

# HARD X-RAYS FROM AGN AN OVERVIEW IN VIEW OF SIMBOL-X



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# Outline

- Fundamental AGN parameters and expectations
- The X-ray continuum from luminous radio quiet AGNs
- Topical cases:
  - Continuum variability: NGC 7469
  - Time lags: MCG -6 30 15
  - Obscured nuclei: NGC 6240  
Arp 299
- Probing nuclear activity in luminous IR galaxies
- Conclusions

# Fundamental Parameters

$$\text{AGN} = \text{SMBH}(M, J) + \dot{M}$$

$$m = \dot{M} / \dot{M}_{\text{EDD}}$$

$$j = J / J_{\text{MAX}}$$

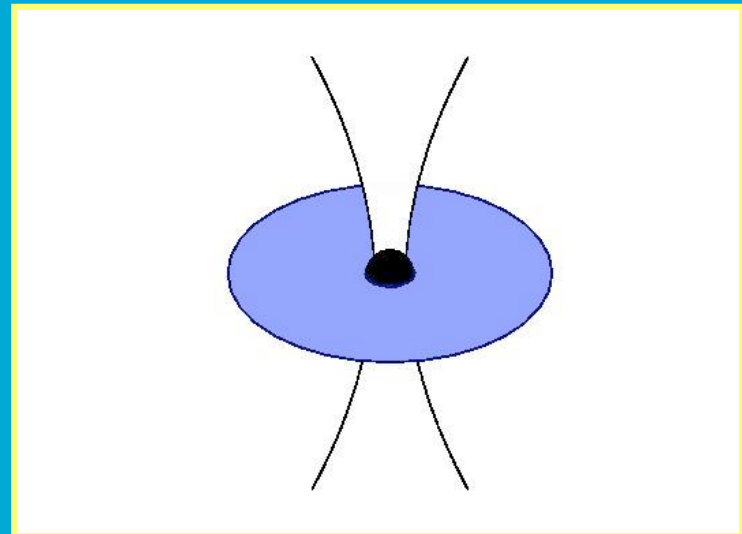
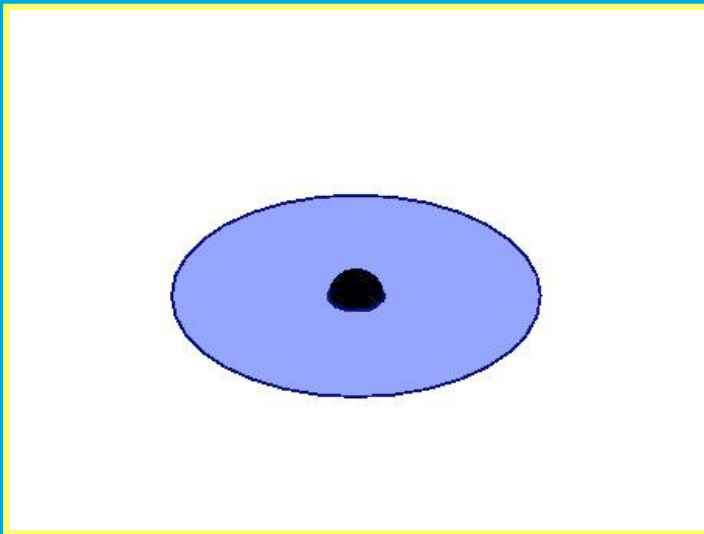
Weak or  
no jet

$j$

Powerful jet



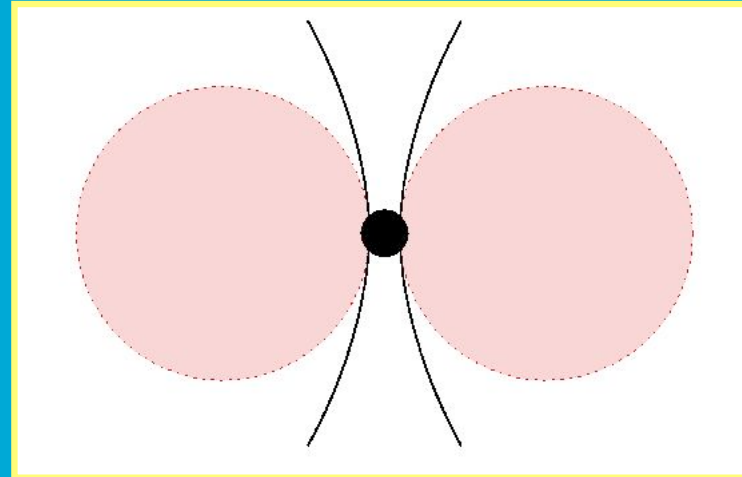
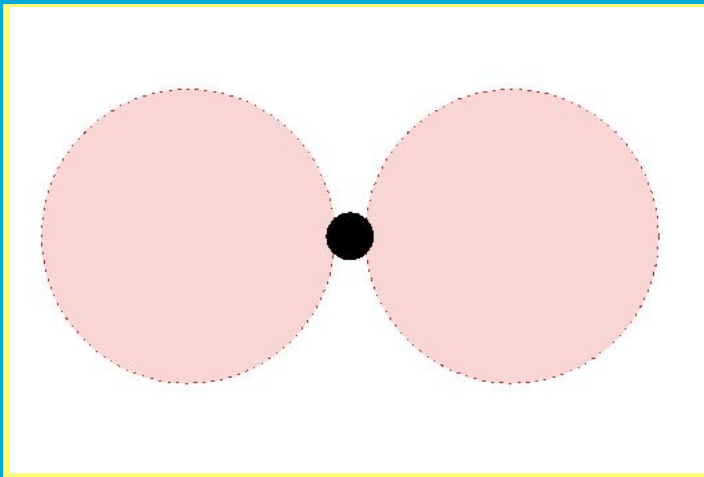
Optically  
thick disc



