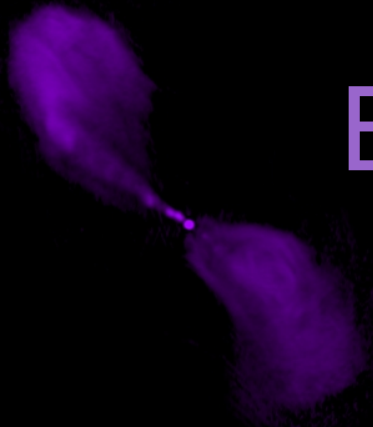


# When AGNs burp

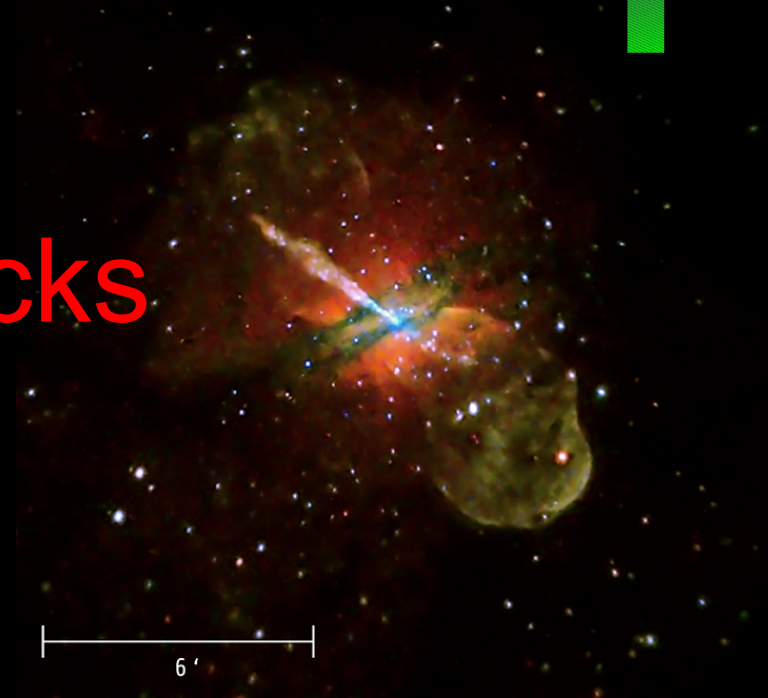


Bubbles

Shocks

And

Feedback



Beatriz Mingo Fernandez

