Analysis of the short wavelength range of QSOs

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Abstract

In this work we try to classify objects using the MgII 2798 Å line from optical spectra. For that, we use BZQ type objects from BZCAT catalogue. From SDSS catalogues we have 618 BZQ objects which have optical spectra and only in 139 objects there are MgII and H_β lines simultaneously (z=0.3345-1.0915). By the shape of MgII lines, we grouped these spectra into 3 categories: Broad & Narrow, Broad+Narrow, and Broad.

Keywords: *QSO, MgII line, blazars, spectral classification*

1. Introduction

Among the Active Galactic Nuclei (AGN) the most interesting are blazars in combinations of two subtypes: a) BL Lac (BLL) objects and special types of quasars (QSO): Optically Violently Variables (OVV) and b) Highly Polarized Quasars (HPQ). A blazar is characterized as a very compact quasar, associated with a presumed Super Massive Black Hole (SMBH) at the center of an active giant elliptical galaxy. Blazars are the most energetic objects in the Universe. The object BL Lac was originally discovered by Hoffmeister as a variable star, and later it was identified by Schmitt as an extragalactic radio source. In Massaro et al. (2015) it was presented the blazar catalog BZCAT v.5, where the objects are distributed into 4 types: BZB (Lacertides, BL Lac or BLL), BZQ (Quasars), BZG (Galaxies), and BZU (Undetermined class).

2. Studied data

In this work, using BZQ sources from BZCAT catalogue, we compare their H_β line profiles with MgII ones. For the spectral data, we cross-corelated BZQ sources with SDSS catalogue. As a result, we have 618 objects which have optical spectra from SDSS catalogue. In the next step we choose objects which have H_β and MgII lines in the optical spectral range (3500-10500 Å). It made it possible to distinguish 139 objects which have both of lines in spectra. Using the shape of MgII line, we grouped these spectra in 3 categories: Broad & Narrow (broad line profile with clearly separated narrow line), Broad+Narrow (a broad component overlapped with narrow line), Broad (simple broad line without any details). In figures 2, 2, and 2 we give these categories.

3. Preliminary Results

In Table 3 (for 12 objects), we give the preliminary results of this work.

In Table 3, we give the shape of MgII line by the activity type for all 139 objects having SDSS spectrum with the presence of both MgII and H_β. A similar distribution is given in Figure 4. Some very preliminary distribution is observed; e. g. some subtypes have only some definite MgII shape (all NLQ1.0 are Broad & Narrow, all Narrow Line QSOs do not have MgII shape “Broad”).

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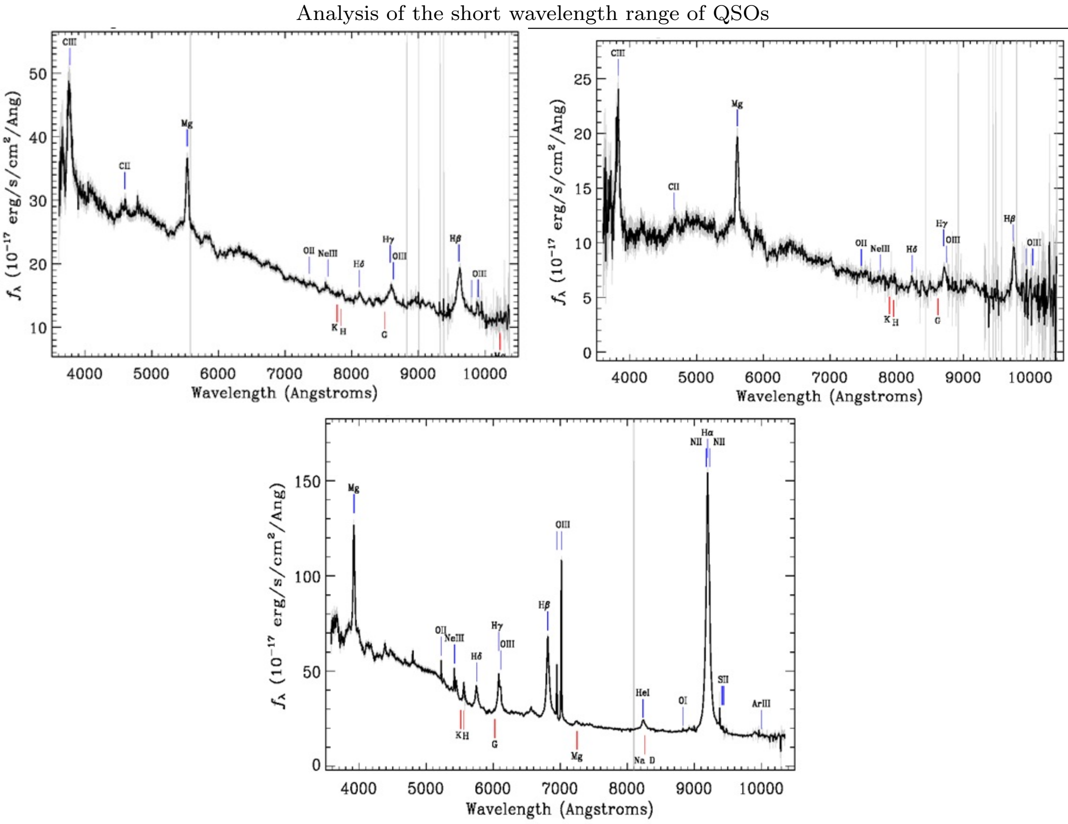

