Partial X-ray eclipse by a BLR cloud in the NLS1 galaxy SWIFT J2127.4+5654

Mario Sanfrutos

Centro de Astrobiología (CSIC-INTA)

and G. Miniutti, B. Agís-González, A. C. Fabian,
J. M. Miller, F. Panessa and A. Zoghbi

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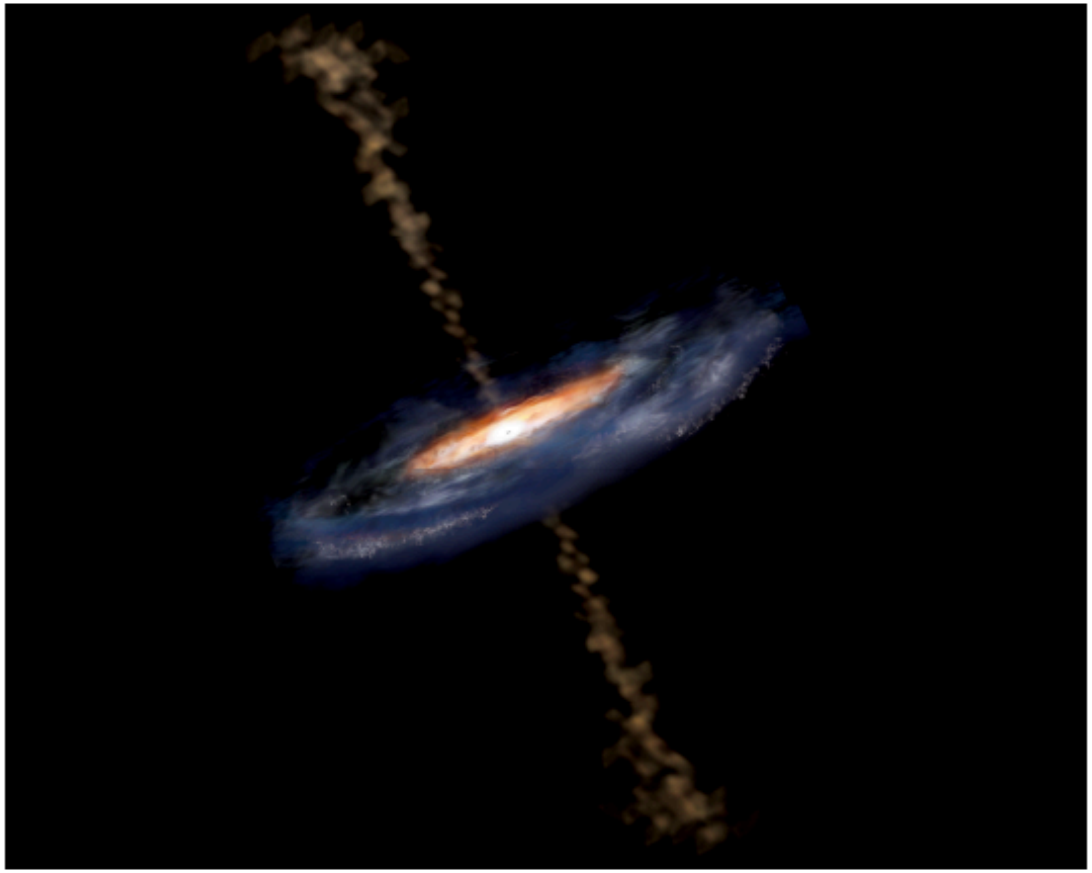
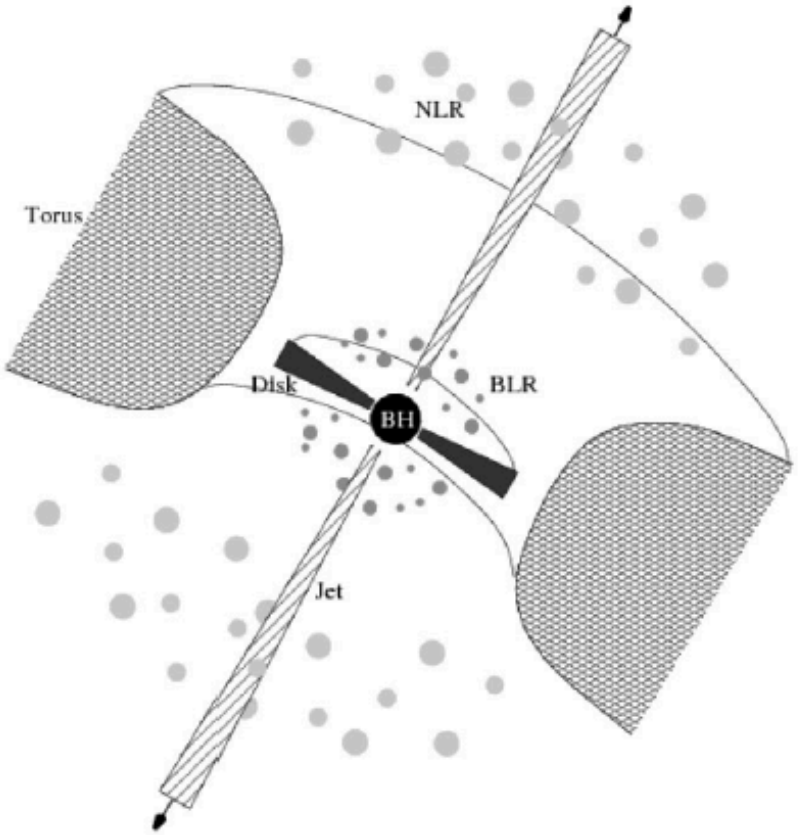
Outline