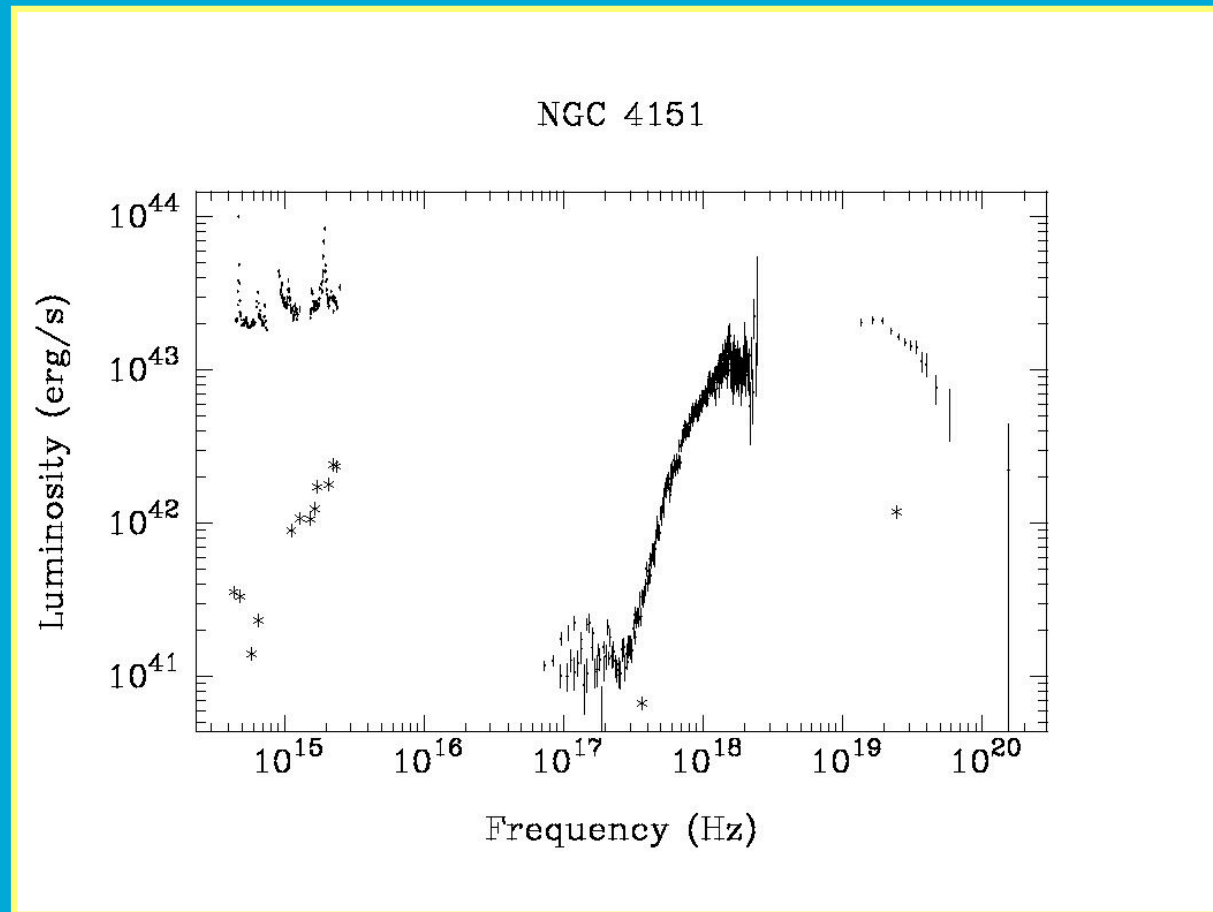
$m$



Optically thin  
hot flow



# The SED of the brightest Seyfert

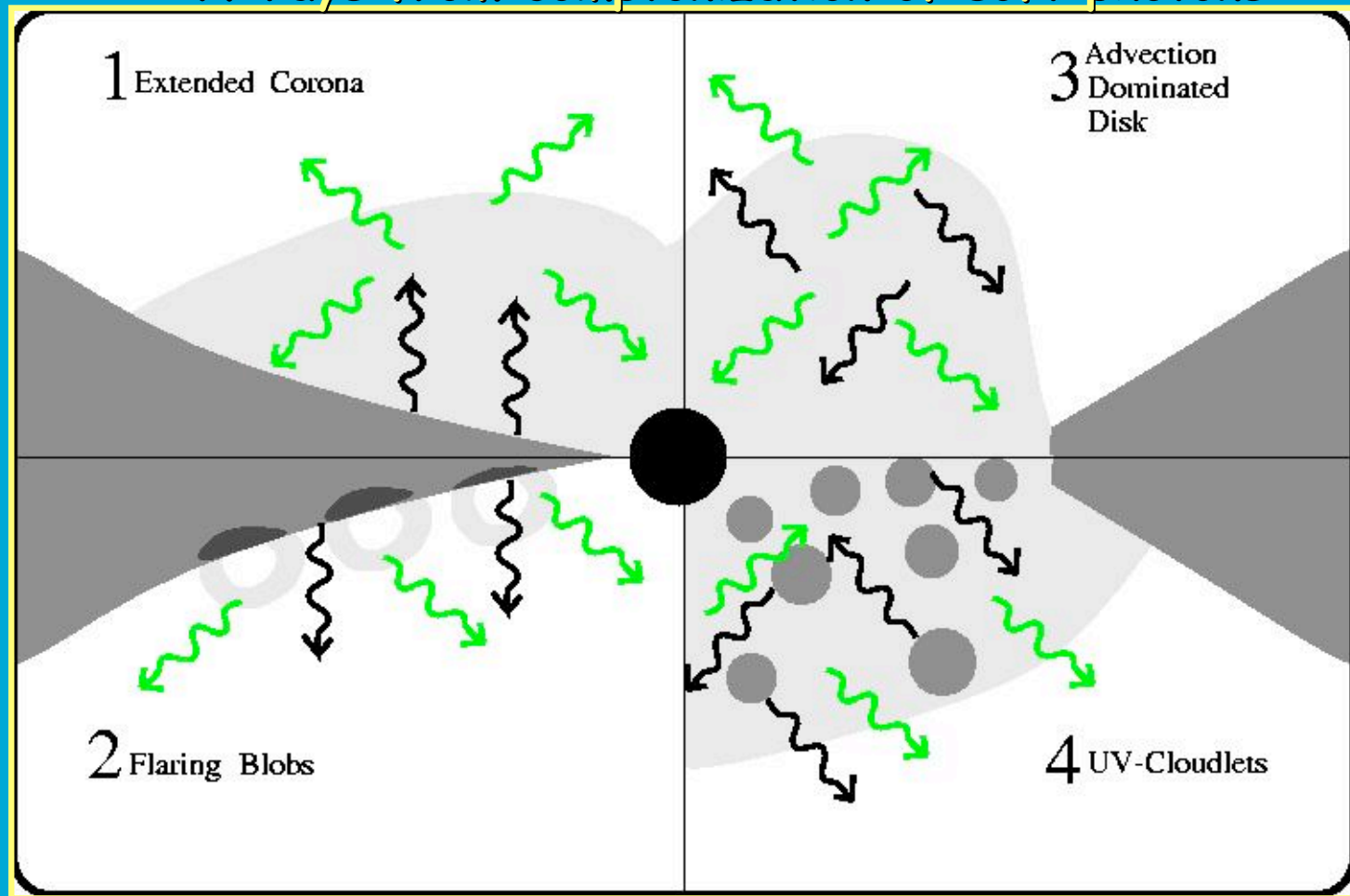


*(Edelson et al. 1996)*

$L_{UV} \sim L_X \longrightarrow$  Standard disk does not work

# Cool and hot regions in the accretion flow

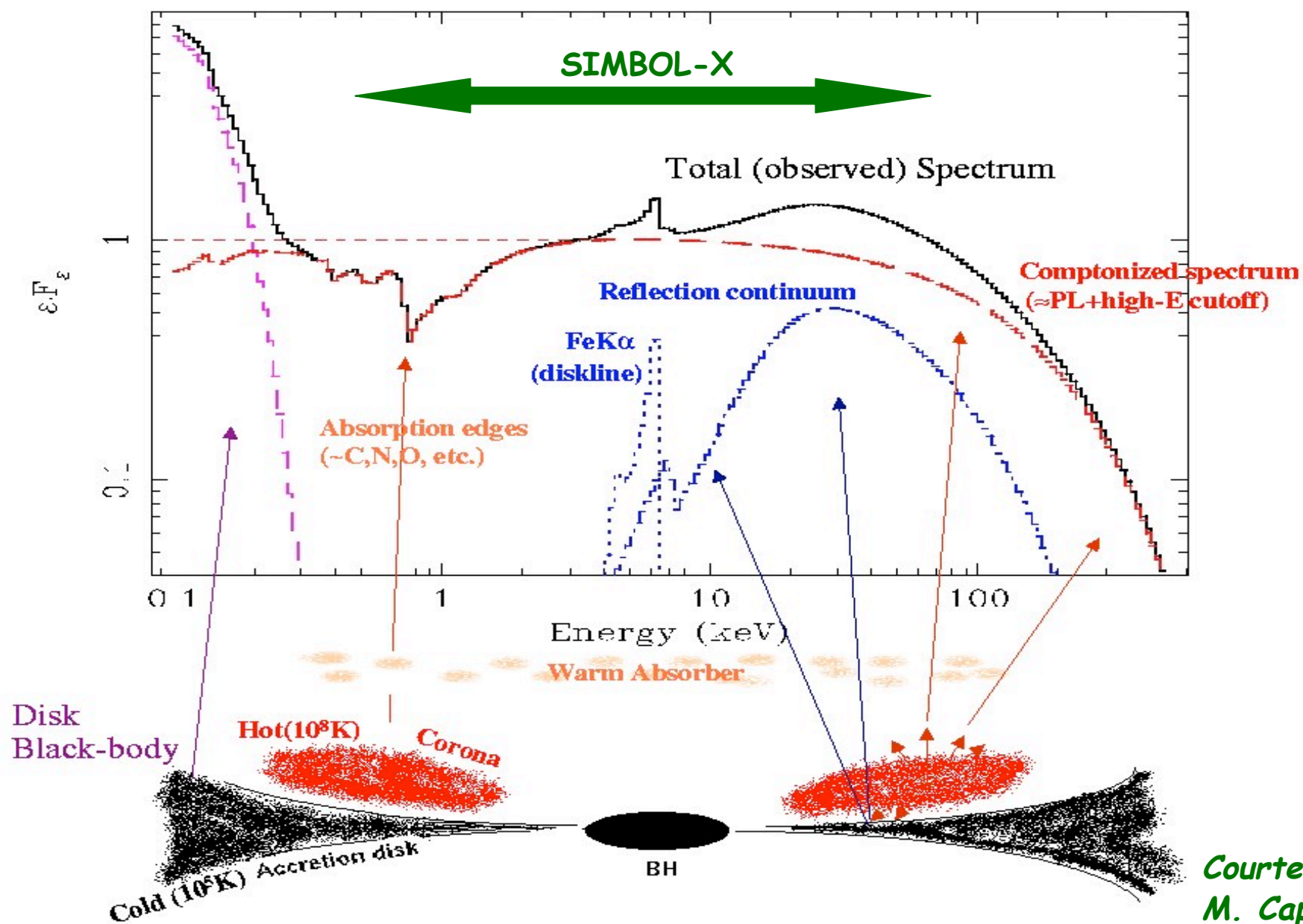
## X-rays from comptonization of soft photons



