International Research Journal of Natural Sciences
Vol.2, No.2, pp.17-24, September 2014
Published by European Centre for Research Training and Development UK (www.eajournals.org)

STATISTICAL STUDY FOR ACTIVE GALAGTIC NUCLEI FROM SDSS: DR9-DR10

AL-Mashhadani Layali Yahya Salih
Department of Physics and Astronomy, Uppsala University, Sweden, Uppsala

ABSTRACT: *We analyze a sample of 4646 broad-line AGN and 3330 neighboring _ AGN from SDSS, Data Release: DR9-DR10 within the redshifts range 0 < z < 0.2.We have been studied the distribution of the galaxies-quasars in the redshifts - absolute magnitude plans: (z-Mu) plan and (z-Mr) plan, absolute magnitude distribution of the objects in the sample, and the redshifts distribution.We have also split the sample depending on their color U-R into two groups of blue galaxies with U-R<2.2 mag and red Galaxies with U-R>2.2 mag.Our results show that the galaxies in the range of Mu are more luminous than galaxies in the range of Mr. we also show that the majority number of the objects in the sample are red galaxies with U-R>2.2 mag and most of the quasars are red luminous objects distribute around the red galaxies at high redshift range of 0.1≤z<0.2.*

KEYWORD: AGN, Galaxies, Quasars

INTRODUCTION

Active Galactic Nuclei or AGN is a compact object in the central regions of the galaxy that refers to the existence of energetic phenomena in the nuclei of the galaxy. The two main luminous subclasses of AGNs are Syfert galaxies (Type I and II) and quasars. [1]Quasars are the most luminous subclass of AGN. Small fraction ~ (5 – 10%) represents strong radio sources which defined basically the quasar class.[2]The high luminosity nature of the quasars is thought to be driven by AGN due to growth of material on to a super – massive black hole produces excess amount of non-stellar radiation over the entire of the electromagnetic spectrum. [3]This black hole is more luminous than the quasar hosts by 4 orders of magnitude and is the bright object in the universe. [4]Many studies using Sloan Digital Sky Survey (SDSS) to study the physics of quasars and the cosmological formation processes. In this work we used a new sample of broad – line AGN from SDSS: DR9-DR10 and investigated the statistical behavior of AGN at redshifts range 0<z<0.2.

DATA AND SAMPLE

The data for galaxies - quasars studied in this work were extracted from Sloan Digital Sky Survey (SDSS): DR9-DR10 catalogues.Our sample includes all quasar-galaxies broad – line Active Galactic Nuclei (AGN) at 0<z<0.2. We also searched for neighboring _ AGN of both galaxies and quasars having photometric redshift in the same range. For all objects we downloaded the spectral line information in the range of 0 < z < 0.2, and Mu, Mr. The angular distance between the (quasar-galaxies) and their neighbors up to 11 arc minutes.The numbers of galaxies – quasars in the two catalogs are 4646 from DR10 catalog and 3330 from DR9 catalog.The objects from DR10 were included 3587 galaxies and 59 quasars. While the number of galaxies from DR9 up to 3274 galaxies and 56 quasars.The results have been analyzed and discuss in the following sections.

DATA ANALYSIS AND RESULTS

In this section we present the results of analysis adopted for our sample to study the absolute magnitude distributions Mu and Mr, the distribution of objects magnitude depending on color, and the redshift distribution of the objects in the range of $0<z<0.2$.

