The SACs Broadening

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Abstract. As we know, some spectral lines of many Oe and Be stars present Discrete Absorption Components (DACs) or Satellite Absorption Components (SACs). The presence of SACs can broaden the spectral line and we call this phenomenon SACs broadening. The recently published **G**aussian-**R**otation model enables to study many parameters of the regions that construct this kind of spectral lines. In this paper we indicate that we can detect the same phenomena in the spectra of many quasars and that we can study them with this method.

Keywords: Hot emission stars, quasars, models, DACs, SACs.
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INTRODUCTION

Into a stellar atmosphere or a disc that exist around hot emission stars, an absorption line can originate from several regions that present the same temperature. From each of these regions an absorption component arises.

The line profile of each of these absorption components is a function of a group of physical parameters, as the radial, the rotational, the random velocities and the optical depth of the region that produce the specific components of the spectral line.

These spectral lines are named Discrete Absorption Components (DACs), if they are discrete [1].

DACs are discrete but not unknown absorption spectral lines. They are spectral lines of the same ion and the same wavelength as a main spectral line, shifted at different $\Delta\lambda$, as they are created in different density regions which rotate and move radially with different velocities [2,3].

In this paper we indicate the existence of the DACs phenomenon in the spectra of some quasars. We propose that a similar phenomenon, which we call SACs phenomenon, is one of the reasons of the broadening and the complex structure of the observed spectral lines of hot emission stars and quasars.

THE DACs PHENOMENON IN QUASARS

DACs are lines, easily observed, when the regions that give rise to such lines, rotate with low velocities and move radially with high velocities.

In Fig. 1 we can see the Mg II doublet in the UV spectrum of HD 45910. In these line profiles we can see the main spectral lines and a group of DACs at the blue side of each one of them. Below the spectra we can see the components that create the observed features.

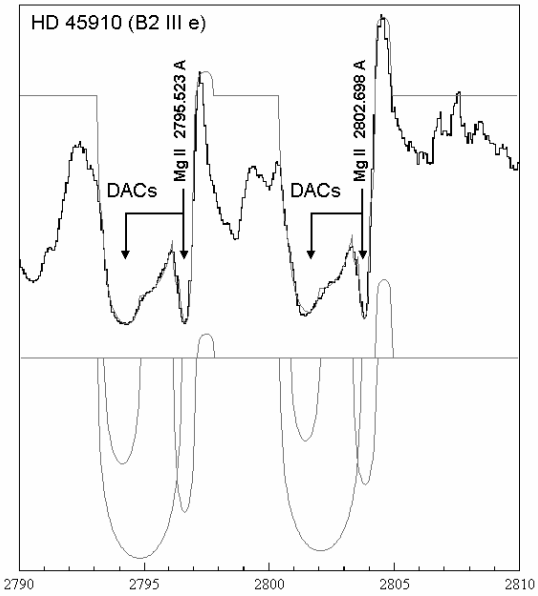

FIGURE 1. Presence of DACs in the Mg II resonance lines of the Be star HD 45910.

It is very important to point out that we can detect the same phenomenon in the spectra of many quasars. In Fig. 2 we can see the C IV doublet of the quasar PG 0946+301. The values of radial displacements and the ratio of the line intensities indicate that the two observable C IV features present a similar DACs phenomenon as in the case of the spectra of hot emission stars.

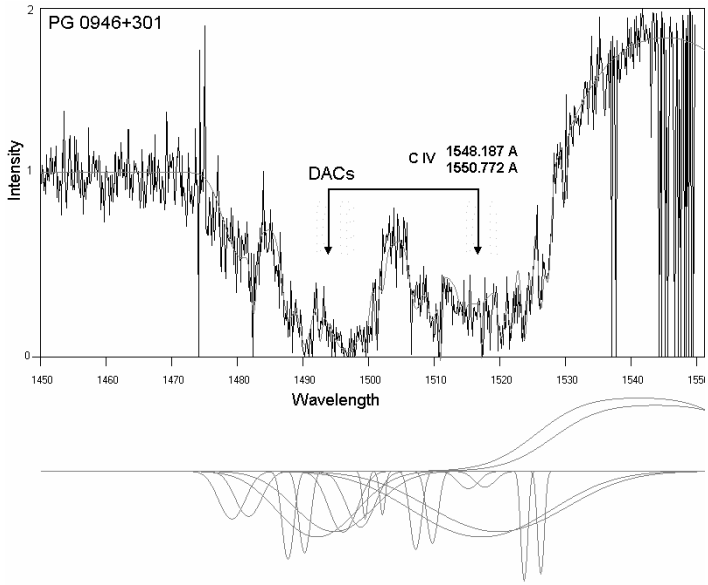

FIGURE 2. Presence of DACs in the C IV resonance lines of the quasar PG 0946+301.

