Kinematics of Broad Absorption Line Regions of PG 1254+047

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Introduction

In a number of quasars (about 10-20%), blue-shifted, broad absorption lines (BALs) are observed in the ultraviolet spectra. These lines are formed in partially ionized outflows with velocities up to 0.1 c. The outflow is likely driven by intensive radiation of the quasar probably along the equatorial directions to the extension at least larger than the broad emission line region (BLR). Disk wind and material evaporating from the putative dust torus are two plausible scenarios for the origin of the gas. In order to understand the nature of outflow in quasars, we need to explore many properties of the outflow such as the global covering factor of BAL region, the column density and velocity fields.

Here we investigate the physical properties of Broad Absorption Line Regions (BALRs) of quasar PG 1254+047 using a model (previously developed for stellar absorption line modelling) proposed by Danezis et al. [1] (GR model).

With this model one 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 of the BALs using the DACs/SACs theory, i.e. the complex profiles of the BALs 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 1254+047 (Z=1.024), taken with HST (FOS/G160L,G270H), on February 17, 1993. We study the C IV ll 1548.187, 1550.772 Å, Si IV ll 1393.755, 1402.77 Å, N V ll 1238.821, 1242.804 Å and Ly a l 1215.68 Å lines.

Results and Discussion

The best fit of the UV spectra with the model is shown in Figure 1. As one can see from Figure 1 there are several absorption components. In Table 1 we presented 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.

As one can see in table 1, the values of the rotational velocities are too large (from 800 km/s to 1500 km/s) indicating that the region of origin of the components is close to the massive black hole. Such large rotational and random velocities are expected near the massive black hole, in difference the large widths observed in stellar spectra (see [4, 5]).

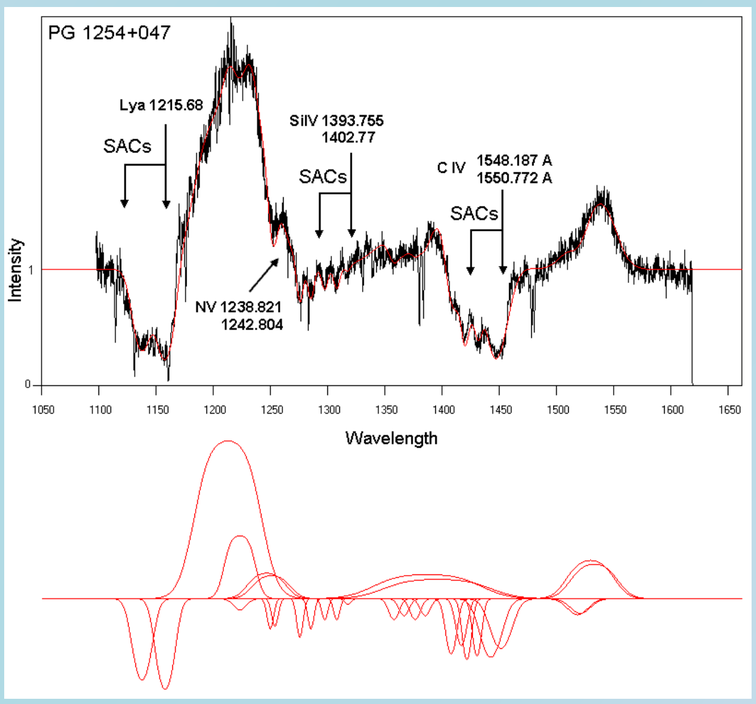

FIGURE 1. Best fit of the C IV, Si IV, N V and Ly a spectral lines. The components obtained from fit are given bottom.

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

Ion	Radial Velocity	Rotational Velocity	Random Velocity
Lya	1973	1500	1162
	-14303	1500	1598
	-19235	1500	1598
	14895	800	291
	1726	800	2912
	20098	800	291
	22688	800	291
	25154	800	291
N V	2658	800	484
Si IV	10442	1200	1768
	5960	1000	707
	3002	1200	581
	-3645	1000	505
	-7719	1000	505
C IV	-5804	1000	1596

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