Absolute Magnitude Vesrs Redshift

The distribution of galaxies – quasars, broad - line (AGN) in the (z-Mu) plane and (z-Mr) plane for DR9-DR10 is shown on the left, middle panels in Figure 1. The figure is clearly show that the larger number of the objects in the sample are galaxies distribute in the range of redshift $0 < z < 0.2$, and there is a little number of quasars are found to be within this range of redshift with most of these quasars were distributed among $0.1 \leq z < 0.2$. All AGN in (z-Mu) plane on the left panel of Figure 1 are more luminous than in (z-Mr) plan on the middle panel of the figure. This is indicating the dependence of the distribution of the galaxies - quasars on the color.The mean values of absolute magnitudes Mu and Mr for all objects from DR9-DR10 are illustrates in Table 1.To see the dependence on the color, we divided the sample into two groups with blue galaxies with U-R<2.2, and red galaxies with U-R>2.2. Then we study the distribution of the quasars around the galaxies. We will notice that the most number of AGN are red galaxies with U-R>2.2, while the blue galaxies represent the minority number of the objects in the sample. We also found that most of the quasars are more luminous red objects distribute around the red galaxies at high redshift $0.1 \leq z < 0.2$. See the right panel of Figure 1.Number of red and blue galaxies that we get from DR9 – DR10 are illustrates in Table 2.The larger number of the data in the table are red – AGN from DR10.

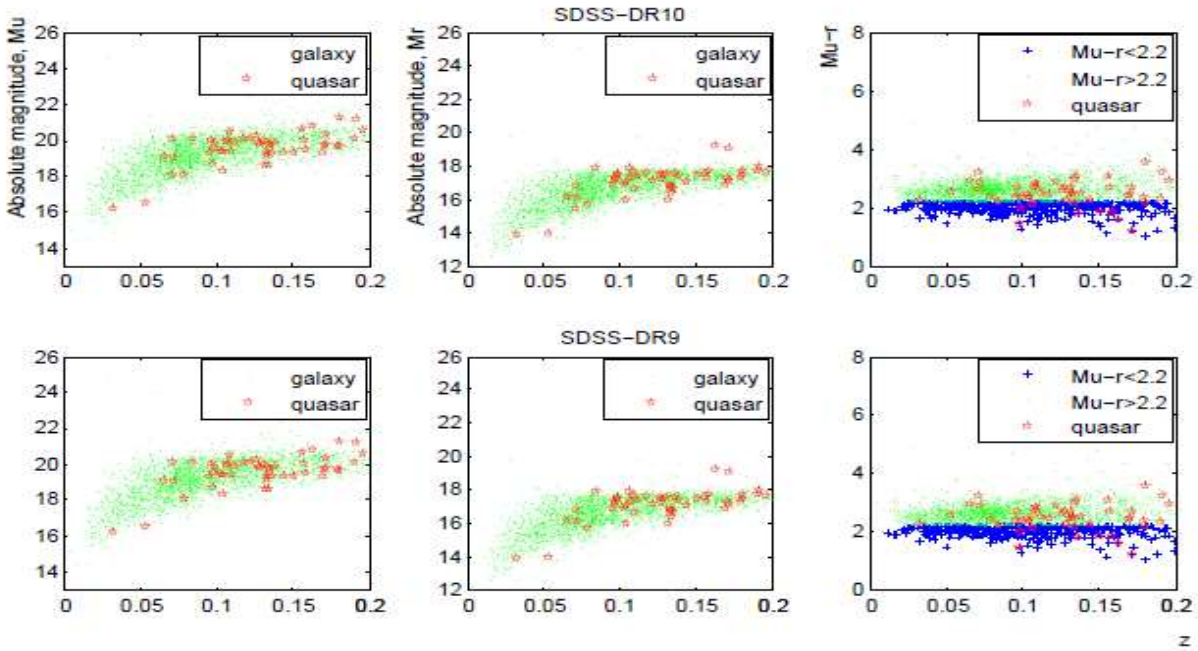

Figure 1. Absolute magnitude for all _ AGN from DR9 – DR9 versus redshift. Left panel shows Mu of galaxies – quasars. Middle panel shows Mr of galaxies – quasars. Right panel shows U-R for blue and red galaxies and quasars.