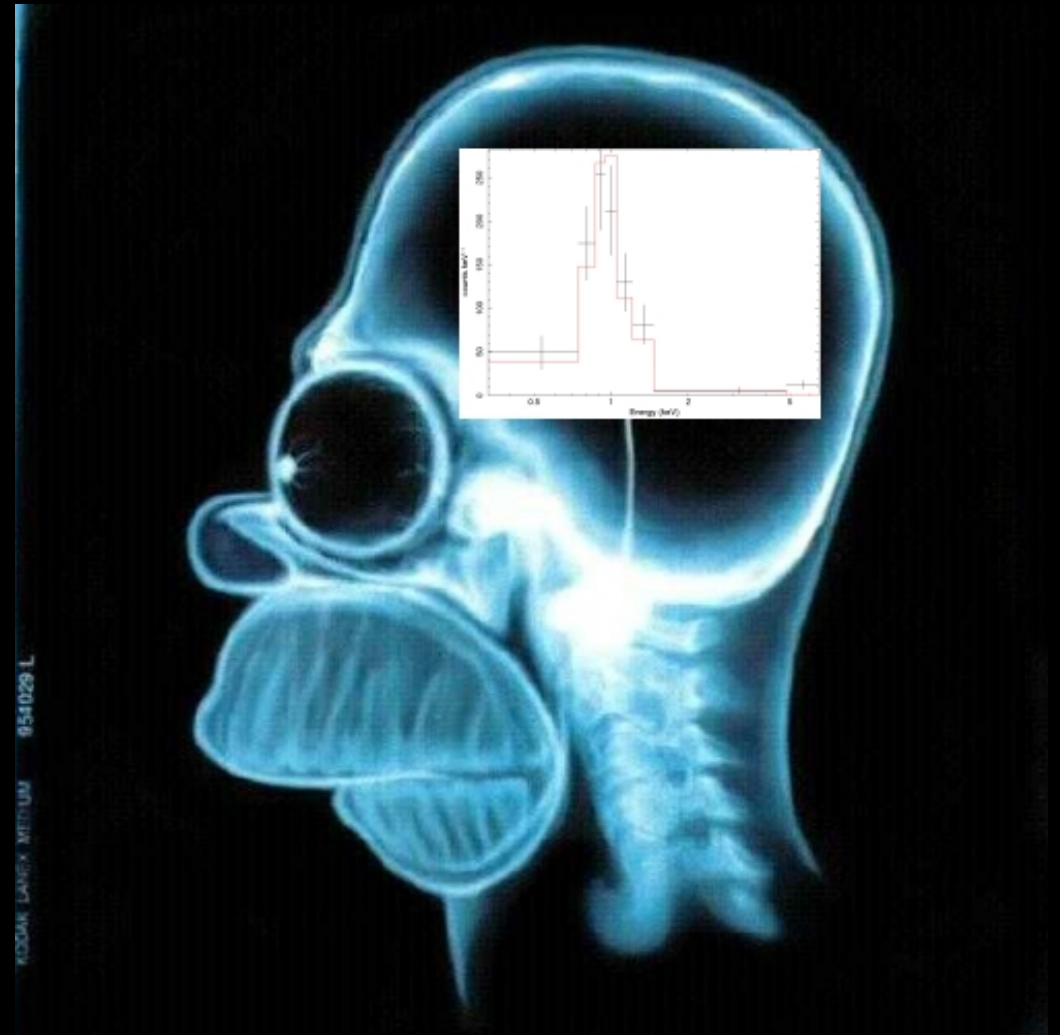
University of Hertfordshire

Supervisors:

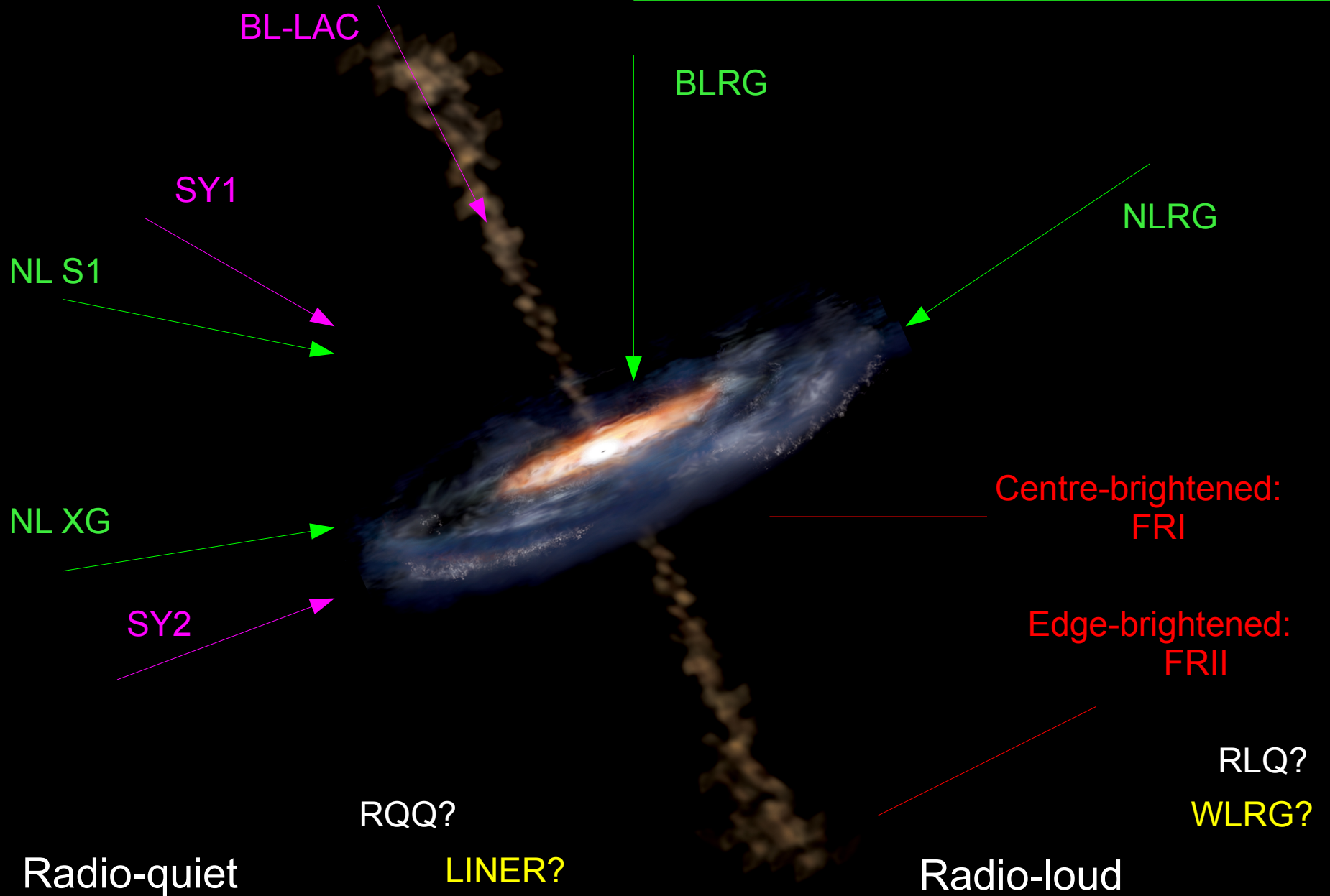
Martin Hardcastle (Univ. of Hertfordshire)

