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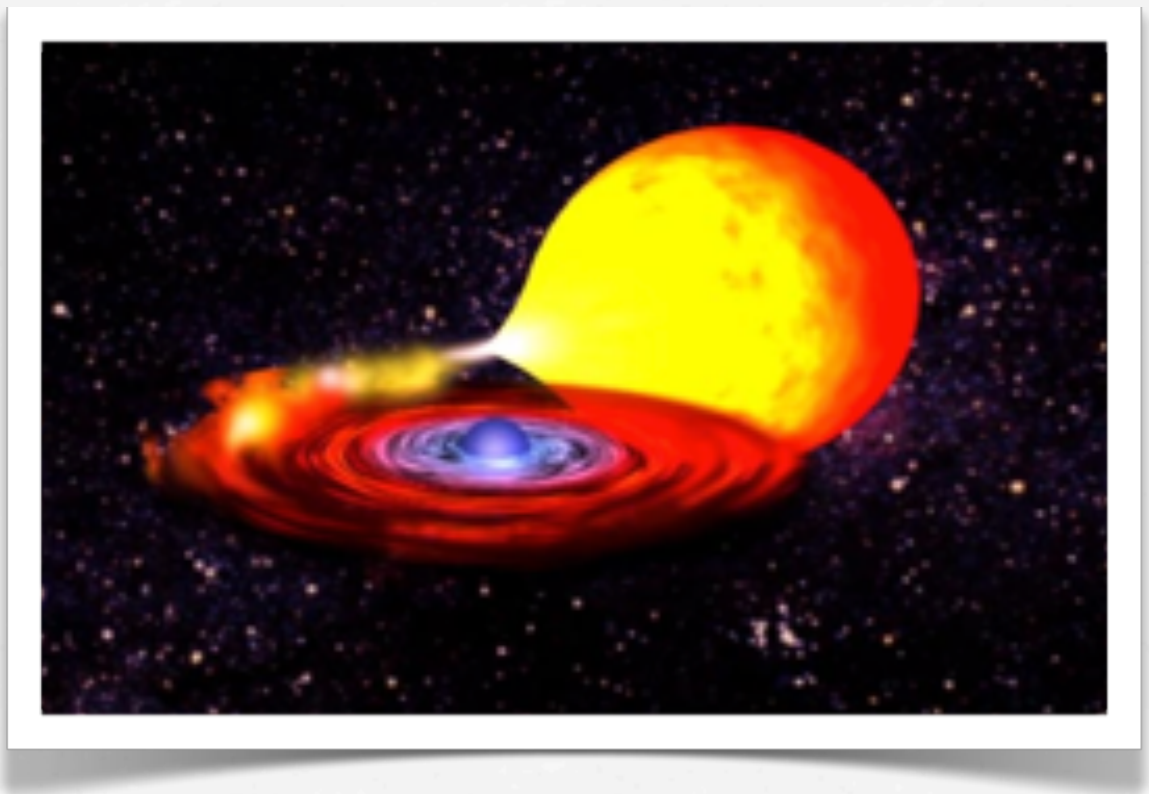
ITN 215212

