THE METALLICITY DISTRIBUTION FUNCTION OF HALO DWARFS AND GLOBULAR CLUSTERS

J. B. Laird, M. P. Rupin and B. W. Carney

University of North Carolina

D. W. Latham and R. L. Kurucz

Harvard-Smithsonian Center for Astrophysics

ABSTRACT: Metallicities have been determined for a chemically unbiased sample of field halo dwarf stars. Their metallicity distribution function is similar to the predictions of a simple model of chemical evolution, but somewhat different from that of globular clusters.

1. FIELD DWARFS

The Carney-Latham (1986) survey of high-proper motion stars has been used to identify a large sample of halo field dwarfs which is unbiased in metallicity. New, accurate metal abundances have been determined for these stars by comparing the spectra obtained for measuring radial velocities, having high resolution but poor signal-to-noise, to a grid of synthetic spectra. A sample of 124 stars, having retrograde orbits, was chosen from the survey to represent a true halo population.

Figure 1 compares the metallicity distribution function of these field stars to the predictions of a simple model of chemical evolution including mass loss (cf. Hartwick 1976, 1983; Searle and Zinn 1978; Bond 1981). The free parameter in the model is the effective yield, which equals $\langle Z \rangle$ when the model goes to completion. The model having $\log(\langle Z \rangle / Z_{\odot}) = -1.5$ is a fairly good fit, although it predicts slightly too many metal-poor stars, as noted in the past. For the first time the metal-rich end of the distributions can be compared, where too few stars are predicted.

2. GLOBULAR CLUSTERS

Metallicity data for the globular clusters have been taken from Zinn's (1985) compilation. A limit was imposed in galactocentric radius of $R \geq 7$ kpc to exclude disk clusters, leaving 43 clusters. The same radius limit cannot be applied to the field stars, so a further restriction, rest frame velocity ≥ 300 km/s, was applied to the field

J. E. Grindlay and A. G. Davis Philip (eds.),
The Harlow-Shapley Symposium on Globular Cluster Systems in Galaxies, 517–518.

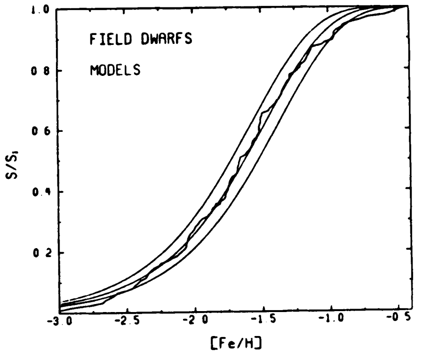

Fig. 1. Field dwarfs vs. the simple model. S/S_1 is the fraction of stars having that metallicity or less. The three models shown have $\log(<Z>/Z_\odot) = -1.4, -1.5$, and -1.6.

stars in order to bias the sample toward outer halo stars. This smaller sample of 36 stars is compared to the clusters in Figure 2. The two distribution functions look substantially different, with the clusters lacking both metal-poor and metal-rich objects. A Kolmogorov-Smirnov test, however, shows that the difference is not significant, due in part to the small number of objects. The clusters were also compared to the predictions of the simple model. The models having $\log(<Z>/Z_\odot) = -1.5$ and -1.6 are significantly different from the cluster results at the 89% and 83% confidence levels, respectively, although a better fitting model will lie between these.

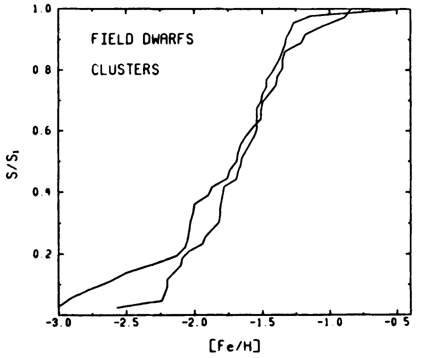

Fig. 2. Field dwarfs vs. globular clusters.

REFERENCES

Bond, H. E. 1981 Astrophys. J. 248, 606.
Carney, B. W. and Latham, D. W. 1986 submitted.
Hartwick, F. D. A. 1976 Astrophys. J. 209, 418.
Hartwick, F. D. A. 1983 Mem. Soc. Astr. Italia 54, 51.
Searle, L. and Zinn, R. 1978 Astrophys. J. 225, 357.
Zinn, R. 1985 Astrophys. J. 293, 424.