COST ACTION MP0905 - BLACK HOLES IN A VIOLENT UNIVERSE
2nd WORKING GROUPS MEETING
15 - 16 November 2010

The INTEGRAL AGN sky

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on behalf of the IBIS survey/AGN team

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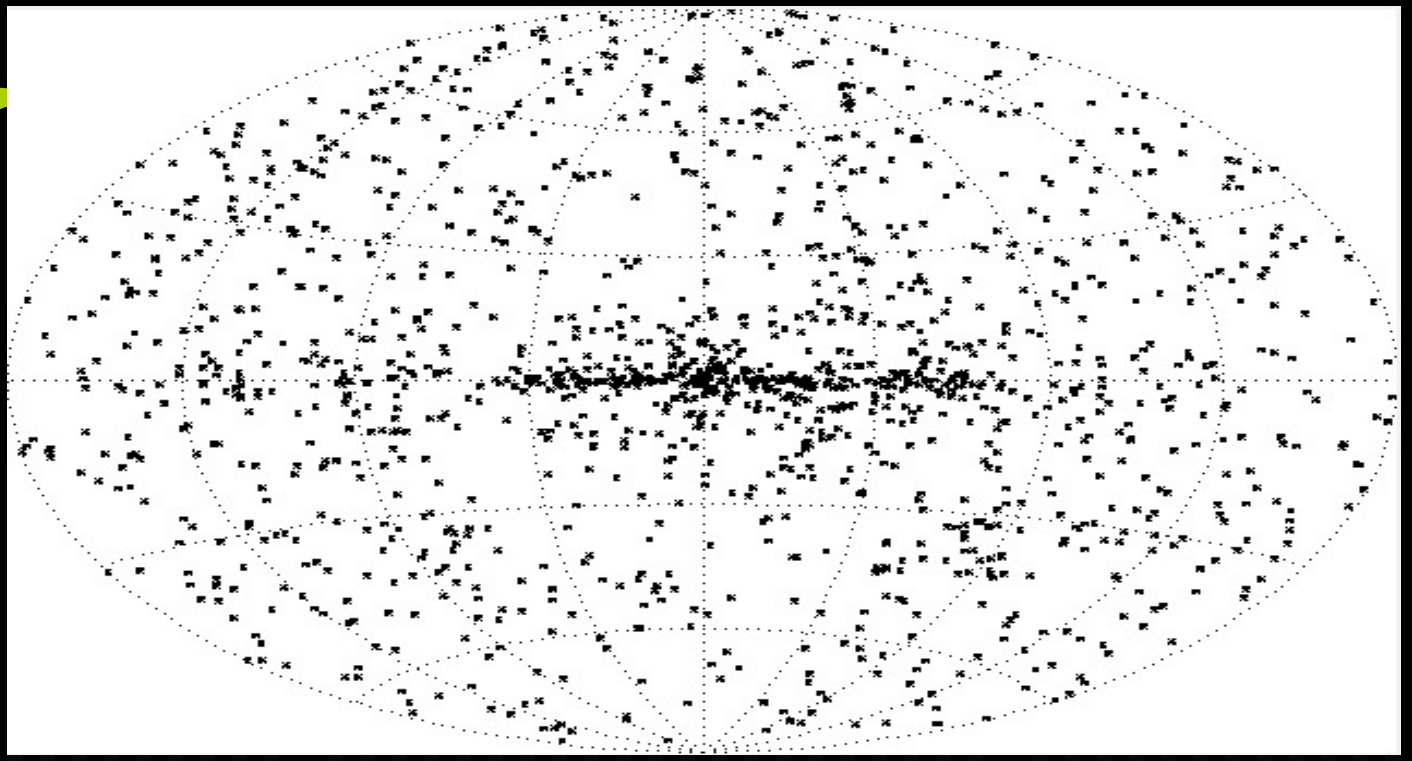
INAF

