

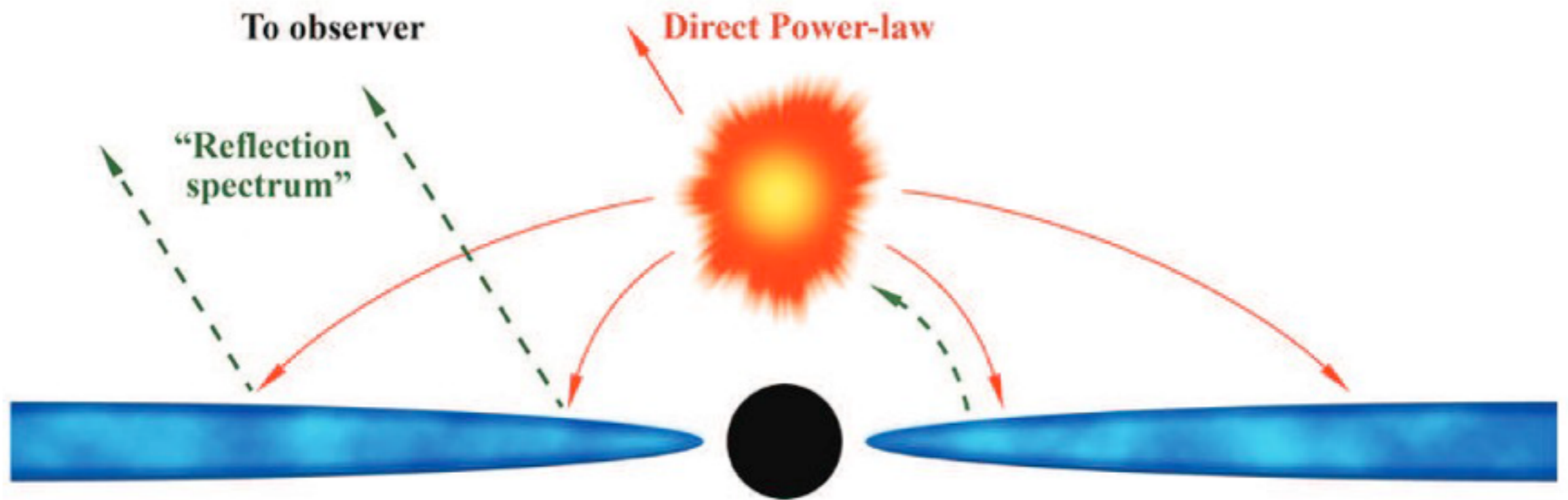
# Relativistic Fe Ka line in bright Seyfert 1 galaxies

Giulia Mantovani  
Paul Nandra, Gabriele Ponti

Shining from the heart of darkness:  
Black hole accretion and jets

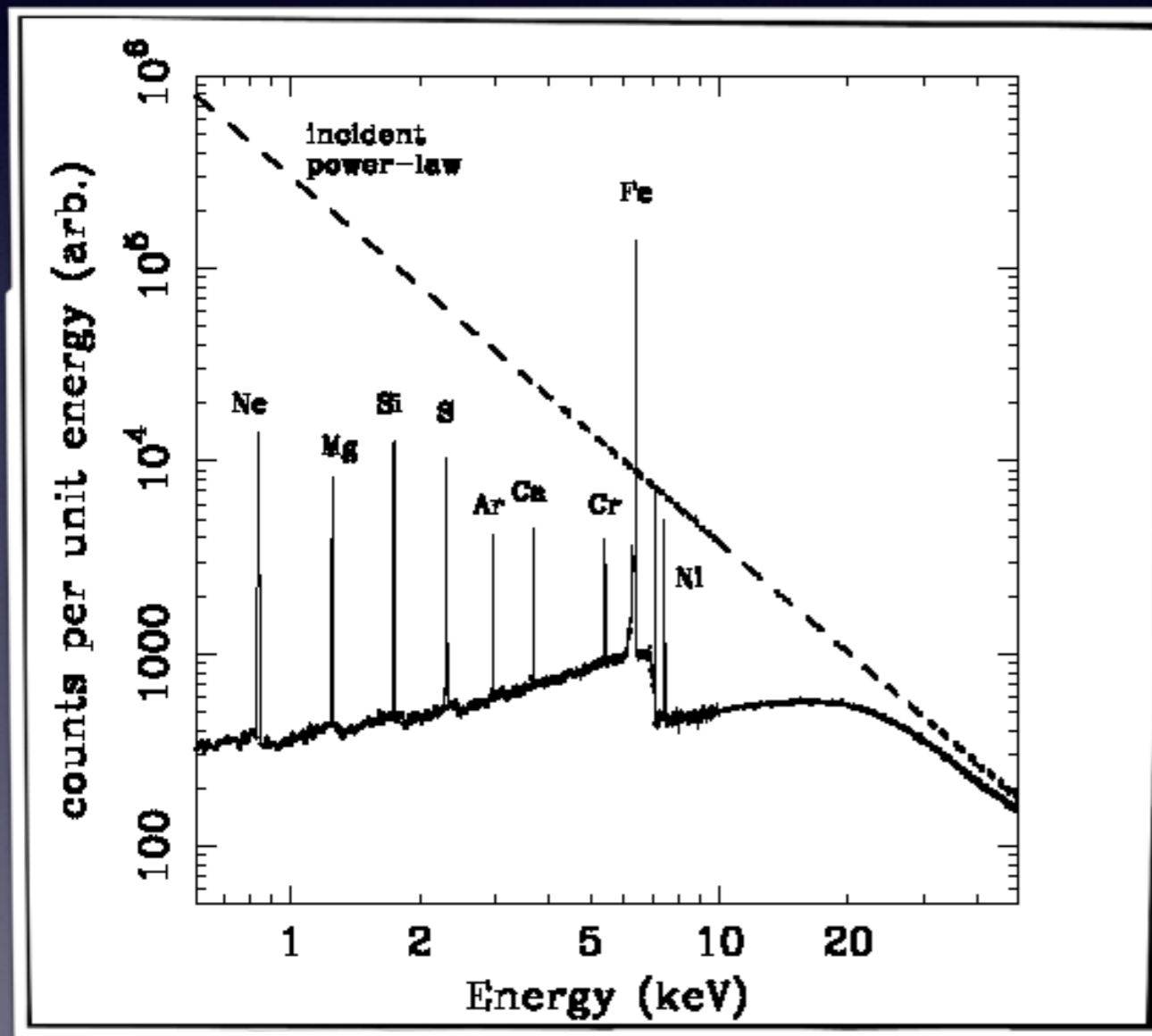


# X-ray Emission



# X-ray emission

The X-ray analysis is a fundamental key to probe the innermost regions of the AGNs.



- Continuum power law
- Fluorescence emission lines
- Compton Hump

# Open Questions

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1) Is a relativistic Fe line ubiquitous in Seyfert 1 galaxies?

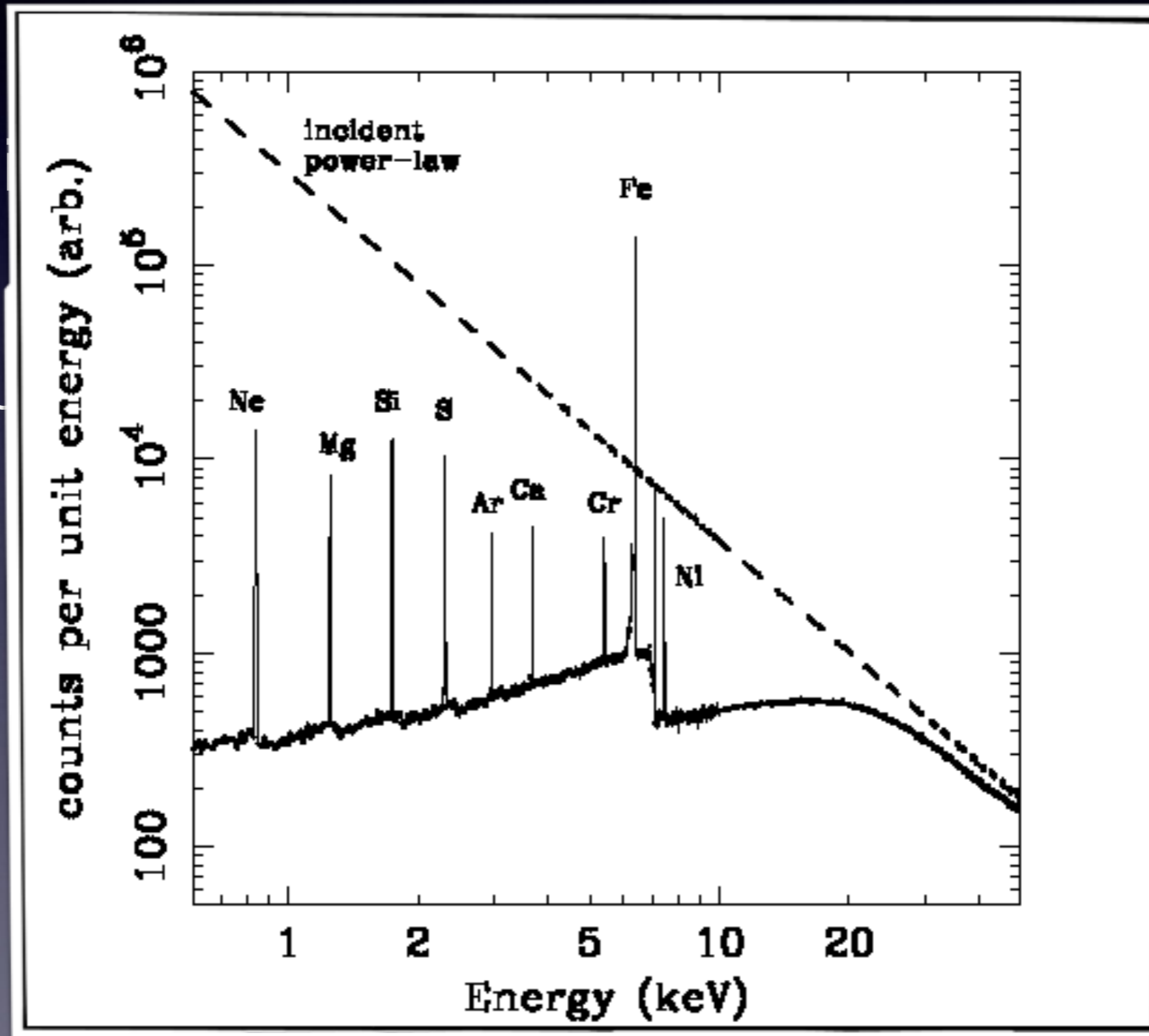
# Open Questions

- 1) Is a relativistic Fe line ubiquitous in Seyfert 1 galaxies?
- 2) If this is true, is the Fe line flux linked to the Compton hump?