The distribution of luminous neighboring _ AGN with mean value of Mu=18.7 mag in the (z-Mu) plane shown on the left panel of Figure 2. Middle panel of Figure 2 illustrates the distribution of less luminous neighboring _ AGN with mean value of Mr=15.976 mag in the (z-Mr) plane.
A lot of the bright red neighboring galaxies with U-R>2.2 mag and the faint blue neighboring galaxies with U-R<2.2 mag are shown on the right panel of Figure 2. Most of the faint blue neighboring galaxies tends to be more faint at high redshift range of $0.1 \leq z < 0.2$. See the right panel of Figure 2.
We also see that the quasars are luminous objects with U-R>2.2 mag.

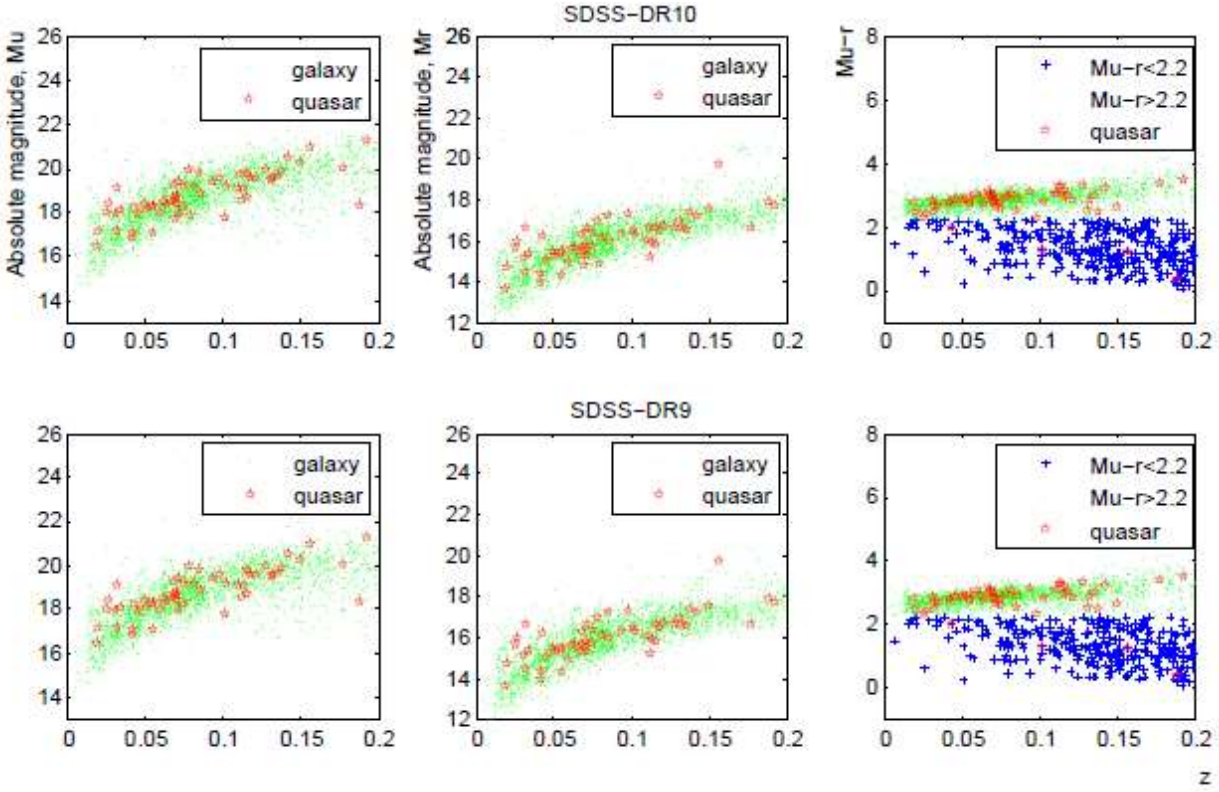

Figure 2. Absolute magnitude for all _ neighboring _ AGN from DR9 – DR9 versus redshift. Left panel shows Mu of neighboring galaxies – quasars. Middle panel shows Mr of neighboring galaxies – quasars. Right panel shows U-R for red and blue galaxies and quasars.