A golden age for hard X-ray studies

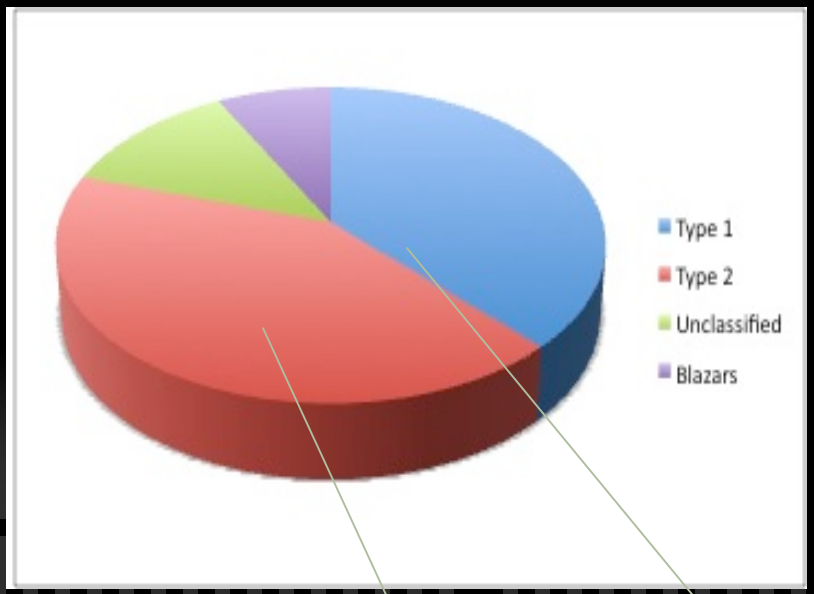


Adapted from Swift-BAT/ INTEGRAL-IBIS surveys

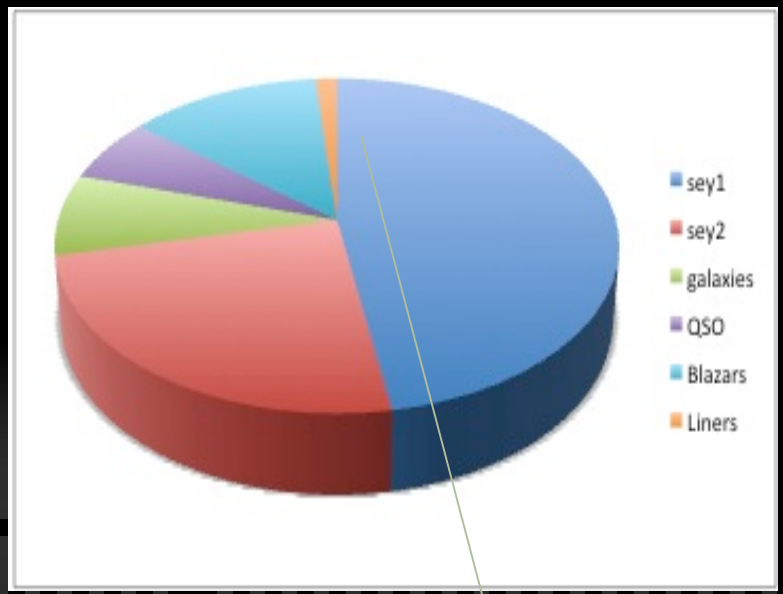
(Cusumano et al. 2010, Bird et al. 2010, Krivonos et al. 2007 and updates)

Around 1500 sources detected so far: most are AGN, even on the galactic plane

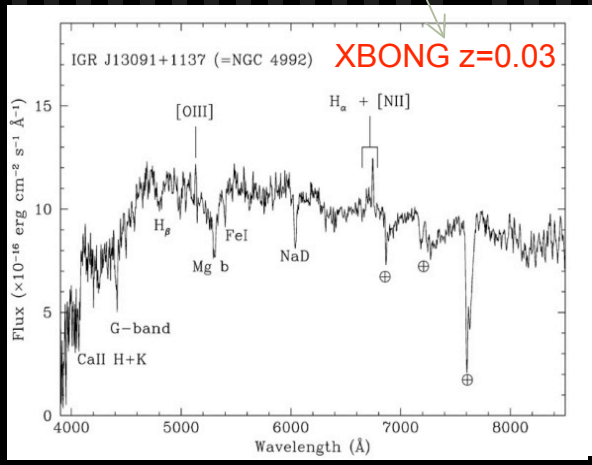
Which AGN are hard X-ray emitters?

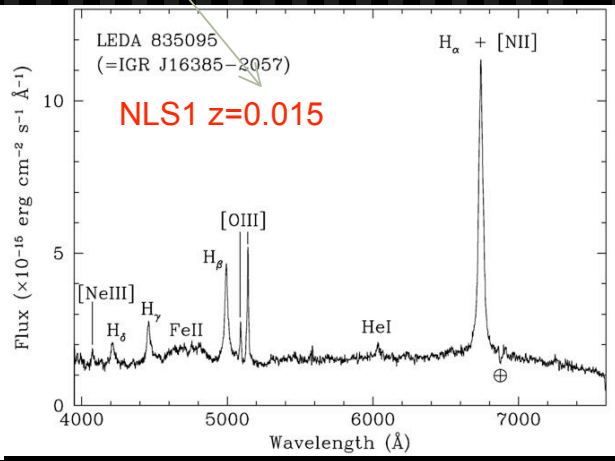


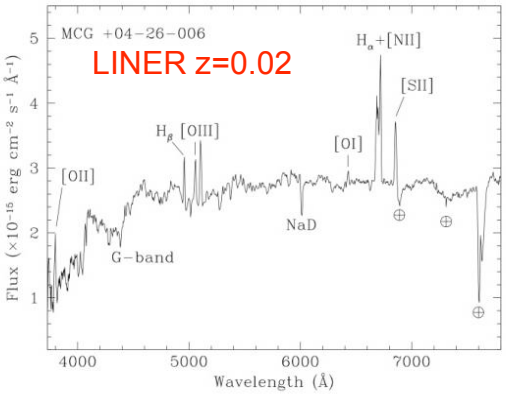
INTEGRAL/IBIS cat4 AGN (Bird et al. 2010)
Total = 258 AGN



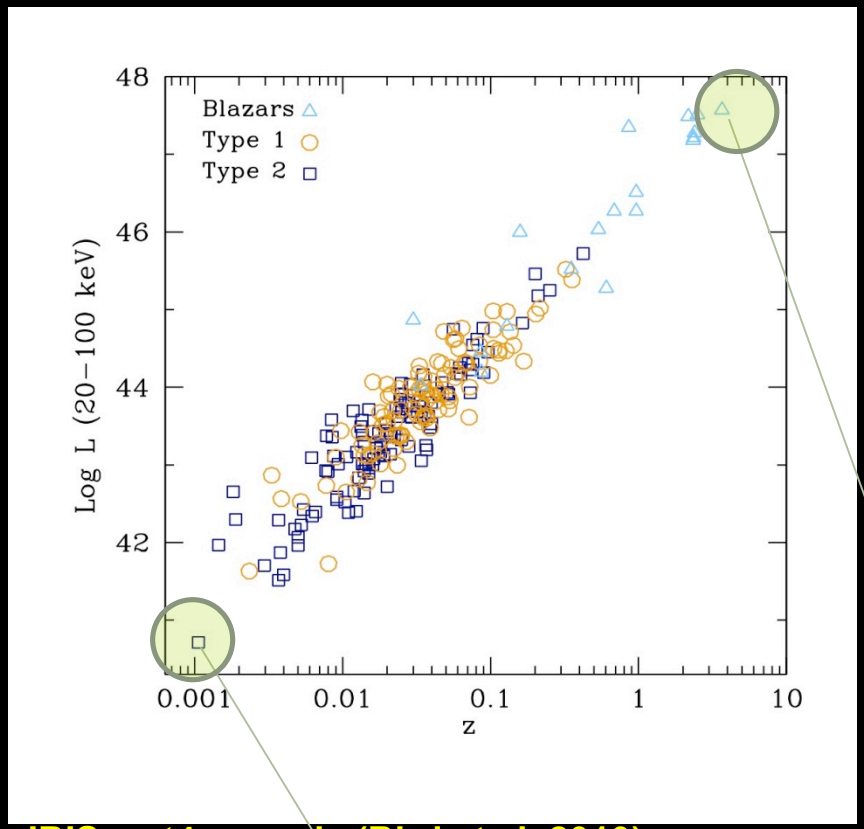
SWIFT/BAT 54 months Cat (Cusumano et al. 2010)
Total = 643 AGN



