STELLAR AND INTERSTELLAR LITHIUM AND PRIMORDIAL NUCLEOSYNTHESIS

Chairperson and Editor: **F. SPITE**

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JOINT DISCUSSION 11 : THE LITHIUM PROBLEM
INTRODUCTION

F. SPITE
Observatoire de Paris-Meudon
Place Janssen, 92195 Meudon Cedex, France

The exact title of the JD 11 was : "stellar and interstellar lithium and primordial nucleosynthesis". The large amount of work recently done about lithium provided an incentive for a discussion among the members of several commissions of the IAU. Lithium is a peculiar element. Since it is not produced in supernovae (at least such a production is not proven and would be quite different from the production of the other elements) its presence in old material is a legacy of the primordial nucleosynthesis. But lithium is a fragile element, and from a theoretical point of view, there are arguments tending to conclude that, in old stars, this legacy has been depleted. This difficult problem is a real challenge, an has been the motivation for many different works. The analysis of the lithium behavior in well known stars, of all kind of ages, metallicities, structures, peculiarities etc. is therefore extremely useful in order to understand the physical processe at work for lithium depletion, and the reader will find here many up-to-date data. The analysis of lithium in interstellar material provides an essential information. Many works about lithium are in progress throughout the world on the different points of interest, so that the General Assembly of the IAU was an excellent occasion to have a review of the recent progresses made in different areas. A summary of (nearly) each communication made during the Joint Discussion 11 may be found hereafter. Longer summaries of the talks, and summaries of the posters will be published in a forthcoming volume of the Memorie of the Società Astronomica Italiana.

I will present here only a few remarks.

About the particular (but important) problem of lithium depletion in stars, various solutions have been presented in the literature : they are all reasonably adjusted to the observations and the differences are not greatly larger than the observational errors. The scatter around the mean Li abundance found in halo dwarfs is particularly discussed , because the supporters of the lithium destruction in halo dwarfs by rotationnal mixing consider

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that this scatter is the signature of the process (Deliyannis et al. 1993). Is the scatter real or is it only the result of errors in the lithium abundance determination ? The two first papers presented hereafter show an important advance in this point, but more progresses are necessary. The errors in the measurements of the equivalent widths of the lithium lines have to be evaluated carefully : they could be larger than usually estimated. The other main source of inaccuracy in lithium abundance determination in stars is the error in defining the effective temperature of the star. In spite of recent advances (e. g. improved opacities) the model atmospheres are not perfectly satisfactory. For example, the effective temperature derived from : 1)the predicted colors; 2)the computed wings of Balmer lines of hydrogen; 3)the excitation equilibrium; should be the same, but this coherence is not always obtained. Fuhrmann and Gehren (1993) have shown that, in halo dwarfs, the convection affects considerably the computation of the wings of the Balmer lines. It is easy to deduce that the colors are also affected, so that a small difference of stellar structure can change significantly the temperature derived from the colors or from the wings of the Balmer lines. Let us recall that, for halo stars which may have different ages, two stars of the same colors may have different evolutionary status. We need a good treatment of the convection. The interferometric determination of the angular diameters of halo dwarfs would be an essential advance in the lithium problem. Finally it happens therefore that an important information on the primordial nucleosynthesis depends on progresses in stellar atmospheres.

Another important point is the production of lithium in the Galaxy. The observation of lithium production in the red giants (see hereafter the last progresses on the subject) show the reality of a process, for which considerable progresses in the theory are also presented hereafter. The detection of ^{6}Li in halo stars, the observation of binaries, are also important points, as all the other subjects presented hereafter (and many more which have been presented in a poster session). The reader will have here an up to date image of most of the main facets of the lithium problem.

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References

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