

# X-ray Warm absorption and emission from Polar scattered Seyfert 1 galaxy MRK 704

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*With*

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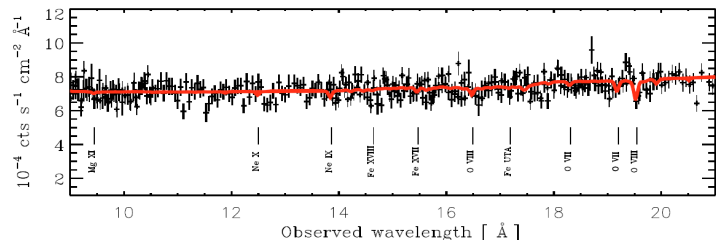


# Overview

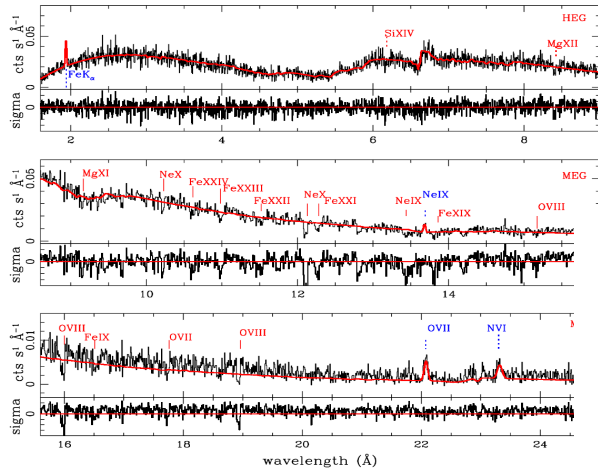
- Warm absorbers in Seyferts
- Polar scattered Seyfert, MRK 704  
(Laha et al , ApJ, 2011)
- XMM data analysis
- Final picture.

# Warm absorbers

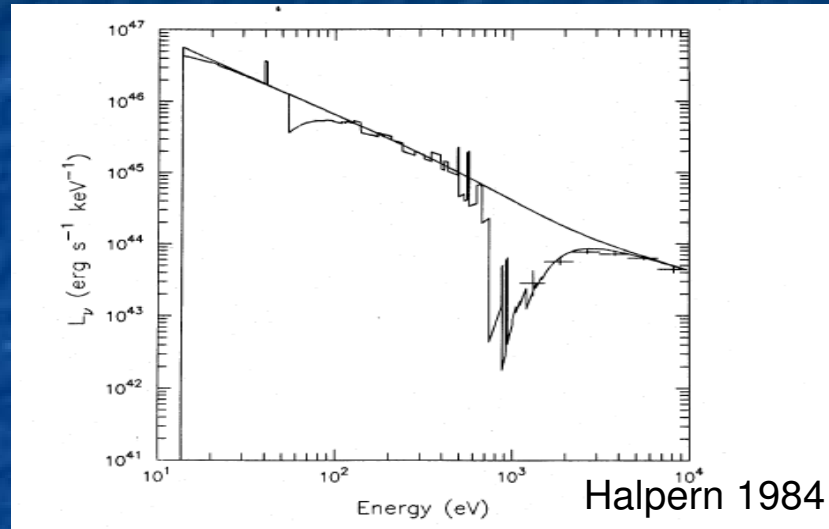
A&A 520, A36 (2010)