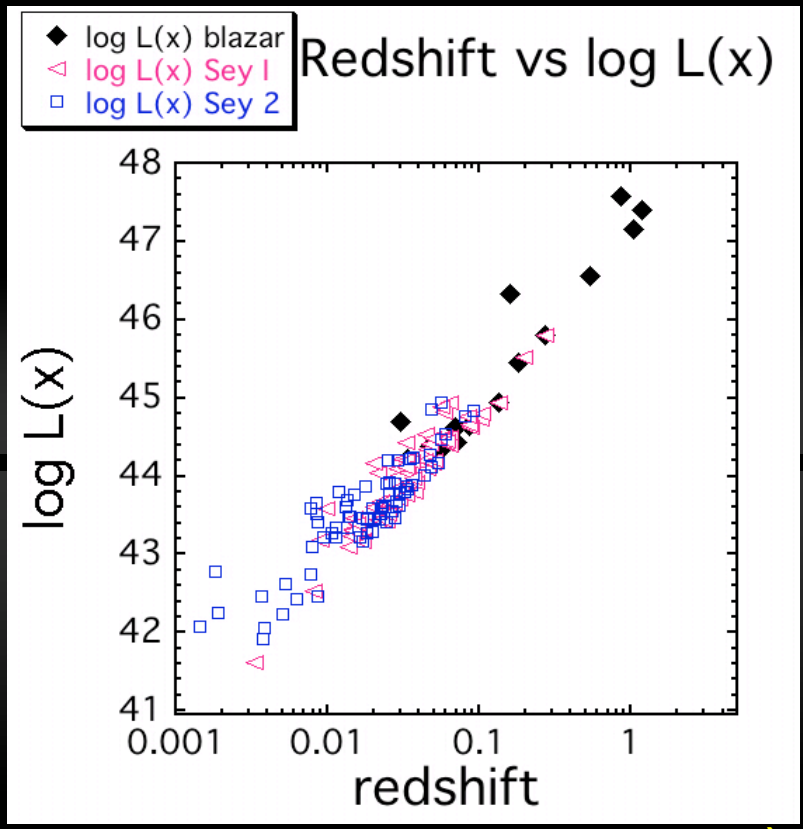




Hard X-ray luminosity versus redshift



IBIS cat4 sample (Bird et al. 2010)



BAT 22 months sample (Mushotzky 2008)

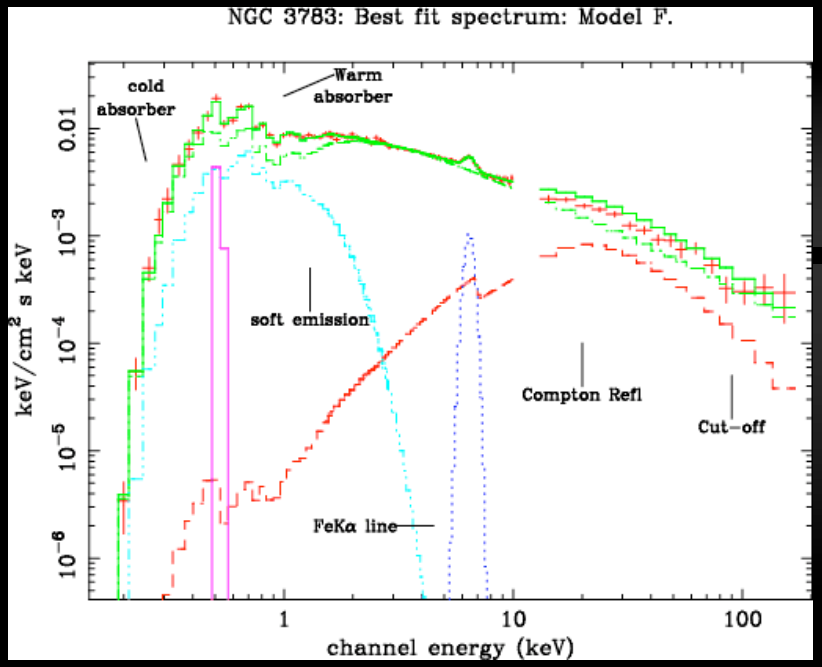
NGC4395 - z=0.001 - Log L=40.7

IGR J22517+2218 - z=3.7 - Log L=47.6

Why hard X-ray studies are important?