Judith Croston (Univ. of Southampton)

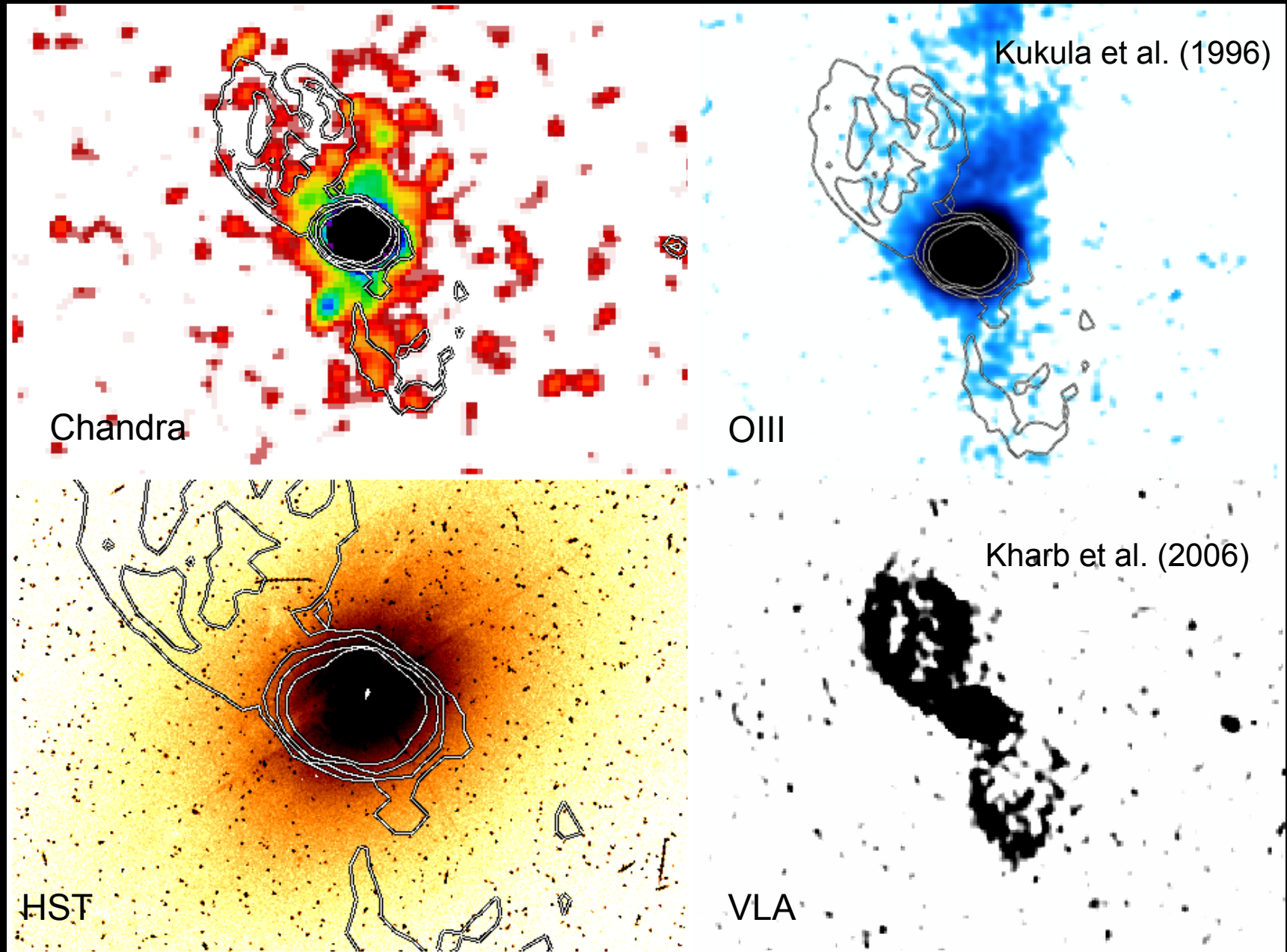
- ◆ The AGN zoo
- ◆ Markarian 6
  - Overview
  - Results:
    - Core
    - Radio bubbles
- ◆ Circinus
- ◆ Conclusions