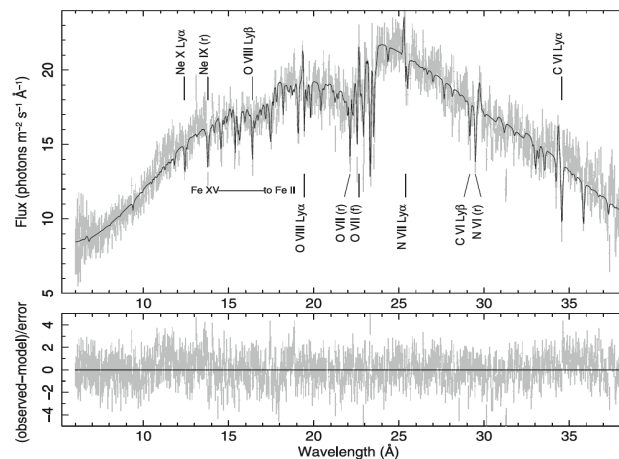
MRK279  
Ebrero+ '10



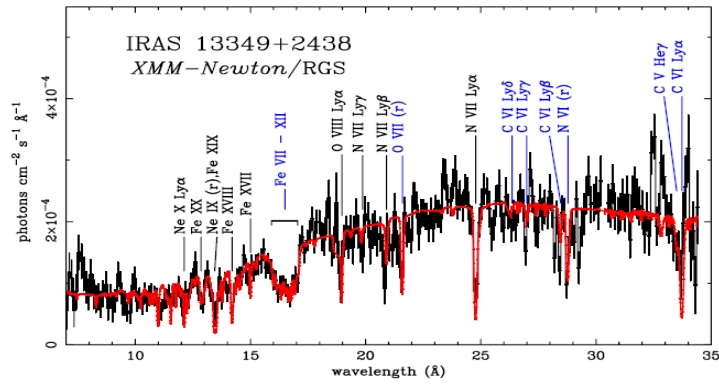
NGC5548 Mercedes+ '10



R. A. N. Smith et al.: XMM-Newton RGS analysis of Arakelian 564



AKN564, Smith+ '08

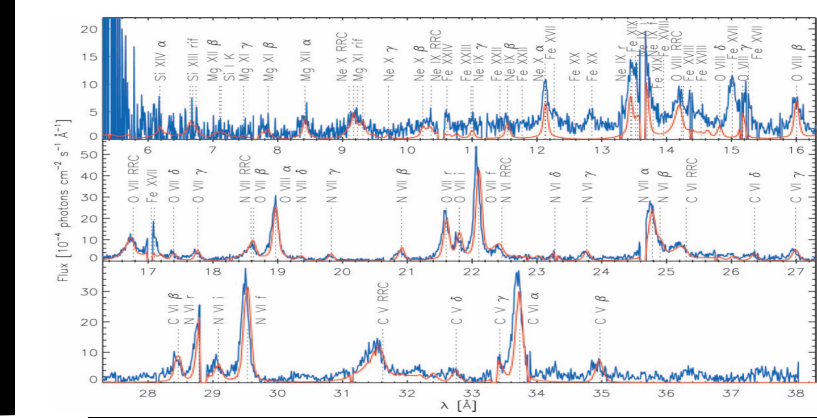


IRAS13349 Sako+ '01

Seyfert 1

50% Sy1s have WA  
Blustin+ '05

Unified Model



Seyfert 2

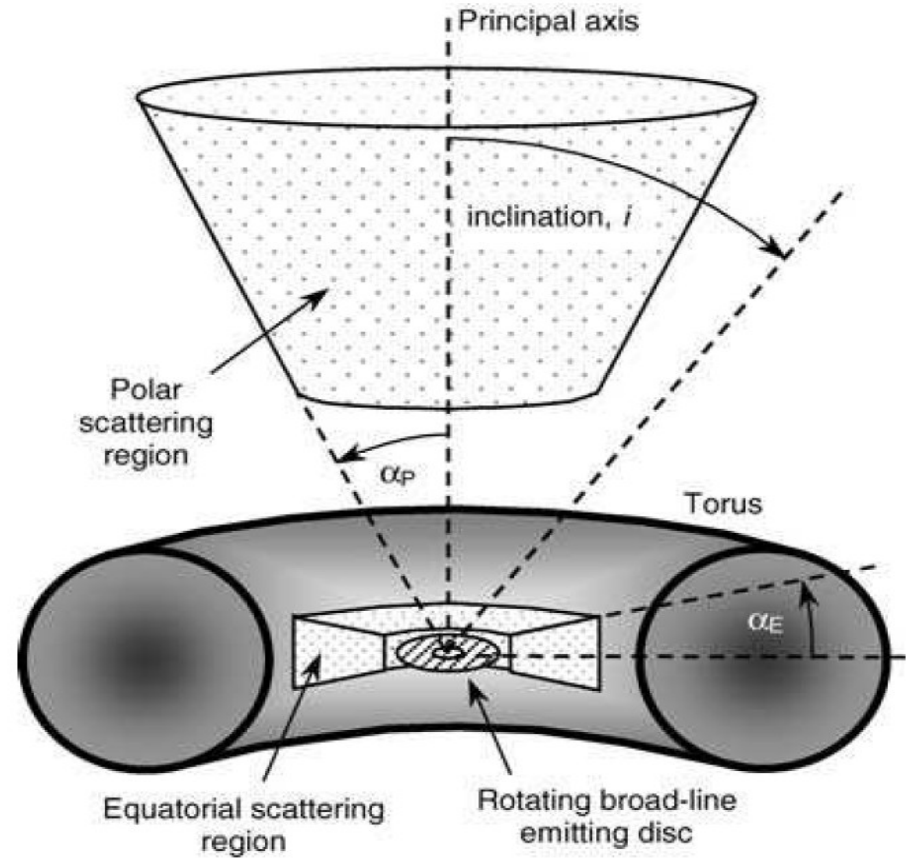
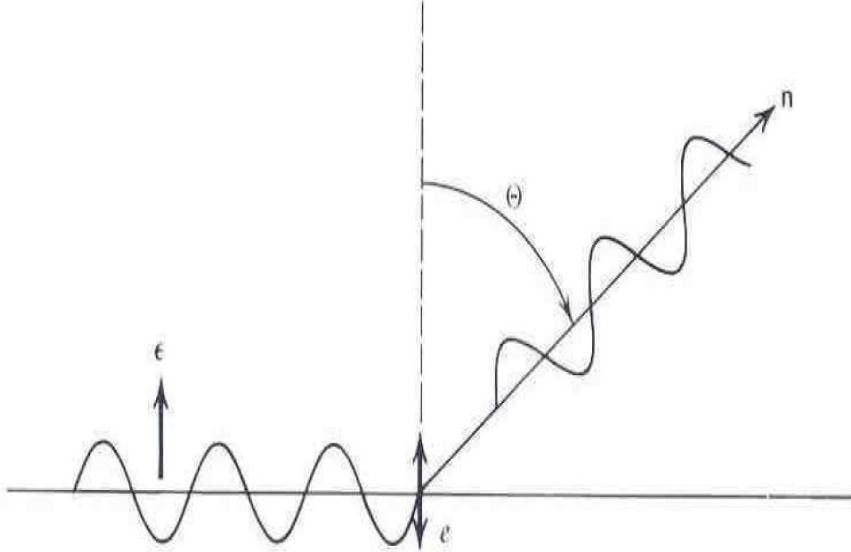
NGC1068 Kinkhabwala+ '02

What if it's intermediate ?

More informations on geometry?