- Active Galactic Nuclei
  - The 'Central Engine' paradigm
  - AGN innermost structure
  - X-ray absorption variability
- Some absorption variability examples
- SWIFT J2127.4+5654
  - Spectral variability
  - Physical constraints

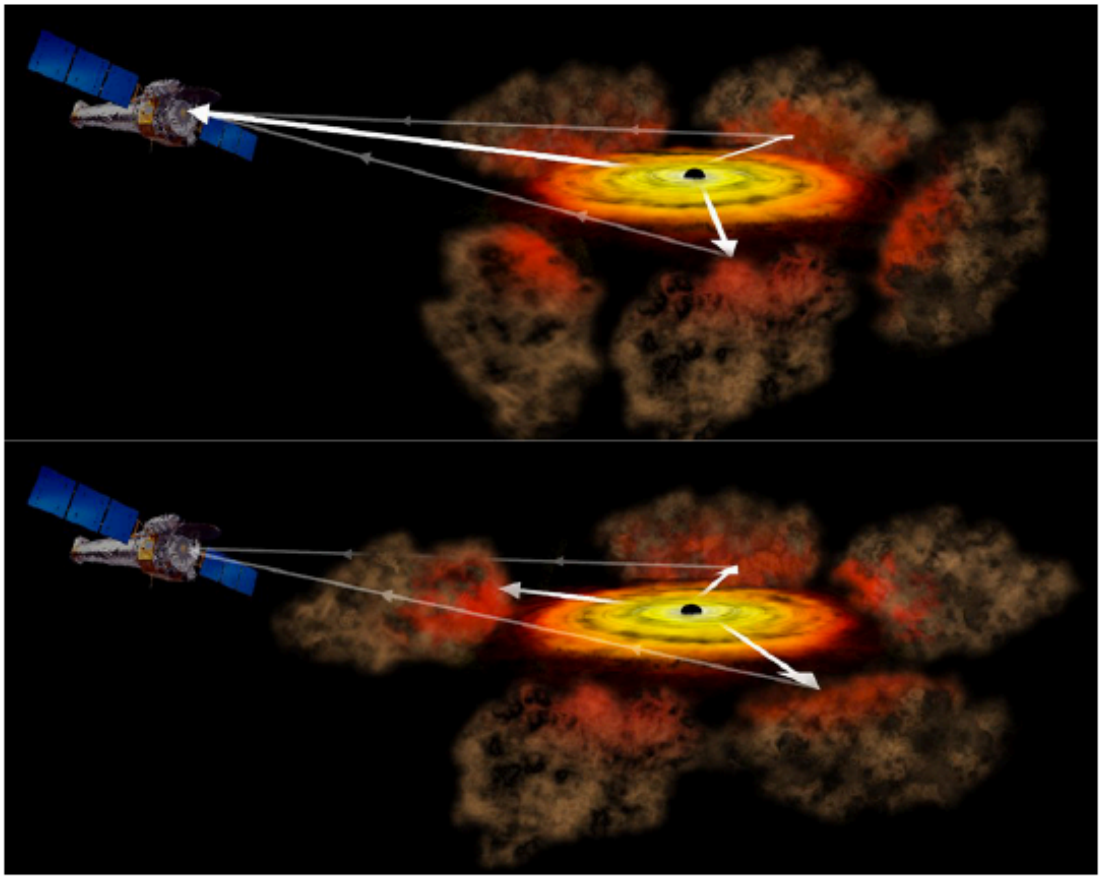
The 'Central Engine' paradigm



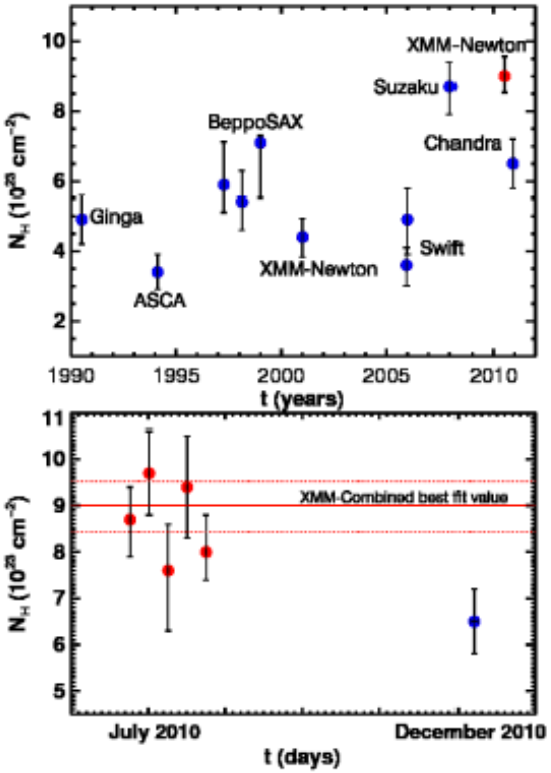
The innermost region structure



