

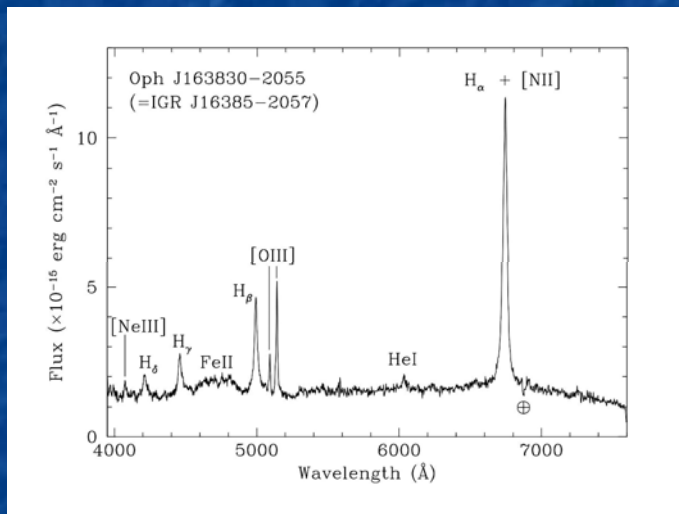
# INTEGRAL/IBIS observations of Narrow Line Seyfert 1 galaxies

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# What is a narrow line seyfert galaxy ?

## Optical Spectra

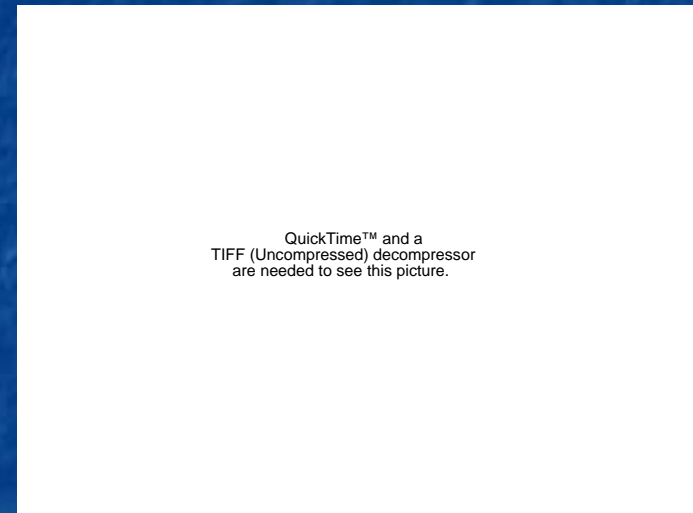
### NLS1



Masetti et al. 2006 Atel 957

Narrow  $\text{H}\beta$  (FWHM < 2000 km/s)  
Strong  $\text{FeII}$  emission  
Weak  $[\text{OIII}]$  ( $[\text{OIII}]\lambda 5007/\text{H}\beta < 3$ )