# Polar Scattered Seyfert-1 Galaxy

Refer to Rene Goosmann's talk



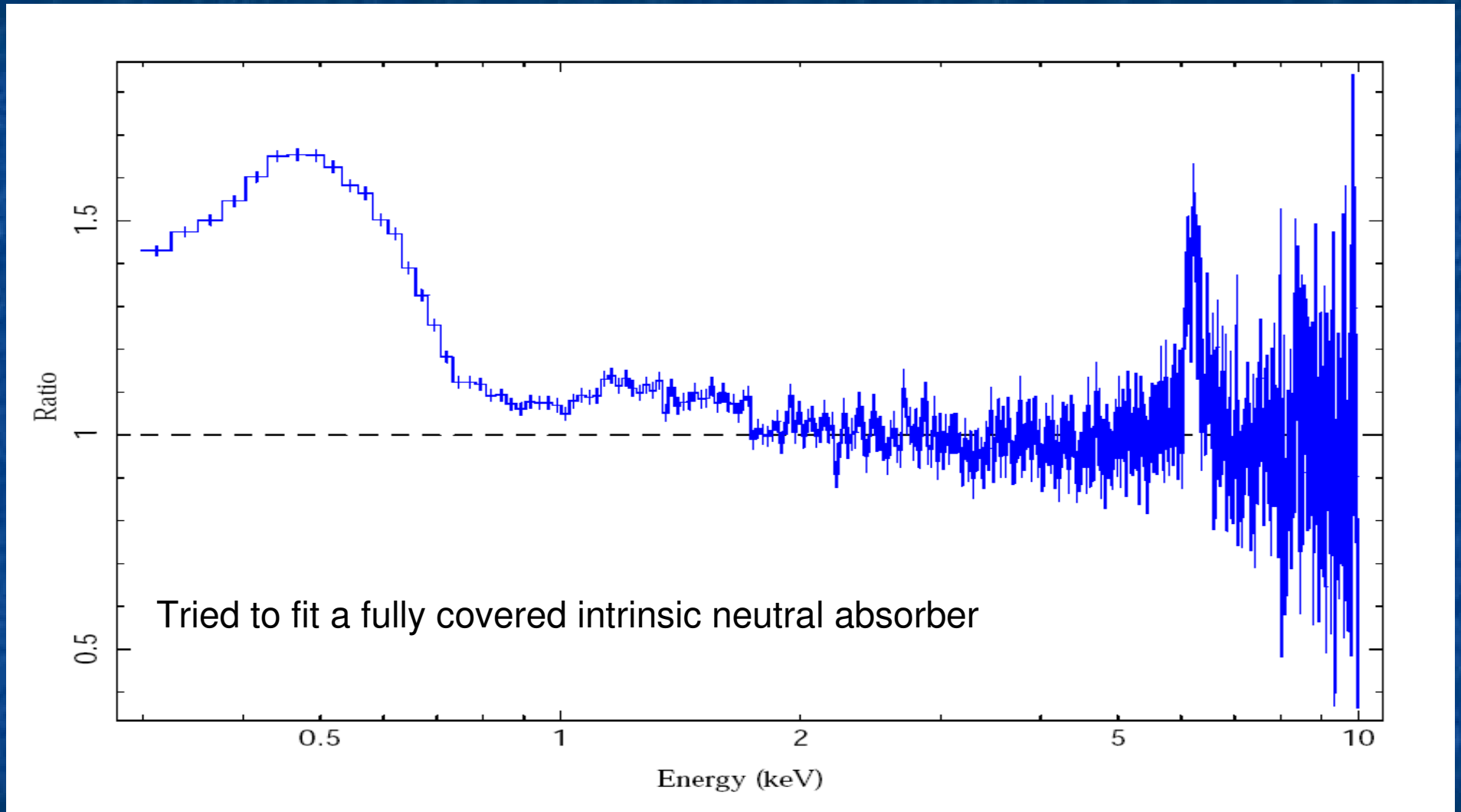
MRK 704

Smith+ '04

# MRK 704

- Nearby galaxy  $z=0.029$
- Moderate Flux  $\sim 1.1 * 10^{-11}$  erg cm<sup>-2</sup> s<sup>-1</sup>  
(2-10 keV)
- Presence of warm absorbers

Fe K alpha line narrow  $\sim \sigma=0.1$  keV



As a Seyfert1, one would expect to have a direct view of the central part

Fit did not improve (with zwabs).



