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ON THE PERIOD OF THE W UMA STAR YZ PHOENICIS

From several timings of minima of the W UMa system, YZ Phoenicis, Gessner & Meinunger (1976) derive a period of $0^d.3052$. Spencer Jones (1989) however, has shown that the period is near $0^d.225$, close to the observed lower limit for periods of W UMa binaries.

Photoelectric observations of YZ Phe were made in 1989 Sep - Nov with the 0.5m and 1.0m telescopes of the South African Astronomical Observatory at Sutherland. Regular observations of the comparison stars used by Spencer Jones (1989) were made and all data were transferred to the $UBV(RI)_C$ system using observations of E-region standard stars (Menzies, Cousins, Banfield & Laing 1989). The mean values for colours and magnitudes of the comparison stars are given in Table 1 together with standard deviations of the means. The results for HD 10521 are in very good agreement with the values given by Spencer Jones (1989) but for HD 10839, the differences in V, (B-V) and (U-B) are +0.02, -0.08 and +0.06 (Spencer Jones minus this paper) and it is possible that HD 10839 is a long-period variable. There is, however, no evidence in the 1989 data for any variation as big as 0.01 in magnitude or colours and so the YZ Phe data were corrected to the mean values of both Table 1 stars.

A phase-dispersion minimisation technique was applied to the YZ Phe data and gave a period of $0^d.234726 \pm 0.000002$ where the error is estimated from the range of results obtained by binning the data in different sized phase intervals. The V magnitudes from the 1989 data, phased with the above period are shown in Fig.1. The light curve clearly has unequal maxima and minima and is typical of a W UMa star. Using the best primary minimum from the 1989 data and the accurate determination of primary minimum by Spencer Jones (1989) results in a period $0^d.23472715 \pm 0.0000001$ where the error corresponds to an error of $0^d.001$ in the 9492 cycles between the two primary minima

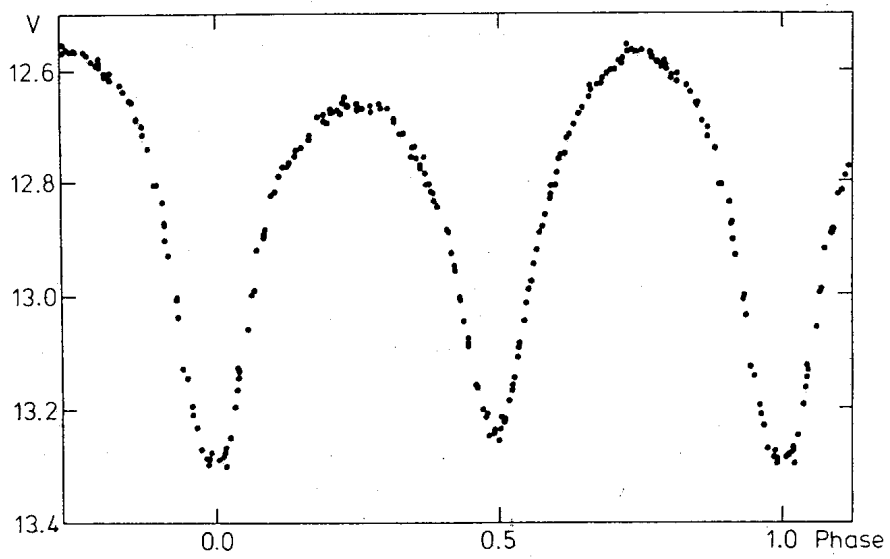

Figure 1. V light curve for YZ Phe from 1989 data.

used. The one cycle aliases ($0^d.23475$ and $0^d.23470$) can be ruled out because adopting these periods results in obvious drift in the phased magnitudes for the 1989 data.

The times of minima measured in 1989 are listed in Table 2 and a linear least-squares solution, including the Spencer Jones (1989) minimum for which we adopt n=0, gives an ephemeris:

$$T(\text{primary minimum}) = 244\ 5621.39679 + 0.23472700.n$$
$$\pm 0.00008 \pm 0.00000008$$

The observed-calculated (O-C) residuals from this ephemeris are also listed in Table 2.

Applying the above period to the Gessner & Meinunger (1976) timings of minima enables a redetermination of the cycle numbers for those minima and then a linear least-squares fit to that data gives a period $0^d.23472 \pm 0.00003$. It does not seem possible to link the Gessner & Meinunger data to the Table 2 data with great certainty because of the large separation (~ 37000 cycles) and because many of the W UMa stars are known to have variable periods (see, for example, Kreiner 1977) which could cause aliasing errors. Comparison of the periods derived from the

Table 1. Magnitudes & colours of the comparison stars

	V	B-V	$V-R_C$	$V-I_C$	n	U-B	n
HD 10521	8.383	0.367	0.219	0.438	29	0.024	15
	±0.004	0.003	0.003	0.005		0.005	
HD 10839	9.052	1.235	0.650	1.226	24	1.301	11
	0.004	0.004	0.002	0.003		0.006	

Table 2. Times of minima of YZ Phe

n	HJD	(O-C)	
0	2445621.39683	0.0000	(Spencer Jones 1989)
9250	7792.6220	+0.0004	
9253.5	7793.4425	-0.0006	
9254	7793.5610	+0.0005	
9258.5	7794.6160	-0.0007	
9296.5	7803.5355	-0.0009	
9313.5	7807.5260	-0.0007	
9437	7836.5165	+0.0010	
9440.5	7837.3370	-0.0001	
9492	7849.4265	+0.0010	

1989 data and the Gessner & Meinunger data, however, suggest that the period might be fairly stable on a timescale of years.

The derived period of $0^d.234727$ for YZ Phe makes it one of the shortest period eclipsing binaries known; according to Mochnacki (1983, Table 2) only CC Com has a shorter period ($0^d.221$).

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