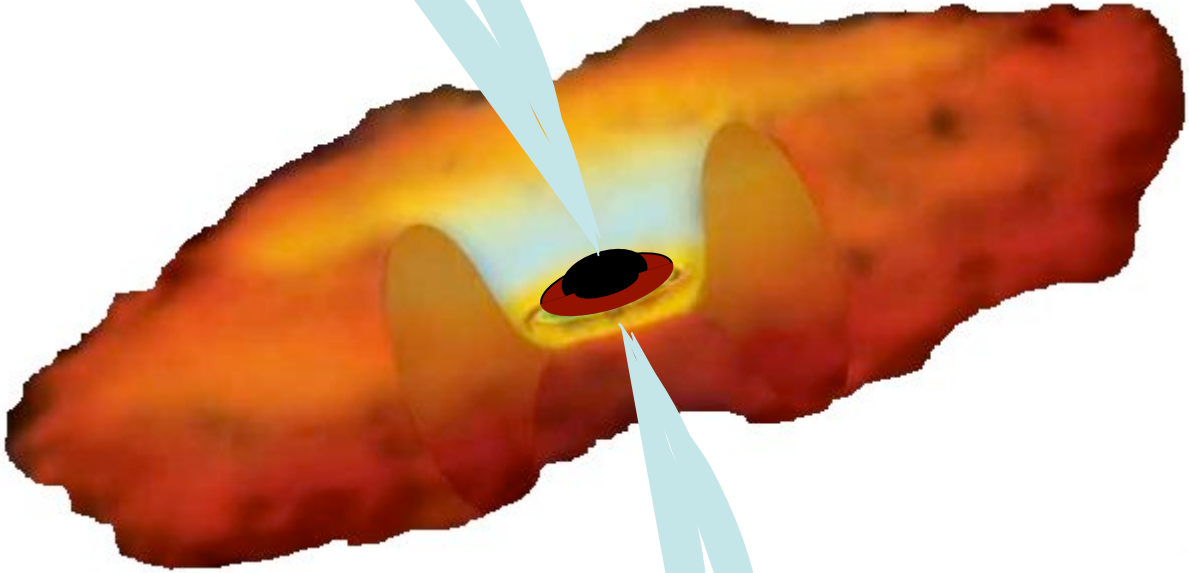
Multi-wavelength analysis of Active Galactic Nuclei



Nuria Fonseca Bonilla

Matteo Guainazzi

Stefano Bianchi

OUTLINE

- **Introduction to AGN:**

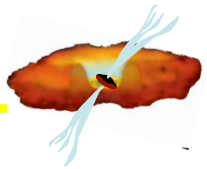
  characteristics ↔ multi-wavelength analysis

- **Projects: description & results**

  - XMM-Newton catalogue of radio-quiet AGN
  - Classification of an individual source: Spectral Energy Distribution (SED)

- **Conclusions**

- **Further analysis**



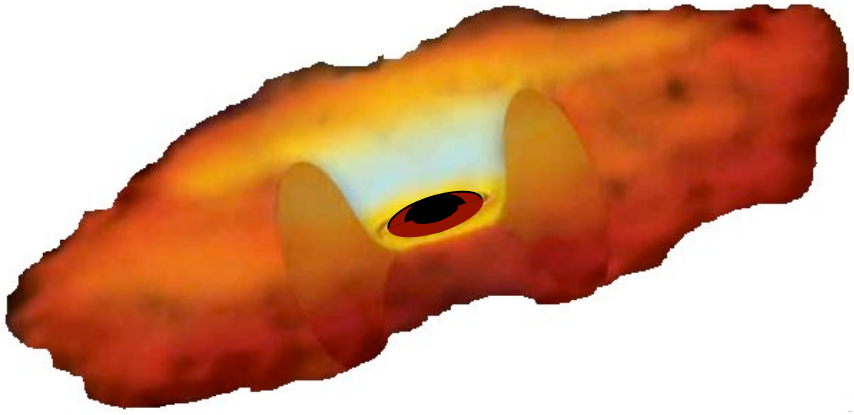
CHARACTERISTICS

AGN

a few galaxies present non stellar emission in inner regions

extreme luminosities: $L \sim 10^{42} - 10^{46}$ erg s^{-1}

- luminosity comes from a compact region: SUPERMASSIVE BLACK HOLE (SMBH)
- energy is produced by accretion: ACCRETION DISK



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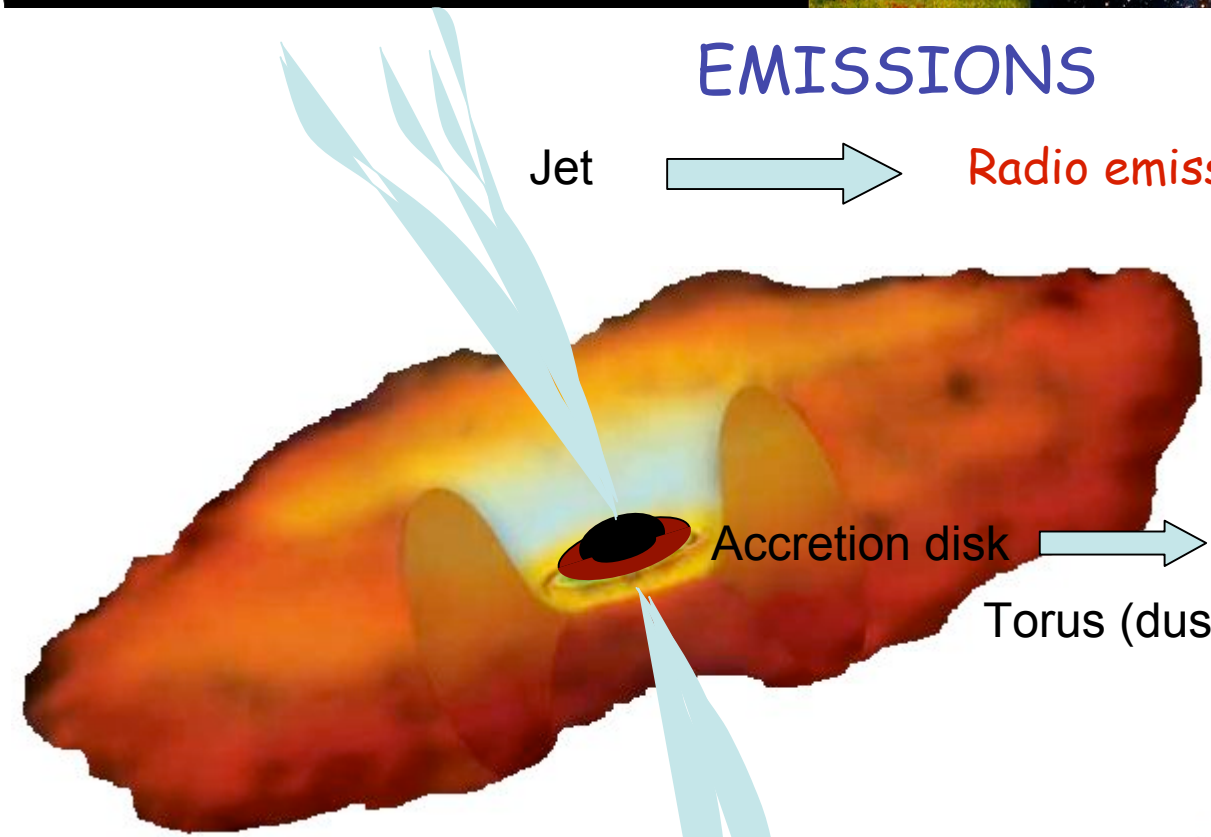
EMISSIONS