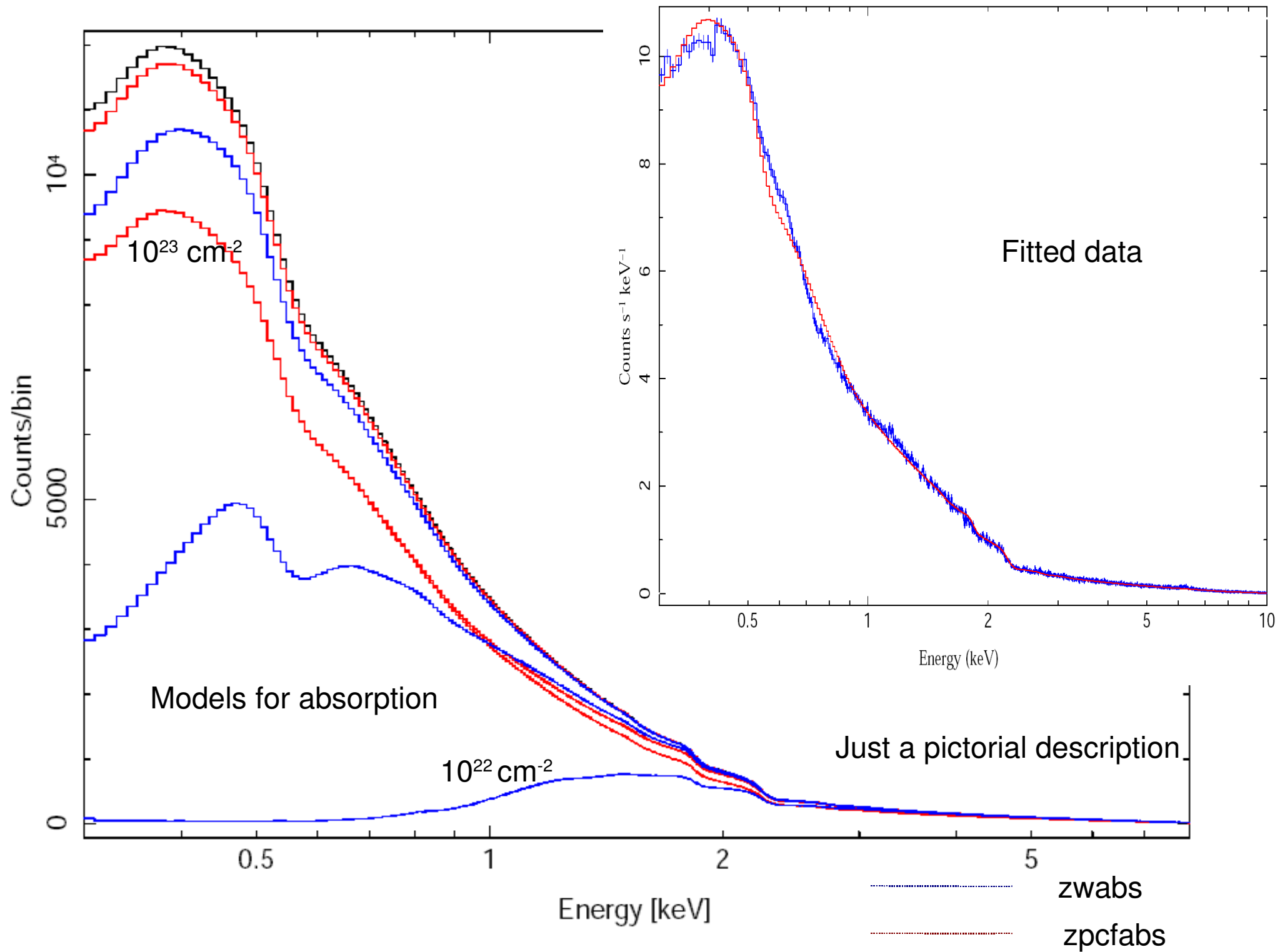
Used a partially covering neutral absorber.

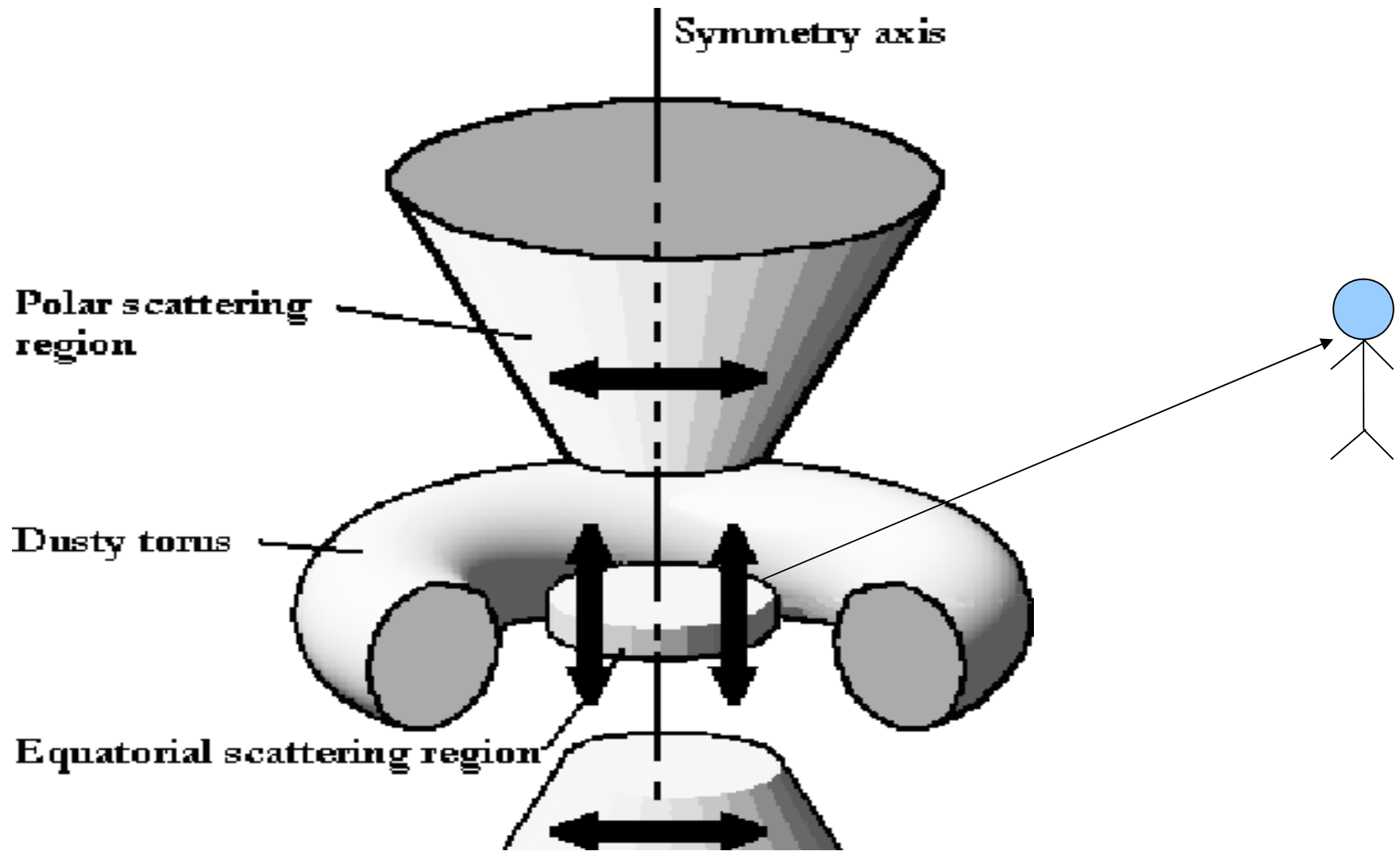


Fit improved.