Obscuring clouds

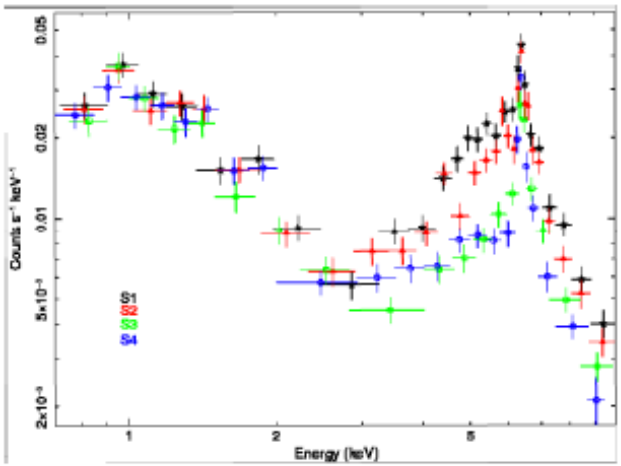


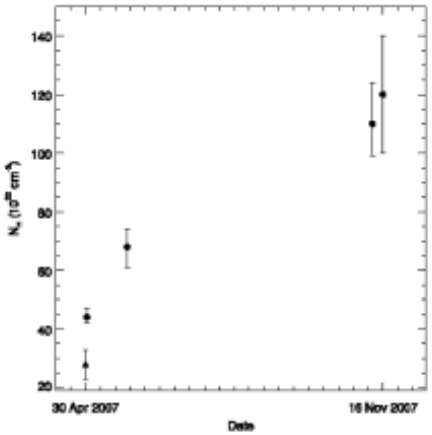
Long timescales variability



- NGC 4507 (Sy 2)
- Marinucci et al. +13
- Several N_H variations in timescales of years
  - Absorption variability due to gas clouds at pc-scale distance
- No evidence of N_H variation in short timescales
  - No absorption by BLR

