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# X-ray Reprocessing & Reverberation in the AGN 1H0707-495

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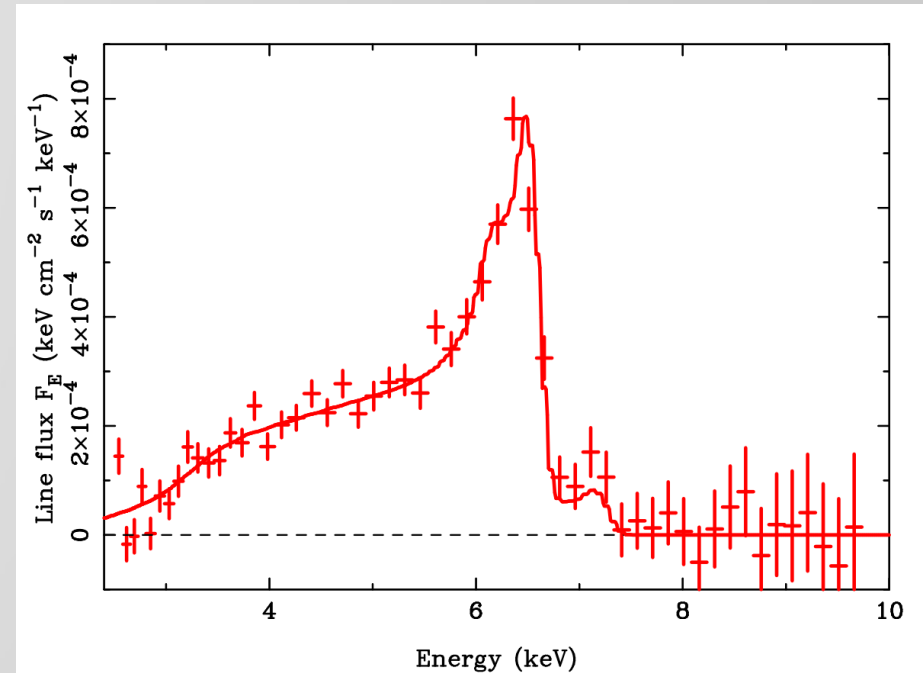
Andy Fabian (IoA)

# Outline

- Broad Lines in AGN.
- 1H0707-495 spectrum.
- Spectral Variability.
- Soft lags.

# Broad K Lines in AGN

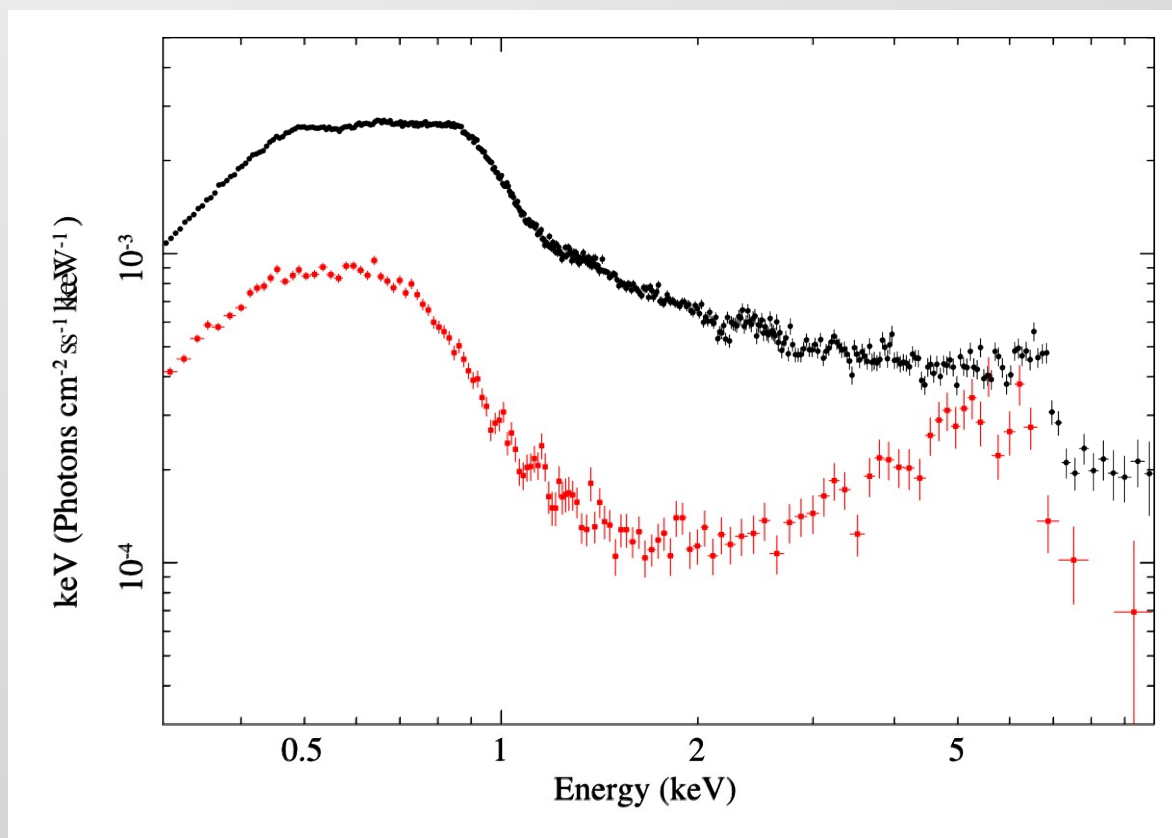
- First discovered in MCG-6-30-15.
- Present in at least half of all Sey1.
- Also seen in GBH and NS and used to infer BH spins.



