

The first 62 AGN observed with SDSS-IV MaNGA: stellar and gas kinematics[†]

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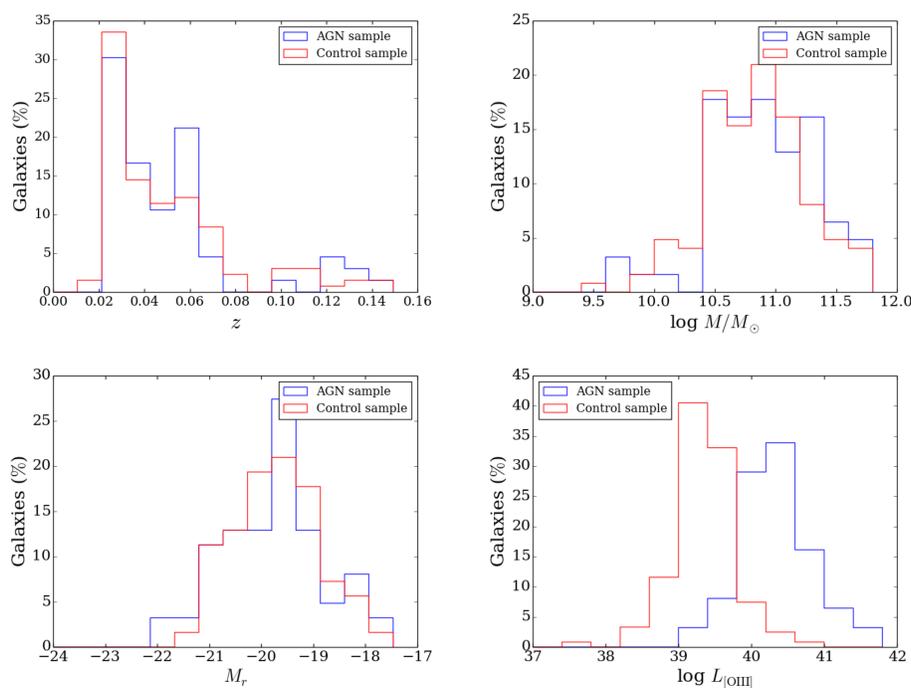


Introduction

Massive gas outflows originated in the accretion disk of AGN are claimed to regulate and couple the growth of the galactic bulge and SMBH [1]. The comparison between the gas and stellar kinematics on kiloparsec scales allows the study of the possible impact of AGN outflows on its host galaxy. We use the observations from the Mapping Nearby Galaxies at the Apache Point Observatory (MaNGA) survey to compare the gas and stellar kinematics of a sample composed by 62 AGN observed with those of a control sample of inactive galaxies, matched with the AGN sample by properties of the host galaxies.

The Sample

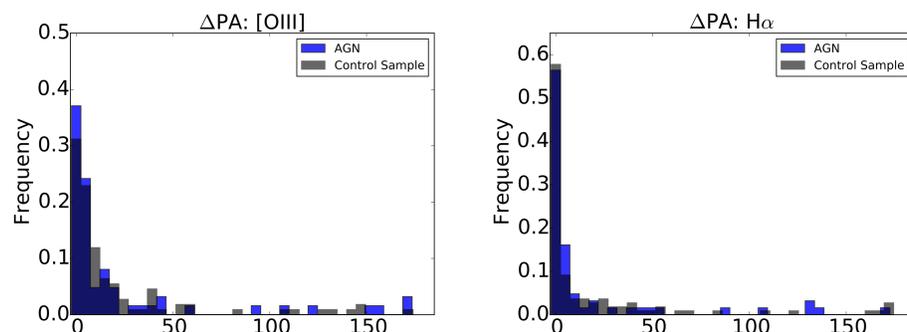
The characterization of AGN hosts and the definition of the control sample of non-active galaxies is discussed in Rembold et al. (2017) [2]. The control sample – comprising two galaxies for each AGN – was selected in order to match the AGN hosts in terms of stellar mass, redshift, visual morphology and inclination. The stellar masses are in the range $9.4 < \log(M/M_{\odot}) < 11.5$, and most objects have redshifts ≤ 0.08 .



Distributions of redshift (a), stellar mass (b), absolute r -band magnitude (c) and [OIII] luminosity (d) of the AGN host sample (blue) and the control sample (red). The AGN and the control sample present markedly different distributions of $L([OIII])$, but have the other parameters similar between the two samples.