Table 1. The mean values of Mu and Mr for AGN and neighboring from SDSS: DR9 – DR10.

	AGN		**Neighboring**	
	Mu(mag)	**Mr(mag)**	**Mu(mag)**	**Mr(mag)**
DR10	19.163	16,586	18.7	15.976
DR9	19.1	16.591	18.654	15.94

Table 2. Number of the red and blue AGN and neighboring from SDSS: DR9 – DR10.

	AGN		Neighboring	
	Red	**Blue**	**Red**	**Blue**
DR10	4149	497	3283	363
DR9	2851	479	2982	348

NUMBER DISTRIBUTION OF ABSOLUTE MAGNITUDE

In figures 3, 4 we explain the absolute magnitudes distributions of AGN and neighboring. We also explained how the color U-R distribution looks for blue and red objects in the sample.
The data of Mu, Mr, U-R<2.2, and U-R>2.2 is grouped into the range of 10 bins, and plotted as bars. Each bar represents a range of the data.The histograms of Mu and Mr for AGN appears to be centered around the mean values of Mu=19.163, Mr=16.586 for DR10, and Mu=19.1, Mr=16.591 for DR9. See the first two panels on the left of Figure 3. In the histograms that follow it would appear that the range of Mu is approximately (14-22) and the maximum numbers of AGN have 18≤Mu<22, while the range of Mr is approximately (13-20) but the maximum numbers of AGN have 16≤Mr<18.Maximum number of the red galaxies with U-R>2.2 as shown in the first panel on the right of Figure 3 are tends to be collected in two main bins of the histogram at range of 2.2<U-R≤3. Following Figure 3, the blue galaxies with U-R<2.2 are collected in one main bin of range 1.5≤U-R<2.2 as shown in the second panel on the right.