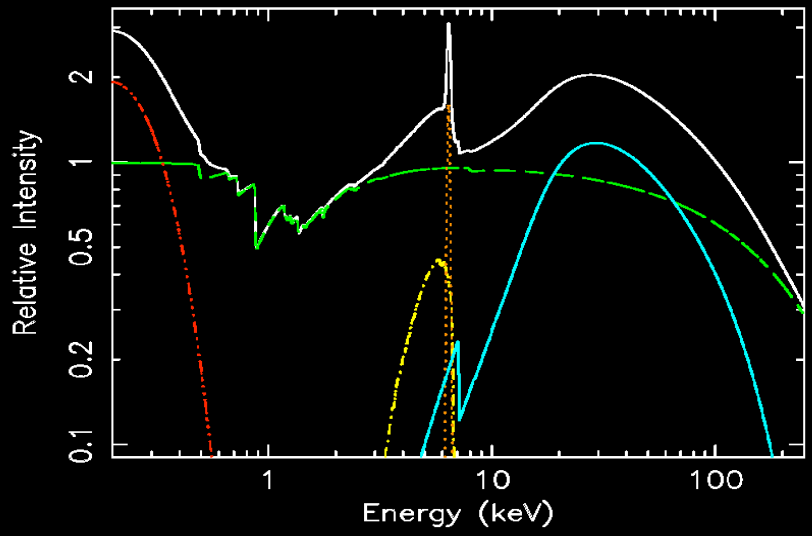
Hard X-rays less bias in terms of absorption

Best definition of Nh distribution



High energy coverage

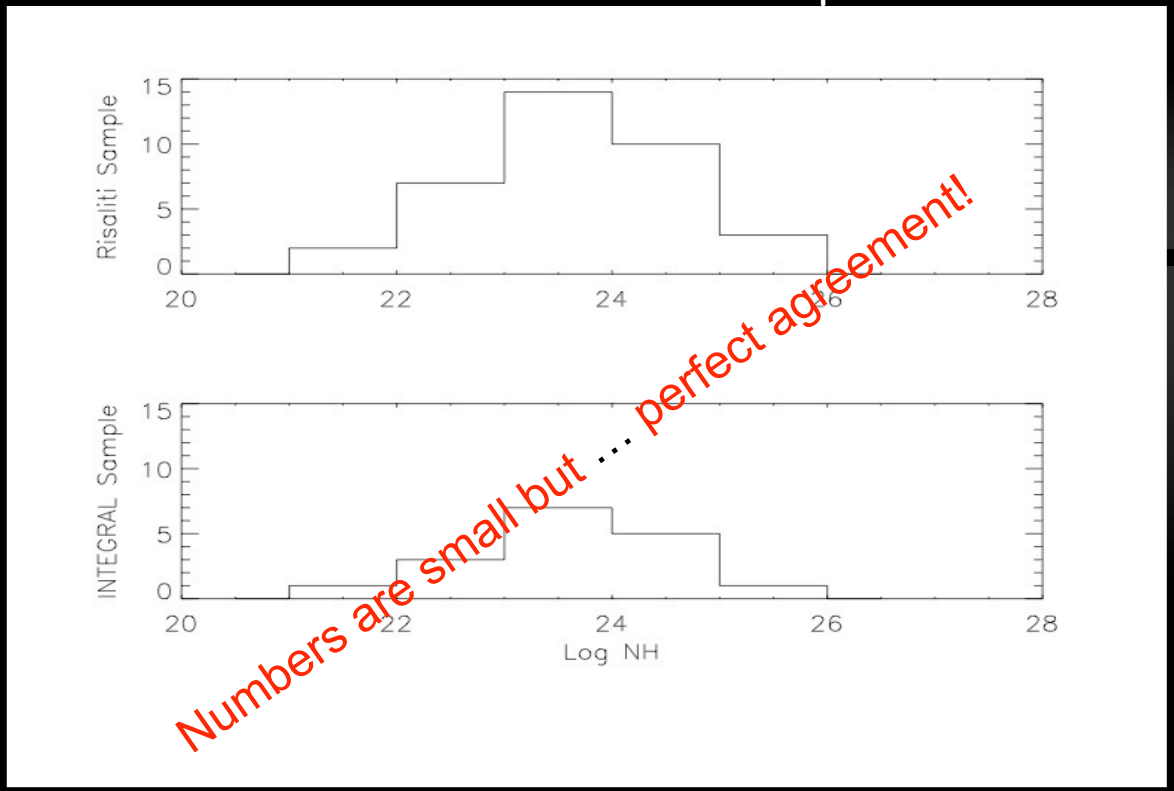
Spectral information on E_c, R , Γ



- AGN modelling & physics
- Unified theory, torus studies, etc
- X-ray Background (XRB) studies

Compton thick AGN fraction in the very local Universe

Comparison of column density distribution in type 2 AGN between Risaliti and INTEGRAL sample for $z \leq 0.015$



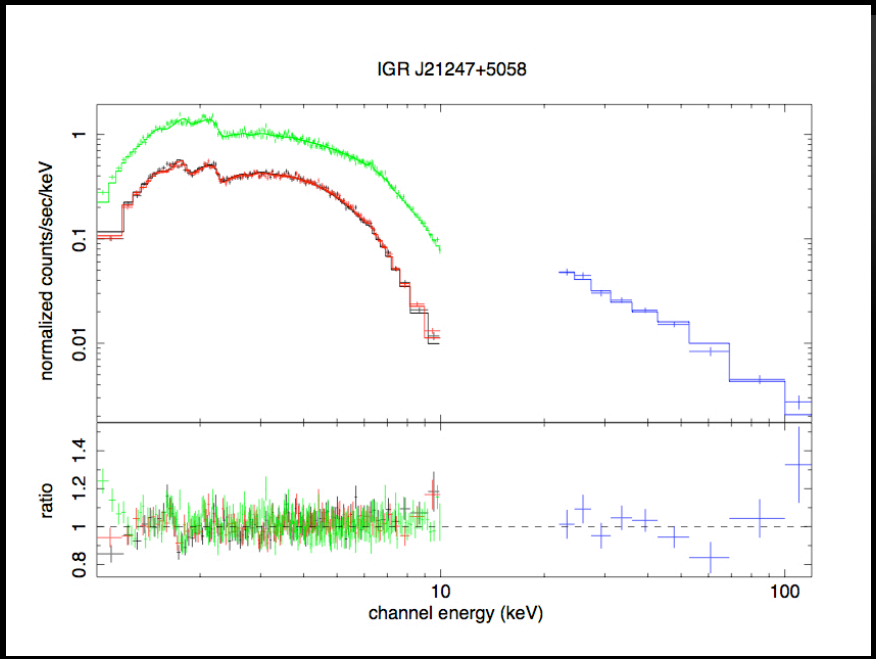
Fraction of objects with Log(NH)≥22 : ~95%
Fraction of Compton thick objects ~36%

