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**CONFIRMATION OF THE CLASSIFICATION OF A NEW  
TYCHO VARIABLE: HD 32456 IS A 3.3-DAY CEPHEID**

The Hipparcos mission of ESA is mainly an astrometric project. Its photometric component, however, is expected to discover thousands of new variables. For a description of the mission see Perryman (1989) and references therein. A first list of 35 bright stars which were discovered to be variable in the course of the data reductions for the Tycho experiment on the Hipparcos satellite was published in IBVS No. 4118 (Makarov et al., 1994). HD 32456 = GSC 3738-234 is one of them. In IBVS No. 4118 the star GSC 8353-620 was erroneously included in the list of newly discovered variables. In fact its variability had already been known. It is RY Arae. (This error was pointed out by H. Mauder, Tübingen.)

The Tycho observations of any particular star are very unevenly distributed in time. Therefore it is usually difficult to derive the type and light curve elements for a newly-discovered variable. This is why in the fall of 1995 a call for observations of the 35 new variables was issued to amateurs.

Within a few weeks visual observations by M. Dahm and E. Born showed that HD 32456 is a Cepheid with a period of about 3.29 days. This information prompted photoelectric observations by F. Agerer, from which the light curves in Figure 1 resulted, along with an improved estimate of the period:  $3.295 \pm 0.001$  days. The Tycho observations in the  $B_T$  photometric band, folded with this period, are shown in Figure 2. They, too, confirm the classification and period determination. The Tycho observations were collected between 1989 and 1993. Small groups of nearly simultaneous Tycho observations were binned before plotting in Figure 2, in order to reduce the scatter. The photoelectric data in Figure 1 were collected around the end of 1995. Combining the two normal epochs for the maxima from these two widely separated data sets, we find the following light curve elements for HD 32456:

$$\text{JD (max)} = 2450015.46 + 3.2942 \times E \\ \pm 2 \qquad \qquad \pm 3$$

These values were derived from a combination of the B and V data. The maximum occurs almost simultaneously in the two channels. Formal standard errors are given in the line below the light curve elements. The normal epoch given refers to Agerer's data (Fig. 1). The corresponding normal maximum epoch from the Tycho data is  $\text{JD } 2448276.14 \pm 0.15$ .

The variability of HD 32456 = HIP 23768 was independently discovered from the data of the Hipparcos main instrument. Compared to Tycho, this instrument gives photometry with much higher precision and a somewhat higher number of individual measurements. Therefore it was possible to independently derive a type and period. Thus, Turon & van Leeuwen (1995) also announced HD 32456 to be a Cepheid of about 3.3 day period, but without giving complete light curve elements. According to van Leeuwen (private communication), best-fit elements from the Hipparcos main instrument alone are:

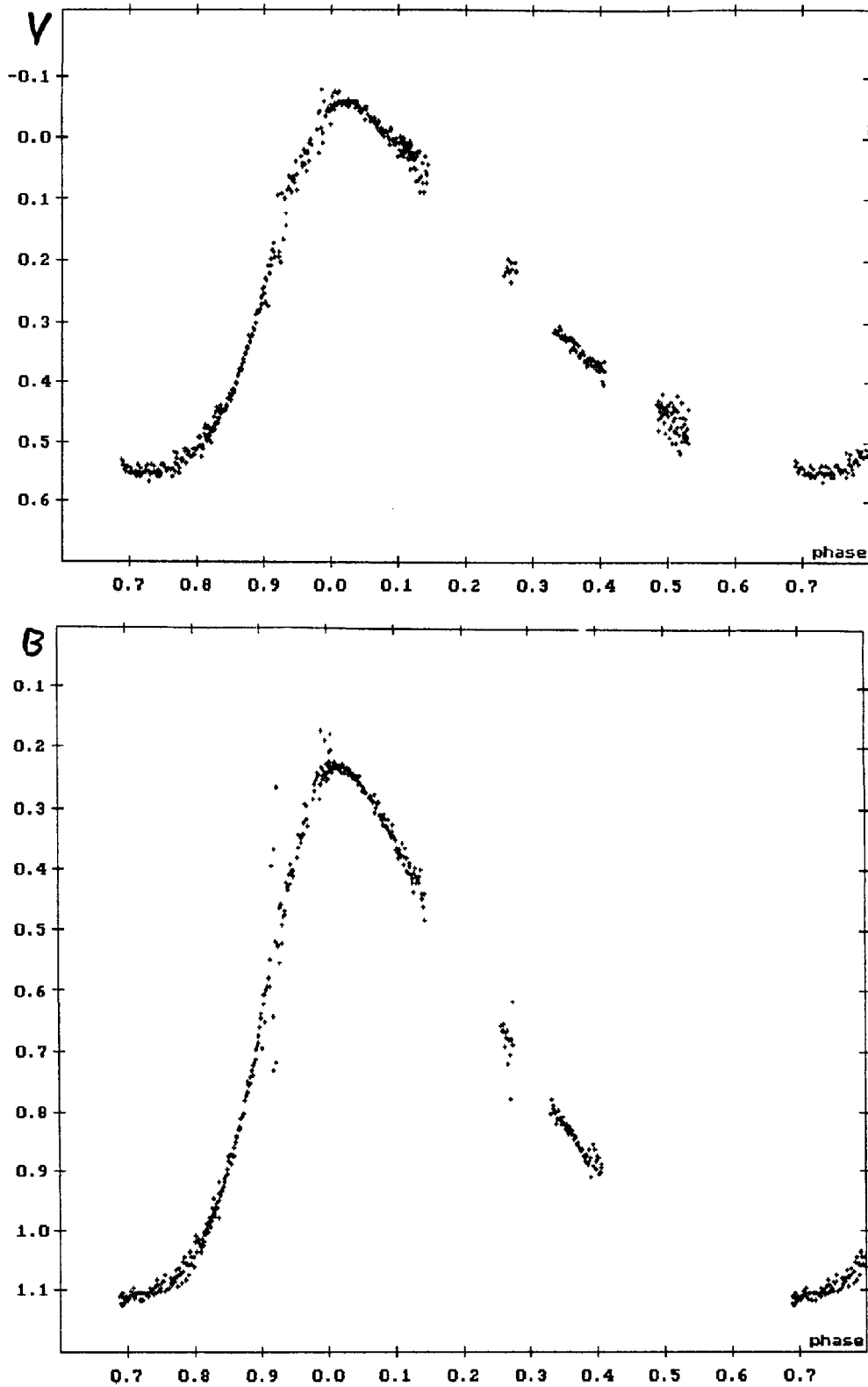


Figure 1. Photoelectric B and V light curves of HD 32456, collected around the end of 1995. The observations were done with F. Agerer's private 0.35m automatic telescope. The photometer was equipped with an uncooled EMI 9781A tube and Schott filters for B and V. The diaphragm was 32" in diameter. PPM 29633 (F8) served as comparison star and PPM 29635 (K0) to check its constancy.

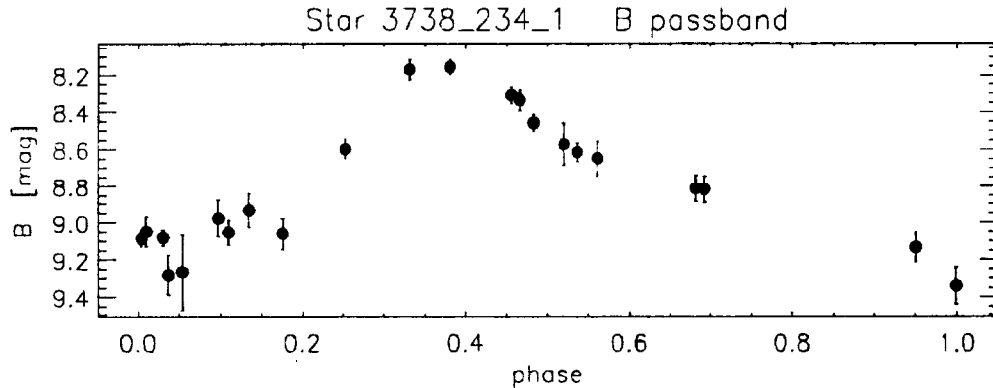


Figure 2. The TYCHO data in the  $B_T$  channel, collected between 1989 and 1993. Figures 1 and 2 are folded light curves, based on an assumed period of 3.295 days.

$$\text{JD (max)} = 2448503.21 + 3.29473 \times E$$

$\pm 5$                    $\pm 5$

Combining the reference epoch from the Hipparcos main instrument with the normal epoch from the ground-based photometry we find as the currently best estimate of the elements of HD 32456:

$$\text{JD (max)} = 2450015.46 + 3.29471 \times E$$

$\pm 2$                    $\pm 4$

It is surprising that such a bright, continuously variable star, with an amplitude as large as 0.6 mag in V and 0.9 mag in B, has remained undetected for so long.

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## References:

Makarov, V., et al., 1994, *IBVS*, No. 4118

Perryman, M.A.C., 1989, *Nature*, **340**, 111

Turon, C., van Leeuwen, F, 1995, IAU Coll. 155, Astrophysical Applications of Stellar Pulsation, ASP Conference Series, Vol. 83, 241