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NEW MAXIMA OF THE HYDROGEN-DEFICIENT PULSATING STAR V652 Her  
(BD+13°3224) AND A REVISED CUBIC EPHEMERIS

The hydrogen-deficient hot star V652 Her (=BD+13°3224) was discovered by Landolt (1975) to be variable and shown by Hill et al (1981) to be radially pulsating. Kilkenny & Lynas-Gray (1982, 1984) found that the period of the star was decreasing and then that the decrease rate was itself decreasing; the most recently published timings of maxima showed close agreement with the previous findings, namely that a cubic ephemeris is necessary to fit the observations (Kilkenny 1988). It seems likely that the decreasing period could be due to contraction of the star as it evolves from the zero-age horizontal-branch towards the helium main-sequence (Jeffery 1984) however, the change in the decrease rate has not been satisfactorily explained, nor is there a clear theoretical model for the pulsation (Saio 1986).

Because this remarkable, apparently unique star is likely to provide a stringent test of theories of stellar evolution and pulsation, we have continued to make timings of maxima. The results, listed in Table 1 were obtained from series of 30 sec integrations using various filters in conventional photoelectric photometers on the 0.5m and 1.0m telescopes of the South African Astronomical Observatory.

Combining the Table 1 results with those from Landolt (1975), Kilkenny & Lynas-Gray (1982, 1984) and Kilkenny (1988) and solving a cubic equation:

$$\text{HJD}_{\text{max}} = T_0 + nP_0 + n^2k_1 + n^3k_2$$

we obtain the coefficients:

$$\begin{aligned} T_0 &= 244\,2216.80406 \pm 0.00035 \\ P_0 &= 0.107\,992\,733 \pm 0.000\,000\,049 \\ k_1 &= (-44.553 \pm 0.021) \times 10^{-10} \\ k_2 &= (+2.958 \pm 0.024) \times 10^{-15} \end{aligned}$$

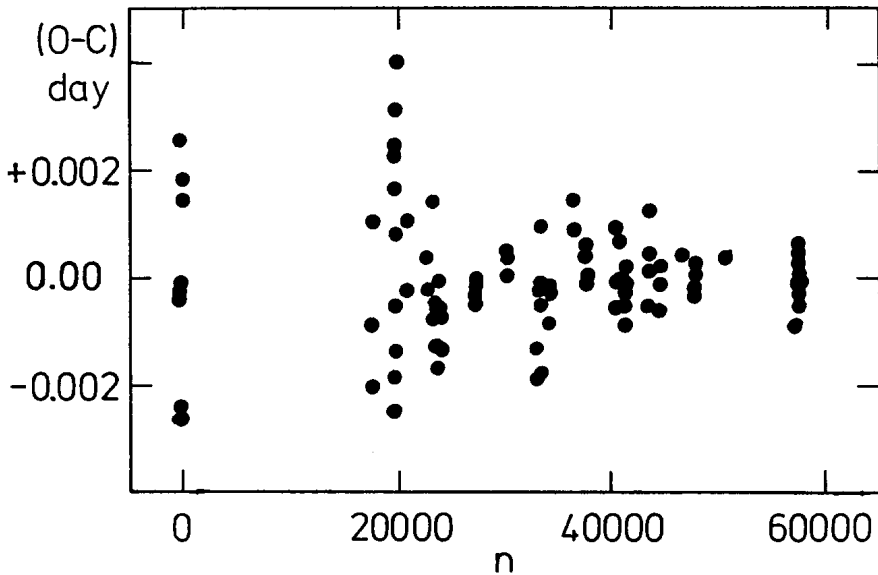


Figure 1. (O-C) diagram for published maxima of V652 Her, including the Table I results and using the ephemeris derived in this paper. The abscissa is cycle number.

Table I. New timings of maxima of V652 Her

HJD	n	Tel.	filter	
244 7270.555	46885	1.0m	V	1988
7354.2605	47663	1.0	V	
7354.368	47664	1.0	V	
7384.2775	47942	1.0	V	
7385.246	47951	1.0	V	
7675.4835	50649	1.0	y	1989
8363.623	57048	0.5	B	1991
8365.559	57066	0.5	B	
8368.569	57094	0.5	B	
8371.5795	57122	0.5	B	
8374.5885	57150	0.5	B	
8376.5245	57168	0.5	B	
8403.510	57419	0.5	B	
8406.4125	57446	0.5	B	
8409.4225	57474	0.5	B	
8410.4975	57484	0.5	B	

from 98 observations of maxima. The errors are the formal errors from the least squares cubic fit to the timings of maxima. The (O-C) residuals for the above ephemeris are shown in Fig. 1.

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