Tanaka et al. (95), Fabian et al. (02), Nandra et al. (07), Miller et al. (09), Cackett et al. (09)

# 1H 0707-495

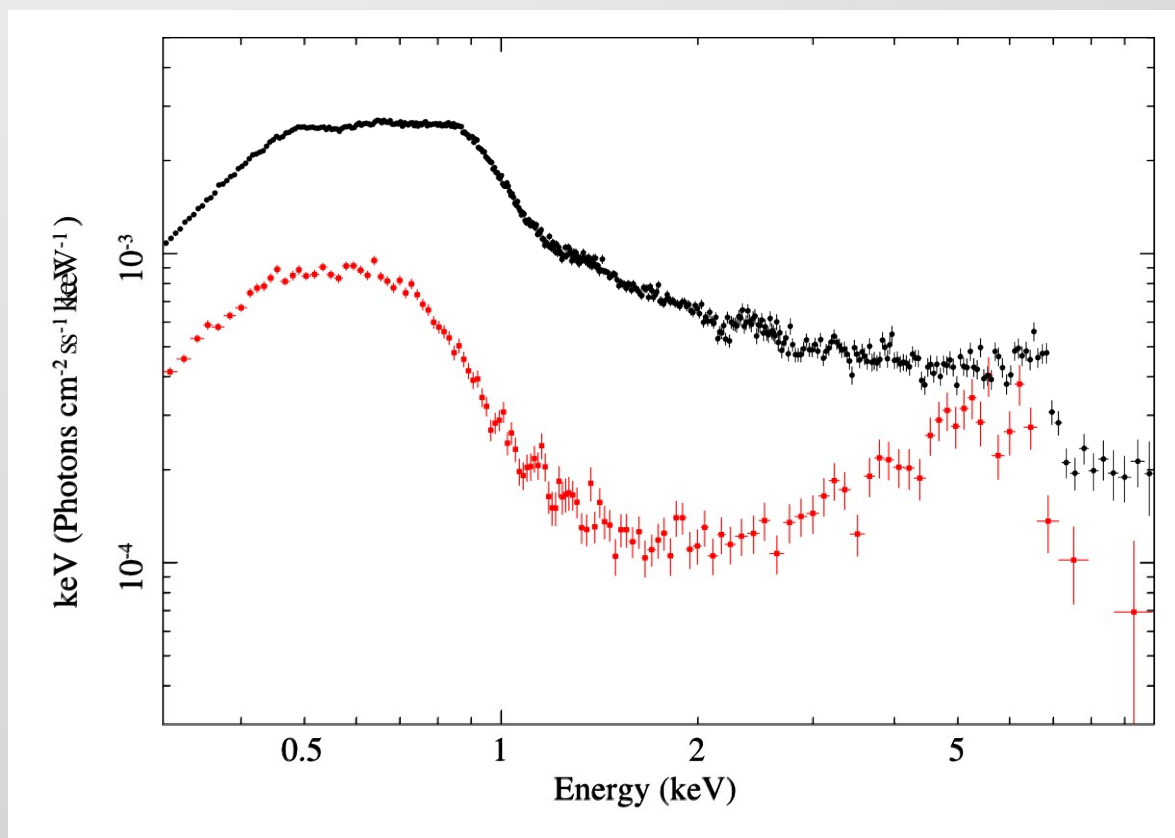
- Early XMM observations: 2000, 2002
- Obtained a longer observation in 2008



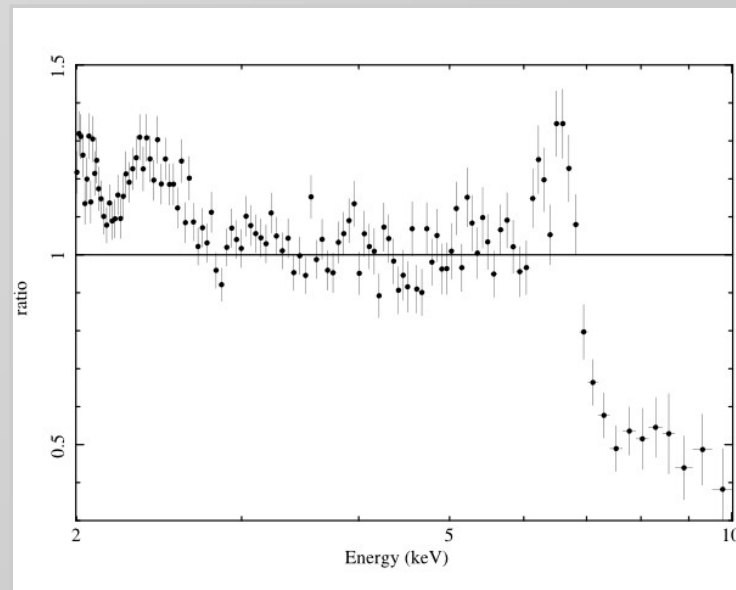
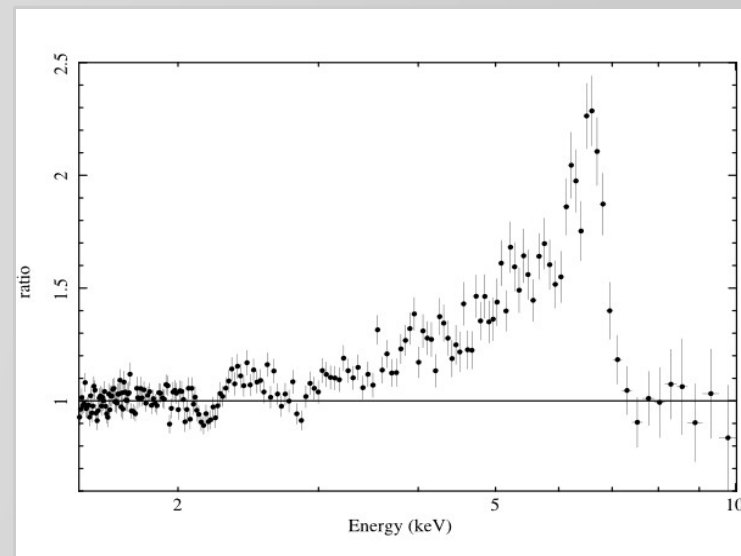
Boller. (02), Gallo et al. (04)