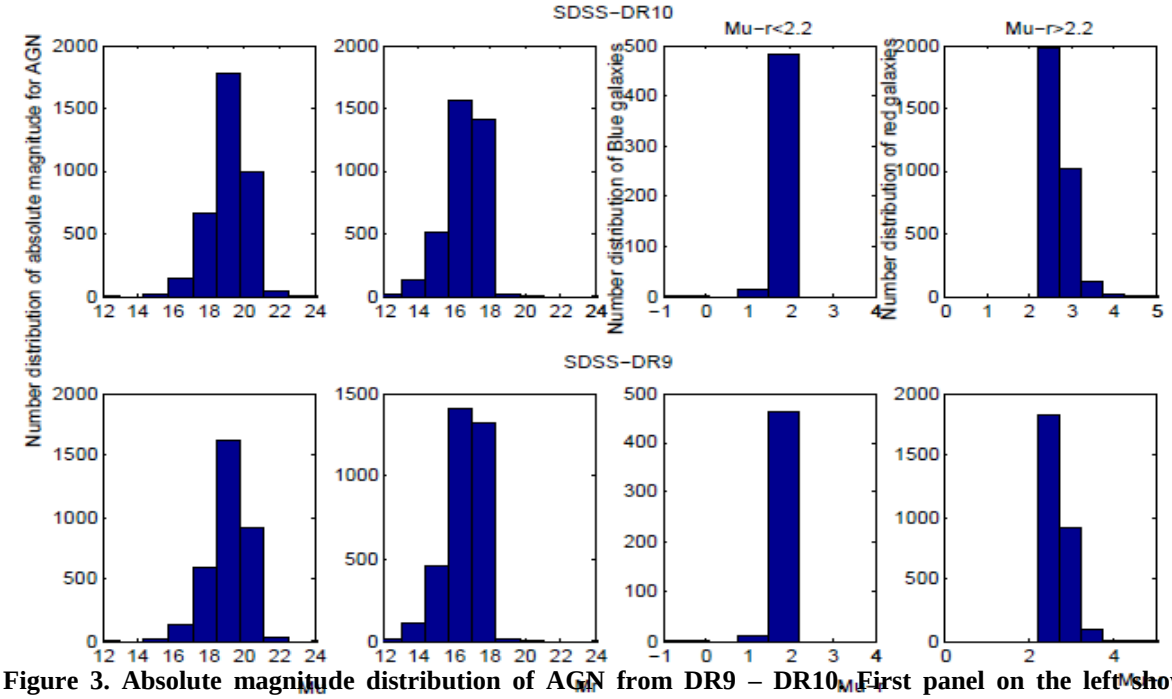

Figure 3. Absolute magnitude distribution of AGN from DR9 – DR10. First panel on the left shows Mu distribution. Second panel on the left shows Mr distribution. First panel on the right explains the distribution of U-R for red galaxies. Second panel on the right shows the U-R for blue galaxies.

Figure 4 illustrates the number distribution of neighboring _ AGN. The number distribution of Mu, Mr is shown in the first two panels on the left of Figure 4. The histograms of Mu and Mr are concentrated around their mean values of Mu=18.7, Mr=15.976 for DR10, and Mu=18.654, Mr=15.94 for DR9.The red and blue galaxies in the first, second panels on the right of Figure 4 can be explained as follows. The red galaxies are collected in two main bins at 2.2<U-R<3.5. The blue galaxies appears to be an equal amount of numbers in each bin on the range of 1≤U-R<2.2. The number of blue galaxies will be slightly decreased in the range of U-R<1.