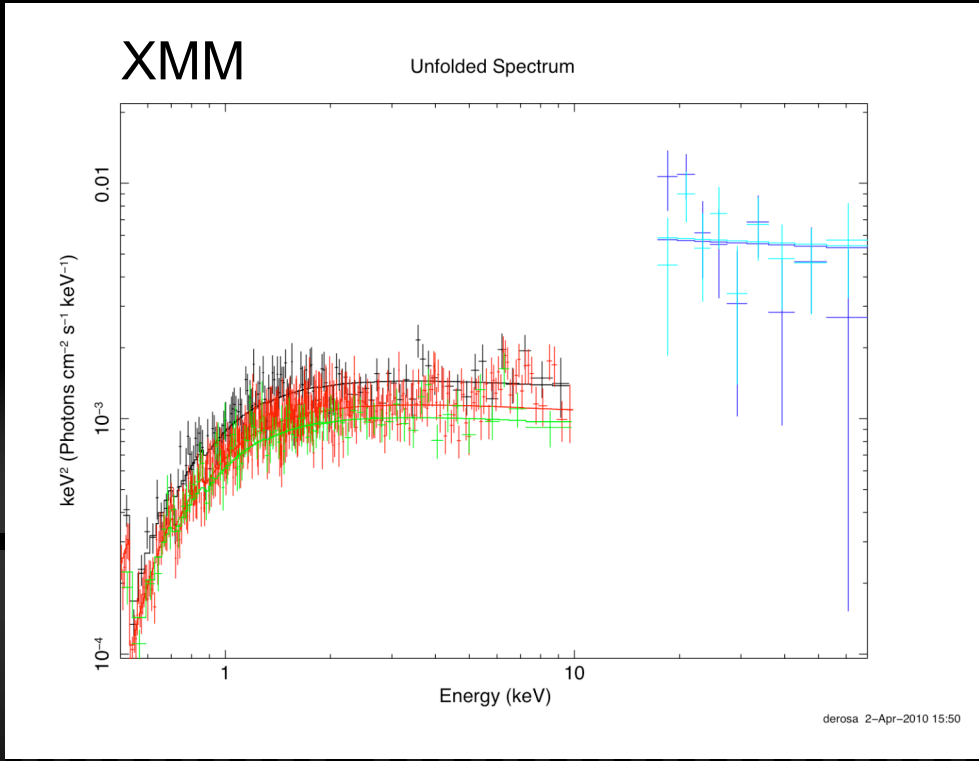
Fraction of objects with Log(NH)≥22 : ~95%
Fraction of Compton thick objects ~35%

Malizia et al. 2009

Absorbed Sey1 & Unabsorbed Sey2

20% of Sey1 are absorbed, half of these have complex absorption, likely variable (ex IGR J21247+5058, Molina et al. 2007)





Also 15% of Sey2 are unabsorbed IGR J16024-6107 in the figure is also variable at soft and hard X-rays, the iron line EW like in Seyfert 1. Simultaneous optical&x-ray data (De Rosa et al. 2010)

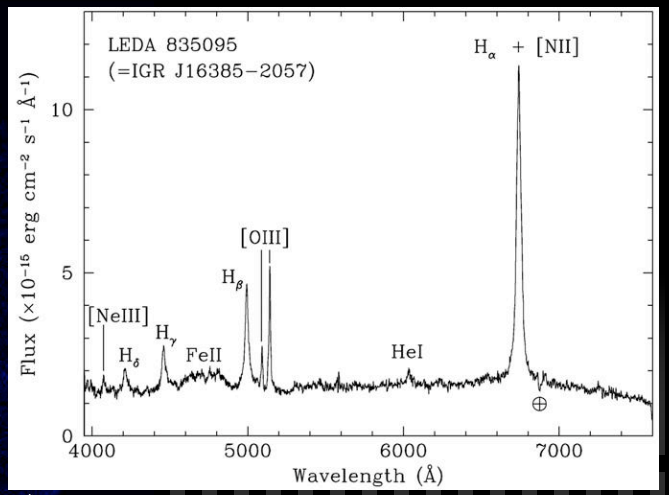
Optical identification and classification

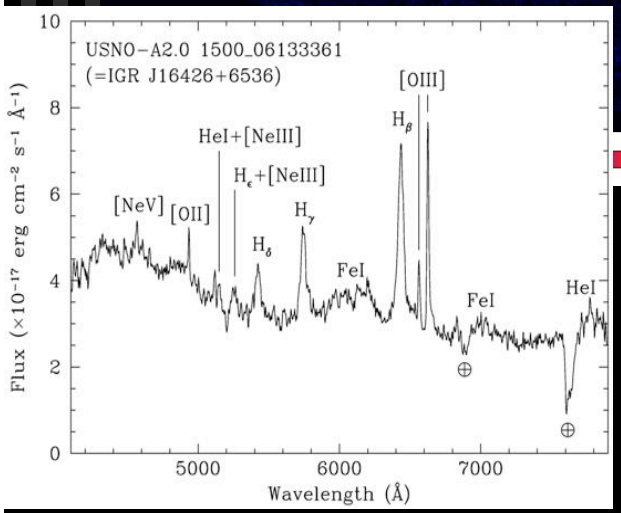
Bird et al. (2010)