*(Haardt et al. 1996)*

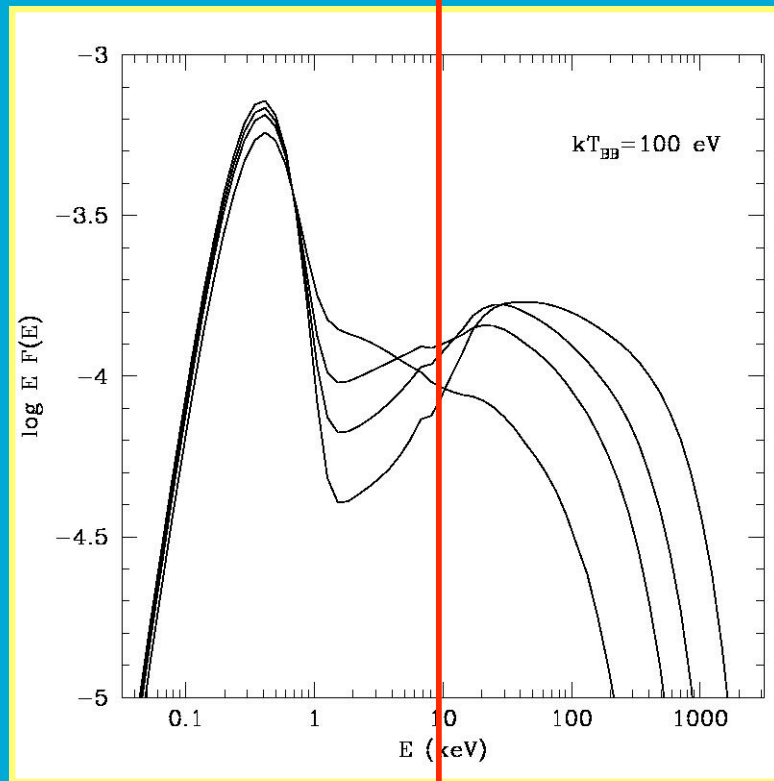
# Typical X-ray Spectrum of a Seyfert 1 Galaxy

□ Standard two-phase Comptonization model



# Disk + Corona Model

*Present* | *Future*



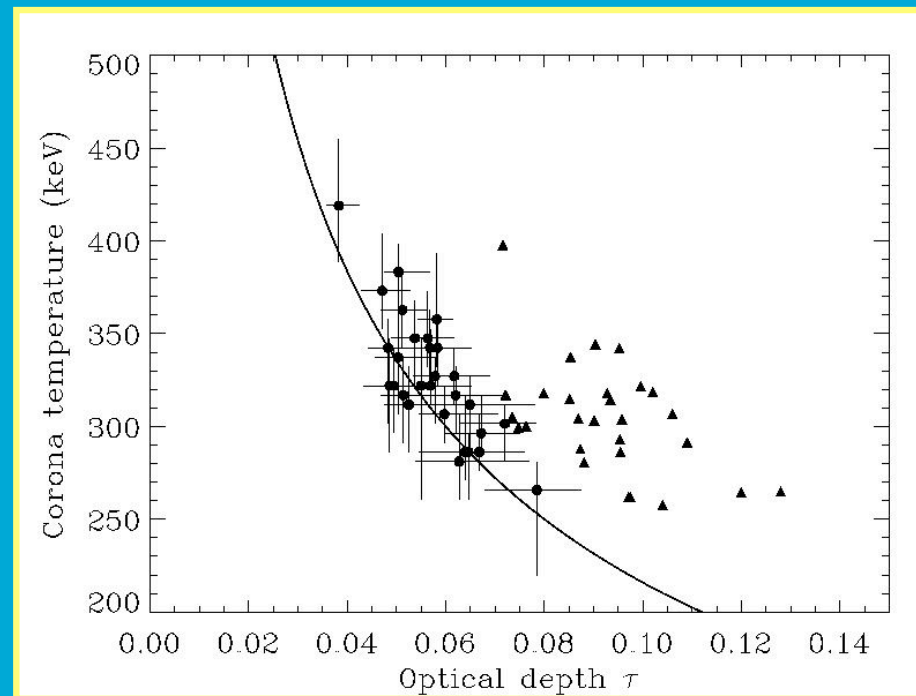
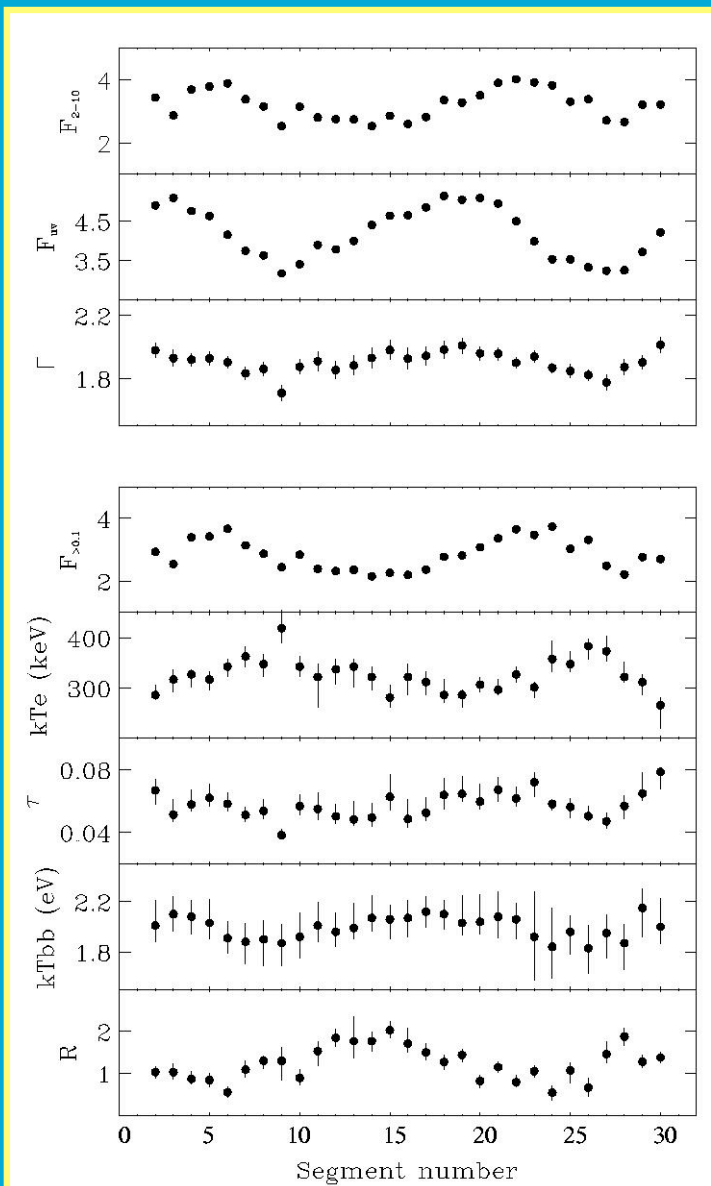
*(Haardt et al. 1997)*

Spectral variability  
expected for constant  
luminosity and varying  
coronal temperature  
and optical depth



# NGC 7496 (I)

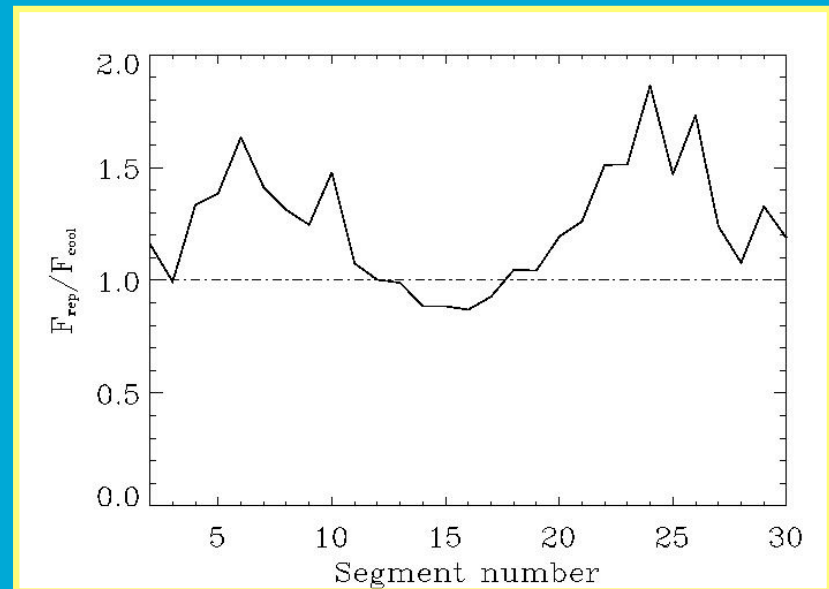
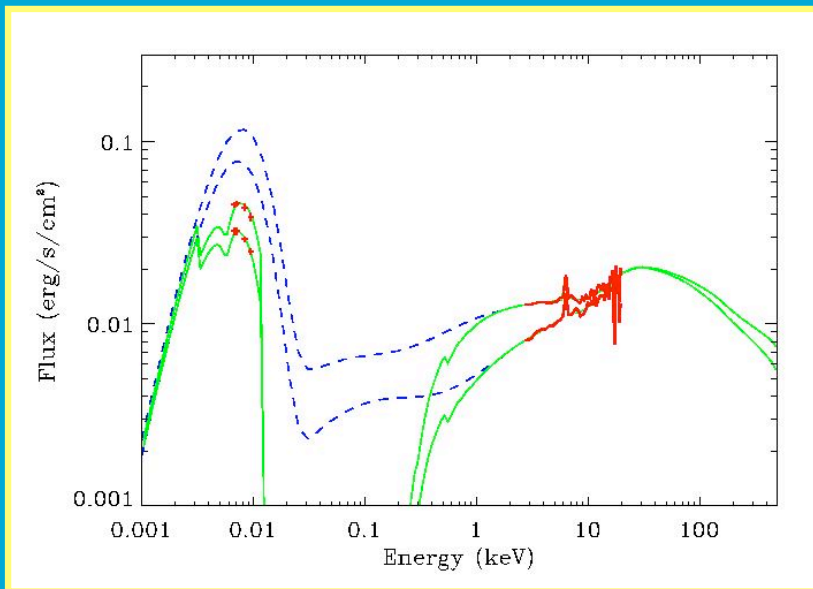
## IUE and XTE campaign