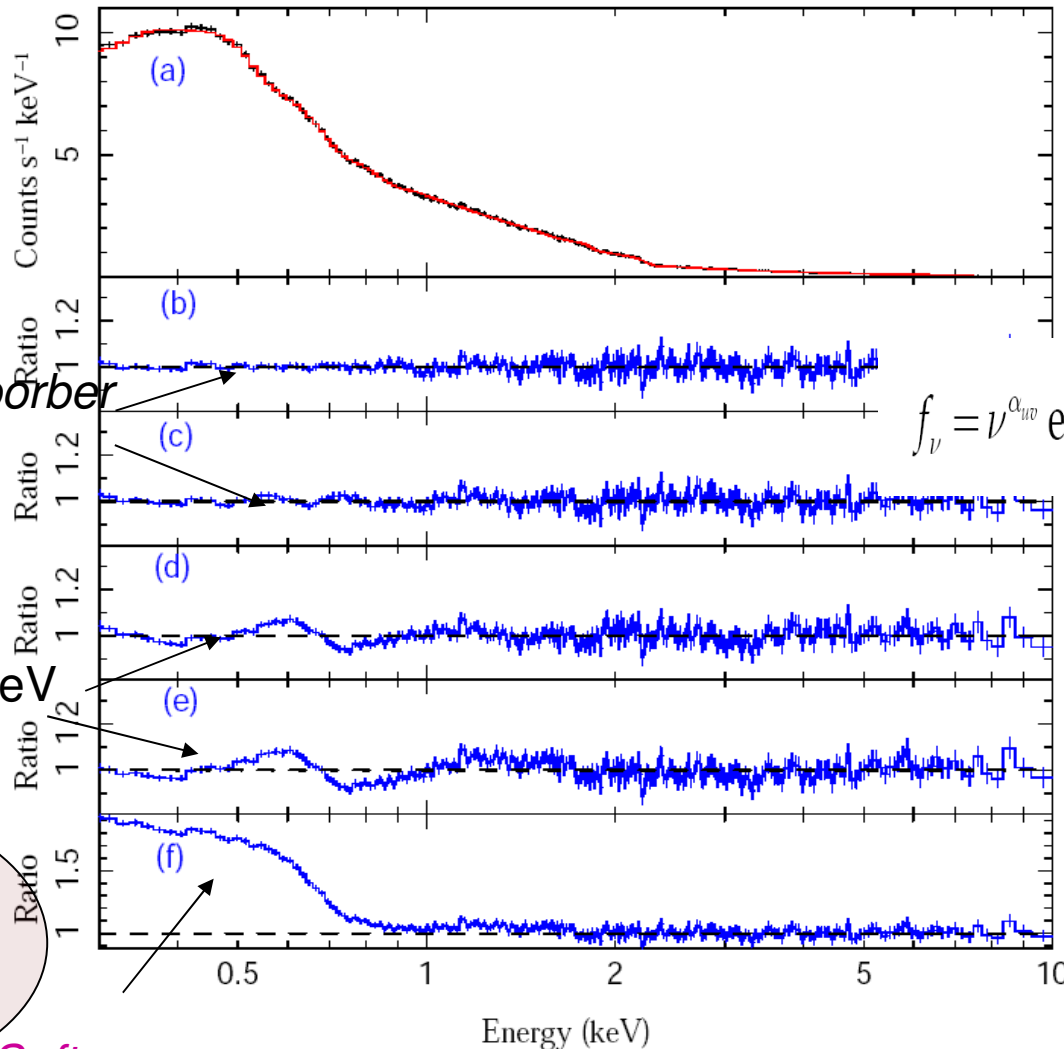
$$C_v \sim 0.2, N_H = 10^{23} \text{ cm}^{-2}$$







# The broad band EPIC-PN spectrum (0.3-10 keV)



Warm absorbers modeled with Cloudy

Fitted with Warm absorber model

$$f_{\nu} = \nu^{\alpha_{uv}} \exp(-h\nu / kT_{BB}) \exp(-kT_{IR} / h\nu) + a\nu^{\alpha_x}$$

Kirk korista continuum

kT = 0.085 , 0.22 keV

Soft-excess+ broadband Continuum also tested with Reflection model Ross+Fabian '05