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1) Is a relation

2) If this is true



galaxies?

Compton hump?

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2) If this is true, is the Fe line flux linked to the Compton hump?

3) Is it possible to measure the size of the Comptonizing region?

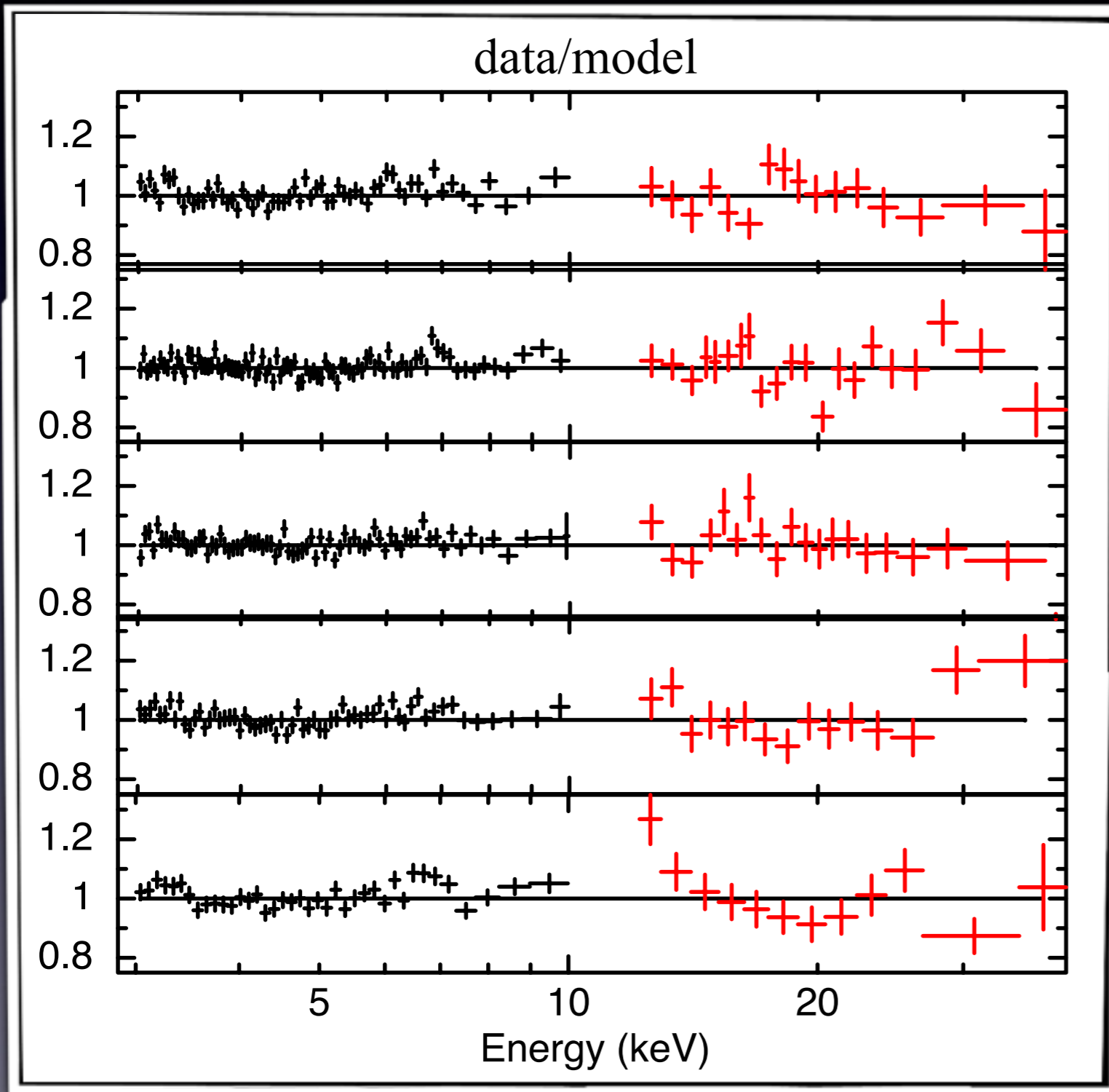


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- 3) Is it possible to measure the size of the Comptonizing region?

Sample of Seyfert 1 objects observed with Suzaku

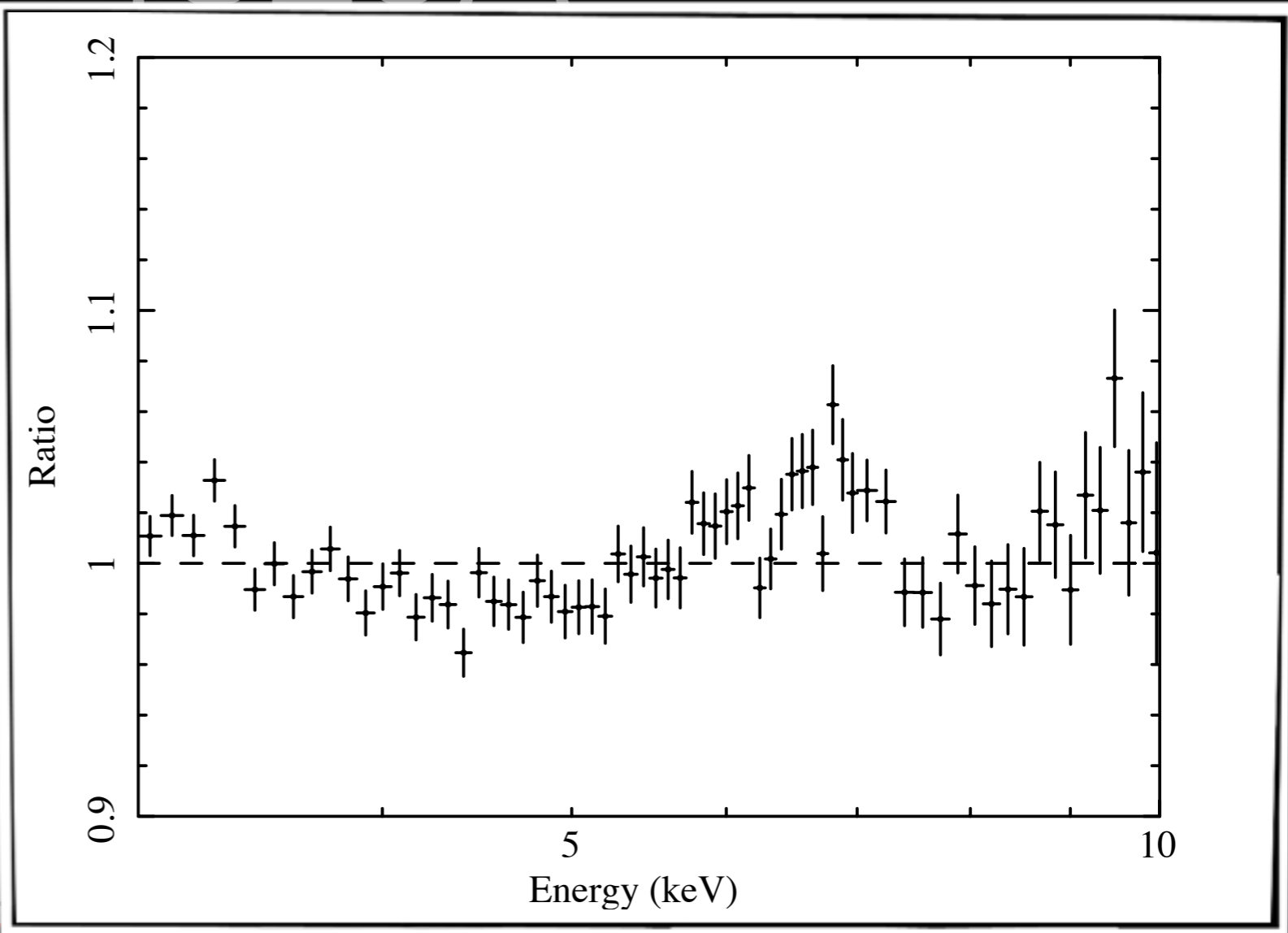
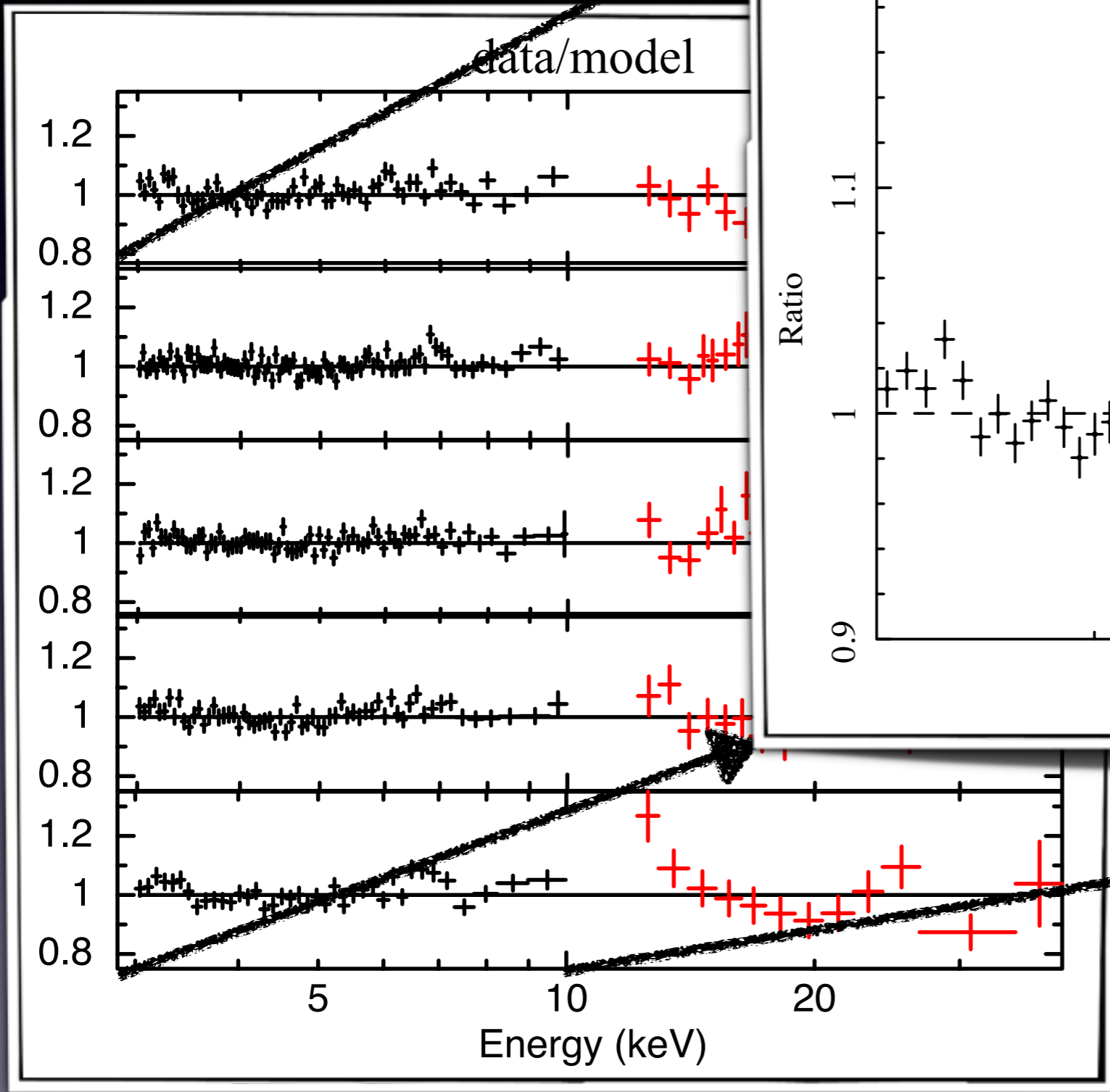
# IC 4329A