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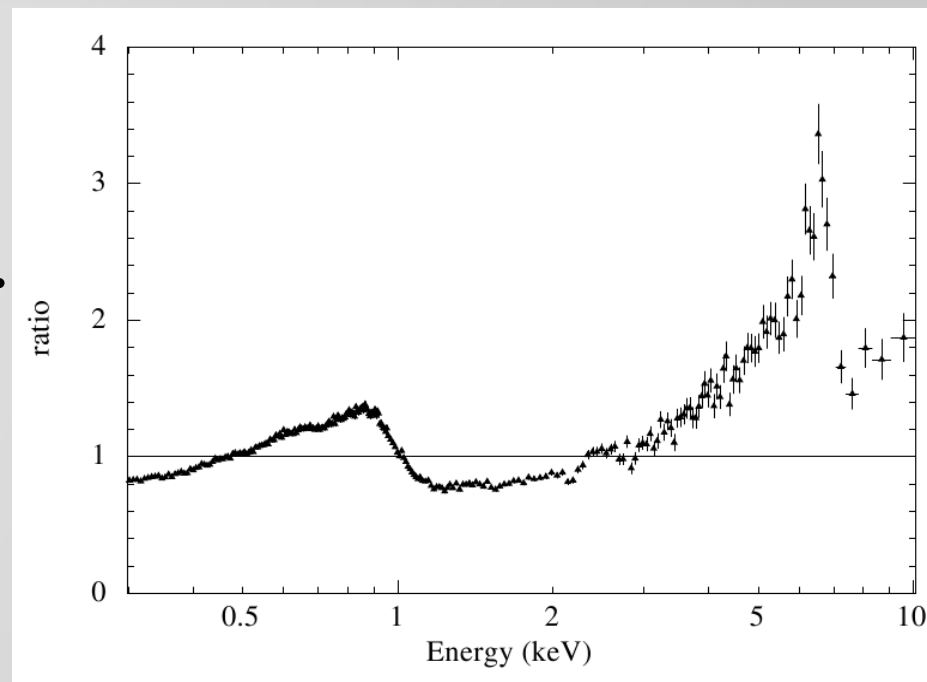
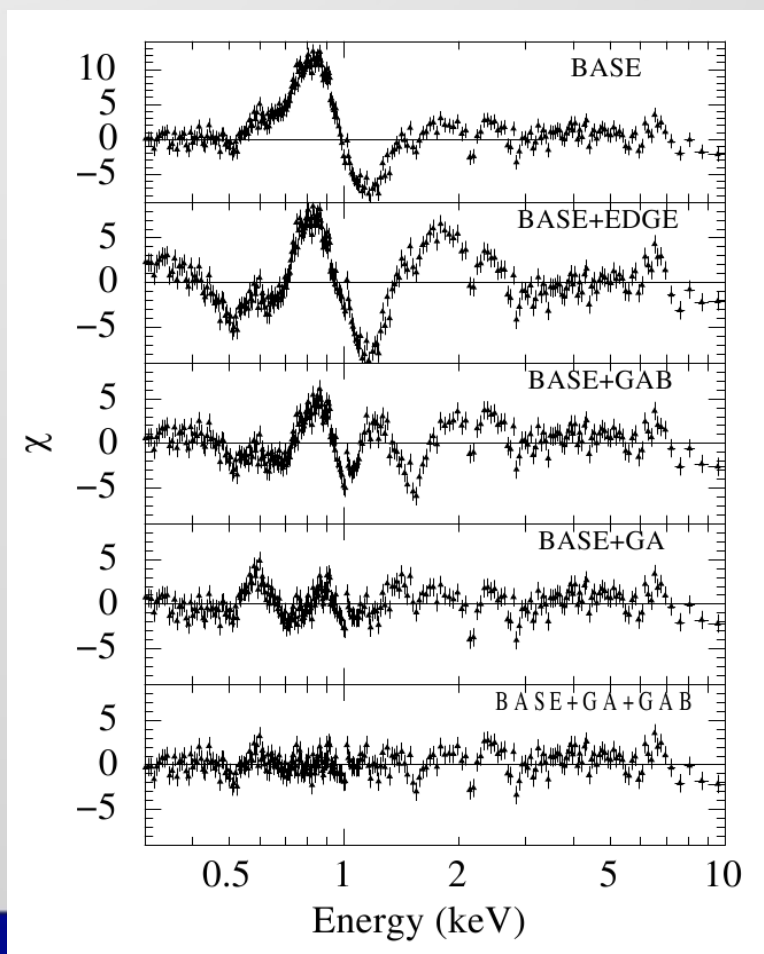


Boller. (02), Gallo et al. (04)



# 1H 0707-495 Spectrum

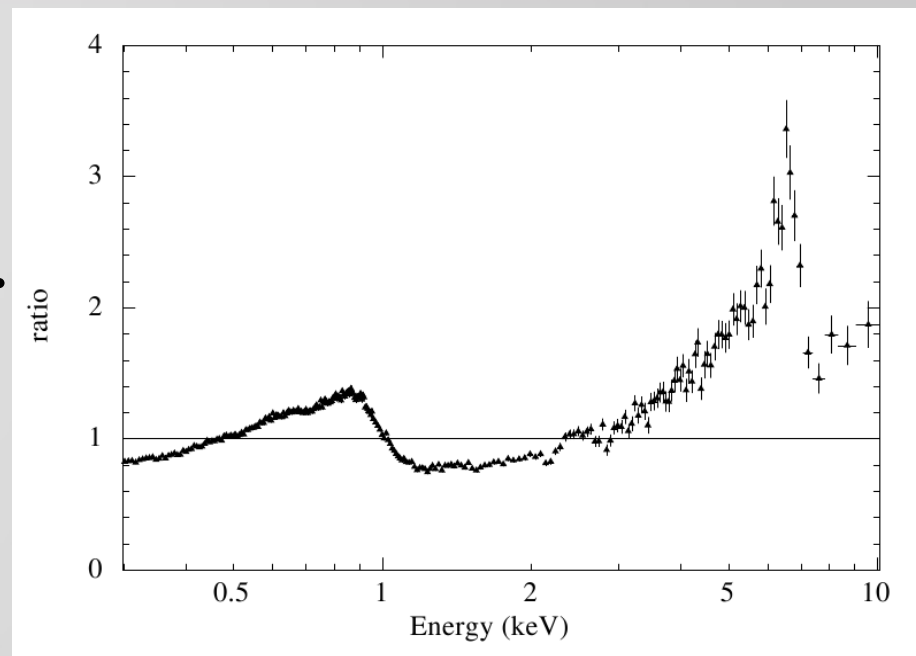
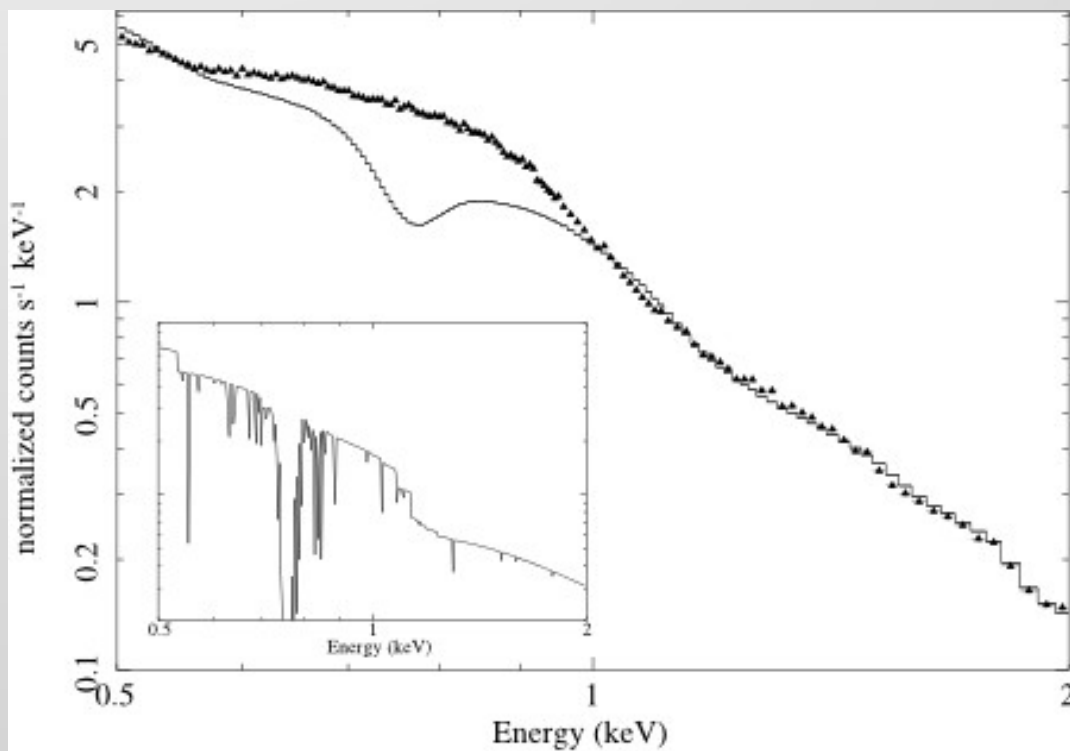
- More interesting when looking at the whole spectrum.



