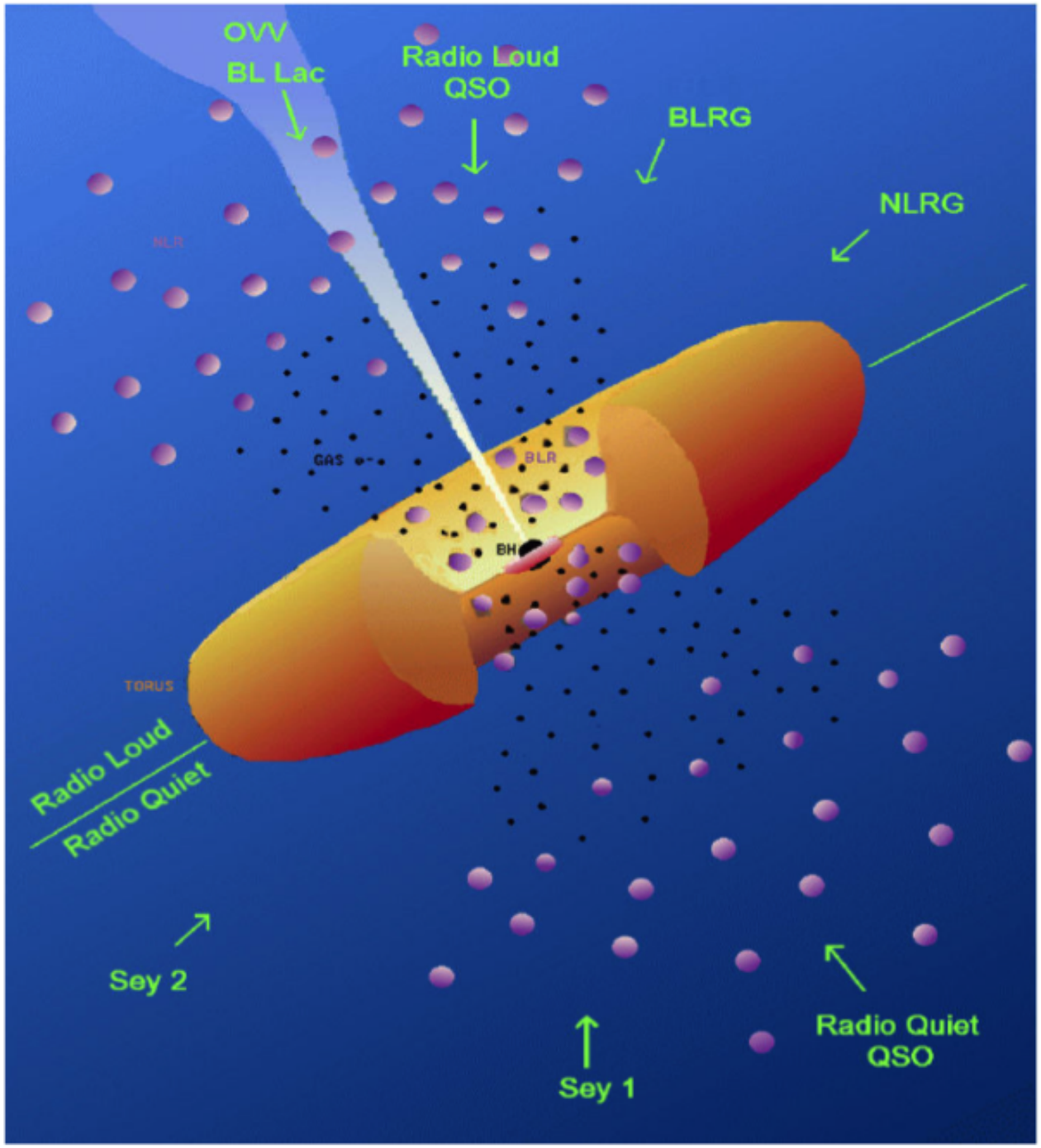
Constraining X-ray reflection in the LLAGN NGC 3718 with NuSTAR and XMM-Newton

Yaherlyn Díaz

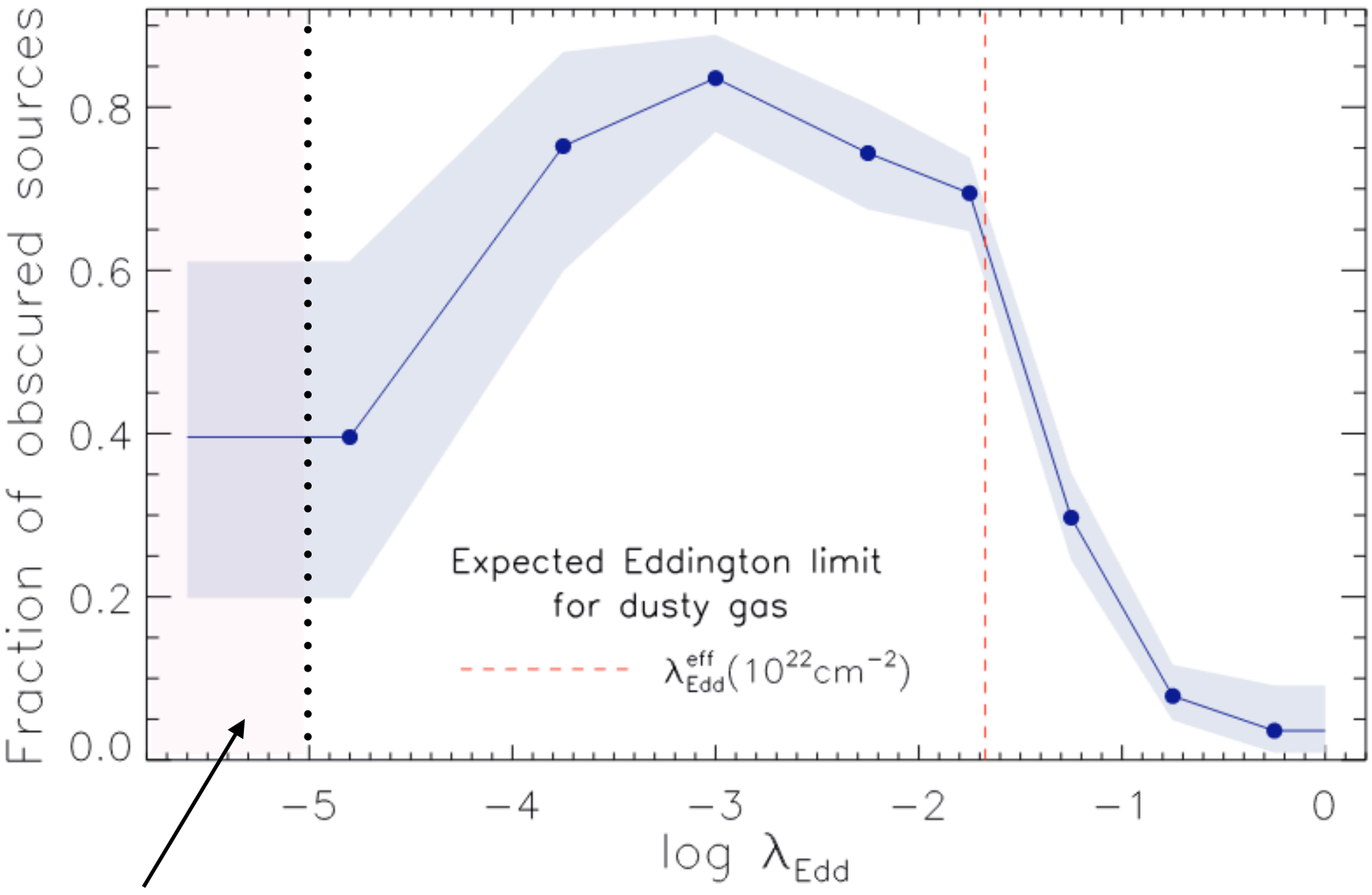
Advisor: Patricia Arévalo and Lorena Hernández-Garcí a

Unified Model



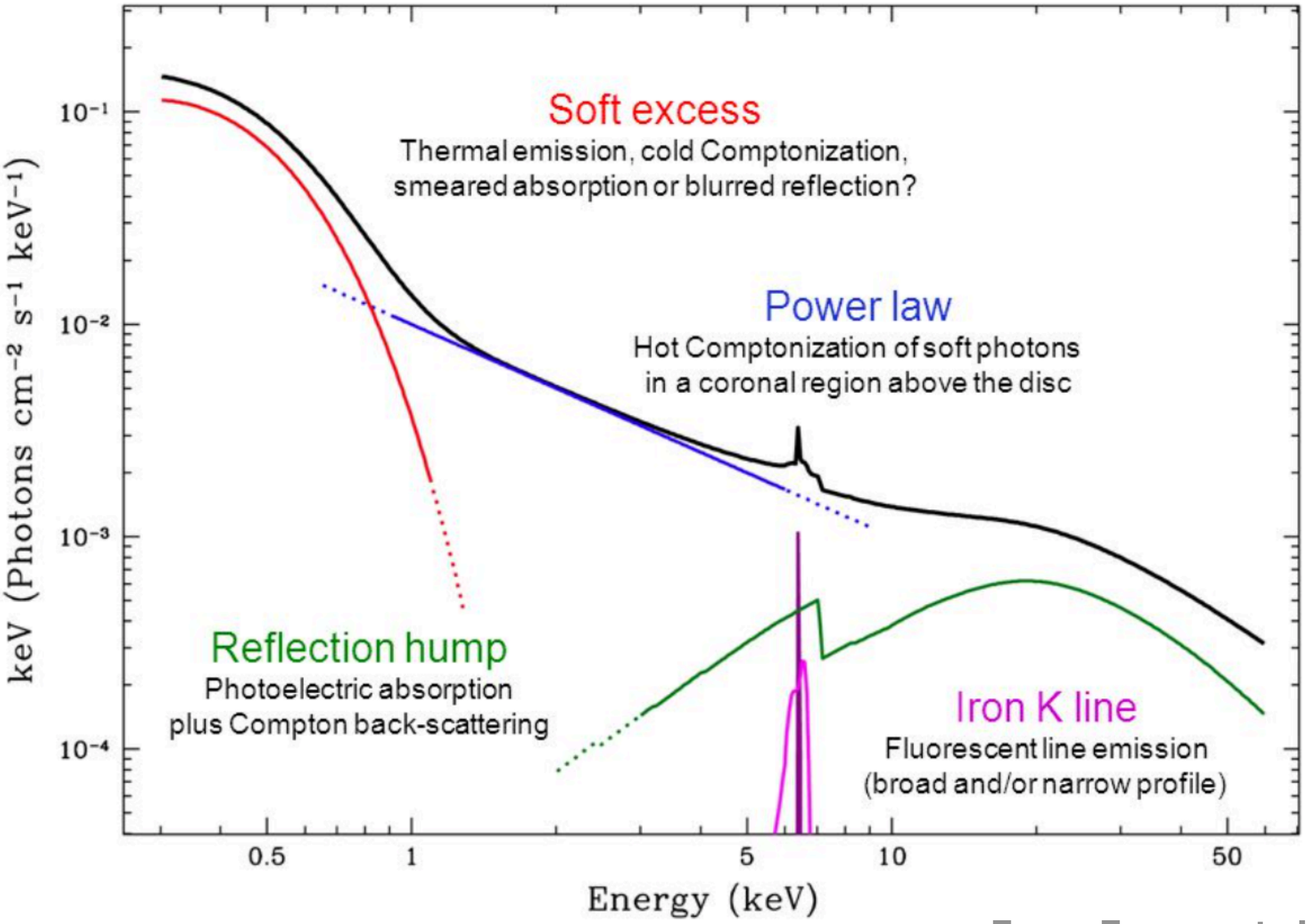
From: Urry & Padovani, 1995

Obscuration is a function of the accretion rate!