Figure 1. Spectra with MgII line "Broad & Narrow" (broad line profile with clearly separated narrow line).

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4. Summary

To understand the behavior of the MgII 2798Å emission line in QSOs spectra and to possibly also use it for the classification (especially for high-redshift objects not showing H_α and H_β in the optical range), we have selected QSOs having both H_β and MgII simultaneously in the SDSS spectral range (3500-10500 Å). These are objects with redshifts between 0.3345-1.0915. 139 objects have been selected and investigated. We have classified their MgII line shape into 3 categories: "Broad", "Broad & Narrow" and "Broad + Narrow". The preliminary results show that this number of objects is still small to have enough statistics and to distinguish any regularity. However, some selected distribution has been found, e. g. some subtypes have definite MgII shape (all NLQ1.0 are Broad & Narrow, all Narrow Line QSOs do not have MgII shape "Broad", etc.). In the following studies, we will continue to investigate the short wavelength range of the QSOs to reveal features that may substitute Balmer lines for their classification by activity types.

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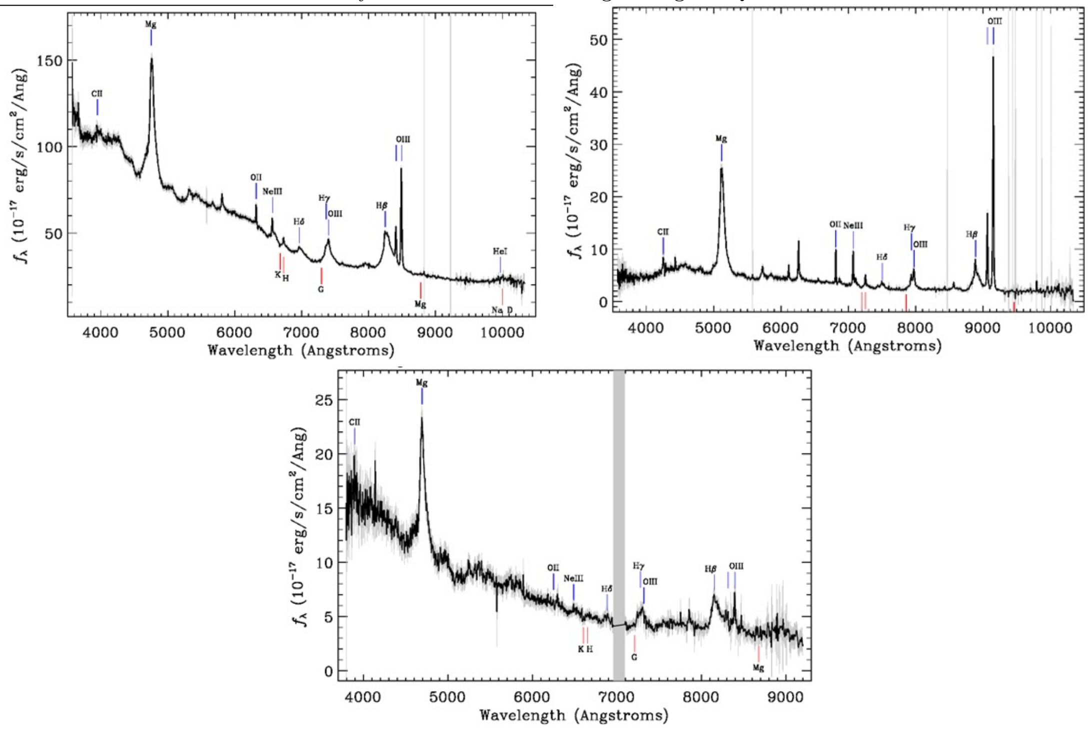