Detection of a relativistic iron line in MXB 1728-34 with XMM-Newton

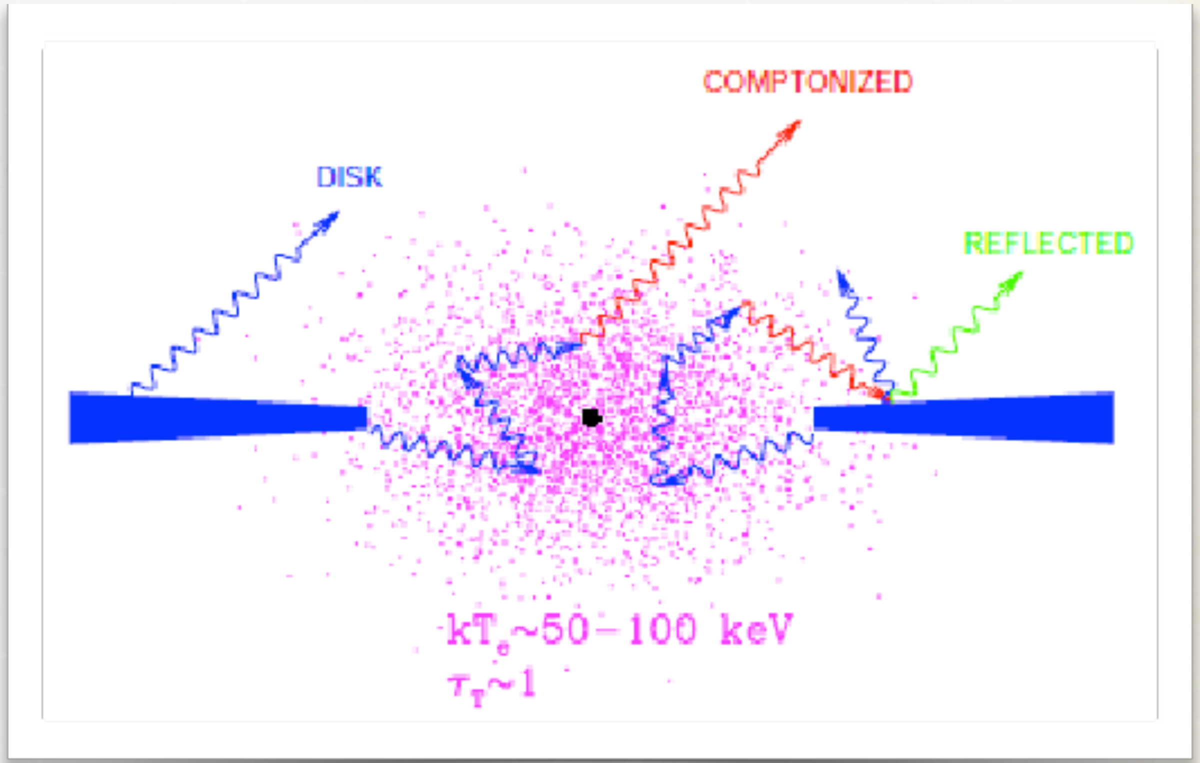


The X-ray Universe 2011
Berlin, June 28th

The Iron Line

- Broad iron line in the energy range 6.4 - 7.0 keV
- Could be produced from irradiation by hard X-rays of the cold matter (accretion disk)

