

Dependence of the broad Fe K α line on the physical parameters of AGN

Zhu Liu¹, Weimin Yuan¹, Youjun Lu¹, Francisco Carrera², Serena Falocco³, Xiao-Bo Dong⁴

1. National Astronomical Observatories, Chinese Academy of Sciences, Beijing 100012, China; 2. Instituto de Física de Cantabria (CSIC-UC), Avenida de los Castros, 39005 Santander, Spain;

3. KTH Royal Institute of Technology, Department of Physics and the Oskar Klein Centre, AlbaNova, SE-106 91 Stockholm, Sweden; 4. Yunnan Observatories, Chinese Academy of Sciences, Kunming, Yunnan 650011, China

Abstract

The dependence of the broad Fe K α line on the physical parameters of AGN is investigated by applying the X-ray spectra stacking method to a sample of Type I AGN. A broad line is detected in the stacked spectra of the high λ_{Edd} sub-sample ($\log \lambda_{\text{Edd}} > -0.9$). The profile of the line can be well fitted with relativistic broad line model. We found hints that the Fe K line becomes broader as the λ_{Edd} increases. A broad line might be present in the narrow-line Seyfert I (NLSI) galaxies. Our results indicate that the detection/properties of the broad Fe K α line may strongly depend on λ_{Edd} , which can be explained if the ionization state and/or truncation radius of the accretion disc changes with λ_{Edd} . The non-detection of the broad line in the BLSI sub-sample can be explained if the the average EW of the relativistic Fe K α line is weak or/and the fraction of sources with relativistic Fe K α line is small in BLSI galaxies.

Introduction

- ➔ Broad Fe K α line is significantly detected in ~50% of AGN (e.g. Nandra et al. 2007).
- ➔ It is important in measuring the BH spin, understanding the growth of BH as well as the accretion history.
- ➔ The reason for the lack of apparent relativistic broad Fe K α line in the X-ray spectra of some AGN is still unclear.

Sample & Method

- ➔ 8862 Type I AGN selected from SDSS-DR4 data (Dong et al. 2012).
- ➔ 156 sources are detected by XMM-Newton with high signal-to-noise ratio.
- ➔ The sample is divided into different sub-samples, see Fig. 1
- ➔ The X-ray spectral stacking method (Corral et al. 2008) is applied to each sub-sample.