Figure 2. Spectra with MgII line “Broad+Narrow” (a broad component overlapped with narrow line).
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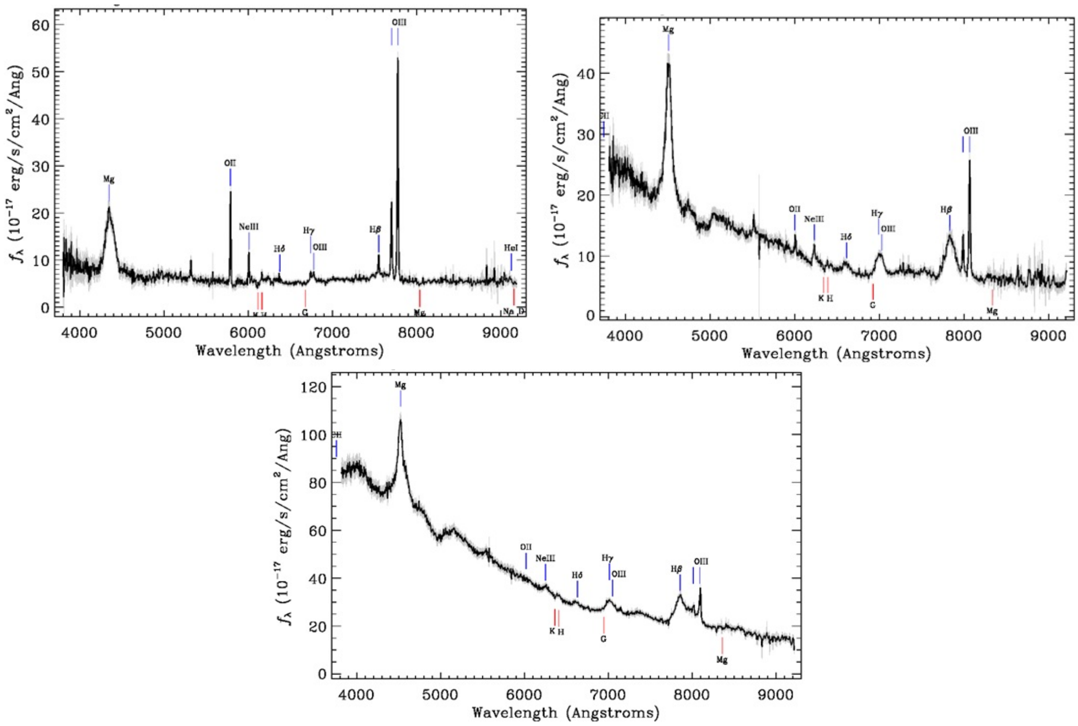

Figure 3. Spectra with MgII line “Broad” (simple broad line without any details).