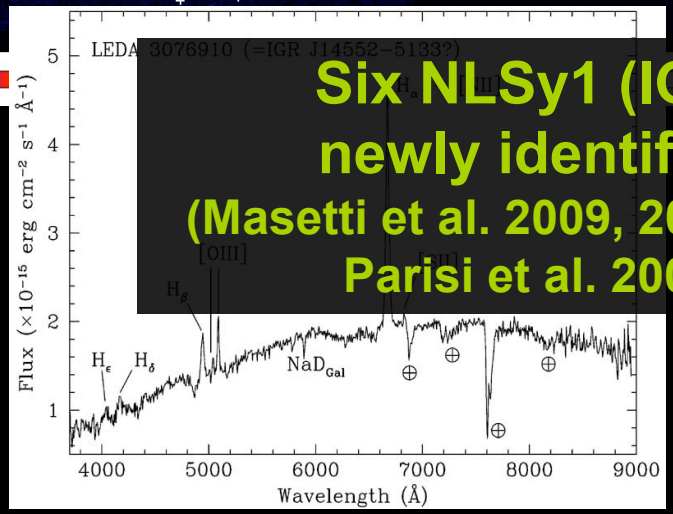
Criteria:

→ [O III] λ5007/Hβ ratio <3
→ FWHM(Hβ) ≤ 2000 km/s
→ Fe II/Hβ > 0.5

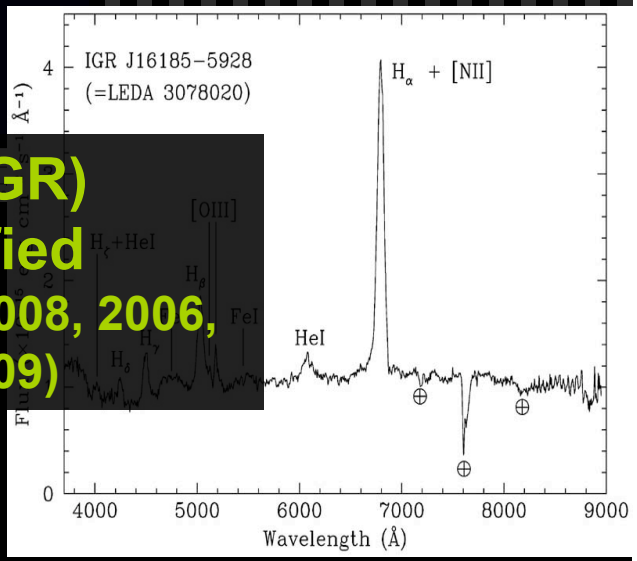
Osterbrock & Pogge (1985)







Six NLSy1 (IGR) newly identified (Masetti et al. 2009, 2008, 2006, Parisi et al. 2009)



Narrow Line Seyfert 1s

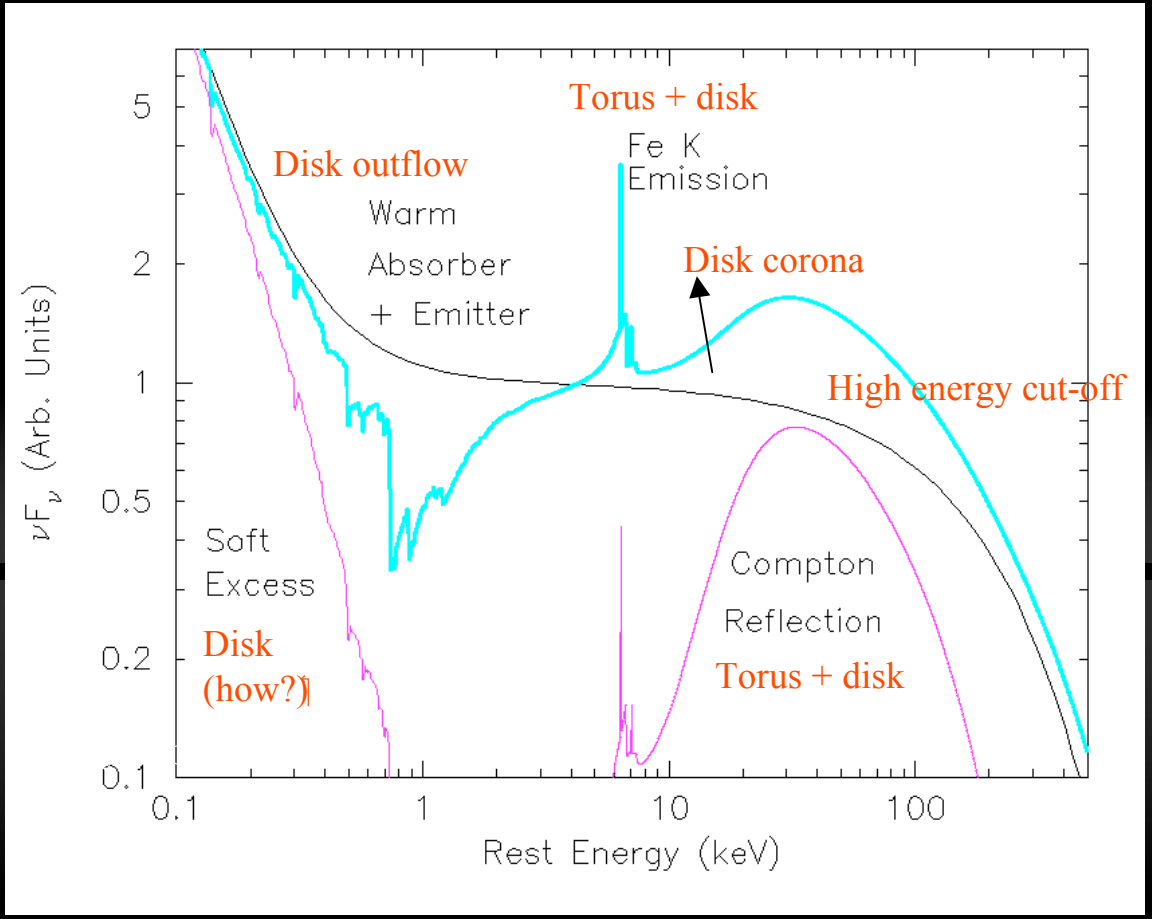
NLSy1 are broad line AGN with peculiar optical properties:

- Smallest Balmer lines from the Broad Line Region (H_β FWHM< 2000 km/s)
- Stronger FeII lines
- Strong anti-correlation between [OIII] and Fe II

→ Fe II is formed in a dense BLR
Photo-ionization + shock in outflows with Fe overabundance

→ Driver of [OIII]-Fe anti-correlation not known

Narrow Line Seyfert 1s



X-RAY spectral complexity:

→ Steep intrinsic hard X-ray continuum
→ Strong soft excess and extreme rapid variability
→ High energy hump, absorption/reflection/light bending models

Narrow Line Seyfert 1s

→ Small BLACK HOLE MASS - link between SMBH and elusive intermediate BH

→ High Eddington rate accretion physics

So far, only a few NLSy1 > 10 keV
(several BeppoSAX/PDS non detections)

Hard X-ray selected INTEGRAL NLSy1

Panessa et al. in prep

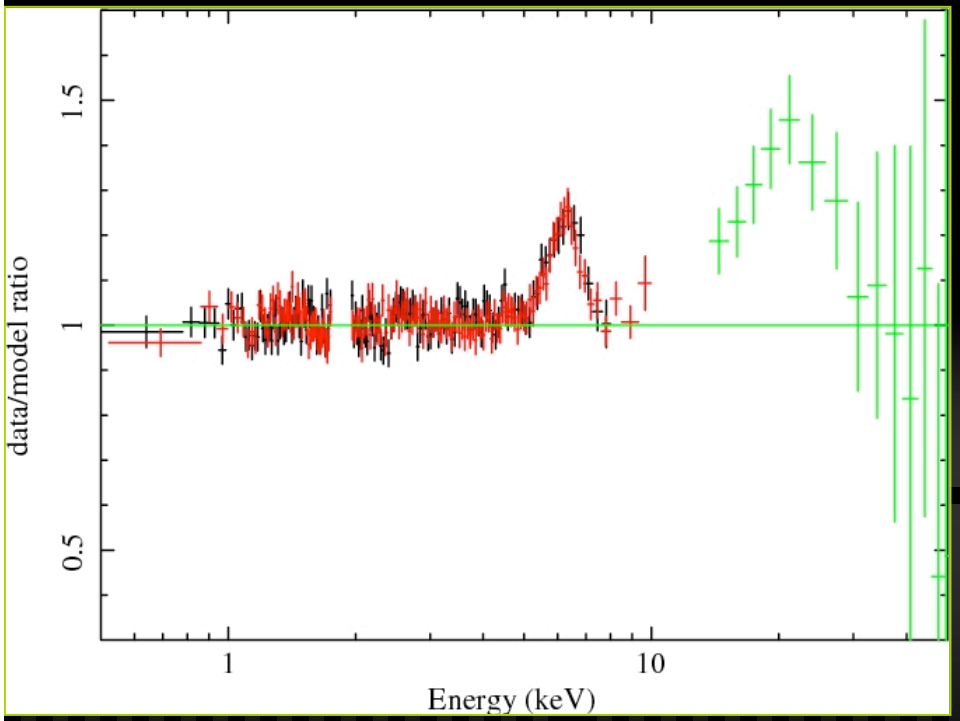
1H 0323+342
Swift J0923.7+2255 (*Swift/BAT)
NGC 4051
Mrk 766
NGC 4748
Mrk 783
NGC 5506
IGR J14552-5133
IRAS 15091-2107
IGR J16185-5928
IGR J16385-2057
IGR J16426+6536
IGR J19378-0617
ESO 399-IG 020
Swift J2127.4+5654

Fourth IBIS Catalogue (Bird et al 2010, ApJS)

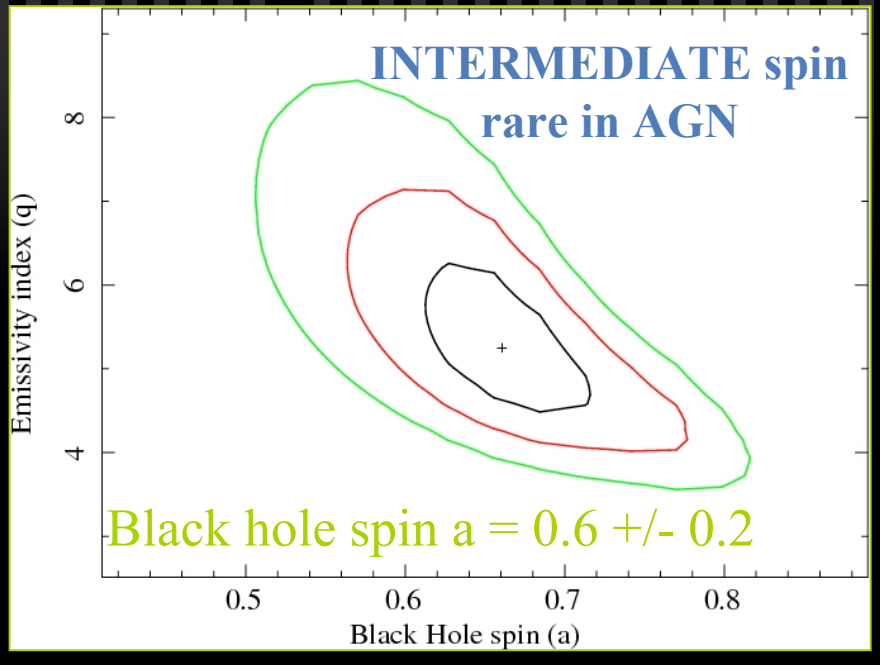
15 Narrow Line Seyfert 1

10 never observed before below 10 keV
8 New XMM observation
2 New Suzaku
1 Fermi Radio-Loud NLSy1
…other new data are coming…