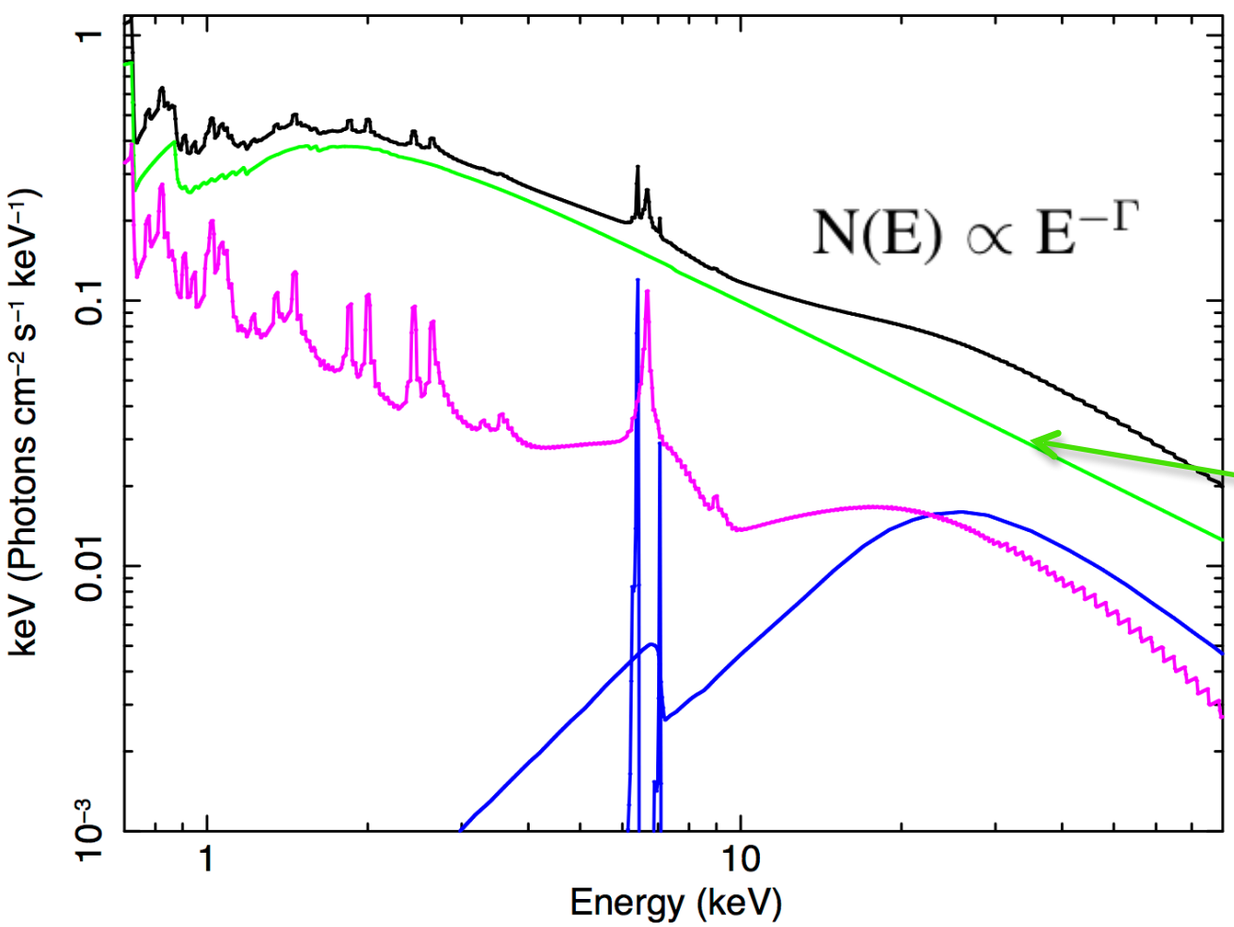


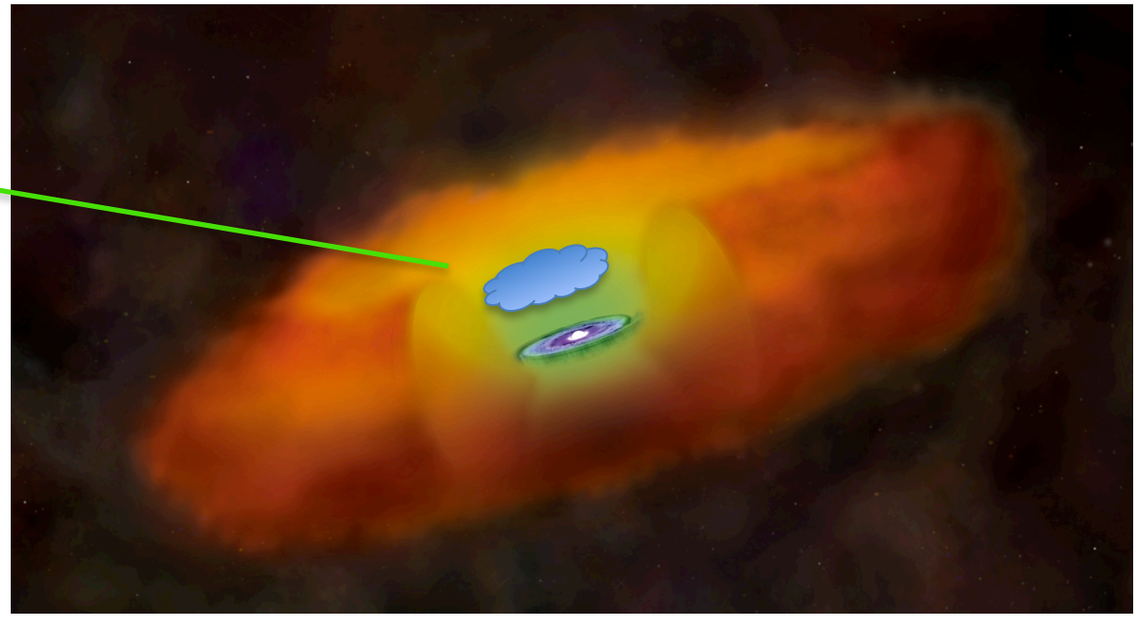
From: Ricci et al. 2017

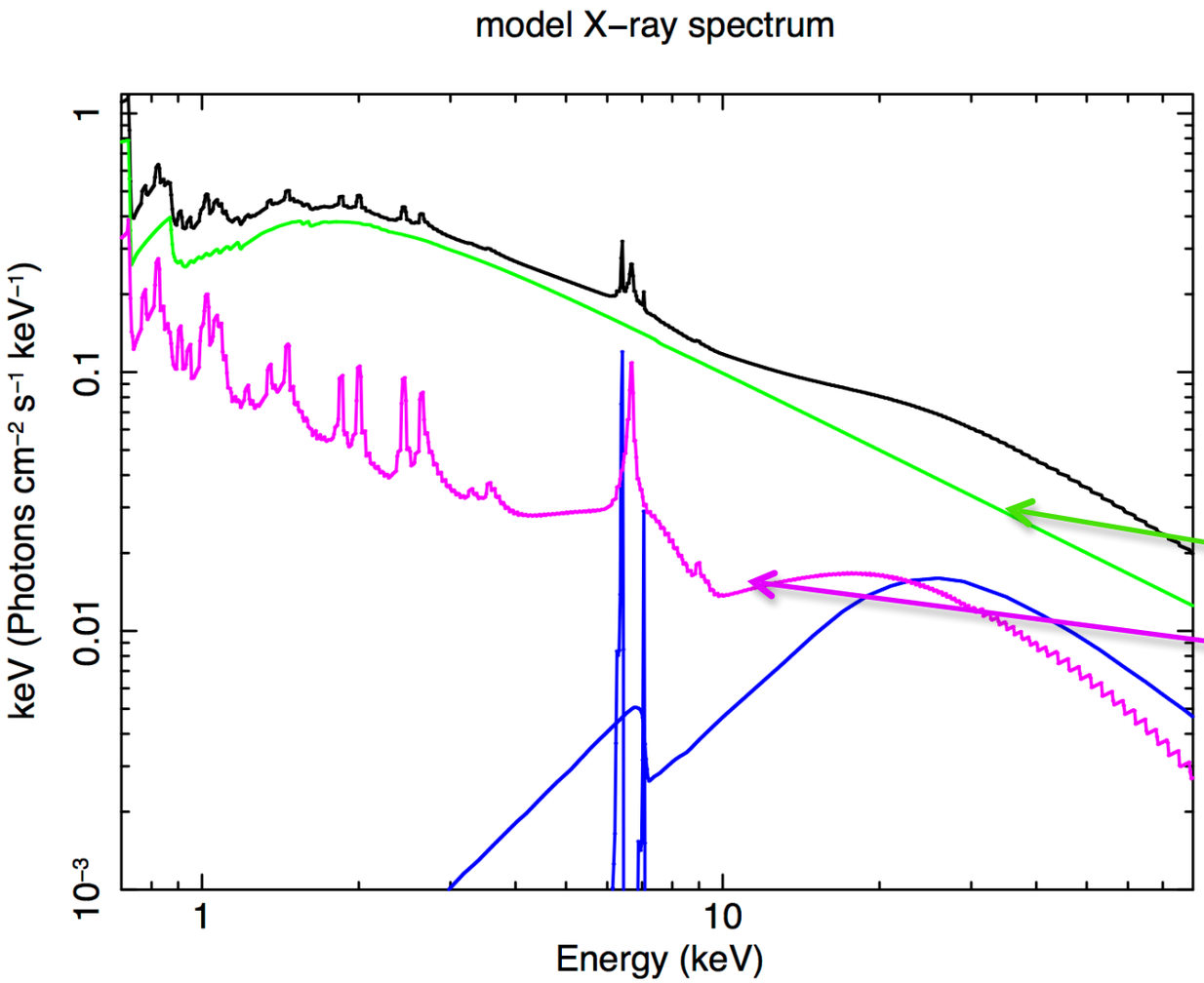
AGN X-ray Spectral Energy Distribution

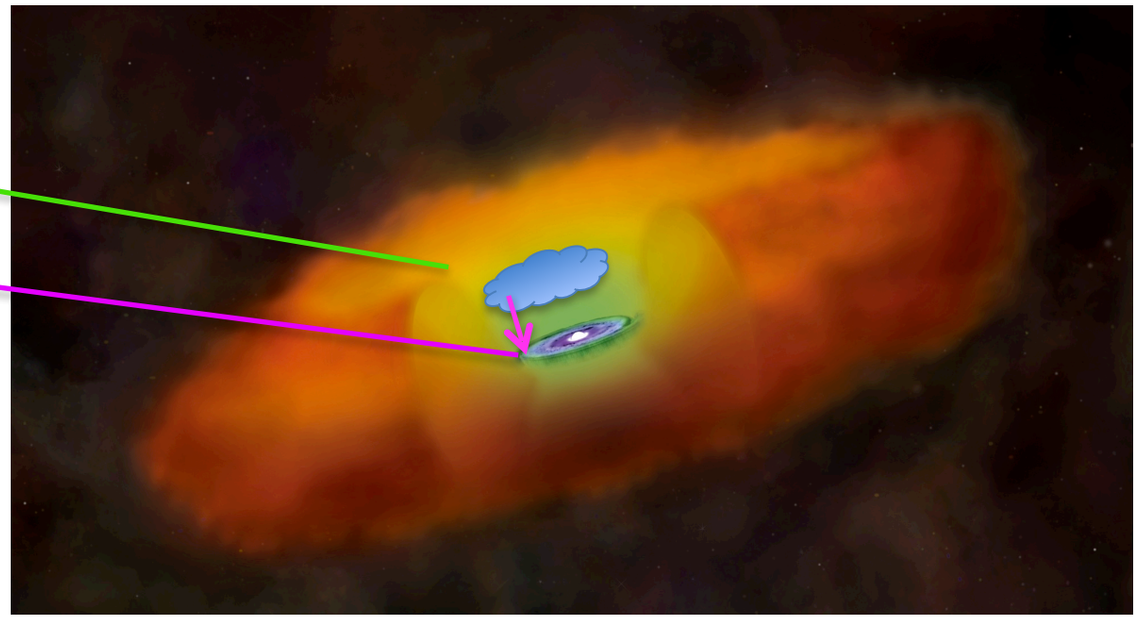


