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THE COMPLEX CORONAL STRUCTURE OF THE Oe STAR HD 175754

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Abstract. We present the study of the HD 175754 coronal regions, based on the model proposed by Danezis et al. (2003). By this model, we can calculate, for all the independent density regions, the apparent expansion/contraction velocities (V_{exp}), the apparent rotation velocities (V_{rot}), as well as the values of ξ, which is an expression of the optical depth.

HD 175754 is a luminous supergiant star of spectral type OeIIf with effective temperature 31800 ±1100 K (Morossi and Crivellari, 1980). Costero and Stalio (1981) and Costero et al (1981) studied the NV, SiIV and CIV profiles of this star and compared them with the profiles of similar type stars. They found individuality, which implies different structures and dynamics of the atmospheric layers above the photosphere. Carrasco et al. (1981) reported only small changes in the UV resonance line profiles. They interpreted them in terms of variations in dynamics and density/ionization structure of the stellar wind. Lamers et al (1982) noted the possibility of the presence of satellite components superimposed on the wide P Cygni profiles of the UV resonance lines. Finally, Franco et al (1983) studied the P Cygni profiles of the above resonance lines of HD 175754 observed at different epochs and they reported variability in the secondary satellite component. They proposed two different mechanisms for the explanation of the variability, namely, a thermal mechanism in a hot region at $Tc=2\times10^5$ K which produces the principal stationary component and a mechanism which gives rise to the secondary component by ionization of cooler high velocity stellar material from X-rays coming from inner coronal region.

In this paper we present the study of the HD 175754 coronal regions, based on the model proposed by Danezis et al. (2003), also presented at the 4th Serbian Conference on Spectral Lines Shapes (IV SCSLS) 2003, Arandjelovac, Serbia, under the title “On modelling SACs regions in early type atmospheres”. This model presupposes that the regions, where these spectral lines are formed, are not continuous but consist of a number of independent absorbing density layers of matter, followed by an emission region and an external general absorption region. By this model, we can calculate, for all the independent density regions, the apparent expansion/contraction velocities (V_{exp}), the apparent rotation velocities (V_{rot}), as well as the values of ξ, which is an expression of the optical depth.

2. SPECTRAL ANALYSIS AND CONCLUSIONS

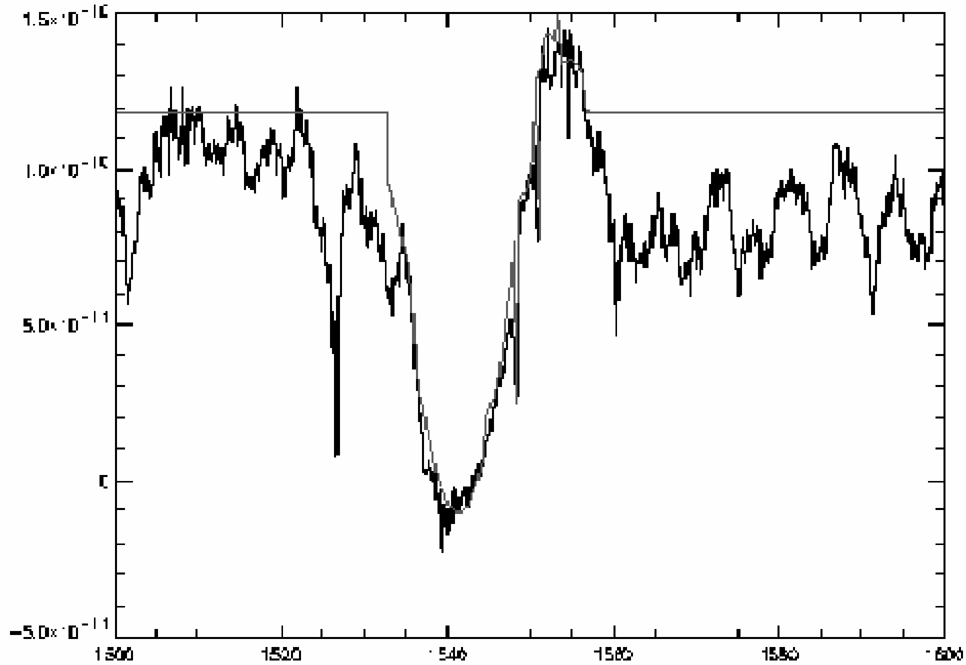

Fig. 1: The CIV resonance lines fittings of HD175754 (SWP 06269). The heavy line presents the observed spectral line profile and the light one the model's fit. The differences between the observed spectrum and its fit are sometimes hard to see, as we have accomplished the best fit.

