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Ionized gas kinetic feedback in MaNGA AGN

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We study 293 Active Galactic Nuclei (AGN) host galaxies and 485 control galaxies from MaNGA-SDSS, we analyzed the ionized gas kinematics using [O,III]λ5007Å, emission line profiles. We observed a positive correlation between $\langle W_{80} \rangle$ and L[O,III] for AGN. We define and we obtain the extent of the Kinematically disturbed regions that is about 55% of the Extended Narrow Line Region in mean. We find that the low-luminosity AGN impact on the host galaxy in a "maintenance mode" feedback.

Powerful AGN exhibit observable interactions with surrounding gas, manifesting as kinetic disturbances like outflows or enhanced velocity dispersion, particularly perpendicular to radio jets and ionization axes. The kinetic feedback on AGN surrounding gas is a complex, multi-phase phenomenon, with various gas phases observable in different spectral domains (Roy et al., 2021). In this study we investigate the ionized gas kinematics, in a sample of 293 AGN host and 485 control galaxies observed by MaNGA-SDSS project, where each AGN was paired with two controls, so that the redshift, inclination, morphology, mass stellar are similar. The criteria of the sample select are described in Rembold et al. (2017). We measurements the W_{80} values (Liu et al., 2013) in the [O III]λ5007Å emission line profiles, fitted with one narrow Gaussian component in the whole sample, except for 45% of the AGN sources with one additional broad component. The distribution of the weighted mean $\langle W_{80} \rangle$ values has a median value of 453 km s^{-1} for the AGN and 306 km s^{-1} for the controls. The median difference in the W_{80} values between AGN and its controls is 143 km s^{-1}. we attribute these larger W_{80} values in the AGN to kinematic disturbances in the gas by the AGN: its radiation pressure, heating and/or outflows (Riffel et al., 2021). We also find a positive correlation between the $\langle W_{80} \rangle$ and L[O III] fo the AGN, strengthening when combined with control galaxy values, indicating that the AGN luminosity plays a dominant role in introducing kinematic disturbances and outflows in the host galaxies (Wylezalek et al., 2020).

We identify the Extended Narrow Line Region (ENLR) and the "kinematically disturbed regions" (KDRs) of the AGN, characterized by $W_{80} \geq W_{80,cut} = 315\,\mathrm{km\,s^{-1}}$ – the mean value for the controls plus its standard deviation. The median of this extents are R_{KDR}=4.3 kpc and R_{ENLR}=8.4 kpc, showing that, typically, the extent of the KDR is about 55% that of the ENLR region, like found in previous studies as in Deconto-Machado et al. (2022).

Finally we estimate the ionized gas mass outflow rate ($\dot{M}_{out}$) and the corresponding kinetic powers ($\dot{E}_{out}$) assuming that the KDR is due to an AGN outflow. Using two methods to obtain the outflow velocity — one based on W_{80} and the other using the velocity of the broad component, we find the following mean values: $\langle \dot{M}_{out,W_{80}} \rangle$ =1.92±0.09×10^{-3} $M_\odot$ yr^{-1} and $\langle \dot{M}_{out,b} \rangle$ =3.59±0.014×10^{-3} M$_\odot$ yr^{-1} for the mass outflow rate;$\langle \dot{E}_{out,W_{80}} \rangle = 1.74 \pm 0.71 \times 10^{38}\, erg\, s^{-1}$ and $\langle \dot{E}_{out,b} \rangle = 4.57 \pm 0.13 \times 10^{38}\, erg\, s^{-1}$, for the outflow powers. The kinetic powers for the outflows that correlate with the AGN luminosity L_{bol}, populating the low luminosity region of this known correlation. This correlation corresponds to a coupling efficiency between the outflow power and AGN luminosity of 0.01% and lower. But the large extent of the KDR, in spite of this low coupling efficiency, shows that even low-luminosity AGN, as those of our sample, can impact the host galaxy in a low, "maintenance mode" feedback.

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