THE SACs BROADENING

However, if the regions that give rise to such lines, rotate with large velocities and move radially with small velocities, the produced lines have large widths and small shifts.

As a result they are blended among themselves as well as with the main spectral line and thus they are not discrete. In such a case the name Discrete Absorption Components is inappropriate and we use only the name Satellite Absorption Components (SACs) [2,3]. The present of SACs can broaden the line shape and we call this phenomenon SACs broadening.

In Fig. 3 we observe the SACs phenomenon in the doublet of Mg II in the case of the Be star HD 41335. Below the spectra we can see the components that create the observed features.

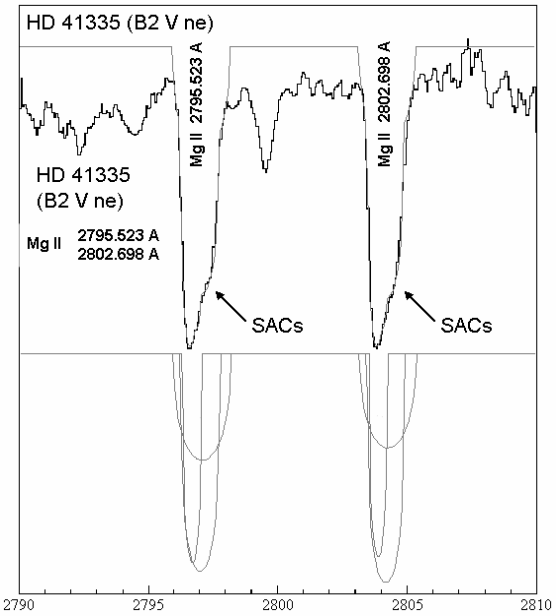

FIGURE 3. Presence of SACs in the Mg II resonance lines of the Be star HD 41335

As we know, around the hot emission stars and the quasars we can detect extensive disc. However, the disc model is not able to reproduce the profiles of many spectral lines.

The question that we examine is the possibility to explain the very complex structure of the spectral lines in many quasars, using the SACs phenomenon. The first conclusions are very promising.

In Fig. 4 we can see the complex structure of C IV doublet and the Si IV, C IV doublet in the spectra of the quasar PG 1700+518 and H 1413+1143 respectively. Below the spectra we can see the components that create the observed features.

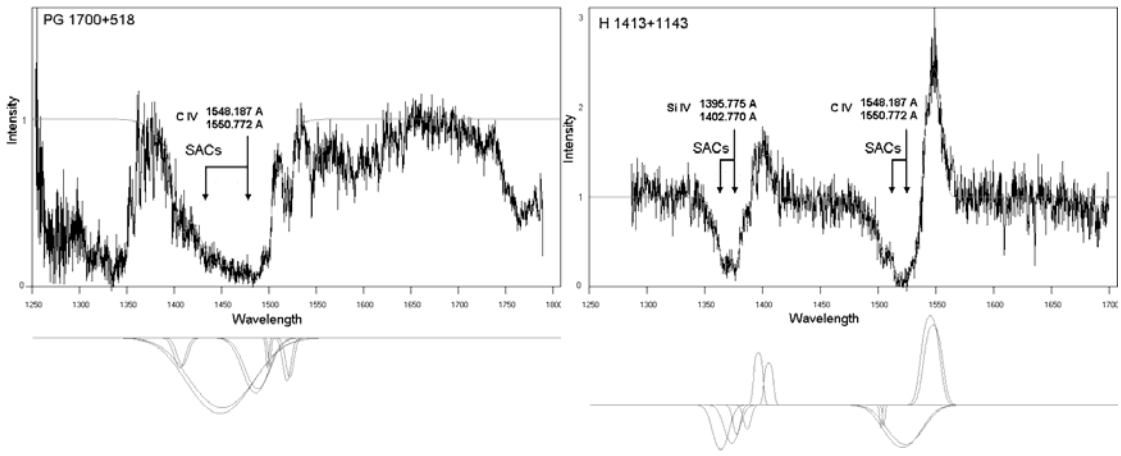

FIGURE 4. Presence of SACs in the C IV resonance lines of the quasar PG 1700+518 and in the Si IV and C IV resonance lines of the quasar H 1413+1143.

CONCLUSIONS

As we see, the presence of SACs can broaden the line shapes and we call this phenomenon SACs broadening. An important point is that we can detect DACs or SACs phenomena not only in the spectra of hot emission stars but also in the spectra of many quasars.

This means that we can study all these line shapes with GR model [4,5].

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