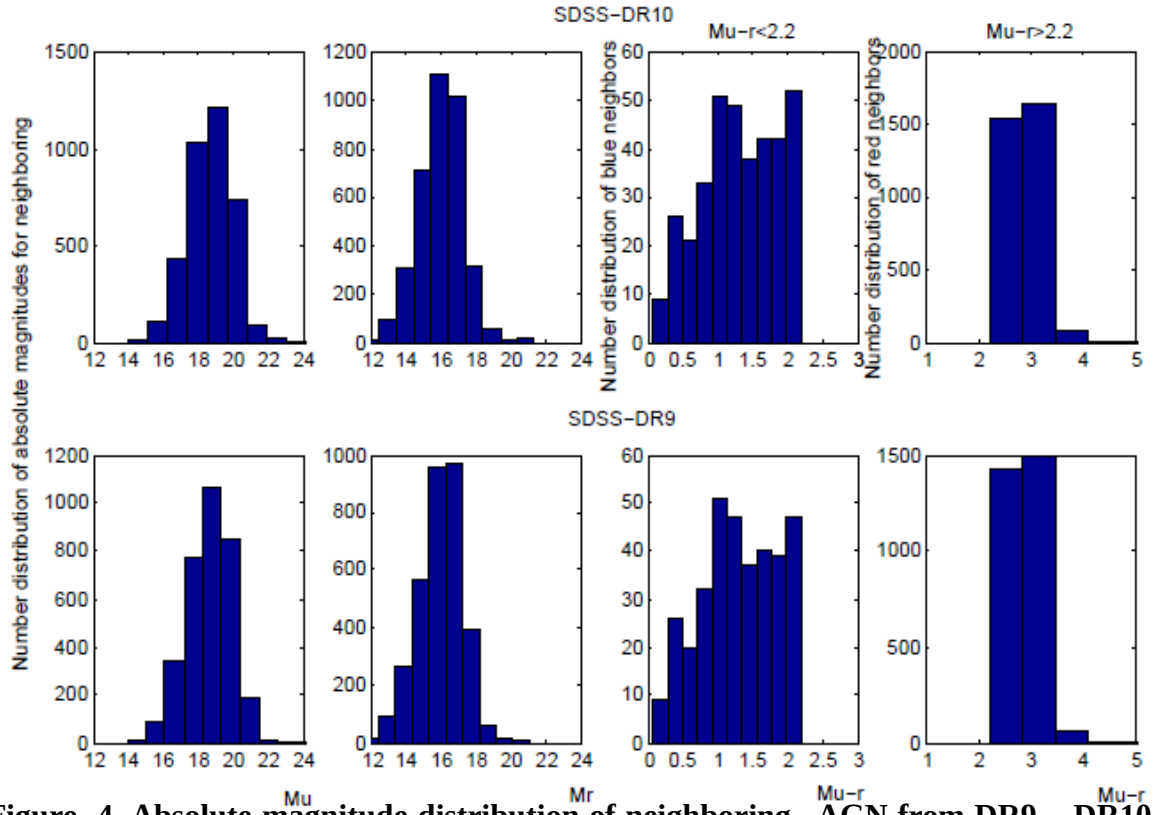

Figure 4. Absolute magnitude distribution of neighboring _AGN from DR9 – DR10. First panel on the left shows Mu distribution. Second panel on the left shows Mr distribution. First panel on the right explains the distribution of U-R for red galaxies. Second panel on the right shows the U-R for blue galaxies.

NUMBER DISTRIBUTION OF REDSHIFT

The normal distribution of the redshifts in the range of 0<z<0.2 for AGN from DR9-DR10 is shown in Figure 5. This figure illustrates that all _ AGN appear to have Gaussian distribution within the range of redshift.The mean values of the redshift $\boldsymbol{\mu_z}$ for the objects in the sample explains in Table 3.AGN irrespective of their color spread out more on the right in direction of high redshift. See the left panel of Figure 5. Similarly the luminous red galaxies on the right panel of the same figure are spreading out more on the right at high redshift range.Middle panel of the figure shows he probability distribution of the less luminous blue galaxies at the range of 0<z<0.2 looks to be concentrated around their mean values of μ = 0.102.

Figure 5 clearly show that the majority of the objects in the sample were bright red galaxies with maximum frequency number in the range of redshift inbetween z =0.05 – 0.1