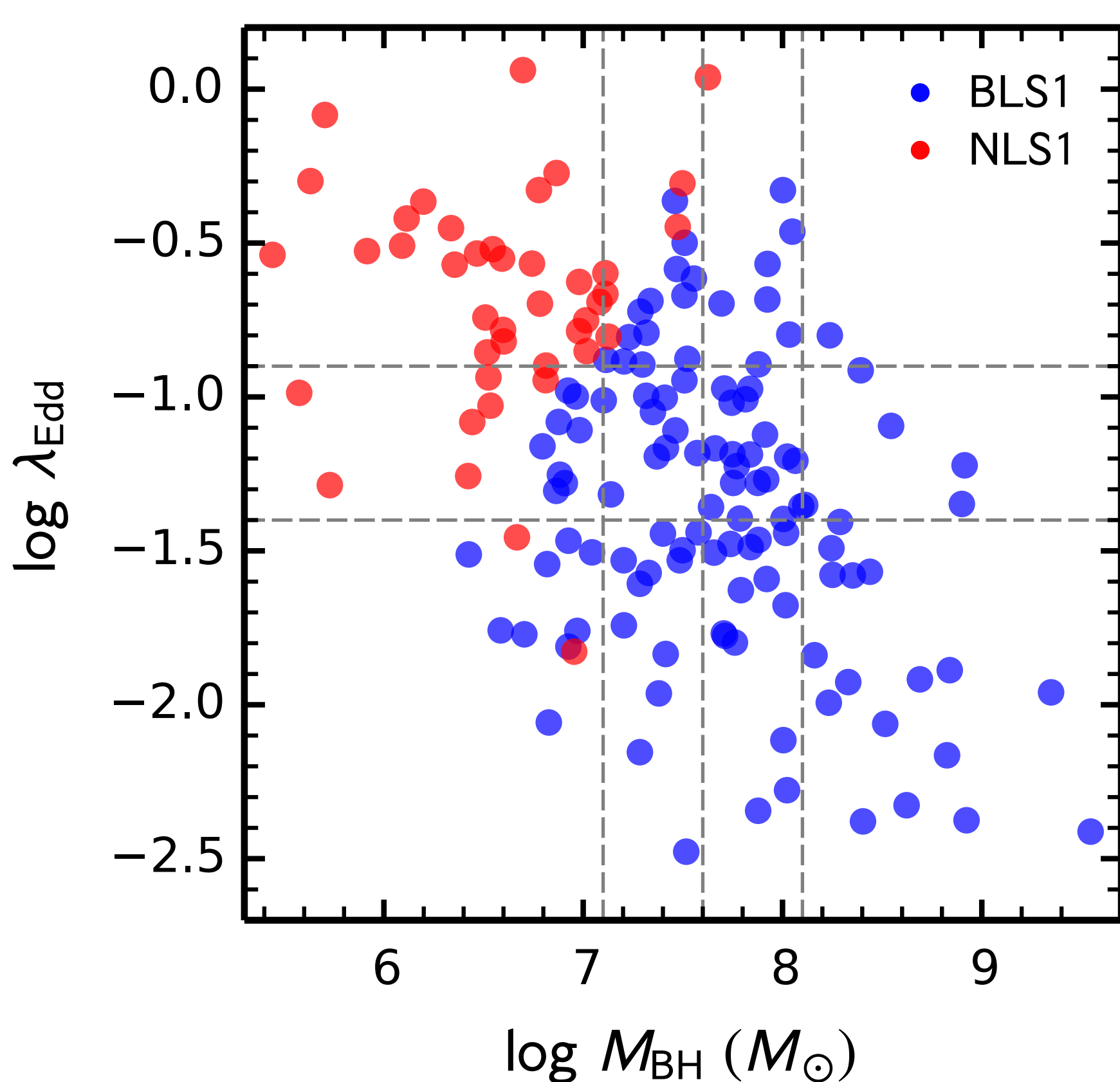
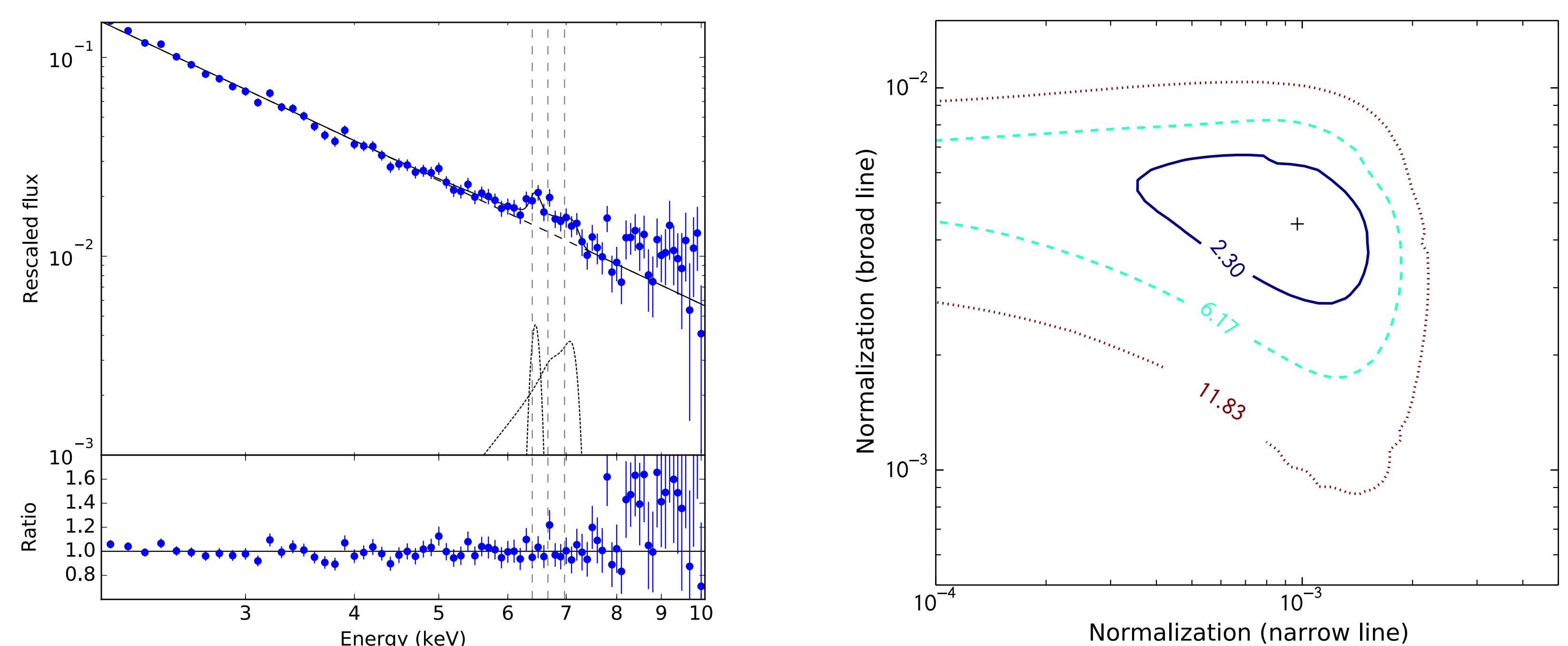