Significance between  
2-4 $\sigma$  for single  
observation

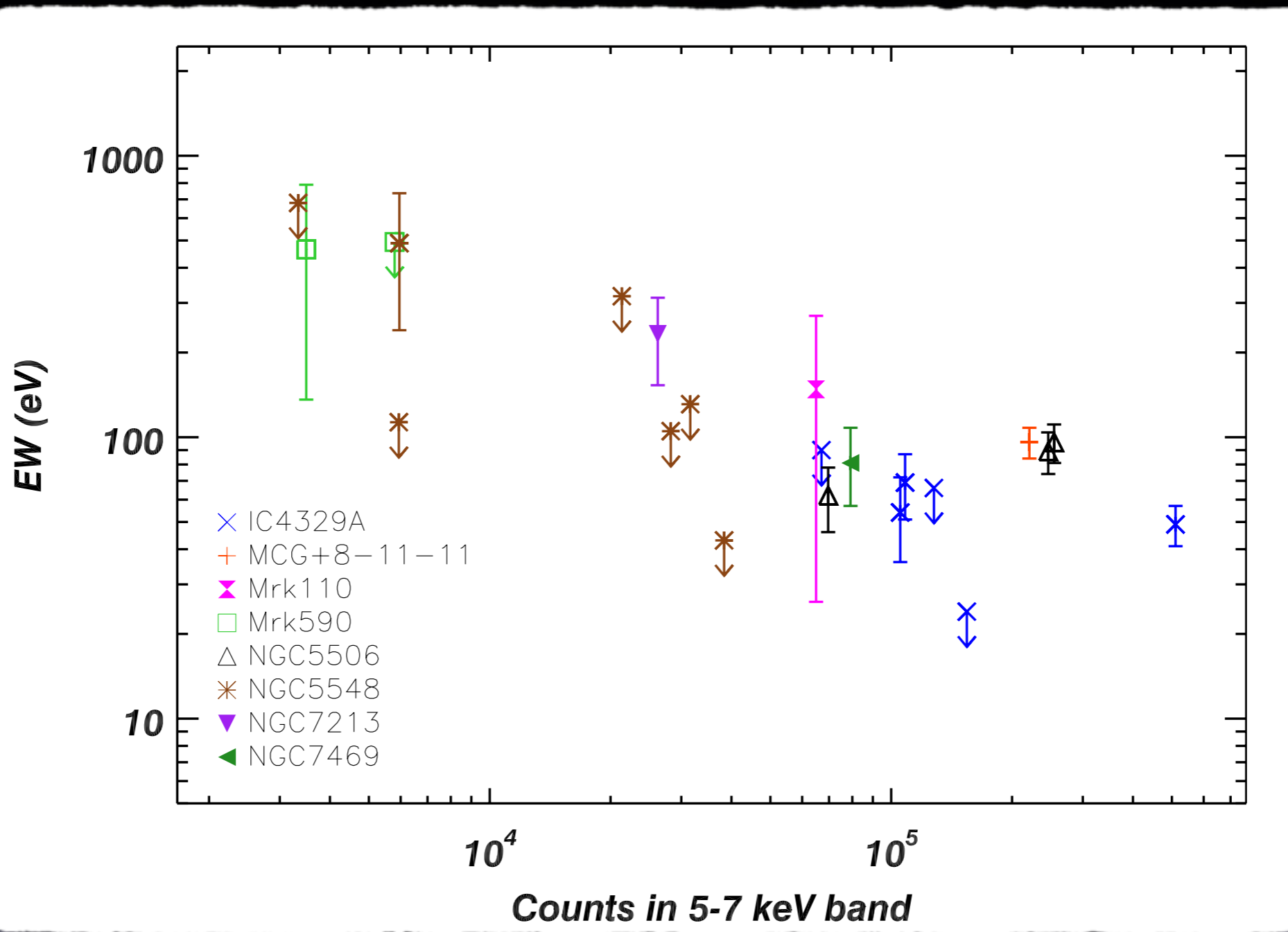
Model:  
zwabs\*(pexrav+zgauss)

# IC 4329A



Model:  $zwabs^*(pexrav + zgauss + Laor)$

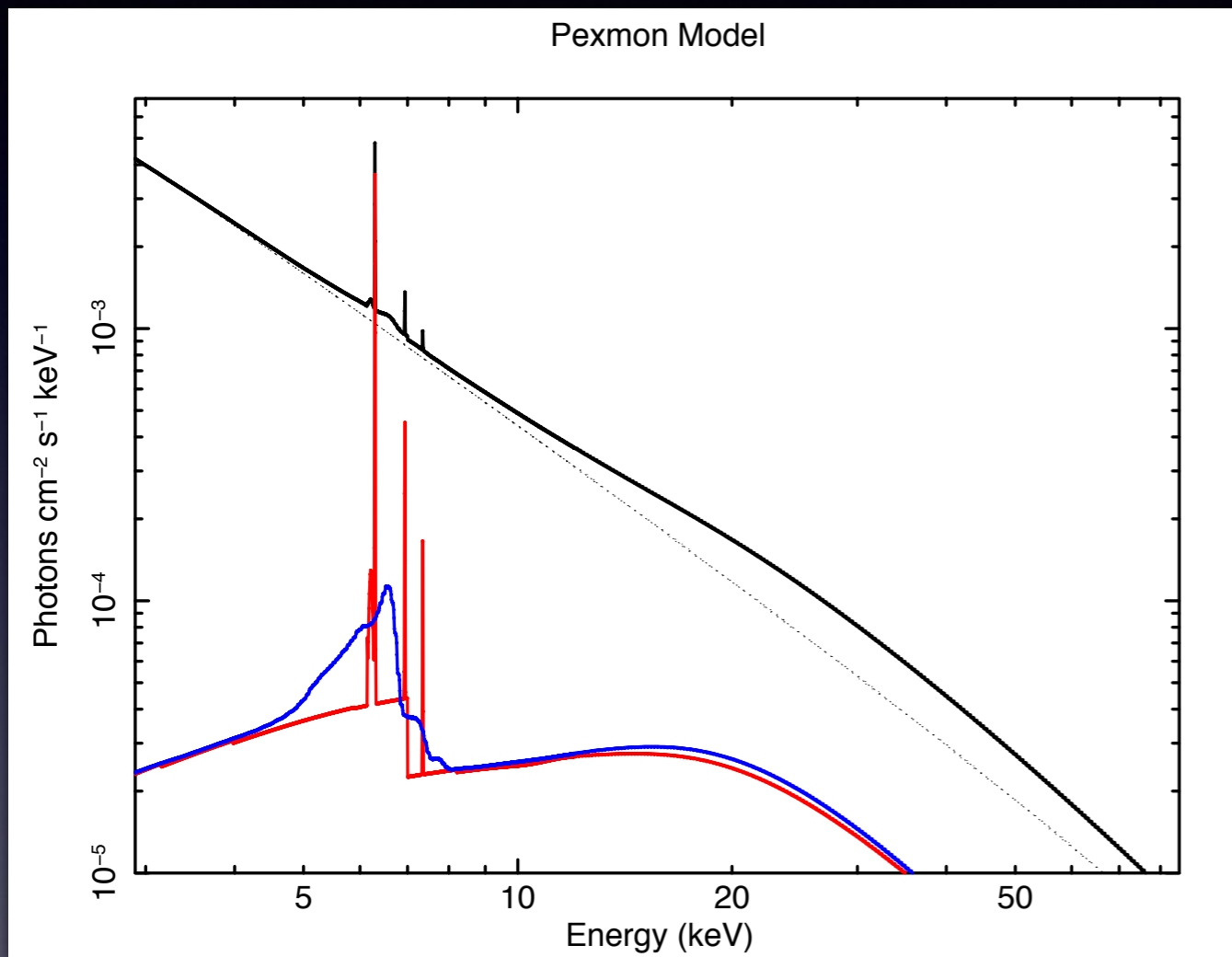
# Sample



Detections for counts  $> 4 \times 10^4$   
Relativistic Iron Ka line common feature in AGN

