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THE ABUNDANCES OF SOME HEAVY ELEMENTS IN THE ATMOSPHERE OF γ TAURI

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ABSTRACT. Comparison of synthetic spectrum of the γ Tauri photosphere and high quality spectral atlases of this star permit us to identify absorption lines of rubidium, indium, disprosium, erbium, osmium in the observed spectra. The abundances of these elements in the atmosphere of γ Tauri with respect to their abundances in the solar atmosphere were determined by the method of spectrum synthesis.

Key words: $r-, s-$processes elements – stellar abundances

The investigations of abundances of $r-$, $s-$processes elements in the atmospheres of stars of different types are important for solving a number of astrophysical problems. The present study is aimed at the determination of the abundance of some heavy elements in the photosphere of γ Tauri.

γ Tauri is a member of Hyades cluster. This is the nearest cluster to the Sun. In time it is only one-tenth. the age of the Sun so its overall chemical abundance will provide evidence of any general enrichment that the Galaxy may have received in heavy elements since the birth of the Sun (Griffin and Holweger, 1989). A high resolution spectral atlases of this star were published by Gratton et al. (1975) and Appelquist et al. (1983). The wavelength regions of these atlases are 3985–4812 Å and 5186–8693 Å, respectively.

The synthetic spectra were calculated for K0 III type star and for solar type star within the wavelength range of spectral atlases of γ Tauri with interval of 0.01 Å. Tsymbal (1992) and Gadun and Sheminova (1988) programs were used. The used line list consists of one of the versions of Kurucz's computations for iron group elements (1991) and files BELLLIGHT, BELLHEAVY, NBSDATA, NLTELINES (Kurucz, 1992, 1993).

We used the following parameters of the atmosphere models: $T_{\rm eff}$=5000 K, $\lg g$=2.7, $v_{\rm micro}$=1.6 km/s for γ Tauri, $T_{\rm eff}$=5777 K, $\lg g$=4.4377, $v_{\rm micro}$=0.9 km/s for Sun. Kurucz (1992) grid of atmosphere models were used. The synthetic spectrum of K0 III type star in the wide spectral region was used only for iden-

Table 1. Abundances of heavy elements in the atmosphere of γ Tauri

							Moore et al.,1966	
Z	Ident.	λ (Å)	lg gf	lg A_γ	lg A_{Sun}	Δ lg A	λ (Å)	Ident.
37	Rb I	7800.26	+0.14	2.39	2.38	+0.01	7800.290	Rb I
49	In I	4511.31	−0.21	1.42	1.51	−0.09	4511.310	In I
66	Dy II	4073.12	+0.10	0.70	0.93	−0.23	4073.125	Dy II
68	Er II	4048.34	−0.57	0.99	1.10	−0.11		
76	Os II	4420.47	−1.53	1.39	1.27	+0.12	4420.460	Os II

tification: the unblended and faintly blended absorption lines of heavy elements, which were not investigated in the atmosphere of γ Tauri earlier, were selected from calculations. Each line selected from the computed list was investigated in the observed spectrum. For these purposes we developed a software for displaying on the screen of IBM PC the observed and synthetic spectra simultaneously, in any desired scale. In such a way the possibility of errors in identification has been forced to zero.

Selected lines were analyzed by the method of spectrum synthesis. The unidentified lines were replaced by artificial lines of iron. Synthetic spectra were broadened by Gaussian type macroturbulence with velocity 4 km/s for γ Tauri or 1.6 km/s for Sun and rotation with velocity 2 km/s for Sun. Kurucz et al. (1984) spectral atlas of solar flux were used. Effects of rotation are not fully taken in account for γ Tauri. Instrumental profile was assumed to be Caussian for γ Tauri.

Results of our work are shown in Table 1: charge of nuclei, identification, wavelength, lg gf, abundance of element in the γ Tauri and solar atmospheres (in the scale lg $A(H)$=12.00), abundance of element in the atmosphere of γ Tauri with respect to the solar one. In the last columns of Table 1 wavelength and identification from the solar spectrum by Moore et al. (1966) are shown.

The abundances of rubidium, indium, disprosium, erbium, osmium in the atmosphere of γ Tauri are solar (in the range of errors).

Observations of γ Tauri with better signal to noise ratio and high spectral resolution are desired to obtain a more precise result.

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