Fabian et al. (09), Zoghbi et al. (09)

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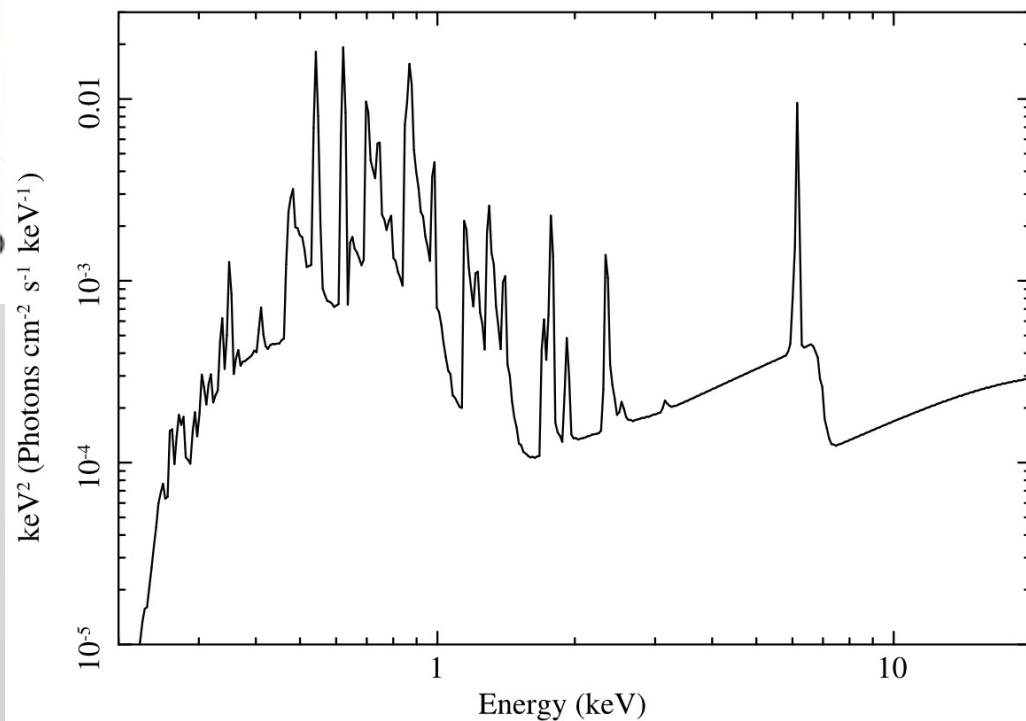
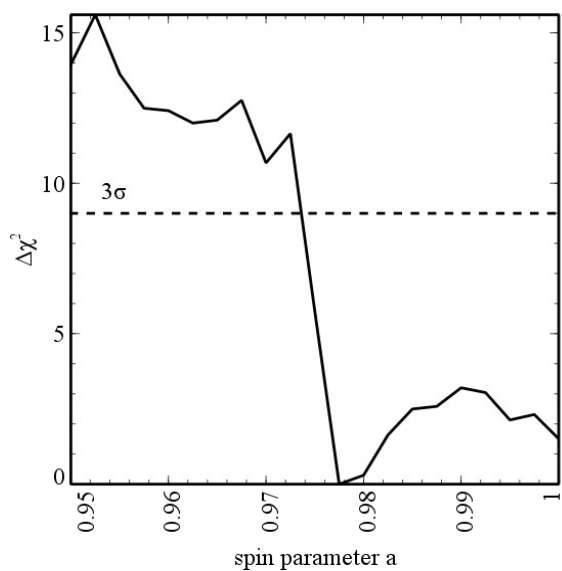
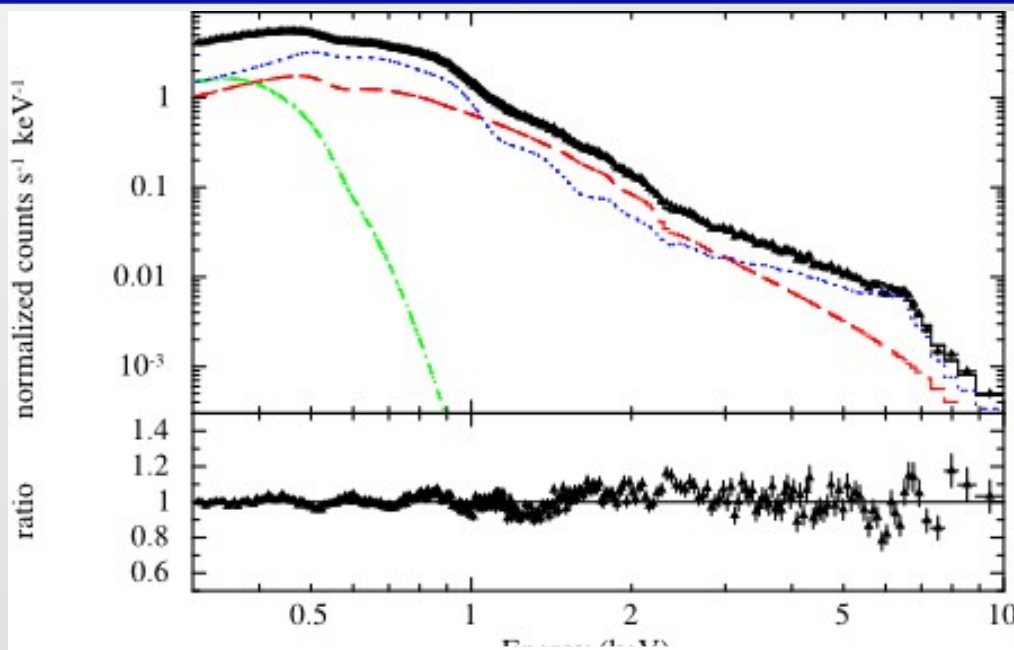
- More interesting when looking at the whole spectrum.