*(Petrucci et al. 2004)*

# NGC 7496 (II)

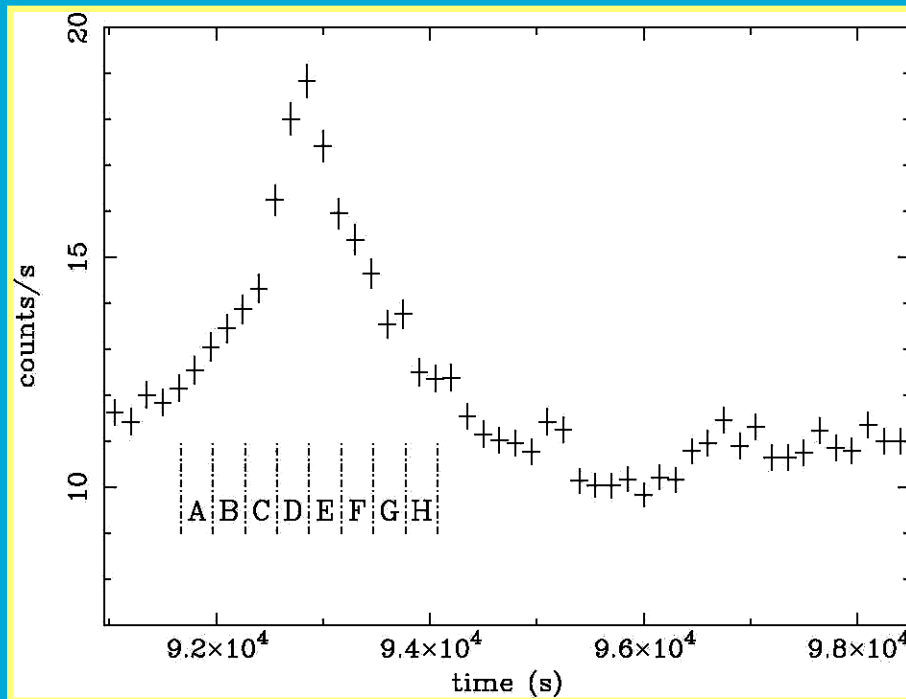
## Comparing different states



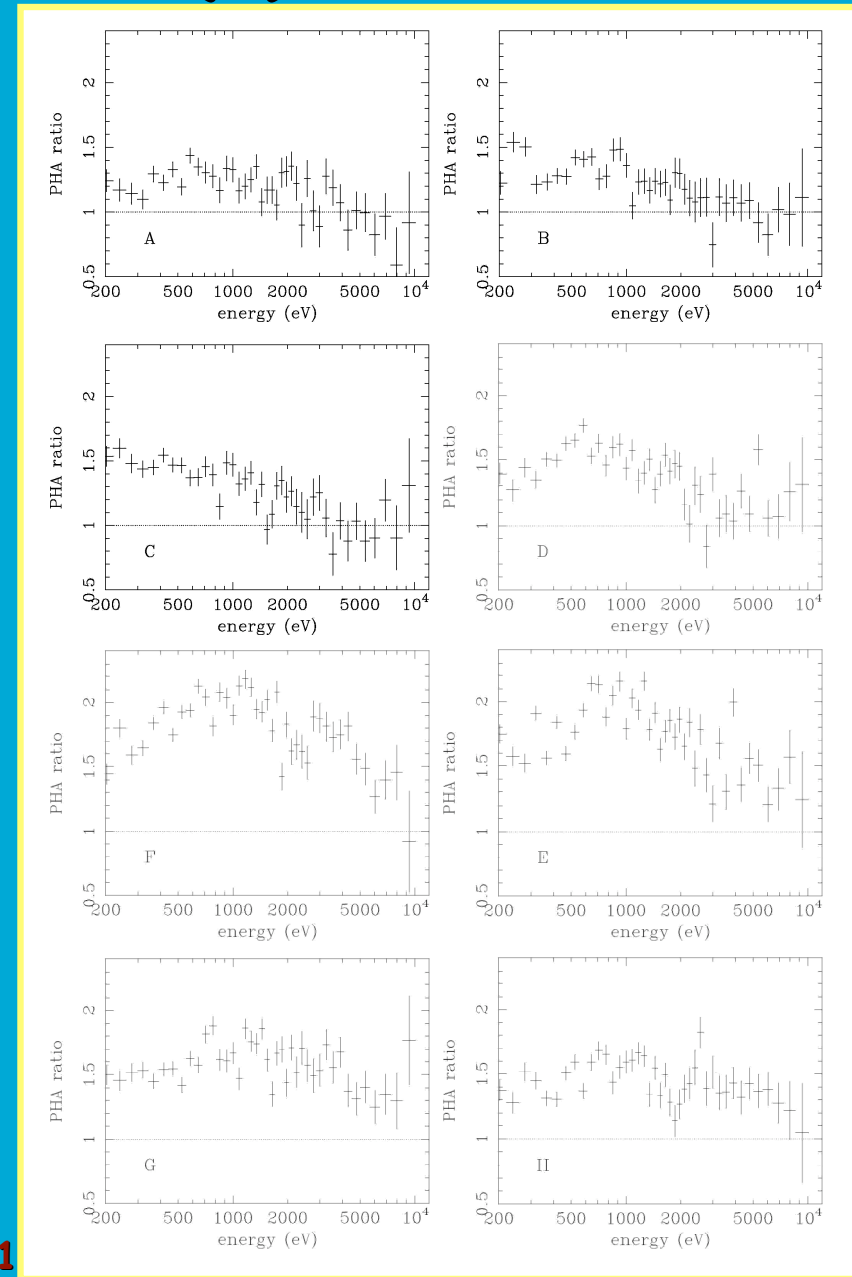
*(Petrucci et al. 2004)*

# MCG -6 30 15 (I)

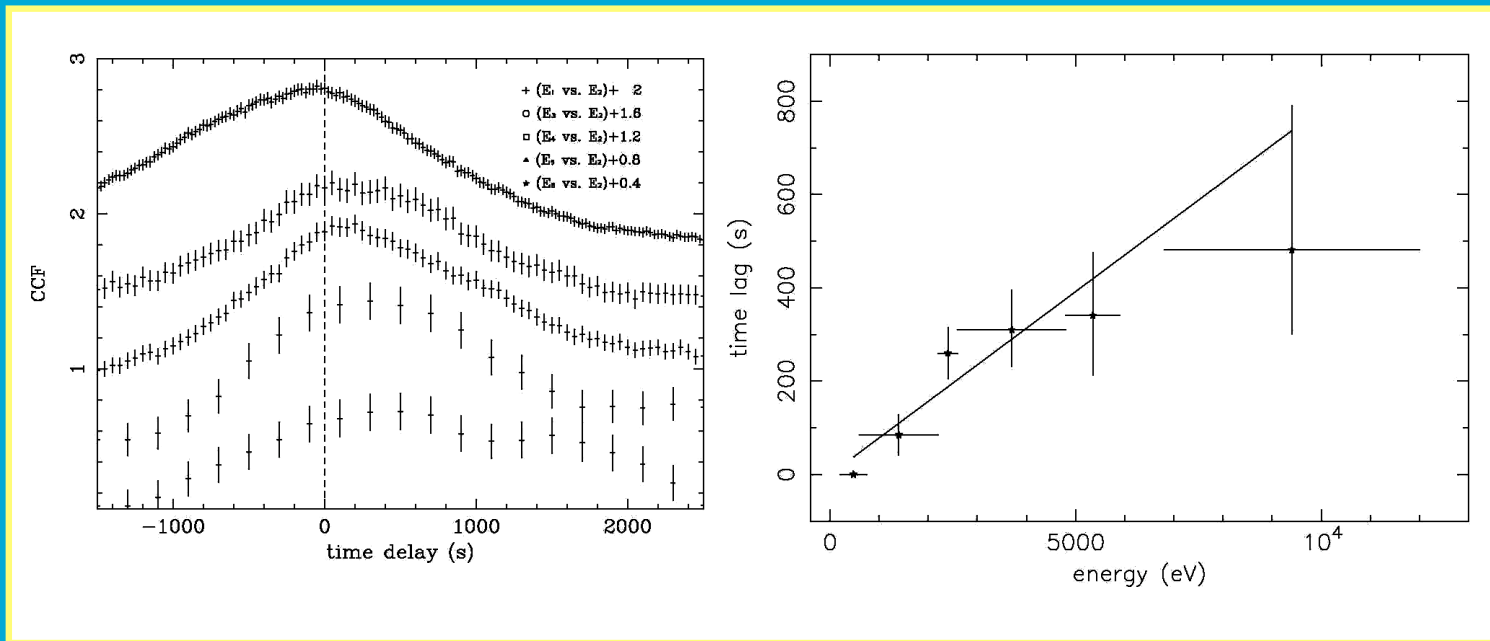
## Spectral Variability observed with XMM-Newton (300s bins)