Jet → Radio emission

X-ray emission

Comptonization

Accretion disk → Optical / UV emission

Torus (dust) → IR emission

Jet → Radio emission

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MULTI-WAVELENGTH ANALYSIS

- Useful to understand the physics of AGN ⇒ better knowledge of their properties
- Examples:
  - Study of possible correlations in different bands with data from the XMM-Newton catalogue of radio quiet AGN
  - Study of the Spectral Energy Distribution (SED) of an individual source

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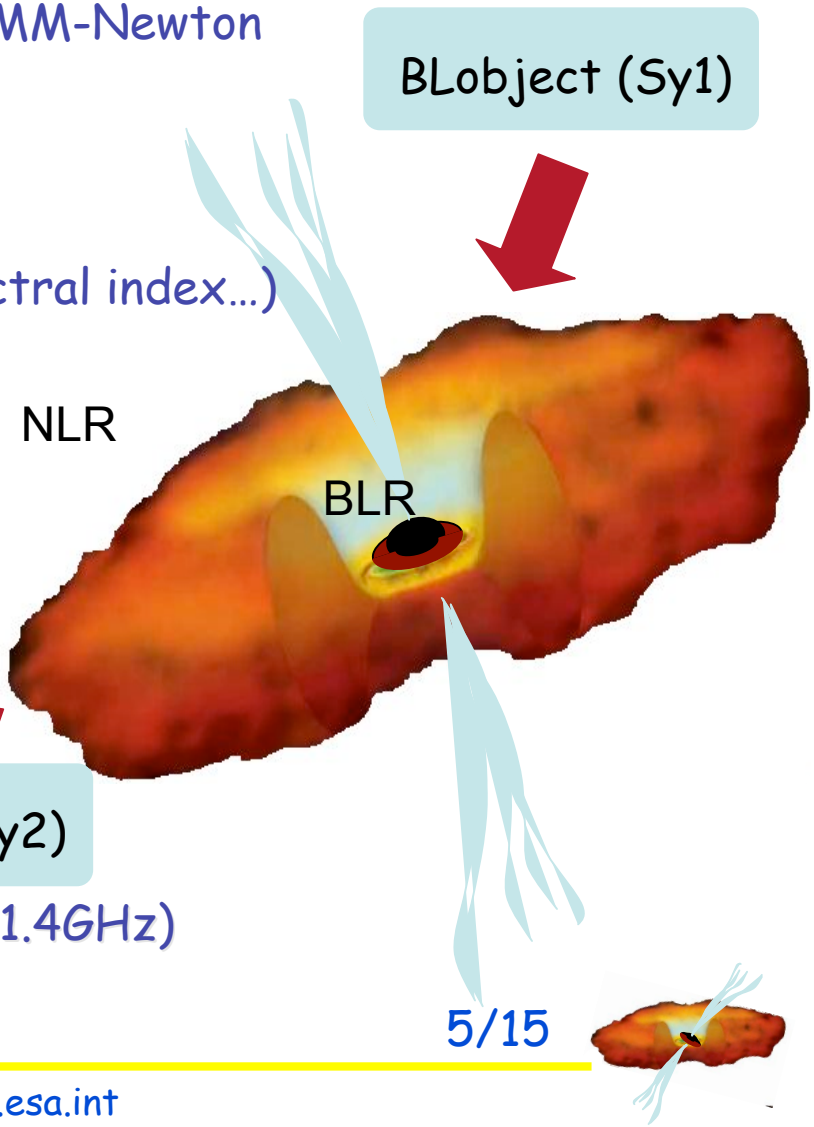
XMM-NEWTON CATALOGUE OF RADIO-QUIET AGN

- X-ray: 157 unobscured AGN targeted by XMM-Newton
  - **Luminosities** in both bands:
    - Soft: 0.5-2keV
    - Hard: 2-10keV
  - Main **espectral properties** (Fe line, spectral index…)
- Optical:
  - M_{ABS} to distinguish between:
    - Quasars: $M_{ABS} < -23$
    - Seyfert: $M_{ABS} > -23$
  - **BH masses**
  - **Hβ FWHM** to classify sources:
    - Narrow line: < 2000km/s
    - Broad line: > 2000km/s
- Radio: **Flux** in 6cm (5GHz) and 20cm (1.4GHz)



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XMM-NEWTON CATALOGUE: DATA

	Entire catalogue	157 sources
M_{ABS}	Seyfert	79
	Quasars	78
Hβ FWHM	BL objects	64
	NL objects	38
	M_{BH}	83
Radio flux	6cm	89
	20cm	117 (29 upper limits)