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Table 1. Preliminary results of this work

Name	**MgII shape category**	**OIII/ H_β**	**Optical class**
5BZQ J0039-1111	Broad	>3	QSO1.8/LINER
5BZQ J0121+1149	Broad	>3	QSO1.8/LINER
5BZQ J0123+2615	Broad	>2	QSO1.5
5BZQ J0745+3313	Broad	>2	QSO1.0
5BZQ J0010+2047	Broad & Narrow	>3	QSO1.5
5BZQ J0106-1034	Broad & Narrow	>2	QSO1.2
5BZQ J0113+1324	Broad & Narrow	>2	QSO1.2
5BZQ J0122-0935	Broad & Narrow	1	QSO1.2
5BZQ J0059+0006	Broad + Narrow	>2	QSO1.2
5BZQ J0112+2020	Broad + Narrow	1	NLQ1.2
5BZQ J0121+0422	Broad + Narrow	>2	QSO1.5
5BZQ J0124+2805	Broad + Narrow	>3	S1.8

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Table 2. Shape of MgII line by the activity type

Activity Type	MgII shape category			**Total**
	Broad	Broad & Narrow	Broad + Narrow	
Sy 1.5		2		2
Sy 1.8			2	2
NLS 1.5		1		1
NLQ 1.0		4		4
NLQ 1.2		11	5	16
NLQ 1.5		1	3	4
NLQ 1.0/LINER		1		1
NLQ 1.2/LINER		1		1
QSO	1	1		2
QSO 1.0	5	6	16	27
QSO 1.2	6	20	24	50
QSO 1.5	3	7	7	17
QSO 1.8		2	5	7
QSO 1.9			1	1
QSO 1.0/LINER		1		1
QSO 1.5/LINER	1			1
QSO 1.8/LINER	2			2
Total	18	58	63	139

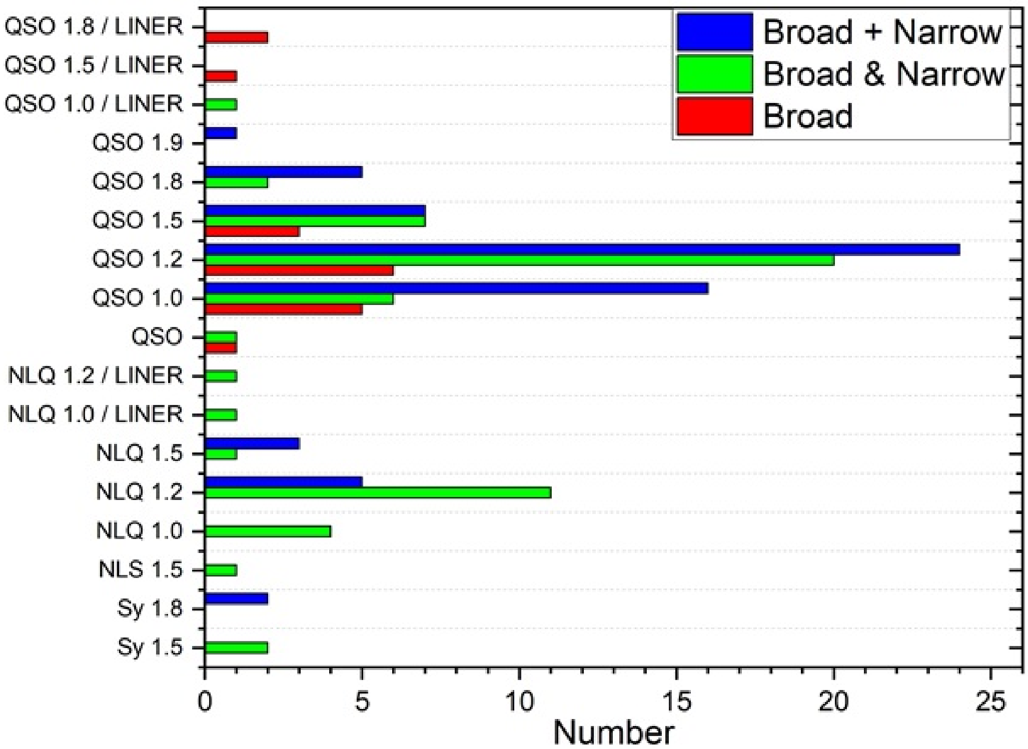

Figure 4. Distribution of shape of MgII line by the activity type.

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