Outflowing clouds in the NLS1 Mrk 766

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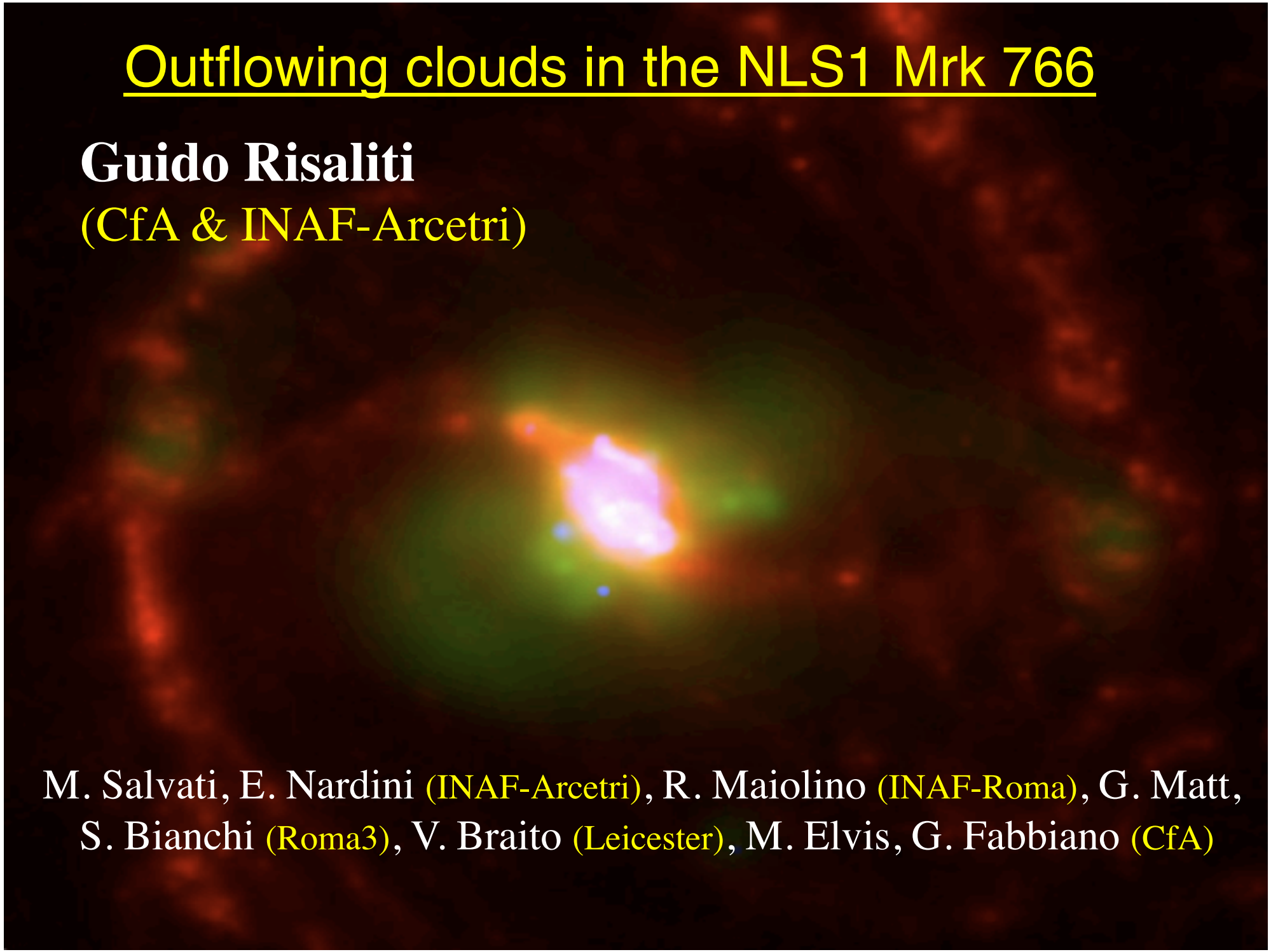

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Search for fast X-ray absorption variability in bright, local AGNs

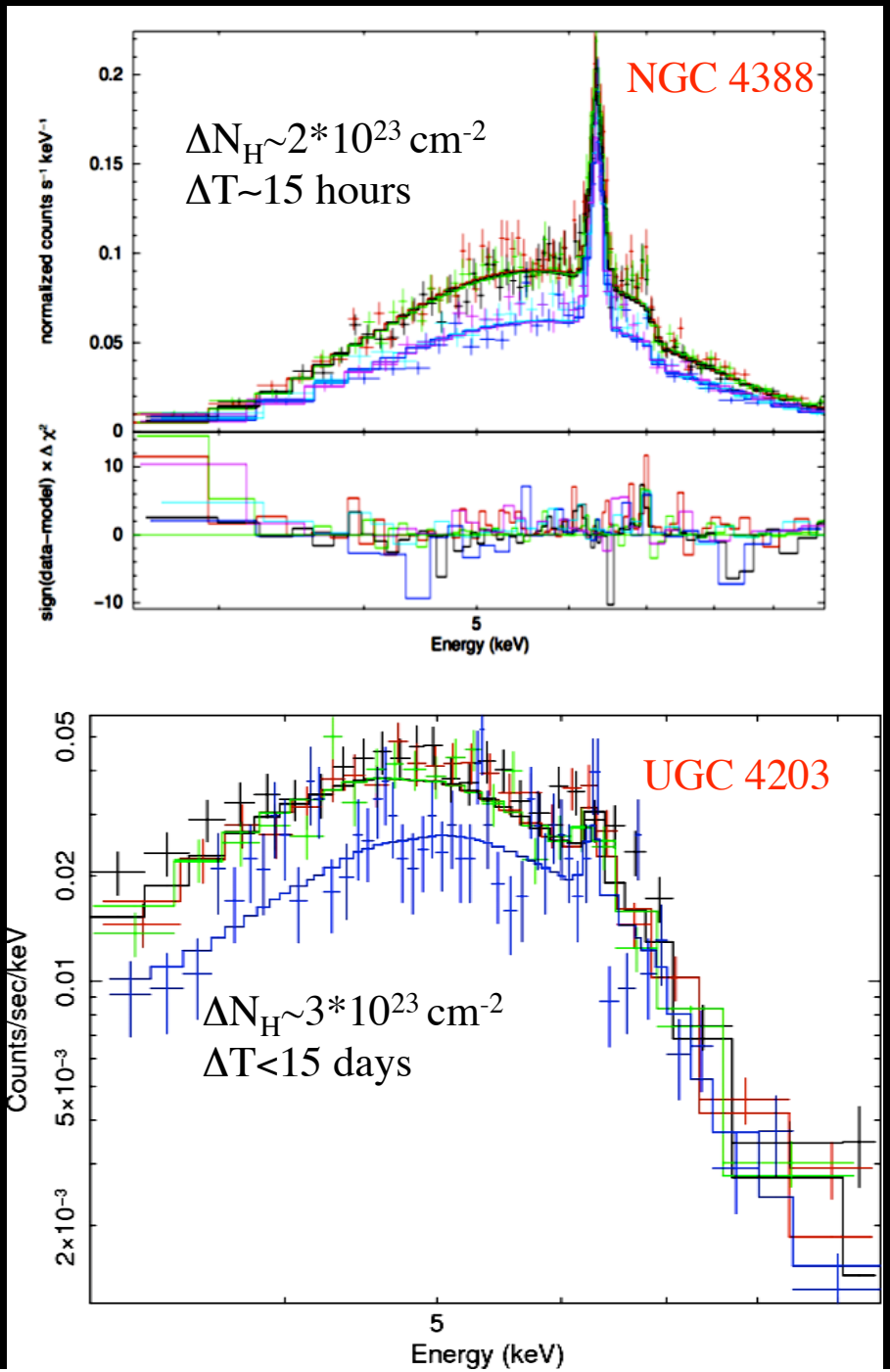
- Long monitorings
- Multiple snapshot observations in short periods