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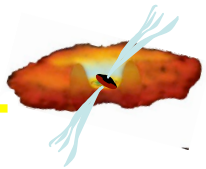
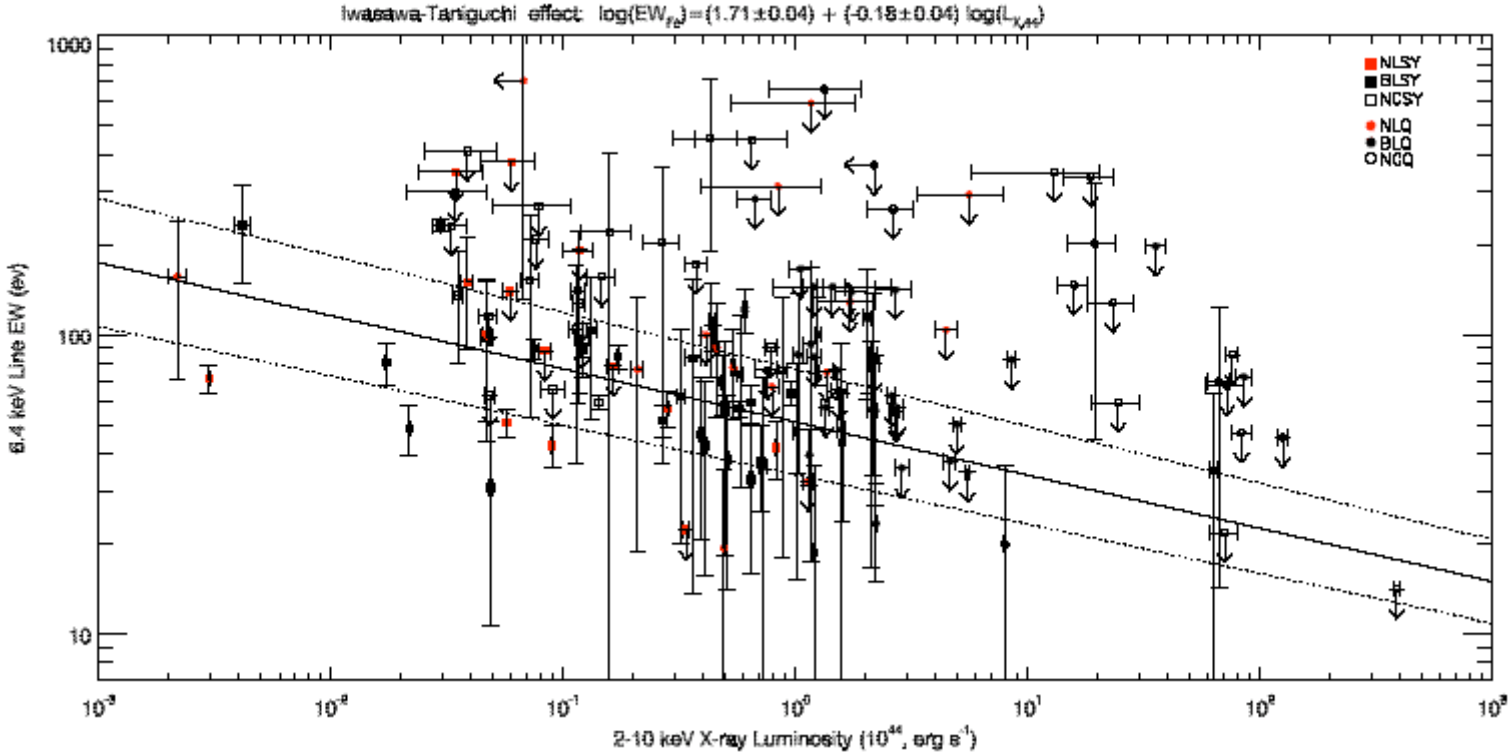
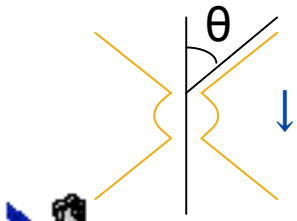


XMM-NEWTON CATALOGUE: IWASAWA-TANIGUCHI EFFECT





Highly significant anticorrelation!!!

↓ covering fraction of torus ⇒ ↑ opening angle of torus ⇒↑ L_{hard}
⇒ ↑ ionization ⇒ ↓EW of neutral Fe line

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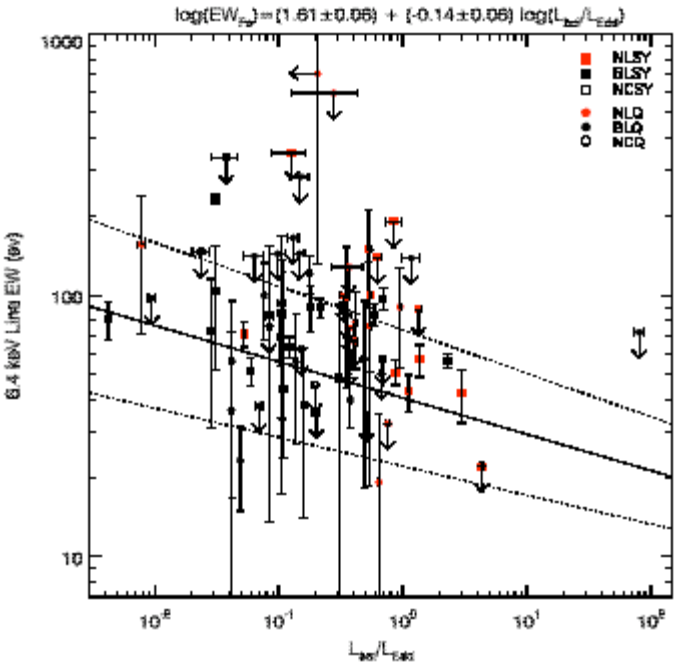
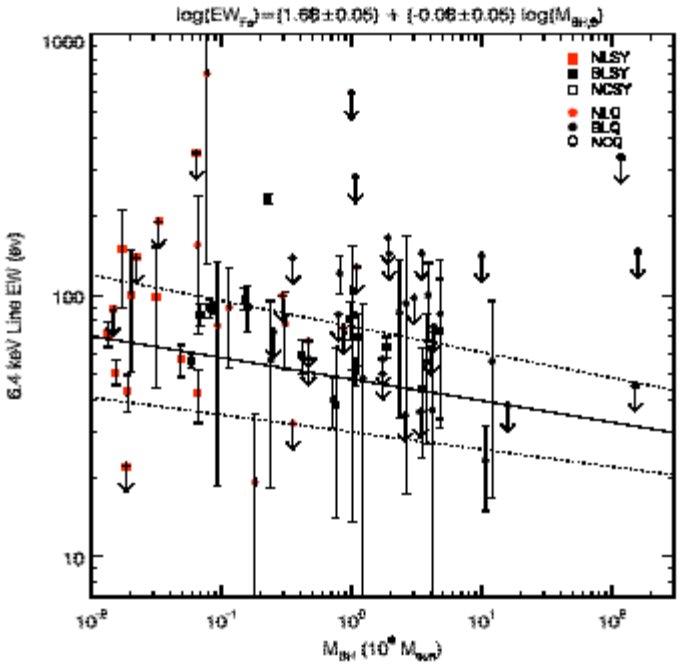
XMM-NEWTON CATALOGUE: IWASAWA-TANIGUCHI EFFECT