# The AGN zoo

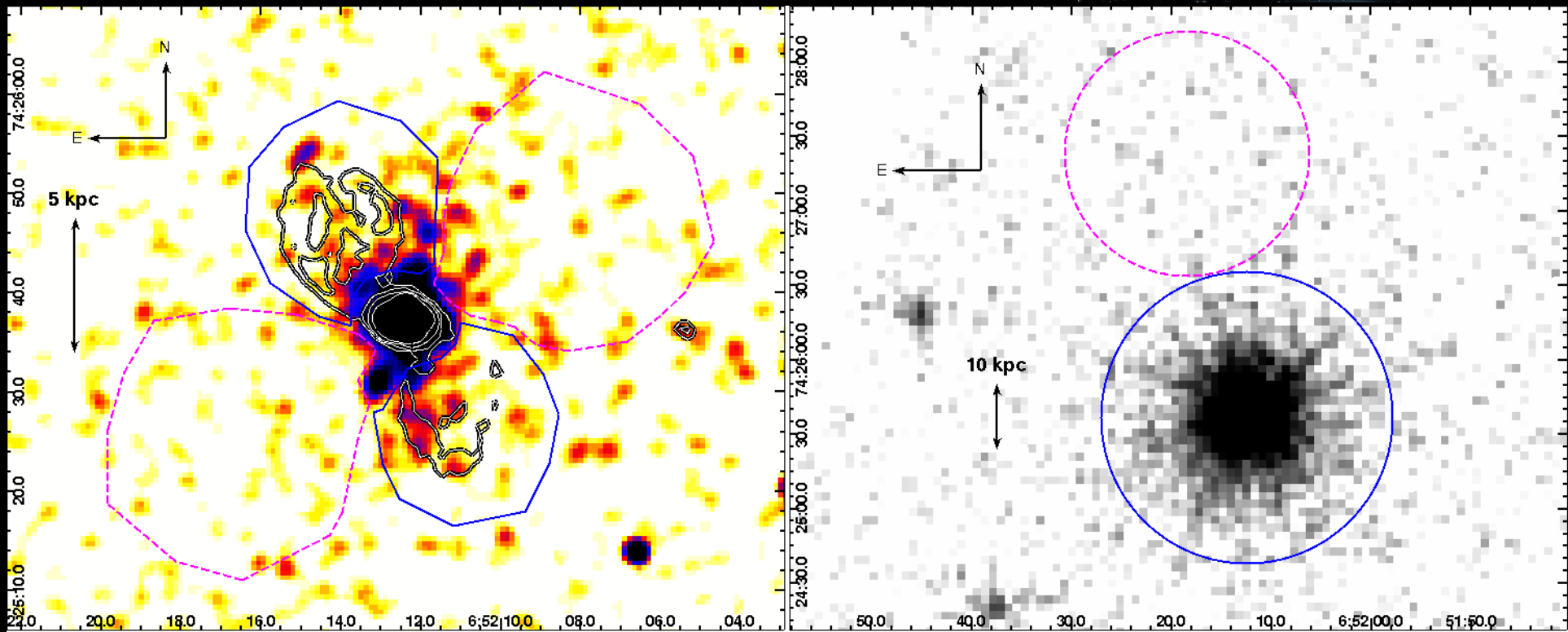
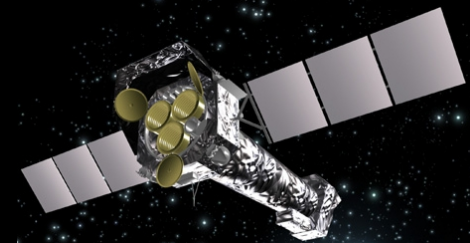
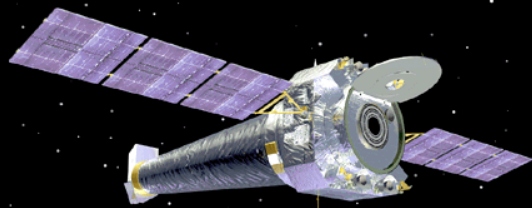