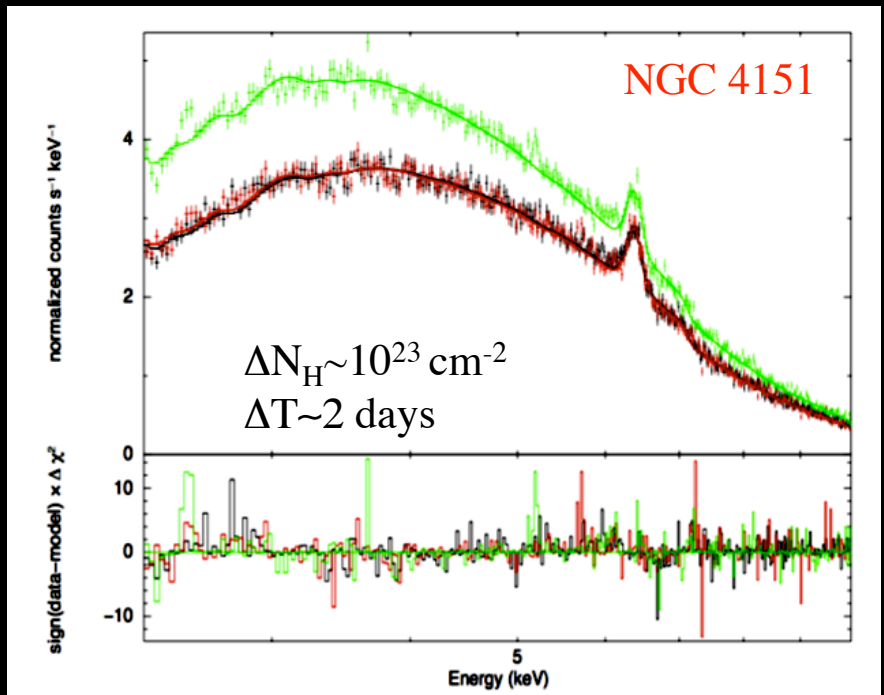
Aims:

- Estimate of the size of the X-ray source
- Distance of the absorber from the X-ray source
- Geometrical structure of the absorber
- Structure of single absorbing clouds

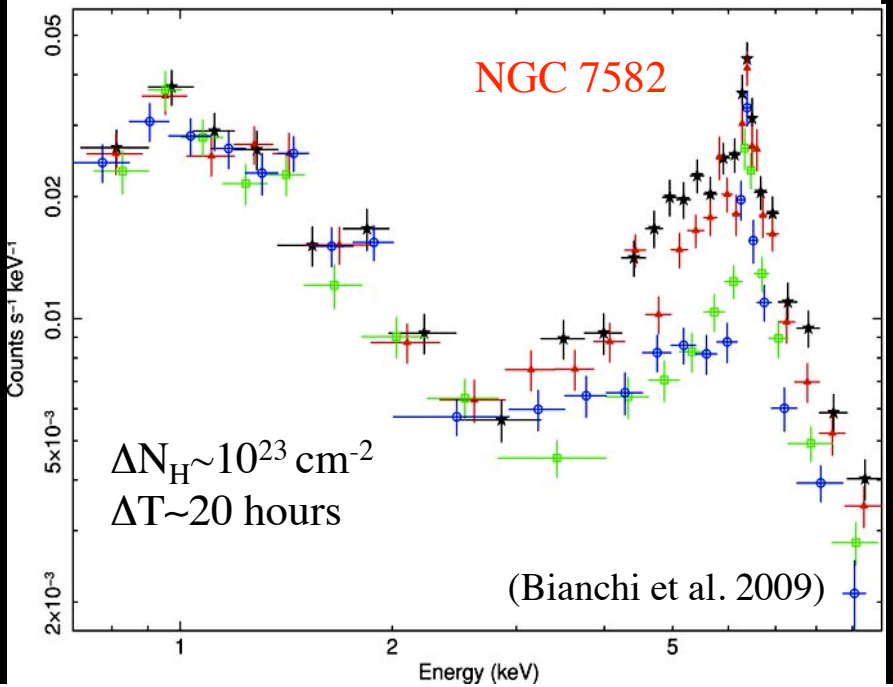
Results:

- Size of the X-ray sorce: a few R_G
- Variability on time scale of hours/days common
- X-ray absorbing clouds == BLR clouds


NGC 4388
ΔN_H~2*10^{23} cm^{-2}
ΔT~15 hours
normalized counts s^{-1} keV^{-1}
sign(data−model) × Δ χ^2
Energy (keV)

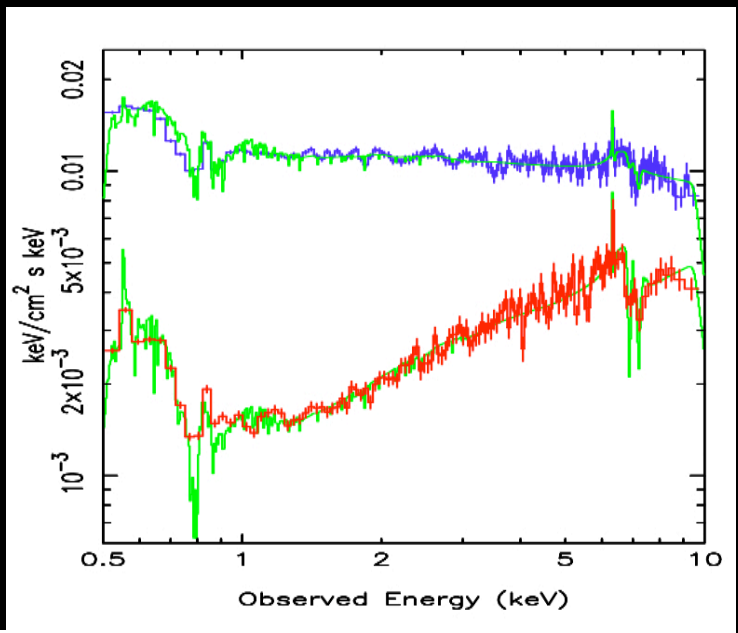

NGC 4151
ΔN_H~10^{23} cm^{-2}
ΔT~2 days
normalized counts s^{-1} keV^{-1}
sign(data−model) × Δ χ^2
Energy (keV)

