5. SPECTROSCOPY OF INDIVIDULAR STARS IN GLOBULAR CLUSTERS AND THE EARLY CHEMICAL EVOLUTION OF OUR GALAXY

Chairman: G. Cayrel de Strobel
Editors: G. Cayrel de Strobel & M. Spite

Supporting Commissions:

29, 35, 36, 37, 47

https://doi.org/10.1017/S1539299600008546 Published online by Cambridge University Press

JOINT COMMISSION MEETING 5, JCM5:
SPECTROSCOPY OF INDIVIDUAL STARS IN GLOBULAR CLUSTERS AND THE EARLY CHEMICAL EVOLUTION OF OUR GALAXY.

Chair: G. Cayrel de Strobel
Supporting Commissions : 29, 35, 36, 37, 47

COMMISSION MEETING CM37/3:
The abundance spread within globular clusters.

Chair: T. Lloyd-Evans

The Proceedings of these two meetings will be edited by G.. Cayrel de Strobel, M. Spite and T. Lloyd-Evans and published by the printing office of Paris Observatory.

We present here an overview of what has been discussed during these meetings.

I - INTRODUCTION

The long lasting interest of astronomers in globular clusters and their star population was once more proved during the scientific sessions at the IAU XX General Assembly. Nothing but, three meetings on globular clusters have been organized; one meeting (CM37/3) was chaired by T. Loyd Evans and was devoted to "The abundance spread within globular clusters". Another meeting (JCM7), directed by Pierre Demarque gave us an overview of : "Stars clusters in the Magellanic Clouds". The third meeting, organized by G. Cayrel de Strobel, has concentrated of what can be done nowadays in high signal/noise spectroscopy of individual stars in globular clusters. The great progress in high resolution spectroscopy of very faint objects has allowed to obtain in recent years a wealth of new results on detailed abundances of cluster stars. These results come principally from observations with CCD detector systems on 4m-class telescopes, as well as from the explosive growth of VAX class computers for both, data analysis and theoretical modeling.

The interpretation of such a wealth of new and sometime contradictory results is not a small affair. A great number of specialists in several fields is needed to understand the spectroscopic messages which are sending the far away cluster stars. This is perhaps the reason why, in spite of two recent IAU Symposia (J.E. Grindlay and A.G.D. Philip 1988, and G. Cayrel de Strobel and M. Spite 1988) dedicated entirely or in part to the better understanding of this subject, three astronomers had the same idea : to make globular clusters the focus of scientific sessions at the XXth General Assembly.

The meetings, JCM5 and CM37/3 were focused on the chemical abundances of globular clusters. Because of the shortness of time allocated to them,being both one half day IAU scientific sessions, they were organized as panel discussions with interventions from the floor.

II - SCIENTIFIC PROGRAM OF JCM5:

Four panel discussions addressed the general subjects of: "The spectroscopy of individual stars in globular clusters and the early chemical evolution of the Galaxy".

The first panel: "Spectroscopic metallicities in Galactic and Magellanic globular clusters : individual chemical abundances in metal poor and metal rich clusters" has had as leaders:

R. Gratton: New spectroscopic cluster to cluster abundance analyses.

D. McNally (ed.), Highlights of Astronomy, Vol. 8, 611–614.

C. Pilachowski: Individual spectroscopic abundances in metal poor and metal rich clusters.

M. Spite: Results from detailed analyses in stars of LMC and SMC.

F. Spite: The lithium abundance in the Magellanic globular clusters: a step toward the primordial lithium abundance.

V. Castellani: Globular clusters, Spectroscopy and evolutionary theories.

The second panel has discussed on: "Metallicity of globular clusters versus metallicity of field halo stars. Do cluster and field halo stars have a common history?" Its leaders have been:

J.B. Laird: The Halo metallicity distribution function.

N. Suntzeff: Can we compare extreme metal poor field stars to very metal poor globular cluster stars ?

R. Peterson: Relative abundances of stars in several extremely-metal-poor systems and in the field Halo stars.

M. Bessell: Oxygen abundances in field halo and globular stars.

J. Truran: Abundance constraints on the dynamical and chemical evolution of the Milky Way globular clusters.

The third panel:"The chemical inhomogeneities within globular clusters : example ω Centauri" has discussed on :

G. Da Costa: Chemical inhomogeneities within clusters.

V. Smith: New spectroscopic results of stars in ω Centauri.

M. Spite: Chemical inhomogeneities in ω Centauri.

K. Freeman: CN inhomogeneities in ω Centauri and 47 Tucanae from individual stars correlated with their velocity distribution.