# Relativistic Pexmon

Nandra et al. 2007



Fe K $\alpha$  (6.4 keV), Fe K $\beta$  (7.06 keV)  
flux 11.3% of K $\alpha$ , Ni K $\alpha$  (7.47 keV)  
flux 5% of K $\alpha$

Compton Reflection (pexrav)

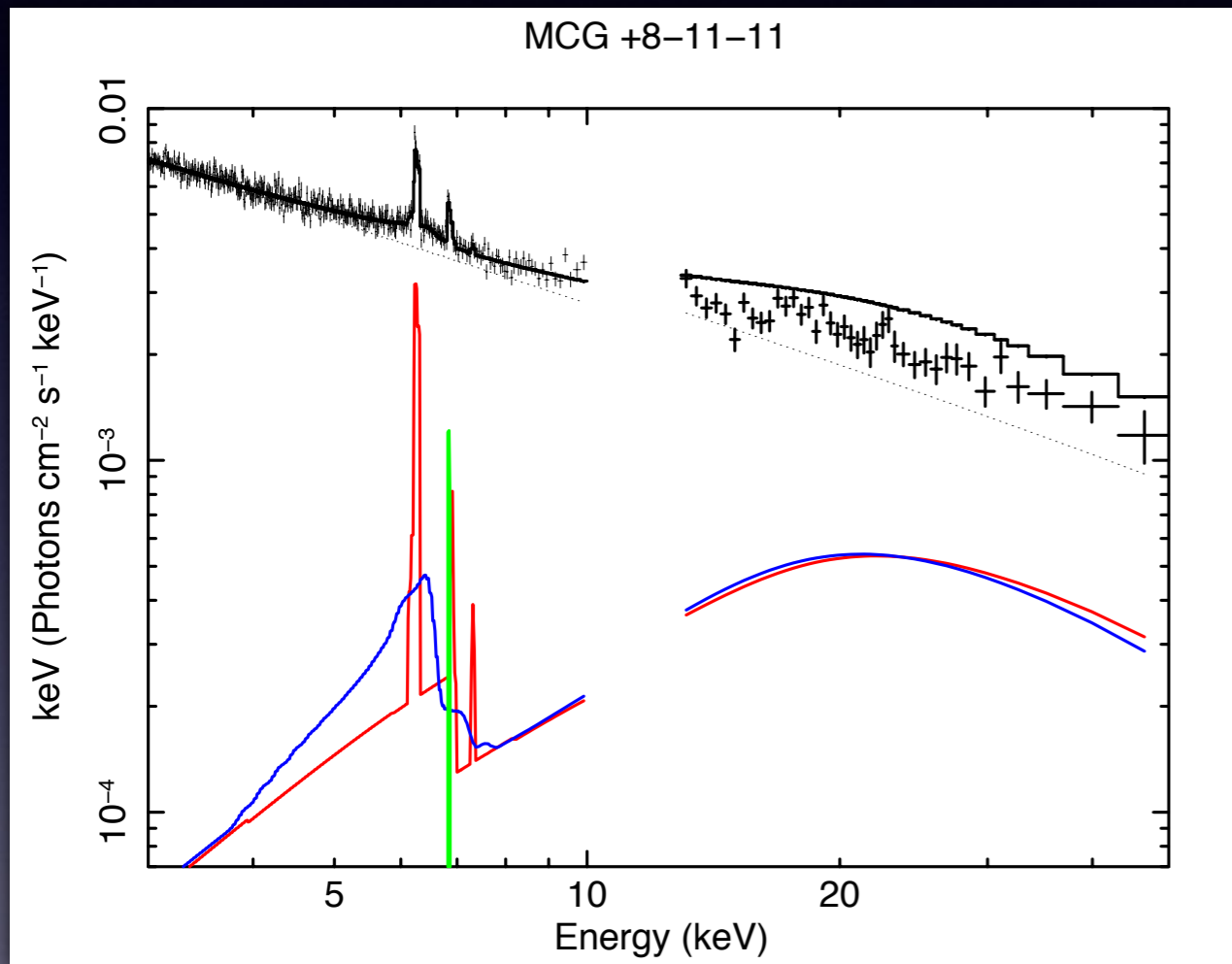
Fe K $\alpha$  Compton shoulder

Fe K $\alpha$  flux linked to Compton Hump

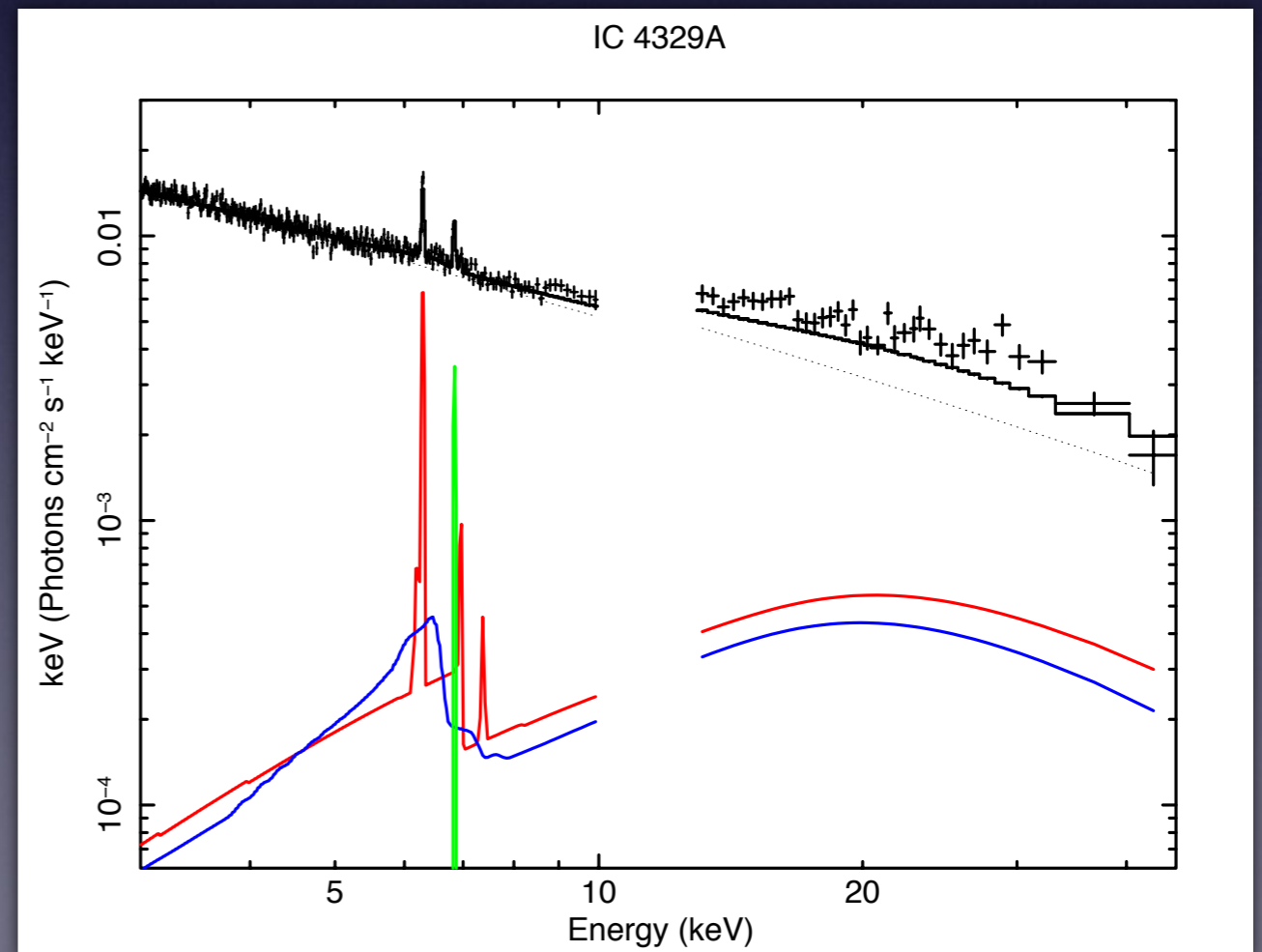
In general, the Pexmon model gives similar fit to the data compared to the phenomenological one