- No Absorption in RGS (Blustin & Fabian 2009)

Fabian et al. (09), Zoghbi et al. (09)

# 1H 0707-495 Spectrum with XMM

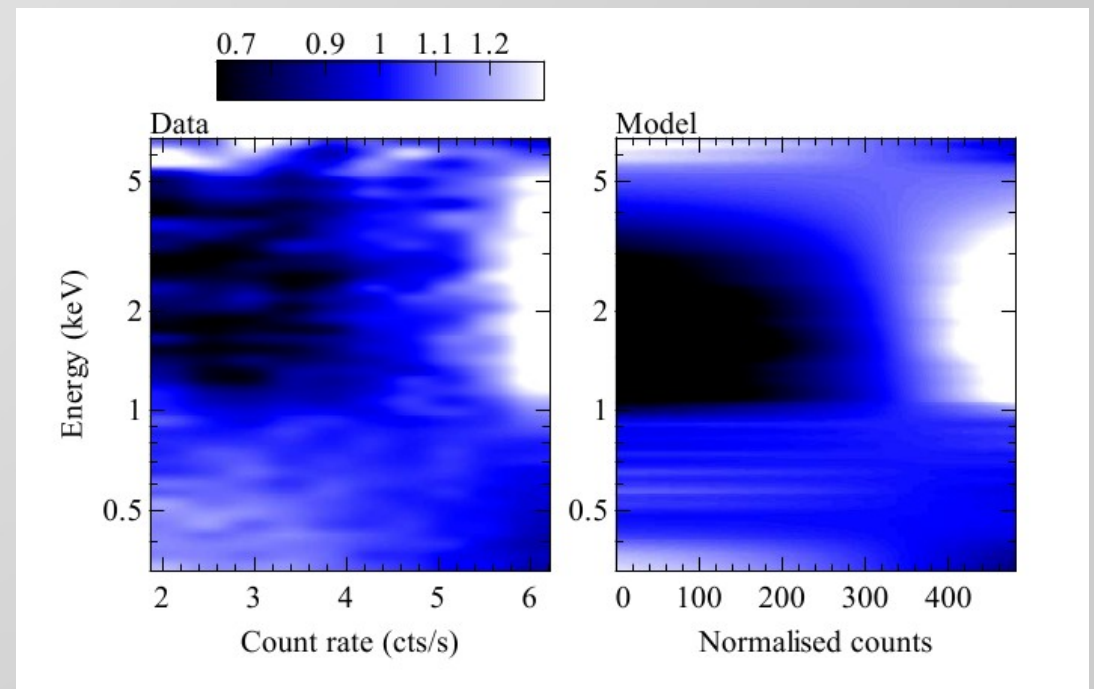
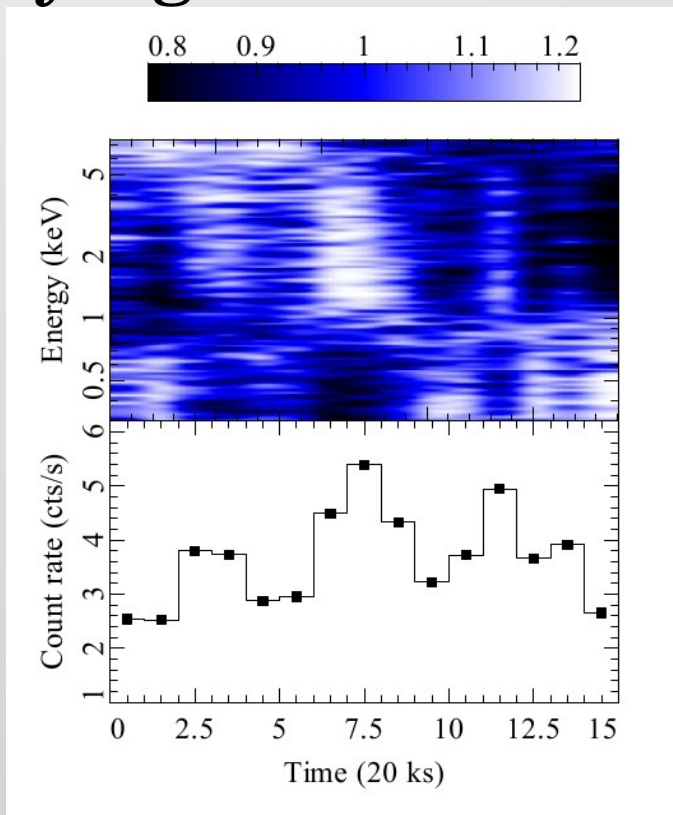


Fabian et al. (09), Zoghbi et al. (09)



