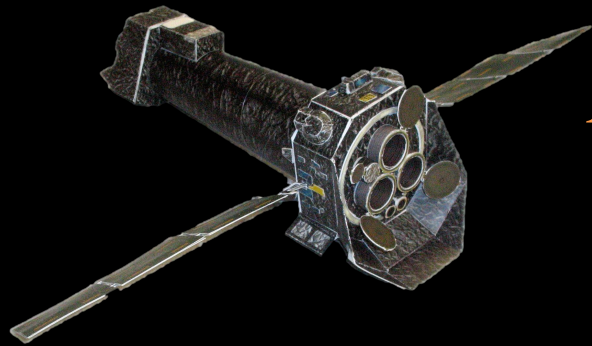




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AGN diagnostic plot in the WISE and 3XMM era: the role of variability



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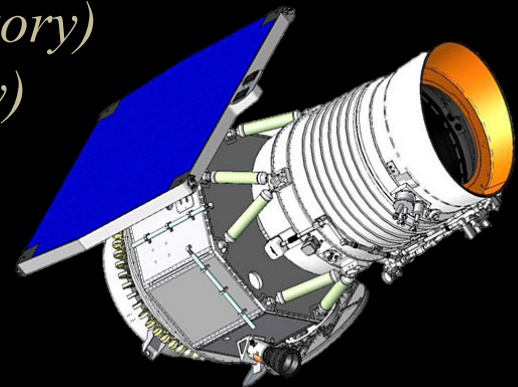
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C. Vignali (Dept. of Physics and Astronomy, University of Bologna)

R. Della Ceca (INAF – Brera Observatory)

L. Ballo (INAF – Brera Observatory)

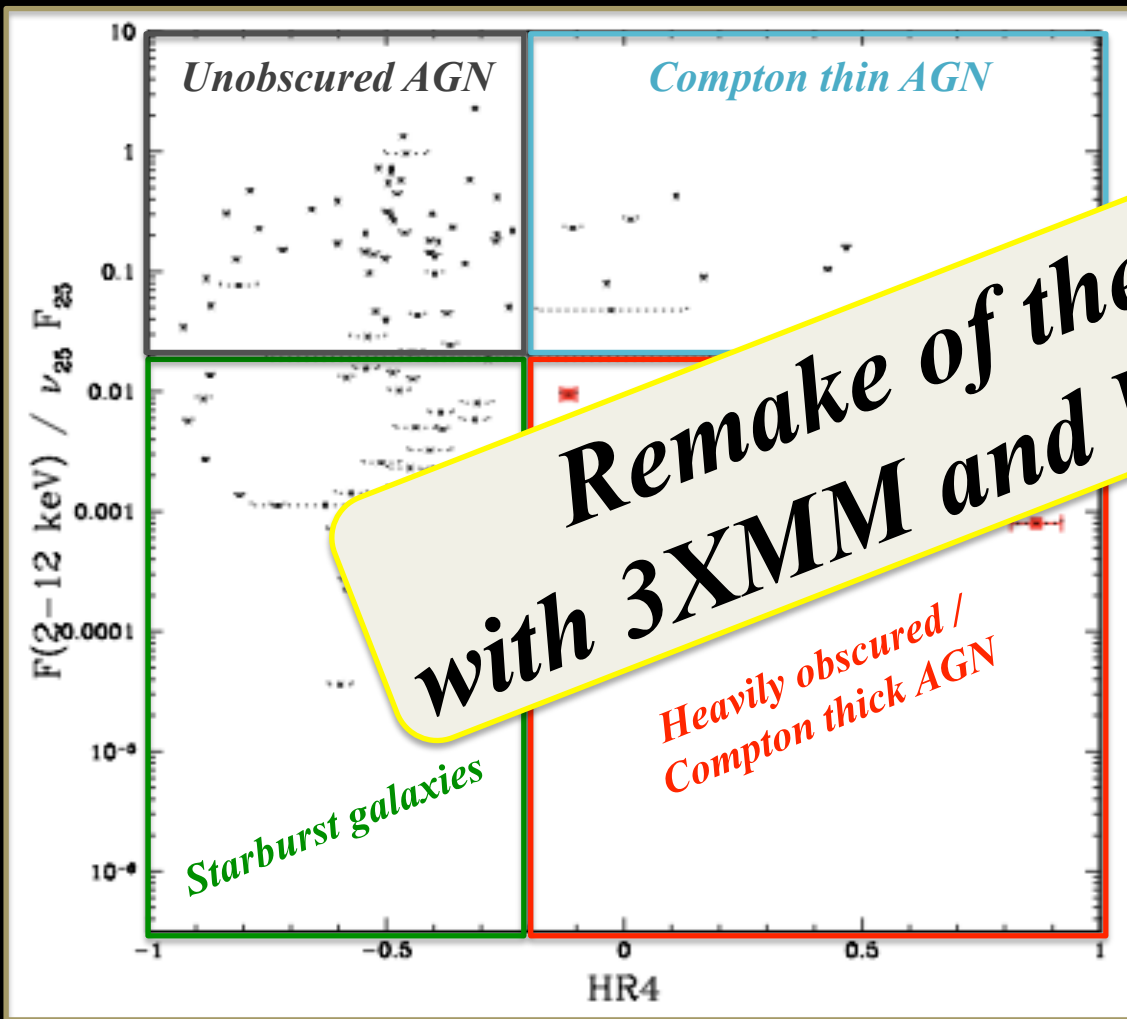


Outline

- ☐ *2XMM-IRAS vs 3XMM-WISE diagnostic plot*
- ☐ *Catching the origin of variability*
- ☐ *Some examples of variable sources*
- ☐ *Conclusions and future perspectives*

Diagnostic plot for AGN classification

✧ *Severgnini et al. (2012)*

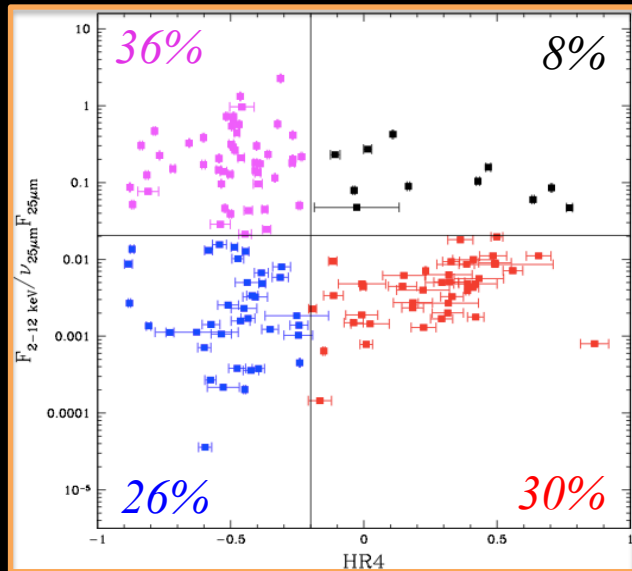


145 sources
 $F_X(4.5-12 \text{ keV}) > 10^{-13} \text{ erg cm}^{-2} \text{ s}^{-1}$
 $0.14 \text{ Jy} < F_{25\mu\text{m}} < 544 \text{ Jy}$

