FOUR-COLOR AND Hβ DIAGRAMS FOR OPEN CLUSTERS - A SURVEY

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Intermediate band photometric data for stars in at least 50 open clusters now exist. This paper reviews the status and desiderata for the uvbyβ subset. Similarities and differences between clusters are highlighted, and the relation of the photometric differences to physical differences is noted. Some of these are stellar age, chemical abundance, rotational velocity, and duplicity.

As the stars in the cluster are at the same distance and presumably have nearly the same age and chemical composition, a "separation-of-parameters" is possible and is a great advantage over analysis of non-cluster stars.

We derive interstellar reddening and absorption values (and the variation over the cluster field), the true distance modulus, the ultraviolet excess and δm_0 (empirical measures of chemical composition), and show color-magnitude and other diagrams for representative clusters. Some discordances with theory are noted.

(This full paper, with additional details, will be published shortly in the Astron. J.).

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DISCUSSION

COX: What is the effect on your indices of helium poor B stars? Can they affect the distance moduli?

CRAWFORD: We don't have data for many. Most do not fit the calibrations, but some do. There are not enough of them to adversely affect the calibration statistically.

ROMAN: The agreement of the distance moduli determined from various parameters is impressive. To what extent are the calibrations independent? What is the systematic accuracy of the calibrations?

CRAWFORD: They are independent in the sense that entirely different data were used. But, naturally, we all have used nearly the same clusters and the same stars. Only a few A and F-type stars have large parallaxes for example.

I feel that things are good in color to $\pm 0^{m}.01$, and in M_V to about $\pm 0^{m}.2$ for the late B to F stars. It's larger for earlier B stars, as the relation between M_V and B is so steep (± 0.4 or 0.5 perhaps).

MORGAN: How would a change in the modulus of the Hyades of $0^{m}.25$ affect your calibration?

CRAWFORD: The Hyades was not used at all in this calibration, so a change in the distance modulus has no effect whatsoever. The natural question, then, is what do we get for the Hyades? The problem is that we get this funny effect in the c_1 index for the Hyades F stars. If you assume that $\delta c_0 = 0$ (which it isn't), then you get a distance modulus of $3^{m}.2$. If you assume that it is real, and due to some real luminosity effect, which I don't think it can be, then you get $3^{m}.4$. But I don't think that's a valid result. If you use the A-stars, where you don't see any Hyades anomaly, we get $3^{m}.2$.

MORGAN: You showed a couple of slides in which you have β vs. c_1, and there were gaps, which you mentioned. Could these gaps be due to your including both cluster and field stars in the distribution?

CRAWFORD: I think those slides only had field stars. There is no question that there are gaps and non-linearities. There are explanations for some and none at all for others. Demarque and I have discussed the one found in the late B's; it falls just where they expect the CNO opacity problem.

MORGAN: Have all of the Pleiades stars which you said were binaries been certified spectroscopically?

CRAWFORD: Most of them have been, but not all.