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Identification of Metal Absorption Lines on Quasar Spectra of SDSS DR9

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Abstract. Absorption lines are an important tool for probing the gas in the Universe. Our group aim to identify the metal absorption lines imprinted on the quasar spectra of the BOSS. In this work, we show the metal absorption lines identified in the spectrum of SDSS J160032.95 + 323638.7.

Key words. Line: identification—quasars: absorption lines—quasars: general.

1. Motivation

Absorption lines are often observed on the quasar spectrum. The intrinsic absorption lines of quasars are often thought to originate in the ionized gas that are physically related with the corresponding quasars, while the intervening absorption lines of quasars are usually associated with the cosmologically intervening galaxies lying on the quasar sightlines. Baryon Oscillation Spectroscopic Survey (BOSS), part of the Sloan Digital Sky Survey-III (SDSS-III; Eisenstein *et al*. 2011), aims to obtain spectra of over 150,000 quasars $z > 2.2$ with high signal-to-noise ratio. SDSS data release 9 is the first release of BOSS spectroscopy to the public, which contains ∼87,000 quasars detected over 3,275 deg^2 (Pâris *et al.* 2012). In the following, we will identify all obvious metal absorption lines in the spectral region longward of quasar $Ly\alpha$ emission line of SDSS J160032.95 + 323638.7.

2. Spectral analysis

We invoke a combination of cubic splines and Gaussians to estimate the pseudo-continuum of J160032.95 + 323638.7 (e.g., Chen 2013; Chen *et al*. 2013). The fitting result is plotted in Fig. 1. The pseudo-continuum fit is used to normalize the spectral fluxes and flux uncertainties. The metal absorption lines will be identified on the pseudo-continuum normalized spectrum. We measure the equivalent width of each absorption line with a Gaussian component, and estimate corresponding significant

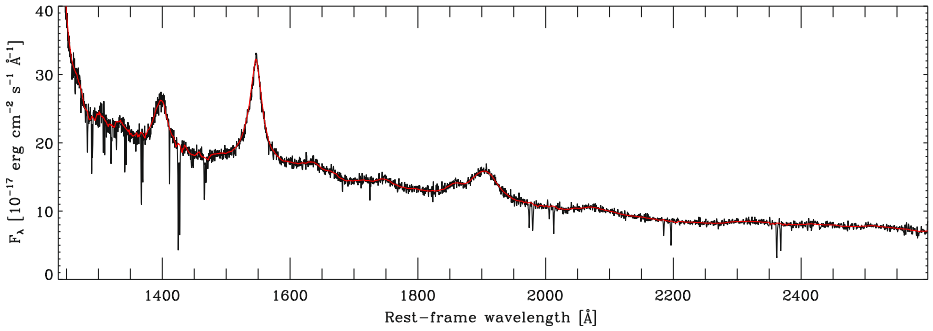

Figure 1. The spectrum of J160032.95 + 323638.7. The red line is the pseudo-continuum fit.

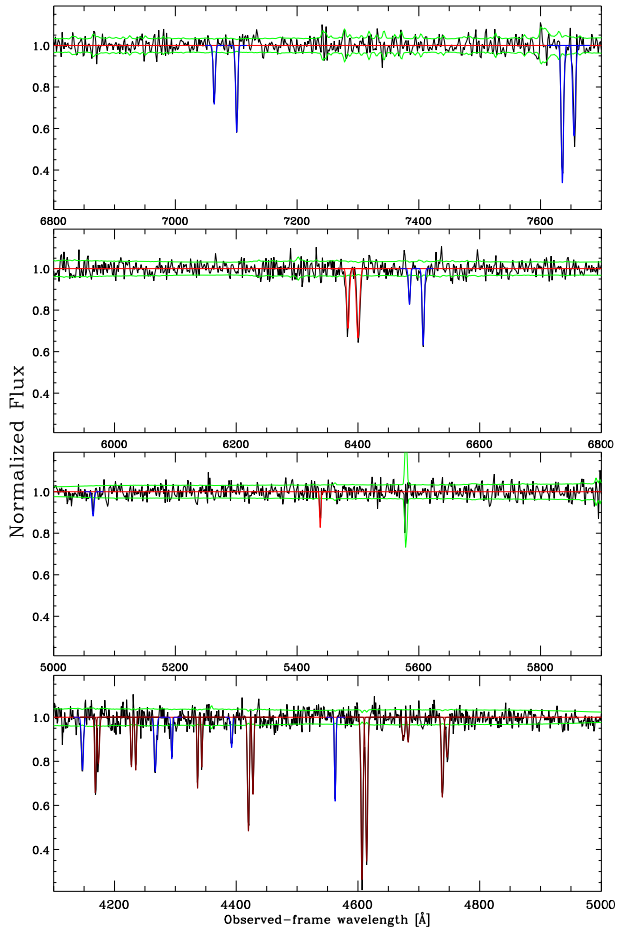

Figure 2. The pseudo-continuum normalized spectrum. The green lines are the flux uncertainties. The blue solid lines are Mg II absorption with $z_{\rm abs} = 1.7307$, and the red solid lines are Mg II absorption with $z_{\rm abs} = 1.2829$. The dark red solid lines are 7 C IV absorption systems with $z_{\rm abs} = 2.0607$, 2.0194, 1.9754, 1.8550, 1.8010, 1.7308 and 1.6924, respectively.

Table 1. Parameters of absorption lines.

		λ											
z_{abs}	Species	2803	2796	2600	2587	2383	2374	1855	1671	1608	1572	1562	1519
1.7307	W_r(Å)	1.18	0.90	0.63	0.41	0.59	0.23	0.18	0.39	0.18	0.20	0.42	0.36
	N_σ	14.4	9.4	12.9	8.5	10.2	5.0	4.1	12.0	3.8	5.2	6.5	6.1
1.2829	W_r(Å)	0.66	0.93			0.22							
	N_σ	8.5	9.8			5.3							

Species	z_{abs}	W_r(Å)	N_σ	z_{abs}	W_r(Å)	N_σ	z_{abs}	W_r(Å)	N_σ	z_{abs}	W_r(Å)	N_σ
λ1548	2.0607	0.49	10.9	2.0194	0.18	3.0	1.9754	1.01	23.8	1.8550	0.68	15.0
λ1551	2.0607	0.33	5.5	2.0194	0.12	3.3	1.9754	0.86	21.1	1.8550	0.41	10.2

Species	z_{abs}	W_r(Å)	N_σ	z_{abs}	W_r(Å)	N_σ	z_{abs}	W_r(Å)	N_σ
λ1548	1.8010	0.28	8.9	1.7308	0.24	6.1	1.6924	0.37	8.6
λ1551	1.8010	0.19	6.3	1.7308	0.24	6.5	1.6924	0.33	5.3

level with the method provided by Qin *et al.* (2013). There are up to 29 obvious metal absorption lines imprinted on the spectrum of J160032.95 + 323638.7. We find that these 29 absorption lines are probably formed in 9 absorbers. We plot the fitting results in Fig. 2 and provide the parameters in Table 1.

3. Future work

The identification of absorption lines is very difficult, especially the identification of all the absorption lines imprinted on the quasar spectrum, for example this work. BOSS will provide more than 150,000 quasar spectra, which will be required for many years to identify all the significant absorption lines. Our group will aim to identify all the significant absorption lines imprinted on the quasar spectra of BOSS in the next 10 years, and will provide latest results.

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