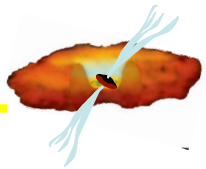
EW vs L_{BOL}/L_{EDD}



EW vs M_{BH}



Weaker anticorrelation with the Eddington luminosity and M_{BH} mass than with X-ray luminosity (L_{hard})



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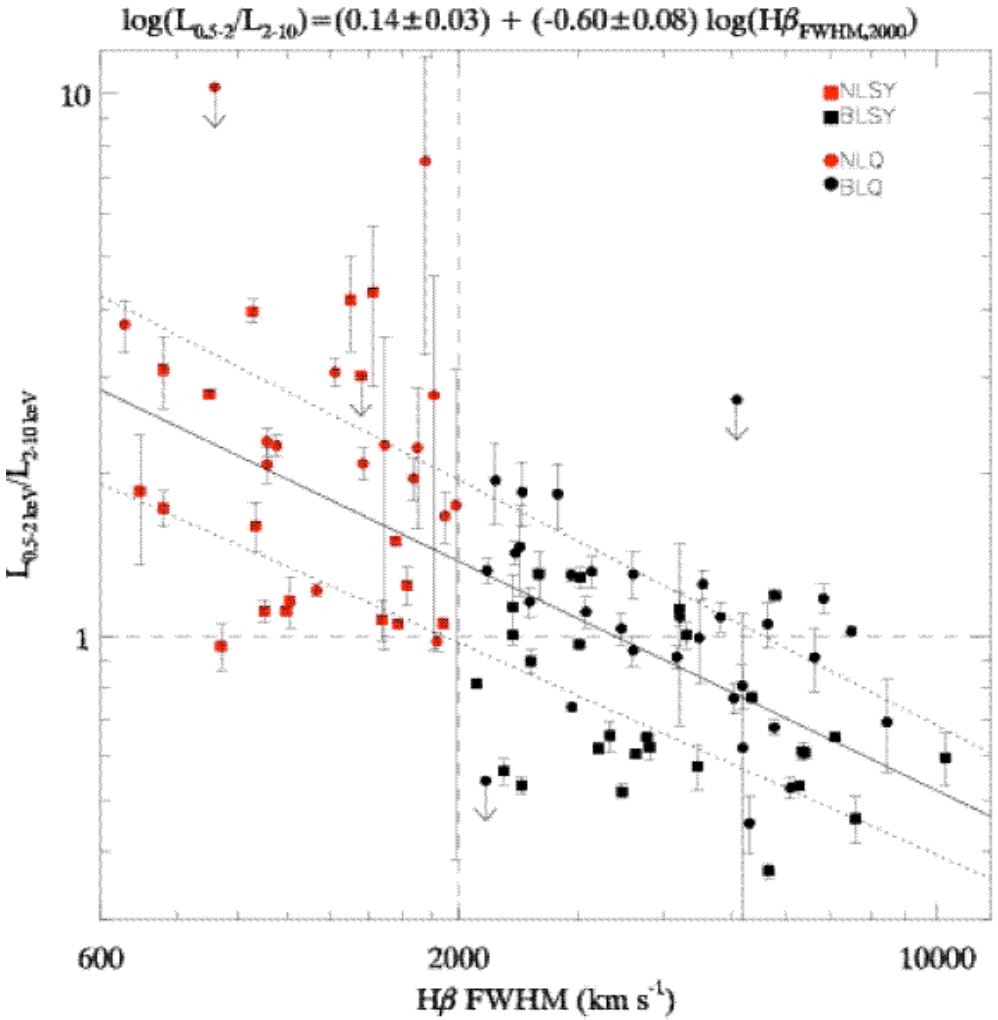
XMM-NEWTON CATALOGUE: X-ray luminosity ratio vs Hβ FWHM