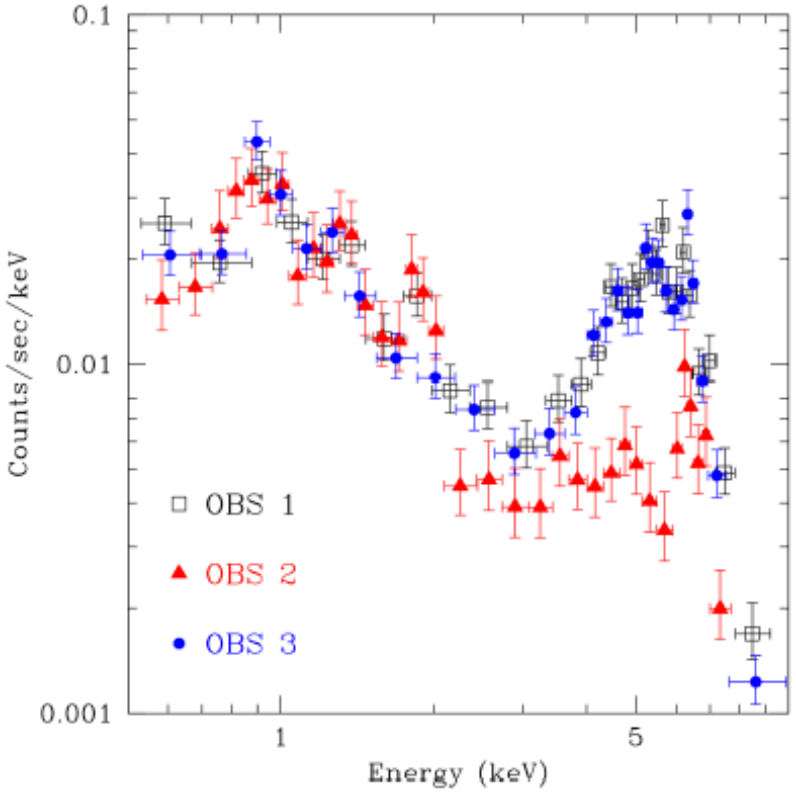
Short timescales variability





- NGC 7582 (Sy 2)
- Bianchi et al. +09
- Suzaku campaign 07
- C-thin to C-thick in 6 months
- 3 absorbers/emitters needed
  - Dust lane >> pc
  - Torus ~ pc
  - BLR clouds < pc

Short timescales variability



- NGC 1365
- Risaliti et al. +07
- 10-day Chandra monitoring
- C-thin to C-thick to C-thin in 4 days
- Absorption due to a BLR cloud at ~300r_g

SWIFT J2127.4+5654

- NLS1 at low galactic latitude ═► very absorbed
- 84 ks XMM-Newton EPIC pn observation
- Extreme spectral variation

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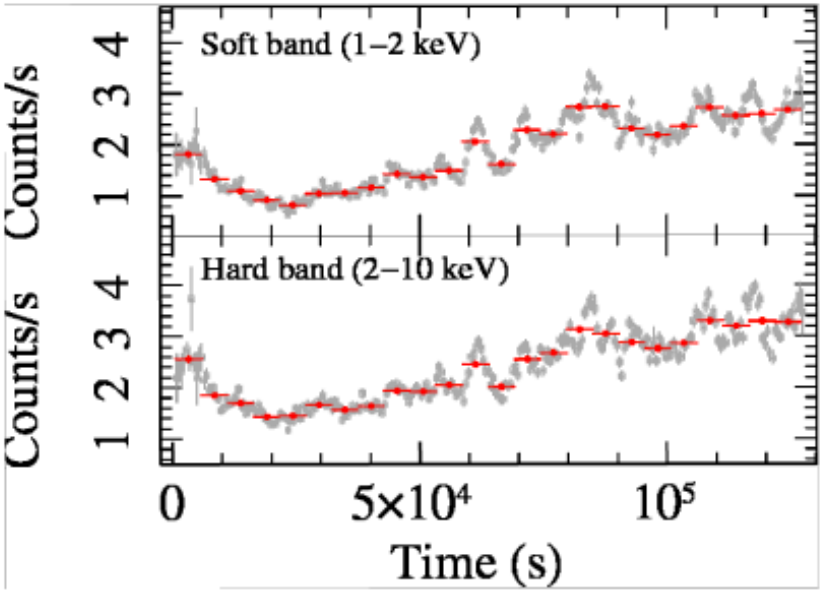
Partial X–ray eclipse by a Broad Line Region cloud in the NLS1 galaxy SWIFT J2127.4+5654

M. Sanfrutos[1⋆], G. Miniutti[1], B. Agís-González[1], A. C. Fabian[2], J. M. Miller[3], F. Panessa[4], A. Zoghbi[5,6]

[1] *Centro de Astrobiología (CSIC–INTA), Dep. de Astrofísica; ESA, P.O. Box 78, E-28691, Villanueva de la Cañada, Madrid, Spain*
[2] *Institute of Astronomy, Madingley Road, Cambridge CB3 0HA, UK*
[3] *Department of Astronomy, University of Michigan, 500 Church St., Ann Arbor, MI48109, USA*
[4] *INAF - Istituto di Astrofisica e Planetologia Spaziali di Roma (IAPS), Via del Fosso del Cavaliere 100, 00133 Roma, Italy*
[5] *Department of Astronomy, University of Maryland, College Park, MD 20742-2421, USA*
[6] *Joint Space-Science Institute (JSI), College Park, MD 20742-2421, USA*