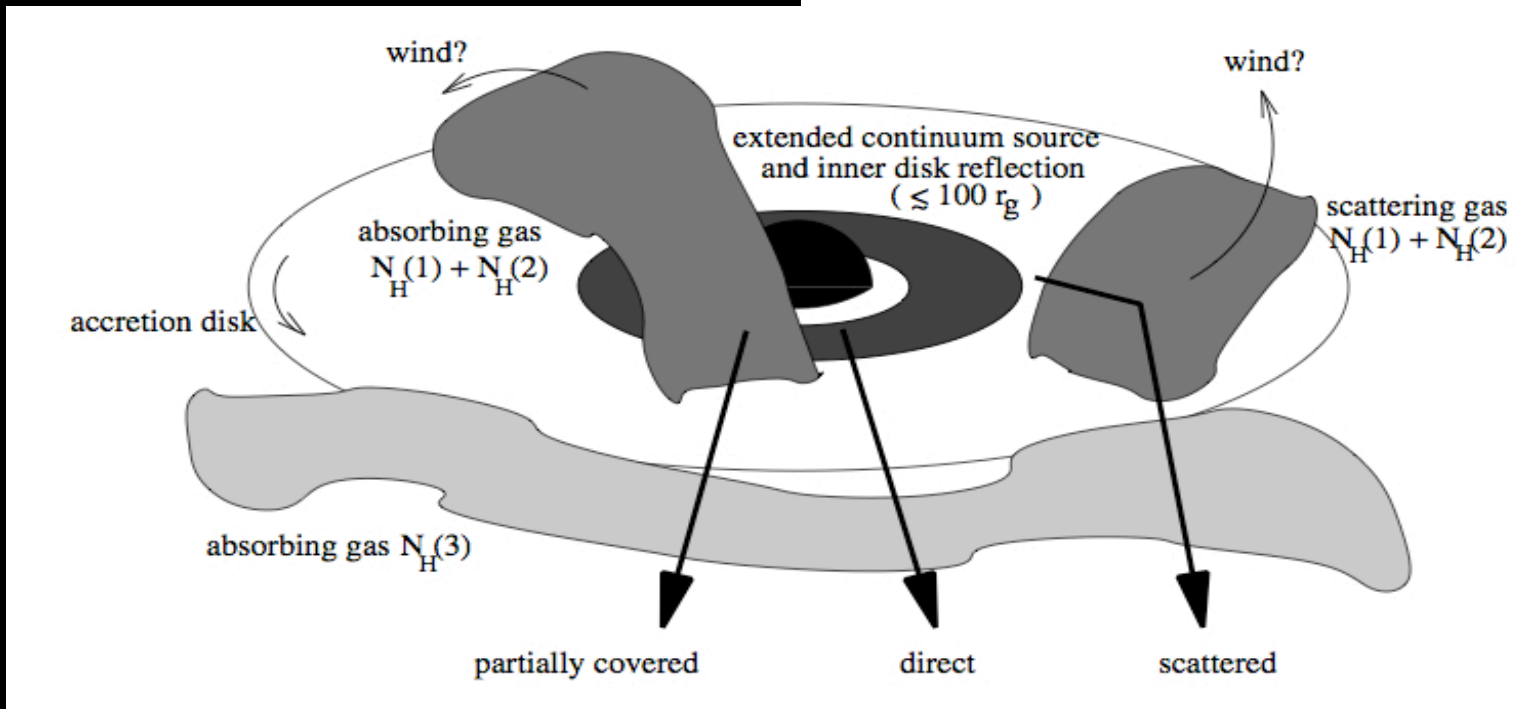
UGC 4203
ΔN_H~3*10^{23} cm^{-2}
ΔT<15 days
Counts/sec/keV
Energy (keV)


NGC 7582
ΔN_H~10^{23} cm^{-2}
ΔT~20 hours
(Bianchi et al. 2009)
Counts s^{-1} keV^{-1}
Energy (keV)

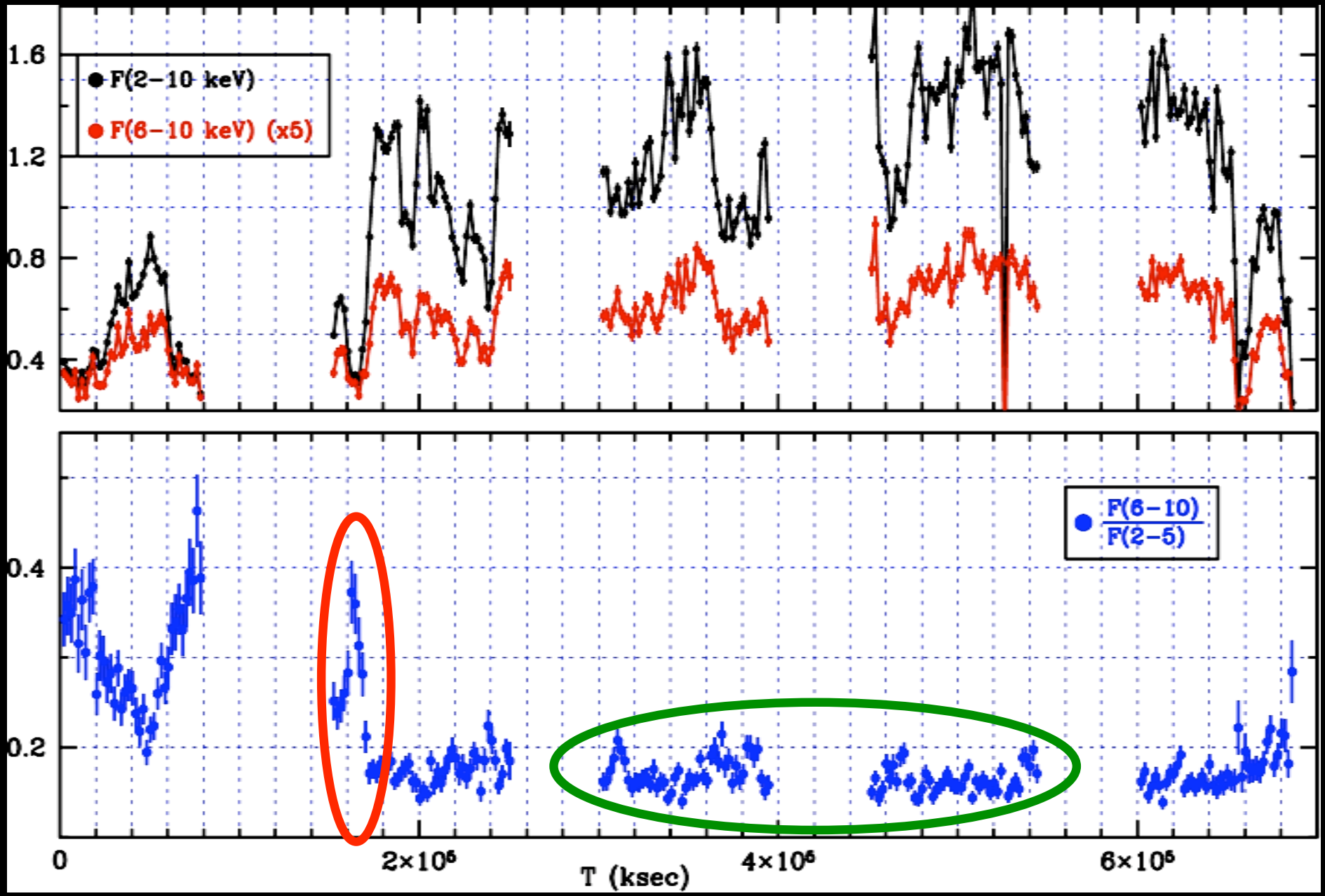
Mrk 766: long (6 orbits, ~800 ks) XMM-Newton observation