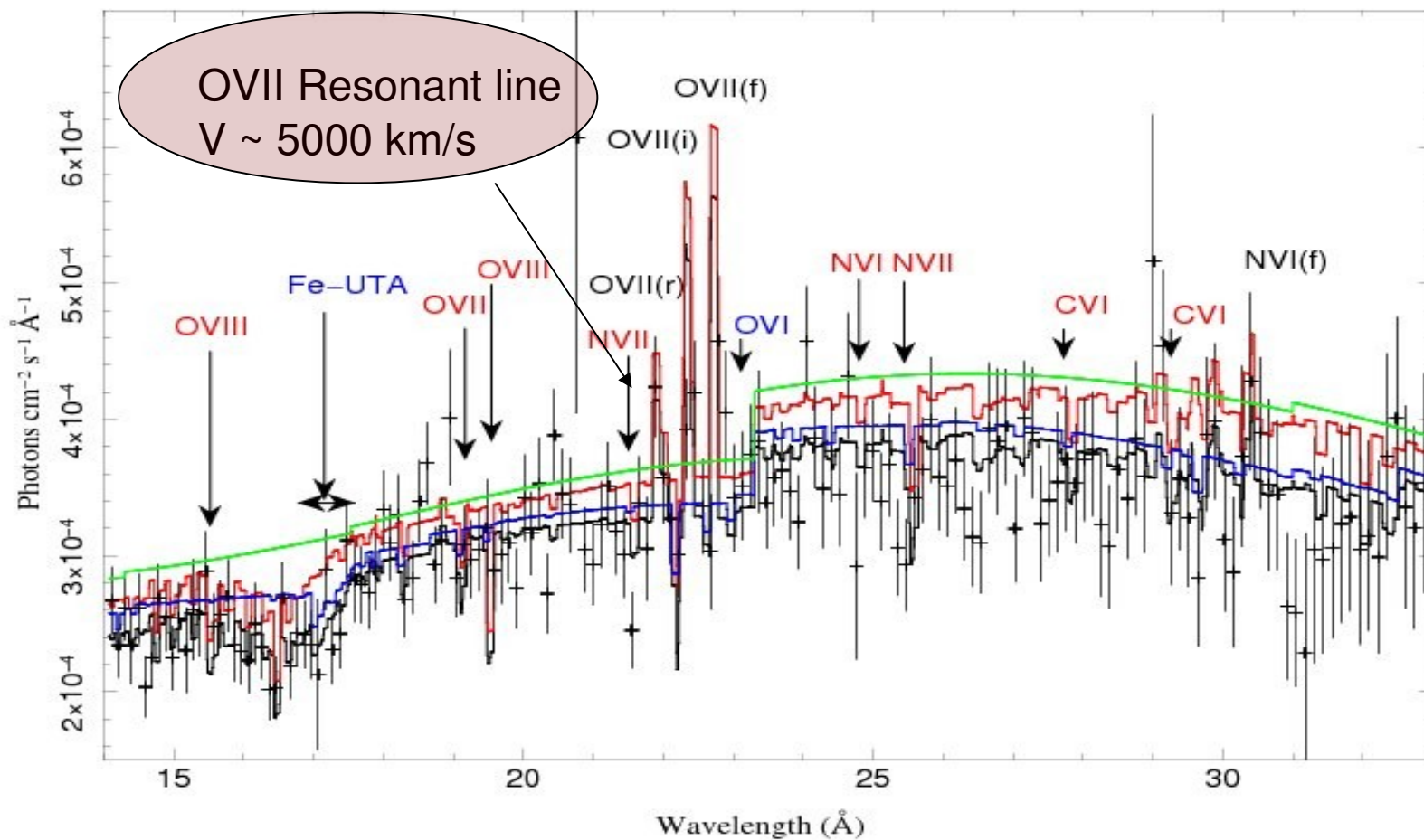
Soft excess

# The high resolution RGS analysis

Winchester, 21 July '11

# The RGS spectrum

(fitted with CLOUDY absorption and emission table models)