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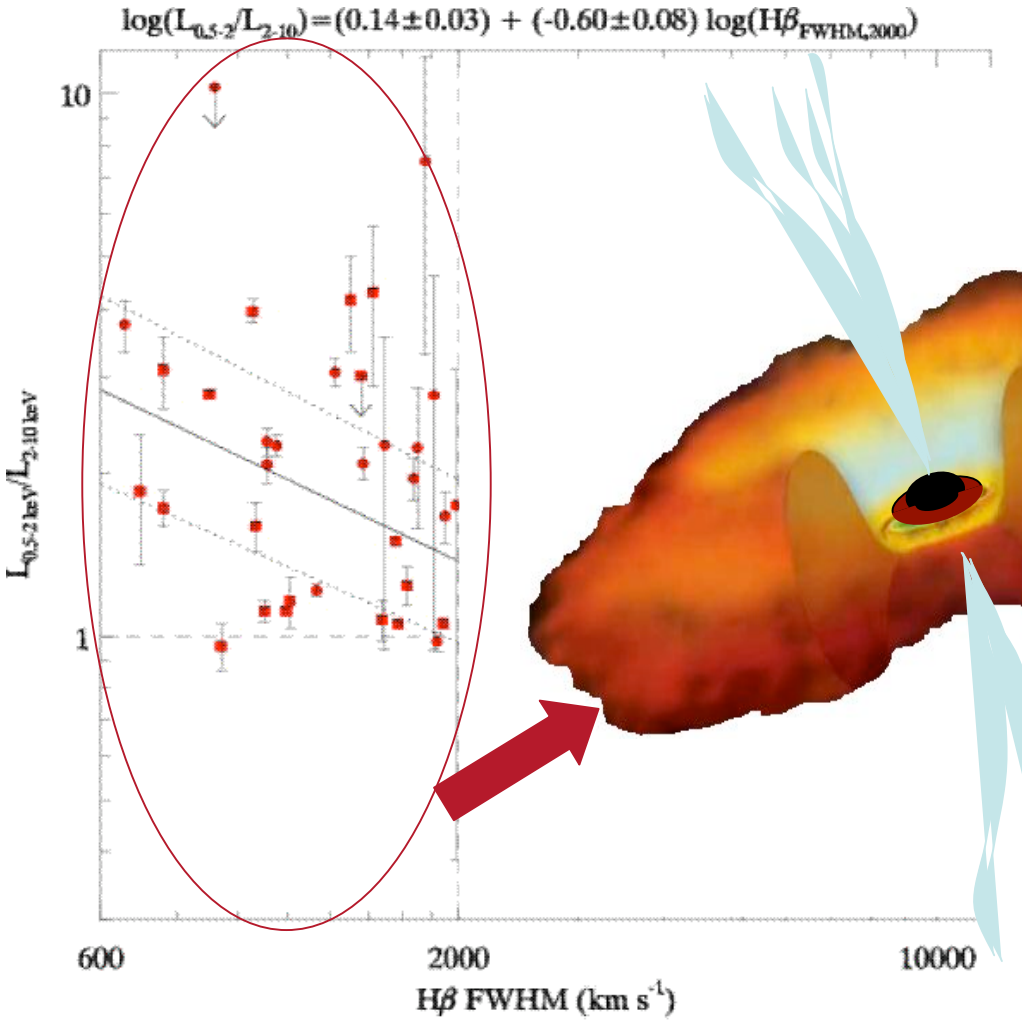
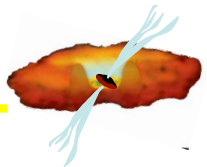
XMM-NEWTON CATALOGUE: X-ray luminosity ratio vs Hβ FWHM

NL objects



E ↓ →soft X-ray



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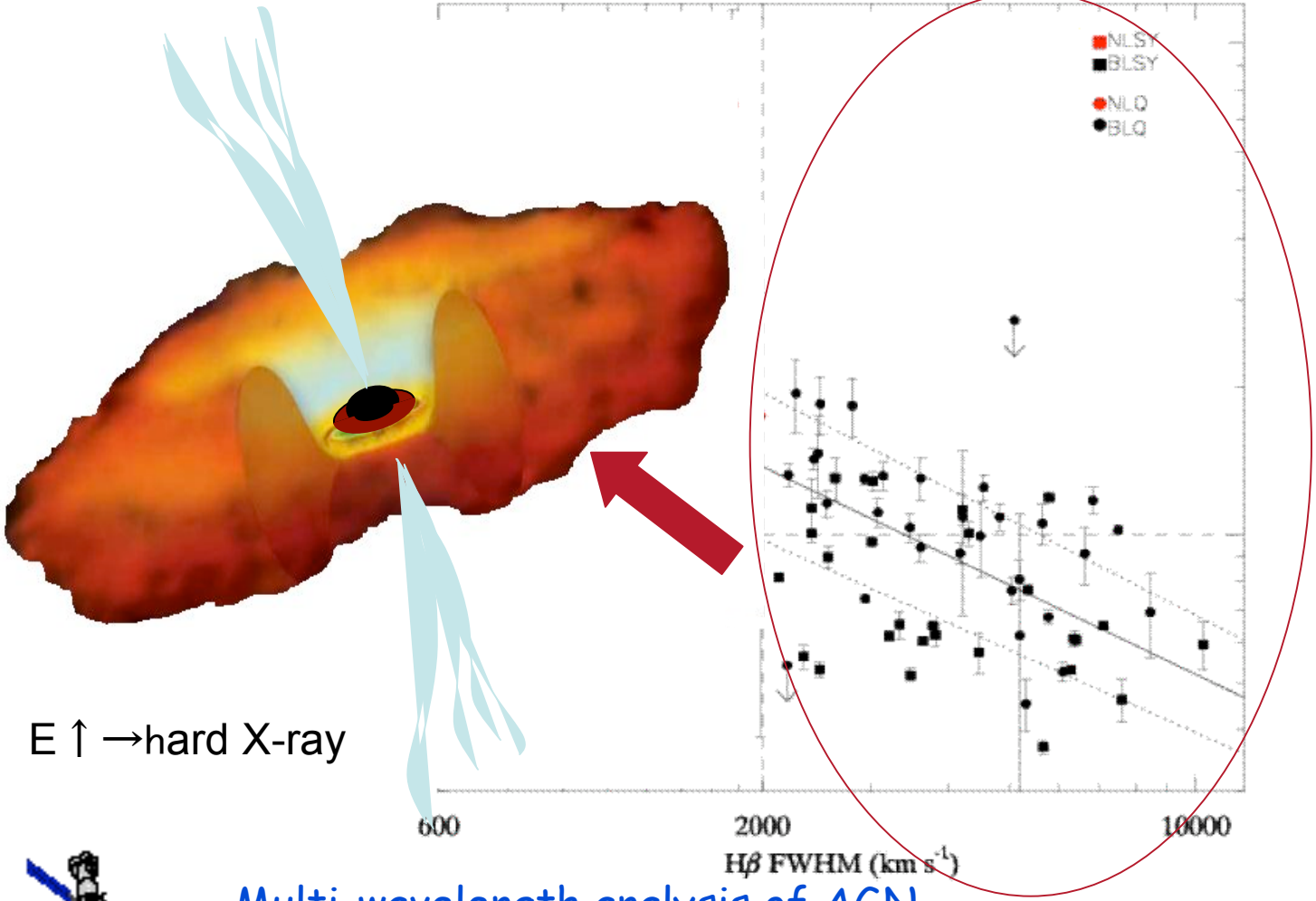
XMM-NEWTON CATALOGUE: X-ray luminosity ratio vs Hβ FWHM