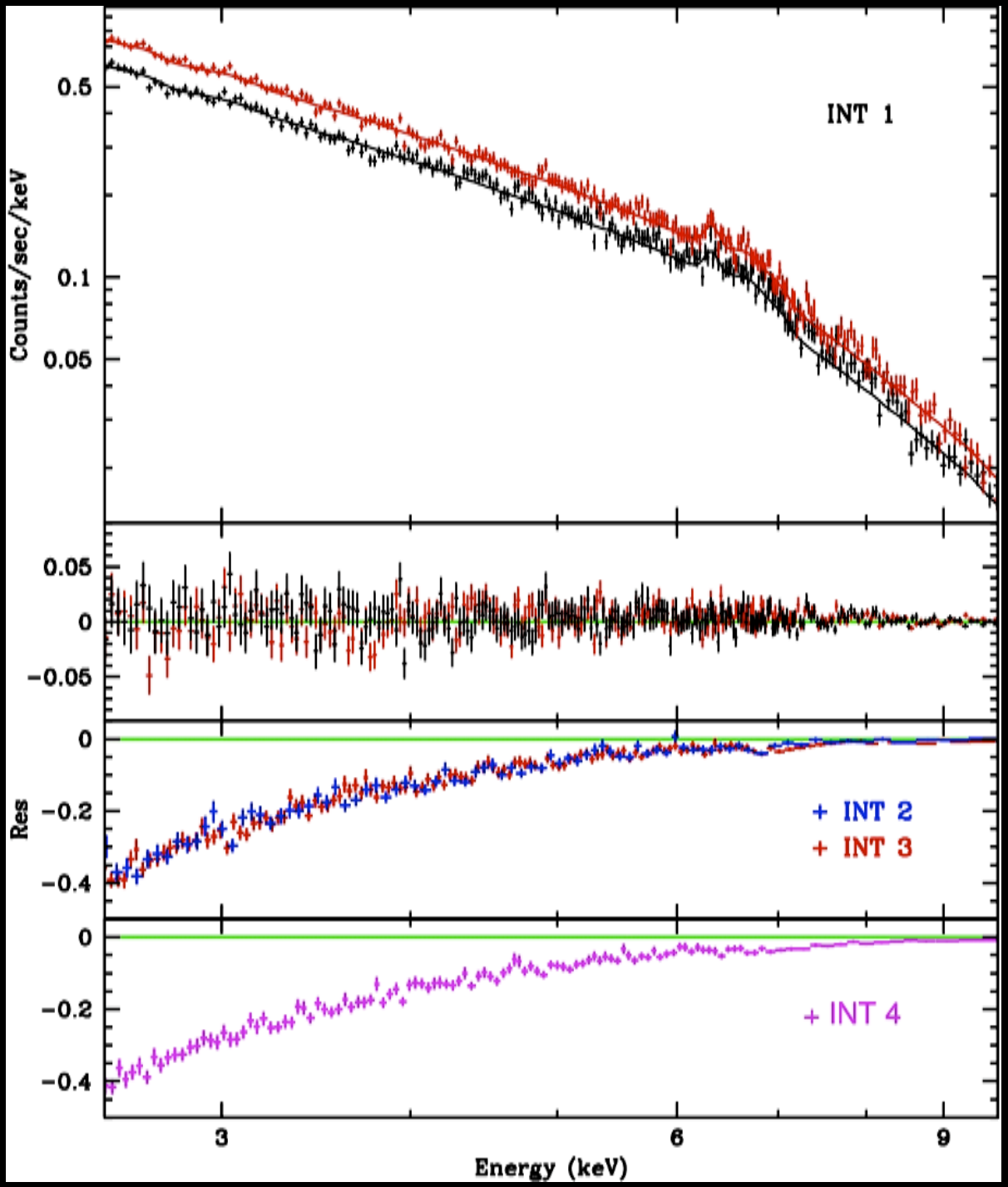
Time-resolved spectral analysis (Turner et al. 2006, 2007, Miller et al. 2007):
One of the most complex *spectral* variability in local AGNs





