An X-ray View of Accretion Disk Winds in Active Galactic Nuclei

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Introduction

Here I present the main results of an X-ray study of the inner regions of AGN, focusing on the formation of high velocity winds by the accretion disk. Constraining AGN winds physical parameters is of paramount importance both for understanding the physics of the accretion/ejection flow around SMBH, and for quantifying the amount of feedback between the SMBH and its environment.

Observational Strategy

Both archival and GO XMM-Newton observations have been used to unveil the X-ray properties of BAL, mini-BAL, and NAL QSOs, known to host high velocity winds associated to their nuclear regions. A three-fold observational strategy has been adopted:

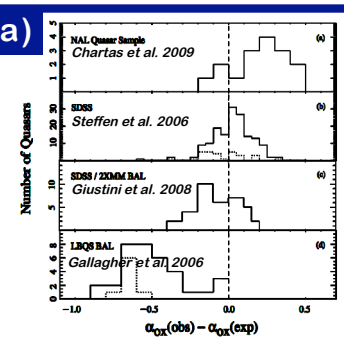
(a) substantial samples of distant <z>~2 sources have been analyzed through spectral, photometric, and statistical techniques, to gain insights into their mean properties as a population;

(b) a moderately sized sample of <z>~0.5 bright sources selected from the PG Catalog has been studied through detailed X-ray spectral analysis, to give a first flavor of the general properties of these sources, also from a time-resolved point of view;

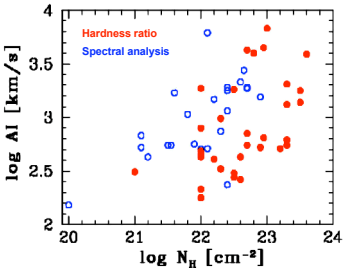
(c) the best nearby z~0.1 candidate, PG 1126-041, has been studied using the most sophisticated spectral analysis techniques applied to a large dataset with a high S/N ratio, including the longest X-ray exposure on a mini-BAL QSO so far.

Main Results

(a)

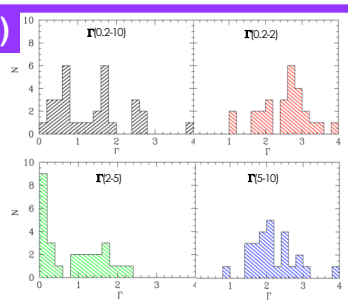


The X-ray weakness is proportional to the width of the blueshifted UV absorption features.

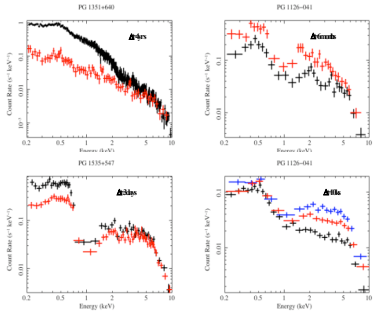


The higher the X-ray absorption, the stronger the UV wind.

(b)

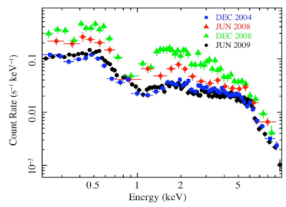


A complex spectral shape: flat Γ in the 0.2-10 and 2-5 keV band; steep Γ in the 0.2-2 and 5-10 keV band.

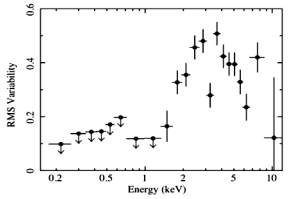


Strong spectral variability over different and multiple time scales.

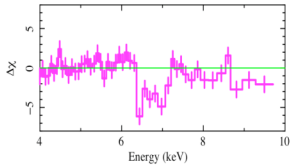
(c)



PG 1126-041 is highly variable over month time scales at E<6 keV.



PG 1126-041 is highly variable over kilosecond time scales at E>1.5 keV.



A highly ionized outflowing absorber is significantly detected in the Fe K band.

Main Conclusions

- ⇨ There is a smooth distribution of UV/X-ray properties between BAL, mini-BAL, and NAL QSOs.
- ⇨ Dramatic X-ray spectral variability on both short and long time scales is common among BAL and mini-BAL QSOs.
- ⇨ In the deepest observations, high column densities of ionized gas along the line of sight are systematically detected.
- ⇨ The ionized absorbers are variable, and strongly contribute to the observed spectral variability.
- ⇨ In the highest S/N ratio observation of a mini-BAL QSO a highly ionized, variable, and outflowing absorber has been detected.
- ⇨ The variations over the shortest time scales suggest a spatial origin of the wind very close to the central SMBH.
- ⇨ ***The temporally resolved X-ray spectral analysis has been finally opened for BAL, mini-BAL, and NAL QSOs: this will allow, in the near future, to unveil the dynamics of the inner accretion/ejection flow in AGN.***

For further details, see M. Giustini Ph.D. Thesis, University of Bologna 2011, or contact me at margherita.giustini@gmail.com