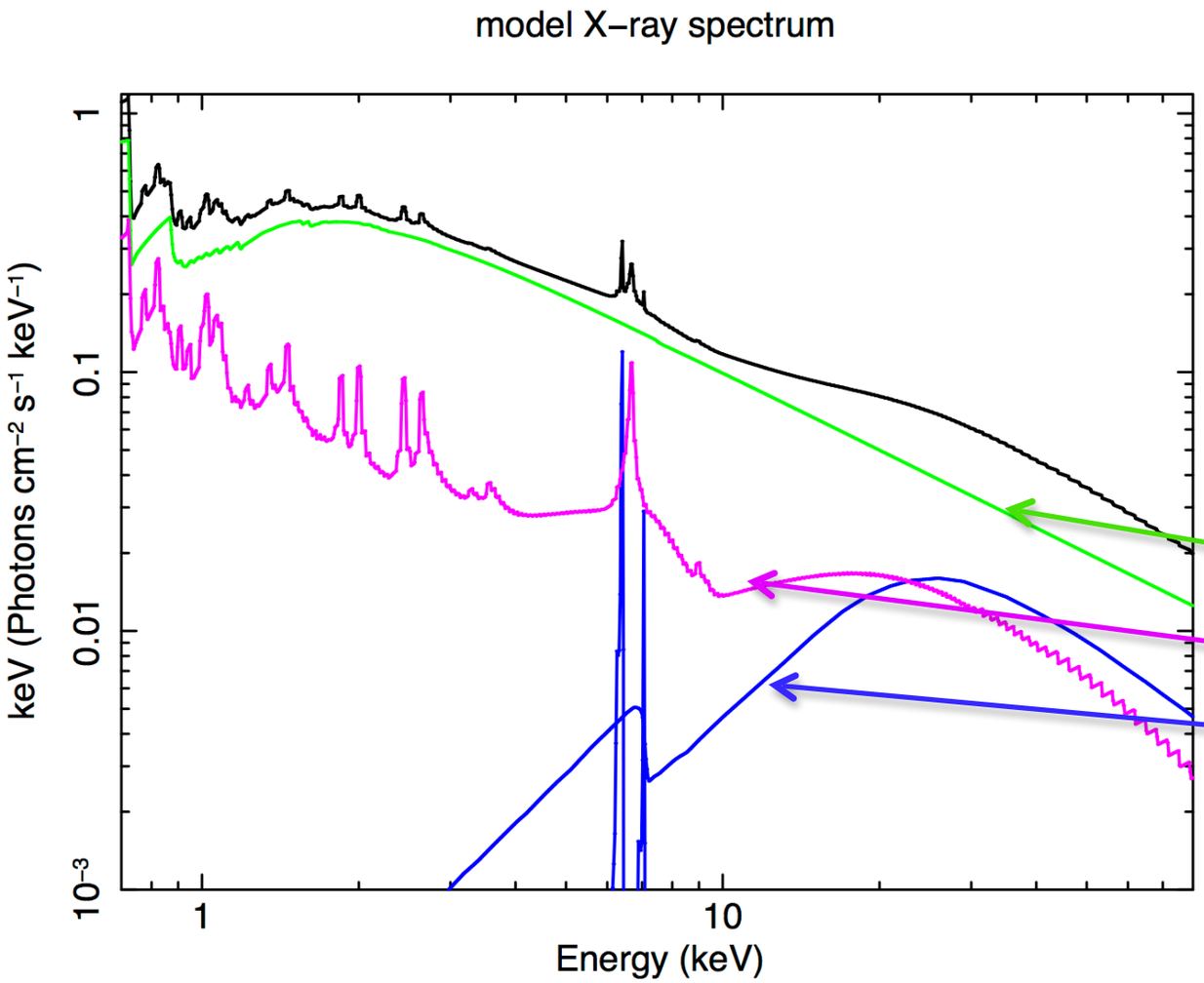
From: Ferrara et al. 2010

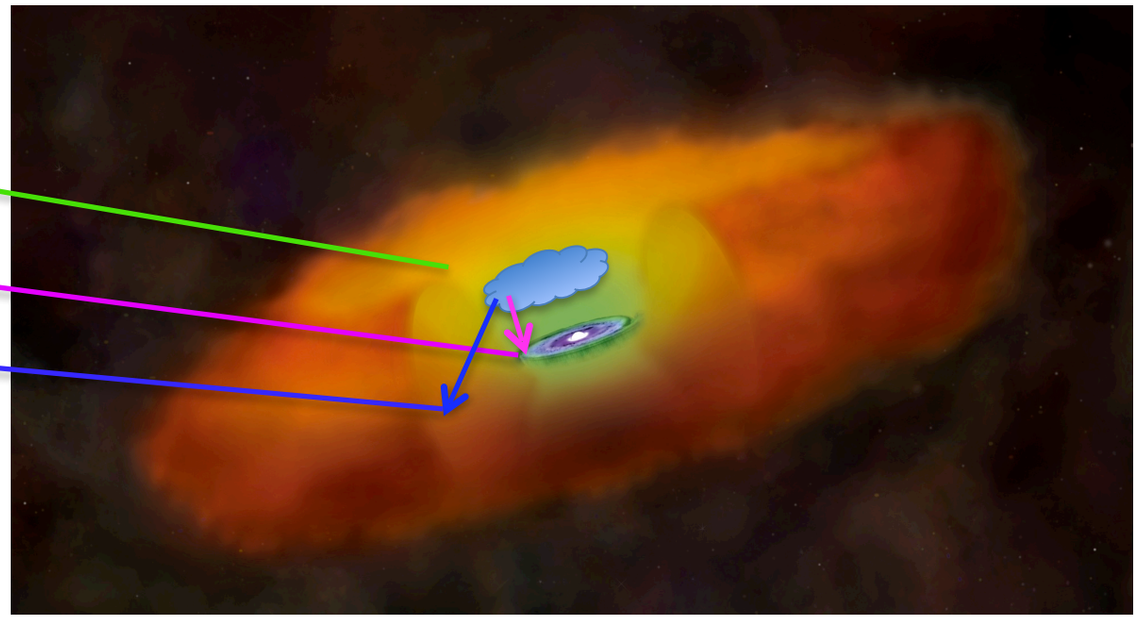

model X−ray spectrum
N(E) ∝ E^−Γ
keV (Photons cm^−2 s^−1 keV^−1)
1
0.1
0.01
10^−3
1
10
Energy (keV)