XMM long look of Mrk 766

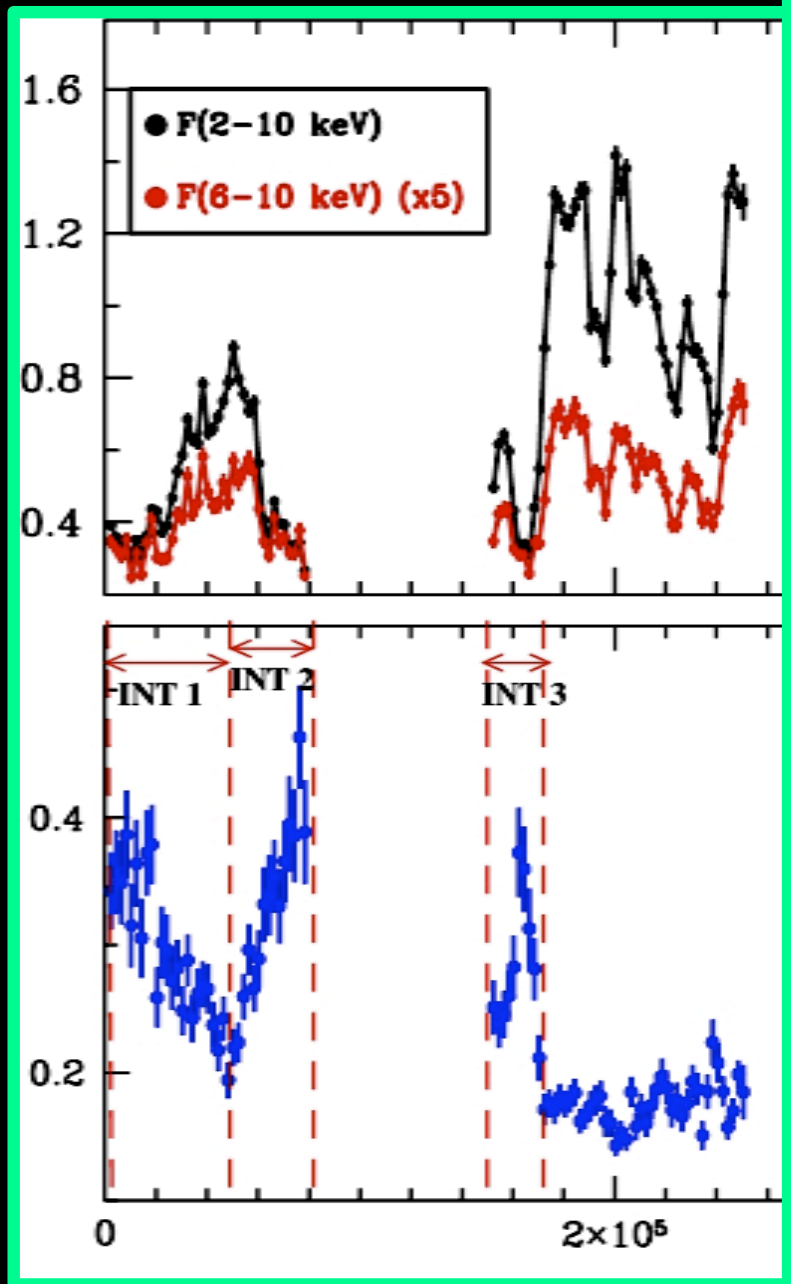


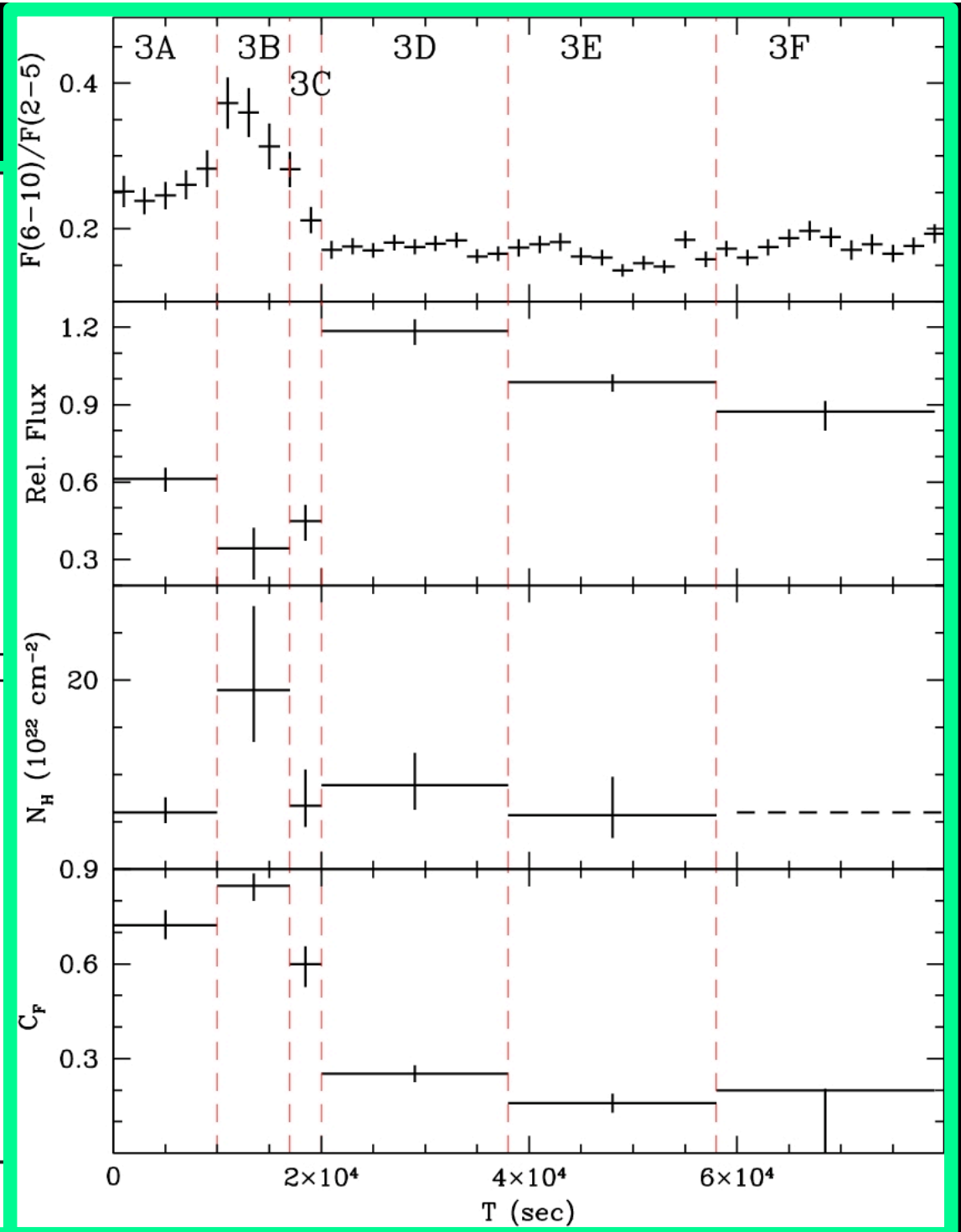


→ No absorption, "standard" model

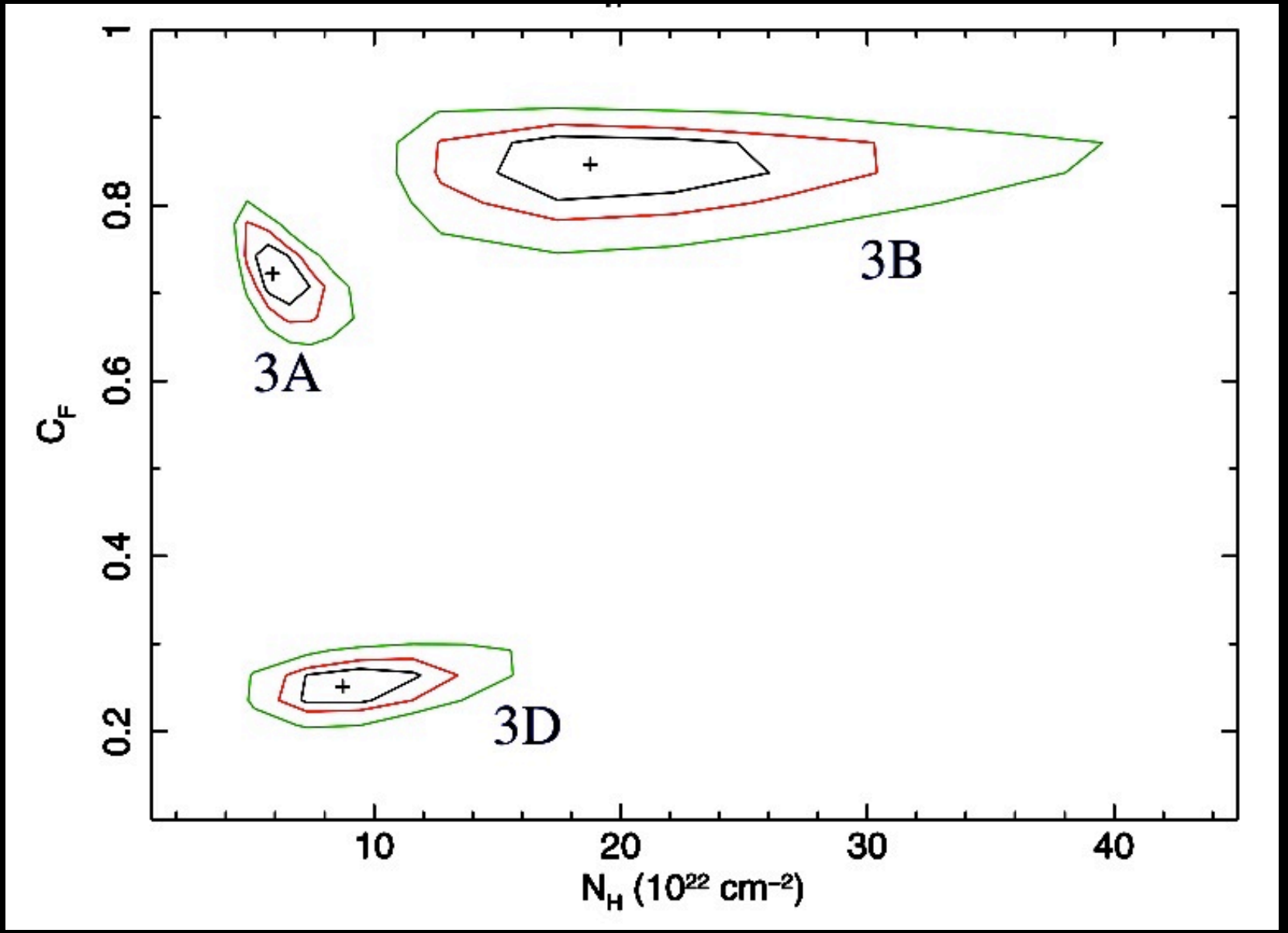
→ $N_H \sim 10^{23} cm^{-2}$, C.F. ~ 50%
No continuum variation