# Warm absorber scenario

## Warm absorber 1-

$$N_{\text{H}} = 1 * 10^{20} \text{ cm}^{-2}$$

$$\log(\xi) = 2.7$$

$$\text{Outflow-velocity} = 540 \text{ km/sec}$$

## Warm absorber 2-

$$N_{\text{H}} = 2 * 10^{20} \text{ cm}^{-2}$$

$$\log(\xi) = 1.27$$

$$\text{Outflow-velocity} = 1350 \text{ km/sec}$$

Spherical geometry assumed

Table 4

Details of the Calculated Warm Absorber Parameters of Mrk 704

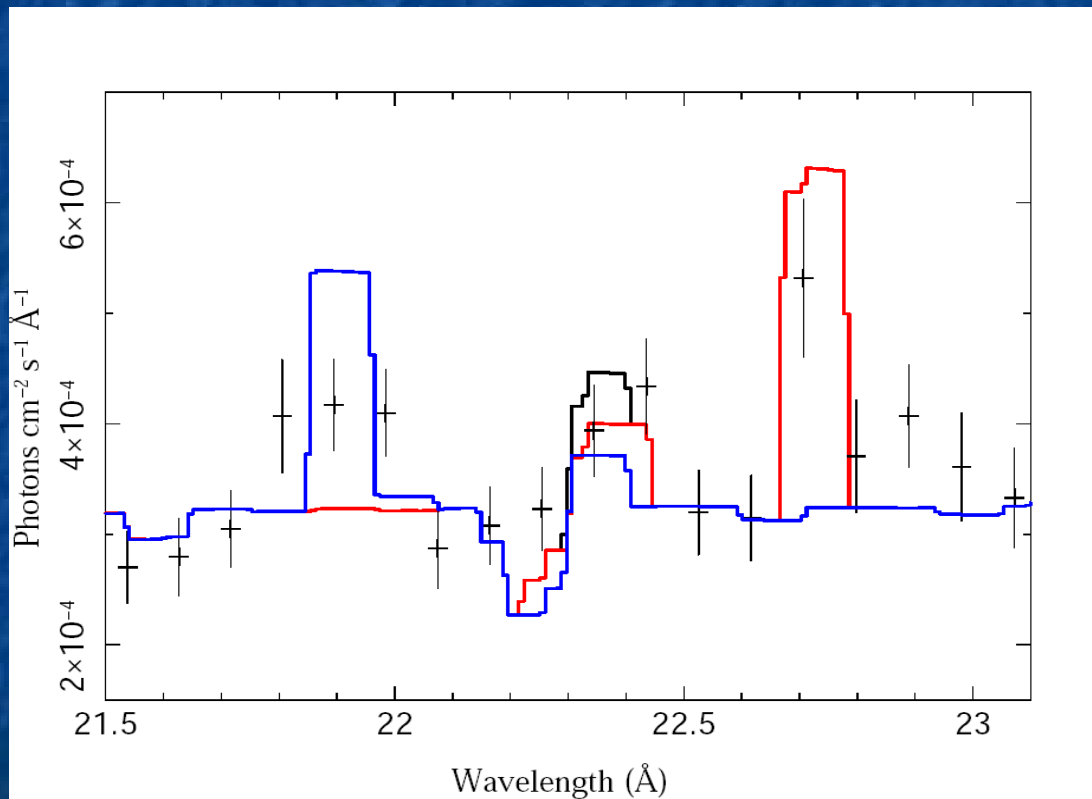
Calculated Parameters	WA Component 1	WA Component 2	Units
	( $\log \xi = 2.7$ )	( $\log \xi = 1.27$ )	
Outflow velocity	$540 \pm 100$	$1350 \pm 300$	$\text{km s}^{-1}$
$r_{\text{min}}$	$R > 10^{-3}$	$R > 2 \times 10^{-3}$	pc
$r_{\text{max}}$	$R < 100$	$R < 10^3$	pc
Volume filling factor ( $C_v$ )	$3.81 \times 10^{-3}$	$2 \times 10^{-5}$	...
Mass outflow rate	$2.5 \times 10^{-5}$	$5.0 \times 10^{-4}$	$M_{\odot} \text{ yr}^{-1}$
$\frac{L_{\text{KE}}}{L_{\text{ion}}}$	$10^{-6}$	$10^{-5}$	...
Width along LOS ( $\Delta R = \frac{N_{\text{H}}}{n_e}$ )	$3 \times 10^{11}$	$5 \times 10^{11}$	cm

# Warm emitter scenario

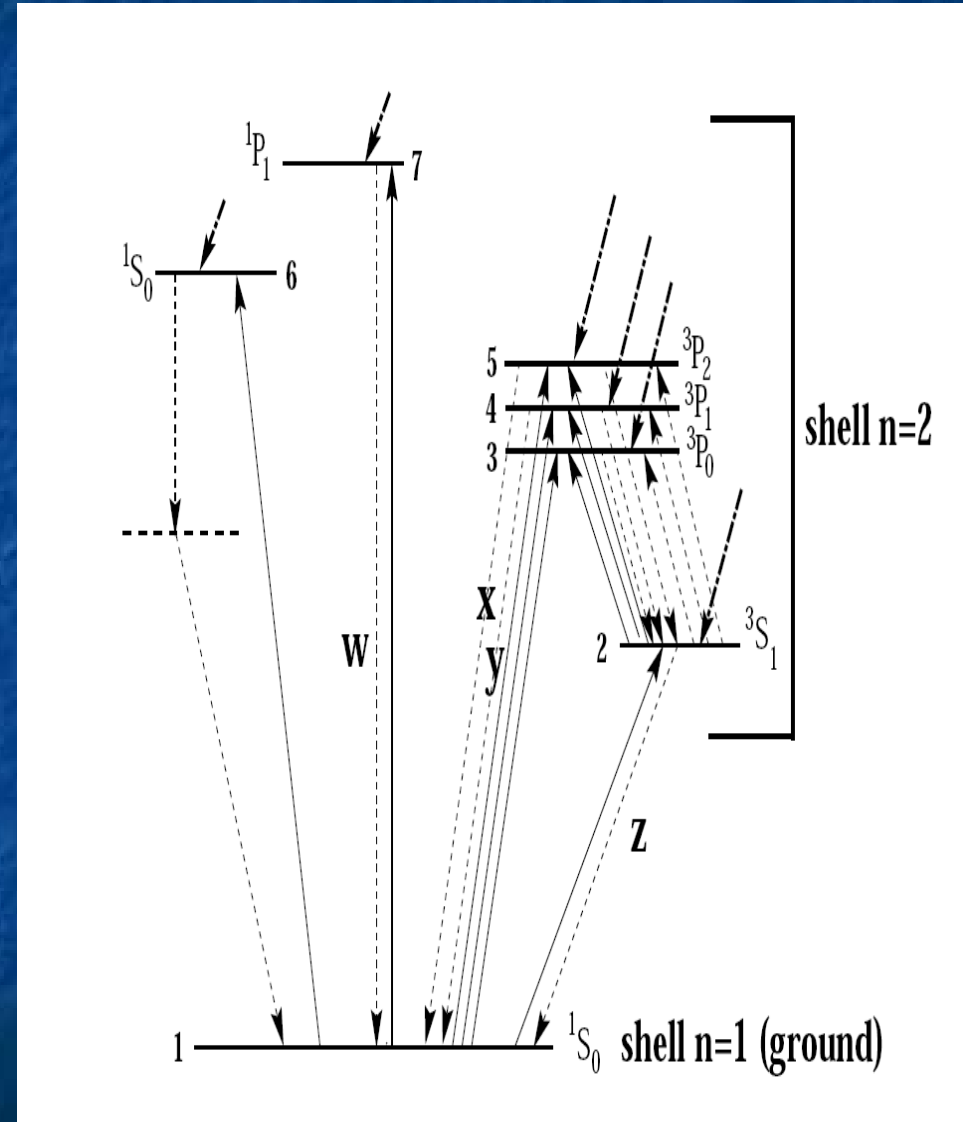
- Emission lines not new, some Sy1s have shown emission lines (MRK509 Behar et al... etc.)
- But given this polar scattering scenario we are tempted to think that it may be generic property and only when the flux level is lower we see them!