BL objects

E ↑ →hard X-ray

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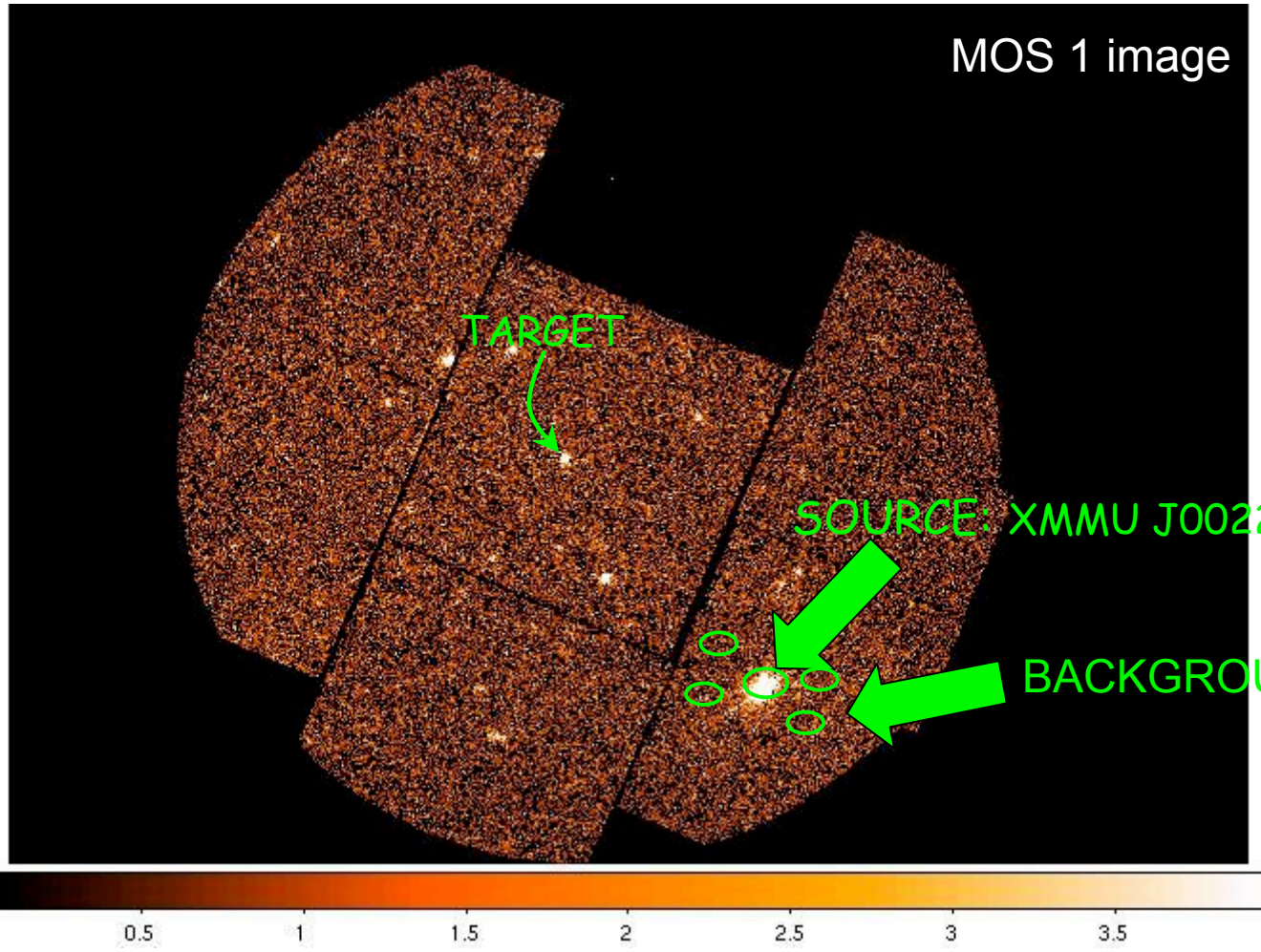
CLASSIFICATION OF AN INDIVIDUAL AGN



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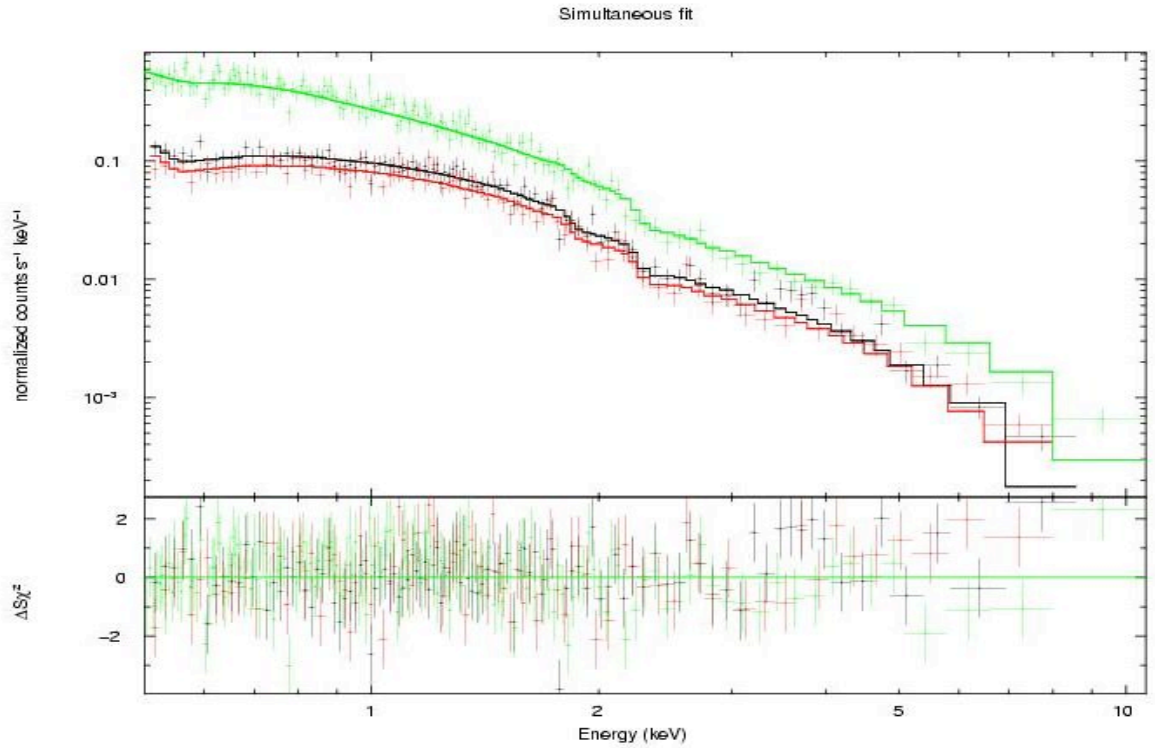
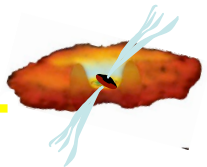
CLASSIFICATION OF XMMU J002200.8+000655 : spectrum