  => reflection component

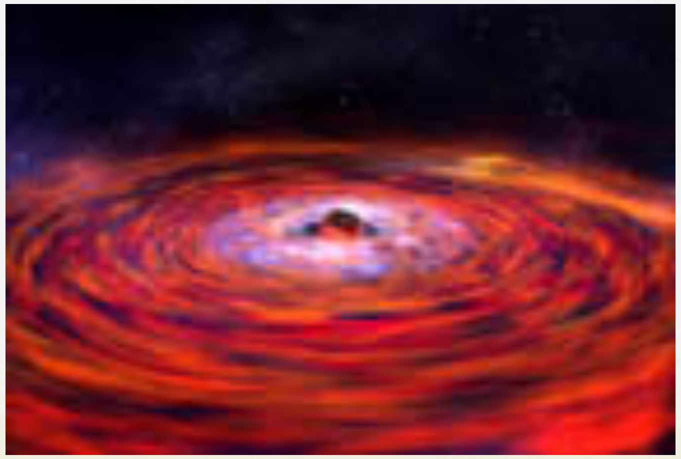


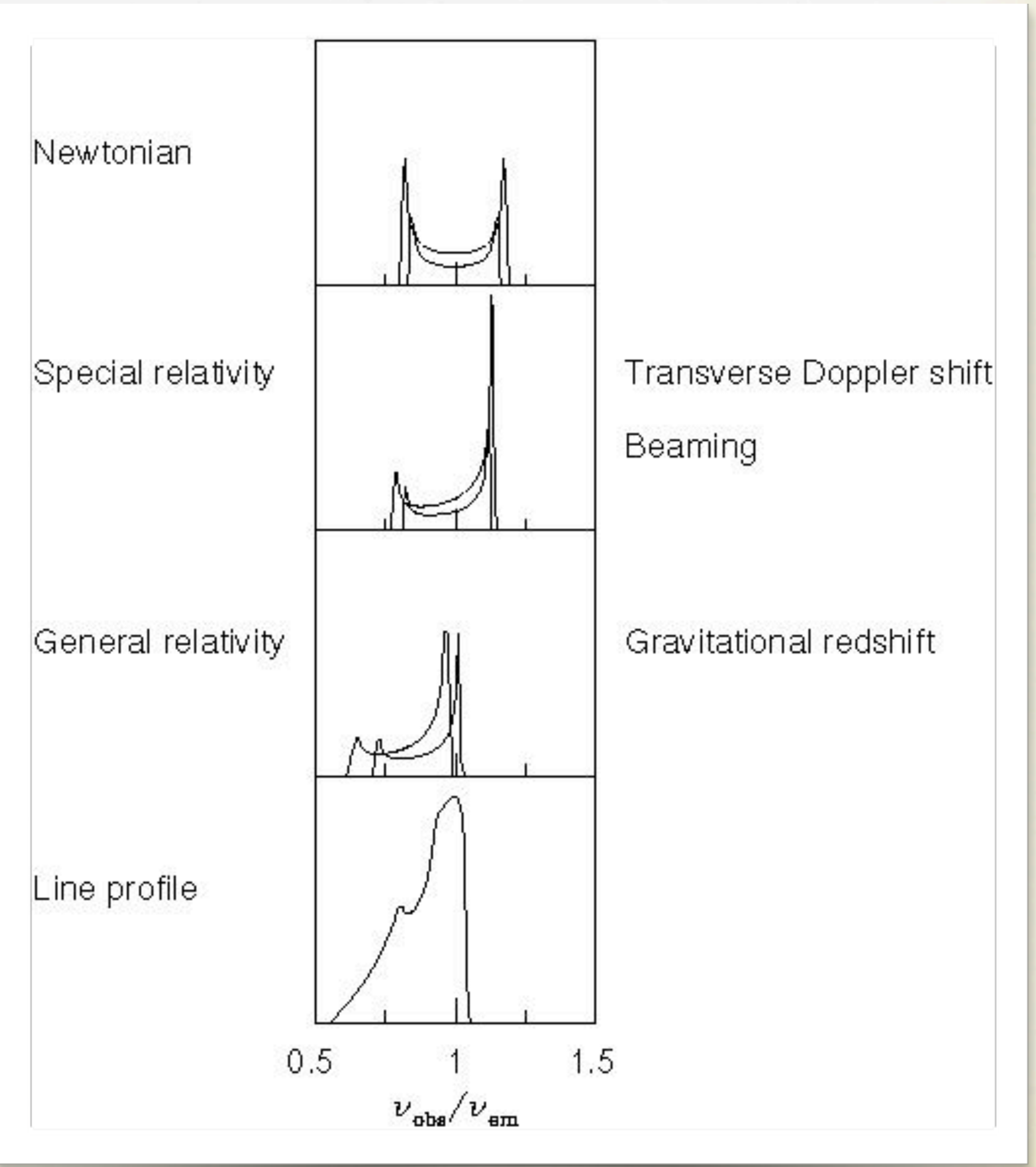
- Identified with Kalpha transition of iron at different ionization states