# W.E scenario

- Cloud1 and Cloud2



Laha+ '11



Porquet+ '00



# W.E scenario

- Forbidden lines are suppressed by
  1. Strong UV flux ( $\sim 5\text{eV}$  photons)
  2. High density ( $>$  Critical density)

# Warm emitters (possible scenarios)

- 1<sup>st</sup> possibility- We see r, i and f lines

There is a high density phase  $n \sim 10^{13} \text{ cm}^{-3}$

- 2<sup>nd</sup> possibility- We see the i and f lines only.

## Warm emitter 1-

$$N_{\text{H}} = 3.9 \cdot 10^{20} \text{ cm}^{-2}$$

$$\log(\xi) = 1.04$$

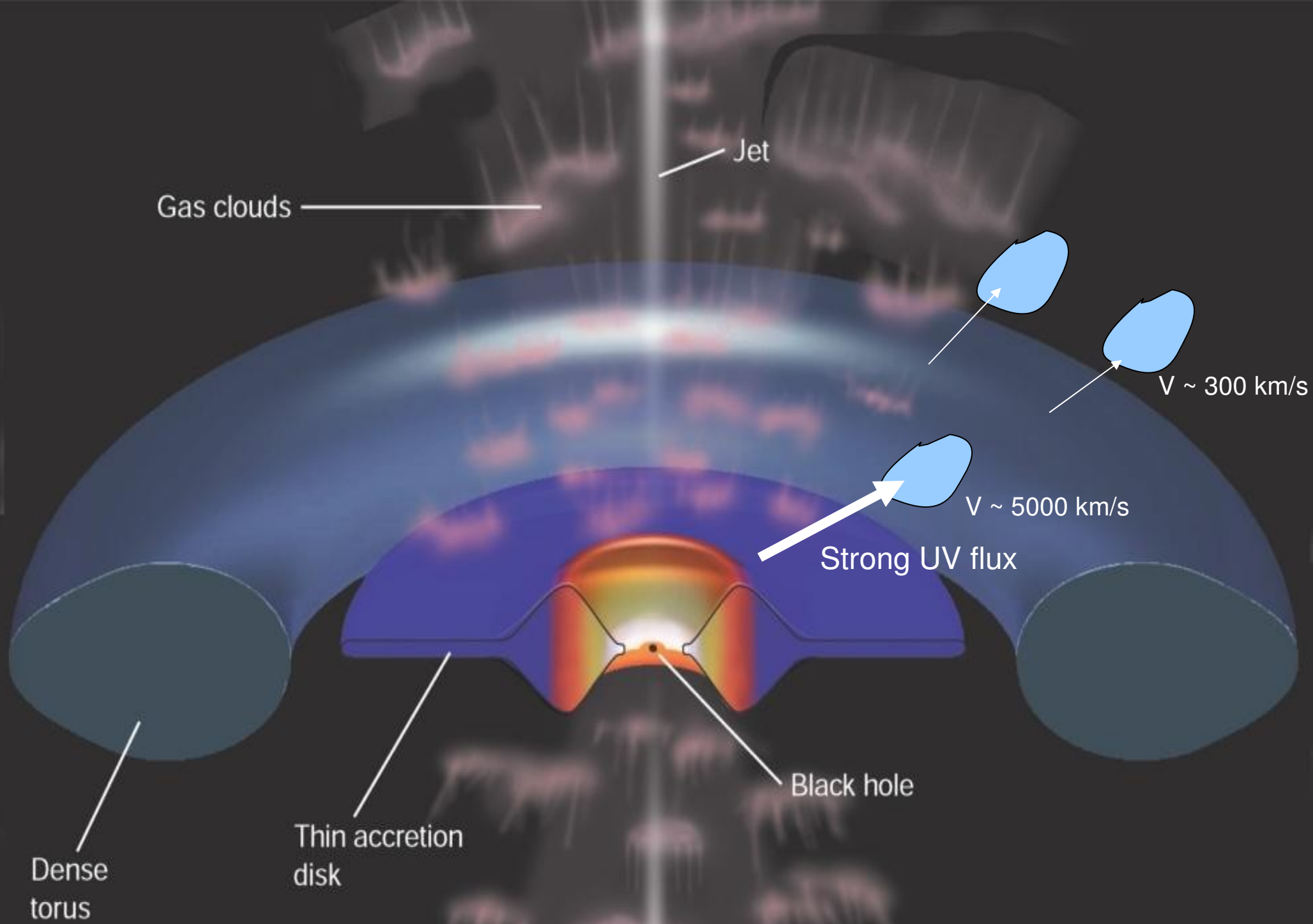
$$\text{Outflow-velocity} = 300 \text{ km/sec}$$

## Warm emitter 2-

$$N_{\text{H}} = 1 \cdot 10^{18} \text{ cm}^{-2}$$

$$\log(\xi) = 1.14$$

$$\text{Outflow-velocity} = 5190 \text{ km/sec}$$



# Summary

- We detected a partial covering neutral absorber
- 2 components of WA, in outflow.
- 2 components of WE. Although a uniform distribution is not ruled out.

# Conclusions

- Our detections of WA and WE falls in line with the PSS scenario but to put robust constraints on the geometry we need to have high SNR data. Follow-up...
- Variability studies would be very interesting for these PSS sources. (Matt+ '11)
- Also a simultaneous multiwavelength studies in optical UV and X-rays.