Flux variability

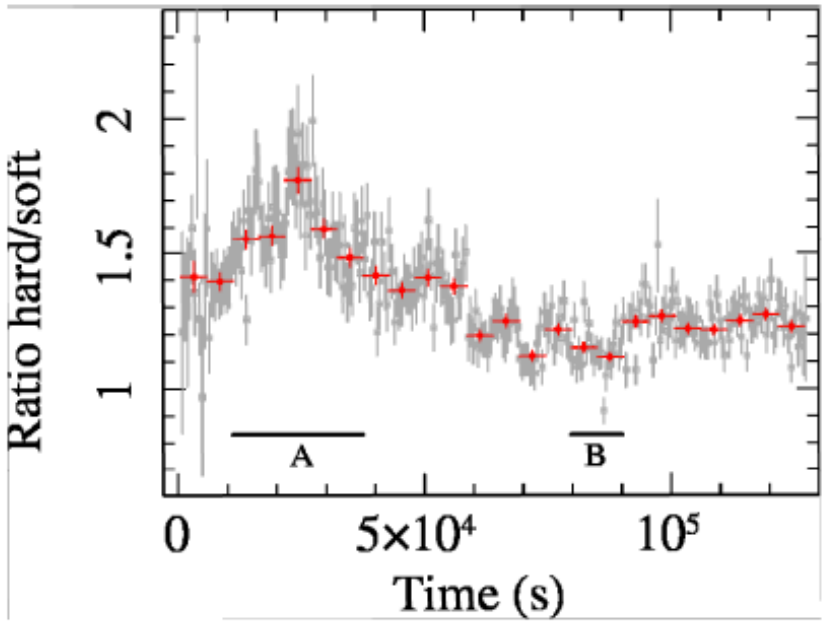


- High variability in **hard** and **soft** bands
- Flux varies up to x4 at **long** timescales (~60ks)
- Variability at **short** timescales ~500s

$\Rightarrow D_S < 1.5\ 10^{13}$ cm

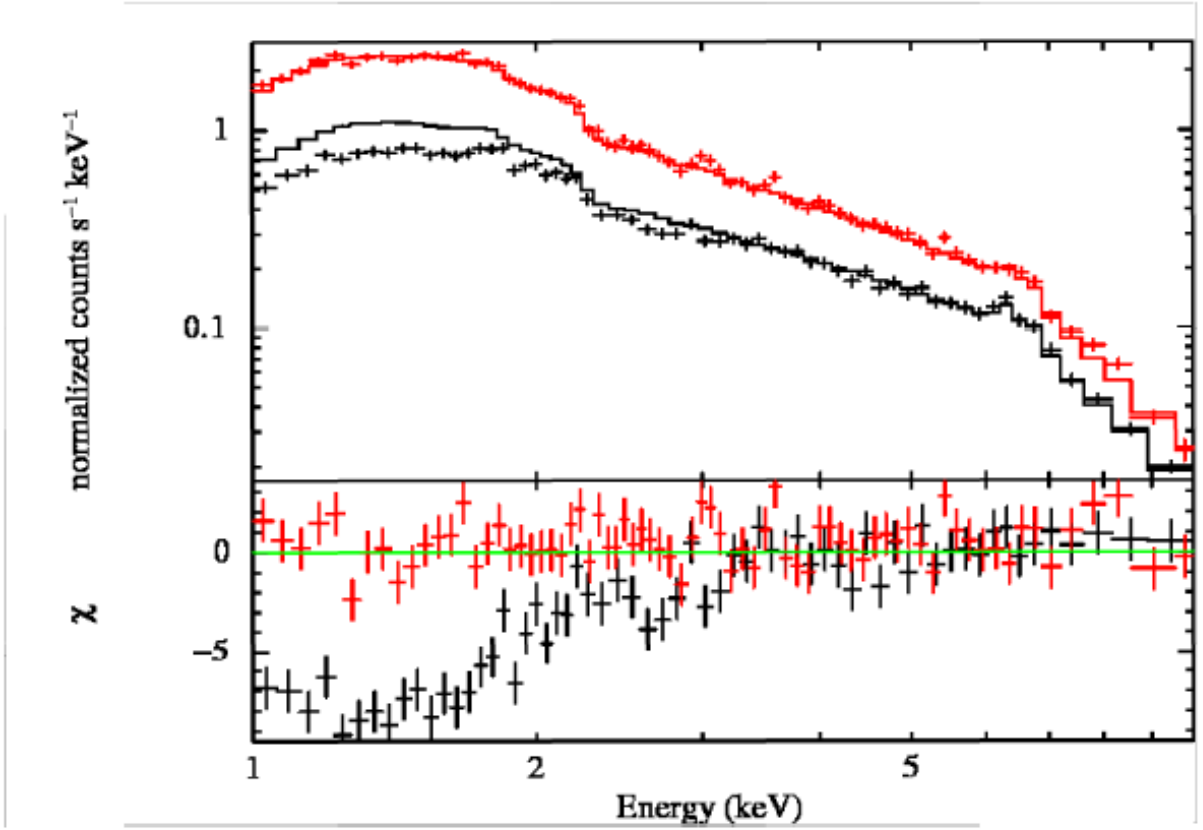
(~16.1 r_g)

