

A negative correlation between R_{UV} and α_{ox} in low-luminosity AGNs

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Abstract. It has been controversial for years that the accretion mode is different for bright active galactic nuclei (AGNs) and low-luminosity AGNs (LLAGNs). In this work, we compile from literature a sample of 32 LLAGNs, consisting 18 LINERs and 14 low Eddington ratio (λ) Seyfert galaxies. A strong negative correlation between the radio loudness R_{UV} and the optical to X-ray spectral index α_{ox} is reported for the first time. We further demonstrate that this negative correlation can be understood consistently and comprehensively under the truncated accretion–jet model, a model that has been applied successfully to LLAGNs. We argue that the scatter in the observations is mainly due to the spread in the viscosity parameter α of a hot accretion flow, a parameter that can potentially serve as a diagnosis of the strength and/or configuration of magnetic fields in accretion flows.

Keywords. accretion, accretion discs - black hole physics - galaxies: active - galaxies:Seyfert

1. Introduction

It has been known for years that, statistically, LLAGNs are distinct in various aspects from bright AGNs. A hot accretion flow is believed to be present in LLAGNs (Narayan & Yi 1994, Bu *et al.* 2016). However, in observations, apart from the global trends observed, large dispersion is also witnessed in both the $\Gamma - \lambda$ correlation (e.g. Gu & Cao 2009) and the $\alpha_{ox} - \lambda$ correlation (e.g. Xu 2011). Obviously these large scatter trends indicate that, besides the accretion rate that controls the luminosities in different wavebands, additional parameters/factors waiting to be identified should also play certain roles. One possible factor is the difference in the viscosity parameter α of the hot accretion flow among different systems.

2. The LLAGN sample

We gather from the literature a sample of LLAGNs, which consist of both LINERs and low- λ Seyfert galaxies. After excluding the LLAGNs whose X-rays may be dominated by emission from relativistic jets, our final LLAGN sample includes 14 low- λ Seyfert galaxies and 18 LINERs (Li & Xie 2017).

3. Main results and theoretical interpretation

For the first time, a very strong negative correlation between R_{UV} and α_{ox} , i.e., $\log R_{UV} = (-2.39 \pm 0.48) \alpha_{ox} + 5.61 \pm 0.49$, is found with the confidence level larger than 99.9 % (Fig. 1). We suggest that this correlation can be well fitted by the truncated accretion-jet model. The scatter in this correlation is argued to relate to the viscosity parameter α of the hot accretion flow component. A theoretical correlation between R_{UV}

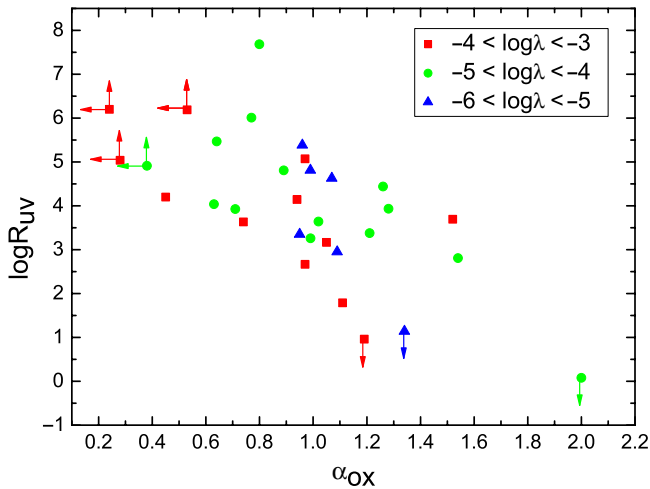


Figure 1. The relationship between radio loudness R_{UV} and the optical to X-ray spectral index α_{ox} for bright AGNs with $\lambda > 10^{-2}$.

and α_{ox} ($\log R_{UV} \approx -3.25 \alpha_{ox} - 0.95 \log \lambda + const.$) can provide very well fitting for the observations (see Li & Xie 2017 for details).

4. Summary

In this work, we gather from the literature a sample of 32 LLAGNs, including 14 low- λ Seyfert galaxies and 18 LINERs. From this sample, we observe a very strong negative correlation between R_{UV} and α_{ox} . Then, based on the truncated accretion-jet model, we provide a comprehensive understanding of this new observation.

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References

Bu D. F., Yuan F., Gan Z. M., & Yang X. H., 2016, *ApJ*, 818, 83
 Gu, M., & Cao, X., 2009, *MNRAS*, 399, 349
 Li, S.-L., & Xie, F.-G., 2017, *MNRAS*, 471, 2848
 Narayan, R., & Yi, I. 1994, *ApJ*, 428, L13
 Xu, Y.-D., 2011, *ApJ*, 739, 64