- Spectrum of the EPIC cameras: MOS 1 and 2, PN
- Simultaneous fitting of the three spectra





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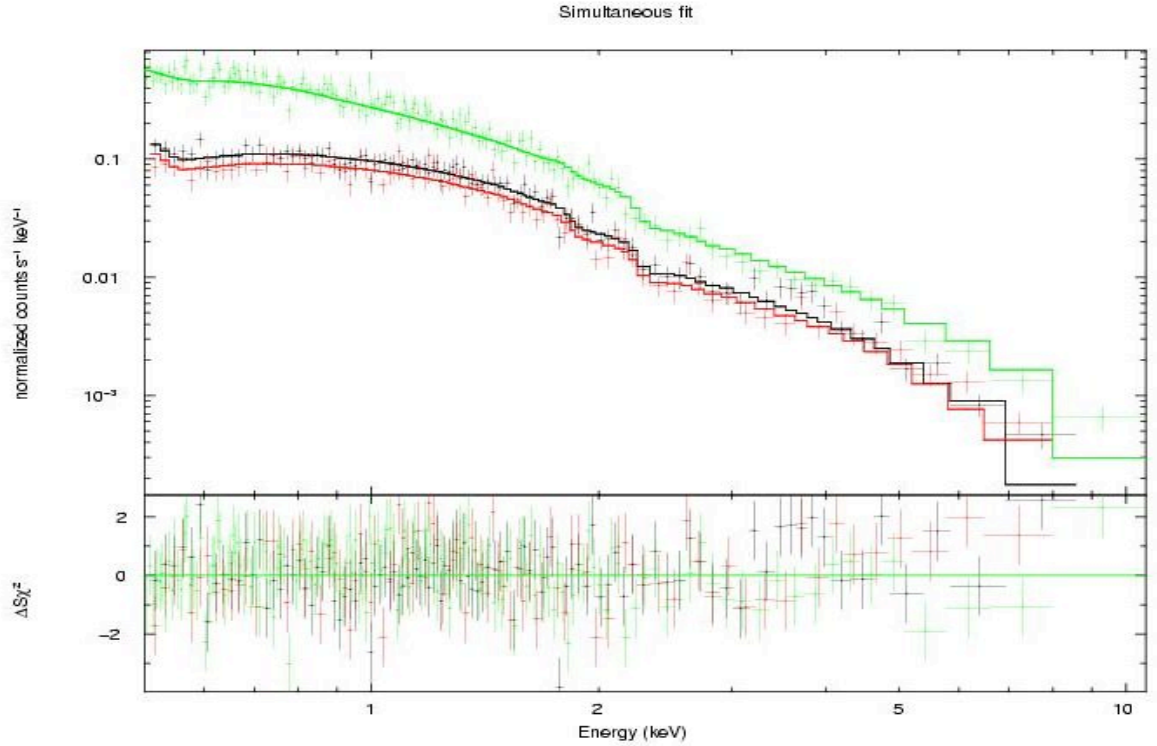
CLASSIFICATION OF XMMU J002200.8+000655 : spectrum

model	N_H [10^{20}cm^{-2}]	Γ	N [10^{-4}]	E_c [keV]	I_c [10^{-6}phcm^{-2}s^{-1}]	EW [eV]	Red.χ^2/ d.o.f.
po+zga	$4.69^{+1.53}_{-1.56}$	$2.29^{+0.049}_{-0.065}$	$7.43^{+0.44}_{-0.44}$	6.4	<4.60	<428	1.002/350



