

ON THE CALIBRATION OF THE uvby PHOTOMETRIC SYSTEM FOR LATE-TYPE STARS

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ABSTRACT. An attempt has been made to calibrate the indices of the uvby photometric system in terms of MK classes equal to and later than that of the Sun. Results are presented for stars of luminosity classes V and III; b-y and c_1 data are given. For stars on the main sequence, the relation between m_1 and b-y is discussed for stars of solar type.

1. INTRODUCTION

It has become increasingly evident that the uvby system provides an excellent basis for determination of effective temperature and luminosity as well as the abundance of heavy elements not only for F-type stars. Recent work has shown it to be of highest value also for cooler stars (Ardeberg and Lindgren 1981, 1982). We have attempted uvby calibration of stars ranging from solar type to M stars. Here, some results are given for a sample of stars with high-class MK and metallicity data.

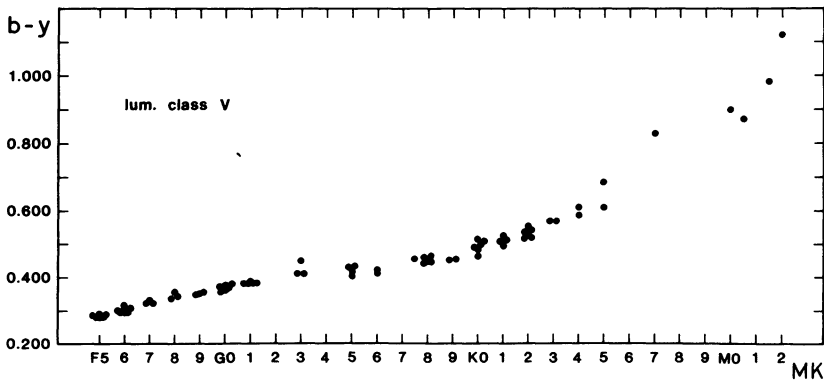


Fig. 1. b-y versus spectral type for main-sequence stars.

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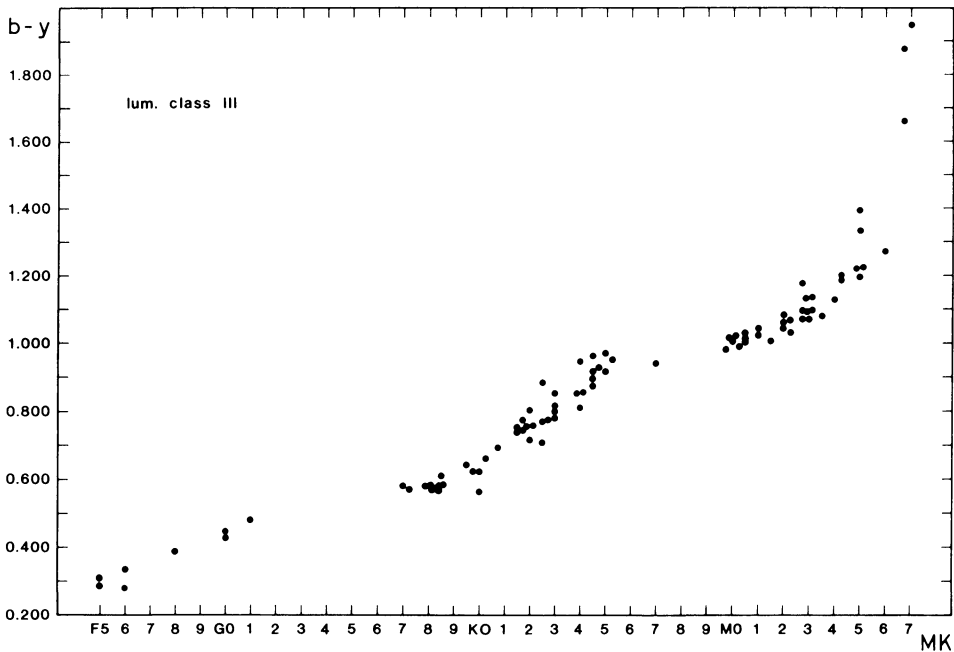


Fig. 2. $b-y$ versus spectral type for giant stars.

2. SELECTION AND OBSERVATIONS OF PROGRAM STARS

We have used only stars with MK classifications by groups including Keenan and/or Morgan. For abundance data we selected investigations from compilations by Cayrel et al. (1980). Most of the stars have been observed in uvby several times. In all cases we used the Strömgren grating photometer on the Copenhagen 50cm telescope on La Silla. For the color indices standard deviations only exceptionally exceed 0.010 mag.

