Investigation of the Post-Coronal Density Regions of Oe Stars, with the N V UV Resonance Lines

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Abstract. The presence of Satellite Absorption Components (SACs) in the N V resonance lines of 20 Oe stars of different spectral subtypes is considered. We calculated the values of the apparent rotational and radial velocities, the random ion velocities, as well as, the Full Width at Half Maximum (FWHM) and the column density of the independent regions of matter which produce the main and the satellites components of the studied spectral lines. We examine also the variations of these physical parameters as a function of the spectral subtype.

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INTRODUCTION

The DACs/SACs phenomenon [1, 2, 3] is able to explain the peculiar and complex spectral line profiles that we observe in the spectra of Oe and Be stars. The presence of Satellite Absorption Components (SACs) in the N V resonance lines of 20 Oe stars of different spectral subtypes is considered. Using the Gauss-Rotation (GR) model [3, 4] on the spectra of 20 Oe stars, taken with International Ultraviolet Explorer (IUE), we detect that the N V resonance lines consist of one to four Satellite Absorption Components (SACs). With the above method we calculate the values of the apparent rotational and radial velocities, the random velocities of the thermal motions of the ions, as well as the Full Width at Half Maximum (FWHM) and the column density of the independent regions of matter which produce the main and the satellites components of the studied spectral lines. We also examine the variations of these physical parameters as a function of the spectral subtype.

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THE PHYSICAL PARAMETERS IN THE N V REGIONS OF 20 Oe STARS AS A FUNCTION OF THE SPECTRAL SUBTYPE

Our sample includes the subtypes O4 (one star), O6 (four stars), O7 (five stars) O8 (three stars) and O9 (seven stars). In our sample we detect that the N V spectral lines consist of one component in 2 stars, two components in 7 stars, three in 9 stars and four in 2 stars.

In Fig. 1, we present the N V doublet of the O9 star HD 34656, and its best fit. The best fit has been obtained with three SACs and one emission component for each member of the doublet. The graph below the profile indicates the difference between the fit and the observed spectral line. Below the fit we present the decomposition of the observed profile to its SACs.

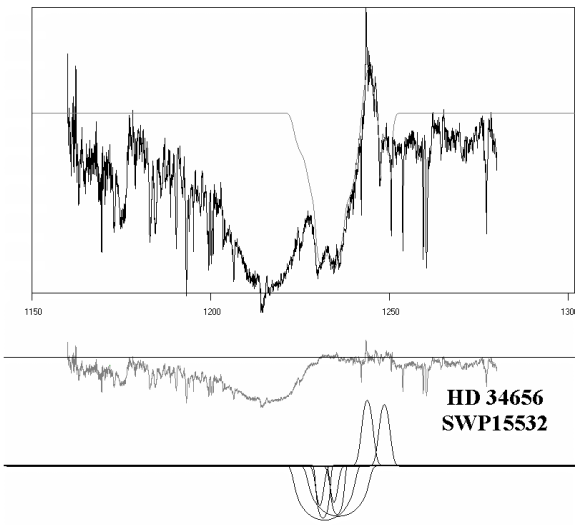

FIGURE 1. The N V resonance lines (λλ 1238.821, 1242.804 Å) in the spectrum SWP18941 of HD 34656. Each of N V spectral lines consists of three SACs and one emission component. Below the fit one can see the decomposition of the observed profile to its SACs.

The Apparent Radial and Rotational Velocities

In Fig. 2a,b we present the mean values of the radial velocities (Fig. 2a) and the rotational velocities (Fig. 2b), of the N V independent density regions of matter which create the 1, 2 or 3 satellite components for each of the N V resonance lines (λλ 1238.821, 1242.804 Å), as a function of the spectral subtype.

In the N V region we detect two groups of radial velocities. The first one has values between -2300 and -1500 km/s and the second between -500 and -100 km/s.

We detect the same phenomenon in the case of the rotational velocities with values between 1800 and 1100 km/s for the first and between 400 and 200 km/s for the second group.

