OXYGEN ABUNDANCE IN NORMAL AND PECULIAR B AND A TYPE STARS

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ABSTRACT. The prominent OI(3s $^5S°$-3p ^5P) triplet near 7774Å has been observed in normal and peculiar B and A type stars, and compared with synthetic non LTE profiles

About fifty spectra of this triplet have been recorded in a dozen of main sequence normal and chemically peculiar (Si and Ap=Sr Cr Eu) stars with the Reticon equipped Coudé Echelle Spectrometer at the 1.4m CAT reflector of the European Southern Observatory. The Observations, taken with a fixed resolving power equal to $\lambda/\Delta\lambda$ = 100000, were restricted to bright stars (visual magnitude less than 6) that have small projected rotational velocities (Vsini $\lesssim$ 50km/s).

The total equivalent width W(7774) of the peculiar stars are systematically smaller than the normal ones of corresponding spectral type. Some of the peculiar stars show unexpected absorption lines in the spectral region around 7774Å.

The theoretical interpretation of the λ7774 triplet in A type stars requires detailed non LTE calculations which were performed by an improved version of the NLTE solar code of Kitt Peak (Auer et al., 1972) with opacities relevant to B and A type stars, and with Traving-Baschek-Holweger (1966) partition functions. The pure radiative atmospheric models used were provided by the program ATLAS6 of Kurucz (1979).

The Voigt profiles of the components of the blend were calculated considering collisional line broadening by (1) neutral hydrogen and neutral helium (interpolated in the Deridder-Van Rensbergen (1976) tables); (2) electrons and protons, according to the Impact Parameter method.

The excitation and ionization transition rates due to electronic collisions are also estimated following this semi-classical method. The multiplet oscillator strength value, f (7774)=0.70, measured by Bromander et al. (1978)is

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used. The effects of stellar rotation are considered to fit the observed profiles.

The observed line profiles of 9 stars with rotational velocities Vsini $\lesssim$ 30km sec^{-1} have been reproduced theoretically with the solar oxygen abundance value, log ϵ(O)=8.92 derived by Grevesse et al.(1984), or less (down to 33% relative to the sun) for the three normal stars. For the peculiar stars (4 Ap and 2 Si), only a few Hundredths of that solar value are needed, except for the strontium star HD165040. The oxygen abundances and the accurate rotational velocities derived are given in Table 1.

The total equivalent width W(7774) of the triplet has been calculated for normal B and A type stars (log g=4.0), with the solar oxygen abundance, as a function of the effective temperature. The results can be represented by a double linear relation, form T_{ef}=8000°K to 8500°K and from 8500°K to 15000°K, for a given microturbulence velocity (v_t); for v_t=0.0 and 1.8 km/s, these relation are :

8000 - 8500°K

v_t=0.0 km/s : W(7774) = (56+0.0600 T_{ef})mÅ r=+0.9626
v_t=1.8 : = (105+0.0643 T_{ef})mÅ r=+0.9481

8500 - 15000°K

v_t=0.0 km/s : W(7774) = (812-0.0292 T_{ef})mÅ r=-0.9996
v_t=1.8 : = (966-0.0376 T_{ef})mÅ r=-0.9997

wherer is the statistical correlation coefficient.

Table 1. Total equivalent width, Vsini and abundances A(O) derived for the stars studied in detail.

HD	Spectral Type	W(7774) (mÅ)	Vsini (km/s)	$\frac{A_*(O)}{A_\odot(O)}$ (%)
17081	B7 V	477	20.0	100
193432	B9.5 V	503	25.0	80
213320	A0 IV	402	20.5	33
165040	A7 p	511	16.5	80
188041	A5 p	133	12.0	1
201601	F0 p	169	13.5	4
221760	A2 p	69	14.5	0.8
25267	B9.5Si	220	26.5	20
187474	A0 Si	110	16.5	2

REFERENCES

Auer,L.H.,Heasley,J.N.,Milkey,R.W.,1972,KPNO Contr.555
Bromander,J.,Duric,N.,Erman,P.,1978,Phys.Scripta 17,119
Deridder,G.,Van Rensbergen,W.,1976,Astron.Astrophys. Suppl. 23,147
Grevesse,N.,Sauval,A.J.,van Dishoeck,E.F.,1984,Astron. Astrophys. 141,10
Kurucz,R.L.,1979,Astrophys.J. 40,1
Traving,G.,Baschek,B.,Holweger,H.,1966,Abh.Hamburger Sternw. 8,1