THE CLASSIFICATION OF BINARY STARS WITH COMPOSITE SPECTRA: CONFRONTATION WITH HIPPARCOS/TYCHO DATA

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ABSTRACT

We chek our data (M_v and $B-V$), based upon infrared spectral classifications for 37 binary systems, with the Hipparcos/Tycho data.

Key words: binaries; composite spectra.

1. INTRODUCTION

Our Hipparcos program deals with composite spectra, composed by a hot dwarf of spectral type B or A and a cool giant or supergiant of type G, K, or M. We have recently published a study of the classifications in the near infrared of the cooler components of these systems (Ginestet et al. 1997). The MK classifications of these objects, when existing, were often in error because in the wavelength region used for the MK classification ($\lambda\lambda 3800-4800$) the spectra of the two components are hopelessly mixed. For this study we had to extend first the standards of the MK system into the near infrared (Ginestet et al. 1994). We analyse here 37 systems fainter than magnitude six, since our proposal did not include the brighter stars which were observed anyway in the survey. As a consequence of this, our conclusions are provisional and will be reconsidered once we are in possesion of the data concerning the brighter objects. We have included in our sample only stars for which the relative parallax error (σ_π/π) is smaller than 0.5, i.e. $\sigma M_v \leq 1$ mag. The distribution over absolute magnitude and distance in given in Figure 1.

2. CHECK WITH THE HIPPARCOS DATA

For each binary of our sample we have determined a total absolute magnitude derived from the absolute magnitudes of the components. These are based upon the spectral types of the components, using the Schmidt-Kaler (1982) calibration. For the cooler components we took our spectral types derived from the near infrared and for the hotter components the classifications given in the literature. If several classifications existed, we selected the one which seemed most reliable. Figure 2 shows the correlation between our absolute magnitudes and those derived from Hipparcos parallaxes. We have done the same with the $B-V$ color indices: the global values obtained from Schmidt-Kaler calibration are confronted with those given by Tycho, converted to the Johnson system (Figure 3).

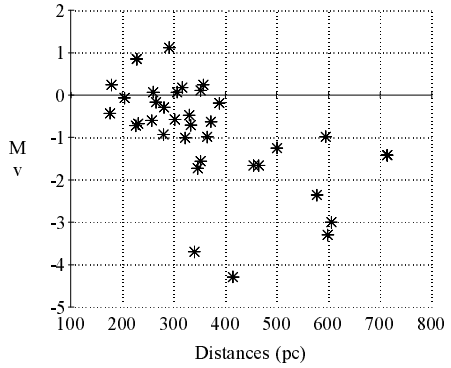

Figure 1. Distribution over absolute magnitude and distance of our sample of binaries with Hipparcos data.

In Figure 3 we find a large dispersion of the points, so that it became important to know what kind of corrections had to be introduced in order to improve the agrement whith the measures from Tycho. We were able to do this for the $B-V$ index by introducing minor modifications, namely: (1) by increasing the absolute magnitude of the cool giants by 0.5 to 0.8, which is within the uncertainty of the absolute magnitudes given by Schmidt-Kaler (see note at the end); (2) by changing slightly, by one or two tenths of spectral class, the spectral type of the hotter component. The results are shown in Figure 4. On the contrary, we could not improve significantly the agreement of the absolute visual magnitude in this way, as can be seen in Figure 5. There we have plotted 'our' absolute magnitudes against those derived from Hipparcos: it can be seen that although the scatter has diminished, the agreement is still unsatisfactory.

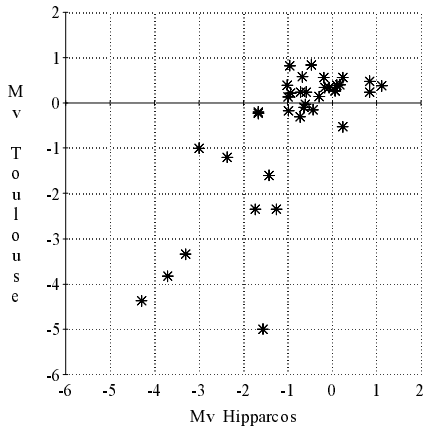

Figure 2. Absolute magnitudes from our IR classifications versus absolute magnitudes from Hipparcos data.

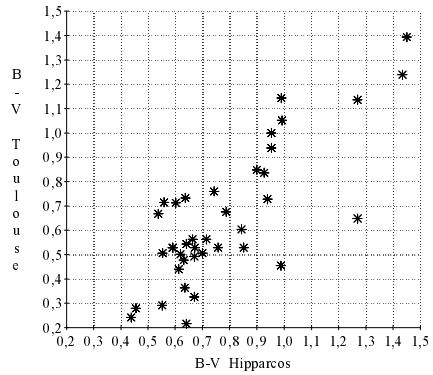

Figure 3. B-V indices from our IR classifications versus B-V from Tycho data.

3. CONCLUSIONS

With the help of Tycho data we confirm our classifications of the cooler components and we can propose better classifications for the hotter components. This last point is specially useful for the fainter systems, which in the violet are more difficult to observe than in the infrared because of the sensibility of the CCD detectors. The difference between our absolute magnitudes and those of Hipparcos can be interpreted at least in two ways: (1) the cooler components of the systems are, in its majority, brighter than normal giants of the Schmidt-Kaler calibration; or (2) the Schmidt-Kaler (1982) calibration provides too faint values for the absolute magnitude of the cooler giants. It is not possible to attribute the differences to interstellar extinction, because among the systems which deviate most from the bisectrix in Figure 5, we find systems whith at all possible heliocentric distances. We expect that the addition of the Hipparcos survey data will permit a choice between the two possibilities. [Note: Several colleagues present at the colloquium found also difficulties with the absolute magnitude calibration of the cool giants.]

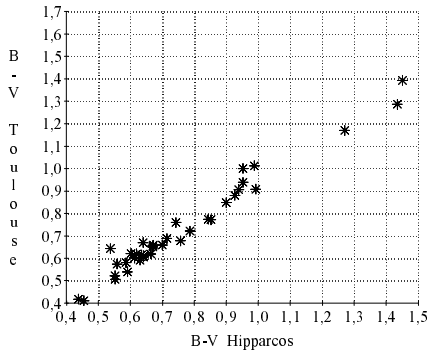

Figure 4. Modified B-V indices (see text) versus B-V from Tycho data.

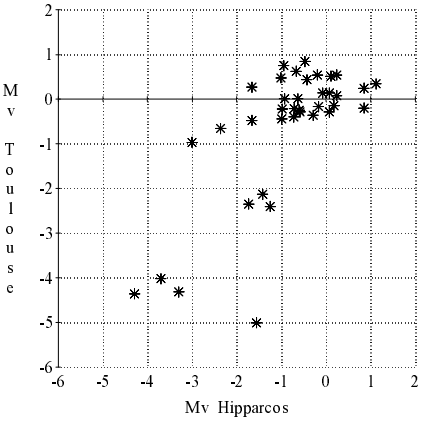

Figure 5. Modified absolute magnitudes (see text) versus absolute magnitudes from Hipparcos data.

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