Mantovani et al. 2016

# Relativistic Pexmon

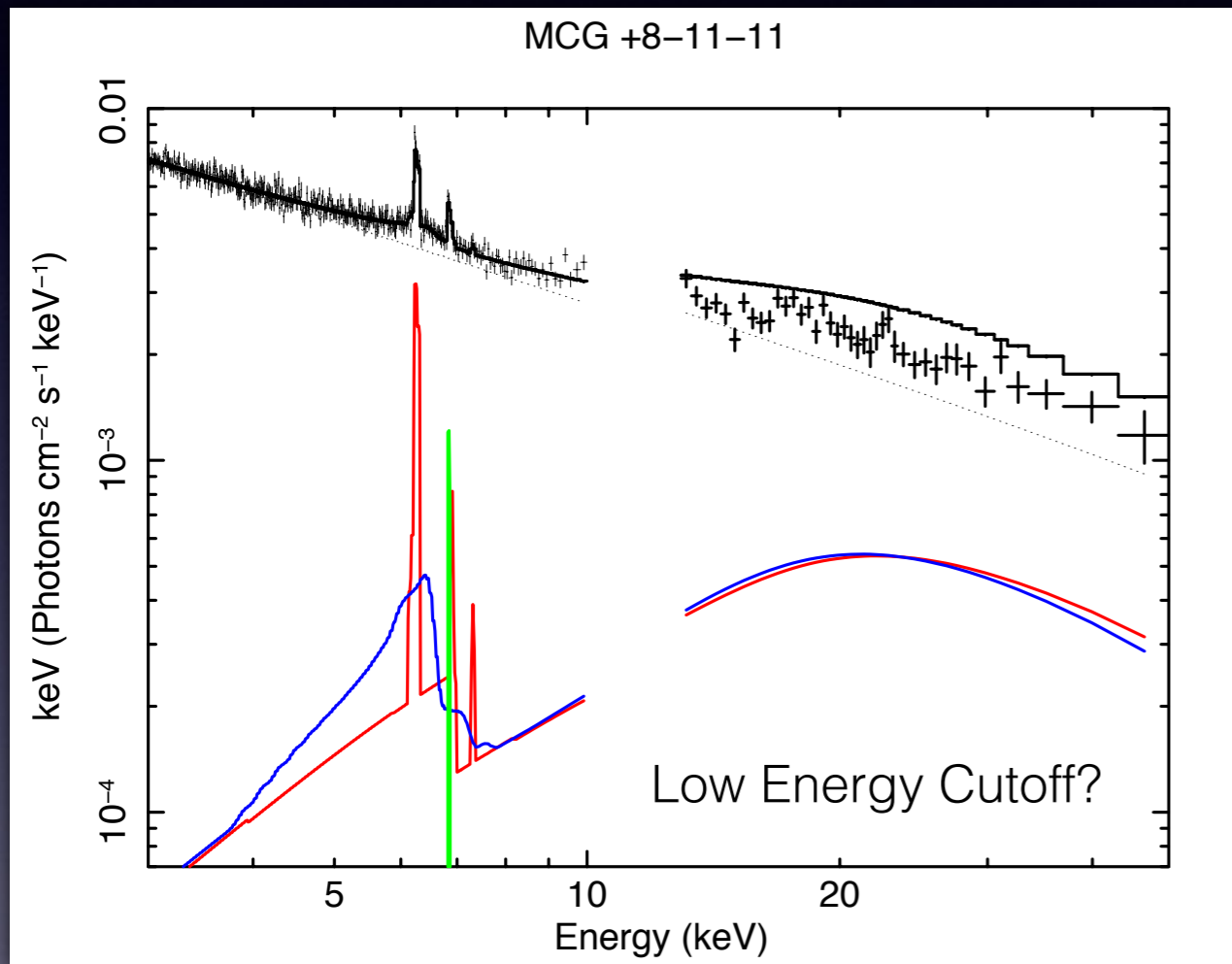


MCG+8-11-11  $\Delta\chi^2/\Delta$  d.o.f.  $> 123/1$

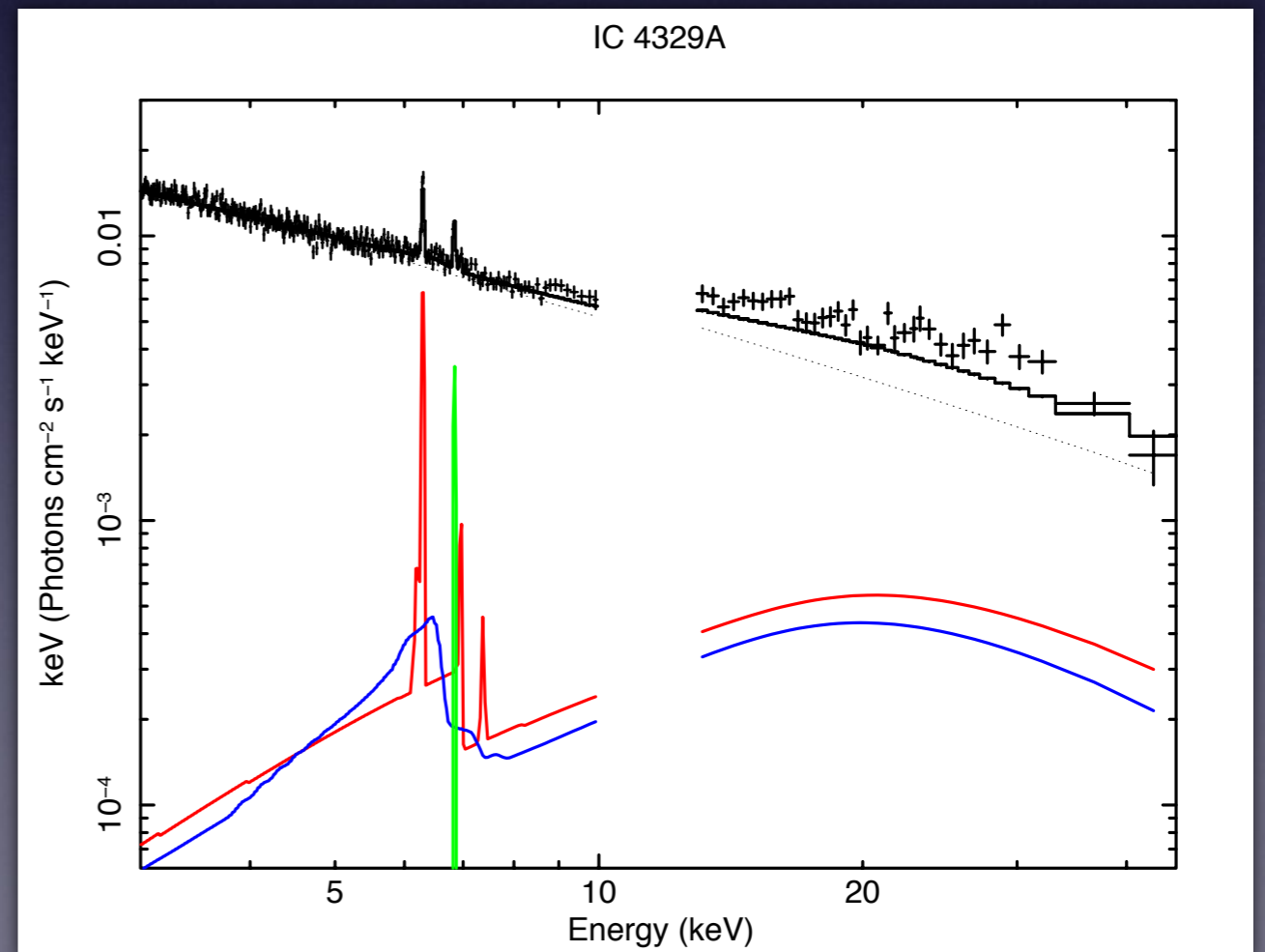


IC 4329A  $\Delta\chi^2/\Delta$  d.o.f.  $> 57/1$