### BLS1



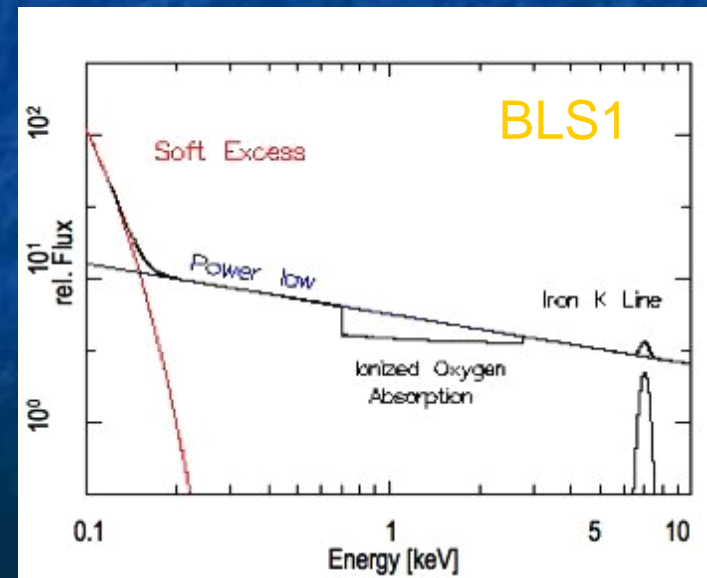
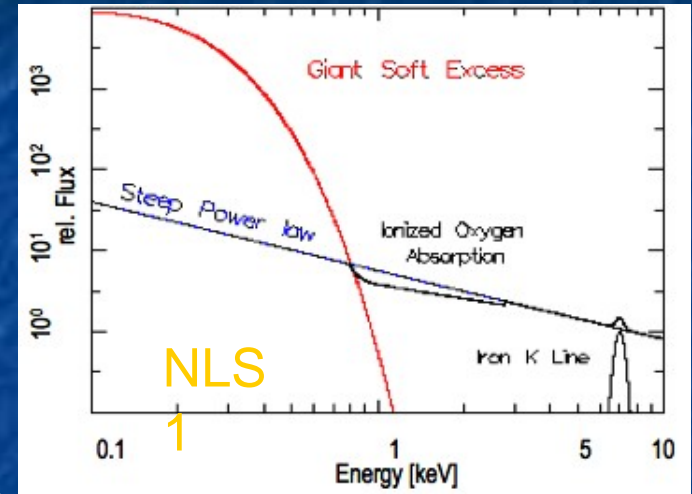
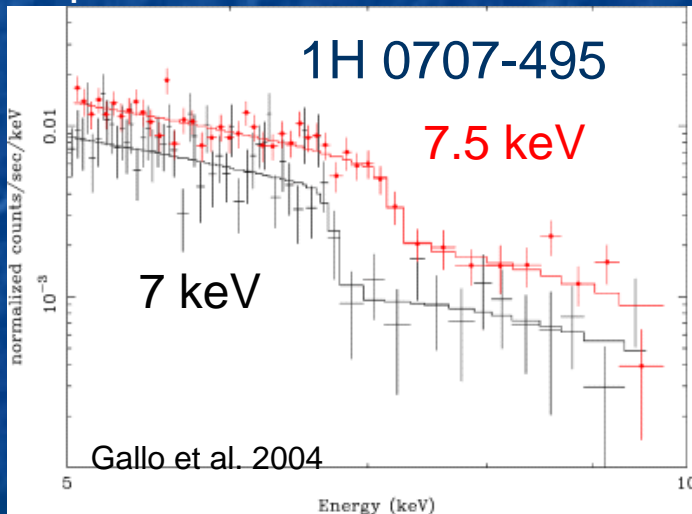
Masetti et al. 2006 A&A 459, 21

Broad  $\text{H}\beta$   
Weak  $\text{FeII}$   
Strong  $[\text{OIII}]$

# Main X-ray ( $\leq 10$ keV) characteristics

★ **Giant soft X-ray emission, steep power law with  $\Gamma$  up to 5**

★ XMM-Newton discovery of sharp spectral drops at  $E > 7$  keV



- width is  $< 160-300$  eV
- no detection of Fe emission
- drop energy changes with time



Probably not due to photoionisation

# Theoretical models

## ✦ Partial covering

QuickTime™ and a  
TIFF (LZW) decompressor  
are needed to see this picture.

## ✦ Reflection/light bending

QuickTime™ and a  
TIFF (LZW) decompressor  
are needed to see this picture.

Observations above 10 keV can help to discriminate between these two models BUT up to now only a few marginal detections of Beppo/SAX-PDS have been available (Comastri 2000).

# INTEGRAL observations

third IBIS Survey (Bird et al. 2007)

Of 128 AGNs 4 NLS1 galaxies

source	z	FWHM(H $\beta$ )	OIII/H $\beta$	FeII/H $\beta$
IGR J14552-5133	0.016	~1700	0.70	<1.7
IGR J16185-5928	0.035	~4000	0.20	0.7
IGR J16385-2057	0.027	~1700	0.50	1.2
Swift J2127.4+5654	0.015	~2000	0.72	1.3

# INTEGRAL data analysis

	Observations		Fit (mo po)		
source	Expo (ksec)	Sigma [17-100 keV]	$\Gamma$	$\chi^2/\text{dof}$	$F_{20-100 \text{ keV}}$ $10^{-11} \text{ erg cm}^{-2} \text{ s}^{-1}$
IGR J14552-5133	1966	5.5	2.35±0.8	3.01/8	0.92
IGR J16185-5928	1945	10.6	2.49±0.5	10.78/8	1.59
IGR J16385-2057	973	6.5	3.12±0.8	7.14/8	1.27
Swift J2127.4+5654	675	12	2.78±0.4	9.46/8	2.37