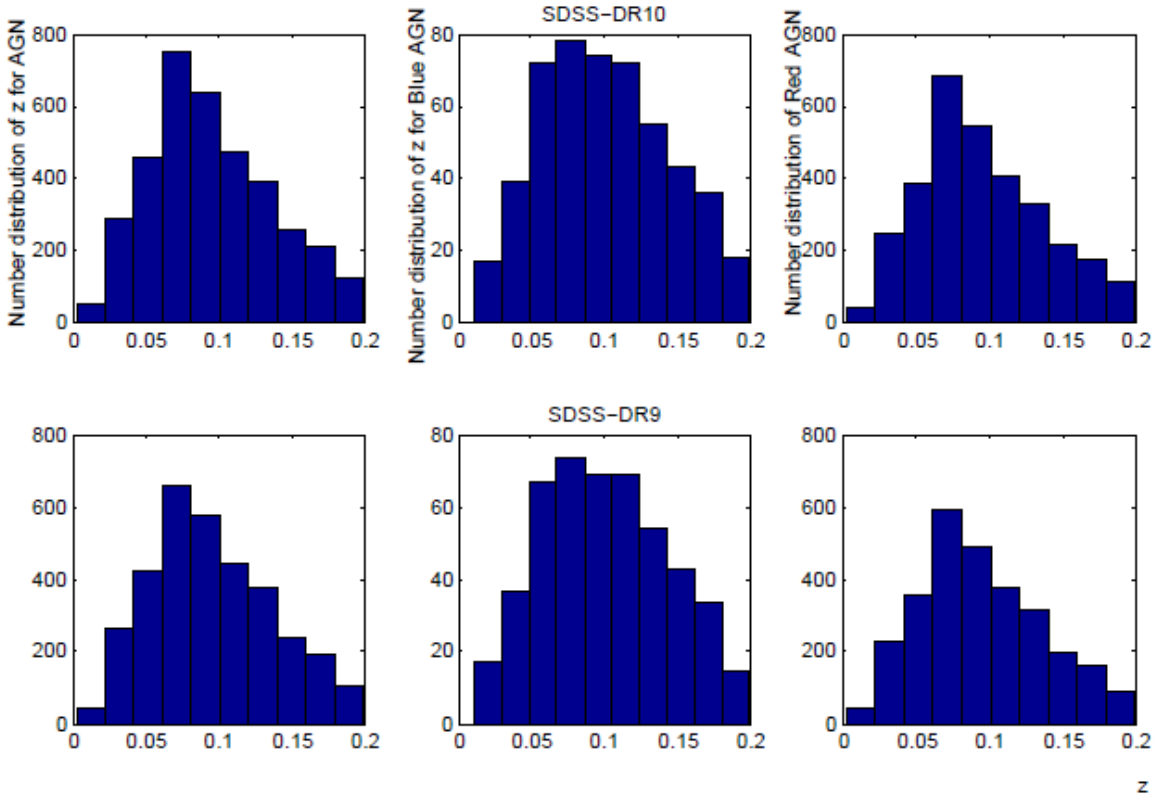

Figure 5. Redshift distribution for AGN from DR9-DR10. Left panel shows the redshift distribution for all _ AGN irrespective on their color. Middle panel, the redshift distribution for blue galaxies. Right panel, redshift distribution for red galaxies.

The normal distribution of redshift in the range of $0<z<0.2$ for neighboring _ AGN is shown in Figure 6. The normal distribution for all _ neighboring irrespective of their color illustrates on the left panel of the figure. Distribution of the red neighboring in the sample shows on the right panel of the figure. The objects in the two panels tend to be centered on the mean values of the redshift. The blue galaxies have different values at each bin of the histogram. But the number of the blue neighboring will be decreasing in direction of the high redshift range $0.1\leq z<0.2$ and the number distribution of the blue galaxies are approximately the same at this range of redshift. This is shown on the middle panel of Figure 6.As in the last figure the majority of the objects in the sample are red luminous galaxies comparable with the faint few blue.