(Ponti et al. 2004)



# MCG -6 30 15 (II)

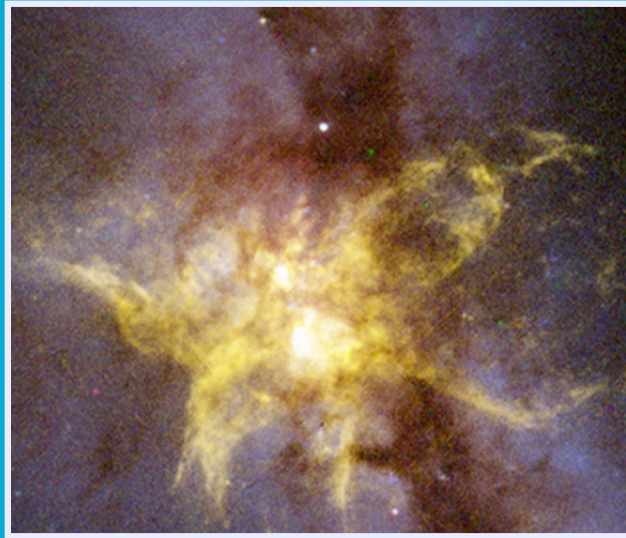


*(Ponti et al. 2004)*

Hard photons lag the softer ones in agreement with Comptonization models

# NGC 6240 (I)

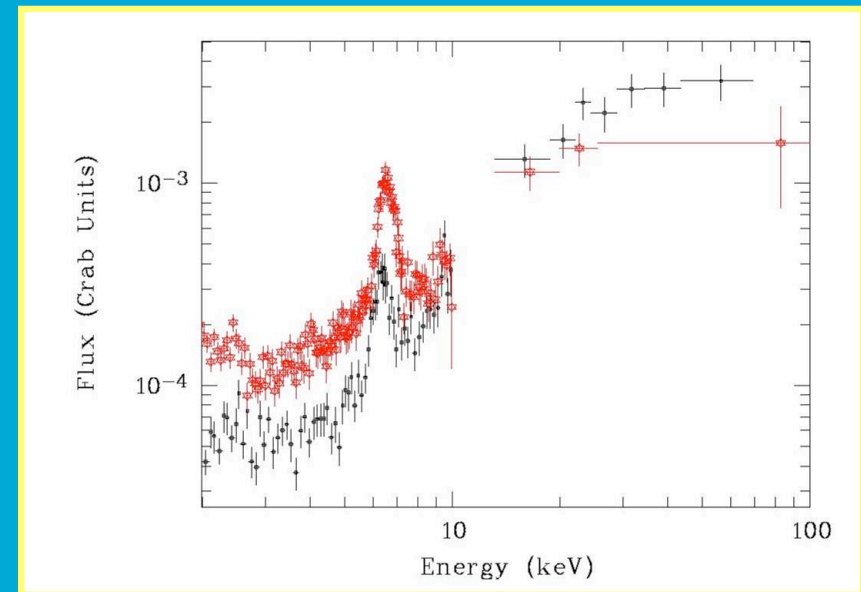
A hidden AGN revealed by *BeppoSAX*



HST - WFC2

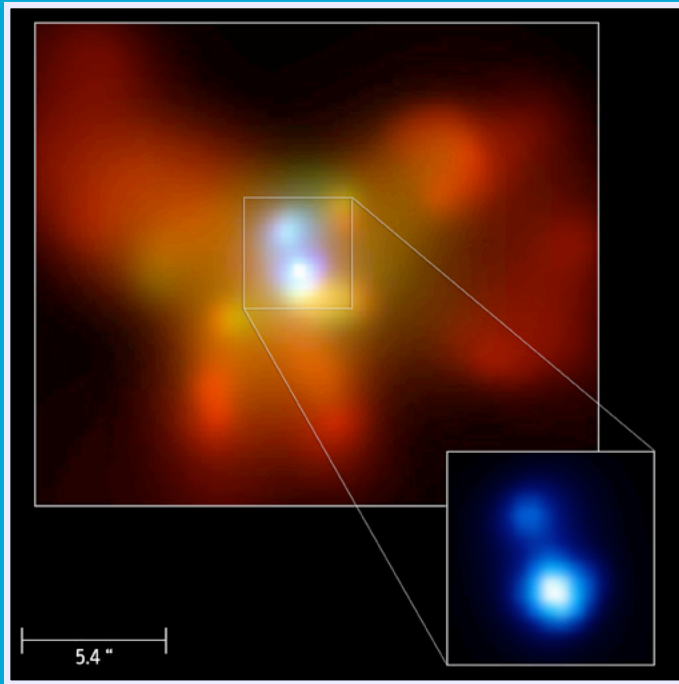
*BeppoSAX* Observations

(Vignati et al. 1999)



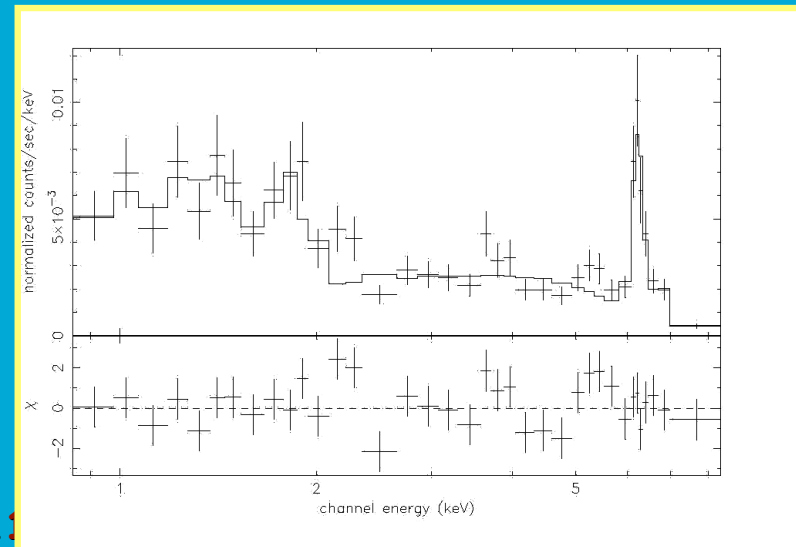
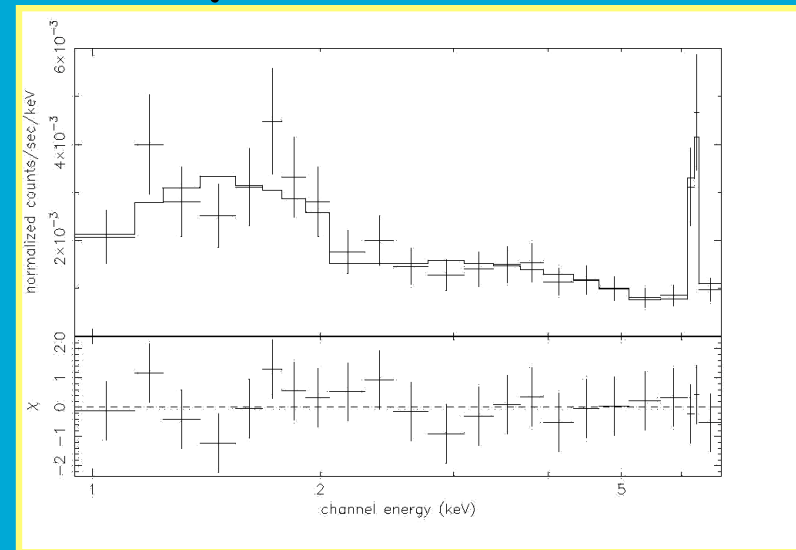
# NGC 6240 (II)

## Two hidden AGNs revealed by *Chandra*



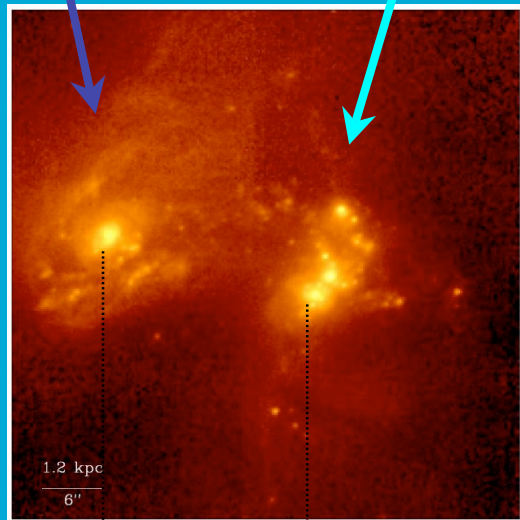
*Chandra*

(Komossa et al. 2003)