# INTEGRAL data analysis: Comparison with BLS1

NLS1 galaxies seem to have harder spectra at high energies when compared with the BLS1s: we have done this comparison taking 4 INTEGRAL BLS1 with similar exposure

ESO 209-12

FRL 1146

IGR J16558-5203

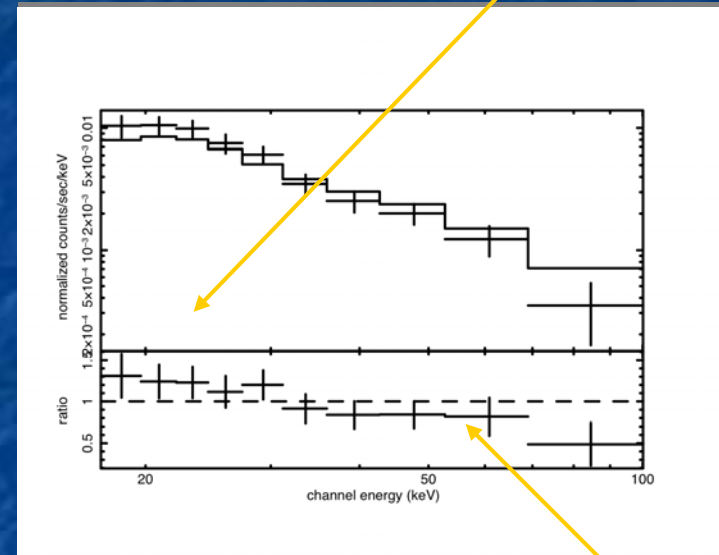
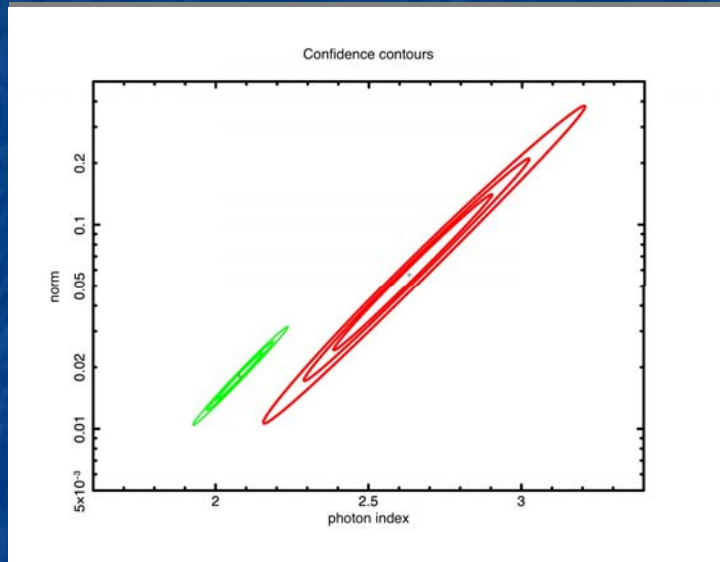
IGR J17418-1212

→ Average spectrum of the two classes

→ Impose the spectrum of the BLS1 into the NLS1 staked spectrum

# Comparison:

excess emission around 20-30 keV resembling a reflection hump



deficit of counts at high energies  
possible due to exponential cut-off

A dichotomy is evident:

NLS1:  $\Gamma=2.64\pm0.29$  (red)

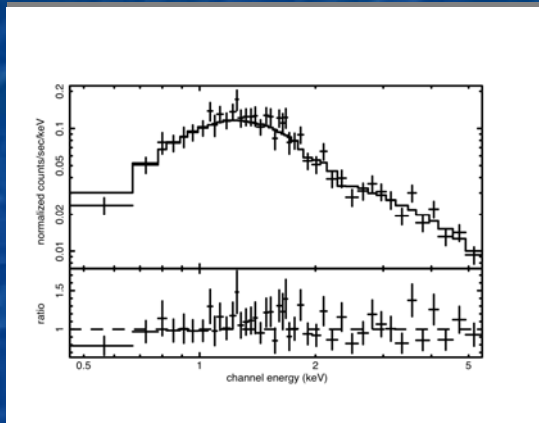
BLS1:  $\Gamma=2.07\pm0.16$  (green)

NLS1 total spectrum with  $\Gamma=2.07$   
fixed

→ Need X-ray data !!