# Markarian 6





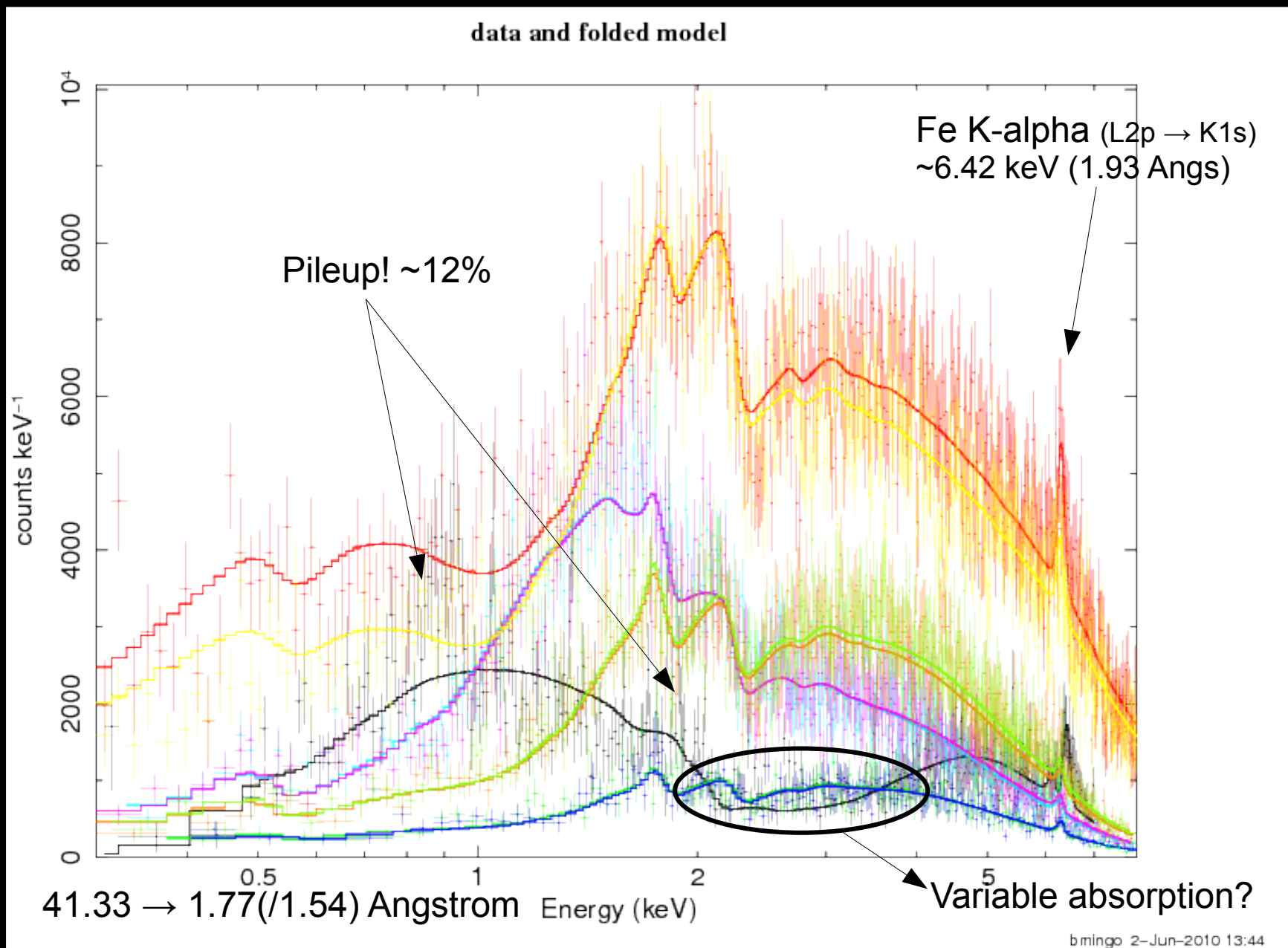
# Mrk6 in the X-rays: Chandra vs XMM



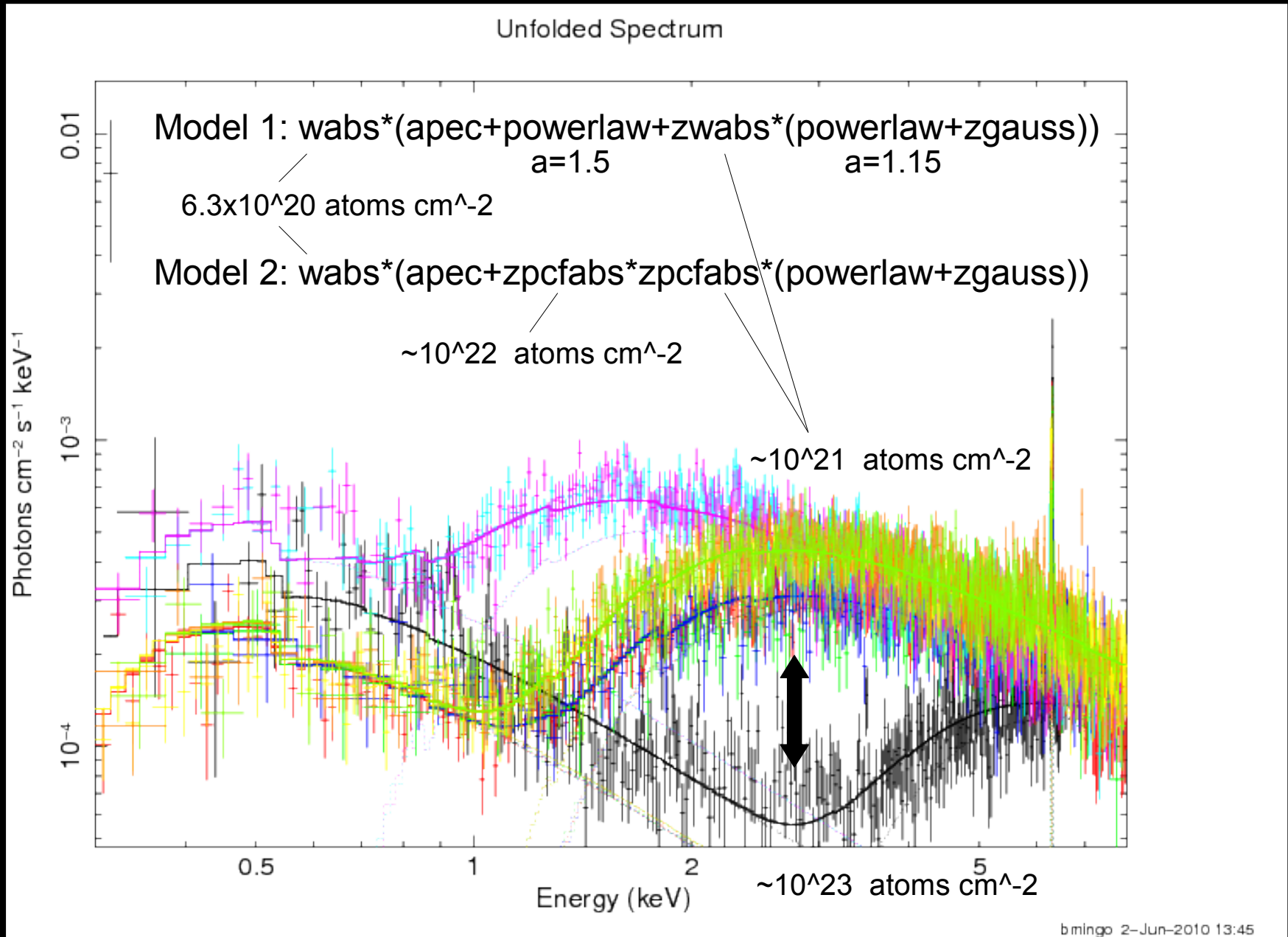