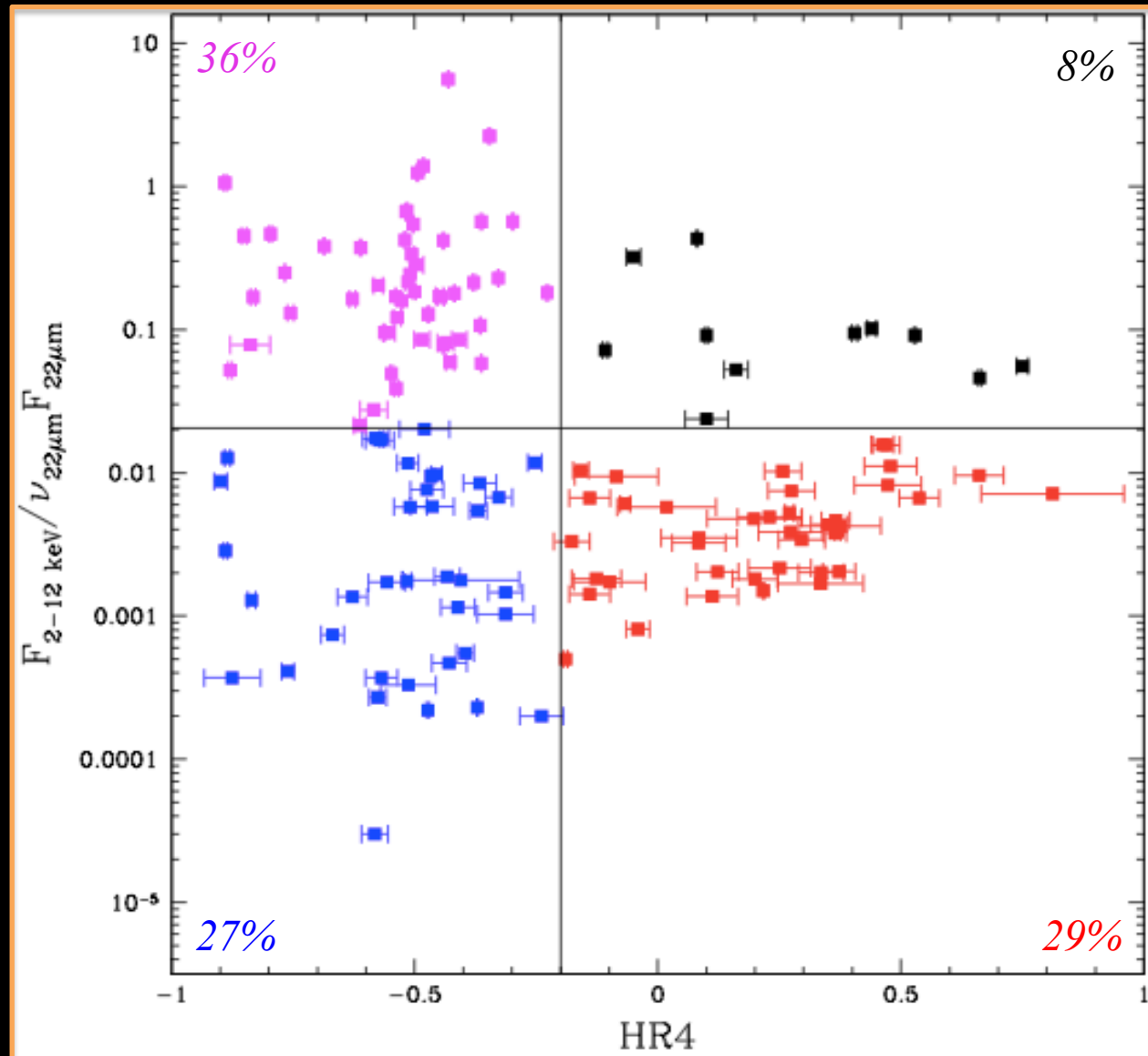
$$HR4 = \frac{cts(4.5-12 \text{ keV}) - cts(2-4.5 \text{ keV})}{cts(4.5-12 \text{ keV}) + cts(2-4.5 \text{ keV})}$$