Results

To verify if outflows from the central AGN affect significantly the kinematics of AGN hosts, we have compared the kinematic position angle (Ψ_0) of the gas and stellar velocity fields. The motion of the stars is dictated by the gravitational potential of the galaxy, while for the gas, an additional component due to outflows is expected for the AGN.



Histograms comparing ΔPA distributions of AGN and control galaxies for [O III] $\lambda 5007$ (left) and $H\alpha$ (right). AGN are shown in blue and controls in gray.

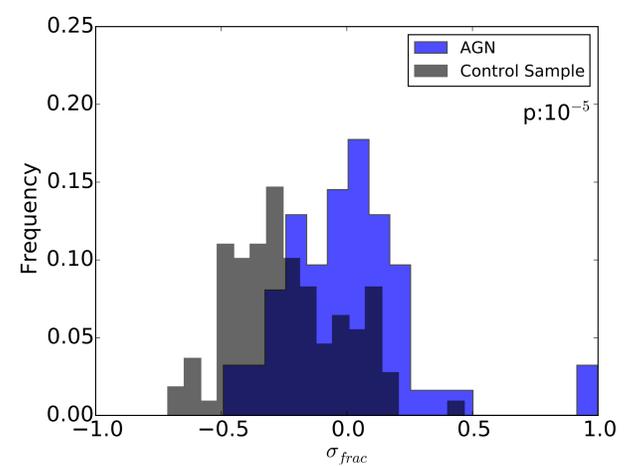
Conclusions

- There is no significant difference in the ΔPA between active and inactive galaxies, indicating that the galaxy scale gas kinematics is dominated by orbital motion in the gravitational potential of the galaxies.
- The AGN show larger σ_{frac} than inactive galaxies within the inner $2.5''$ diameter. The mean values are $\sigma_{frac} = 0.05$ for the AGN and $\sigma_{frac} = -0.23$ for the control sample. This difference is interpreted as being due to outflows from the active nuclei. This indicates that, although the AGN of our sample do not affect the gas kinematics on large scale, it does affect it at least within the inner kpc.
- We find a correlation between [O III] $\lambda 5007$ Å luminosity and σ_{frac} when putting together the AGN and control samples, indicating the impact of the outflows increase with the luminosity of the AGN.

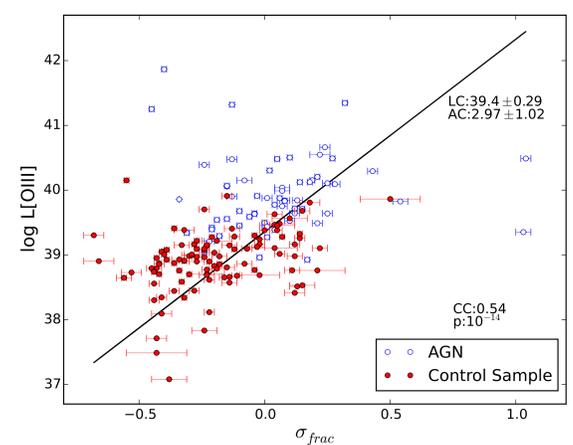
To search for signatures of outflows close to the nuclei of the galaxies, we compare the stellar (σ_{\star}) and gas (σ_{gas}) velocity dispersion values within the inner $2.5''$ (on average 2 kpc at the typical redshift of the sample galaxies), using the σ_{frac} parameter, defined as:

$$\sigma_{frac} = \frac{\sigma_{gas} - \sigma_{\star}}{\sigma_{\star}}, \quad (1)$$

which measures the fractional difference between the gas and stellar σ , and thus higher values of σ_{frac} are indicative of a disturbed kinematics and most probably due to outflows.



Histograms comparing σ_{frac} distributions of AGN and control galaxies for [O III] $\lambda 5007$. AGN are shown in blue and controls in gray.



Plot of logarithm of [O III] $\lambda 5007$ Å luminosity versus σ_{frac} for AGN (blue open circles) and inactive galaxies (red closed circles). The Spearman test confirms that these properties are correlated resulting in a correlation coefficient of 0.54 and p-value of 10^{-14} . The black line is the result of linear fit of data.

References

- [1] Hopkins, P. et al. 2005, ApJ, 630, 705.
[2] Rembold, S. et al. 2017, MNRAS, 472, 4382.

Acknowledgements