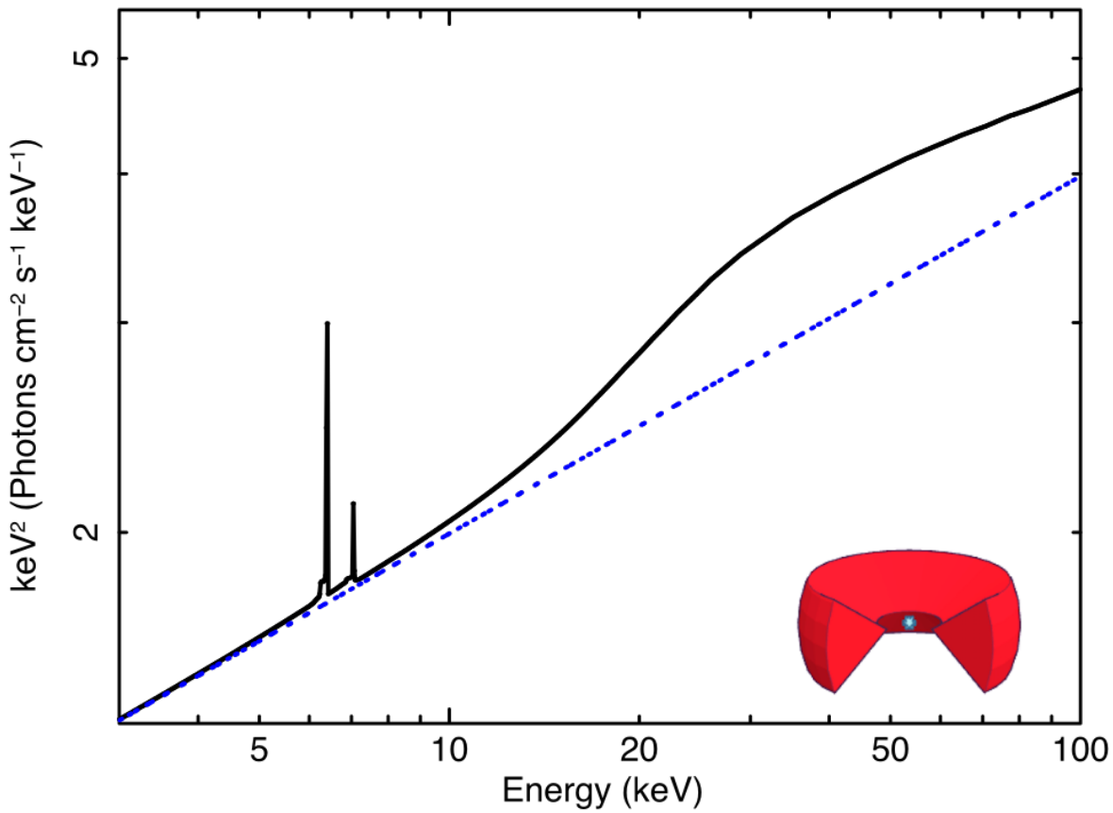

model X−ray spectrum
keV (Photons cm⁻² s⁻¹ keV⁻¹)
1
0.1
0.01
10⁻³
1
10
Energy (keV)

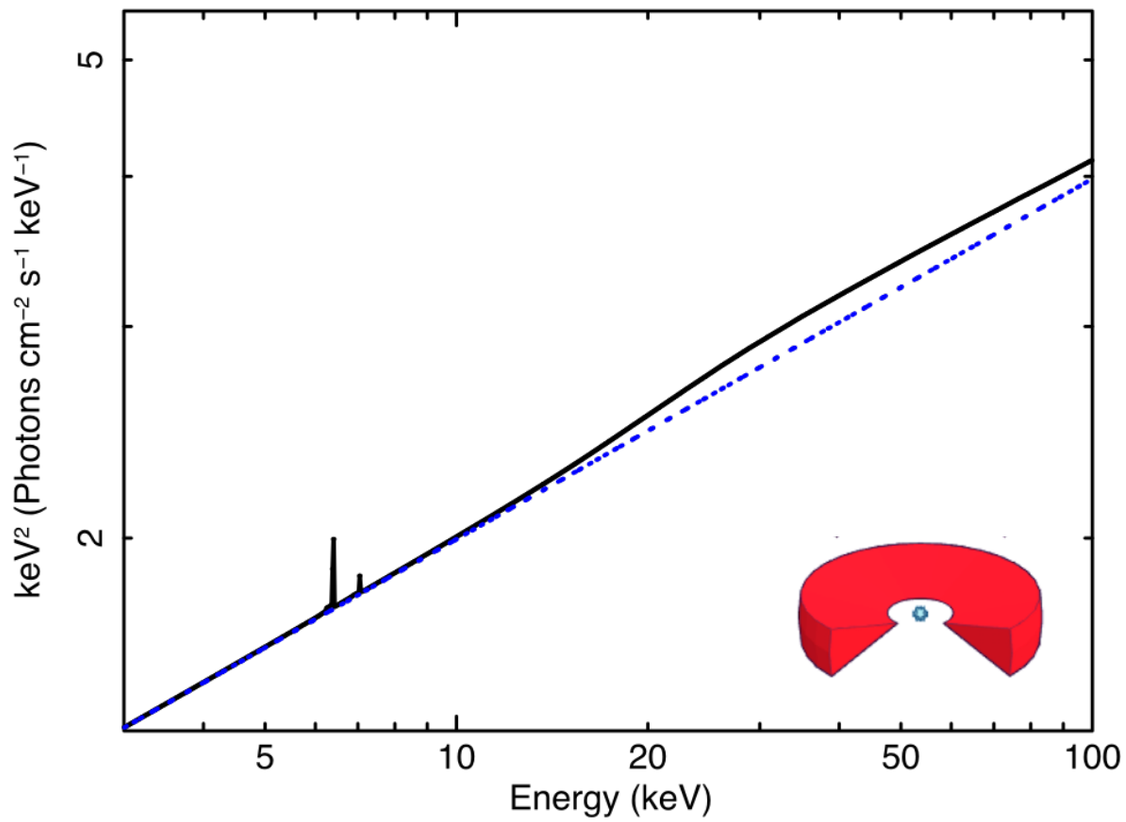



model X−ray spectrum
keV (Photons cm⁻² s⁻¹ keV⁻¹)
1
0.1
0.01
10⁻³
1
10
Energy (keV)