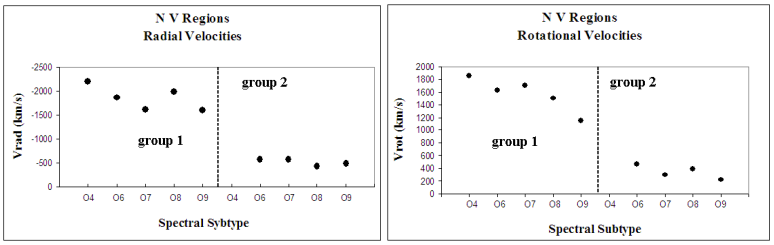

FIGURE 2a,b. The radial velocities (left) and the rotational velocities (right) of the independent density regions of matter which create the 1, 2, 3 and 4 SACs of the N V resonance lines (λλ 1238.821, 1242.804 Å) as a function of the spectral subtype.

The Random Velocities and the Full Width at Half Maximum (FWHM)

In Fig. 3a,b we present the random velocities of the thermal motions of the ions (Fig. 3a) and the Full Width at Half Maximum (FWHM) (Fig. 3b), of the 1, 2 or 3 satellite components of the N V resonance lines (λλ 1238.821, 1242.804 Å), as a function of the spectral subtype.

There are two groups of values of the random velocities. The first has values between 400 and 200 km/s and the second between 150 and 80 km/s.

We detect the same phenomenon for the FWHM, with values between 18 and 10 Å for the first and between 6.0 and 2.0 Å for the second group.

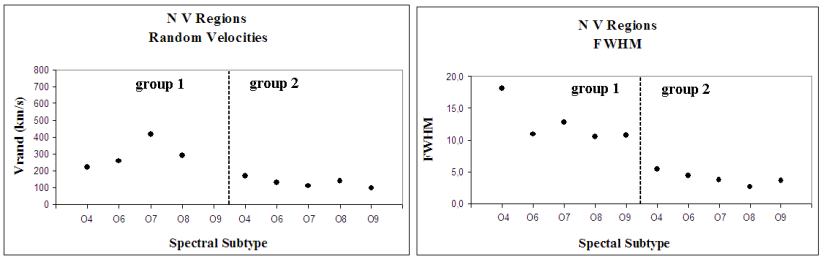

FIGURE 3a,b. The mean random velocities of the thermal motions of the ions (left) and the Full Width at Half Maximum (FWHM) (right) of the 1, 2, 3 and 4 SACs of the N V resonance lines (λλ 1238.821, 1242.804 Å), as a function of the spectral subtype.

The Column Density

In Fig. 4a,b we present the Column Density (CD) in 10^{10} cm^{-2} for the independent density regions of matter which create the 1, 2 or 3 satellite components of the N V resonance lines (λ 1238.821 Å in Fig. 4a and λ 1242.804 Å in Fig. 4b), in all the stars of our sample, as a function of the spectral subtype. We detect also two groups of the values of the column density. The first has values between 5 $\times 10^{10}$ cm^{-2} and 3 $\times 10^{10}$ cm^{-2} and the second about 2.5 $\times$ 10^{10} cm^{-2}.

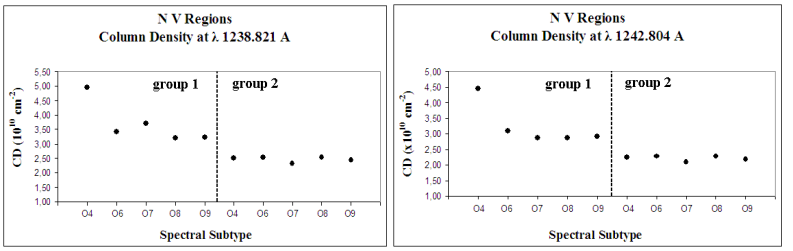

FIGURE 4a,b. The Column Density (CD) in 10^{10} cm^{-2} of the N V resonance line at λ 1238.821 Å (left) and λ 1242.804 Å (right) for the independent density regions of matter which create the 2, 3, 4 or 5 satellite components as a function of the spectral subtype.

CONCLUSIONS

We found that the N V regions present similar values of radial and rotational velocities and FWHM with the C IV regions [7]. We detected higher values of random velocity and lower values of column density than the C IV [7] regions. In [1, 5, 6] it is noted that there are two mechanisms which create the radial velocities. The first one creates high and the second one low radial velocities. We detect the same phenomenon for all the studied parameters, which present two levels of values. The first has high values and the second has low values.

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