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ABSOLUTE MAGNITUDES AND LOCAL FREQUENCY OF β CEPHEI STARS

Lesh & Aizenman (1973) have determined MK spectral types, effective temperatures, and visual absolute magnitudes for 17 stars considered to be unambiguously certain specimens of β Cephei type variability. Among this small sample, there are only two spectral sub-groups which comprise more than 2 objects, viz., B1 III: 4 stars, and B2 IV: 6 stars. In both these groups the M_V, as given by Lesh & Aizenman, reveal a very significant but certainly unreal dependence on the apparent magnitudes, the intrinsic brightness of the more distant objects being systematically overestimated. At present, one cannot decide, whether this effect is originating in the spectrophotometric behaviour of the fainter stars, or may be caused by misinterpretation of some really interstellar influence on the luminosity criteria used by the authors of that calibration. Thus, an interpolation formula for the absolute magnitudes of the β Cephei stars is to be based only on 10 objects brighter than m = 4.1. By a least squares solution we readily get the formula:

$$M_V = \underset{\pm.06}{-3.80} + \underset{\pm.10}{0.44}\,(Sp\text{-}B1,5) + \underset{\pm.08}{0.35}\,(LC\text{-}III). \qquad (1)$$
(p.e.)

$$\sigma(M_V) = \pm 0^m.21 \quad \text{(standard deviation)}$$

This result reveals the good internal consistency of the three parameters involved in formula (1). Indeed, if the inevitable deviations in the practically continuous scale of magnitudes due to the relatively coarse frame of spectral and luminosity classes are taken into account, the formally calculated standard deviation ±0.21 nearly equals to its theoretically possible minimum value.

Now, this formula may be safely used to determine the visual absolute magnitudes not only for the 17 stars considered by Lesh & Aizenman, but for any other β Cephei star with spectral and luminosity class known. Among those stars included in the Supplement issues 1 to 3 (1971 to 1976) to the GCVS 1969, there are 11 brighter than BW Vul (m=6.52), the faintest one in Lesh & Aizenman's list. Since beyond this limit the completeness of information available for stars of this type is rapidly decreasing, in the present investigation the distance moduli E=m-M have been determined only for that relatively complete sample of 28 β Cephei stars, after having applied,in some instances of spectroscopically or interferometrically known companions, the appropriate corrections to m. The distances themselves were derived with due regard to the galactic absorbing layer, according to a table given previously by Ferrari & Jenkner (1973).

Thus, it has been found that 24 out of the 28 stars considered here are situated within a cylindrical space of 450 pc radius, and 350 pc height perpendicular to the galactic plane. A more realistic measure for the local frequency of β Cephei stars is derived from the fact that 15 of them are included in a cylindrical space of only 250 pc radius, and 300 pc height. From the latter data we conclude that there are, at least,

$$25\ \beta \text{ Cephei stars per } 10^8 \text{ cubic parsec.} \qquad (2)$$

The limits just given for the space under consideration are sufficiently large so that any accidental or systematic error, increasing the true distances of some marginal stars by about 10 percent, would not at all diminish the numerical value (2). We arrive at the conclusion that β Cephei stars, notwithstanding the small number of specimens recognized with certainty, are nearly equally frequent as, e.g., Mira type variables.

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