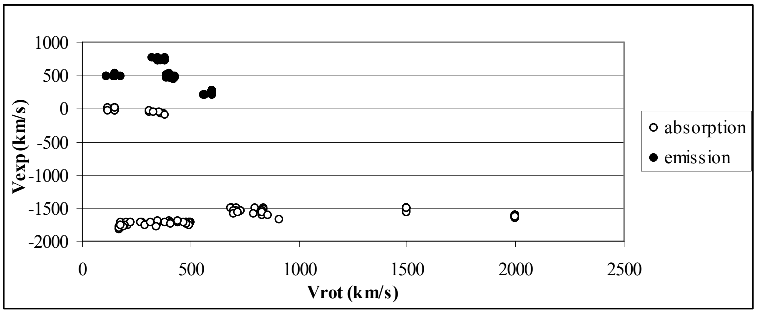

Diagram 1: Expansion/contraction velocities of the absorption and the emission components as a function of the rotation velocities. We can notice that the emission regions present only positive values of the apparent expansion/contraction velocities, while the respective apparent rotation velocities present values up to 600 km/s. For the absorption regions, we can discern two levels of negative expansion velocities. The first, about 0 km/s, present rotation velocities up to 400 km/s and the second, about -1500 km/s, presents rotation velocities between 100 and 2000 km/s.

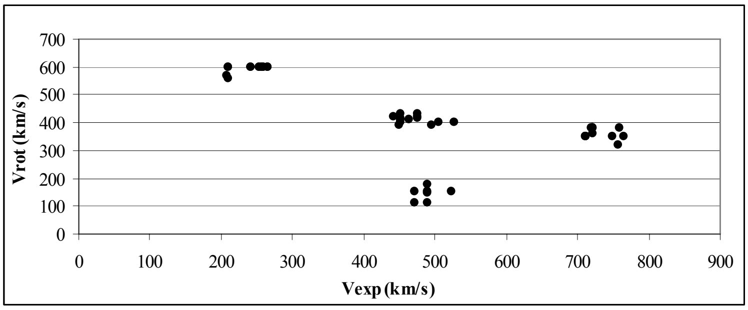

Diagram 2: Rotation velocities for the emission component as a function of the expansion/contraction velocities. We can notice that for small values of V_{exp} (about 250 km/s), the V_{rot} presents great values (about 600 km/s). For greater values of V_{exp} (about 500 km/s), we can discern two levels of V_{rot}, about 150 and 400 km/s, respectively. Finally, for V_{exp} about 750 km/s, the V_{rot} lies at 350 km/s.

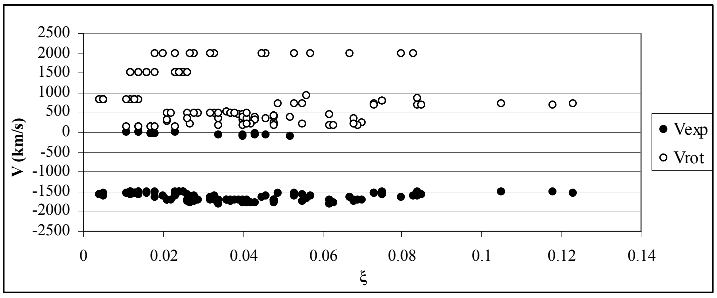

Diagram 3: Expansion/contraction and rotation velocities of all the SACs as a function of the ξ values. We can notice two levels of V_{exp} and V_{rot}. The first level of V_{exp} (about -1500 km/s) is observed for all values of ξ between 0 and 0.13. The second one is observed only for ξ values between 0 and 0.05. The V_{rot} values present a similar behavior. The first level (about 500 km/s) is presented for all ξ values, while the second one (about 2000 km/s) is presented only for ξ values between 0 and 0.08.

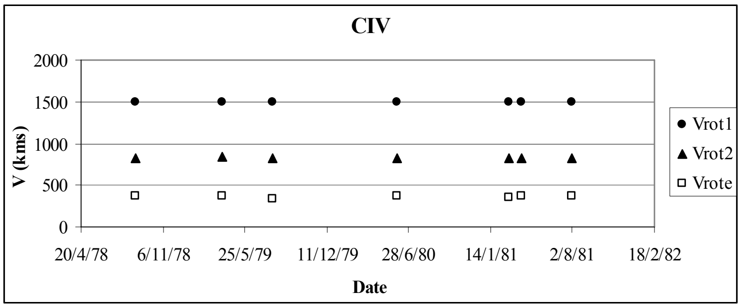

Diagram 4: Evolution with time of the apparent rotation velocities of the CIV absorption (Vrot1, Vrot2) and emission (Vrote) components. The V_{rot} for the three detected density regions remains constant with time.

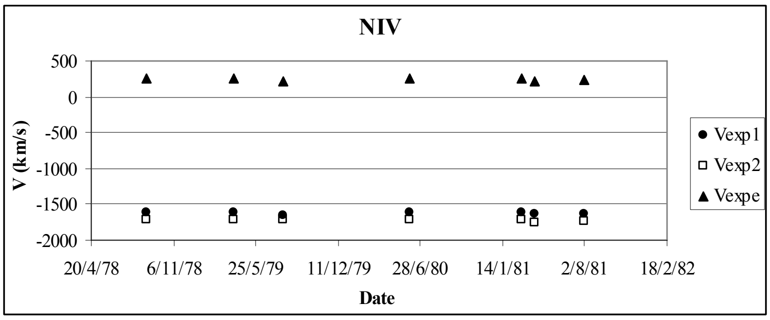

Diagram 5: Evolution with time of the expansion/contraction velocities of the NIV absorption (Vexp1, Vexp2) and emission (Vexpe) components. The V_{exp} for the three detected density regions remains constant with time.

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