2XMM-IRAS vs 3XMM-WISE plot

2XMM-IRAS



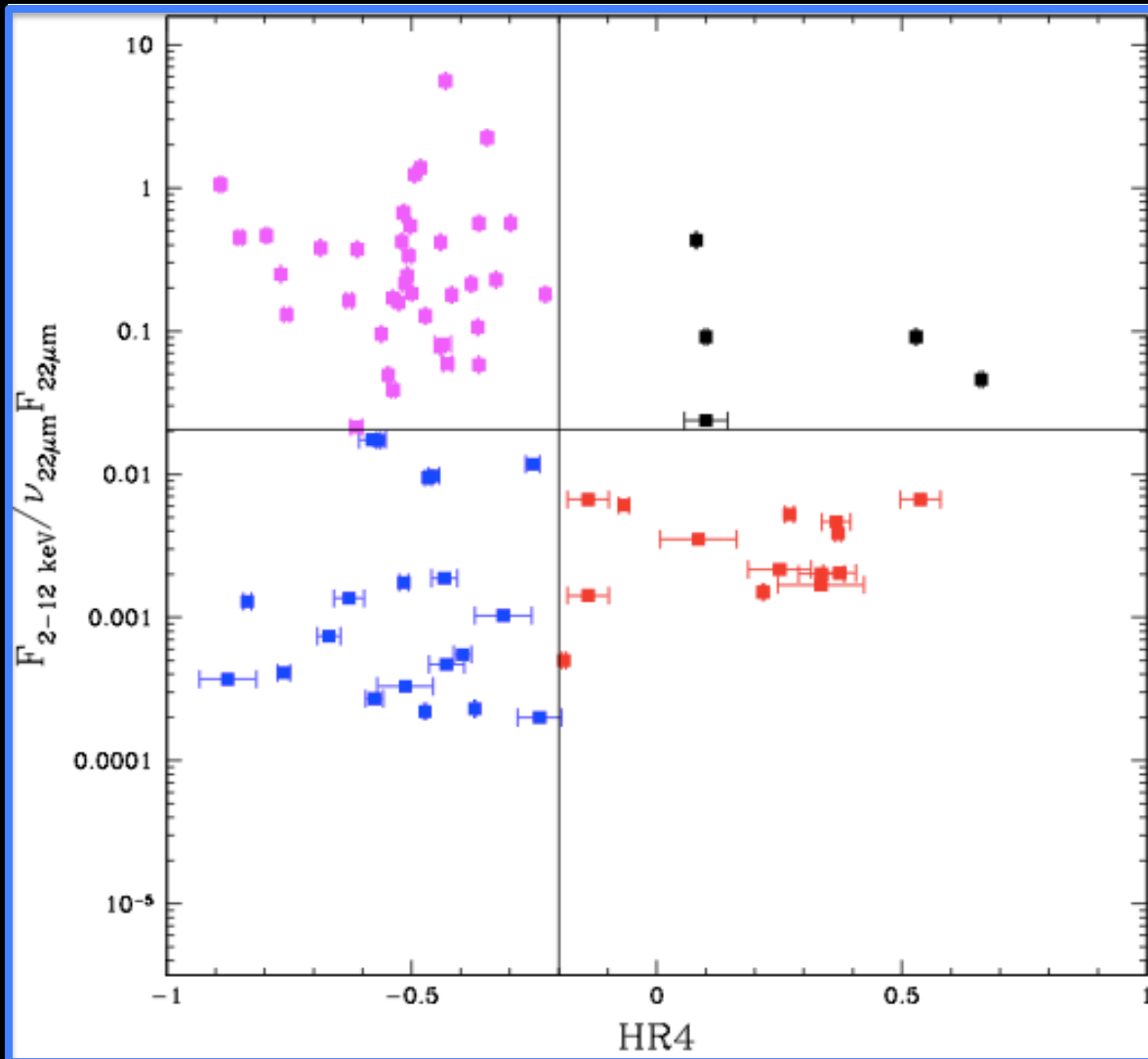
3XMM-WISE



- *Stability of the diagnostic plot*
- *Only <5% of the sources change its location within the plot*

Does variability play a role?

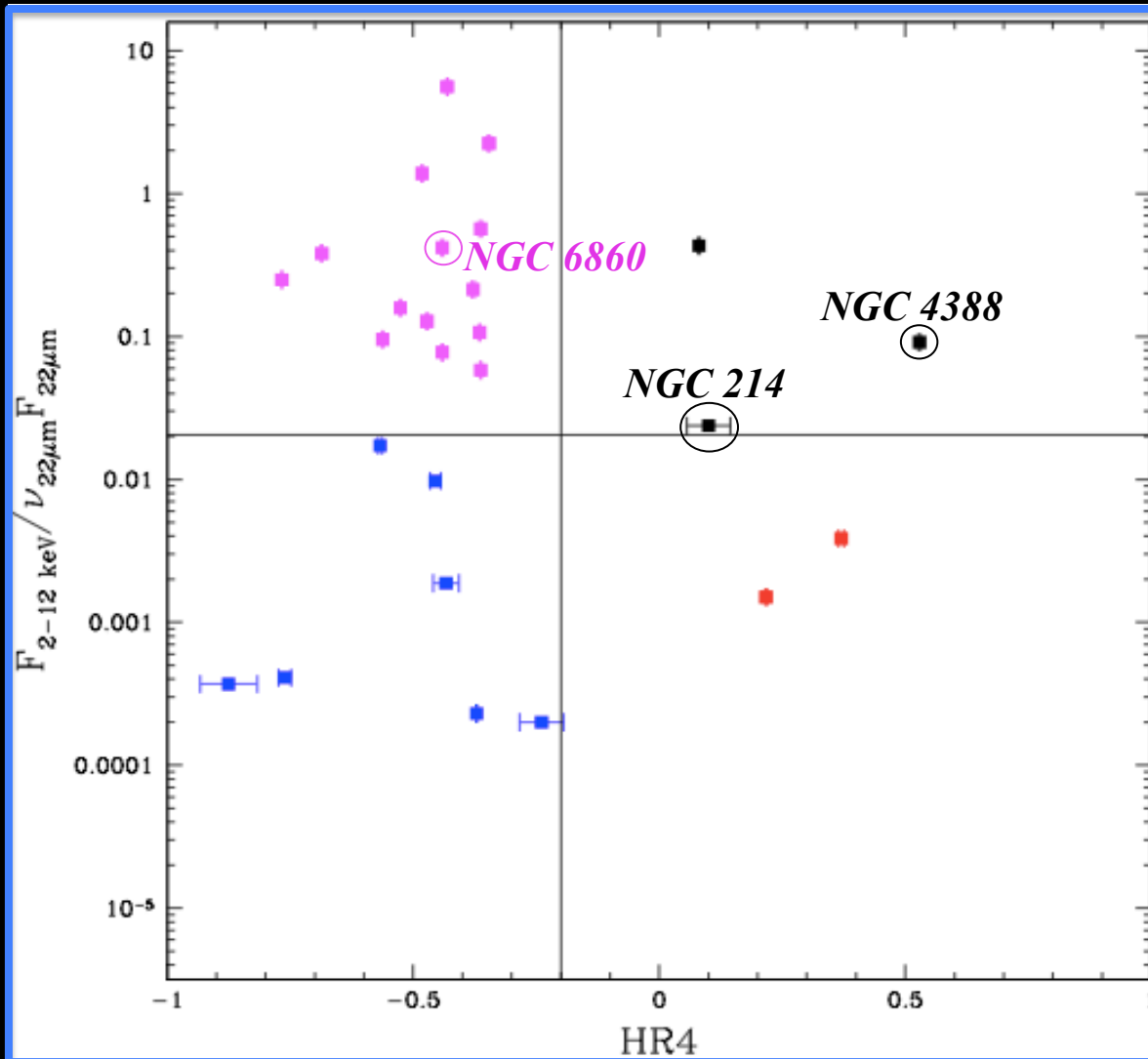
Sources with multiple detections in the 3XMM catalogue



~55% of the sources

Does variability play a role?