Spectral variability

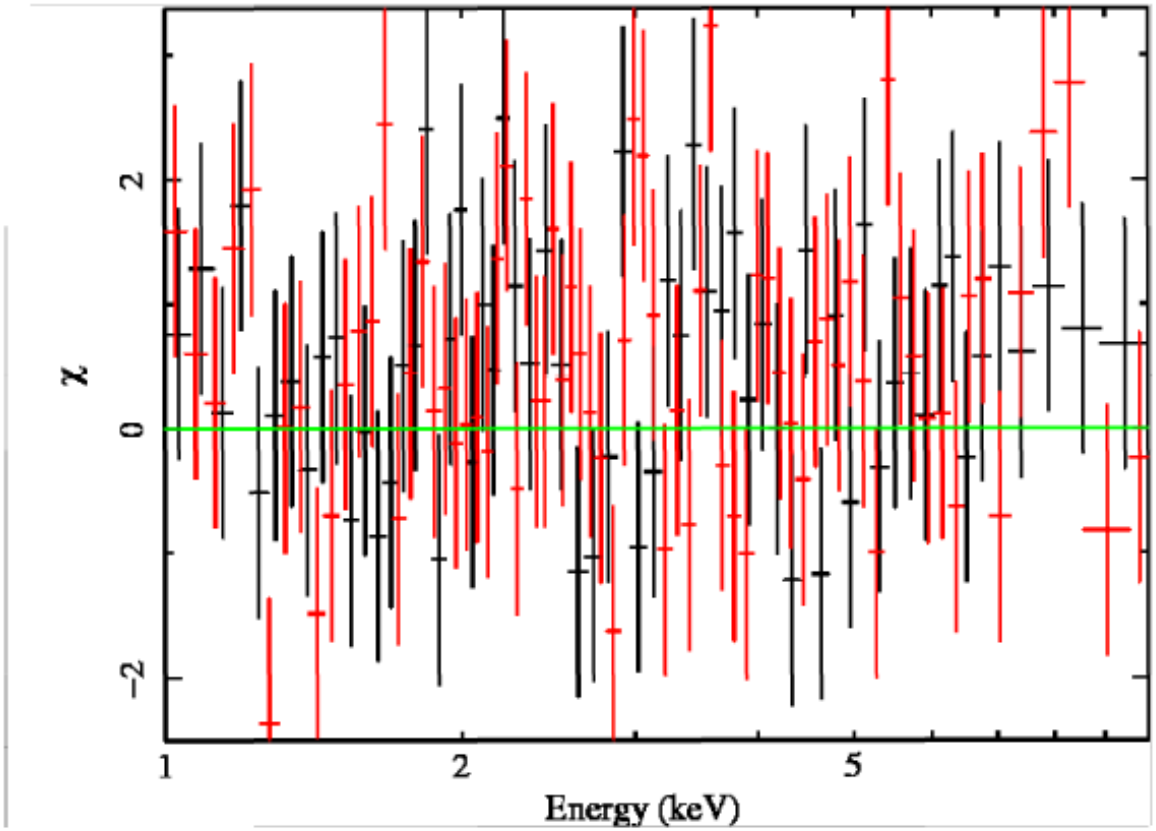


- Spectral variability during the first ~90ks
- H/S ratio constant during the subsequent ~35ks
- We extract two spectra: **high** and **low** ratio state