# Spectral Variability

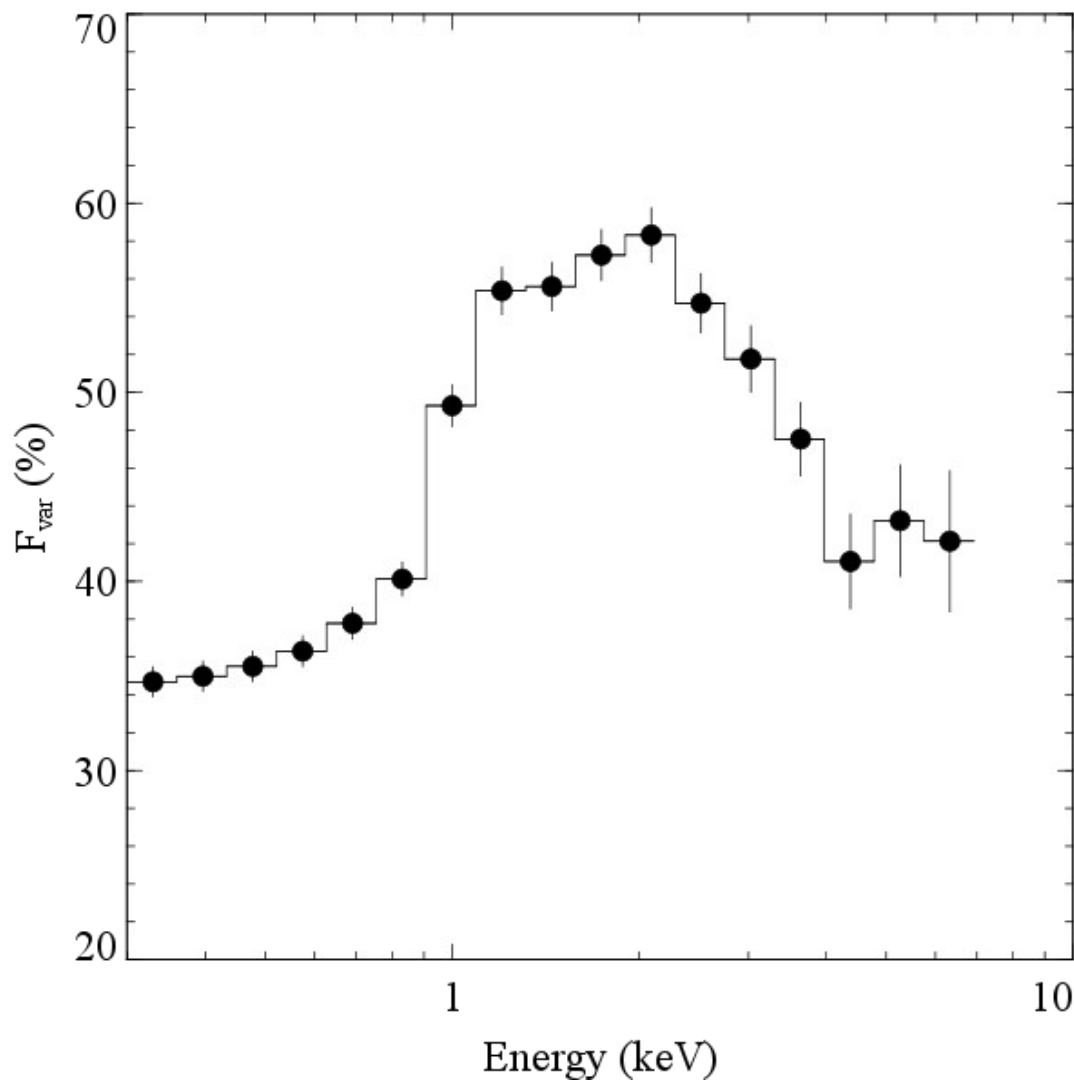
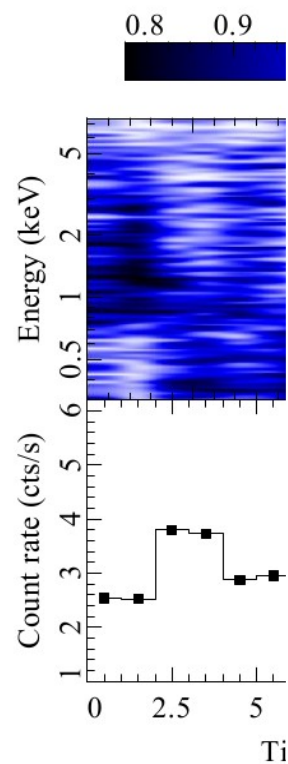
- Variability shows that the spectrum is composed of two components: a variable PLC (1-4 keV) & slowly varying Reflection.



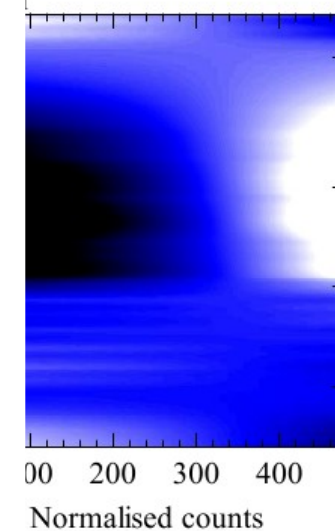
Zoghbi et al. (09)

# Spectral Variability

- Variability composed of two components: a fast varying component and a slowly varying component.



