HD 152786: A LITHIUM GIANT?

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ABSTRACT. We were presented poster about interpretation of spectrum of the late-type lithium star HD 152786 acquired within UVES Paranal Observatory Project. Using the Synspec code for synthetic spectrum calculations we obtained some physical characteristics of the star and chemical abundances of some elements including Fe and Li.

We concluded that HD 152786 appears to be supergiant of spectral class K3 II or K3 Ib with effective temperature $T_{\rm eff} = 4500\,{\rm K}$, surface gravity $\log g = 0.5$, metallicity of [Fe/H] $= -0.41$ and lithium abundance of $A_{\rm Li} = 1.15$. From H-R diagram with evolutionary tracks we estimated mass of the star of (6–9) $M_\odot$.

Key words: star HD 152786, luminosity class, chemical composition, lithium

1. HD 152786 in present publications

The star lies near the Galactic plane and it is classified as young star of population I. In Astronomical Database Simbad are presented some basic data of the star: beside others parallax (5.68 ± 0.91) mas, magnitude in filter V: 3.13 mag, colour index $B - V = +1.60$ mag and $U - B = +1.96$ mag and spectral type of K3 III.

A parallax of the star obtained by Hipparcos astrometric satellite is nearly an order of magnitude smaller then its earlier values. Therefore, the luminosity of the star as well as the luminosity class determined before Hipparcos are not in agreement with the Hipparcos measurement. According to the Hipparcos mission, a distance of the star is 176 pc and absolute magnitude in filter V is -3.95 mag. The luminosity of HD 152786 can be estimated as about $6310\,L_\odot$. As you can see in Fig. 1, position of the star in the H-R diagram is different.

Based on the new measurements, the star should be classified as a bright giant or a supergiant, with the luminosity class of II or Ib.

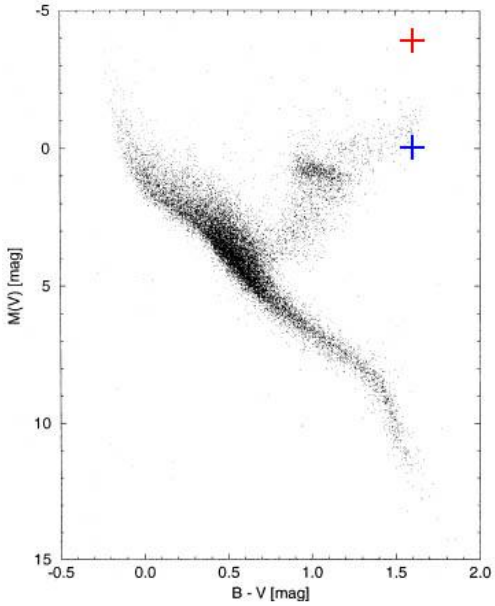

Figure 1: The position of the star in the H-R diagram (figure from Perryman et al., 1997) has been dramatically changed after the Hipparcos measurements were done (*blue* and *red crosses* denote the position prior and after the Hipparcos, respectively).

2. Spectral analysis

Using the Synspec code we calculated synthetic spectra for several parameters of star atmosphere. The parameters of the star atmosphere can be considered to be the same as that of the calculated spectrum with the best fit to normalized measured data. Four different regions of the matching spectra are presented in Fig. 2.

3. Results

By means of comparing synthetic and measured spectra we determined the effective temperature as $T_{\rm eff} = 4500\,{\rm K}$, surface gravity $\log g = 0.5$ and abundances of some chemical elements for the star listed in Tab. 1.

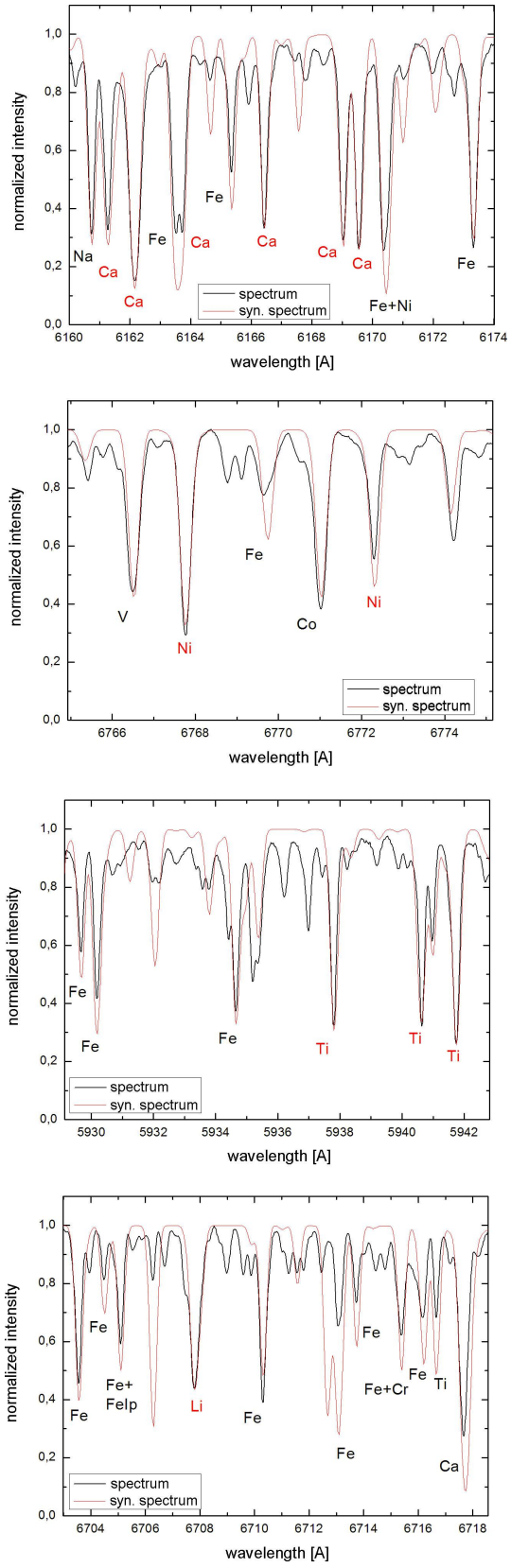

Figure 2: Different regions of the matching spectra (*red line* – calculated spectrum, *black line* – measured spectrum).

Table 1: Obtained abundances of some elements.

A (element)	A_A	[A/H]
Li	1.15	+0.10
Al	5.60	−0.77
Ca	5.90	−0.41
Ti	5.90	+1.00
V	4.95	+0.95
Fe	7.04	−0.41
Co	4.78	−0.14
Ni	5.30	−0.93

The value of surface gravity confirms assigning the star to the supergiants class.

From the physical parameters the star can be placed into the H-R diagram with evolutionary tracks and than its mass and approximate evolutionary state could be estimated (see Conclusion).

4. Conclusion

According to the research HD 152786 appears to be supergiant of spectral class K3 II or K3 Ib with effective temperature $T_{\rm eff}$ = 4500 K, surface gravity $\log g$ = 0.5 and metallicity of [Fe/H] = −0.41, which confirms that HD 152786 is a metal-rich population I star. Obtained lithium abundance $A_{\rm Li}$ = 1.15 does not correspond to values of lithium stars. The mass estimated from H-R diagram is (6–9) $M_\odot$. Therefore, the evolutionary state must be close to the point where the energy source in the star's interior is changing. As consistent with current theories, the measured value of lithium abundance is in a good agreement with the guessed state of the star.

References

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