Sources with multiple detections in the 3XMM catalogue



*check for
variability*

$$\Delta F_X > 2$$

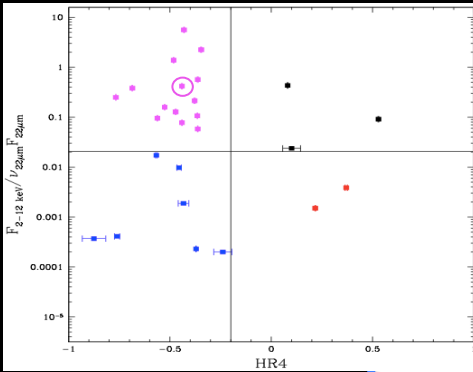
and/or

$$\Delta \text{HR4} > 2$$

*~33% of the sources
with multiple detections*

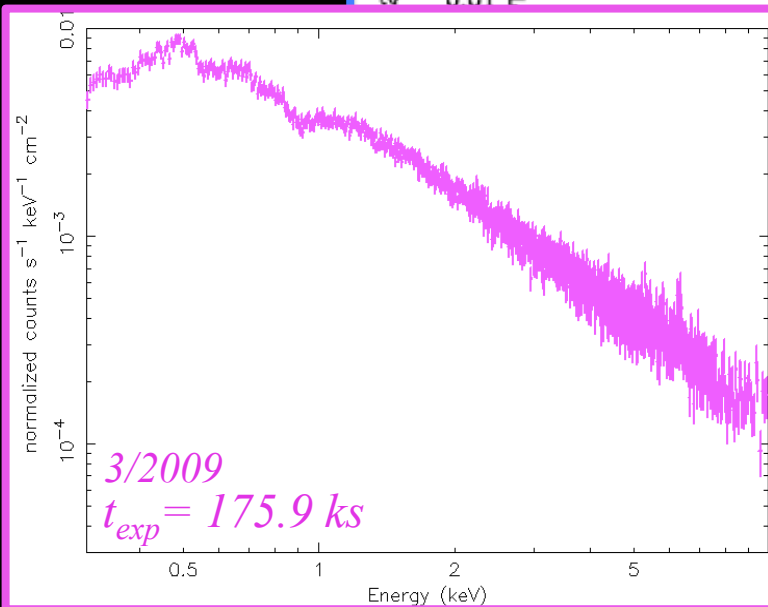
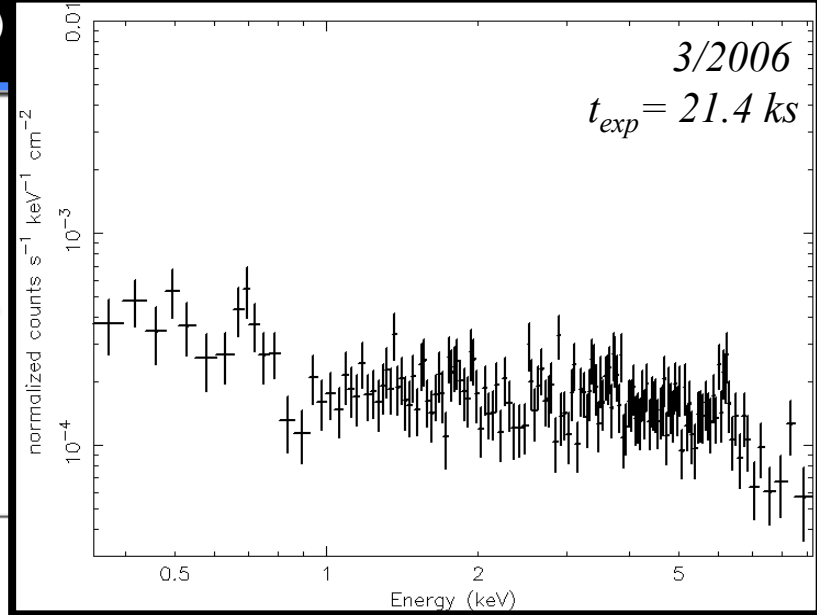
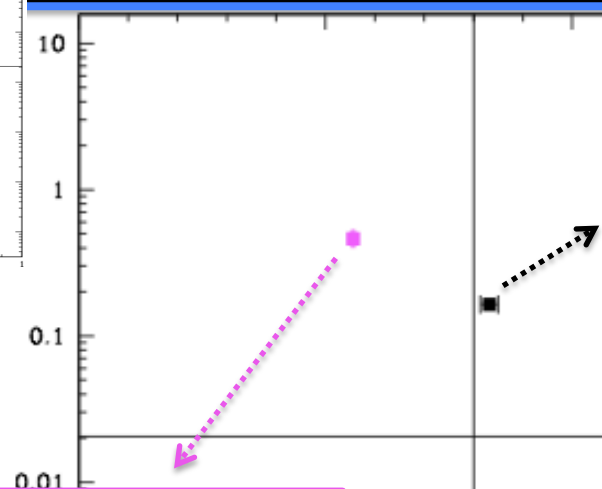
Some examples of variable sources - NGC 6860

Winter et al. (2007)

