The Photospheric And The Respective Si IV Regions' Rotational Velocities In 27 Be Stars

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Introduction

A significant phenomenon in the spectra of hot emission stars is the existence of Discrete Absorption Components (DACs) [1] or Satellite Absorption Components (SACs) [2,3].The appearance of these components results to the complex profile of many spectral lines in the spectra of Oe and Be stars. The difference between the DACs and SACs phenomena is explained in [2-6].

In this paper we study the relation between the rotational velocities of the Si IV regions of 27 Be stars and their photospheric rotational velocities, using the method described in [4], where the C IV regions in 20 Oe stars have been analysed. Finally, we compare the results of the Si IV regions of 27 Be stars and the C IV regions in 20 Oe stars.

The relation between the photospheric and the respective Si IV regions rotational velocities of 27 Be stars

This study is based on the analysis of 27 Be stellar spectra taken with the IUE –satellite (IUE Database http://archive.stsci.edu/iue). We examine the complex structure of the Si IV resonance lines (λλ 1393.755 Ǻ, 1402.77 Ǻ). Our sample includes all the subtypes from B0 to B8. The values of the photospheric rotational velocities are taken from the catalogue [7].

We found that the Si IV spectral lines consist of three components in 7 stars, four in 15 stars and five in 5 stars. The ratio Vrot/Vphot of the first to fifth detected components as a function of the photospheric rotational velocity (Vphot) is presented in Figs. 1a to 5a, respectively. In such a way we obtain an indication of how much the rotational velocity of the specific Si IV layer is higher than the apparent rotational velocity of the star. In Figs. 1b - 5b the respective ions' random velocities (Vrand) are presented as a function of the photospheric rotational velocity, where Vrot is the rotational velocity of the successive Si IV regions that form each of the considered components. We observe that the dispersion of the random velocities decreases from the first to the fifth component.

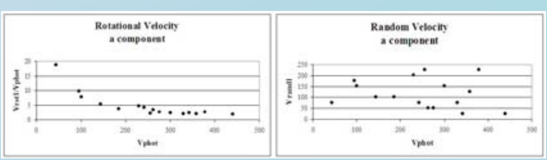

FIGURE 1a, b.: The ratio Vrot/Vphot (left) and the ions' random velocities (right) as a function of the photospheric rotational velocity Vphot of the first component in the sample of 27 Be stars.

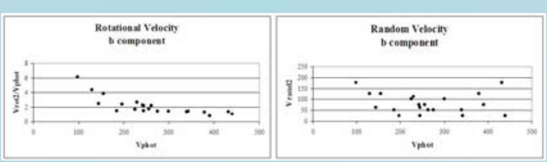

FIGURE 2a, b.: The ratio Vrot/Vphot (left) and the ions' random velocities (right) as a function of the photospheric rotational velocity Vphot for the second component in the sample of 27 Be stars.

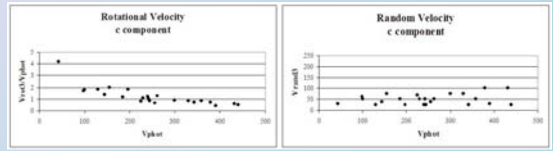

FIGURE 3a, b.: The ratio Vrot/Vphot (left) and the ions' random velocities (right) as a function of the photospheric rotational velocity Vphot for the third component in the sample of 27 Be stars.

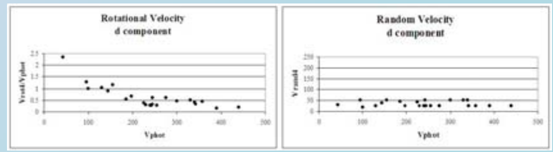

FIGURE 4a, b.: The ratio Vrot/Vphot (left) and the ions' random velocities (right) as a function of the photospheric rotational velocity Vphot for the fourth component in the sample of 27 Be stars.

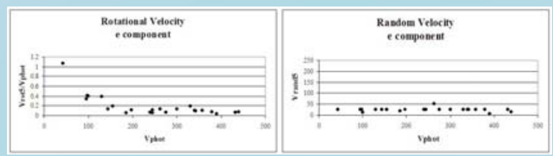

FIGURE 5a, b.: The ratio Vrot/Vphot (left) and the ions' random velocities (right) as a function of the photospheric rotational velocity Vphot for the fifth component in the sample of 27 Be stars.

Results

Our results are very similar with the ones extracted from the study of the C IV regions in 20 Oe stars [4]. The Si IV resonance lines are composed of three four of five components, depending on the star. This means that there exist three to five independent density regions responsible for the creation of these components. The difference with the case of the C IV resonance lines in the spectra of 20 Oe stars, is that they are composed of two, three or four components. However, in both cases, in each region and for each component there exists a logarithmic relation between the ratio Vrot/Vphot and the photospheric rotational velocity Vphot. For the satellite components of the Si IV resonance lines, the maximum ratio Vrot/Vphot varies from 19, for the first to 1 for the fifth component (Figs. 1a - 5a). The same phenomenon appears in the case of the C IV resonance lines in 20 Oe stars, where the maximum ratio Vrot/Vphot varies from 40, for the first to 5 for the fourth component [4].This variation may be due to the inclination of the stellar axis. In order to test the validity of our model we check, for all the studied stars, whether the ion's random velocities of each Si IV component, are constant and do not depend on this angle, as it is theoretically expected. Our results confirm this phenomenon, meaning that the mean values of the ions' random velocities are almost constant (Figs. 1b, 2b, 3b, 4b, 5b). The same results are also extracted from the study of the C IV regions in 20 Oe stars [4].

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