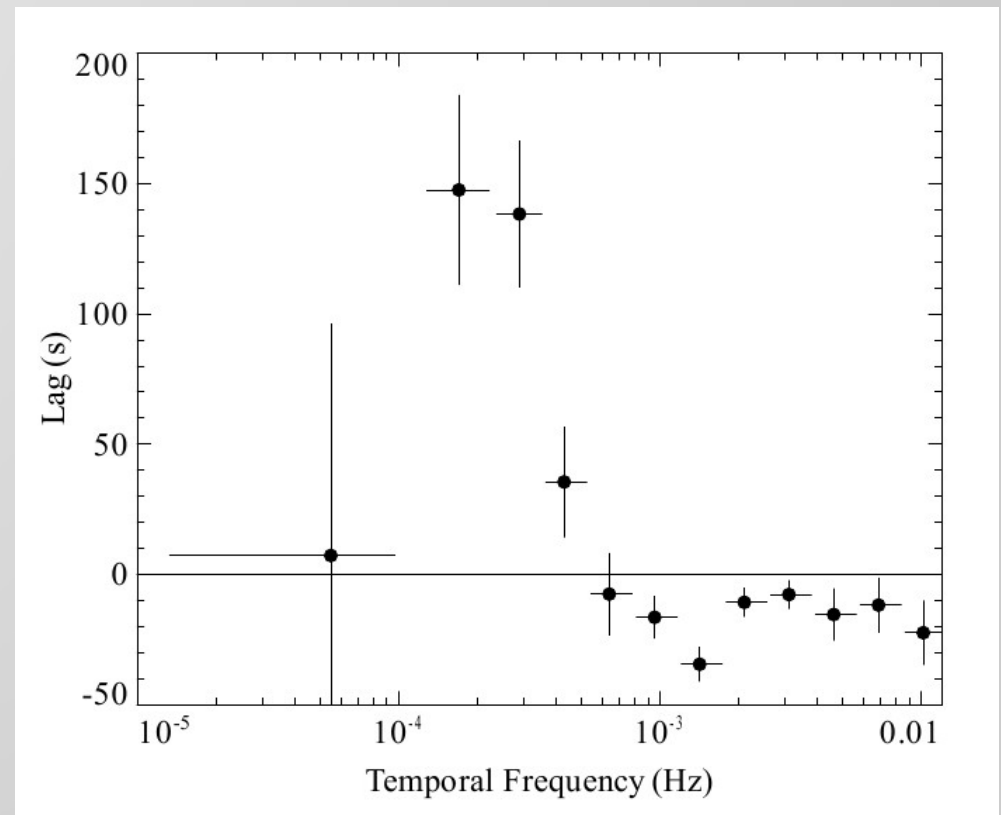
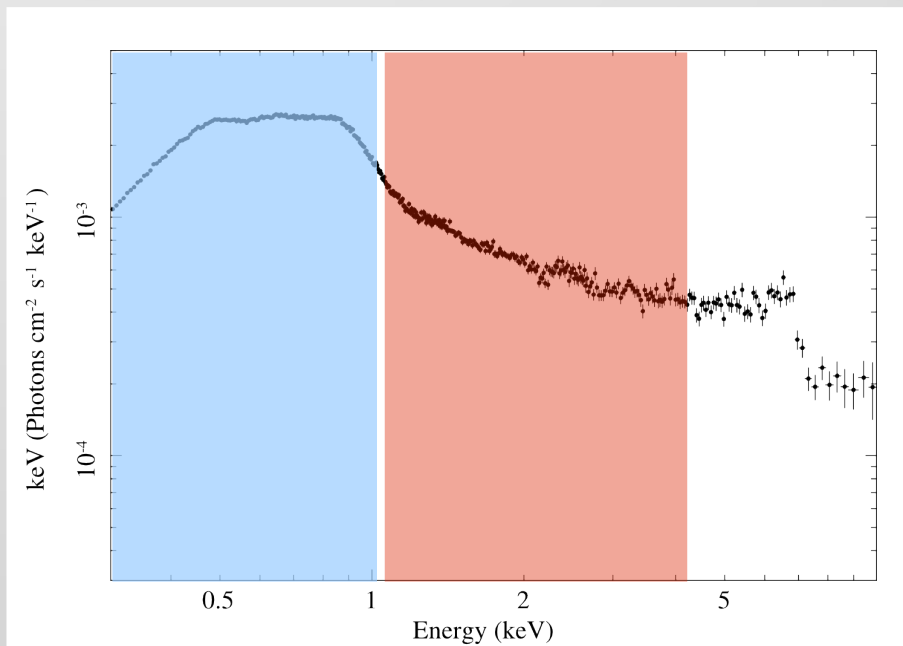
composed of  
& slowly



Zoghbi et al. (09)

# Time Lags

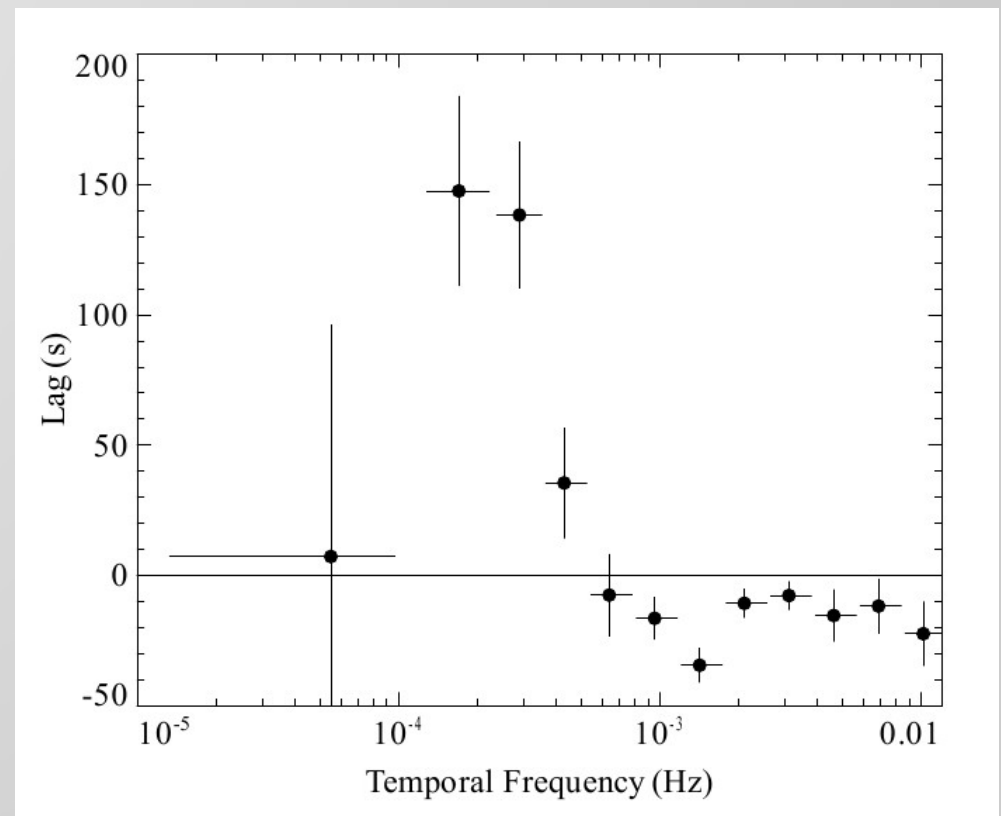
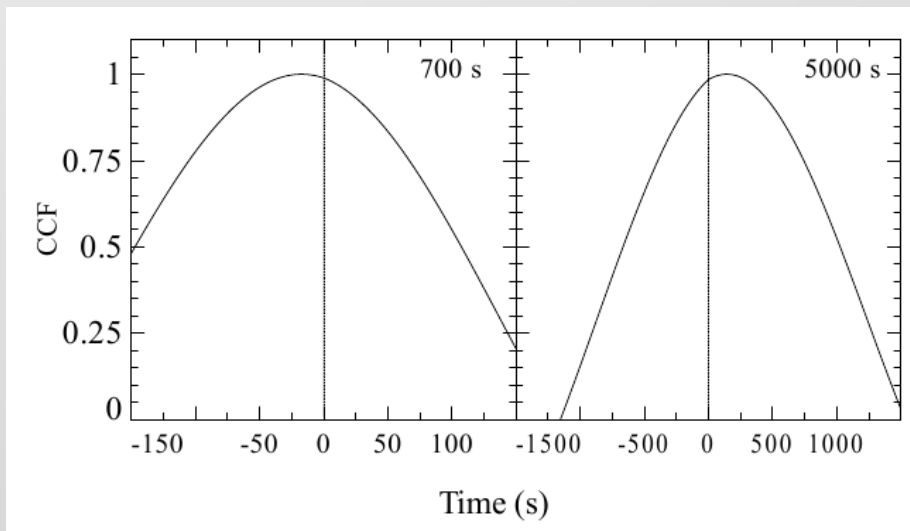
- The first significant soft lag of  $\sim 30$ s between 0.3-1 and 1-4 keV