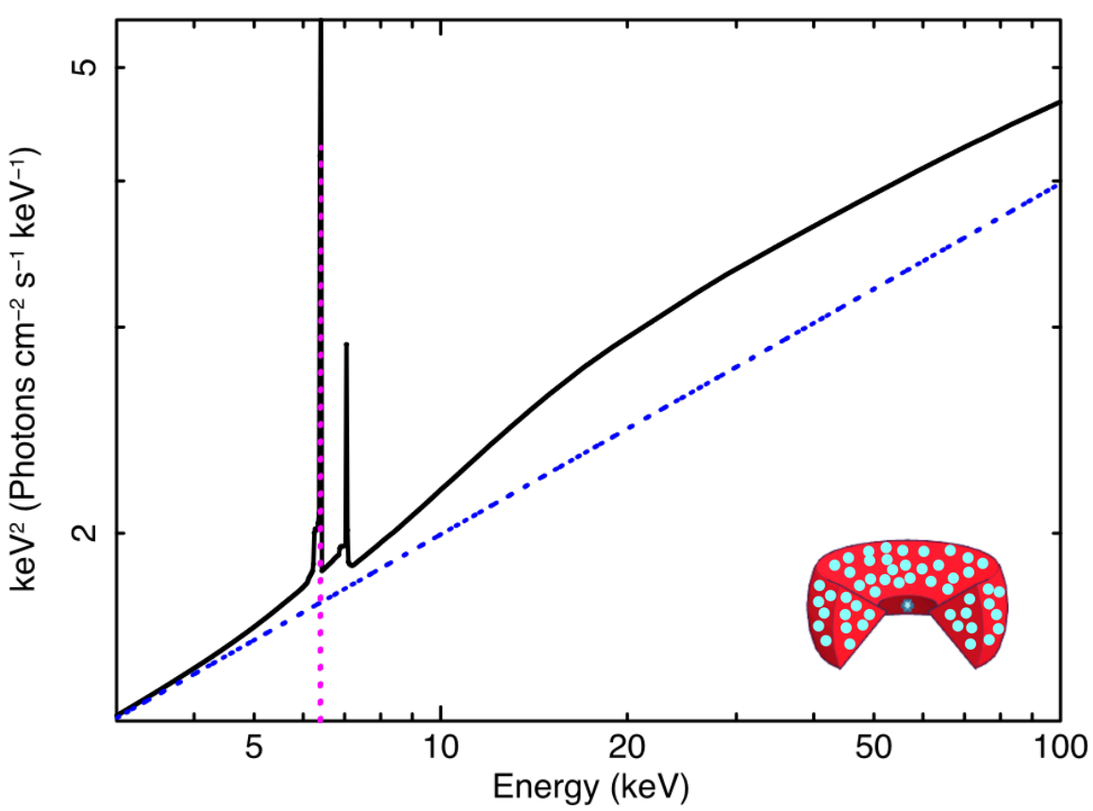


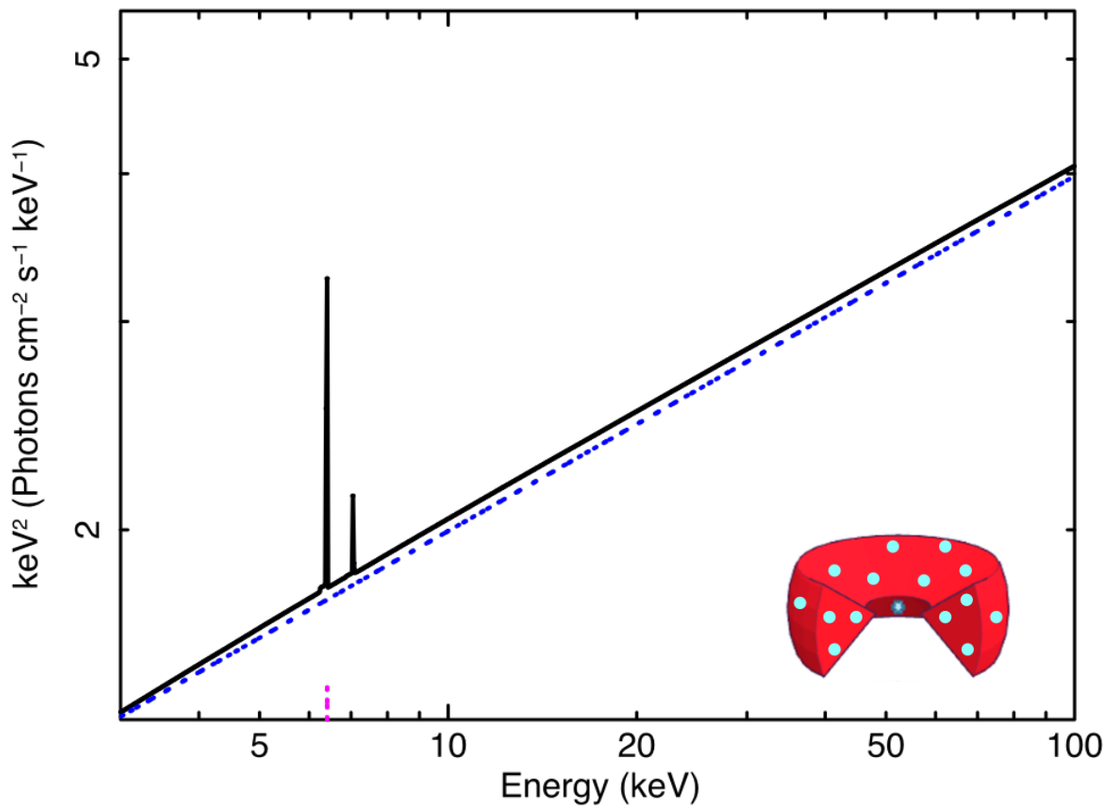
decreasing covering fraction

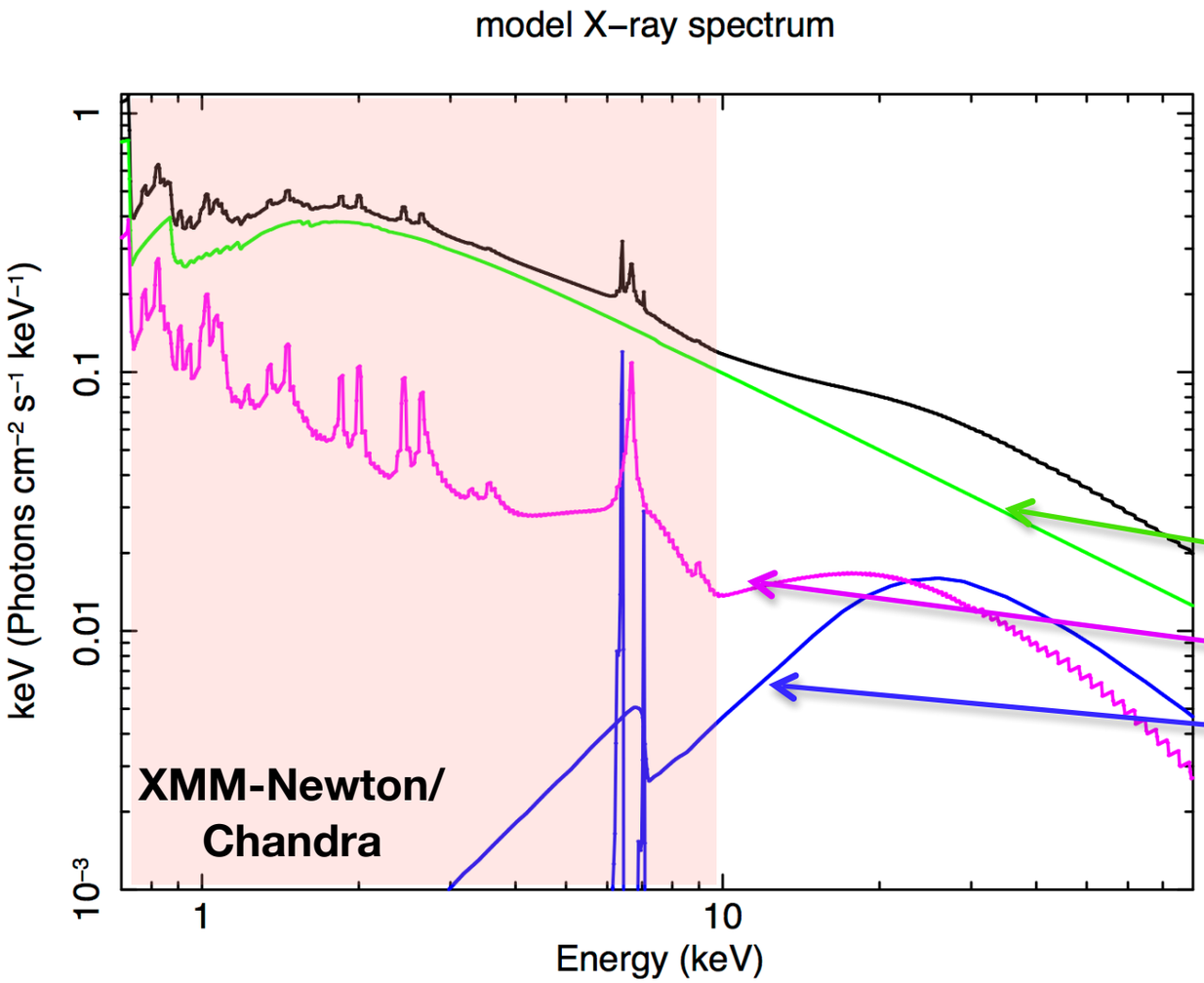


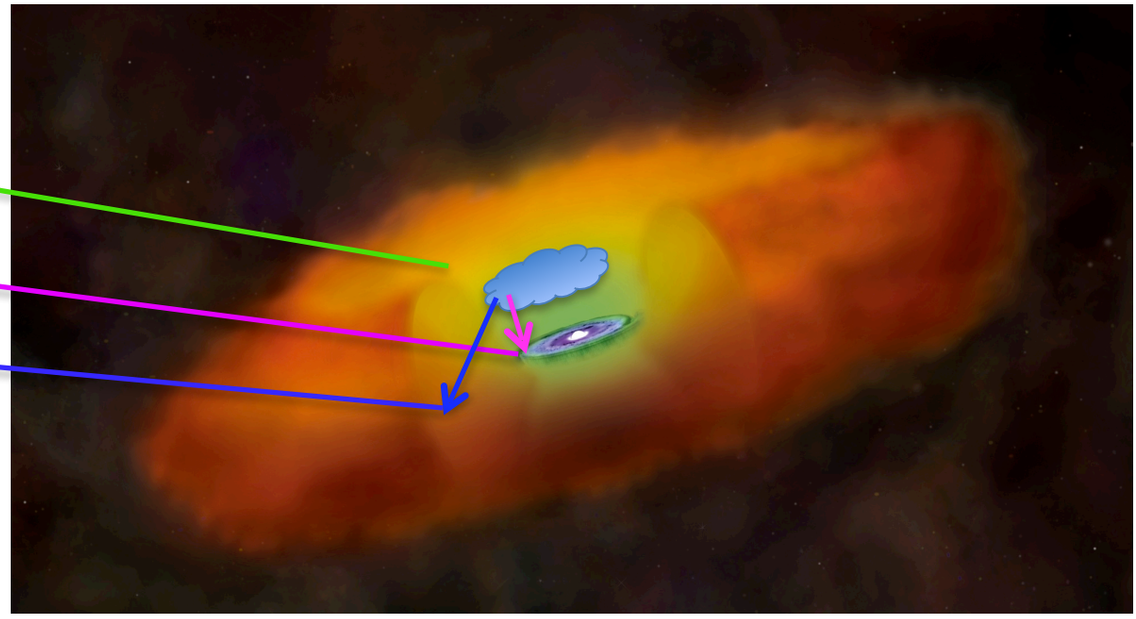


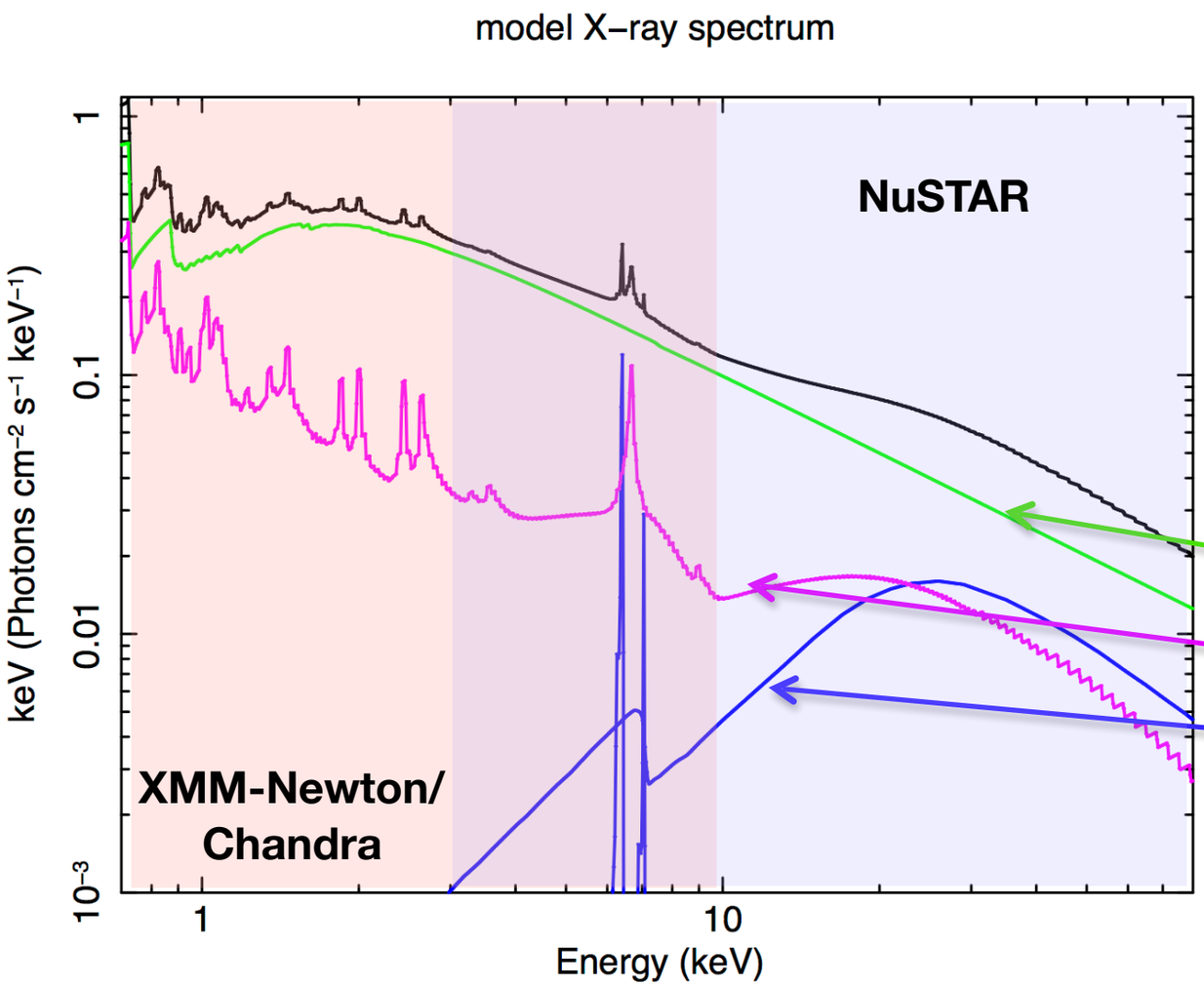
decreasing column density

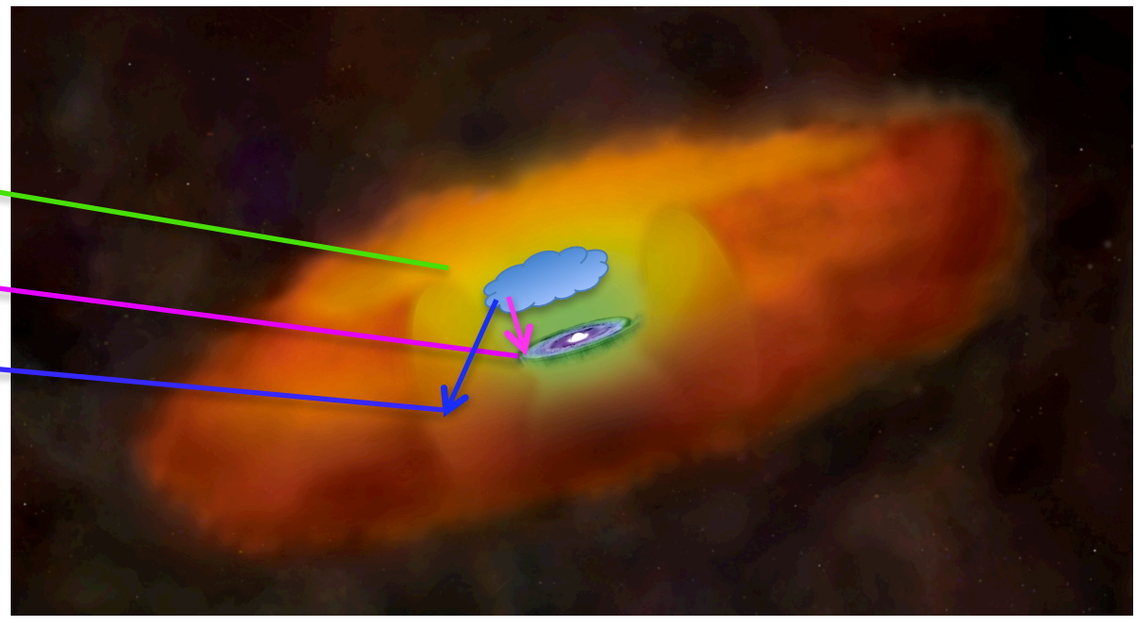




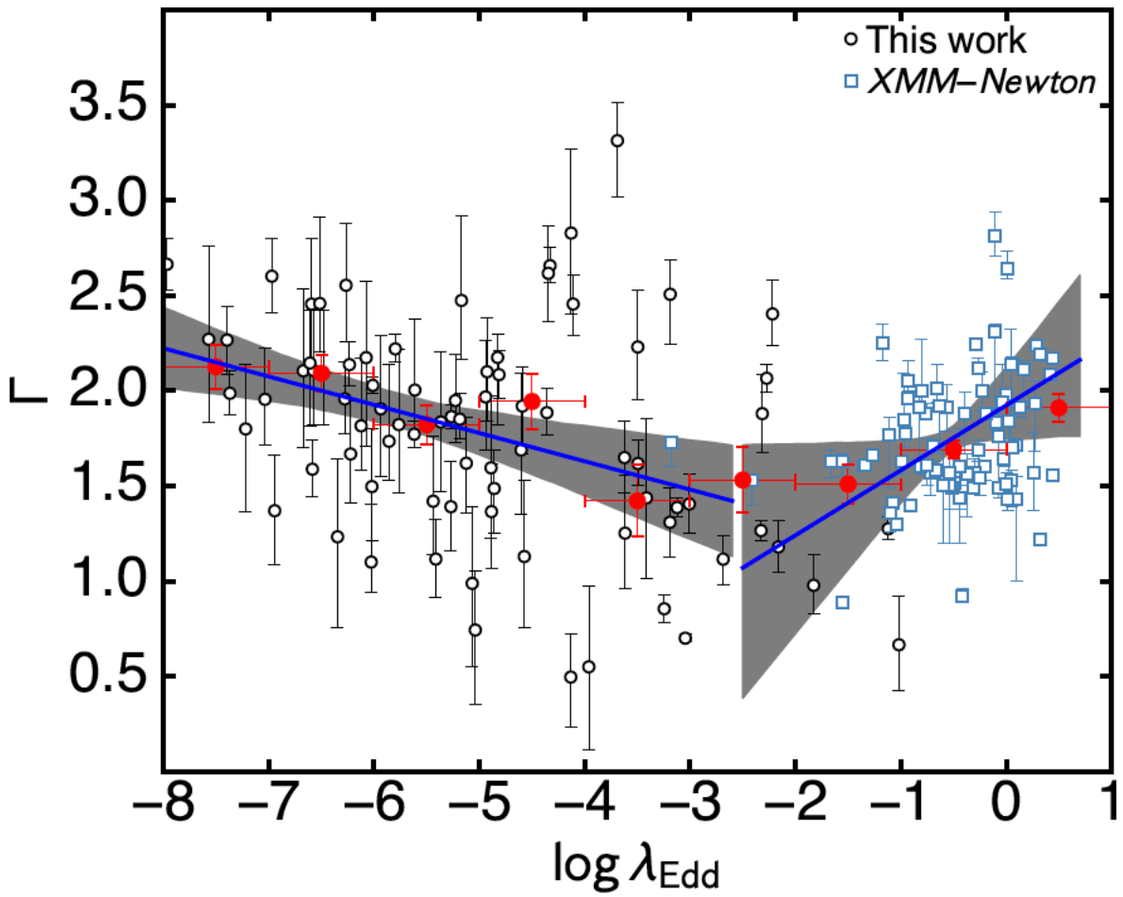

model X−ray spectrum
Photons cm⁻² s⁻¹ keV⁻¹)
keV (
1