3. RESULTS AND DISCUSSION

Figures 1 and 2 show that there are tight relations between spectral type and $b-y$ index for main-sequence and giant stars. It appears that $b-y$ is a very suitable temperature parameter down to a spectral type of about M5. Whereas the scatter displayed in Figure 1 should be close to the intrinsic spread in $b-y$, some effects of reddening are probably present in Figure 2. Figure 3 demonstrates the high resolving power of the uvby system for late-type stars. The $(b-y, c_1)$ diagram provides solid data for effective temperature and luminosity. It is shown in Figure 4 that the metallicity also can be determined with high accuracy from uvby observations. The relation for solar-type stars is well defined. The same is true for giant stars. For G/K-type stars $d[\text{Fe}/\text{H}]/dm_1$ is typically around 8.

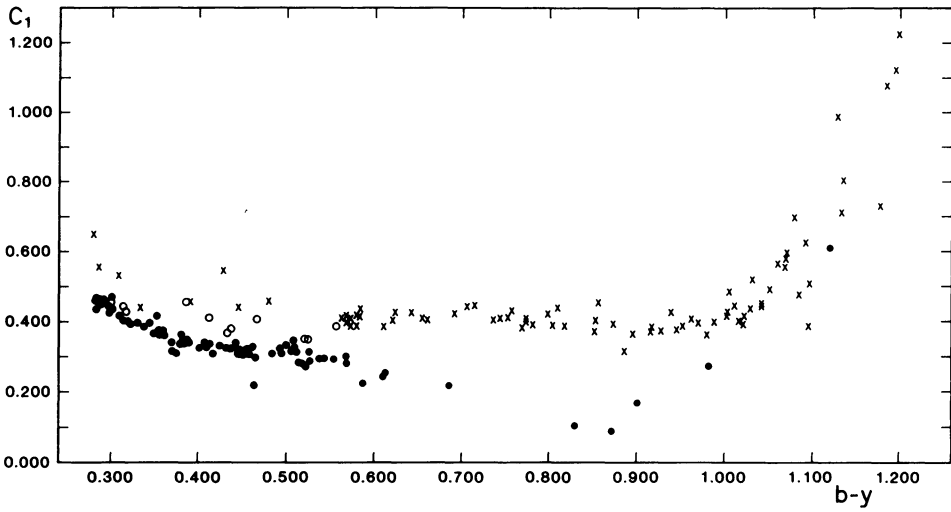


Fig. 3. $b-y, c_1$ diagram. Crosses denote stars of luminosity class III, open circles IV and filled circles V.

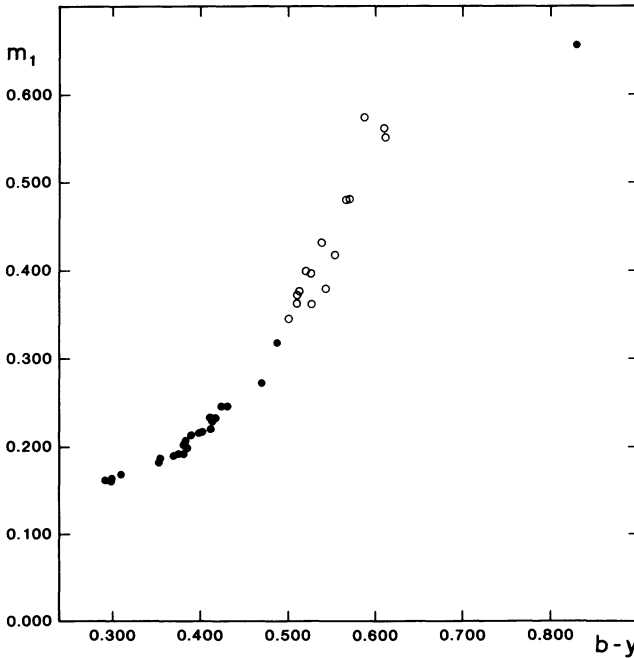


Fig. 4. $b-y, m_1$ diagram for solar-type stars of luminosity class V. Filled circles denote stars with $[Fe/H] > -0.10$, open circles stars with high quality MK data but with weak or no $[Fe/H]$ data.

REFERENCES

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- Ardeberg, A. and Lindgren, H. 1982, in Proc. Nordic Astron. Meeting, ed. G. Larsson-Leander (Lund. Obs. Rept. No. 18, Lund), p. 81.
- Cayrel de Strobel, G., Bentolila, C., Hauck, B. and Curchod, A. 1980, Astron. Astrophys., 41, 405.

DISCUSSION

JASCHEK: How did you calibrate your absolute magnitude relation?

ARDEBERG We have, so far, attempted calibration of our uvby quantities only with MK luminosity classes.

JASCHEK: What explanation do you propose for the (b-y), c_1 relation found?

ARDEBERG: The Balmer discontinuity explains the (b-y), c_1 relation only down to spectral type around late K.