BROWN DWARFS: MYSTERY AND SHOW

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ABSTRACT. Results of the numerical simulation of the spectrum of the brown dwarf candidate Teide1 discovered by Rebolo et al. (1995) are discussed.

Key words: brown dwarfs: spectra: lithium abundances.

INTRODUCTION

Low luminosity M-dwarfs of the bottom of Main Sequence are the best brown dwarf candidates. Rebolo et al.(1992) and Magazzu et al. (1993) put forward the idea of *lithium test* for search these substellar objects. Last year Basri et al. (1995) reported the discovery of Li I resonance lines in spectrum of M-dwarf PPL15 in Pleiades. PPL15 lays on the boundary between brown dwarfs and low mass stars. Recently Rebolo et al. (1995) using a deep IR survey of the Pleiades center found a cluster of very low luminosity objects. Strong enough Li lines were observed in spectra of two members of the group labeled Teide1 and Calar3 (Rebolo et al. 1996).

PROCEDURE

Computations of LTE synthetical spectra were performed by WITA30 program (Pavlenko 1996) for Allard and Hauschildt (1995) model atmospheres.

OBSERVATIONAL MATERIAL

In this paper we use Teide1 spectrum λλ6200-9300 Å observed with effective resolution 3.0 Å by Rebolo et al. (1996) at 10 m Keck telescope(Mauna Kea, Hawaii).

RESULTS

The fit of low-resolution Teide 1 spectrum by JOLA: 6200-9000 Å region

The shape of the visible region of Teide1 spectrum is governed by the absorption of TiO and VO bands (Fig.1, see also Kirkpatrick at al.1991).

We found:

– Teide 1 spectra may be fitted by JOLA in the visible region, at least around Li I lines λλ6708 and 8126 Å.