Profile of the line

- **Broad and Asymmetric :**

- Doppler shifts
- Relativistic beaming
- Gravitational redshifting

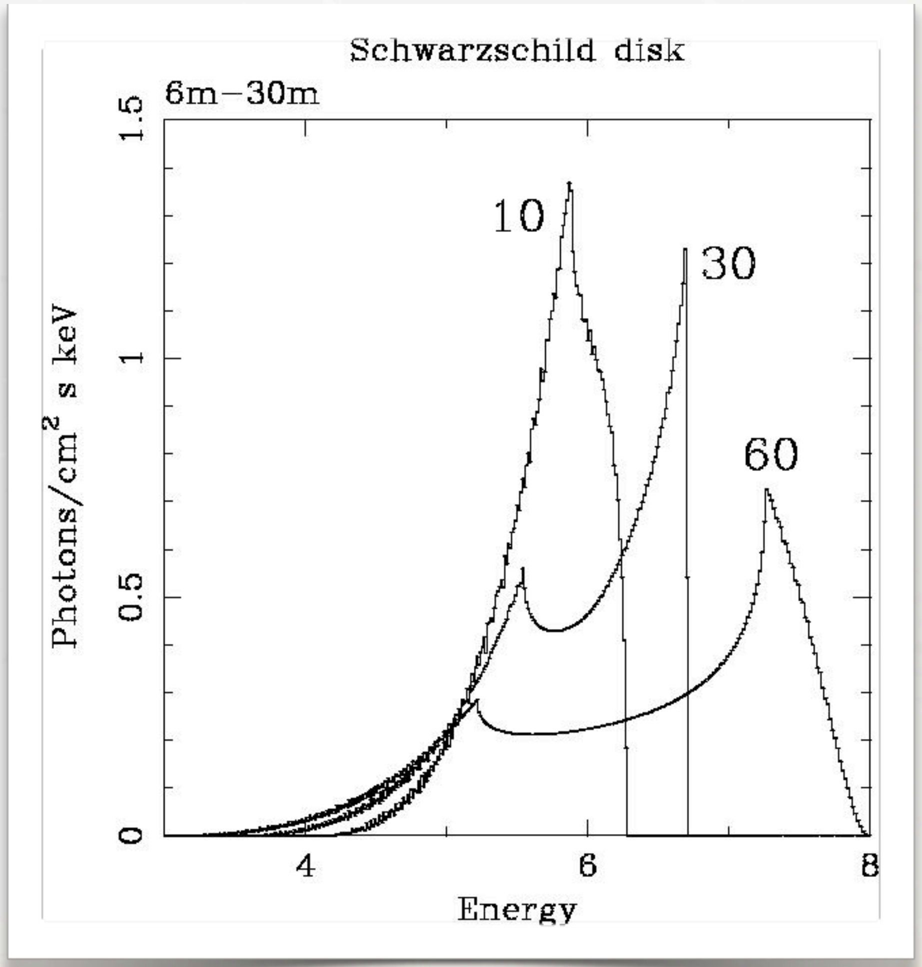




Useful informations

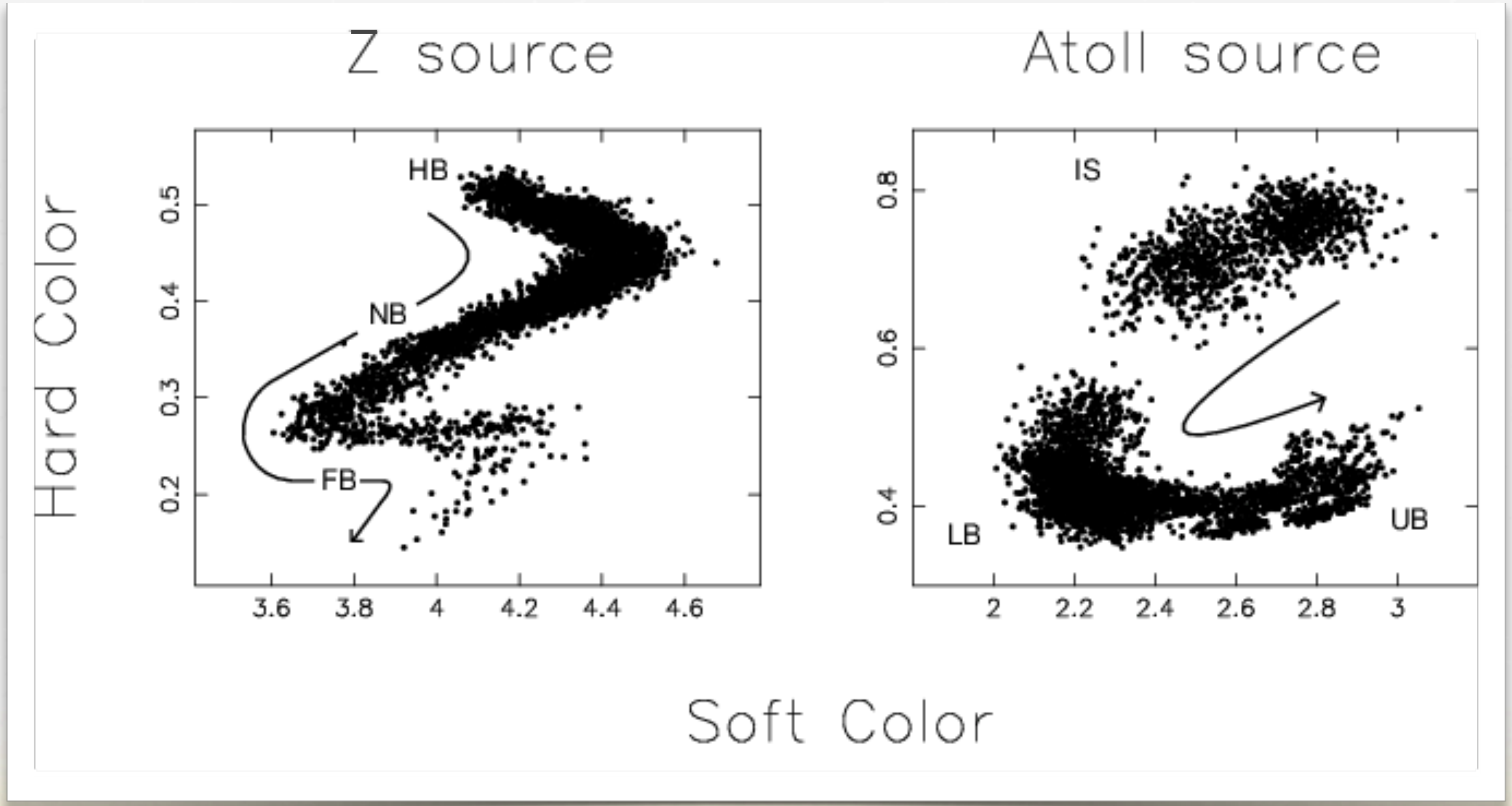
- **Determination of parameters of the accretion disk :**
    - Inner radius
    - Outer radius
    - Inclination of the system ⟶
    - Ionization parameter :