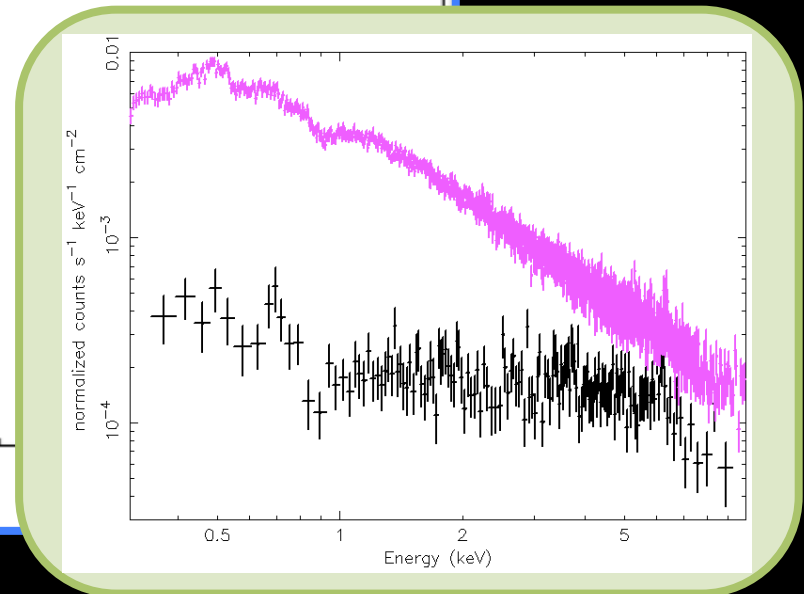


$z \sim 0.015$

$F_{22\mu m}$



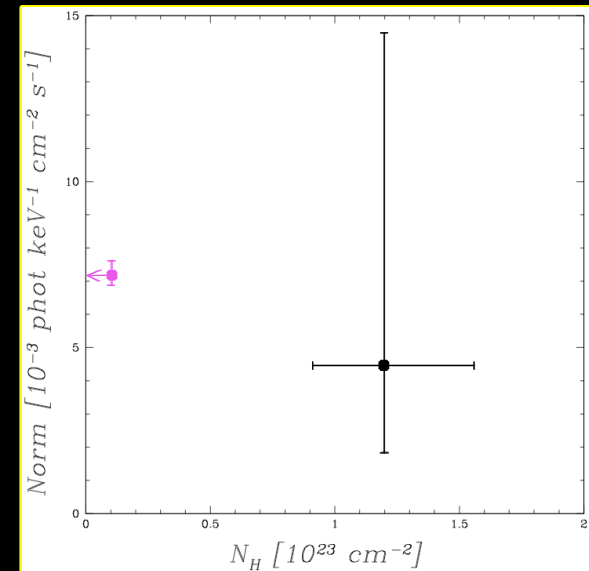
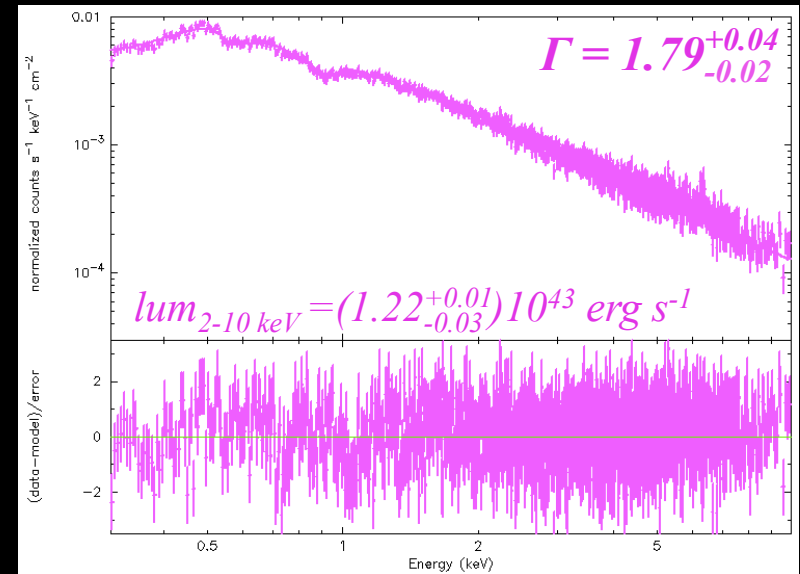
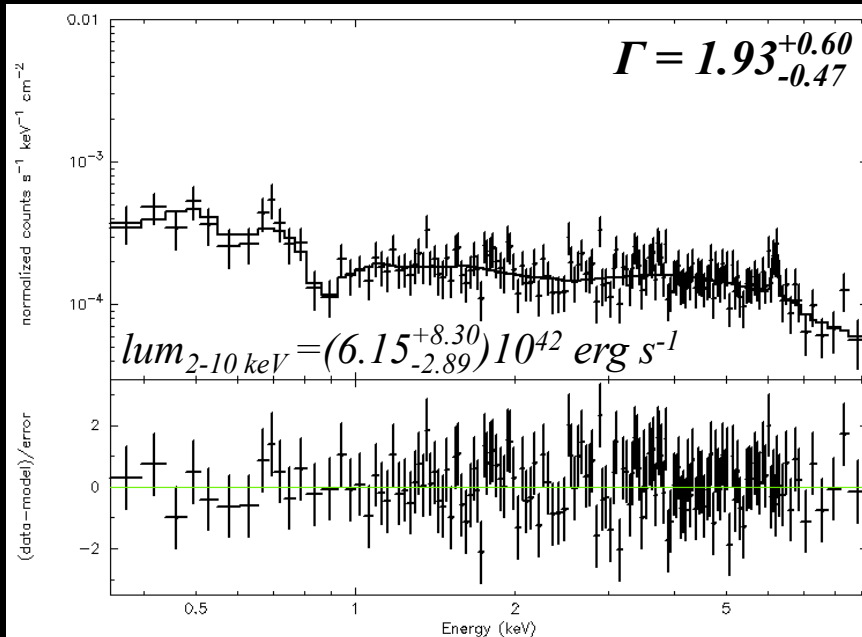
Winter et al. (2010)



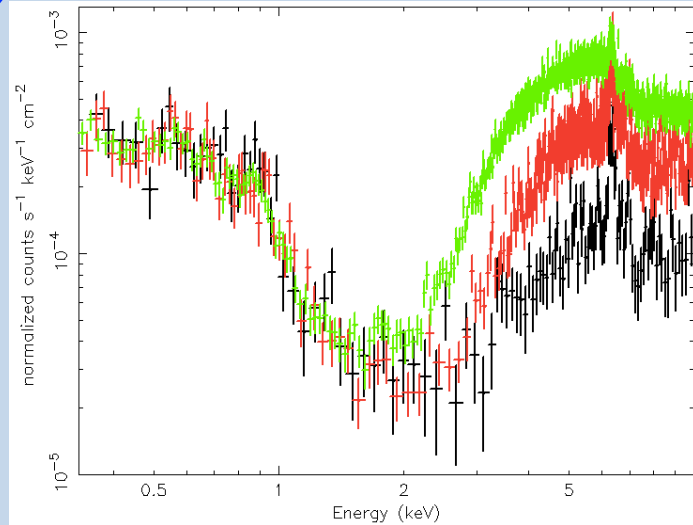
Some examples of variable sources - NGC 6860

- *absorbed powerlaw*
- *ionized absorber*
- *reflection component*
- *FeI k_α line*

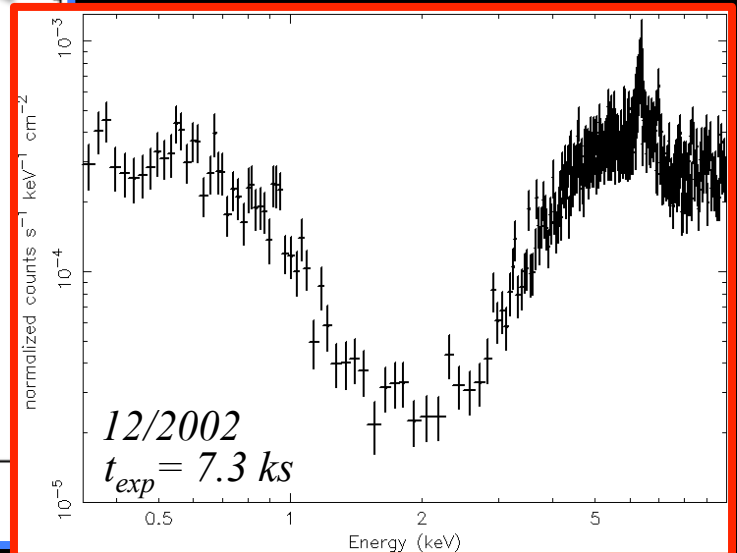
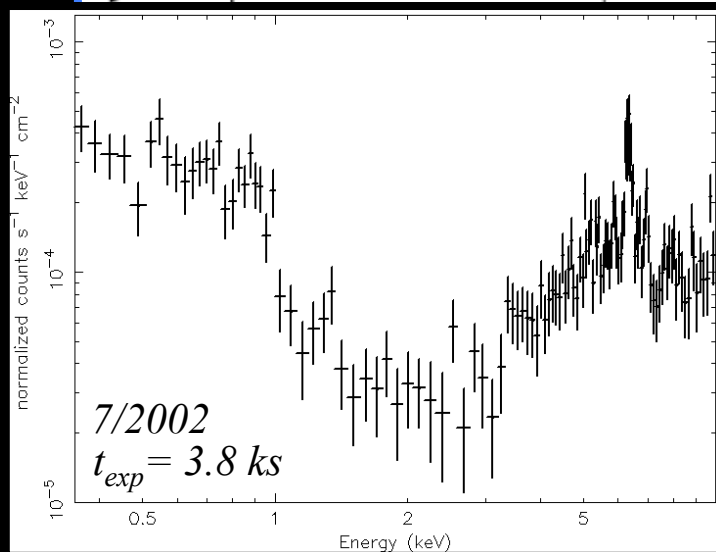
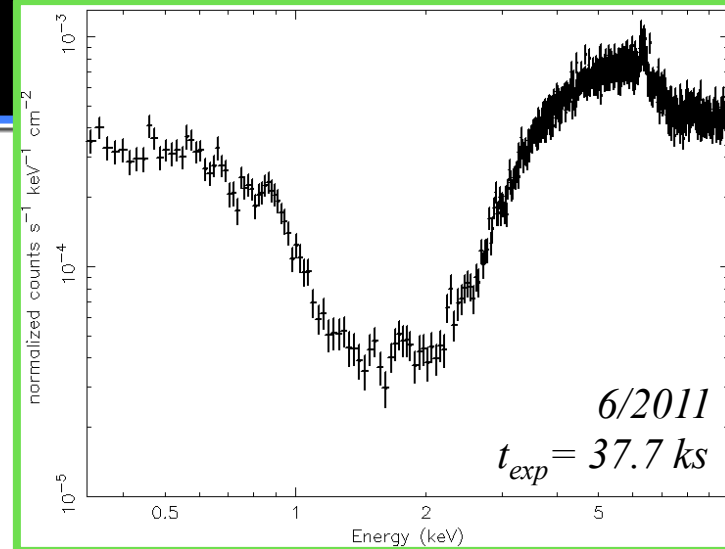
$z \sim 0.015$