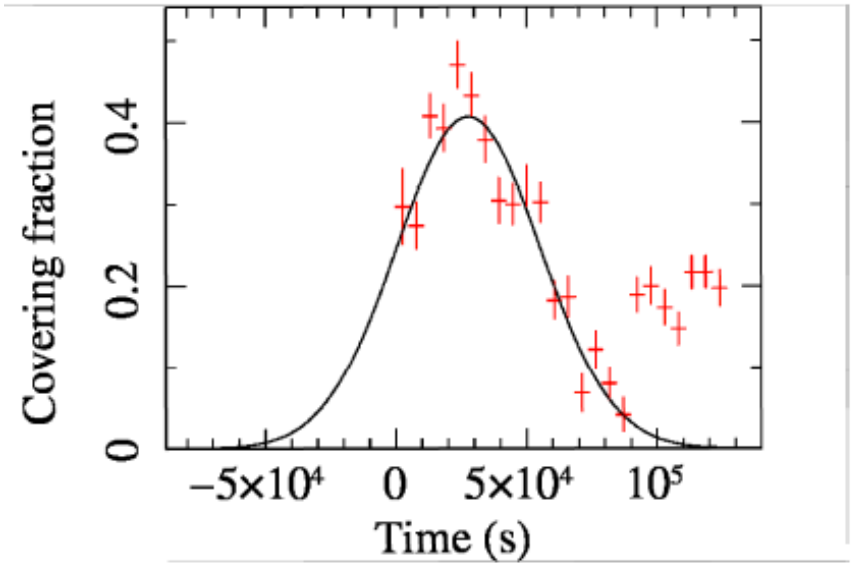
The covering fraction model



The covering fraction model

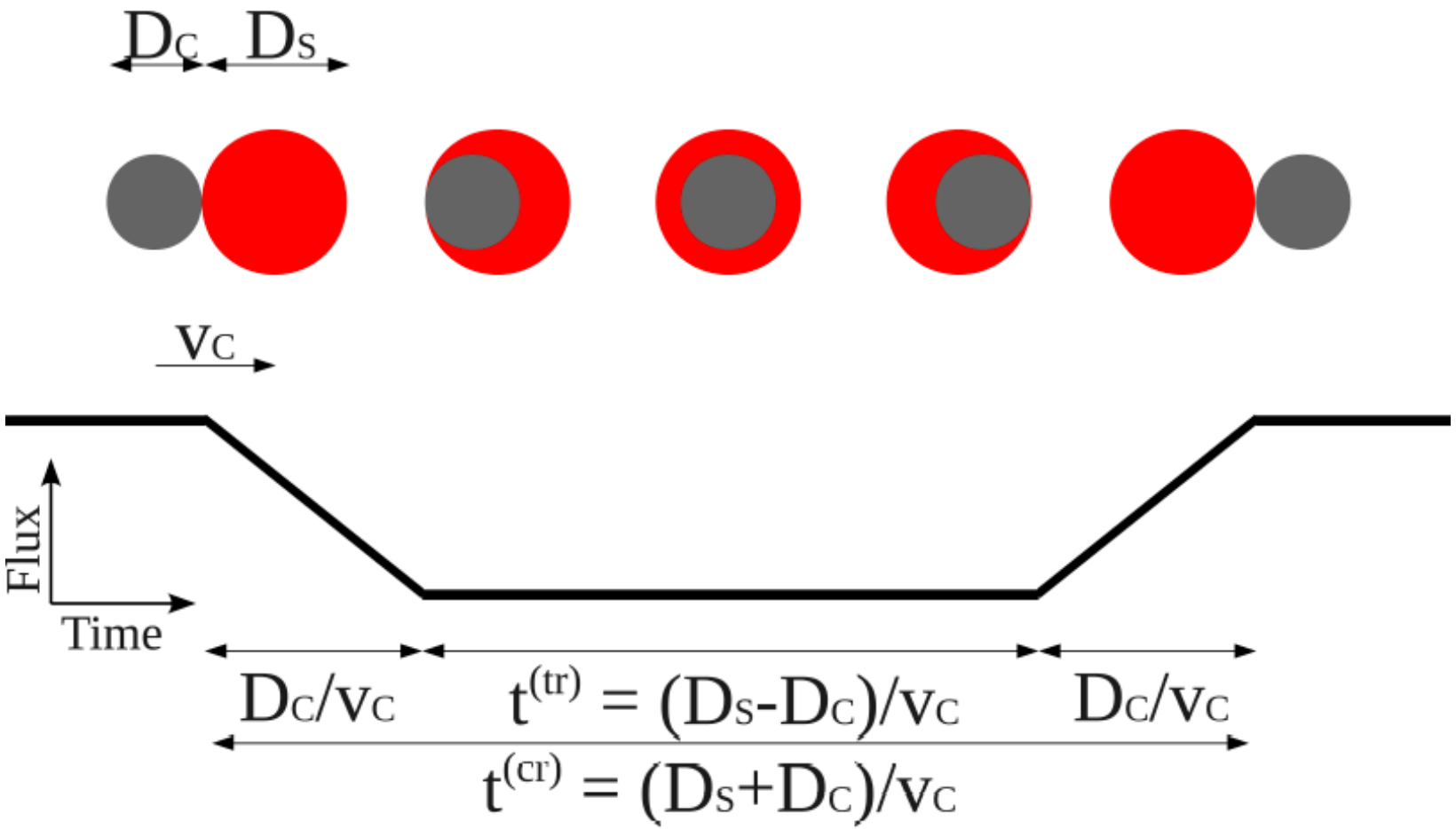


The covering fraction model



- χ^2/dof = 8301/8671
- CF from 17 spectra
- $N_H = 2.0^{+0.2}_{-0.3}\ 10^{22}cm^{-2}$
- $\Gamma = 2.147 \pm 0.003$
- $CF_{max} = 0.41 \pm 0.02$ at 26±3 ks from t=0
- $CF_{min} < 0.02$ at 96^{+9}_{-8} ks from t=0

Physical constraints



Physical constraints

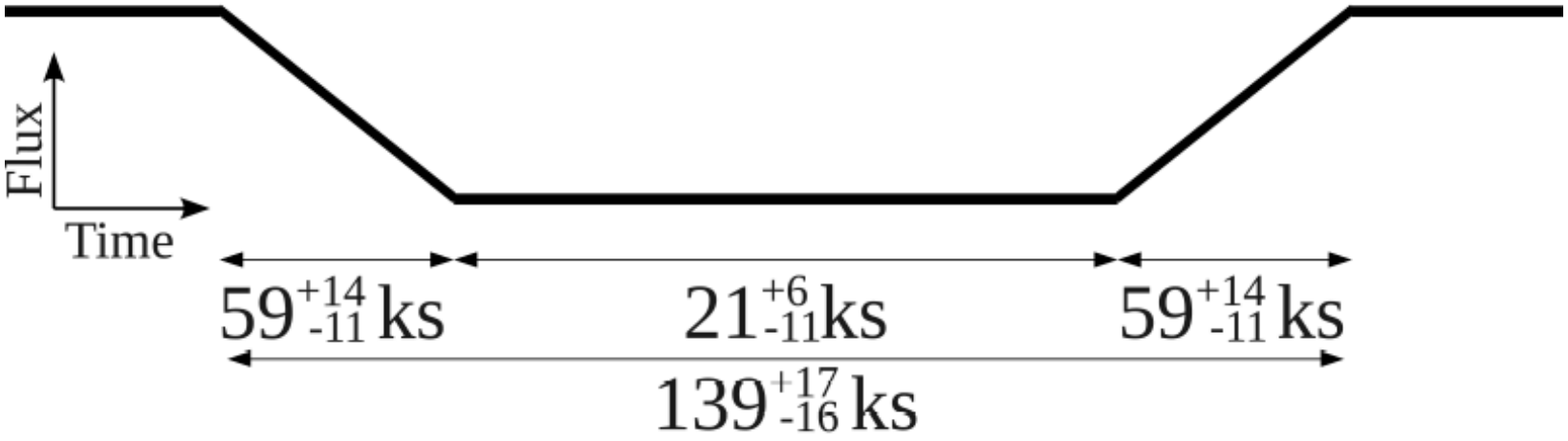
D_C = [1.2-9.7] 10^{12} cm = 1.3-10.5 r_g

D_S = [1.9-15.0] 10^{12} cm = 2.0-16.1 r_g

v_C = [0.24-1.99] 10^3 km/s

R_C = [0.7-4.3] 10^{17} cm ~ 0.02-0.14 pc

N_H = [1.7-2.2] 10^{22} cm^{-2}



Conclusions

- This cloud
  - $N_H = [1.7\text{-}2.2]10^{22}$ cm^{-2}
  - $D_C = 1.3\text{-}10.5\ r_g$
  - $v_C = [0.24\text{-}1.99]10^3$km/s
  - $R_C \sim 0.02\text{-}0.14$ pc
- BLR clouds
  - $N_H \sim [10^{22}\text{-}10^{24}]$cm^{-2}
  - $D_C \sim$ a few r_g
  - $v_C \sim [10^3\text{-}10^4]$km/s
  - $R_C \sim 0.1$ pc

Therefore we identify the eclipsing cloud with a BLR cloud.