REMARKS CONCERNING THE MASSES OF HORIZONTAL-BRANCH A STARS

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Studies are underway concerning the masses of horizontal-branch A stars. Hayes and Philip (1979) discussed masses determined for seven field HB stars using gravities and temperatures obtained from spectrophotometric scans. They found a mean mass of 0.6 $M_\odot$ ± 0.4 for these stars. However, there was a strong trend of mass with temperature. In the present study four-color measures of over 150 FHB and BHB stars have been dereddened and plotted in the grid relating (b-y), c_1 and log g, T_{eff} (Philip and Relyea 1979). If one calculates a mean mass, again the figure of 0.6 $M_\odot$ is obtained. A more detailed look at the data, however, reveals structure in the distribution of points in the various diagrams. A discussion of this result follows.

In the four figures solid triangles represent BHB stars in the globular cluster M 4 and hollow triangles represent the best observed FHB stars (an average of 44 observations each). The four-color indices c_1 and m_1 are plotted vs. the index (b-y) in Figs. 1 and 2. Most of the points fall along a line in each diagram, but there are four dotted symbols in each figure that fall away from the main relation. In M 4 this main relation represents a line of constant mass in the c_1 vs. (b-y) diagram. The dotted symbols were selected from the distribution of points in Fig. 3 in which the mass (calculated from the four-color indices transformed to log g and T_{eff}) is plotted versus T_{eff}. In this diagram the points scattered about two relations, marked A and B. The four most extreme points on relation B were dotted. In Fig. 4 (mass vs. log g) it can be seen that these four points are the most extreme points in the graph.

A. Maeder and A. Renzini (eds.), Observational Tests of the Stellar Evolution Theory, 171–173.

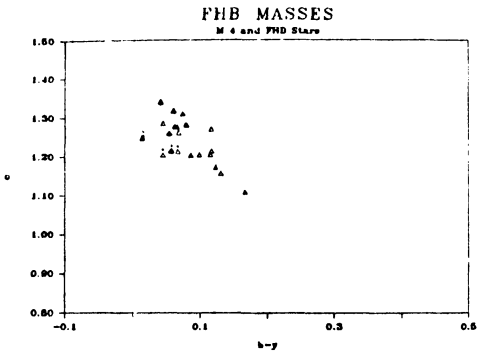

Fig. 1.

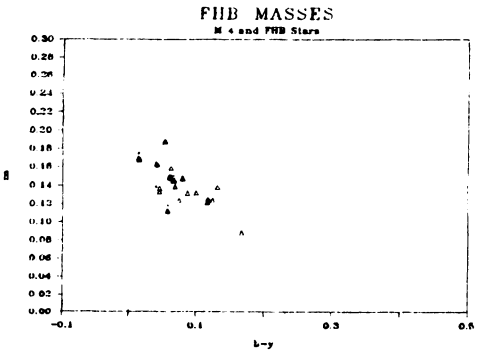

Fig. 2.

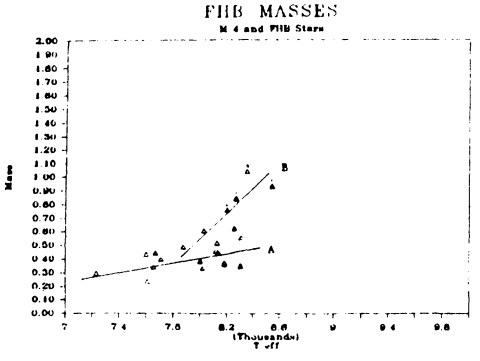

Fig. 3.

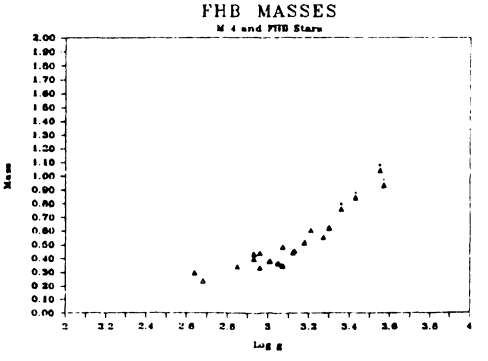

Fig. 4.

Our interpretation of the distribution of points in these four graphs is that some of the BHB stars in globular clusters and some of the FHB stars have higher masses (and lower c_1 and m_1 indices) than the majority of horizontal-branch A-stars. We plan to use the line of constant mass in the c_1 vs (b-y) diagram to calibrate the Population II grid relating c_1 and (b-y) to log g and T_{eff}. At present the relation A in Fig 1. has a slope and the masses predicted by the relation are too small; most probably the surface gravities are somewhat in error. There should be no trend of mass with temperature.

Additional four-color observations are planned of BHB stars in globular clusters and H β observations of the FHB stars in order to obtain additional data to confirm our results. HD 117880 is one of the FHB stars that has a high mass; it also has peculiar UV and IR colors.

REFERENCES

Hayes, D. S. and Philip, A. G. D. 1979 PASP 91, 71.
Philip, A. G. D. and Relyea, L. J. 1979 Astron. J. 84, 1743.

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DISCUSSION

Richer: Do you place the magnitude of the horizontal branch of M4 at V = 13.6?

Philip: In the four colour system measures that I make, I measured the quantities b-y, c_1 and m_1. I do not reduce the y magnitude. For informational purposes the V magnitudes for the M4 BHB stars were taken from Greenstein's 1939 paper in the Ap.J.

Alcaino: Our determination of the horizontal branch position of M4 is at a visual observed magnitude of V_{HB} = 13.4.

Lub: Have you tried the later and improved version of the Kurucz models?

Philip: The Kurucz models used were the revised models reported in 1976 (Problems of calibration of multicolor photometry, Dudley Obs. Report no 14). The grid relating the four colour indices $(b-y)_o$ and $(c_1)_o$ to log g and T_{eff} for [Fe/H] = -1 was given in Philip and Releya (1979, Astron. J. 84, 1743).

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