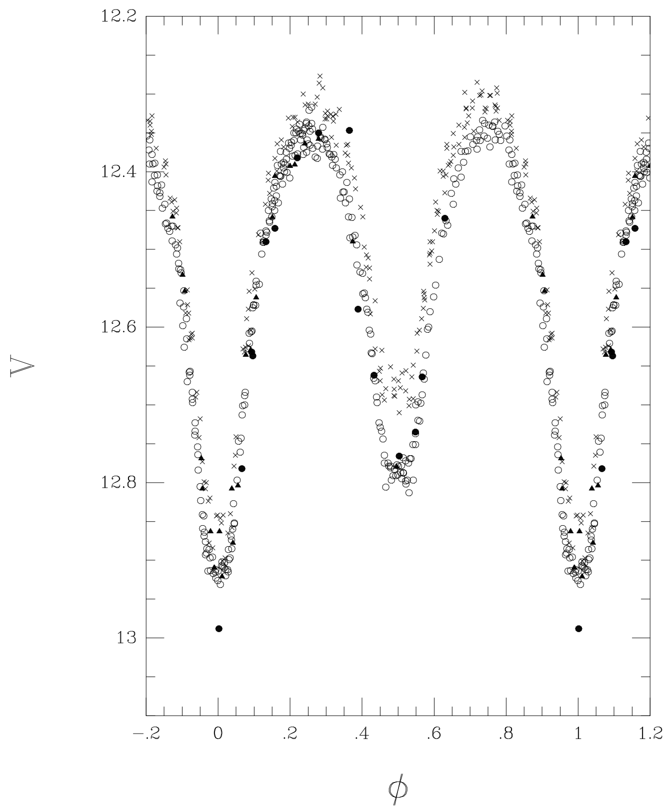

Figure 1. The light curve of V719 Her. The various symbols indicate the year of the observation as follows: filled circles, 1989-91; open circles, 1993; triangles, 1995; X's, 1997.

The brighter magnitudes in 1997 might be accounted for by the presence of a third star which had increased in brightness, by the brightening of one of the stars in the binary or by large spots one one or both of the stars. The first possibility does not seem likely because the increased brightness in both minima cannot be accounted for simultaneously. On the other hand, since the smaller star is eclipsed totally during the secondary minimum (since it has a flat bottom), the larger star would need to be the variable if the second explanation is correct. To a first approximation this model fits the fact that the brightening during primary minimum and at maximum is approximately the same and the brightening during secondary minimum is larger. However, a more detailed analysis which considered the scatter within a given season as well as the longer term variations is needed to verify this hypothesis. To evaluation of the third alternative would require detailed modelling with a larger data set.

Although the unusually large period change which originally motivated this study proved to be incorrect, the light curve variations make this an interesting star which should be studied further.

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