Immler et al. (2003); Schurch et al. (2006)

The AGN spectra look really different too - Why?

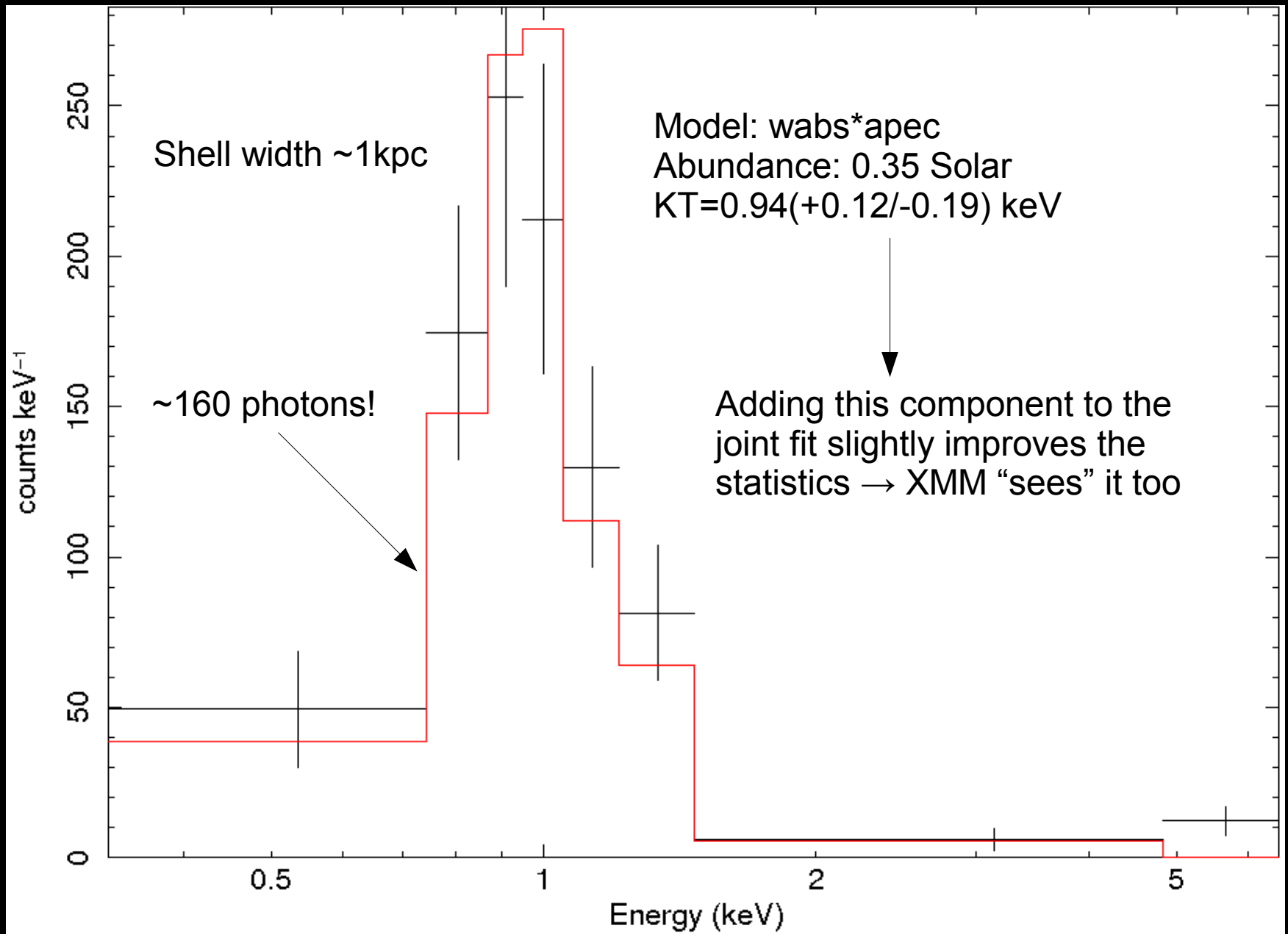
# Mrk6 results – Core (I)



