

# Testing the Planet-Engulfment Hypothesis as the Origin of Li-rich Giants

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It is known that a small fraction (~1 %) of red giant stars show unusually strong Li line (indicative of considerably large Li abundance in the photosphere), in marked contrast to normal red giants mostly showing significant depletion of surface Li because of the dilution due to evolution-induced envelope mixing. One of the various mechanisms proposed so far to explain this Li-enhancement is the accretion/swallowing of substellar companion (planets or brown dwarfs) by the red giant star (see [1] and the references therein). This hypothesis can be tested by spectroscopically checking  ${}^6\text{Li}$  or Be, which are expected to exist in such cool low-mass companions. That is, if this is the case, we may as well detect  ${}^6\text{Li}$  and/or overabundance of Be.

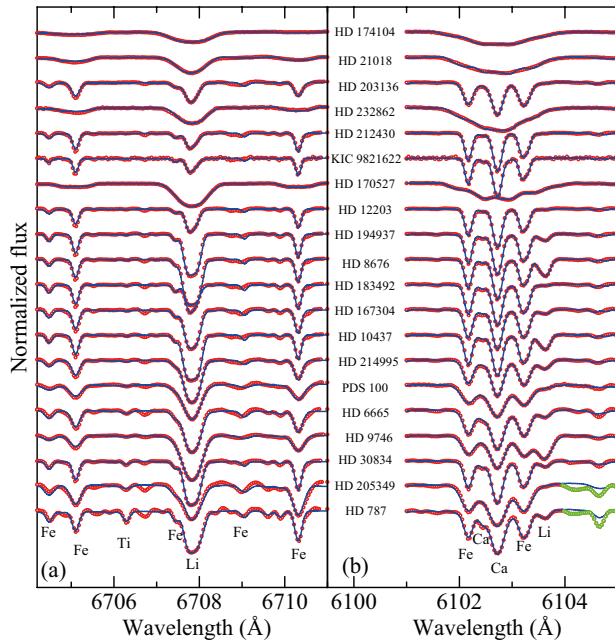


Figure 1: Synthetic spectrum fitting for Li abundance determination.

We recently carried out a comprehensive spectroscopic study on 20 Li-rich giants based on the Subaru/HDS spectra and compared their observational characteristics with those of ~300 normal red giants. According to the resulting Li abundances determined by applying the spectrum-fitting method to Li I 6708 and Li I 6104 lines (Figure 1), we could not detect any signature for the existence of  ${}^6\text{Li}$  (Figure 2). It was also confirmed from our analysis of Be II 3131 line that Li-rich giants are deficient in Be (just like normal giants) without any sign of enrichment. Consequently, we conclude that the hypothesis of “engulfment of substellar companions” (accretion of unprocessed gas or solid material) is rather

unlikely as the origin of Li-rich giants (at least as the major mechanism),

See [2] for more details of this study.

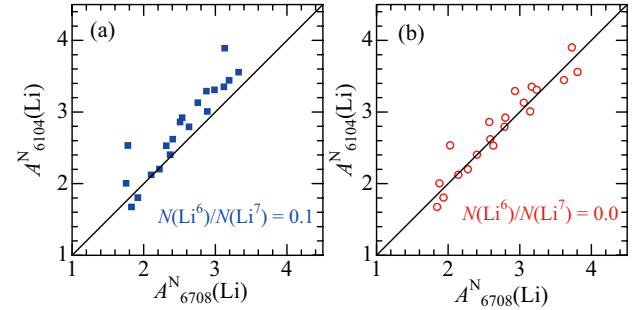


Figure 2: Effect of  ${}^6\text{Li}/{}^7\text{Li}$  ratio on the  $A_{6104}^N(\text{Li})$  vs.  $A_{6708}^N(\text{Li})$  correlation.

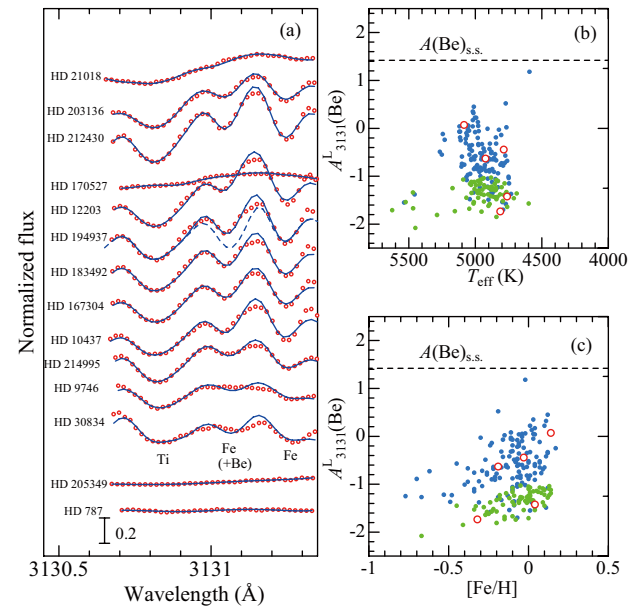


Figure 3: Synthetic spectrum fitting for Be abundance determination, and the resulting Be abundances plotted against  $T_{\text{eff}}$  and  $[\text{Fe}/\text{H}]$  (small filled circles are normal giants for comparison, where blue and green symbols denote established abundances and upper limits for indeterminate cases, respectively).

## References

- [1] Aguilera-Gomez, C., et al.: 2016, *ApJ*, **829**, 127.
- [2] Takeda, Y., Tajitsu, A.: 2017, *PASJ*, **69**, 74.