The last and fourth panel of JCM5 concerned only indirectly the spectroscopy of individual stars in globular clusters, but it seemed interesting to conclude JCM5 with the question: "Is there an age spread among the galactic globular clusters?"

Three specialists have been chosen to lead this discussion:

R.J. Dickens: The age of globulars?

B. Carney: Is there an age spread among the galactic globular clusters?

P. Demarque: Globular cluster ages from new data on turnoff-fitting and horizontal-branch modelling.

III - SCIENTIFIC PROGRAM OF CM37/3.

The subject of CM37/3: "The abundance spread within globular clusters" was quite similar to that of the third panel discussion in JCM5. However it has been

https://doi.org/10.1017/S1539299600008546 Published online by Cambridge University Press

discussed, reviewed and commented in a different way than in JCM5 by the panelists and speakers of CM37/3.

In CM37/3 five speakers presented results and theoretical constraints and five panelists commented on them.

The speakers have spoken on:

N. Suntzeff:	The metal-poor clusters
G.H. Smith:	The metal-rich clusters
R.J. Dickens:	Omega Centauri
C.A. Pilachowski:	High resolution spectroscopy: quantitative results and critical tests
A.V. Sweigart:	Theoretical considerations.

The panel discussion was animated by:
R.A. Bell, K.C. Freeman, R. Gratton, J.E. Hesser, R.P. Kraft.

IV - SCIENTIFIC HIGHLIGHTS OF THE MEETINGS, JCM5 and CM37/3.

Chemical abundances of individual stars in different galactic globular clusters have been widely discussed. Evidence of a number of fascinating variations among stars in different clusters have been displayed and the theoretical implications of these results have been analyzed.

Galactic globular clusters are "fossils" of the epoch of galaxy formation and samples of a very early but still present stellar generation. The situation is different in the Magellanic Clouds where globular clusters with different ages can be found. The question why young globulars, in other words "blue globular clusters", can be found in the Magellanic Clouds and not in our Galaxy is very important for the general understanding of galactic evolution. For two of these young clusters, one of the SMC and one of the LMC, preliminary abundance values could be derived for some stars. Surprisingly their [Fe/H] value was very low for such young stars, ($\approx$-1.3 dex).

The most striking features of the analyzed stars in the young globulars of the Magellanic Clouds are overabundances of the light metals, in particular sodium, and also an overabundance of the rare earth.

Another problem has been discussed concerning similarities and differences between halo field stars and stars in galactic globular clusters.

In recent years, a considerable effort has been made in the determination of accurate element-to-element abundance ratios in field halo stars, mainly thanks to the advent of high S/N linear detector. A short review of the abundances of the principal elements in the field halo stars is given here below:

O and other "even" light elements (Mg, Si, Ca and Ti) are overabundant in metal poor ([Fe/H]<-1) field halo stars by $\approx$+0.4 dex with respect to Fe.

C scales approximately as Fe in metal poor stars (it might be overabundant in the most extreme metal poor stars, ([Fe/H]<-2.5).

light odd elements (Na and Al)` are underabundant with respect to Mg (the run with respect to Fe is still somewhat uncertain).

there is an enhanced odd-even effect in the Fe-group elements in metal poor stars.

https://doi.org/10.1017/S1539299600008546 Published online by Cambridge University Press

Ba and some other neutron rich element are underabundant; however other neutron rich elements (probably originated mainly from r-processes) are not deficient (see the case of Eu).

N shows a very special behaviour not presently understood.

The field halo and globular cluster stars do not appear to come from the same parent population, although the mean metallicities are almost identical, the cluster metallicity function is narrower than that of the field. Does the difference in the metallicity distribution function between field halo and globular clusters stars arise only from a lack of an unbiased sample of field stars and its small number, or is this difference real? This is one question which remained unanswered.

The abundance variation of stars within clusters has also raised many questions. Omega Centauri has been taken as the most glamorous example of a system exhibiting wide metallicity variations among member stars. Various explanations have been invoked to explain this property, including primordial origin and enrichment from a previous generation of stars.

Another open question was of course the age of globular clusters, which has been discussed very intensively during the final panel.

Have the globular clusters been formed in a common short interval of time or has their formation spread over a period of several billion of years?

As we can see many interesting and important questions concerning the mode of formation and the early evolution of globular clusters remained unanswered. However we hope, that the panel discussions during JCM5 and CM37/3 injected new enthousiasm among the specialists of globular clusters and will attract new energies toward this very exciting domain.

https://doi.org/10.1017/S1539299600008546 Published online by Cambridge University Press