# Relativistic Pexmon

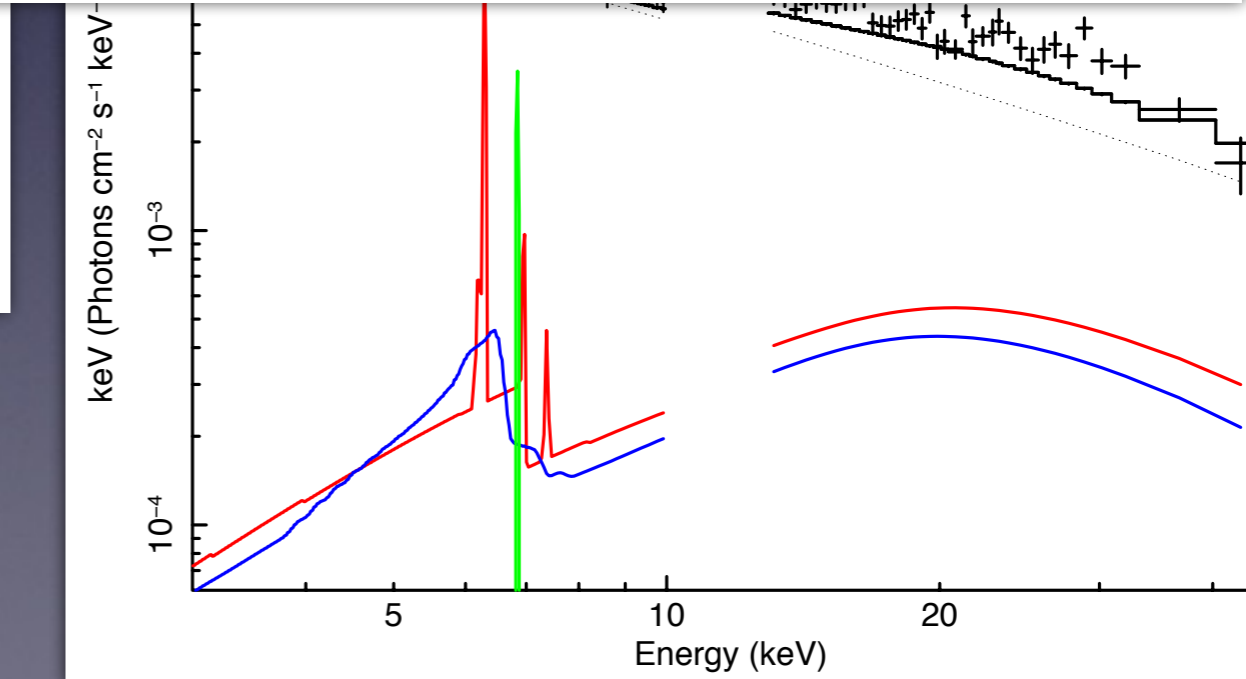
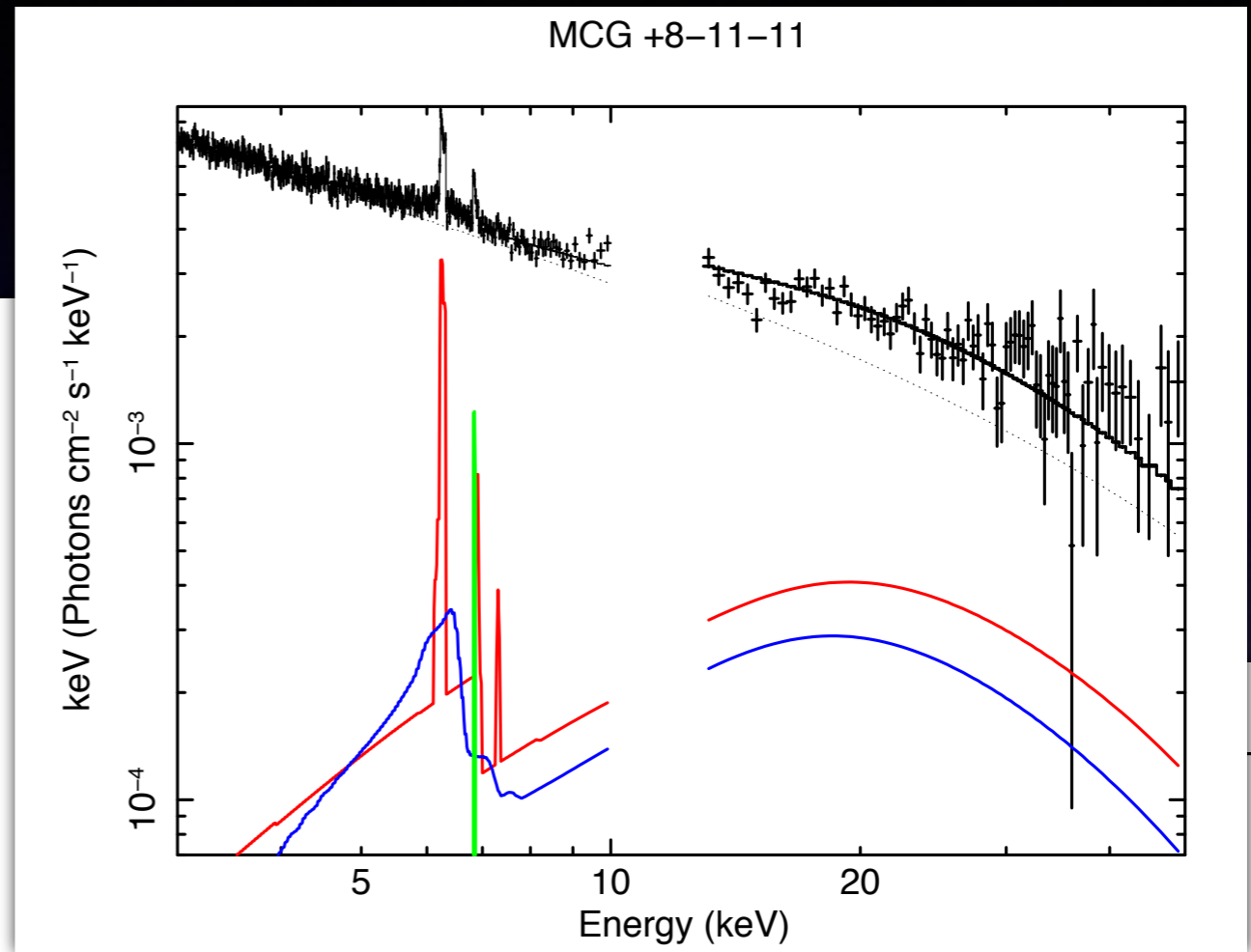
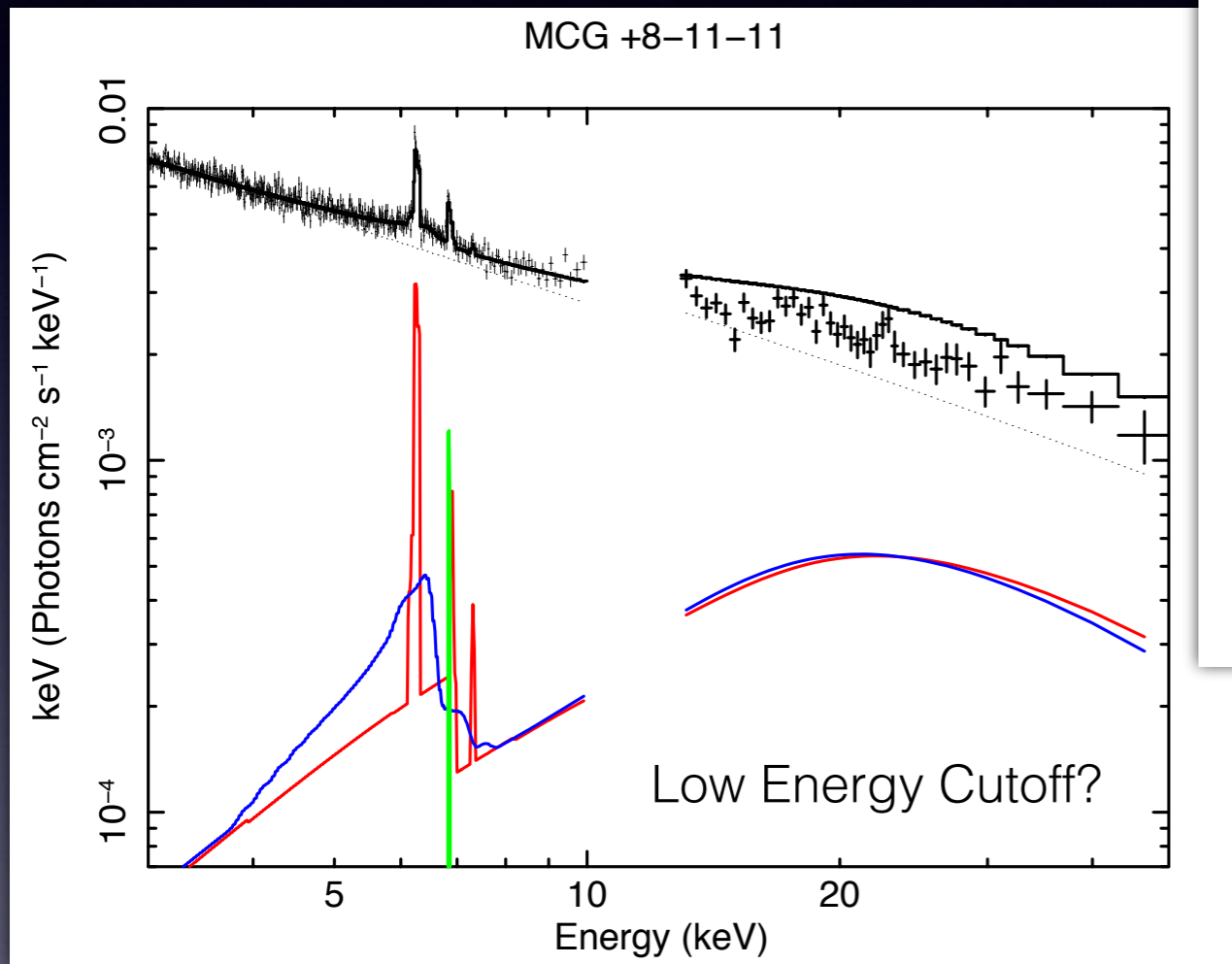


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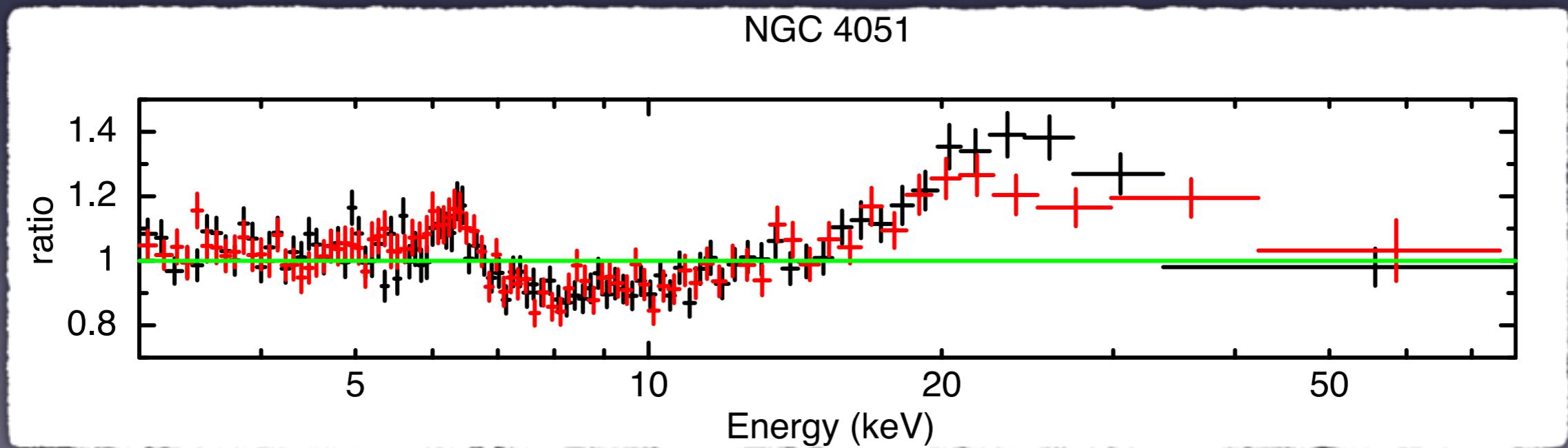
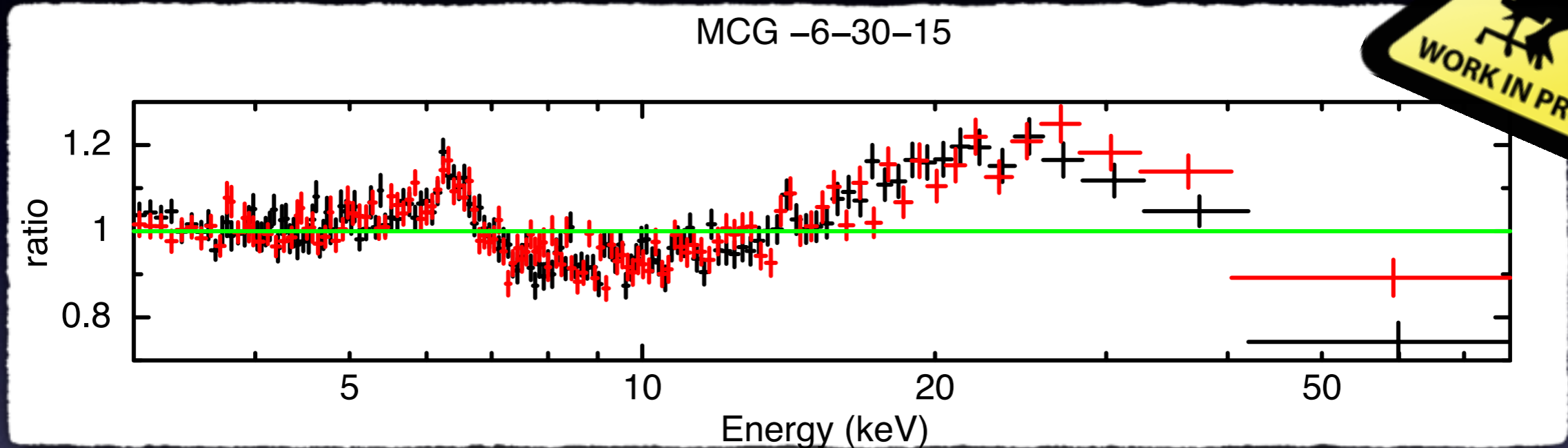