Some examples of variable sources - NGC 4388



$z \sim 0.008$

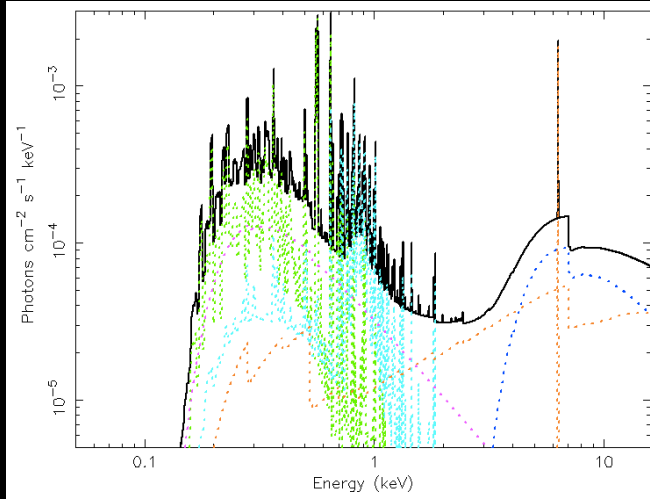


Beckmann et al. (2004)

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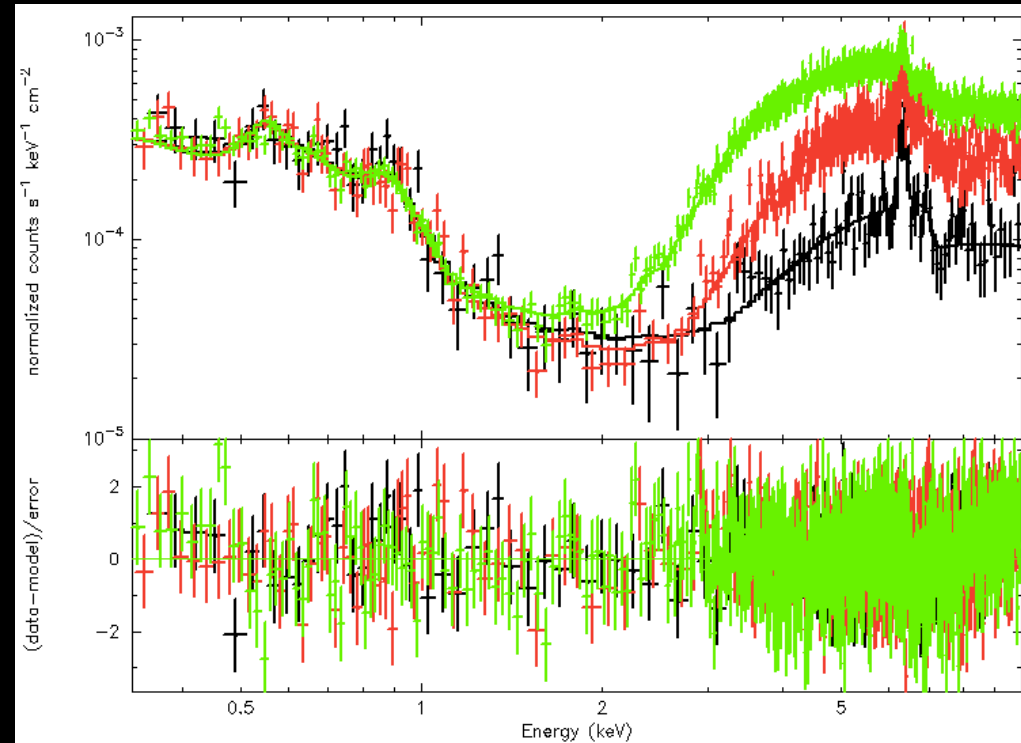
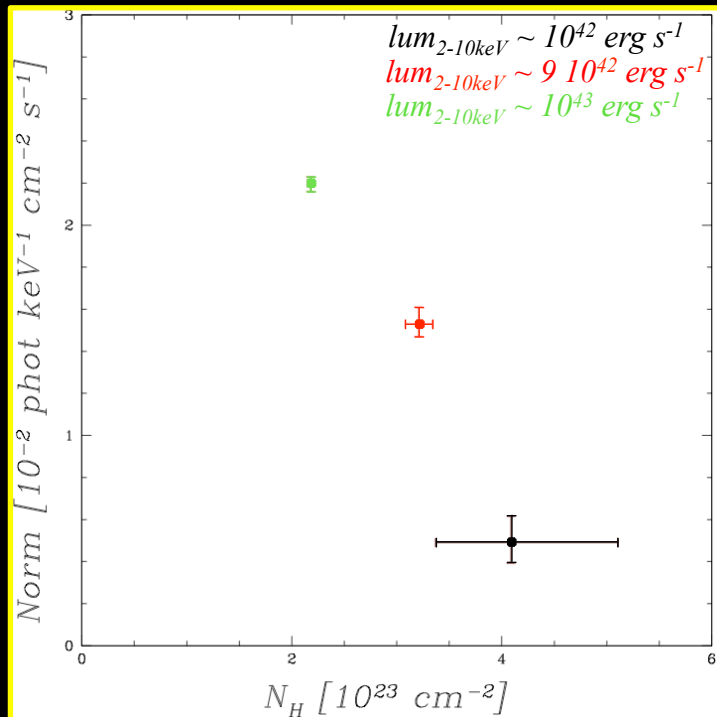
Beckmann et al. (2004)