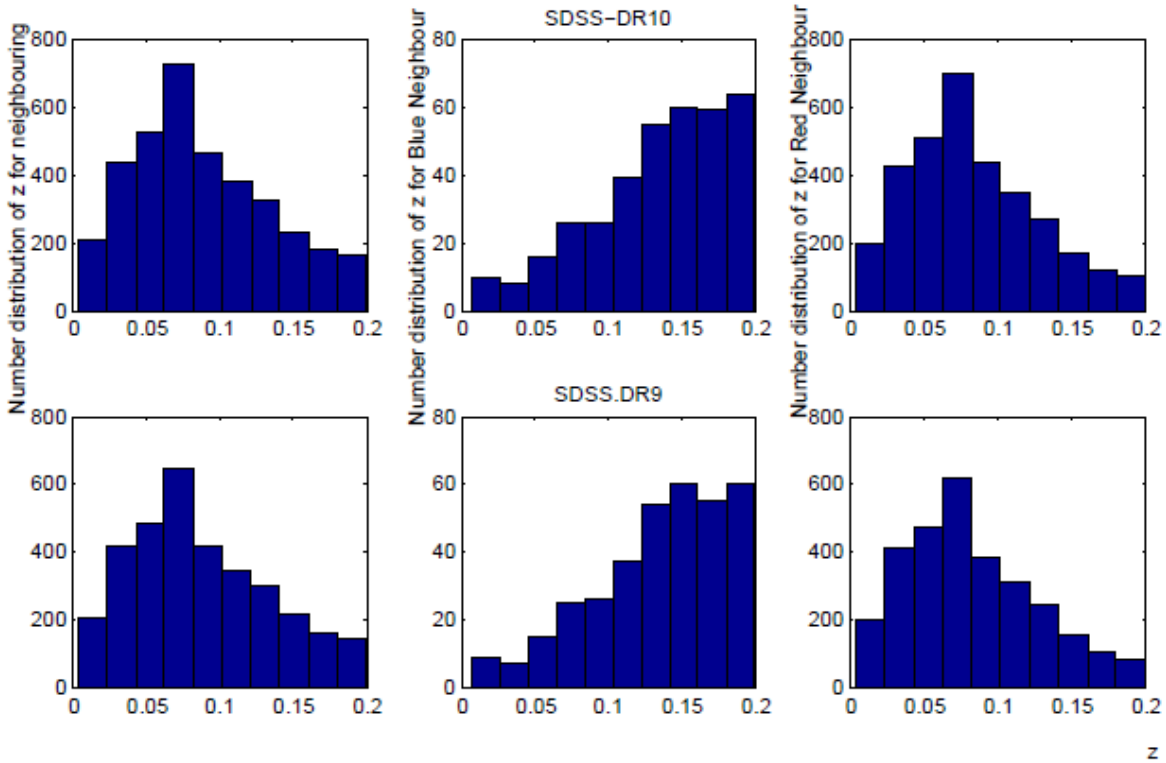

Figure 6. Redshift distribution for neighboring AGN from DR9-DR10. Left panel shows the redshift distribution for all _ neighboring AGN. Middle panel, the redshift distribution for blue neighbors. Right panel, redshift distribution for red neighbors.

Table 3. The mean values of redshifts μ_z for AGN and neighboring.

	μ_z for AGN			μ_z for neighboring _ AGN		
	All	**Red**	**Blue**	**All**	**Red**	**Blue**
DR10	0.095	0.094	0.102	0.088	0.083	0.134
DR9	0.96	0.095	0.102	0.087	0.082	0.135

DISCUSSION

In this project we have studied a sample of AGN from SDSS: DR9 – DR10 in the range of redshift 0<z<0.2. We study the luminosity and redshift distribution for all _ AGN and neighboring. We also explain the distribution of blue and red galaxies depending on their color.

Our results can be summarized as follows:

1- The objects in our sample seem to be more luminous in the range of absolute magnitude Mu comparable with Mr.

2- When we compared the objects according to their color U-R. We see that the majority of these objects were red bright galaxies with U-R>2.2.

We found that the red galaxies are ~ 4149, while the less luminous blue galaxies represent only 497 of the total number of 4646 AGN for DR10. Numbers of galaxies that we found in the

neighboring are ~2851 red galaxies, and ~479 blue galaxies of the total number of 3330 neighbors for DR9.

3- Most of the quasars within the sample are more luminous objects with U-R>2.2 distributed around the red galaxies at high redshift range of $0.1 \leq z < 0.2$
4- The redshift distribution diagram for all _ AGN and neighboring shows Gaussian distribution of the objects within the range of redshift $0 < z < 0.2$. The maximum frequency number of objects in the sample represent the luminous red galaxies in the range of redshift inbetween z =0.05 – 0.1.

REFERENCES

Bradley M. Peterson (1997). *An Introduction to Active Galactic Nuclei Paperback,* Cambridge University press, UK.

Falomo; D. Bettoni; K. Karhunen; J. K. Kotilainen; and M. Uslenghi; (2014). *Low redshift quasars in the SDSS Stripe 82. The host galaxies,* Astro-Ph, 1.

Li Shao; G. Kauffmann; C. Li; J. Wang; T. Heckman; (2013). *The Nature of Obscuration in AGN: I. Insights from Host Galaxies*, Astro-Ph, 1.

Erin S. Sheldon; Carlos C.; Rachel M.; J. Brinkmann and Benjamin A.Weaver; (2011). *Photometric Redshift Probability Distributions for Galaxies in the SDSS DR8,* Astro-Ph, 1.