Accreting X-ray Pulsars with INTEGRAL

Ingo Kreykenbohm

Integral Workshop, Oct. 18., Sardinia

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Vela X-1 and 4U 1909+07

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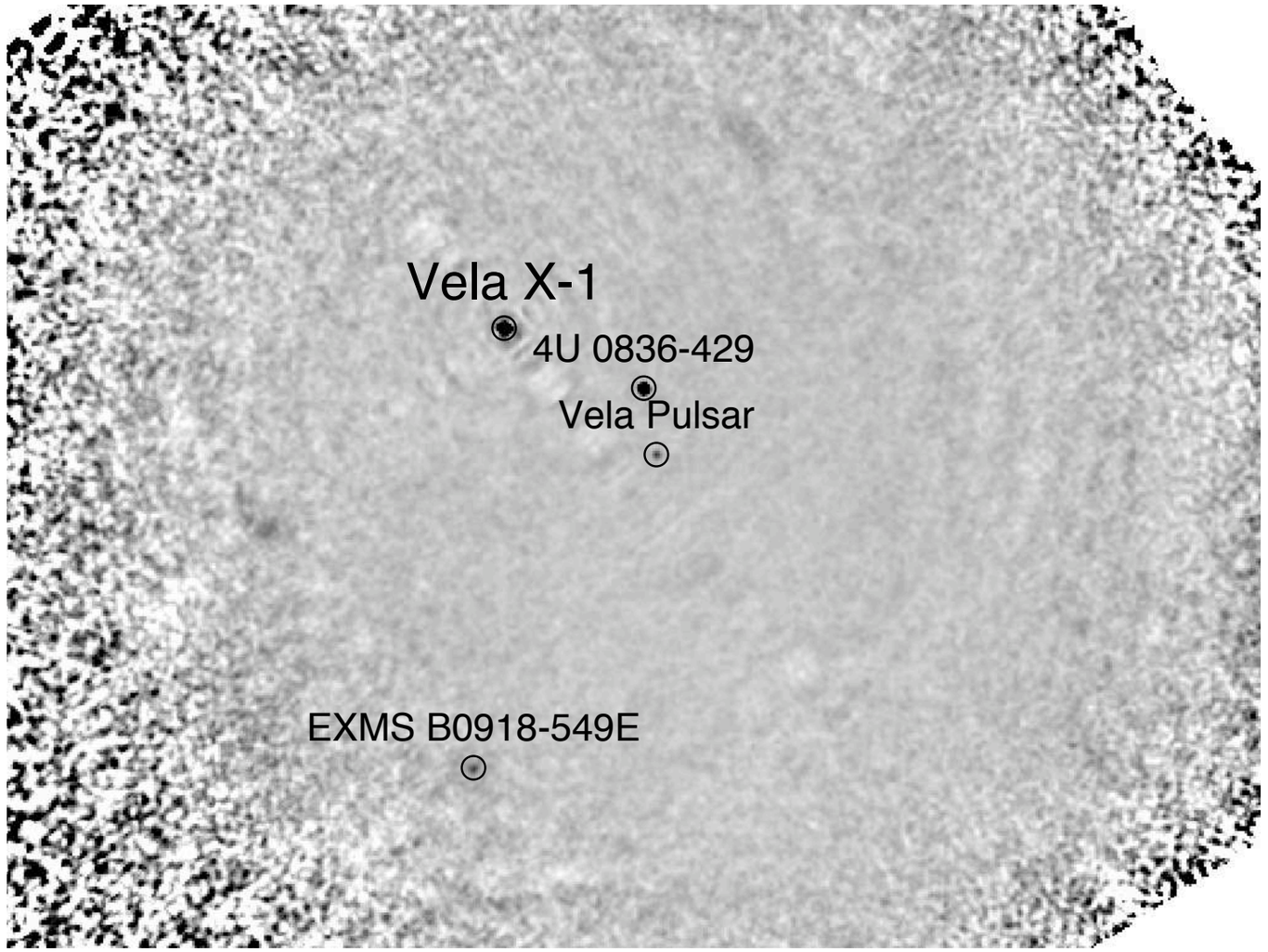
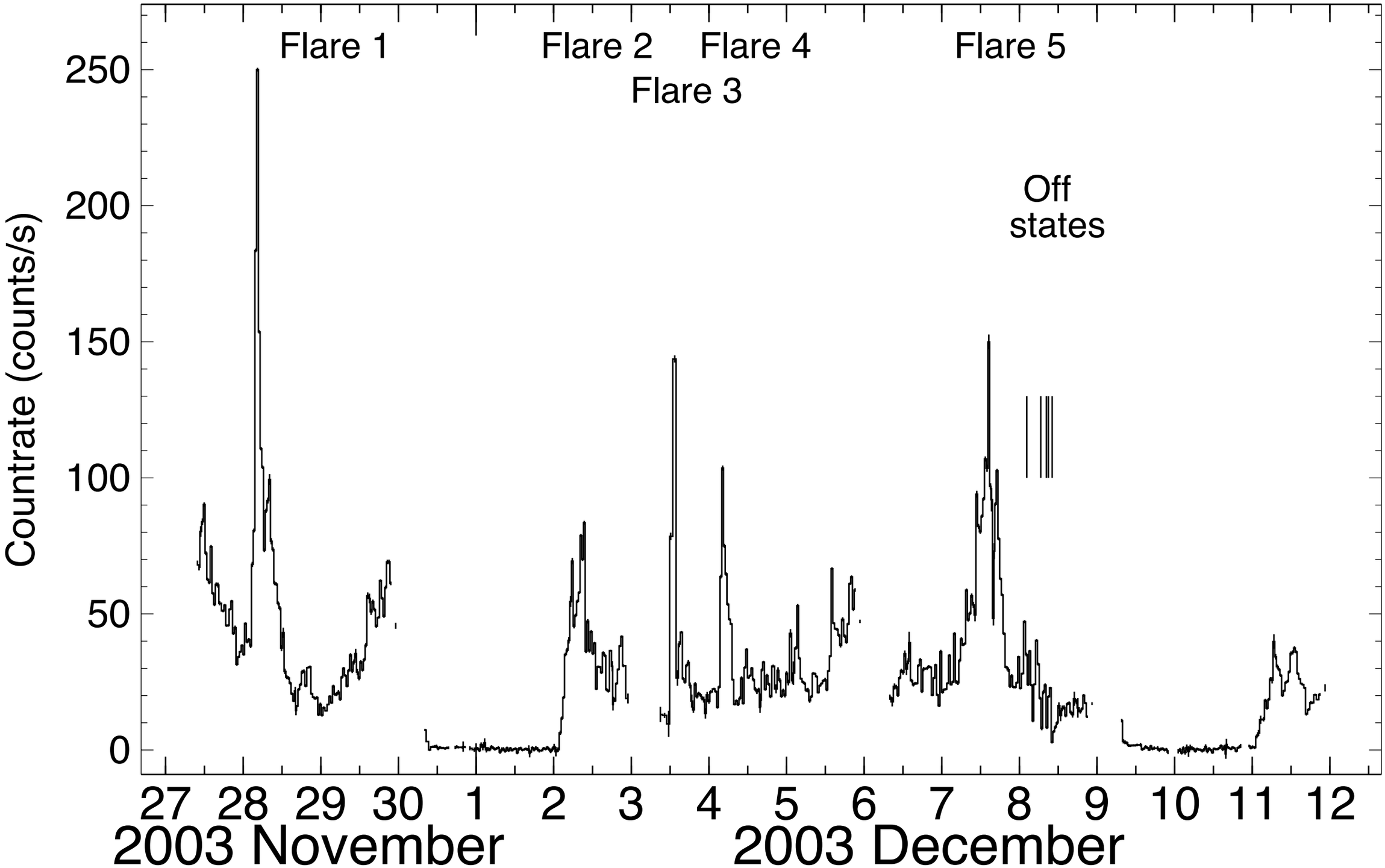
Vela X-1

