THE VARIABILITY OF NN CEPHEI

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NN Cep is shown to be an eclipsing star with a period of $2^{d}\cdot058216$. This confirms the results of Figer and Rolland[3].

Introduction

NN Cep (= HD 217796 = BD $+61^{\circ}$ 2384 = CSV 8815) was discovered to be variable by Tate and Burke[1]. The *Second Supplement to the GCVS*[2] gives it as a possible RR Lyrae star with a photographic range 8·2–8·7.

Observations

Between 1975 April and 1976 December the writer made 294 visual observations of this star as part of the BAA VSS Binocular Group observing programme. A further 52 observations were made between 1979 September and December. Tripod-mounted 8×40 and 8×30 binoculars were used and the comparison stars were taken from the BAA VSS Binocular Group chart for RW Cep.

Results

GMAT was used throughout the analysis as the light-time corrections are small compared with the other errors involved.

Inspection of the nightly light-curves suggested a period of about $1^{d}\cdot0$. In order to determine the period more accurately, a lightcurve was drawn up including all those observations made between 0930 and 1030 GMAT. This showed a spurious period of 34^{d} where the spurious period, Ps, is related to the real period, Pr, by the equation:

$$\mathrm{Pr} = 1 \pm \frac{1}{\mathrm{Ps}}$$

This gave $0^{d}\cdot971$ and $1^{d}\cdot029$ as the possible values for the real period. The latter was found to fit observations made outside the above interval better than the former. The $1^{d}\cdot029$ period was then refined to $1^{d}\cdot029108$ by comparing mean light-curves for observations from different months. Finally, the period was doubled to $2^{d}\cdot058216$ for reasons given below.

The mean light-curve for all the observations with this period is shown in figure 1. The small dots represent the means of between 8 and 17 observations; the large dots, 18 to 27 observations. The standard deviation about the points averages $0^{m}\cdot15$ which is rather large, even for visual estimates. Possible causes could be the position-angle effect and bias.

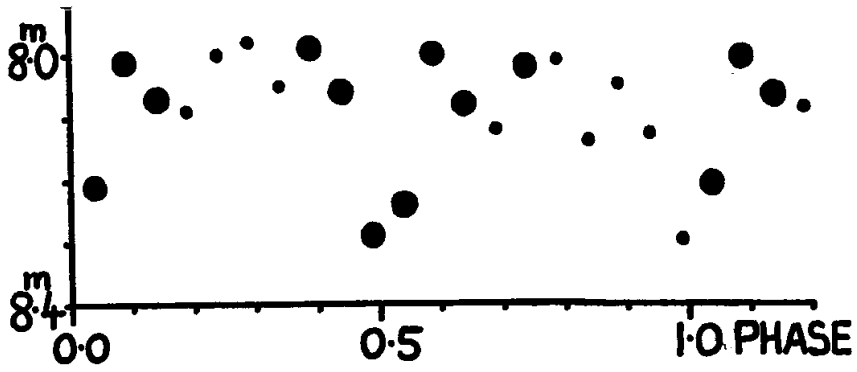

FIGURE 1. Mean light-curve of NN Cep.

The light-curve is that of an eclipsing star but it is not clear whether it is Algol type with flat maxima, or β Lyrae type with rounded maxima. The minima are of similar depth but the one at phase 0·0 was taken to be primary minimum for reasons given below. It is unlikely that the period is half of $2^{d}\cdot058216$ because this would make the duration of the minimum improbably long when compared with the period. The following elements can be used to predict future minima:

$$\text{Min I} = \text{JD } 2442700\cdot24 + 2\cdot058216.E$$

The estimated error in the period is $\pm0^{d}\cdot00007$ and that of the epoch $\pm0^{d}\cdot06$.

Figer and Rolland[3] found a period of $2^{d}\cdot058 \pm 0^{d}\cdot002$ from a series of visual observations made between 1975 May and August. Their epoch of JD hel. $2442959\cdot57 \pm 0^{d}\cdot07$ agrees very well with the above elements. They were also able to distinguish primary and secondary minima and their labelling has been adopted in this paper.

References

1 Tate, R. C. and Burke, E. W., *IAU Commission 42, Bibliography and Program Notes on Eclipsing Binaries*, **19**, 11 (1971).
2 Kukarkin, B. V. *et al.*, *Second Supplement to the General Catalogue of Variable Stars*, Moscow, 1974.
3 Figer, A. and Rolland, R., *IAU Information Bulletin on Variable Stars*, No. 1231 (1977).