# The merging system Arp 299

IC 694      NGC 3690

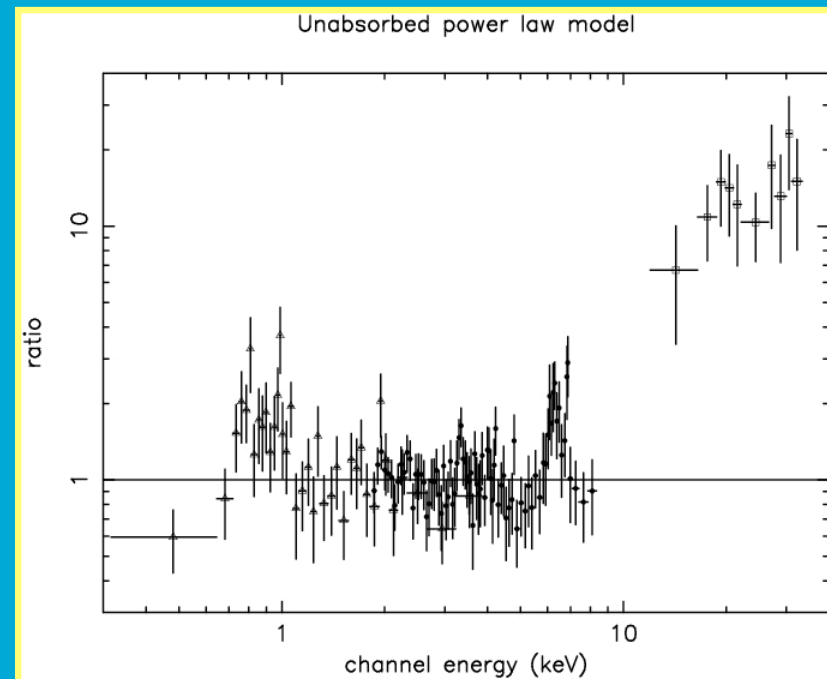


(Alonso-Herrero et al. 2000)

$\sim 22'' = 4.6 \text{ kpc}$

## BeppoSAX observations:

- ✓  $N_{\text{H}} = 2.5 \cdot 10^{24} \text{ cm}^{-2}$
- ✓  $L_{(0.5-100 \text{ keV})} = 1.9 \cdot 10^{43} \text{ erg s}^{-1}$



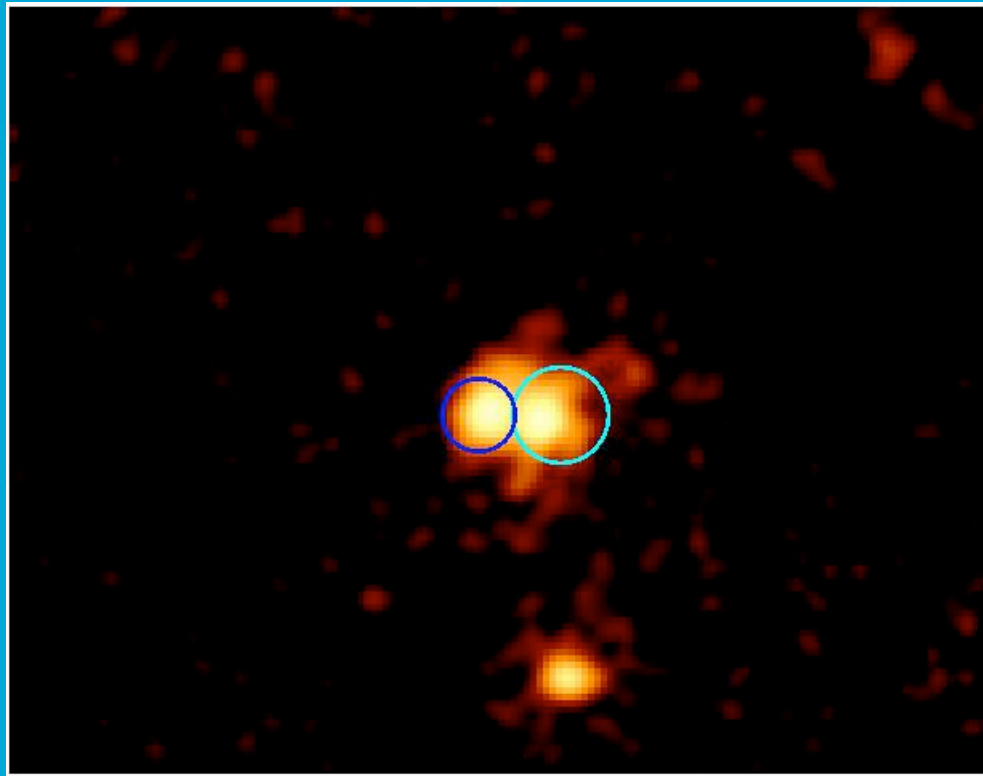
(Della Ceca et al. 2002)

✓  $L_{\text{FIR}} = 1.1 \cdot 10^{45} \text{ erg s}^{-1}$

✓ Optical and mid-/far-IR: LINER and/or starbursting

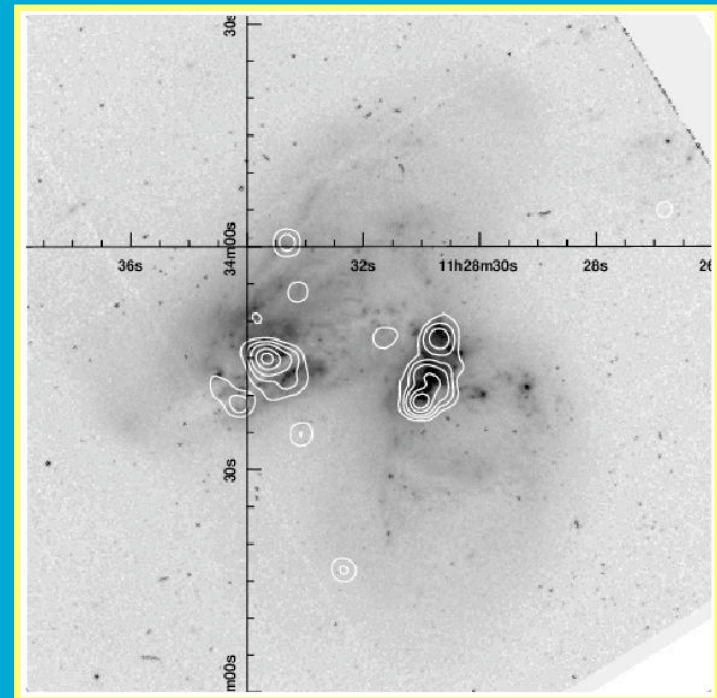
# Arp 299 (II)

Two Active Nuclei in two merging galaxies?

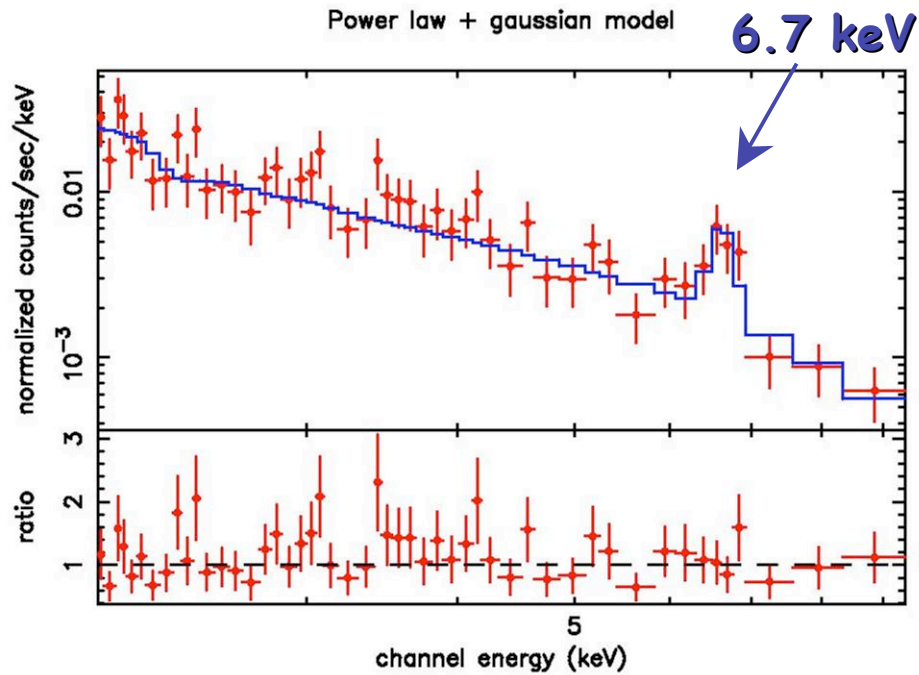


*Chandra imaging*  
(2 - 10 keV)

