

# The Calibration of Colours and Luminosities for Classical Cepheid Variables

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## Abstract

Current progress is described for an ongoing program to secure new observational data (star counts, photoelectric, photographic & CCD photometry, and spectroscopy) for stars in the large sample of potential Cepheid calibrating clusters and associations.

New Baade-Wesselink radii have been obtained for 11 Cepheids using a variant (Turner 1988) which uses KHG spectrophotometric data to isolate phases of equal effective temperature in Cepheid light curves. The resulting best fit to the data is described by  $\log R/R_{\text{sun}} = 1.07 + 0.75 \log P_0$ , with a scatter of only  $\sim 2\text{-}4\%$ , versus  $5\text{-}8\%$  with more traditional methods. Space reddenings for cluster Cepheids, combined with KHG-based reddenings (Turner *et al.* 1987) and similar reddenings (all  $< 0.5$ ) tied to this system, are a useful tool for testing the photometric reddening systems in the literature. The Fernie (1990) compilation, for example, suggests that there is a large, period-dependent scatter in Cepheid intrinsic colours, but this is not supported by the space reddening data, which suggest a smaller colour width for the strip and no striking change in strip width with the pulsational period.

Recent studies of main sequence stars in clusters of comparable age to classical Cepheids indicate that stellar rotation is likely to be an important parameter affecting distances derived from ZAMS-fitting or  $H\beta$  photometry, as well as Cepheid space reddenings. It may also produce the main sequence colour spread observed in reddening-free colour-magnitude diagrams for Cepheid clusters, and have important ramifications for Cepheid luminosities derived from UV observations of their hot companions. A newly discovered circumstellar reddening effect tied to rapid rotation of cluster B stars may be an additional concern for cluster ZAMS fitting (Turner 1993, in press). A  $P$ - $L$  calibration has been made using the 10 program clusters which have been observed to date. The resulting calibration for SU Cas, SZ Tau (an overtone pulsator), CV Mon, V367 Sct, DL Cas, S Nor,  $\zeta$  Gem, WZ Sgr, SW Vel and SV Vul gives  $\langle M_V \rangle = -1.15 - 2.94 \log P_0$ , with a scatter much reduced from earlier calibrations. The strip filling is not yet complete enough to derive the colour term unambiguously, although initial studies indicate it may lie in the range 2.5 to 3.5. The cluster Cepheid BB Sgr is very important in this regard, since it appears to lie on the red edge of the instability strip.

## References:

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