$$\xi(r) = 4\pi F_X(r)/n(r)$$



MXB 1728-34

- LMXB containing a weakly magnetized neutron star
- Atoll class

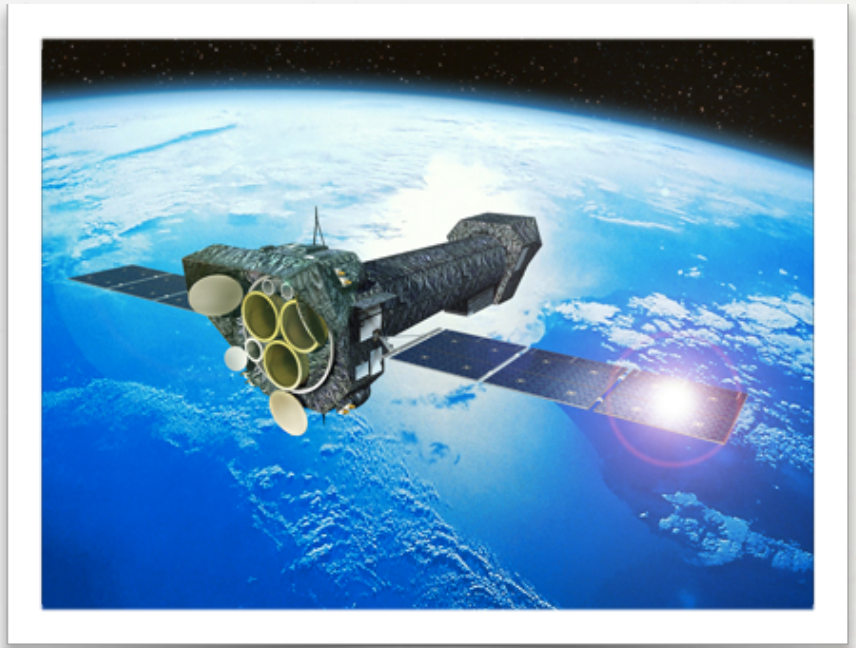


MXB 1728-34

- LMXB containing a weakly magnetized neutron star
- Atoll class
- Optical counterpart unknown
- Frequent type I X-ray bursts
  => constrain the distance to the source ($4.1 < d < 5.1$ kpc)