0.1
0.01
10⁻³
XMM-Newton/
Chandra
1
10
Energy (keV)




model X–ray spectrum
NuSTAR
XMM-Newton/
Chandra
keV (Photons cm⁻² s⁻¹ keV⁻¹)
Energy (keV)
1
0.1
0.01
10⁻³
1
10



Is the Spectral Index (Gamma) a function of the Eddington ratio in AGNs?



From: She et al. 2018

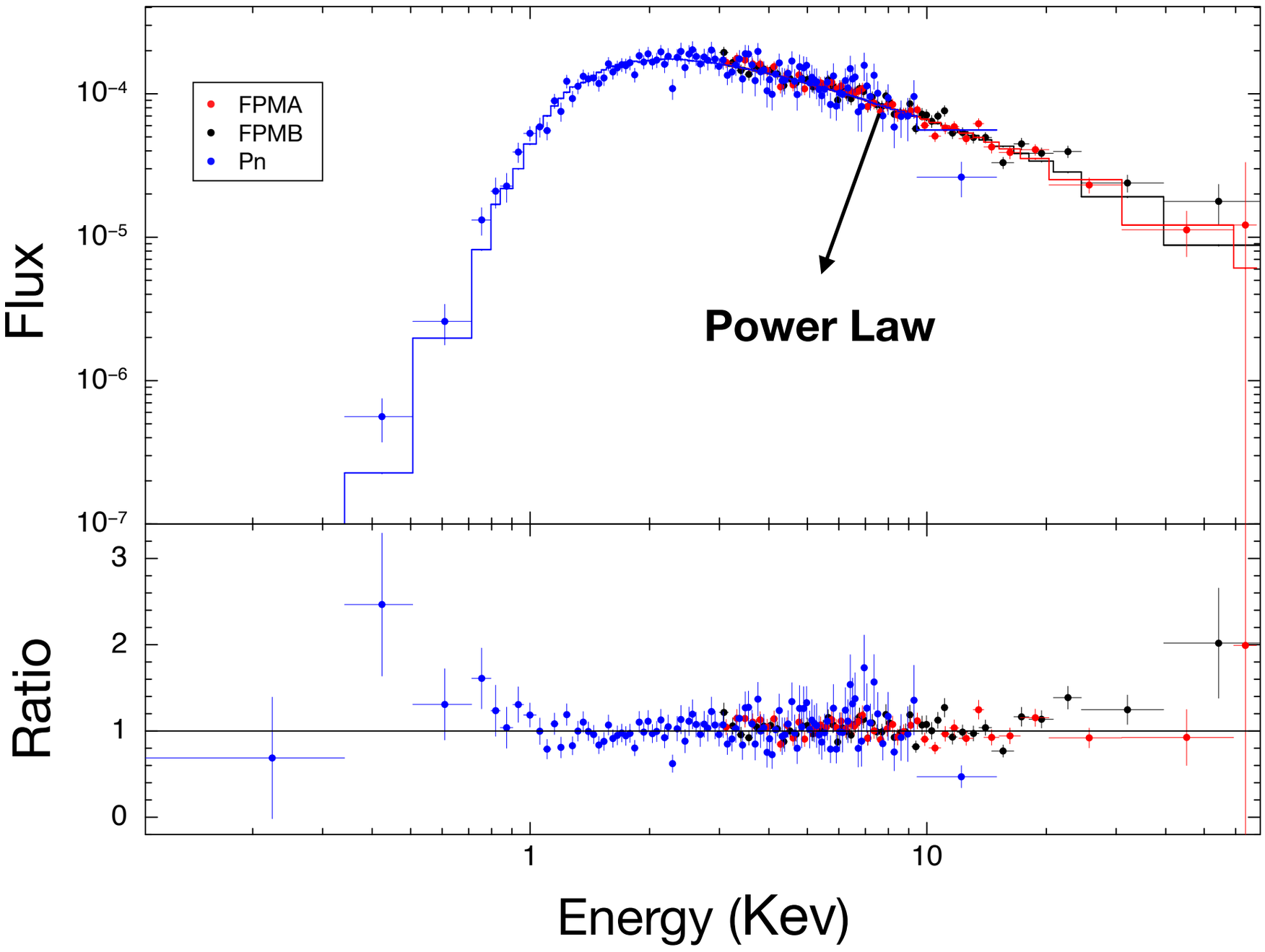
- For high Luminosity AGNs: Positively correlation
- For Low luminosity AGNs: Negative correlation

