

JD4

**Astrophysical Impact of Abundances  
in Globular Clusters**

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## Summaries of Papers Presented at Joint Discussion Session 4: Astrophysical Impact of Abundances in Globular Cluster Stars

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**Abstract.** In this contribution we give summaries of the oral and poster papers presented in Joint Discussion Session 4, *Astrophysical Impact of Abundances in Globular Cluster Stars*, at the XXVth IAU General Assembly. The full text of the papers can be found in Volume 75, issue 2, of the *MEMORIE della Società Astronomica Italiana* (Journal of the Italian Astronomical Society; see the web address: <[sait.oat.ts.astro.it](http://sait.oat.ts.astro.it)>).

## 2. Foreword

Globular Clusters (GCs) are a basic tool for a number of important astrophysical problems – star formation, stellar evolution, stellar populations and cosmology to name but a few. The advent of new large telescopes is allowing detailed comparisons between the properties of stars in GCs and those in the halo field, a necessary comparison to obtain fundamental cluster parameters (e.g. age and distance) which, in turn, allow GCs to be used as probes of the properties of galaxies.

A proposal to hold a Joint Discussion session on the chemistry of GC stars was accepted by the IAU as part of the program of the XXVth General Assembly. The aim of the Joint Discussion was to give an updated overview of both observations and theory and to give insight into the following areas:

- The early chemical evolution of GCs, particularly as regards the mechanism(s) of formation of GCs, the role of self-enrichment, and possible pollution within clusters. Here observations go hand-in-hand with increased understanding of the details of stellar evolution: from the massive stars that explode as supernovae, through the intermediate mass stars whose Asymptotic Giant Branch evolution may contribute to the observed abundance anomalies, to the low mass we observe in GCs today.
- The physical processes that affect the surface chemistry of low mass stars. Here new observations of main sequence stars in GCs can provide tests of the

microscopic diffusion of light elements and metals, a process that can affect the age determination of GCs. Similarly, observations of extensive samples of red giant stars have the potential to reveal the presence of rare but significant objects of peculiar chemical composition, whose explanation may provide new insights.

Consequently, the program of the JD was built around four topics:

- 1) Observational results and emerging abundance patterns, with a focus also on the reliability of abundance determinations. In this context, a round-table discussion, chaired by B. Barbuy, was held in which possible abundance determination errors, stemming from the assumptions made in modeling stellar atmospheres, were discussed.
- 2) Models relevant to the observed chemical patterns, particularly, the explosive nucleosynthesis of massive stars, the more quiescent nucleosynthesis of intermediate-mass AGB stars and their role in forming the abundance and abundance spreads in GCs.
- 3) Physical processes and surface chemistry. Here abundances in main sequence stars constrain the role of atomic diffusion and radiative accelerations, while abundances in red giants constrain 'standard' and 'non-standard' mixing processes. Lithium abundances are also a key topic in this area. A second round-table discussion on these subjects was chaired by D. Vandenberg.
- 4) Formation and evolution of globular clusters. This section featured specific talks on GC formation and talks on possible mechanisms for producing observed abundance anomalies as part of the GC formation process. This included the popular idea that a second stellar generation formed in GCs directly from the ejecta of massive AGB stars. A third round-table discussion on these topics was chaired by R. Cayrel.

The meeting was evidently popular with IAU-GA participants, as the sessions were well attended and much lively discussion occurred. All participants left with many new ideas and suggestions for future work.

The SOC for the Joint Discussion was made up of F. D'Antona (Italy, Co-Chair), R. Gratton (Italy, Co-Chair), B. Barbuy (Brazil), G. Cayrel (France), G. Da Costa (Australia), P. Denissenkov (Russia), R. Kraft (USA), J. Lattanzio (Australia), G. Meylan (USA), K. Nomoto (Japan), J. Truran (USA) and D. Vandenberg (Canada). G. Da Costa acted as the local liaison contact. All involved in the Joint Discussion were very grateful to the IAU-GA local organizers for their assistance in making the meeting run smoothly.

### **3. Summaries of Presentations**

Following this paper is a summary of the oral contributions in the order in which they were presented during the Joint Discussion. The latter part of that summary contains the poster paper abstracts. In each case the first named author was the presenter. Unfortunately, Bob Kraft was unable to attend the meeting and his paper was presented by Chris Sneden.