Observation & Spectral Analysis

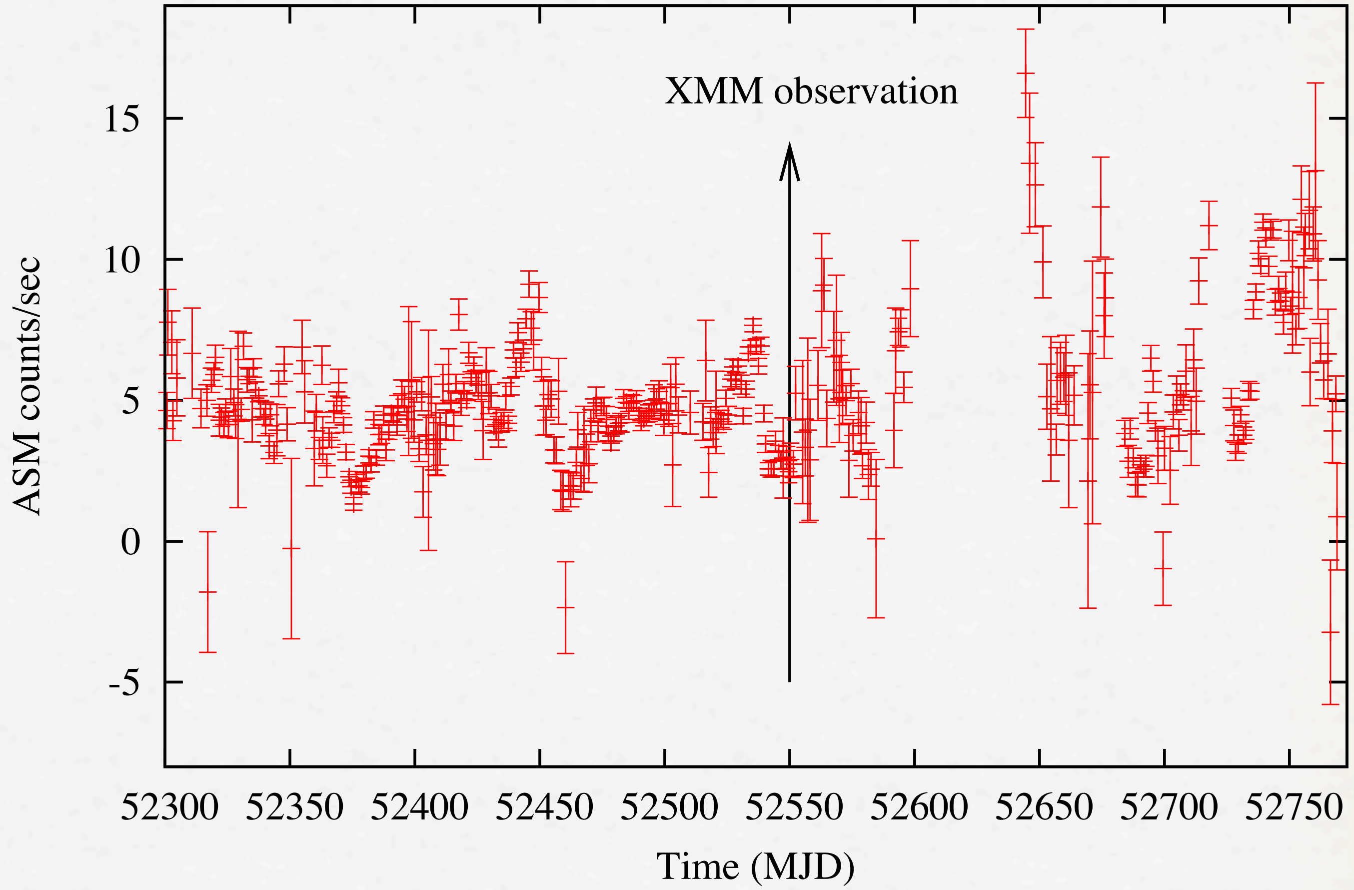
- Observed by XMM-Newton on 2002 October 3rd
- Observing time of 28 ks
- EPIC-pn, MOS1, MOS2, RGS1, RGS2
- OM not active



- XMM-Newton/EPIC-pn data published by Ng et al. (2010)

RXTE/ASM lightcurve :