Fabian et al. (2009), Zoghbi et al. (2009)

# Time Lags

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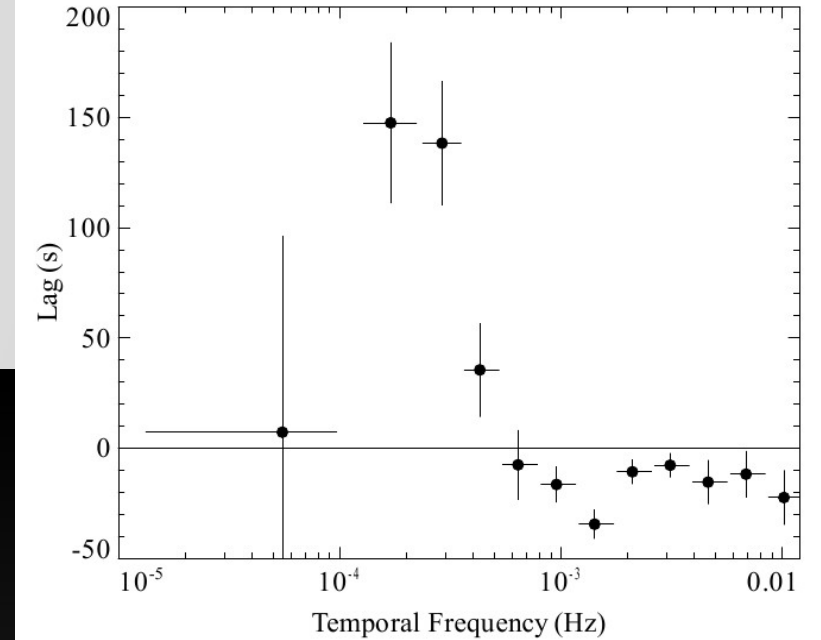
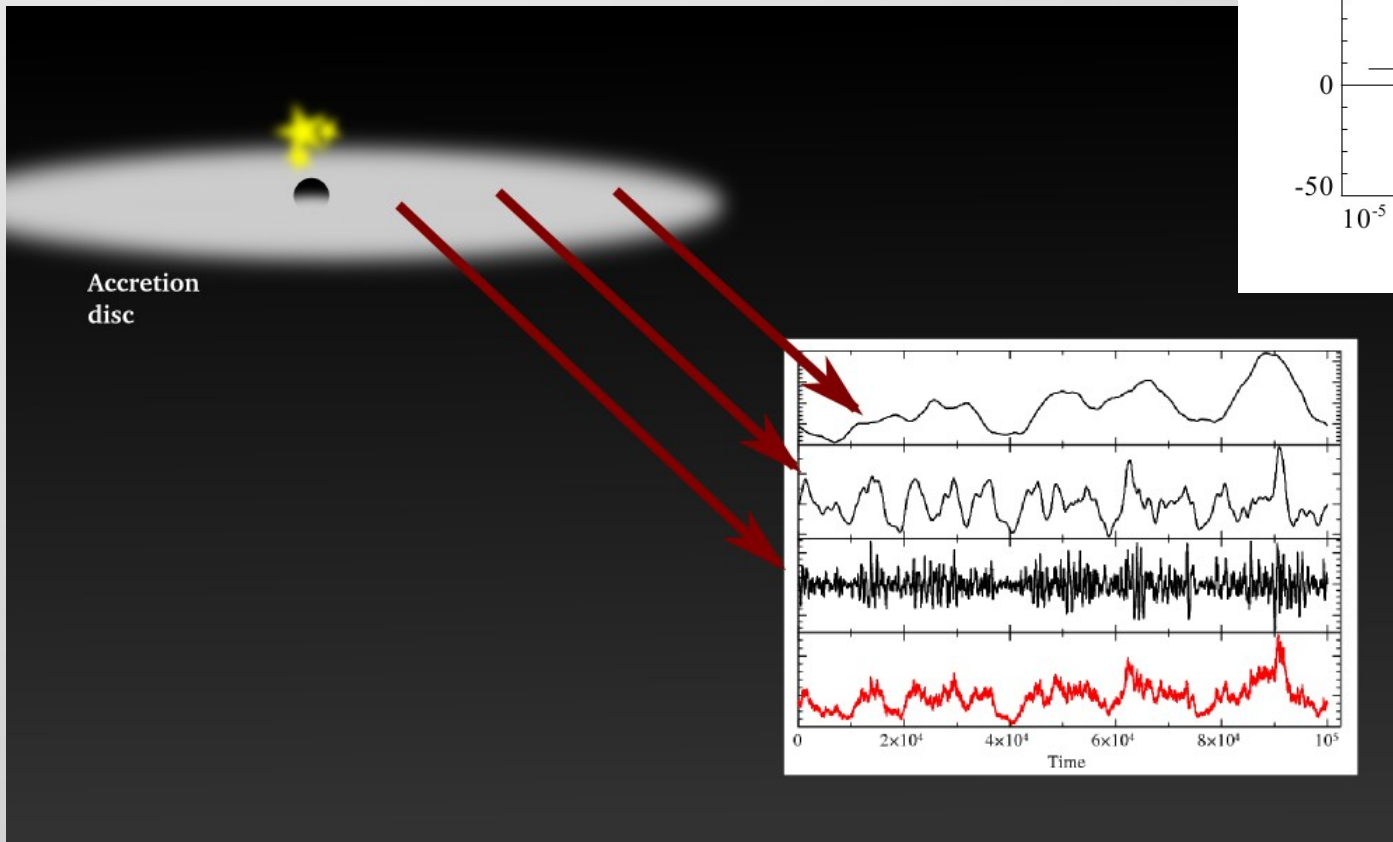


... and it is significant

Fabian et al. (2009), Zoghbi et al. (2009)

# Time Lags

- What does it mean?



Lyubarskii (97)  
Arevalo & Uttley (06)

# Concluding Remarks

- No warm absorption: a clear view of the inner accretion disc.
- Strong soft excess: due to iron over-abundance.  
Explain the strong Fe lines in the optical seen in this and other NLS1 ?
- Soft excess: reprocessed emission from ionised material.
- Probing the accretion on scales of  $\sim 30$  light **seconds** in a source that is  $\sim 600$  **million** light **years** away.