# Mrk6 results – Core (II)



# Mrk6 results- radio bubbles (I)





# Mrk6 results – radio bubbles (II)

- Too few photon counts outside the bubbles

- Simulated spectra + real data → upper limit

- X-ray L constraints +  $L_B$  → O'Sullivan et al. 2001

- Ne, P, for a range of kT (0.1 → 0.6 keV)

- Rankine-Hugoniot shock conditions (strong)  $\frac{\rho_{shell}}{\rho_{out}} = 4$

	kT (keV)	Ne (cm <sup>-3</sup> )	P (Pa)
Shells (N/S)	0.95	1.61/1.97 x10 <sup>-2</sup>	4.5/5.0x10 <sup>-12</sup>
ISM	0.1-0.2	2.2-15x10 <sup>-3</sup>	1.3-4.4x10 <sup>-13</sup>

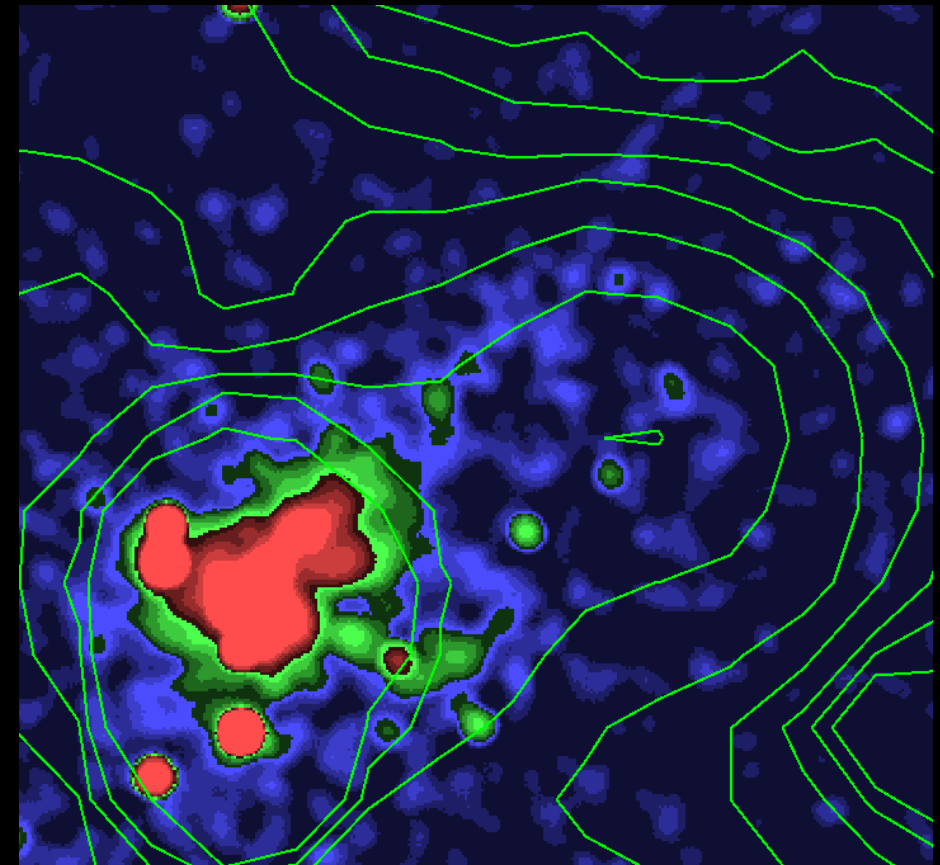
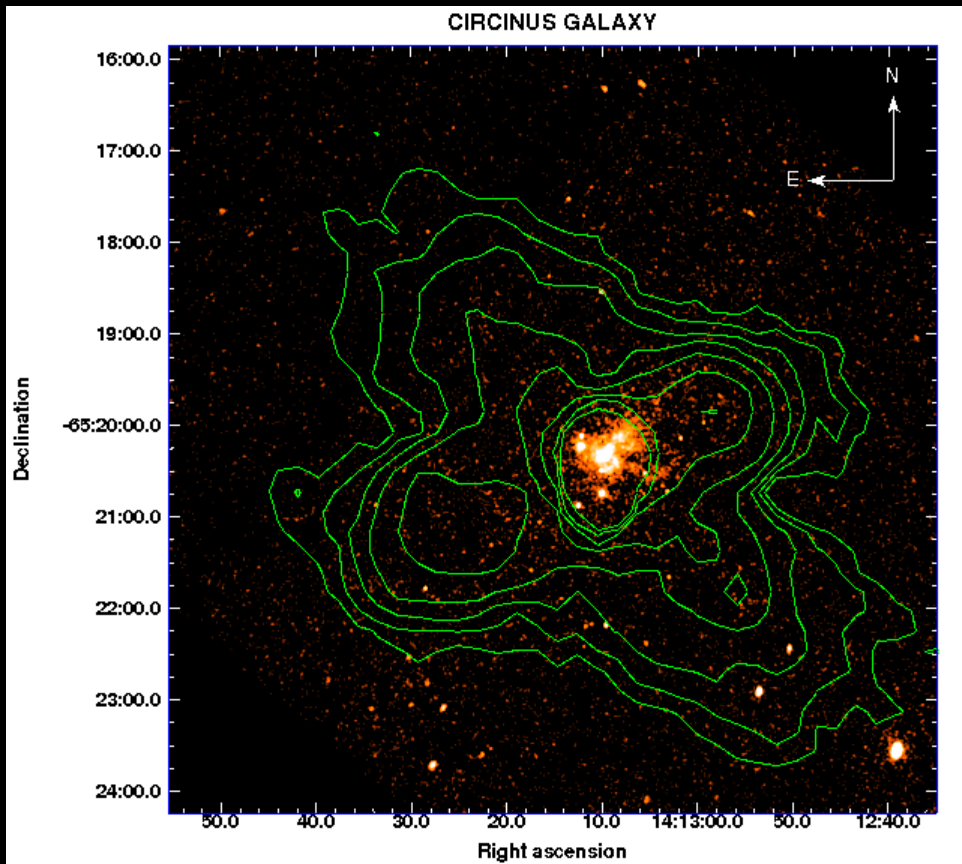
Mach number: 3.5-5.8

Total E (thermal + kinetic): 6.1-6.6x10<sup>(56)</sup> erg

Timescale: ~10<sup>7</sup> years

# Circinus

- \*  $D=4\text{Mpc}$ , sAb, Sy2, close to galactic plane ( $b=4\text{deg}$ ,  $nH=58 \times 10^{20}\text{cm}^{-2}$ ), 25x radio fainter than CenA
- \* Lots of grating data (Chandra and XMM), but just 1 ACIS imaging observation: 25ksec.  $kT(\text{W bubble})=0.75(\pm 0.1)\text{keV}$
- \* Chandra proposal: 180ksec



## ◆ Markarian 6:

- Variable absorption → clumpiness near BH
  - How equivalent are low and high power RG?
- Bubbles driving shock into the ISM with  $M=3.5-5.8$ 
  - Consistent with results from Cen A (Kraft et al. 2003, Croston et al. 2007) and NGC 3801 (Croston et al. 2008)
- Mingo et al. 2010 (in prep.)

## ◆ Circinus galaxy:

- Preliminary results really promising: similar to NGC 6764 (Croston et al. 2008), data in 2011/2012

# Questions?