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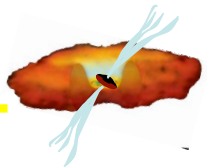
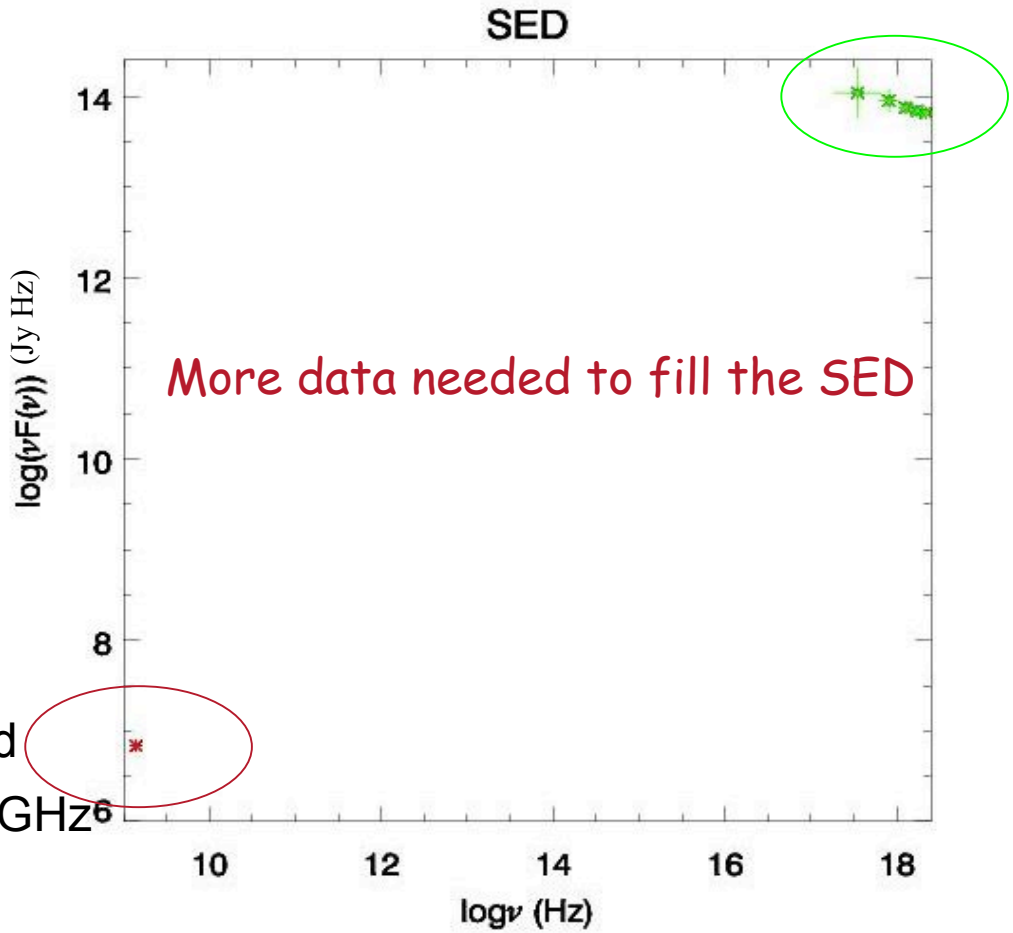


CLASSIFICATION OF XMMU J002200.8+000655 : SED



X-ray band

0.5-10keV

Radio band

1point: 1.4GHz

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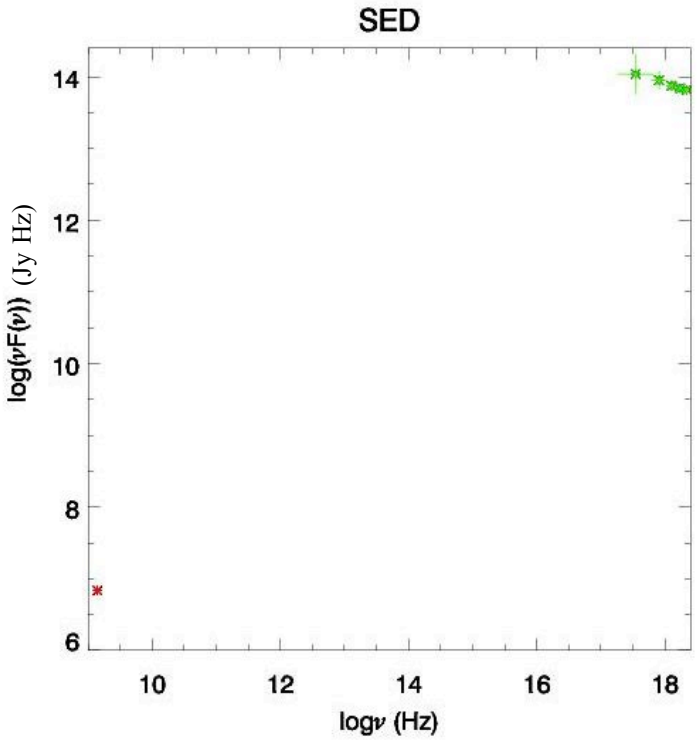
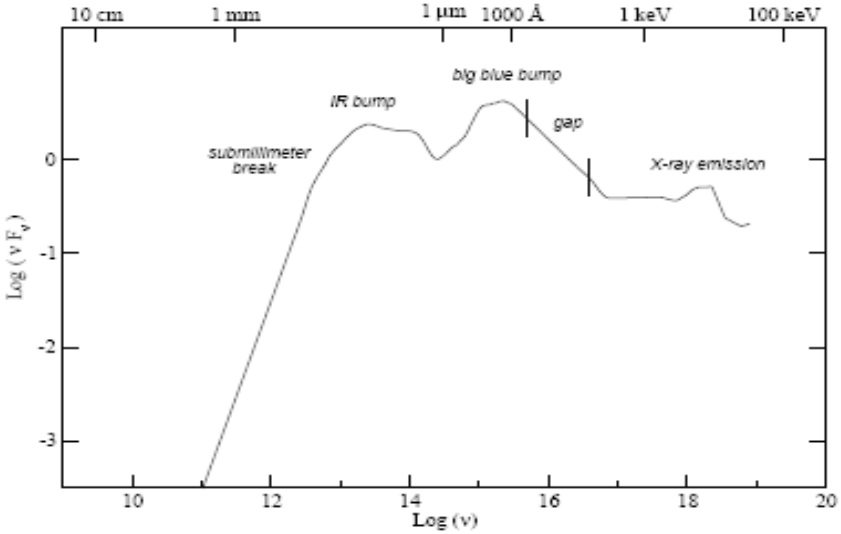
CLASSIFICATION OF XMMU J002200.8+000655 : SED





It seems to be a radio-quiet source

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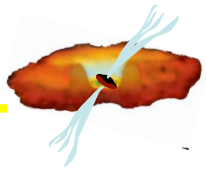

CONCLUSIONS

1. XMM-Newton catalogue of radio-quiet AGN
   - IT effect: anticorrelation between EW Fe and L_{hard}, M_{BH} and L_{BOL}/L_{Edd} (more details in Bianchi et al. 2007)
   - Anticorrelation between the X-ray luminosity ratio and Hβ FWHM

2. Classification of XMMU J002200.8+000655
   - The source seems to be a radio quiet AGN

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FURTHER ANALYSIS

1. XMM-Newton catalogue of radio-quiet AGN
   - IT effect: more details in Bianchi et al. 2007
   - Entire catalogue is nearly to be published

2. Classification of XMMU J002200.8+000655
   - More data needed in radio and other bands to fill the SED
   - Comparison with standard SED in order to classify the source

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Thanks a lot for your attention!!