- 1.5-12 keV energy range
- Average count rate :
  3 counts/s

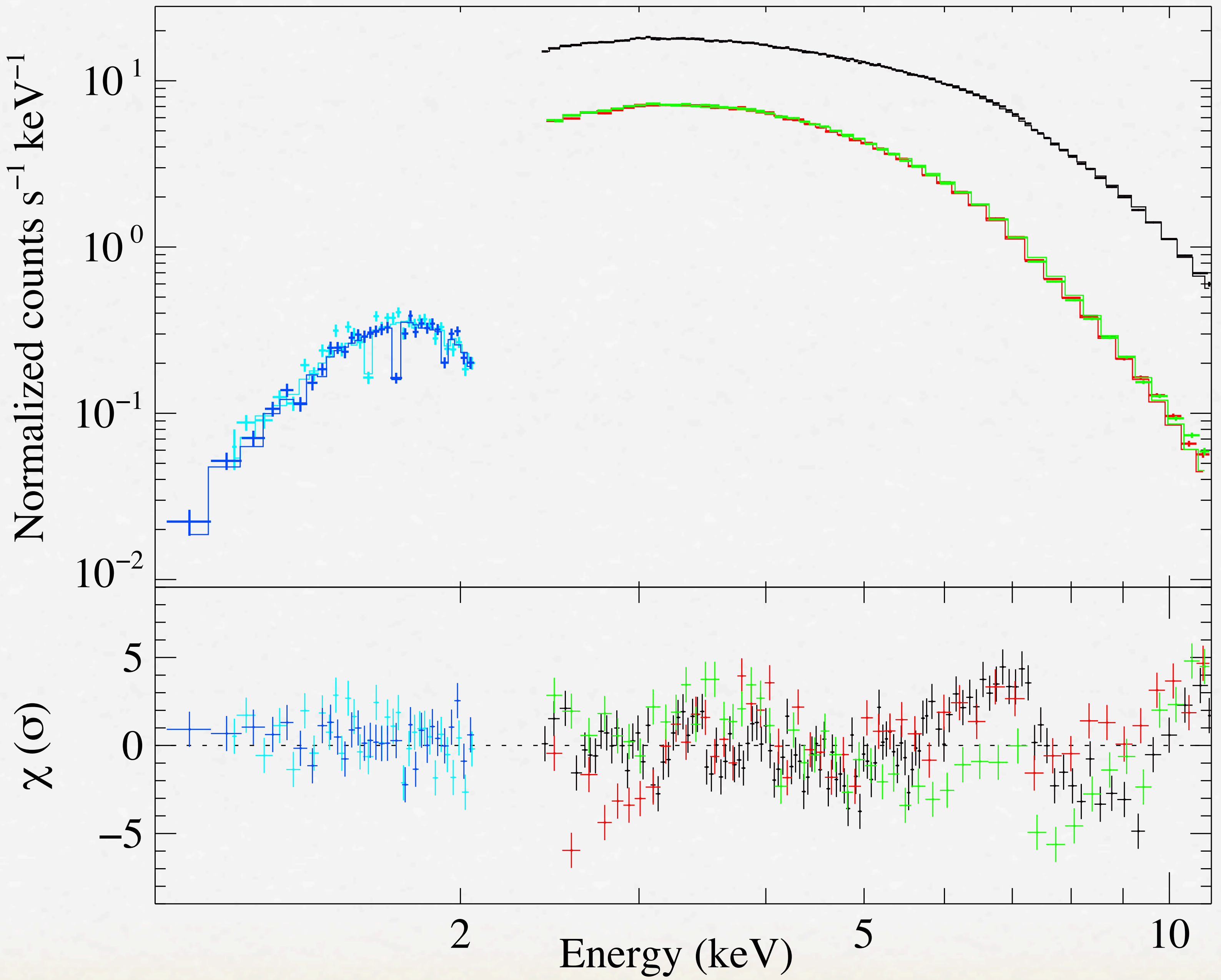


=> Not activity period during the XMM-Newton observation

Data reduction with SAS

- **EPIC-pn and MOS => Timing Mode**
- **No contamination from the background solar flares**
  => lightcurve in 10-12 keV
- **Pile-up did not affect the data**
  count rate : 110 counts/s << 800 counts/s
- **RGS => Standard spectroscopy mode**

Detection of the iron line



Comparison between 4 models

	Gaussian	Diskline	Relline	Reflionx
E line (keV) Rin (Rg) Inclination	6.57 ± 0.05 - -	$6.45^{+0.05}_{-0.07}$ 18^{+3}_{-6} (60°)	6.43 ± 0.07 19^{+3}_{-4} (60°)	- 20^{+29}_{-6} $> 44°$
Chi2 (d.o.f.)	1489 (901)	1463 (899)	1464 (899)	1555 (901)

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200 simulations :
probability of chance improvement = 1%

=> The diskline model is preferred

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in agreement

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Addition relativistic smearing :
Chi2 (d.o.f.) = 1463 (900)

=> Relativistic smearing required

Conclusion

- We presented a different approach of Ng et al. (2010) to the data analysis.
  => 5 instruments
  => different continuum
  => different models (favor in a broad and relativistic line)

- First time XMM data from MXB 1728-34 fitted with a self-consistent reflection model.

- Diskline model preferred to Gaussian

- Relativistic smearing required in the reflection model

=> The iron line is relativistic


Thank you !!!