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ON THE PERIOD AND VELOCITY CURVE OF THE β CEPHEI STAR HR6684

In a recent paper McNamara (1978) derived a velocity curve for the β Cep star HR6684 (=HD 163472) that differs considerably from those obtained by Pike (1974, 1978) and Bolton, Percy and Shemilt (1975, hereafter BPS). McNamara does not consider the differences in velocity amplitude to be real, though he does suggest that his observations indicate some asymmetry in the velocity curve. The purpose of this note is to show that the differences found by McNamara are due to the method of analysis and the use of a slightly incorrect period.

Inspection of Figure 1 of McNamara (1978) shows that the sinusoidal velocity curve has been fit to the data assuming the descending branch crosses the γ -velocity at the time of maximum light predicted by the ephemeris of Morton and Hansen (1974),

$$\text{Max. light} = \text{JD}_0 2441442.048 + 0^d.1398903 \cdot E.$$

BPS showed that this is the correct relationship between the light and velocity curves. However, McNamara's velocities were obtained almost 58.000 cycles before the epoch of the light ephemeris, so even a small error in the period could produce a substantial phase shift between the true and computed ephemerides.

I have fitted sine curves to all three sets of radial velocity data with the γ -velocity, amplitude, and time of maximum radial velocity as free parameters. The results are given in Table I.

Table I

Element	McNamara	Pike	BPS
V_0 (km s ⁻¹)	-16.6(4)	0.2(6)	-15.5(3)
K (km s ⁻¹)	7.2(8)	8.2(11)	8.8(5)
$T(\text{JD}_0 2400000+)$	33332.92116(3)	42225.6705(2)	42229.74375(8)
ϵ (km s ⁻¹)	2.5	3.8	1.4
O-C (d)	-0.08876	-0.008	+0.00844
n (cycles)	-57968	+5602	+5631

V_0 is the γ -velocity, K the velocity semi-amplitude, T the JD_0 of maximum velocity, ϵ the RMS scatter about the fitted curves, $O-C$ difference between the observed and predicted time of maximum velocity according to the ephemeris of Morton and Hansen, and n is the number of cycles elapsed between the epoch of the ephemeris and the epoch of the observations. The standard errors of the fitted quantities in the sense of the uncertainty in the last digit quoted are given in parantheses following the parameters. I have used the measures from Pike (1978) rather than the earlier measures Pike (1974). This accounts for the widely discrepant γ -velocity for this data set.

None of the velocity curves show any evidence of asymmetry, and there is excellent agreement among the velocity semi-amplitudes. If we ignore the velocity curve of Pike, which was obtained only 4 days before that of BPS and is of much lower accuracy, then the $O-C$'s indicate that the period given by Morton and Hansen should be increased by 1.53×10^{-6} day to $0.^d13989183$.

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