Mrk 766 – 2nd orbit

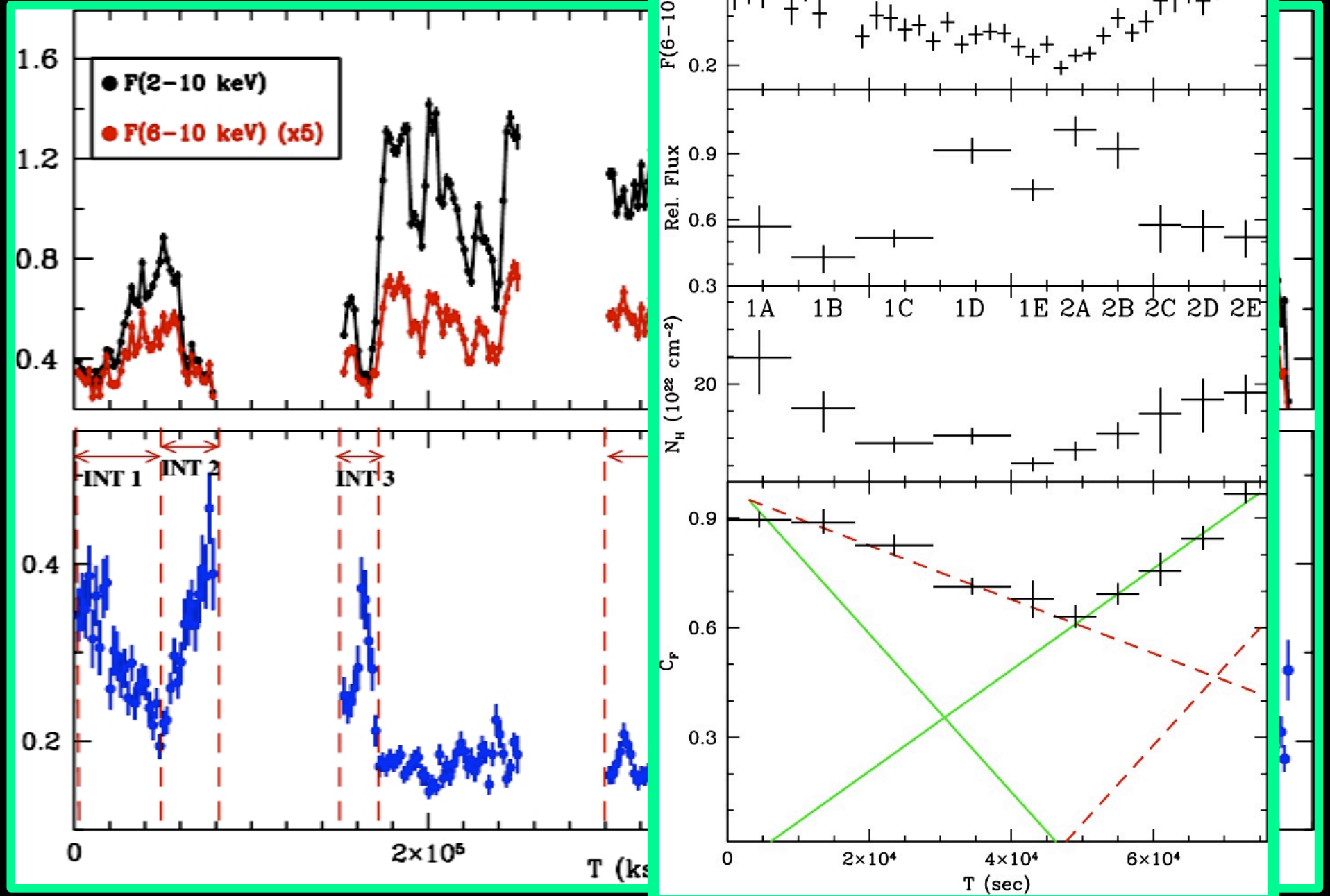




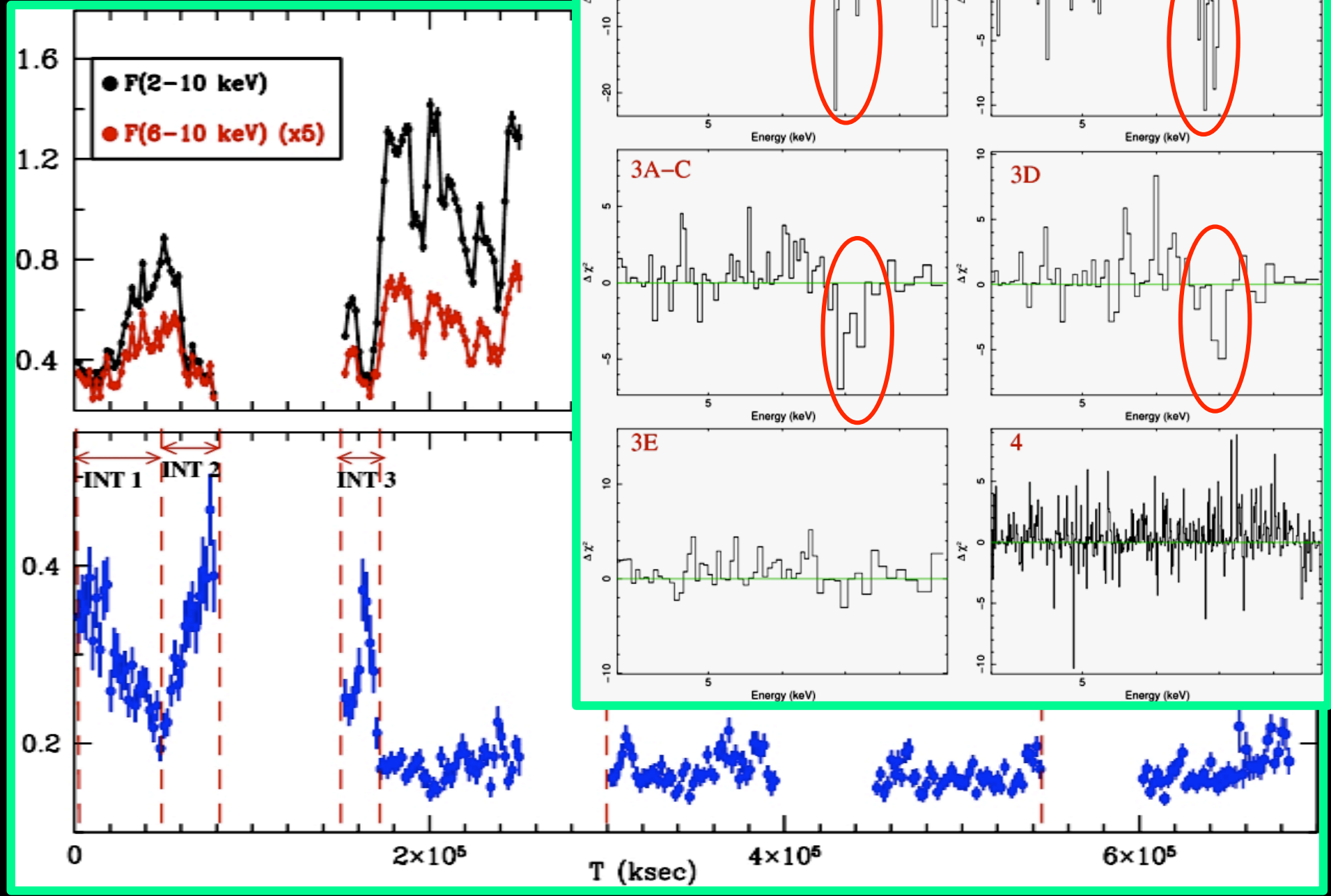
Mrk 766 – 3rd orbit C_F – N_H contours



Mrk 766 – 1st orbit



Mrk 766

