GLOBULAR CLUSTER AGES AND DISTANCES

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Deblanketing vectors derived from subdwarf photometry and spectrophotometry are used to transform published *UBV* photometry of globular cluster main sequences into an effective temperature scale defined by model atmosphere surface fluxes. Conversion of apparent visual magnitudes into apparent bolometric magnitudes is accomplished using subdwarf bolometric corrections, which are functions of effective temperature and metallicity. The results do not depend on stellar evolution models.

Cluster ages are derived by comparing effective temperatures of the main sequence turnoff points in each cluster with model isochrone results. Helium abundances are not very important in deriving these ages, but the uncertain [O/Fe] ratio has a marked influence. There is a wide variation in cluster ages, if the Ciardullo and Demarque (1977) isochrones are used, and a correlation between age measured in billions of years, t_9, and metallicity is well-fit between [Fe/H] = -0.2 and -2.1 by $t_9 = -6.3\,[Fe/H] + 6.1$. If the Iben and Rood (1970) tracks are used, the clusters fail to show any significant age differences, although the tracks cannot be applied to the most metal-rich cluster, M71. The table below compares the derived cluster ages.

A subdwarf helium abundance of Y = 0.20 (Carney 1979) is used to compare isochrones of the appropriate metallicity and age to the globular cluster main sequences and thereby derive cluster distances. Because trigonometric and statistical parallaxes define the subdwarf distances, the cluster distances are independent of the isochrones except for the relative differences in metallicity and the unknown variations in helium abundances. If the clusters all have the same helium abundance, the derived distances imply that the absolute visual magnitudes of the cluster RR Lyrae variables and horizontal branch stars, M_V(RR/HB), are about +0.7 in the mean, with only a weak dependence on metallicity.

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It is suggested that in view of the comparable ages and metallicities of the clusters M3, M13, and NGC 6752, the differences in their horizontal branch morphologies may be due in part to differences in stellar rotation rates, evidenced by the presence of many blue stragglers in M3.

Cluster	[Fe/H]	t_9(CD)	t_9(IR)	M_V(RR/HB)
47 Tuc	-0.5	10	∿ 18	0.53
M3	-1.6	18	19	0.80
M5	-1.1	14	16	0.68
M13	-1.5	17	18	0.69
M92	-2.1	19	20	1.07
NGC 6752	-1.5	15	16	0.56
M71	-0.2	6		
M15	-2.0	17	17	0.99

REFERENCES

Carney, B.W.: 1979, *Astrophys. J.* (in press).
Ciardullo, R.B., and Demarque, P.: 1977, *Trans. Yale U. Obs.* 33.
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DISCUSSION

WALLERSTEIN: I believe the Kurucz models give for the solar effective temperature a *B-V* about 0.57 or 0.58 mag, which can't possibly be right. I mean, it might be 0.62, it might be 0.66. Does this uncertainty in their calibration affect your work in any way?

CARNEY: No, that's only a synthetic colour which comes off the surface flux distribution. The fundamental surface temperature scale really is tied to Vega and Sirius, and Kurucz' temperature scale agrees with that and produces the right temperatures from angular diameter measurements for many stars. The problem with synthetic colours may be due to filter transmissions and I'm investigating this by taking stars that I have the spectrophotometry for and deriving temperatures. They have known colours and I'm just going to compare the known colours against what Kurucz predicts. I've done it for a few stars already and I can see a trend of about the size you see: something on the order of 0.03 to 0.05 mag in *B-V*, which unfortunately, will affect, of course, the direct translation of isochrones into colours.

RENZINI: I would like to point out that the effective temperature of the turnoff is also sensitive to mixing length. That's precisely the reason why theoreticians working in this field never use the effective temperature of the turnoff to derive cluster ages.

CARNEY: But one virtue, at least, of the setup that I have now is that the temperatures and the luminosities (or the bolometric corrections, at least) have been defined independently of stellar evolution codes. They can be compared to any set of isochrones that comes out. What α really is or about isn't a meaningful. . .

RENZINI: You need the isochrones eventually to get the ages and the temperature of the isochrones depends on the mixing length.

CARNEY: I completely agree.

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