

HD 39853: A High Velocity K5III Star With an Exceptionally Large Li Content

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High dispersion spectra of the high velocity star HD 39853 show that it is a slightly metal-poor ($[Fe/H] = -0.5 \pm 0.1$) giant of the old disk population, with exceptionally strong lithium lines. The abundance of Li, derived by synthetic spectra of the 6103.6 and 8126.4 Å lines, is $\log N(Li) = 2.8 \pm 0.2$. Abundances for the other observed elements are typical for mildly metal-poor giants: oxygen is slightly overabundant ($[O/Fe] = +0.25 \pm 0.15$); the C/N ratio is large (10 ± 2); the $^{12}C/^{13}C$ ratio is small (6.6 ± 1.2); and light elements (Na, Mg, Al, Si, Ca and Ti) are enhanced with respect to Fe by about a factor of 2.5. Observed s-elements (Zr and La) are not overabundant. Finally, no variation in the radial velocity of the star were detected at a level of 1 Km s^{-1} .

We explored several possible scenarios which may have produced the abnormally large surface Li abundance in HD 39853. Preservation of the primordial Li content is very unlikely, since the low $^{12}C/^{13}C$ ratio indicates that mixing of surface material with regions of uncomplete H-burning has occurred. Pollution of the outer convective envelope by material expelled by the nova explosion of a possible white dwarf companion is also improbable, due to the absence of variation in the radial velocity. Engulfing of a brown dwarf having a mass $M \leq 0.065 M_{\odot}$ may explain the observed Li abundance in the atmosphere of HD 39853 only if the original Li abundance was $\log N(Li) \geq 3.3$, in contrast with the old age indicated by the large space velocity and low metal content. It is also difficult to invoke mixing of material after or in connection with a He-shell flash, in view of the low luminosity and of the small mass inferred from the space velocity.

We conclude that the present knowledge of stellar evolution seems to preclude any of the proposed scenarios. Further theoretical work is required to provide a plausible interpretation of this star.