↓

Change of the accretion physics

In this work…

Step 1: Spectrum of NGC3718



- Redshift 0.003

(L. Hernández-Garcia et al. 2014)

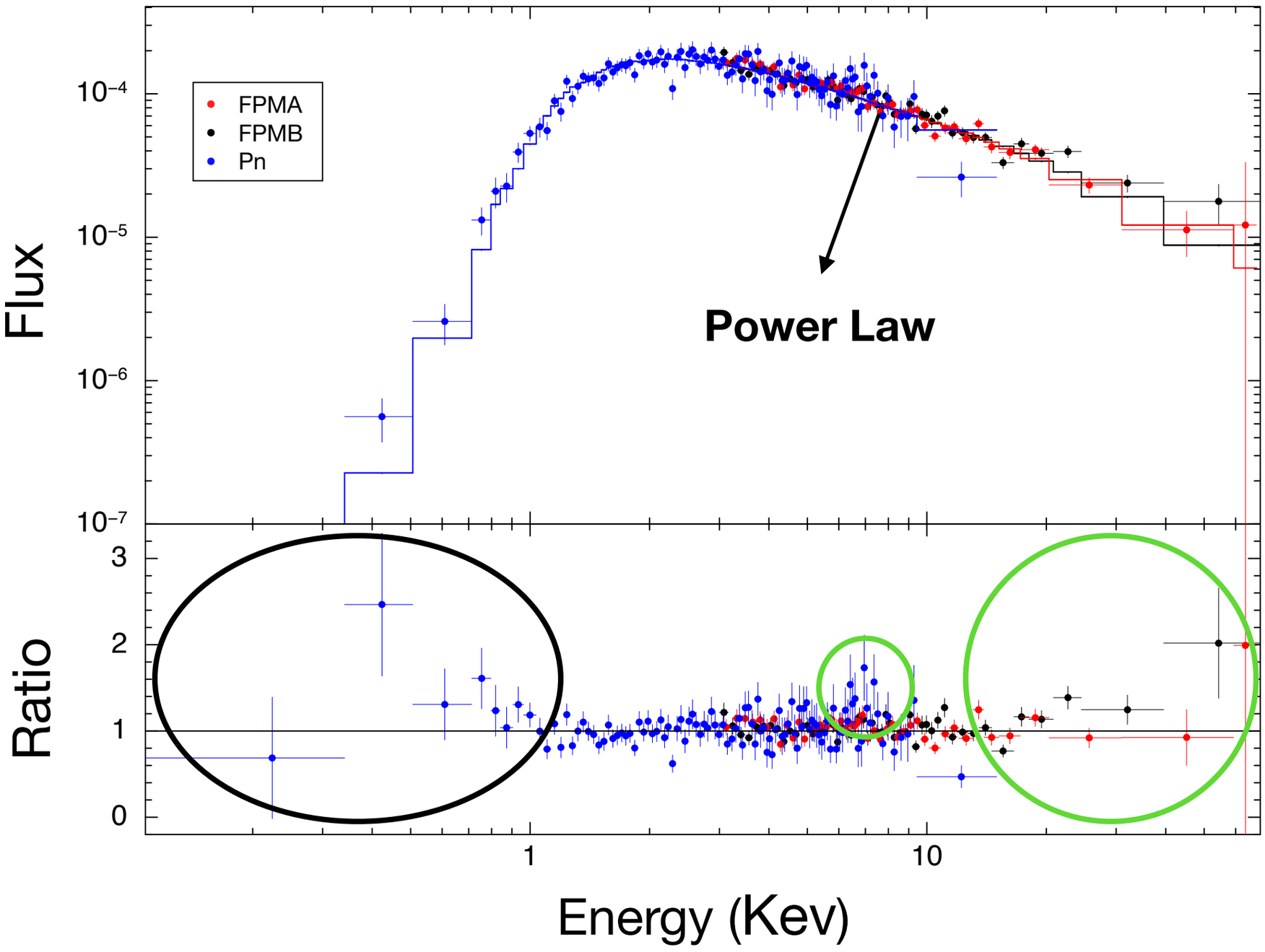
- LINER 1.9 (optical classification)

(Ho et al. 1997)

- Low Accretion rate $L_{Edd}/L_{Bol} \sim 10^{-5}$

(L. Hernández-Garcia et al. 2014)

Step 1: Spectrum of NGC3718



- Redshift 0.003

(L. Hernández-Garcia et al. 2014)

- LINER 1.9 (optical classification)

(Ho et al. 1997)

- Low Accretion rate $L_{Edd}/L_{Bol} \sim 10^{-5}$

(L. Hernández-Garcia et al. 2014)

A power law model fails

Hints of Reflection!

Our Model…

$$A * \mathrm{N_{gal}}(\mathrm{N_{H1}} \times \mathrm{PL} + \mathrm{N_{H2}} \times \mathit{table} + \mathrm{N_{H2}} \times \mathrm{cPL})$$

Column density of absorbing material acting on the scattered power-law

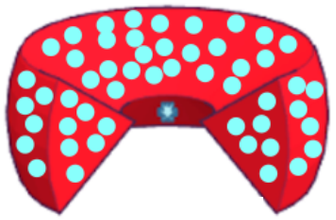
Column density acting on the nuclear components

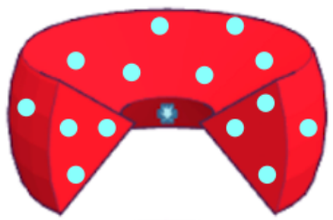
Our Model…

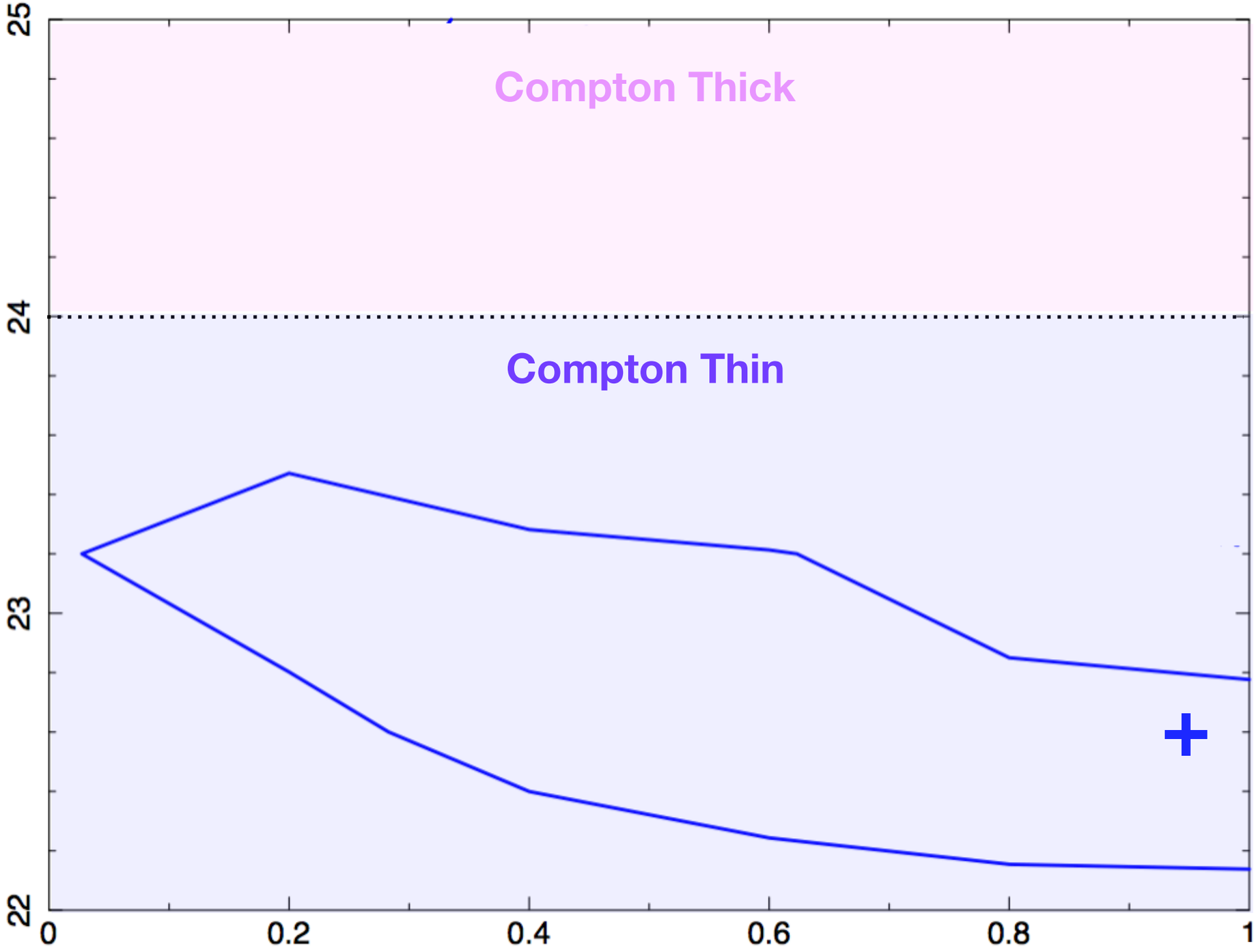
$$A * N_{gal}(N_{H1} \times PL + N_{H2} \times table + N_{H2} \times cPL)$$

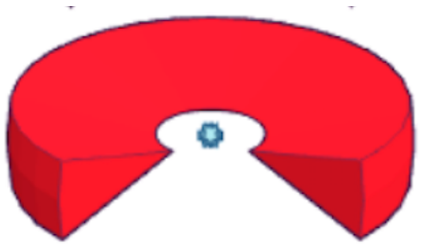
- PL → Power-Law
- cPL → Cutoff Power-Law
- table → Reflection models
  - Borus02 (Baloković et al. 2018)
  - MYTorus (Murphy & Yaqoob 2009)
  - Relxill (García et al 2013)
    - Xillver
    - XillverCp