IC 4329A  $\Delta\chi^2/\Delta$  d.o.f.  $> 57/1$

Mantovani et al. 2016



# Evidence for light bending in MCG -6-30-15 and NGC 4051



NuSTAR spectra

Mantovani et al., in prep

# Evidence for light bending in MCG -6-30-15 and NGC 4051

- Strong Fe line (EW ~ 300 eV)
- High reflection fraction ( $R > 1$ )



# Evidence for light bending in MCG -6-30-15 and NGC 4051

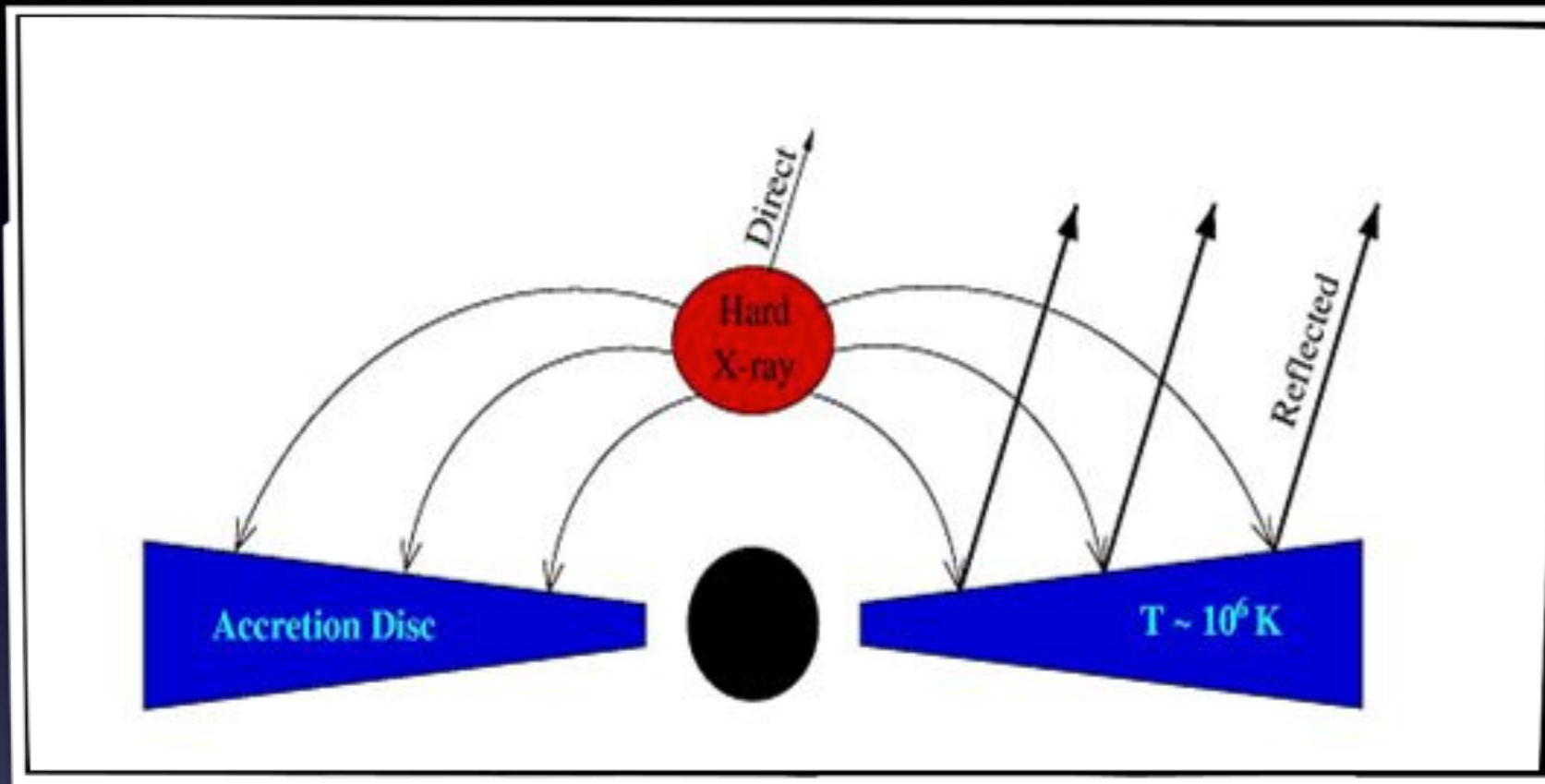
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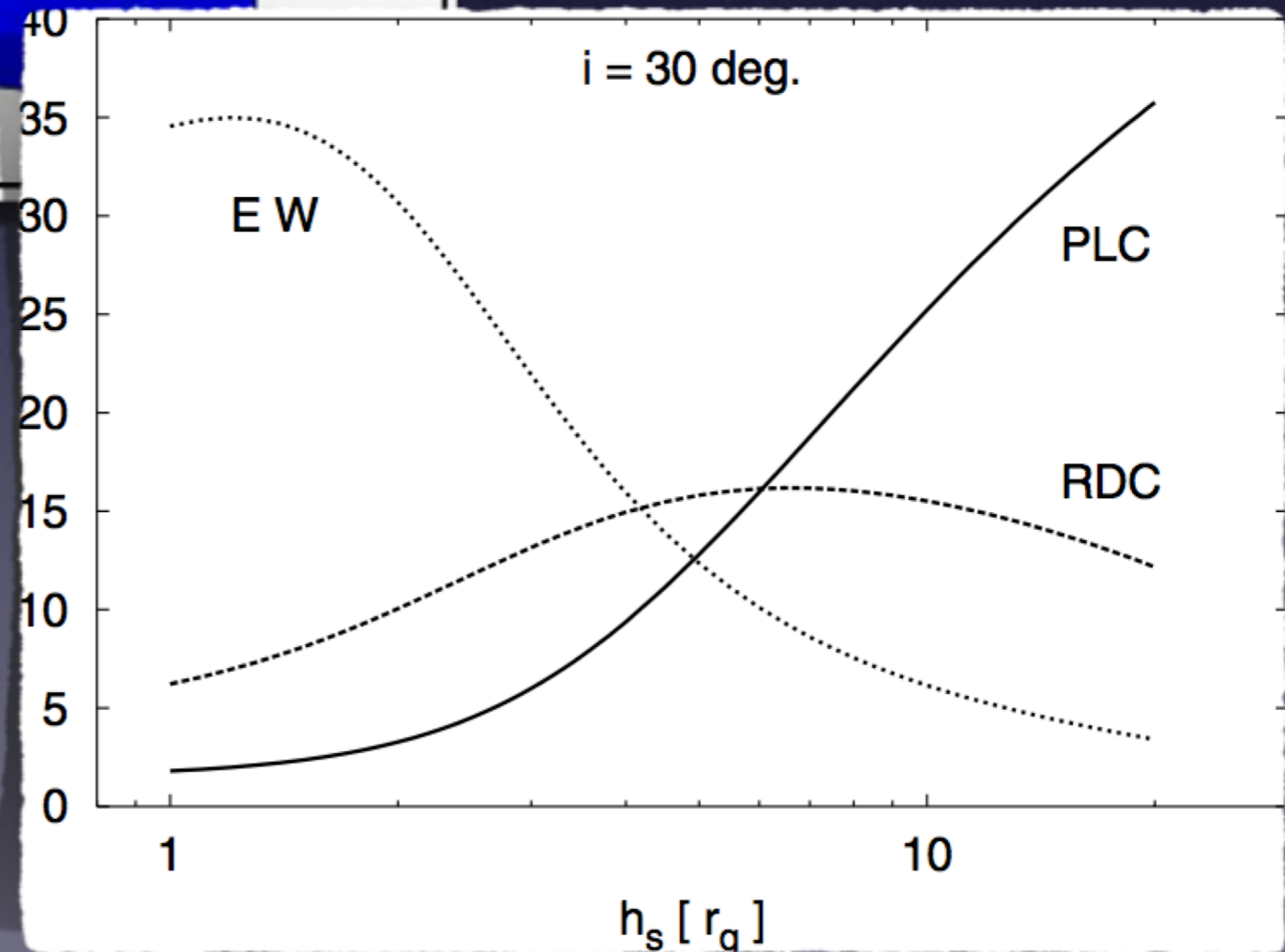
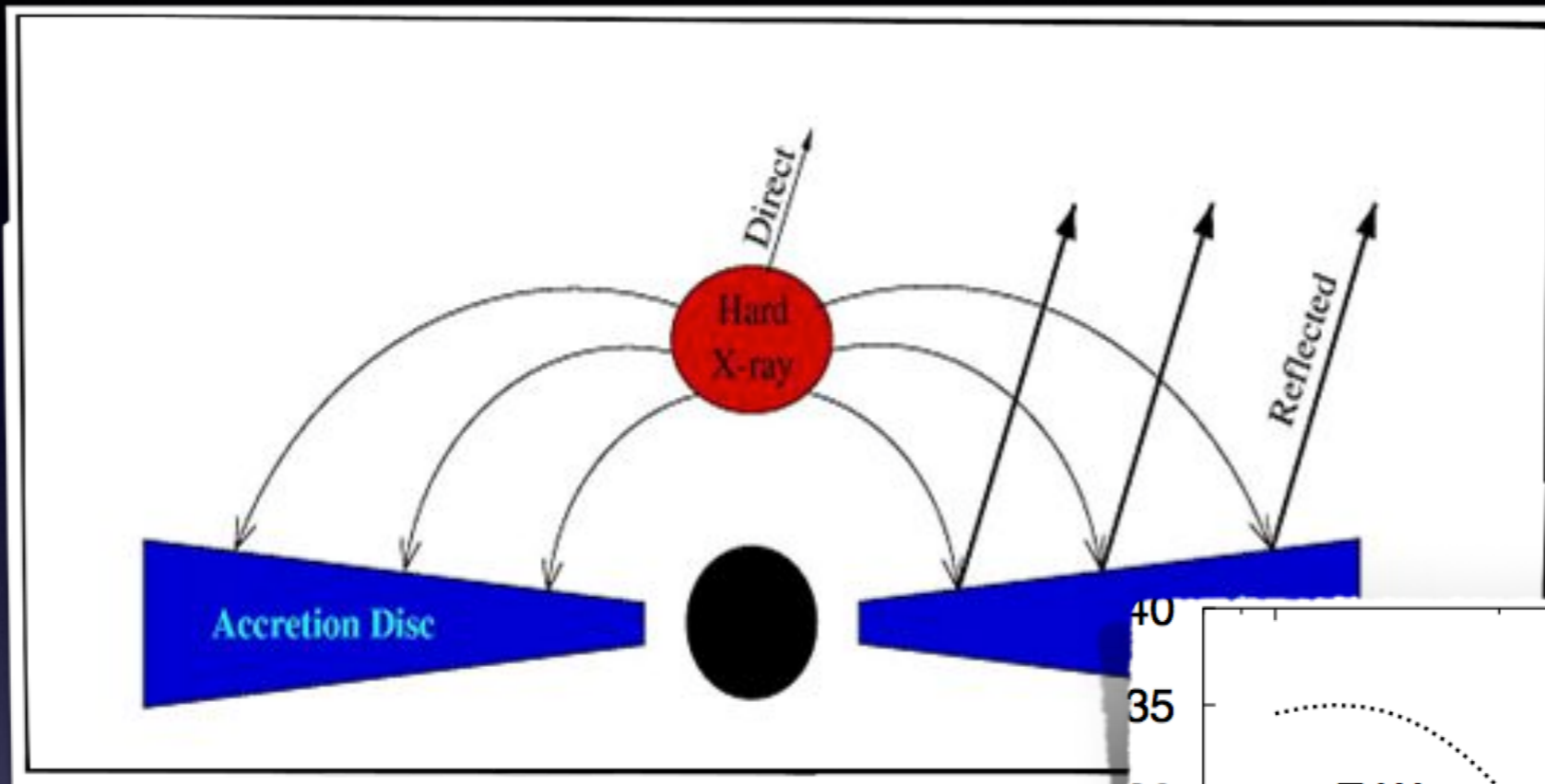
Gravitational Light  
bending effects