Some examples of variable sources - NGC 4388

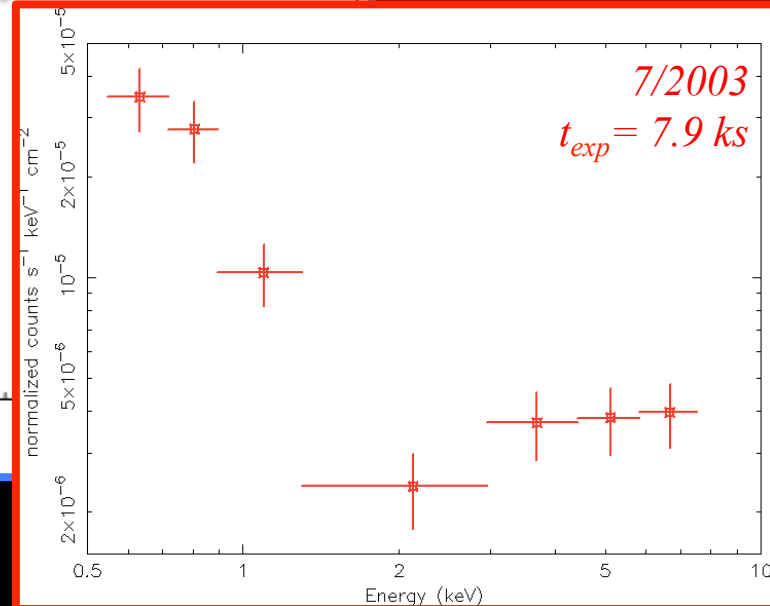
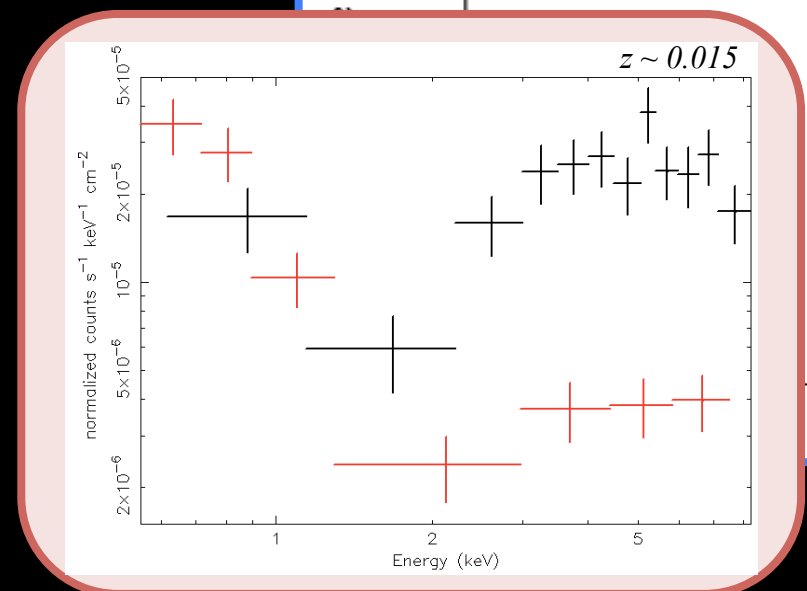
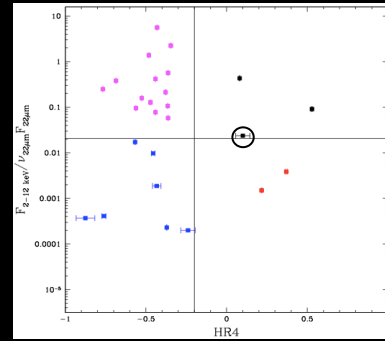
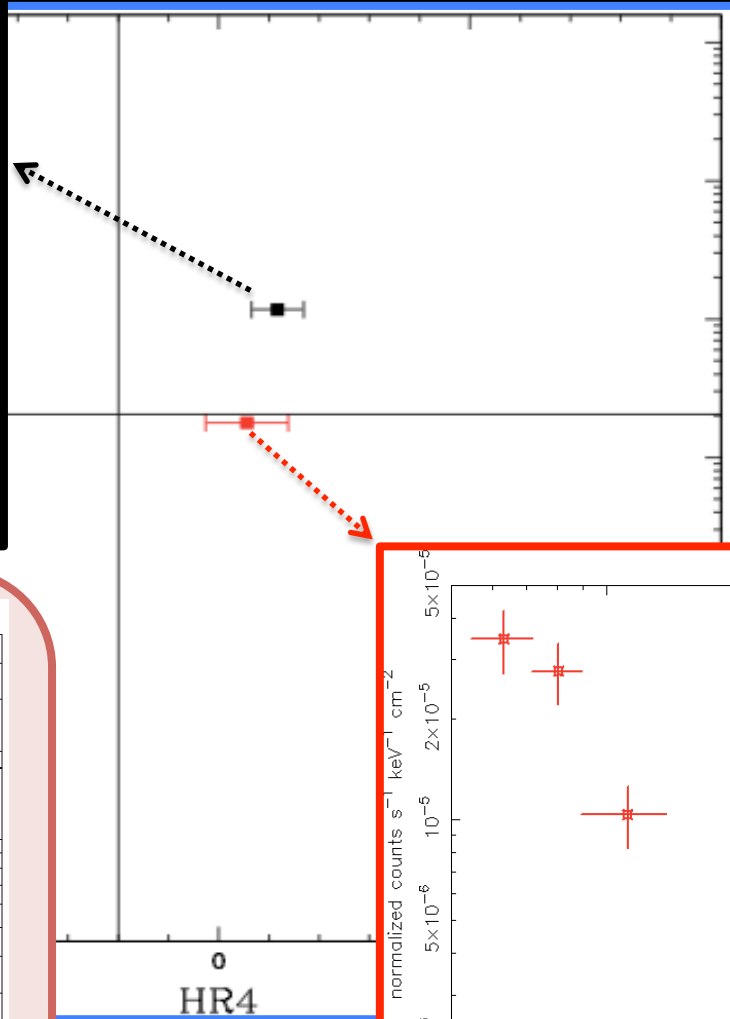
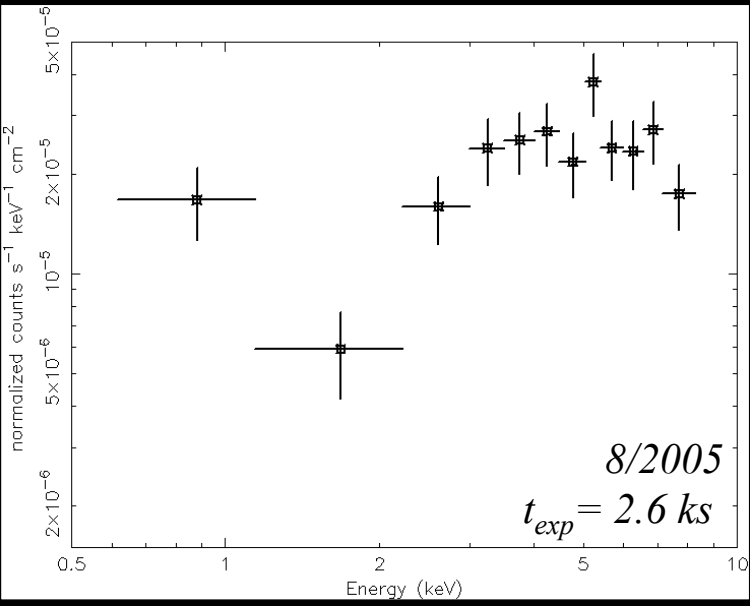


