Setting the scene for Gaia and LAMOST
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On Atomic Diffusion and the Cosmological Lithium Abundance

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When it comes to lithium in late-type stars, atomic diffusion (AD) refers to the slow gravitational settling below the convective zone. Richard, Michaud & Richter, J. (2005) computed the influence of diffusion on the lithium abundance with different additional mixing (AddMix) parameters, after 13.5 Gyr with an initial Li abundance compatible with BBN. Without AddMix the abundance of lithium would decrease when the temperature of the star increases. This is depicted by the dashed green line in the left panel of Fig. 1 and is in contradiction with the existence of a lithium plateau. But with a model including ad-hoc AddMix, where the AddMix diffusion coefficient is given by $D_{\rm T}$ and is connected to $D_{\rm He}$(AD) at a reference temperature of $\log T_0 = 6.25$, it is possible to reproduce the plateau as seen in the figure (solid green line). AD with AddMix has so far been shown to be at work in two globular clusters (GC) with different metallicities. Korn *et al.* (2007) showed the effects in NGC 6397 at [Fe/H] $= -2.1$. More recently Gruyters *et al.* (2013) have shown smaller effects, but similar in nature, in NGC 6752 at [Fe/H] $= -1.6$. The Li abundance for both clusters can be brought in to agreement with predictions from the cosmic microwave background radiation and Big Bang nucleosynthesis (CMB+BBN) by using stellar structure models including AD and AddMix, although with different efficiencies of AddMix. It seems there is an evolution of AddMix with metallicity which renders AD less efficient. As AddMix acts only in the outer regions, helium settling in the core is not affected, and so the overall evolution (e.g. $T_{\rm eff}$-age relation) will be similar regardless of this parameter.

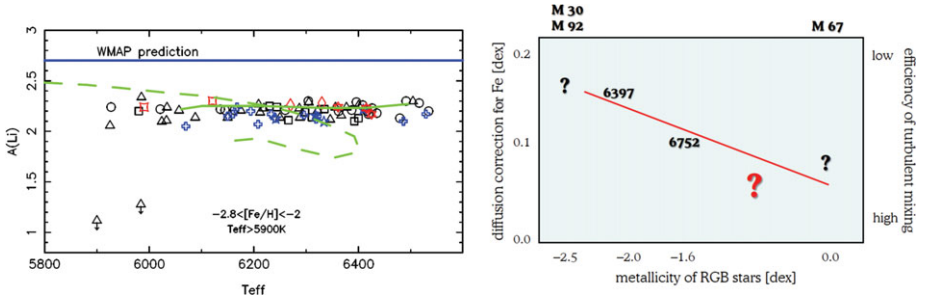

Figure 1. *Left:* The lithium plateau for warm metal-poor halo stars. Overlaid are stellar structure models including atomic diffusion with (dashed green line) and without (solid green line) additional mixing. Taken from Spite, Spite & Bonifacio (2012). *Right:* A qualitative representation of the possible additional mixing – metallicity relation. As the metallicity increases, it seems that the effectiveness of additional mixing increases as well.

References

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