LITHIUM ABUNDANCE OF HALO STARS WITH NEW T_{EFF}

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The lithium observed in the atmospheres of unevolved halo stars is believed to be an essentially unproccessed element which reflects the primordial yields. The primordial nature of Li is inferred from the presence of a constant Li abundance for all the halo dwarfs where convection is not effective ($T_{eff} \geq 5600$ K). Such an uniformity is taken as evidence for the absence of any stellar depletion during the formation and the long life of the halo stars and also as evidence for the absence of any production mechanism acting either before or at the same time of the formation of the halo population. The existence of a real *plateau* has been recently questioned by Thorburn (1994), Norris et al (1994) and Deliyannis et al (1993). These results open the possibility of substantial depletion by rotational mixing where a certain degree of dispersion is foreseen for different initial angular momenta of the stars and/or to a significant Galactic Li enrichment within the first few Gyrs.

Lithium abundances in a sample (39) of halo dwarfs have been redetermined by using the new T_{eff} derived by Fuhrmann et al (1994) from modelling of the Balmer lines. These T_{eff} are reddening independent, homogeneous and of higher quality than those based on broad band photometry. The sample represent a significant fraction of the presently available Li determinations, and form an unique sample with a good and homogeneous T_{eff}. Fuhrmann et al are also able to provide errors in the T_{eff} for individual stars and in most cases they are as good as $\pm$ 50 K, which is a factor 2 smaller than the grossly estimated errors for photometric-based T_{eff}. The Li equivalent widths have been taken from the literature and the theoretically derived random errors from Deliyannis et al (1993) or computed following their prescriptions. Abundances have been derived by generating new atmospheric models by using the ATLAS-9 code by Kurucz (1993) with enhanced α-elements and without the overshooting option. If we use the Kurucz 1993 grid which includes overshooting the Li abundance

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is increased by $\approx$ 0.08 dex.

The Li abundances show a plateau extending up to nearly 6500 K, with no evidence of falloff at the hottest edge as expected by microscopic diffusion models, and with the depletion region bending at $T_{eff} \approx 5700$ in good agreement with what observed in the Hyades. The revised abundances show a remarkably flat *plateau* in the Li-T_{eff} plane for $T_{eff} > 5700$ K with no evidence of trend with T_{eff} or falloff at the hottest edge. Moreover, Li abundances are not correlated with metallicity for [Fe/H]< -1.4 in contrast with Thorburn (1994).

In our data sample both the lowest metallicity stars, i.e. the oldest, and the hottest subdwarf, i.e. the less depleted, share the same Li abundance. On the plateau all the determinations are consistent with the same pristine Li abundance and the errors estimated for individual stars fully account for the observed dispersion. It seems likely that the dispersion claimed by Thorburn (1994) or the correlations of Li with metallicity or temperature are artifacts caused by errors in the effective temperatures. The weighted mean on the plateau of the 24 stars with $T_{eff} \geq 5700$ and [Fe/H]$\leq$ -1.4, where each abundance is weighted inversely by its own variance in the sum, is [Li]=2.204 $\pm$ 0.006. When the non-LTE corrections of Carlsson et al (1994) are considered, the mean rises to 2.218 $\pm$ 0.006. This value is somewhat higher than the 2.08$\pm$0.1 previously estimated by several authors and results from the increase of the Fuhrmann et al effective temperatures.

The present analysis shows that when very precise effective temperatures and individual errors are considered, the Li abundances on the plateau show no trends either with T_{eff} or with the stellar metallicity. The Li abundances are all closely gathered and are consistent with the same initial abundance, thus confirming that the Li observed is essentially undepleted and very close to the primordial value as already put forward by Spite and Spite (1982). More details are given in Molaro et al (1994).

References

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