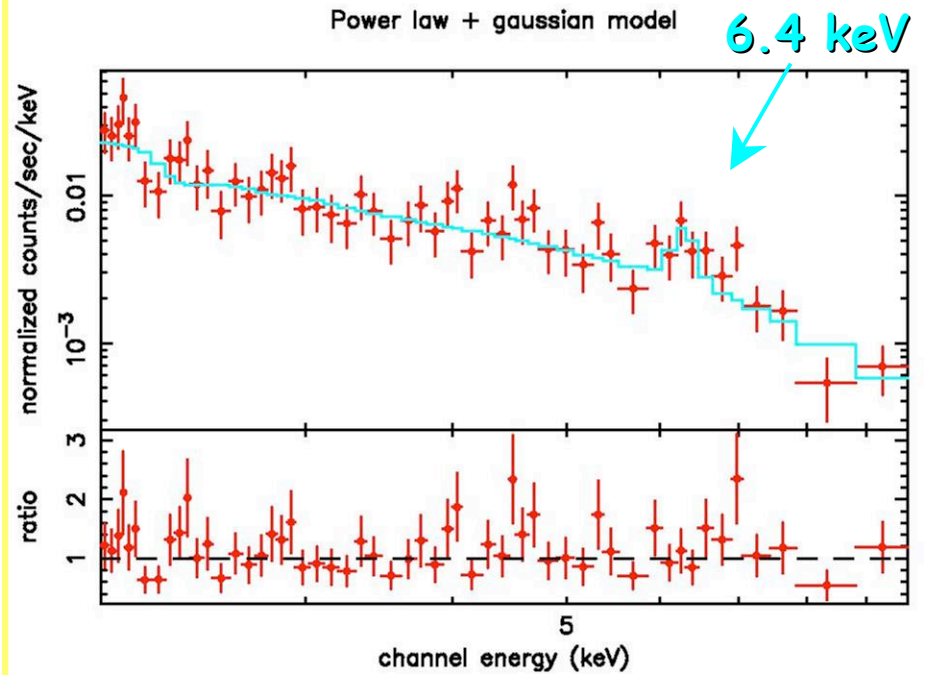
*XMM-Newton*







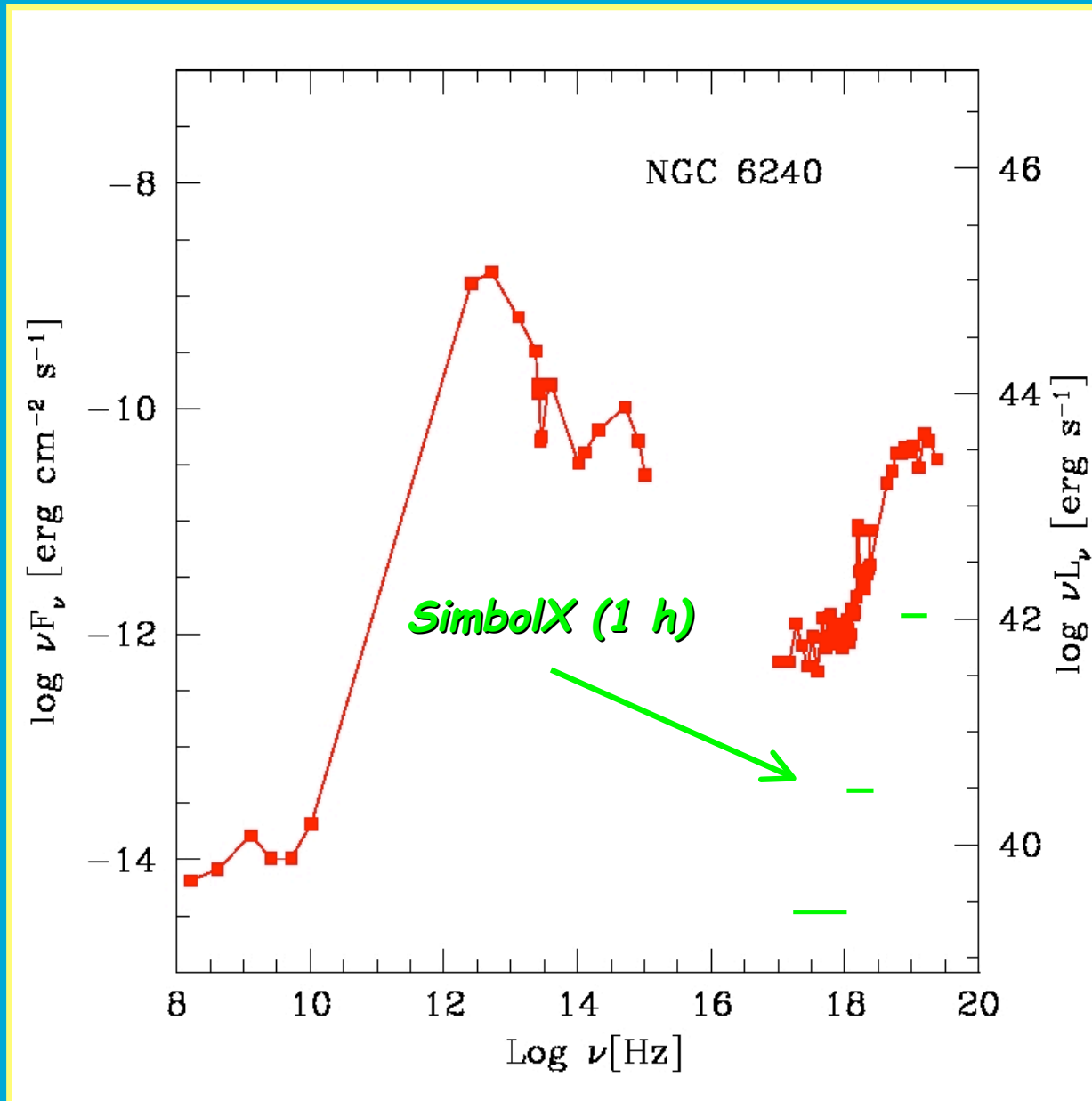
IC 694



NGC 3690

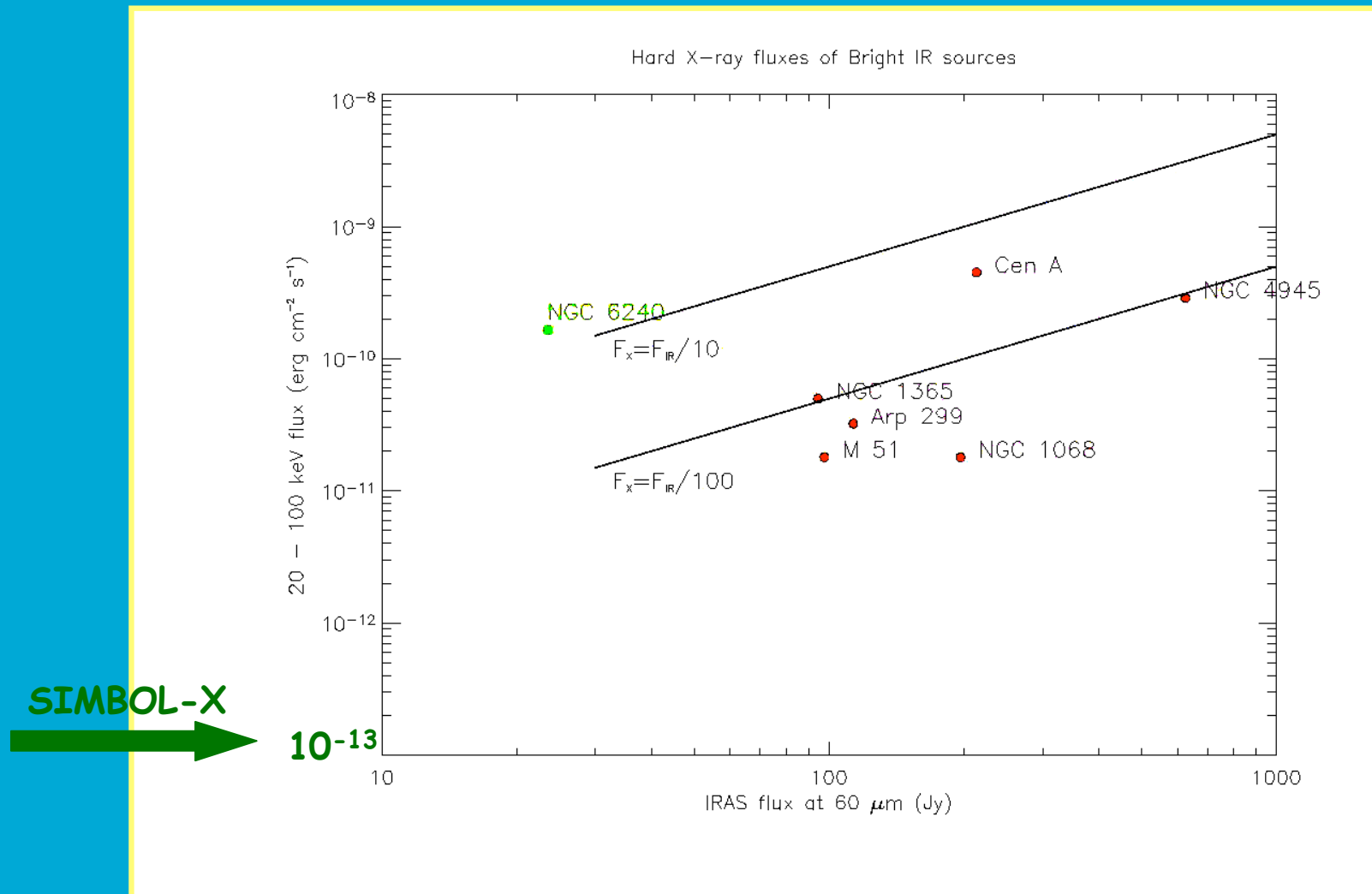
(Ballo et al. 2004)

