DACs and SACs in the UV spectrum of the quasar PG 0946+301

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Introduction

In the spectra of many quasars we observe complex profiles of broad absorption lines, mainly in the case of high ionization ions (e.g. C IV, Si IV, N V). These complex profiles are composed of a number of DACs or SACs which are created in the Broad Absorption Line Regions (BALR) that result from dynamical processes such as accretion, jets,
ejection of matter etc.

By applying the model proposed by Danezis et al. [1] (GR model) we can accurately fit the observed complex profiles of both emission and absorption spectral lines. With this model we can calculate the apparent rotational and radial velocities, the random velocities of the ions, as well as the Full Width at Half Maximum (FWHM), the column
density of the independent density regions of matter which produce the main and the satellite components of the studied spectral lines and the respective absorbed or emitted energy. We are able to explain the observed peculiar profiles using the DACs/SACs theory, i.e. the complex profiles are composed by a number of DACs or SACs which
are created in different regions [2, 3].

In this paper we apply the GR model on the spectrum of the BALQSO PG 0946+301 (Z=1.216), taken with HST (FOS/G400,G570), on February 16, 1992. We study the C IV ll 1548.187, 1550.772 Å, and Si IV ll 1393.755, 1402.77 Å lines. We point out that the C IV doublet of this BALQSO is one of the very few lines that present clearly the DACs phenomenon.

Results

With GR model we were able to fit accurately the studied spectral lines (see Figure 1). Here we present only the kinematical parameters of the absorption components, i.e. the random velocities of the studied ions as well as the rotational and radial velocities of the BALRs that create the DACs or SACs of the studied lines. The calculated values are given in table 1. As one can see in table 1, some components of the C IV and Si IV resonance lines, present much larger radial velocities (large shifts). These absorption components are discrete (DACs) and appear on the left side of the main absorption features. On the other hand, the main absorption features are composed by a number of SACs (Figure 1).

As one can see in table 1, the values of the rotational velocities of the first two C IV components are too large. In order to explain this large broadening, we propose a new idea, based on the theory of SACs phenomenon [4, 5, 6], absorption lines which are created due to micro- turbulence effects. This means that around the main density region where the main spectral line is created, there may exist some micro-turbulent movements that give rise to some narrow absorption components with different shifts, around the main spectral line. If these lines are many and have small differences in their radial velocities, they blend among themselves (SACs phenomenon) and the result may be a very broad absorption line. Thus, the very broad absorption line might result from the composition of many narrow absorption lines that are created by micro-turbulent effects.

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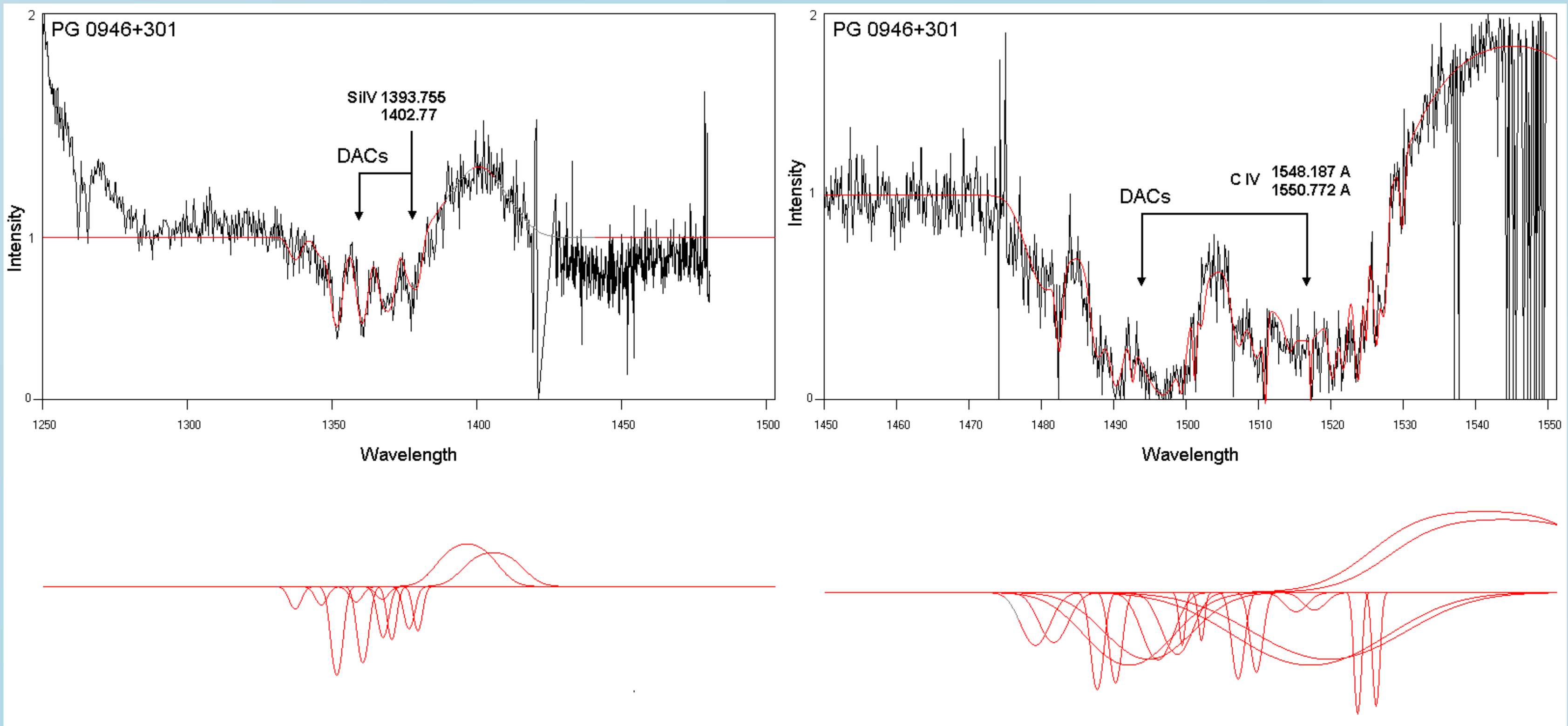

FIGURE 1. Best fit of the Si IV and C IV, resonance lines. We can explain the complex structure of these lines as a DACs or SACs phenomenon. Below the fit one can see the analysis of the observed profile to its DACs/SACs.

TABLE 1. Random (*Vrand*), Rotational (*Vrot*) and Radial (*Vrad*) velocities (in km/s) of the studied regions.

Ion	Radial Velocity	Rotational Velocity	Random Velocity
Si IV	-7611	400	505
	-9005	400	204
	-5617	400	204
	-12071	400	204
C IV	-5998	3000	615
	-10835	1800	615
	-10061	600	228

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