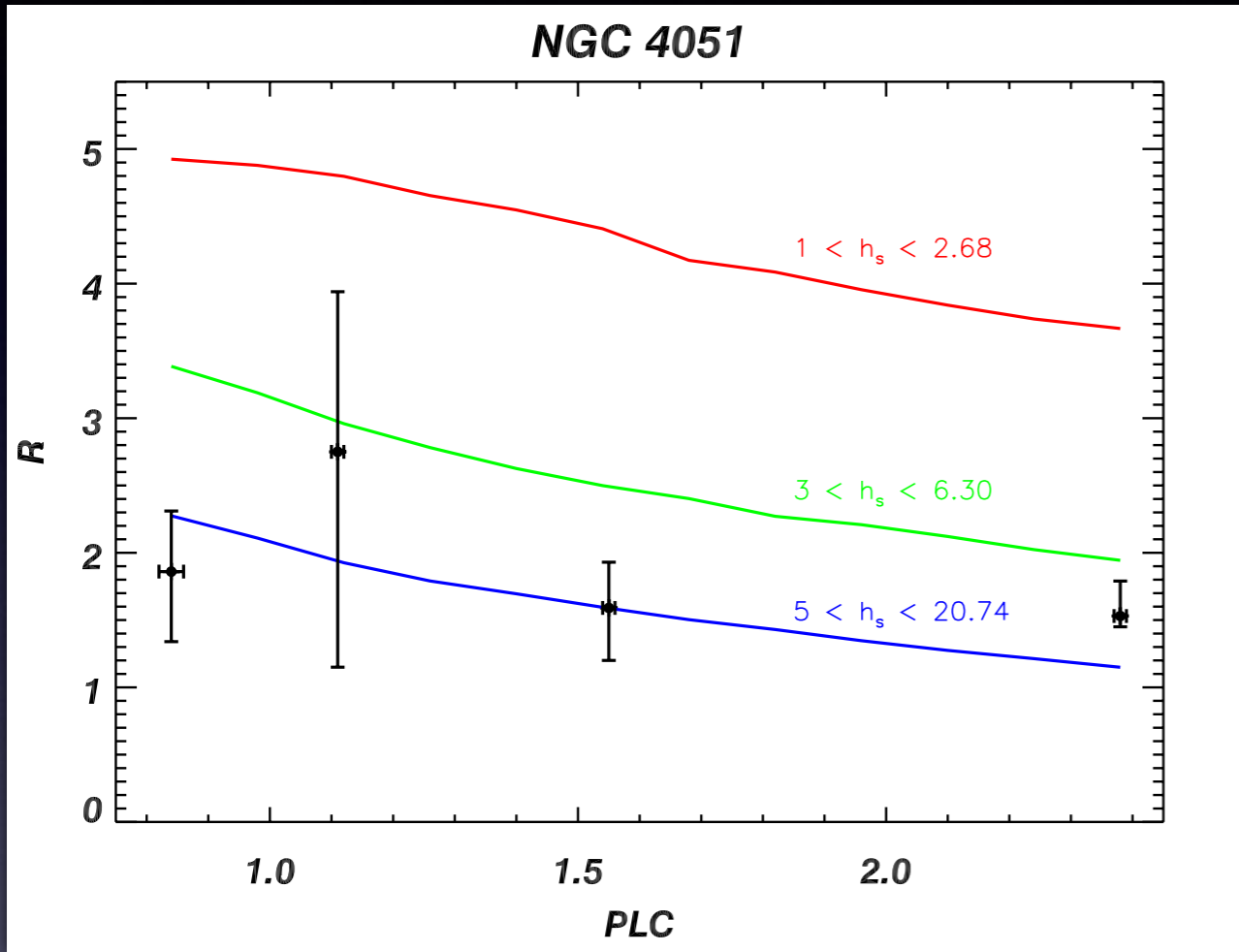
# Light Bending effects



# Light Bending effects

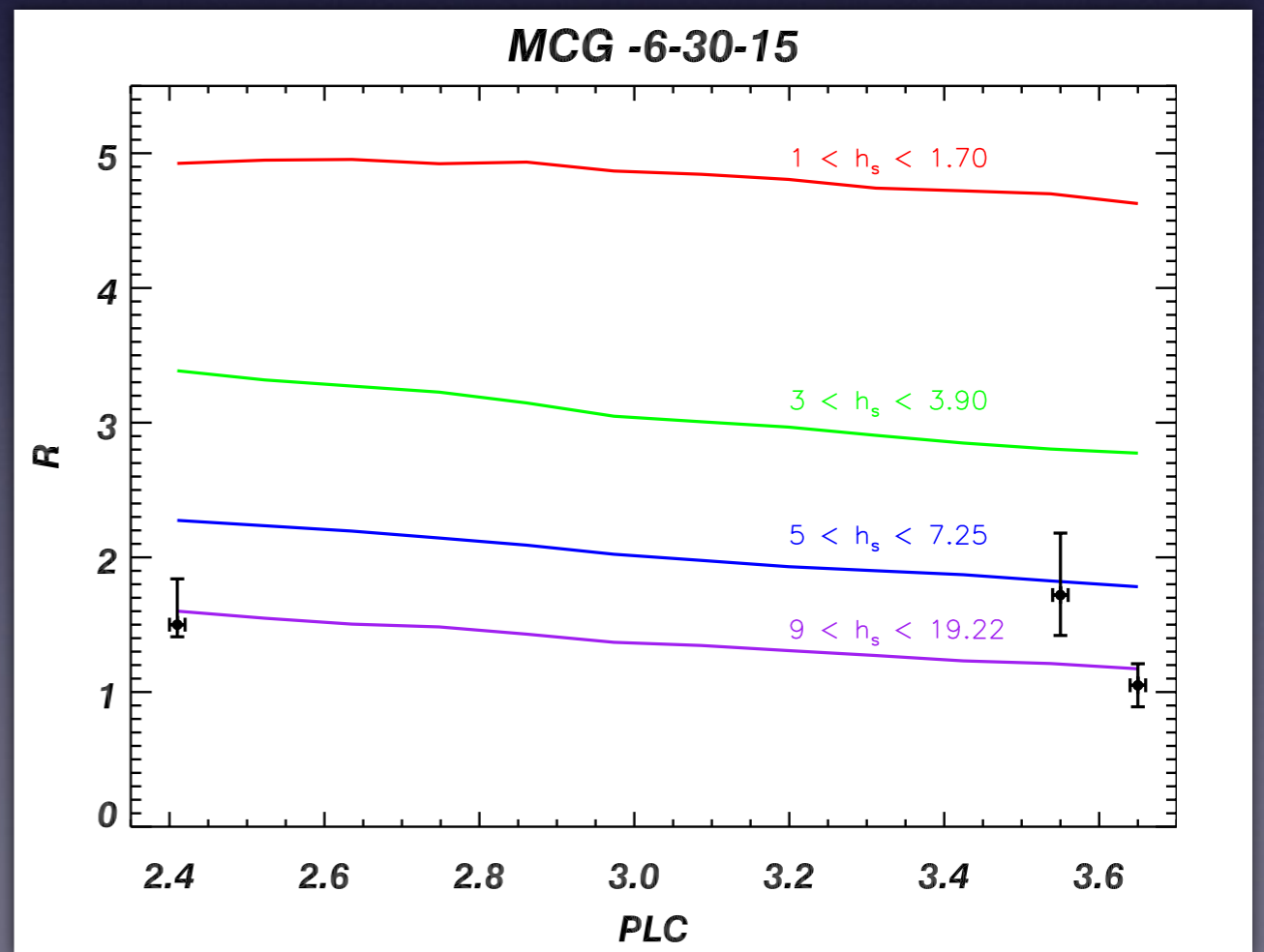


# Evidence for light bending in MCG -6-30-15 and NGC 4051



NGC 4051  
 $5 r_g - 20 r_g$

MCG -6-30-15  
 $9 r_g - 19 r_g$



# Conclusions

- Relativistic Fe line ubiquitous in Seyfert 1
- Both narrow and broad Fe line tracing emission of the Compton hump
- Thanks to NuSTAR, we were able to constrain the size of the Comptonizing region in NGC 4051 and MCG -6-30-15