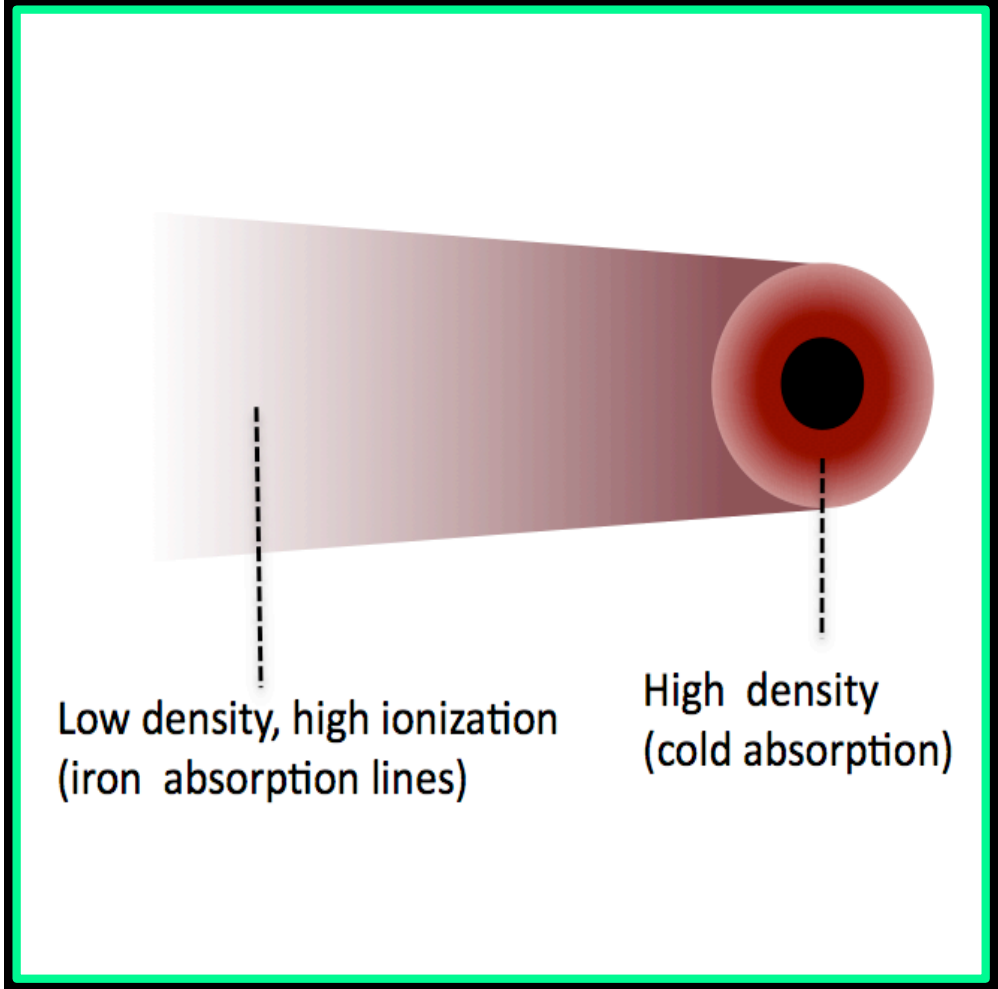

F(2–10 keV)
F(6–10 keV) (x5)
1.6
1.2
0.8
0.4
INT 1
INT 2
INT 3
0.4
0.2
0
2×10⁵
4×10⁵
6×10⁵
T (ksec)

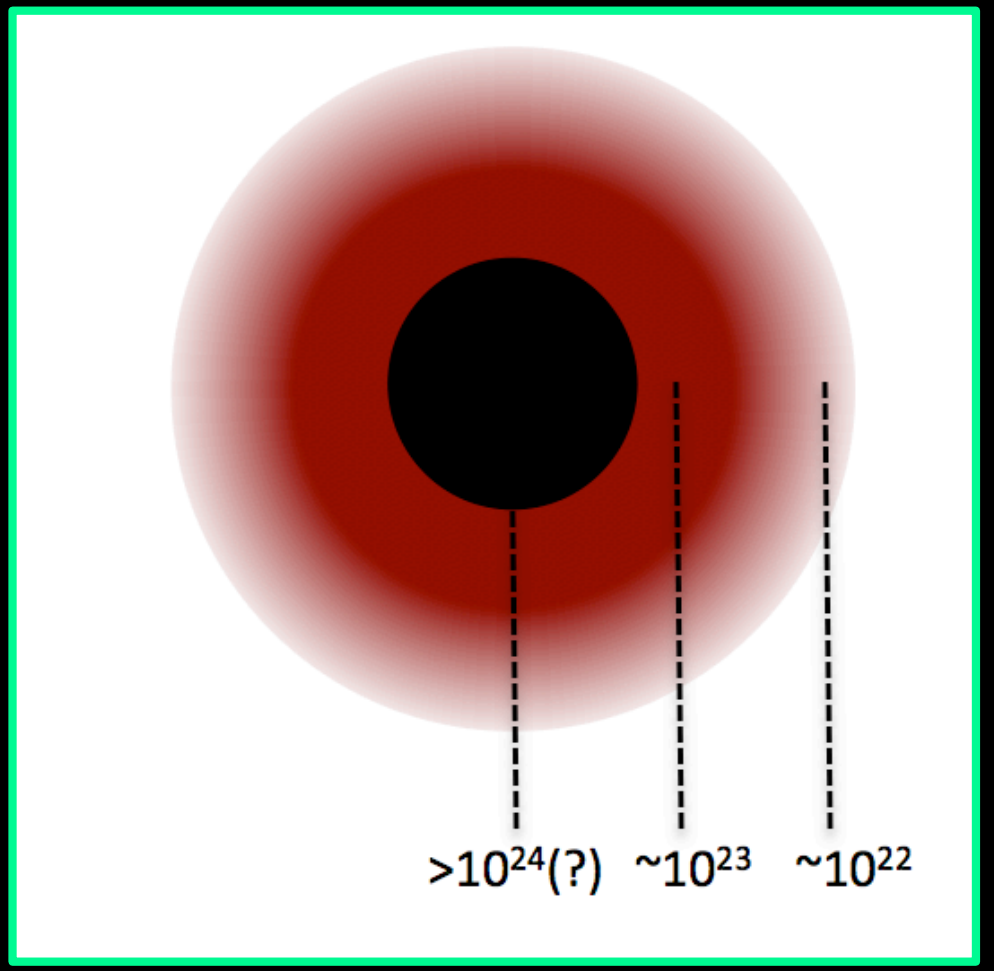
1
2
3A–C
3D
3E
4
Δχ²
Energy (keV)

