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# Investigation of Kinematics of the NLR from the SDSS AGN Sample

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**Abstract.** Using Active Galactic Nuclei (AGNs) spectra collected from the latest data release Four (DR4) of the Sloan Digital Sky Survey (SDSS), we study the kinematical properties of the [OIII] $\lambda\lambda$ 4959, 5007 Å narrow emission lines. The sample was selected using the following criteria: (i) the redshift of AGNs is $z < 0.79$ and (ii) the signal to noise ratio is $S/N > 35$. The aim of this work is to investigate an asymmetry in the [OIII] lines that may indicate an outflow in the AGNs Narrow Line Region (NLR).

## 1 Introduction

The forbidden [OIII] $\lambda\lambda$ 4958.911, 5006.843 Å spectral lines are among the most prominent in the spectra of fotoionized gas around AGNs. They are typical for AGNs and originate from the Narrow Line Region gas surrounding the accreting super massive black hole in the center. Since both lines originate on the same energy level, both have negligible optical depth and since the transitions are strongly forbidden, these lines have exactly the same emission-line profile. If there are multiple clouds in NLR that contribute to the emission, the observed emission-line profiles are composed of the same mixture of individual cloud complexes [1], so the shapes of the emission lines are affected by the NLR kinematics [2]. The asymmetry in the line shapes could be explained by outflow of the NLR clouds caused by the interaction with radio jet [3]. Here we present our investigation of the kinematics of the NLR from the SDSS AGN sample. The sample contains around 60 AGN spectra with high signal-to-noise (S/N) ratio, which can be used for this investigation.

## 2 The Sample and Analysis

We selected AGNs from the latest Date Release Four (DR4) of SDSS Database[1] using the criteria that their spectrum has S/N $> 35$. After that, we substracted

[1]More details about the Sloan Digital Sky Survey can be found on the following website http://cas.sdss.org/.

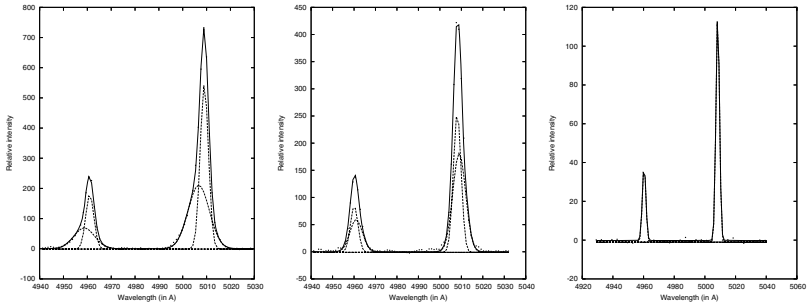


Figure 1. Examples of the fitted spectrum with the blue asymmetry (a, b) and with no asymmetry (c).

the continuum and compare the shape of 4959 Å and 5007 Å lines, by using the DIPSO software. We selected only those AGNs where these lines have the same shapes. To analyse the kinematics of NLRs we apply the $\chi^2$ minimalization routine [4], and fit the lines with two Gaussian functions. Most of the [OIII] lines can be well fitted with two Gaussians (Figure 1).

## 3 Preliminary Results

Here we present the fits of 31 AGNs from the sample. We found that most of the AGNs have the complex [OIII] lines, where blue asymmetry is present (Figure 1a b). Only a small fraction of the AGNs (around 15% from the considered sample) have no asymmetry (Figure 1c). Analyzing the shift of [OIII] emission lines, we found the outflow velocity from the relation: $V_{out} = (d1 - d2)c$, where

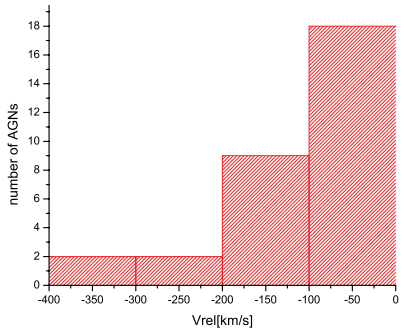


Figure 2. Histogram showing the distribution of the outflow velocity of the studied AGN sample.

d1 and d2 are shifts of two Gaussians we used for fitting each of the [OIII] line. The most of NLRs show outflow with a velocity in the range 0 km/s to -200 km/s (Figure 2). More detailed analysis will be presented elsewhere.

## References

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