- thermal components: $kT_1 = (0.19 \pm 0.01) \text{ keV}$
 $kT_2 = (0.67^{+0.04}_{-0.03}) \text{ keV}$
- scattering < 1%
- absorbed powerlaw: $\Gamma = 1.7$ (fixed)
- reflection component + FeI k_α line

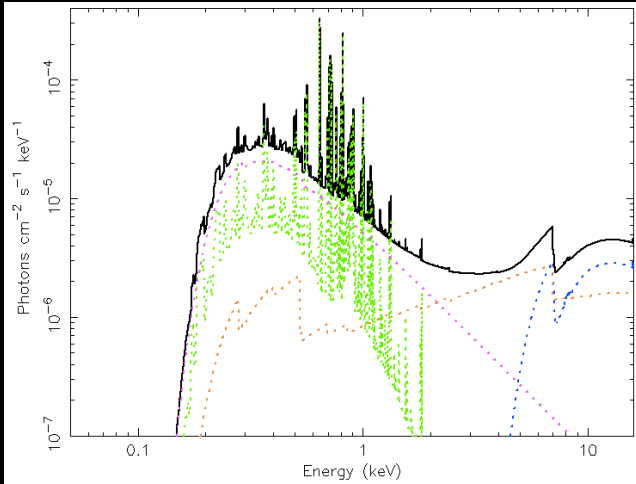
$z \sim 0.008$



Some examples of variable sources - NGC 214



Some examples of variable sources - NGC 214



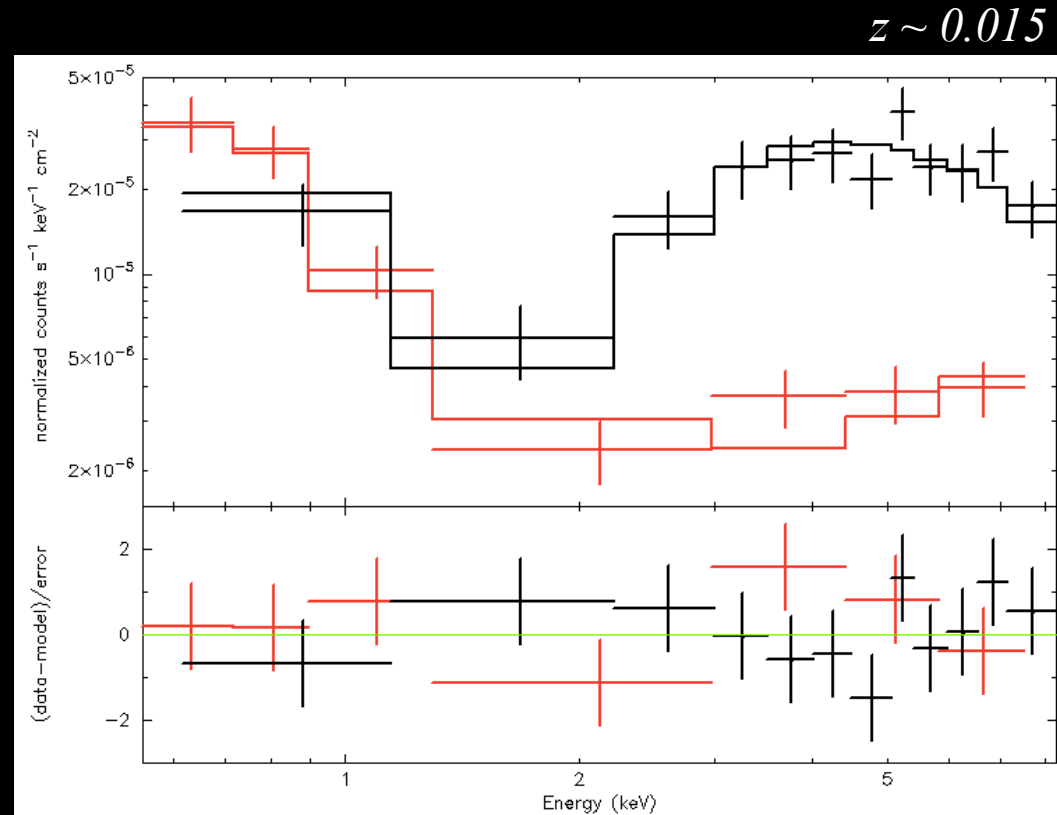
- *thermal component: $kT = 0.35^{+0.29}_{-0.10}$ keV*
- *scattering < 1%*
- *absorbed powerlaw: $\Gamma = 1.9$ (fixed)*
- *reflection component*

$$N_H = (1.19^{+0.43}_{-0.29}) 10^{23} \text{ cm}^{-2}$$

$$N_H = (1.23^{+0.97}_{-0.32}) 10^{24} \text{ cm}^{-2}$$

$$lum_{2-10\text{keV}} \sim 10^{42} \text{ erg s}^{-1}$$

$$lum_{2-10\text{keV}} \sim 10^{42} \text{ erg s}^{-1}$$



Conclusions and future perspectives

Summary:

- *Revisiting mid-IR/X-ray selection of local AGN sources with the latest 3XMM and WISE data*
- *Investigation of the role of variability within the AGN selection and classification through a diagnostic plot*

Conclusions:

- *Plot stability*
- *Diagnostic plot as hint of the origin of source variability*
- *Overall, plot in agreement with spectral analysis*

Future perspectives:

- *Carry out variable sources spectral analysis*
- *XMM/NuSTAR proposal to investigate the origin of variability*
- *Investigation of starbursts variability*



Thank you!

Napoli, 26-29 September 2016

Active Galactic Nuclei 12
a Multi-Messenger perspective