– the comparison of observed and computed spectra

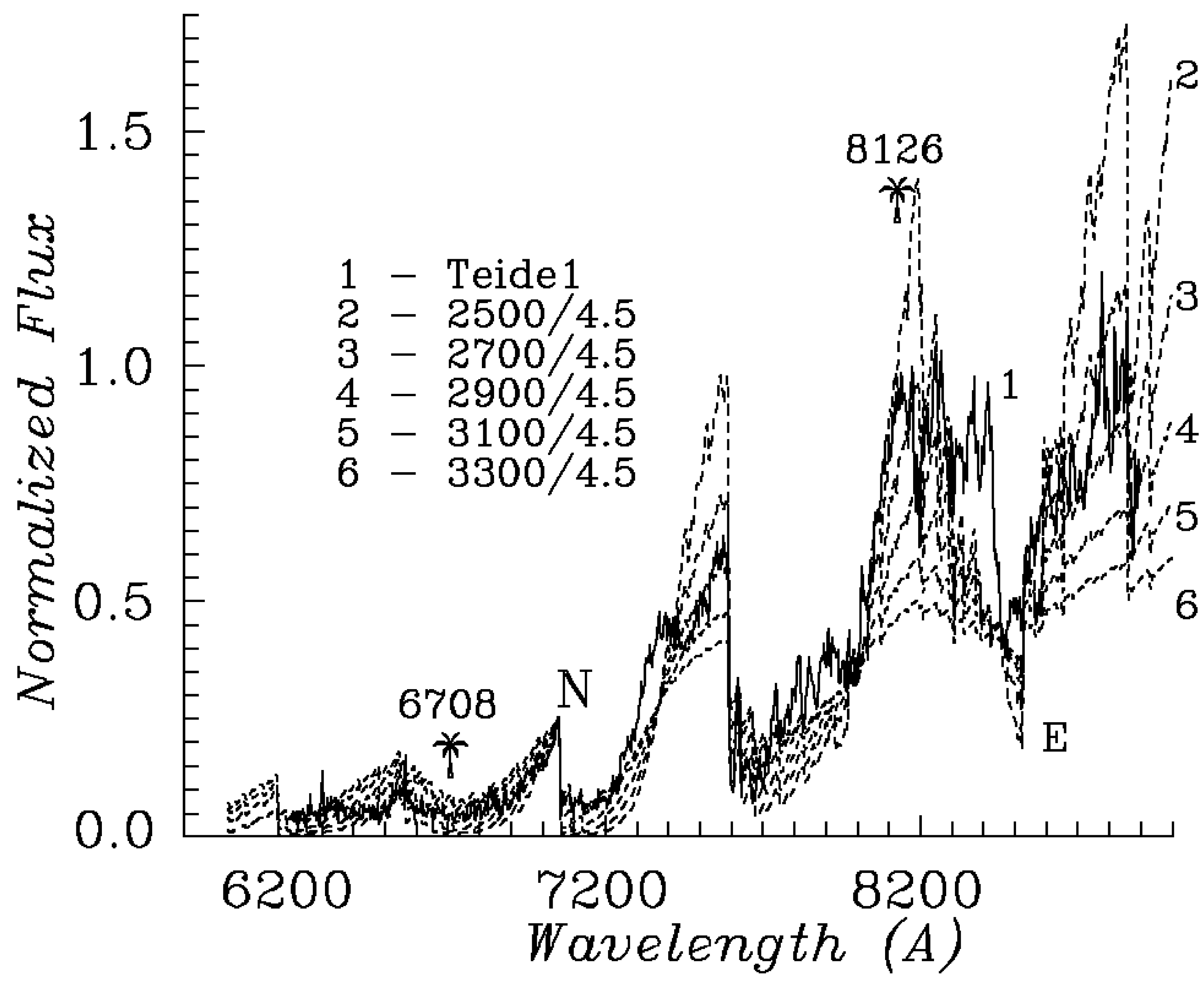

Figure 1: Observed Teide1 spectrum (solid line). Dashed lines show theoretical JOLA fluxes normalized to equal value at 6709 Å

shows that the effective temperature of Teide1 $T_{eff} \approx$ 2700 K.

Equivalent width's analysis

Rebolo et al. (1996) obtained the "pseudoequivalent widths" of λλ6708 and 8126 Å Li I doublets (W_λ =1.0± 0.2 Å and 100 ± 25 mA, correspondingly) in Teide1 spectrum. These W_λ were measured with respect to the spectrum (pseudocontinuum) of M-dwarf (VB10) of the same T_{eff} , which does not show any Li lines. For several model atmospheres we computed theoretical "pseudoequivalent widths" $W^J_\lambda = f(logN(Li))$ (Fig.2):

$$W^J_\lambda = \int (1 - H^{JOLA+Li}_\nu / H^{JOLA}_\nu) d\nu$$

Note, even for $logN(Li)$ =3.5 the W^J_λ is much lower than measured by Rebolo et al. (1996) in spectrum Teide 1 .

The spectrum nearby λ 8126 Å line is less blended. So the equivalent width determination should be more confident here. For W^J_λ= 100 mA we have got $logN(Li)$ = 2.9.

Let me note another important result:

W^J_λ values *for both lithium doublets* are practically the

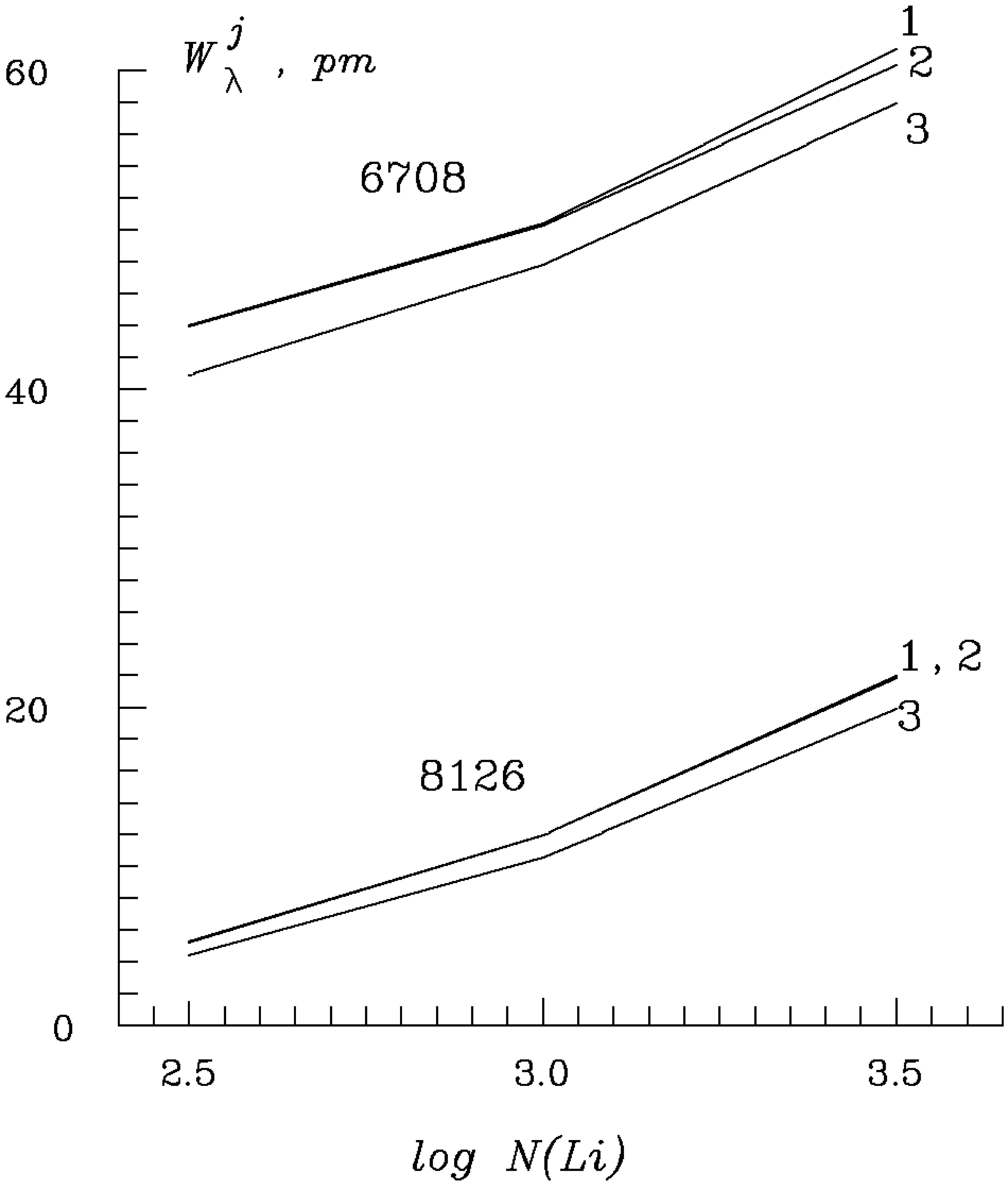

Figure 2: Pseudoequivalent width of Li I lines computed for model atmospheres from AH95 grid: 2500/5.0 (1), 2700/5.0 (2) 3000/5.0 (3)

same for 2500/5.0 and 2700/5.0 model atmospheres in the wide range of $logN(Li)$.

DISCUSSION

From analysis of pseudoequivalent widths of resonance and subordinate lithium lines in Teide1 we obtaine high lithium abundances in its atmosphere. So we have got strong argument to identify Teide1 as the *real brown dwarf.*

The results obtained in this paper are model dependent. We used theoretical model atmospheres, simplified model of molecular absorption. Our computations were performed in the frame of LTE.

On another hand we could fit low resolution spectrum of Teide1 using these input data and physics. Differences in $logN(Li)$ obtained for resonance and subordinate lines are caused by a few reasons. Saturated Li I resonance lines are formed in the outermost atmospheric layers which may be affected by non-classical phenomena: NLTE, chromospheres, etc. In that sense the use of subordinate Li I line 8126 Å should give better results.

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