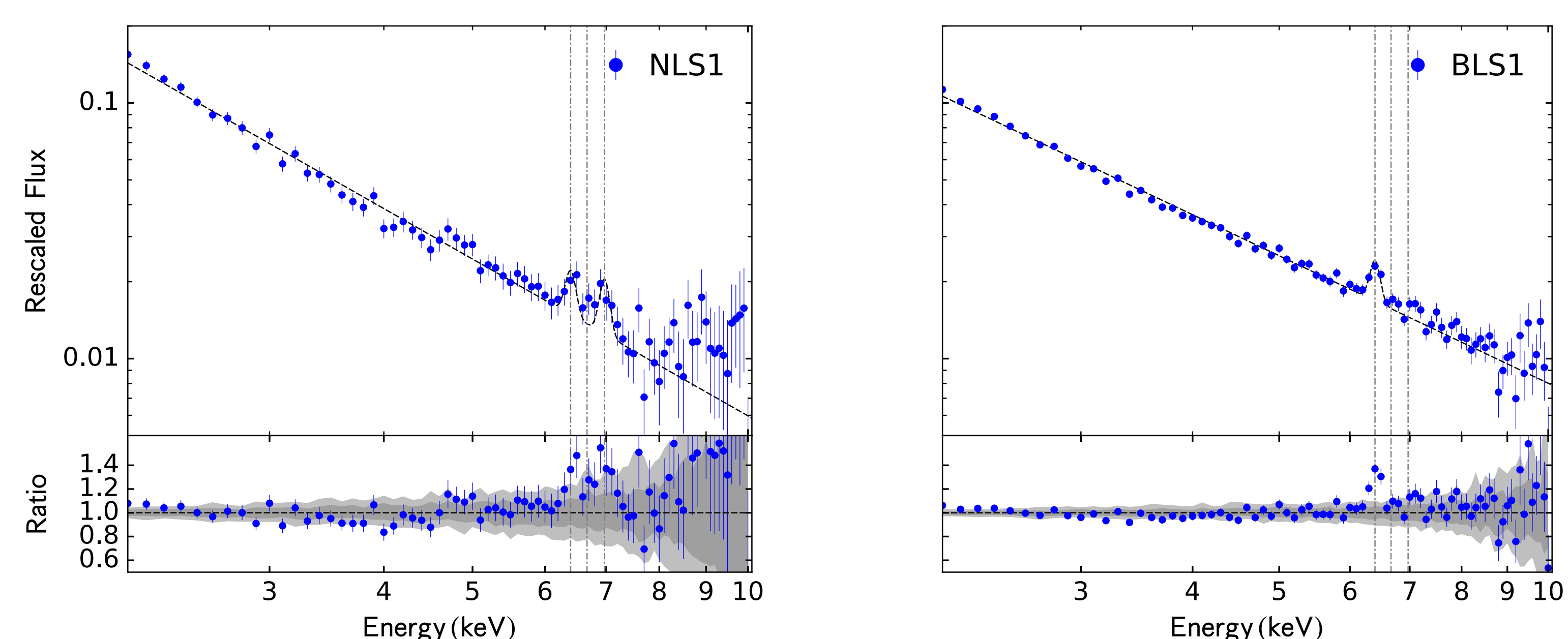
Fig 1. Distribution of the sources in the $M_{\text{BH}} - \lambda_{\text{Edd}}$ plane. The dashed lines mark the boundaries of different sub-samples.

Results I: stacked spectra of λ_{Edd} sub-samples



- ◆ A significant broad Fe K α line is detected in the high λ_{Edd} sub-sample.
- ◆ The line width of the Fe K α line increases with λ_{Edd} , consistent with Inoue et al. 2007

Results II: stacked spectra of NLSI/BLSI sub-samples



- ◆ A broad Fe K α line might be shown in the NLSI sub-sample, consistent with Liu et al. 2015.
- ◆ No broad line is shown in the BLSI sub-sample.

Conclusion

- Our results indicate a dependence of properties of the broad FeK α line on the λ_{Edd} .
- ★ Ionization state of the accretion disk changes with λ_{Edd} ?
- ★ Disk truncation?
- A broad line is shown in the NLSI sub-sample, though with low significance.

References

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