Variable broad Fe: SWIFT J2127.4+5654



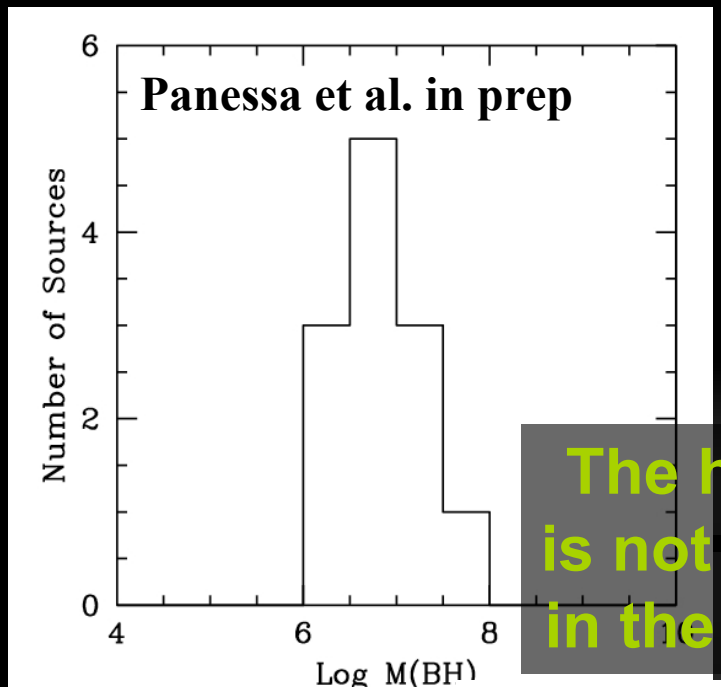
→ Broad relativistic iron emission line (originating in reflection from the innermost region of the AD)

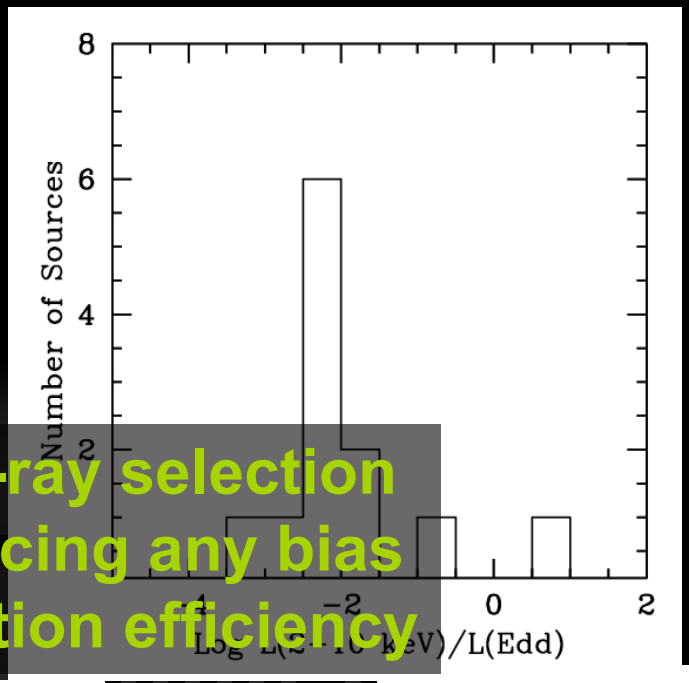


→ recent merger
→ chaotic accretion episodes
→ rotational energy extraction via magnetic fields

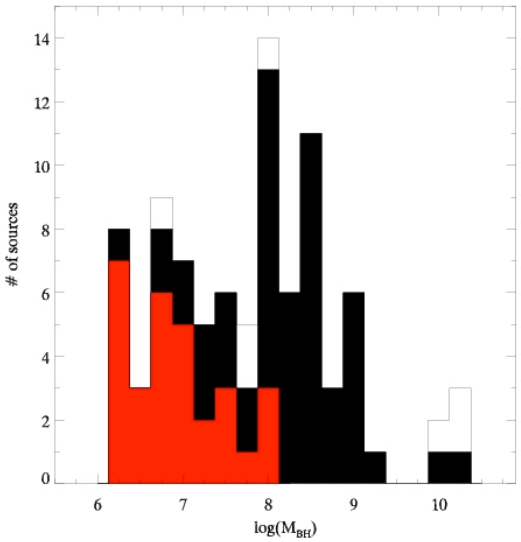
(Miniutti, Panessa et al 2009 MNRAS)

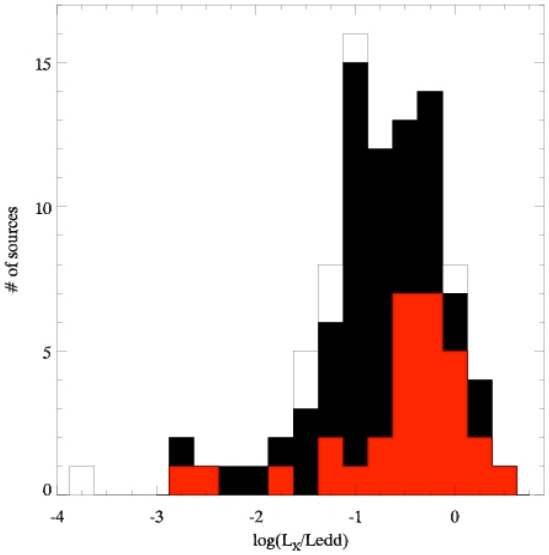
Black hole mass and Eddington ratio





The hard X-ray selection is not producing any bias in the accretion efficiency





Bianchi et al. 2009

Conclusions

The INTEGRAL and Swift hard X-ray surveys

- Discovery of new, bright and peculiar AGN
- Unbiased view of the main Unified Models & XRB ingredients

The missed hard X-ray AGN sky:
Importance of follow-up of INTEGRAL AGN - very bright sources - very easy to get high statistics spectra