# Comparison of X-ray and IR luminosity



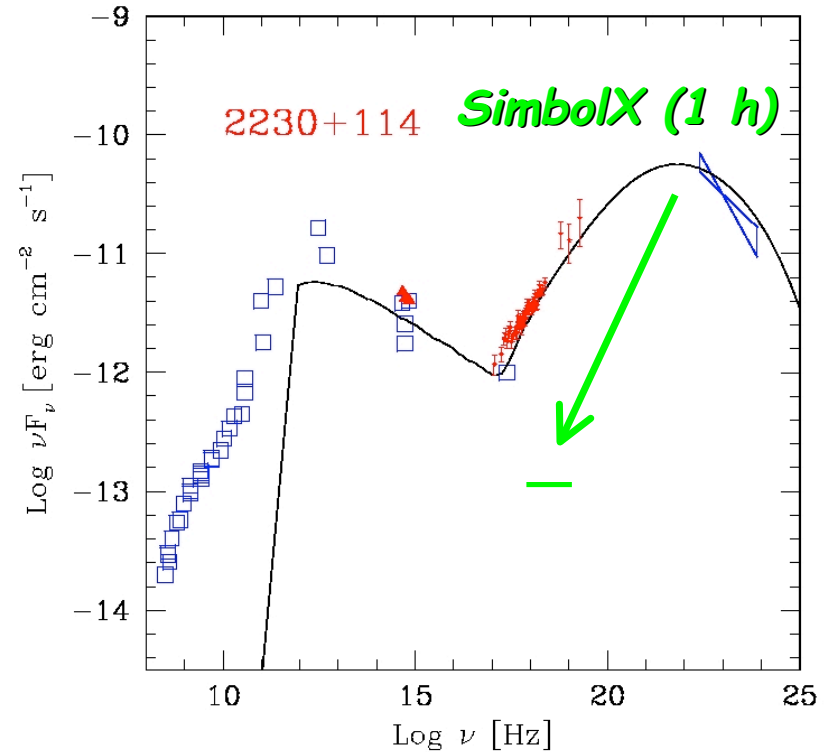
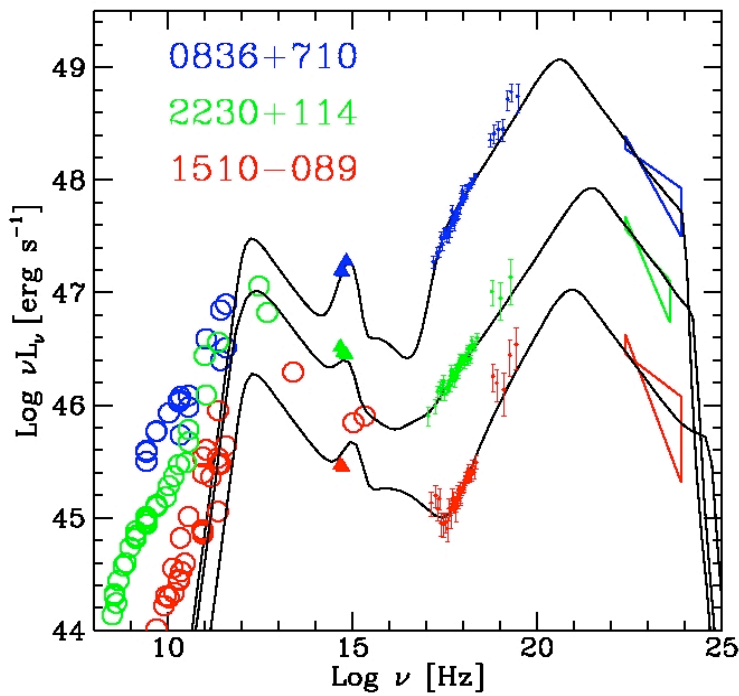
# FX vs FIR

## Probing nuclear activity in luminous IR galaxies



# BLAZARs (Jets)

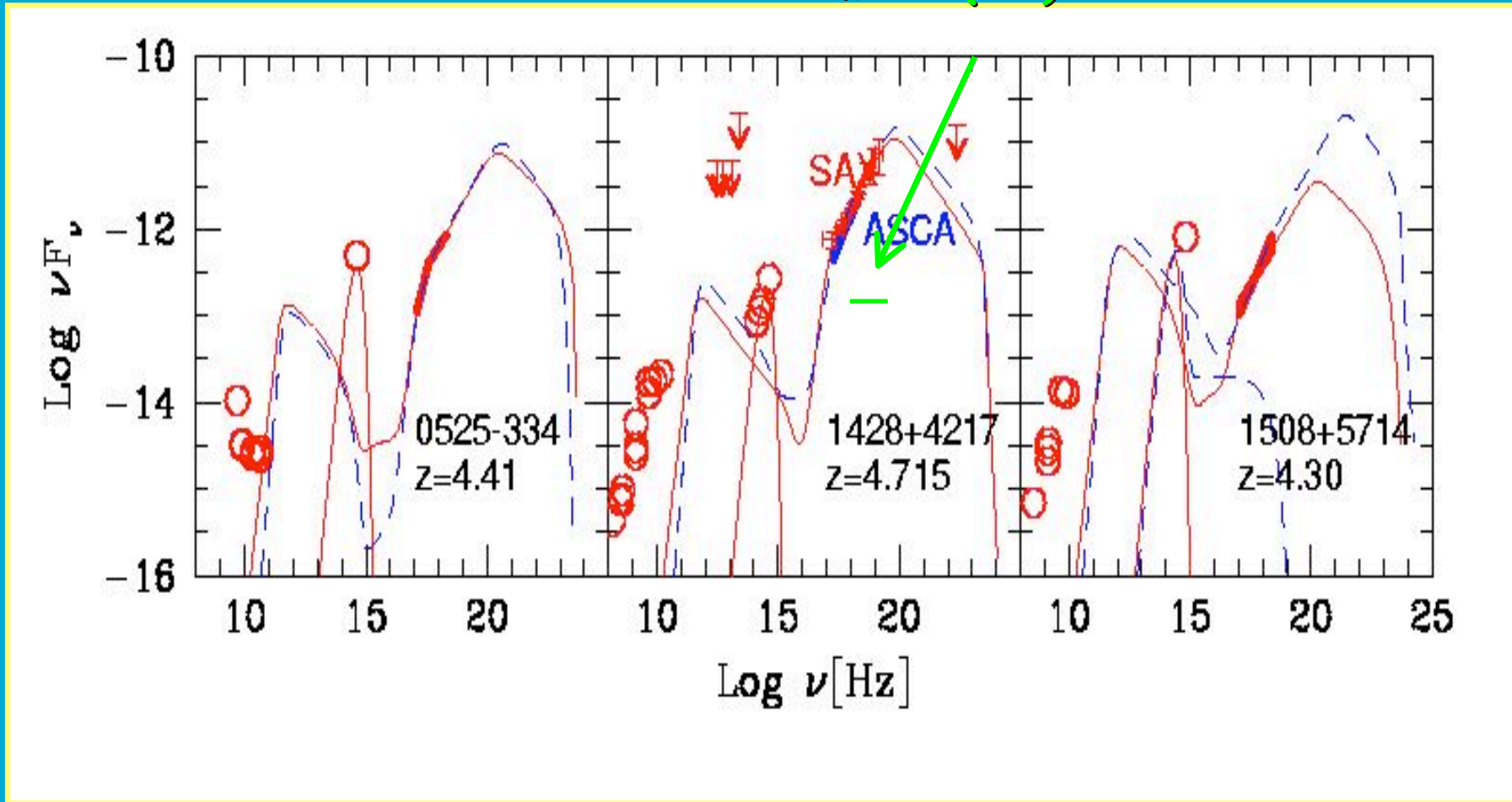
A hard X-ray - Gamma-ray mountain



(Tavecchio et al. 2000)

# BLAZARs at high $z$

*SimbolX (1 h)*



*(Ghisellini et al. 2002)*

# CONCLUSIONS

The energy range, sensitivity and resolution of SIMBOL X are essential for:

- ✓ understanding the origin of the continuum and disentangle the reflection component in Seyfert galaxies;
- ✓ probing highly absorbed Active Nuclei in luminous infrared galaxies;
- ✓ probing the hard continuum of powerful blazars up to at least  $z = 5$ .