Mrk 766 – Absorption line fits

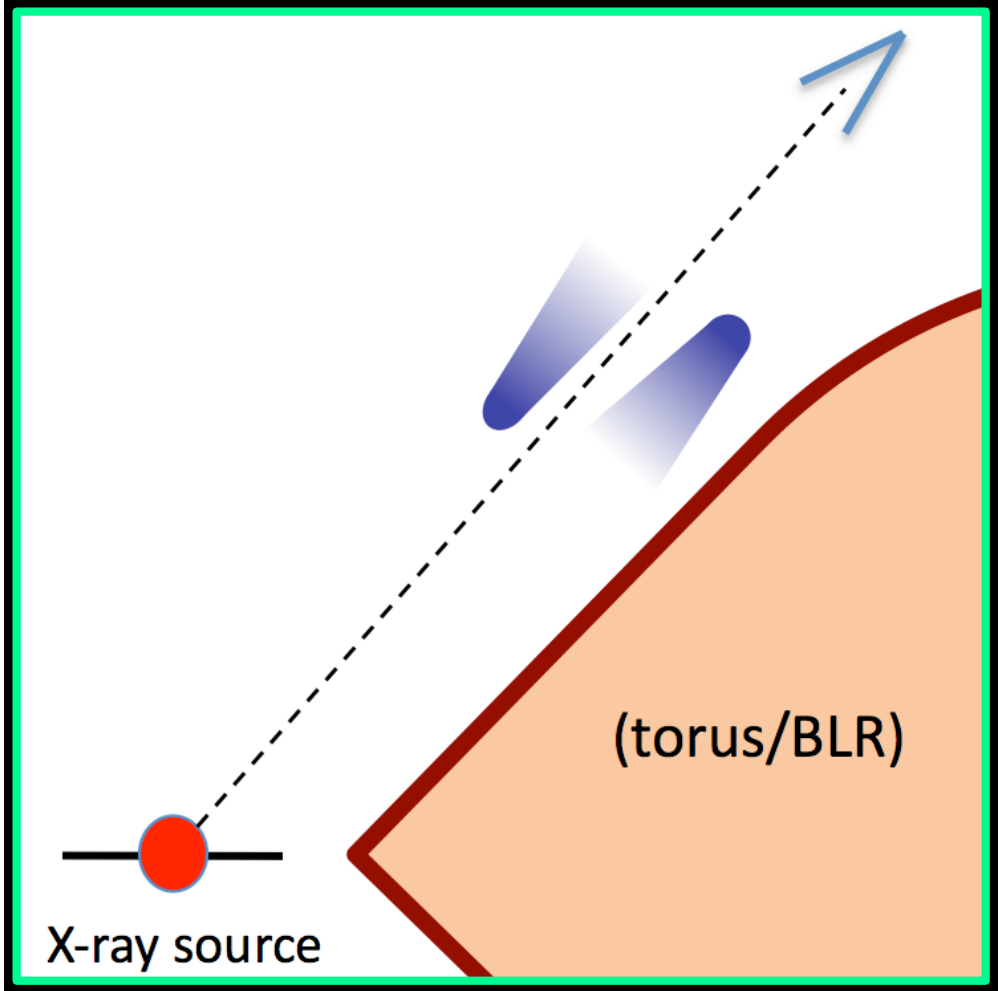
INT	v^a	EW_1^b	EW_2^b	$\Delta\chi^2$
1	$11\,000^{+900}_{-1100}$	61^{+15}_{-14}	50^{+18}_{-18}	70
2	3000^{+1200}_{-1200}	43^{+18}_{-17}	64^{+18}_{-17}	43
3A–C	$16\,000^{+3000}_{-3000}$	58^{+26}_{-40}	46^{+30}_{-35}	20
3D	8100^{+3500}_{-3600}	39^{+22}_{-21}	35^{+20}_{-20}	6
3E–F	$<13\,000$	<30	<30	4
4	$<10\,000$	<18	<20	3

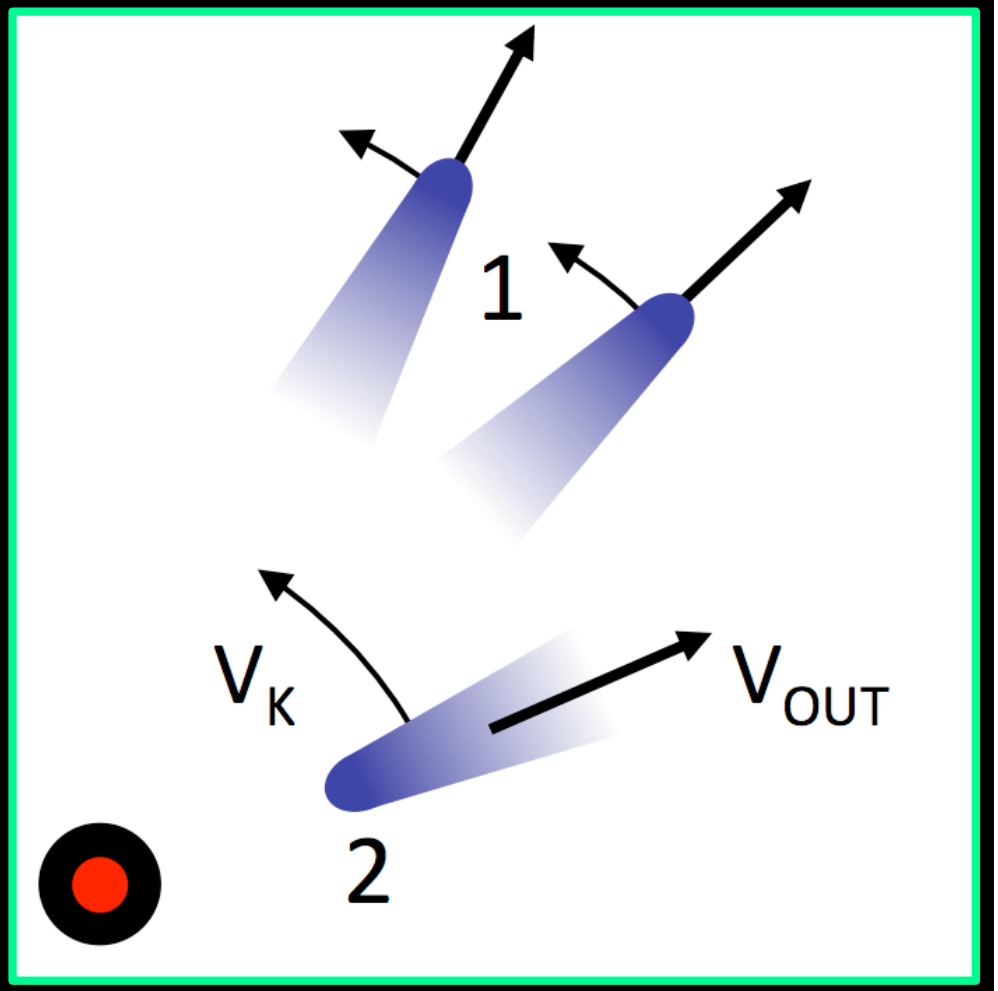
Mrk 766 – Structure of absorption lines





Mrk 766 – Geometry of the absorber





CONCLUSIONS

- Variability on short time scales reveals eclipses in Mrk 766
  → X-ray absorber == BLR clouds
  → Size of the X-ray source ~ a few R_G

- High ionization absorber together with ~neutral absorber; different eclipsing times
  → "Cometary" shape of clouds
  → distribution of cloud velocities

- Strong and variable blueshift
  → outflowing clouds

Risaliti et al. 2011, MNRAS 410, 1027