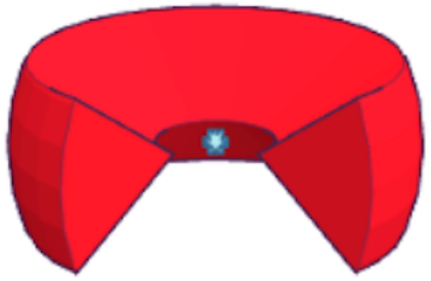
Reflection: Torus

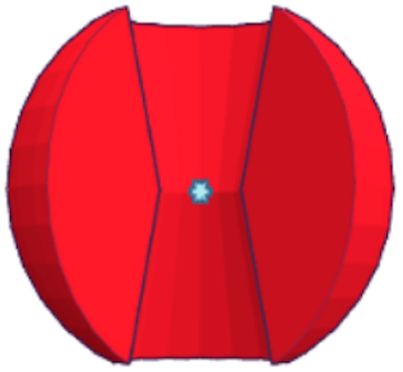




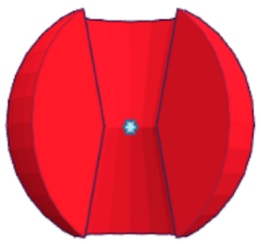


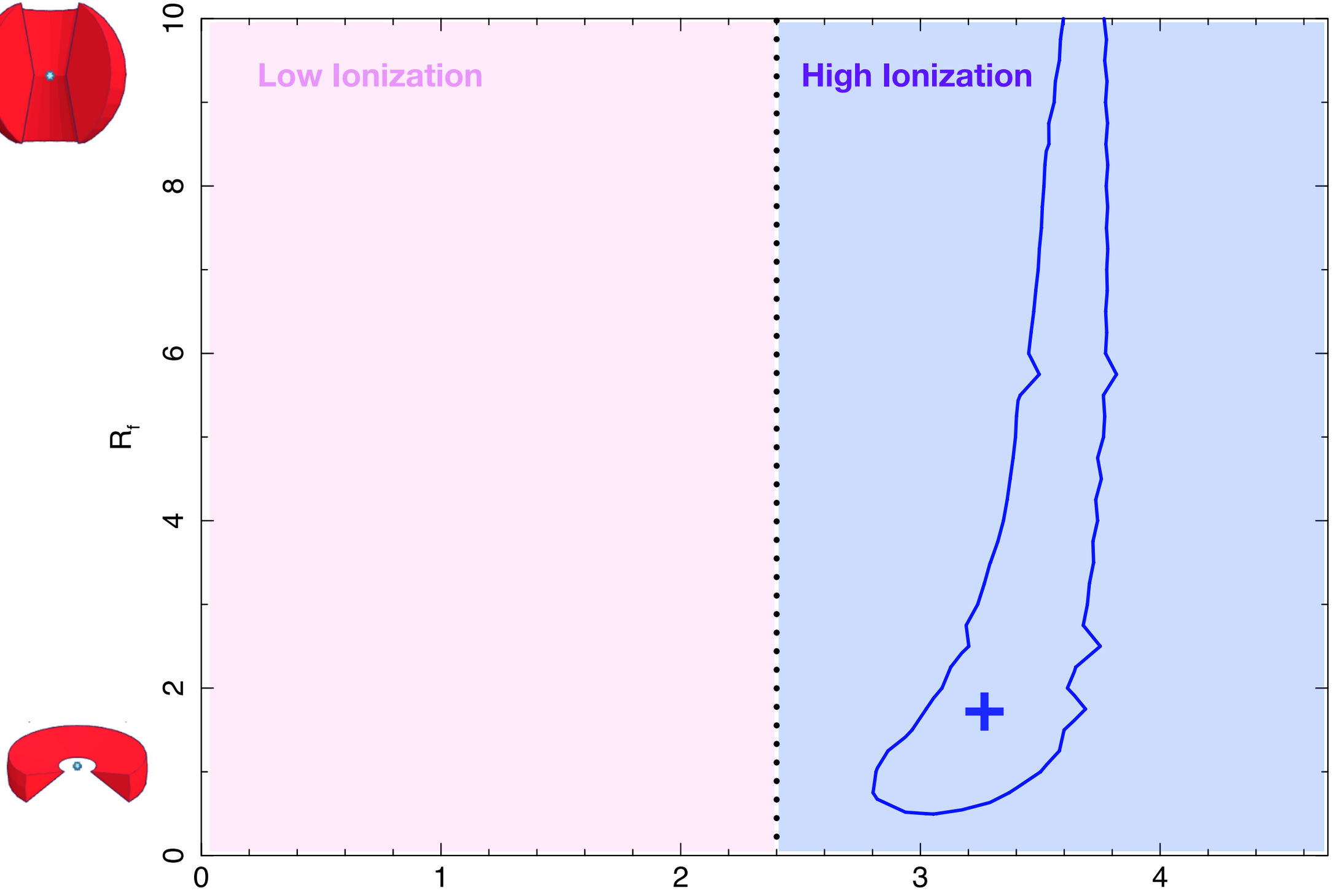


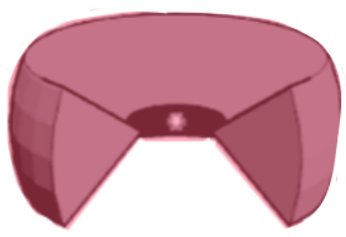




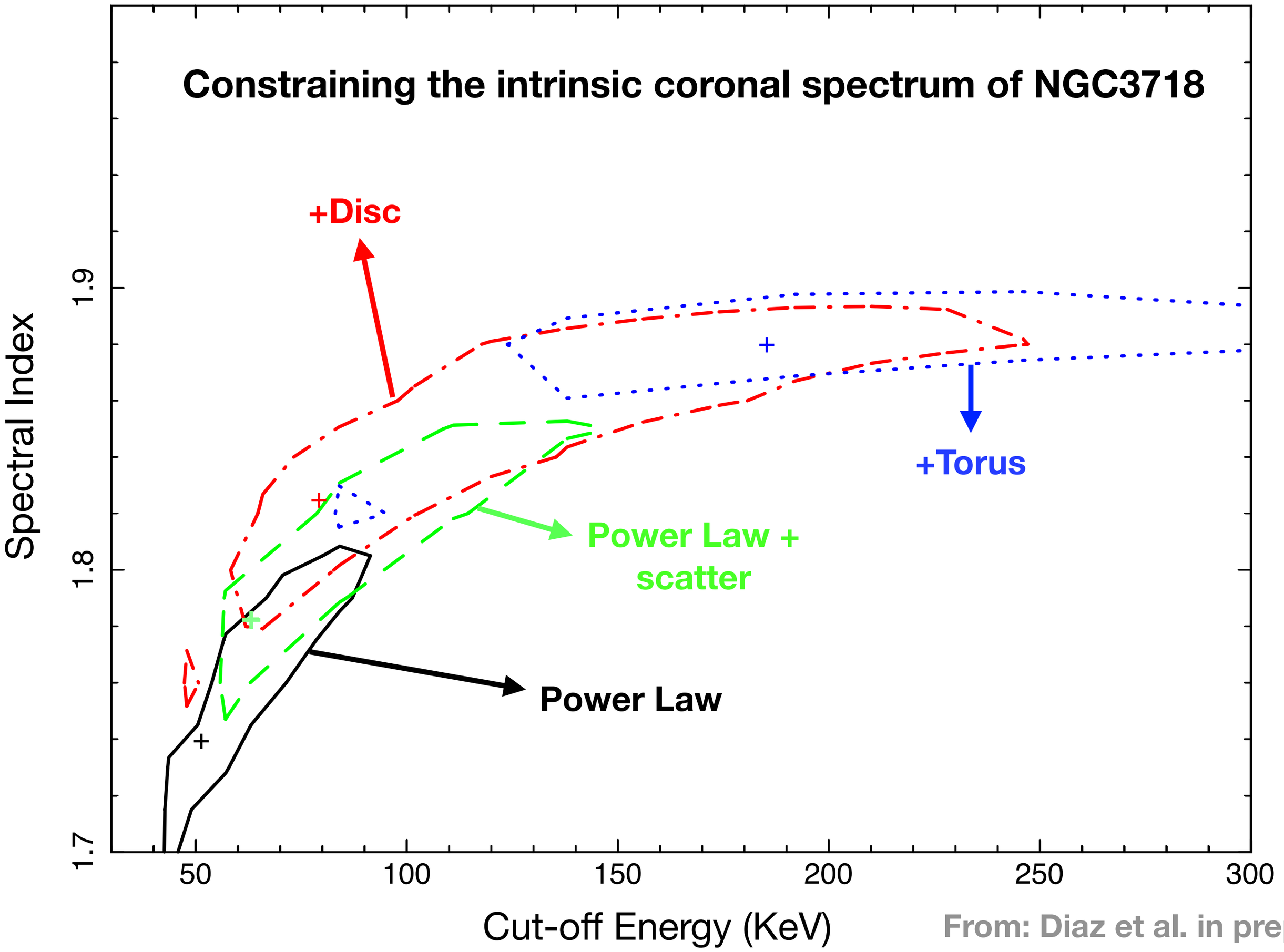
Reflection: Accretion Disk







Constraining the intrinsic coronal spectrum of NGC3718



From: Diaz et al. in prep

Conclusion

- The type of reflector affects the measurement of the power-law parameters.

- The reflector in the low luminosity AGN could be a low column density torus covering a large fraction of the sky or a highly ionized accretion disk.

- The energy range of the data affect in the estimation of the photon index. Low energy data allows to adjust a simple power-law model and underestimate the parameters of the primary X ray emission.

Conclusion

- The type of reflector affects the measurement of the power-law parameters.

- The reflector in the low luminosity AGN could be a low column density torus covering a large fraction of the sky or a highly ionized accretion disc.

- The energy range of the data affect in the estimation of the photon index. Low energy data allows to adjust a simple power-law model and underestimate the parameters of the primary X ray emission.

Future work

- Study the Accretion physics → Correlation between Gamma and Accretion rate using high quality X-ray spectra and a variety of new models from Ho et al. (1997) sample.

That's all Folks!