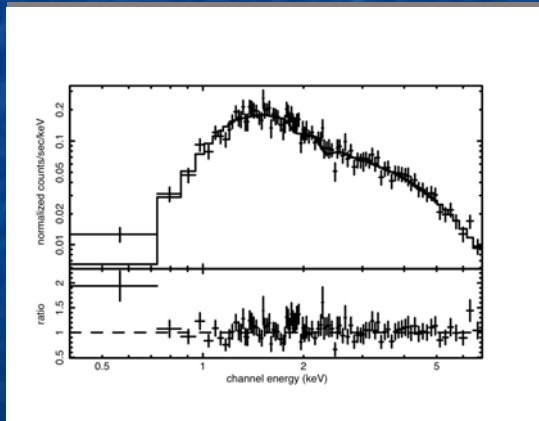


# Swift-XRT data: IGR J14552-5133 & Swift J2127.4+5654



source	$NH_{\text{Gal}}$ (a)	$\Gamma$	$\chi^2/\text{dof}$	$F_{2-10 \text{ keV}}$ (b)
IGR J14552-5133	0.337	$1.9 \pm 0.07$	71/77	0.89
Swift J2127.4+5654	0.787	$1.9 \pm 0.05$	150/15 7	2.20

(a) in units of  $10^{22} \text{ cm}^{-2}$ ; (b)  $\times 10^{-11} \text{ erg cm}^{-2} \text{ s}^{-1}$

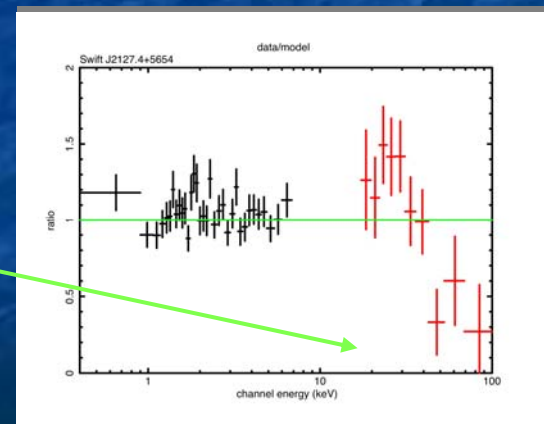
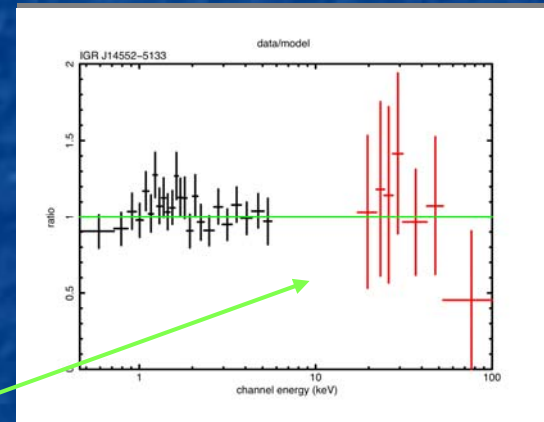


- ✧ No evidence of soft excess
- ✧ Typical value of photon index

# XRT-ISGRI data

Broad band spectra fitted with simple power law absorbed by Galactic column density

source	$\Gamma$	C	$\chi^2_{\nu}$
IGR J14552-5133	$1.93 \pm 0.06$	$1.01 \pm 0.2$	0.87
SwiftJ2127.4+5654	$1.91 \pm 0.05$	$0.93 \pm 0.3$	1.08



typical of S1 galaxies OK

# NLS1 percentage

- ✧ ~ 15% of optically selected samples (e.g. Williams et al. 2002)
- ✧ up to 50% of soft X-ray selected samples (e.g. Grupe 1996)

**we detect only 4 over 128 (3%) AGN optically classified in the third IBIS Survey**

**we find only 3 in the complete IBIS sample of 70 AGNs detected in 20-40 keV band (Malizia et al. in preparation), i.e. 4%.**

Is this due to the steepening of the high energy spectra??

# Work in Progress

- ✧ IGR J16385-2057 and IGR J16185-5928:  
**Swift-XRT approved** (the first just observed!)
- ✧ IGR J16185-5928 and Swift J2127.4+5654:  
**Suzaku (AO2 approved)**
- ✧ IGR J16185-5928, IGR J16385-2057 and Swift J2127.4+5654: **XMM-Newton AO7 submitted**