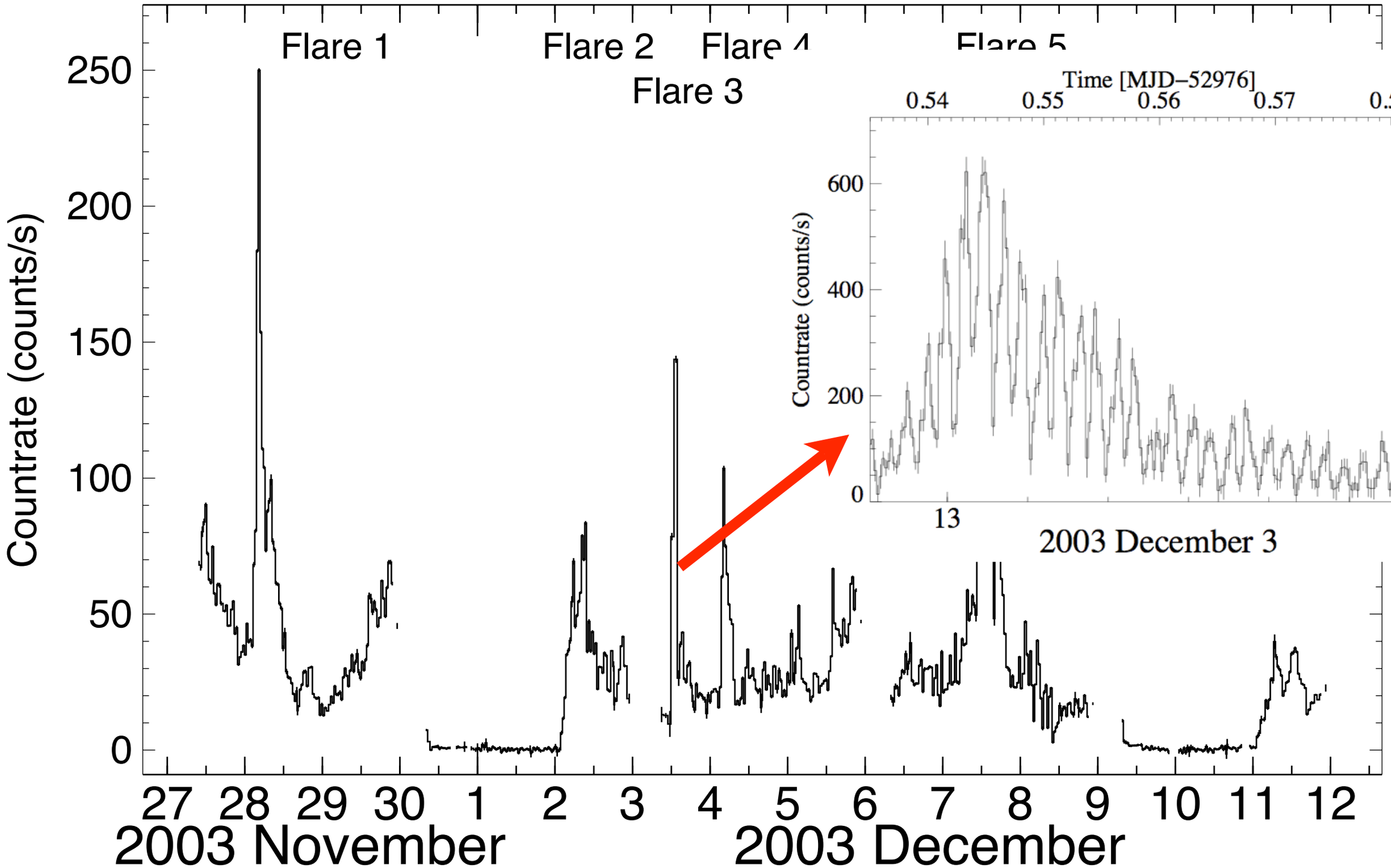
- spin period: 283.5s
- normal: 200mCrab
- flares: up to 6 Crab
- 2 Msec public data



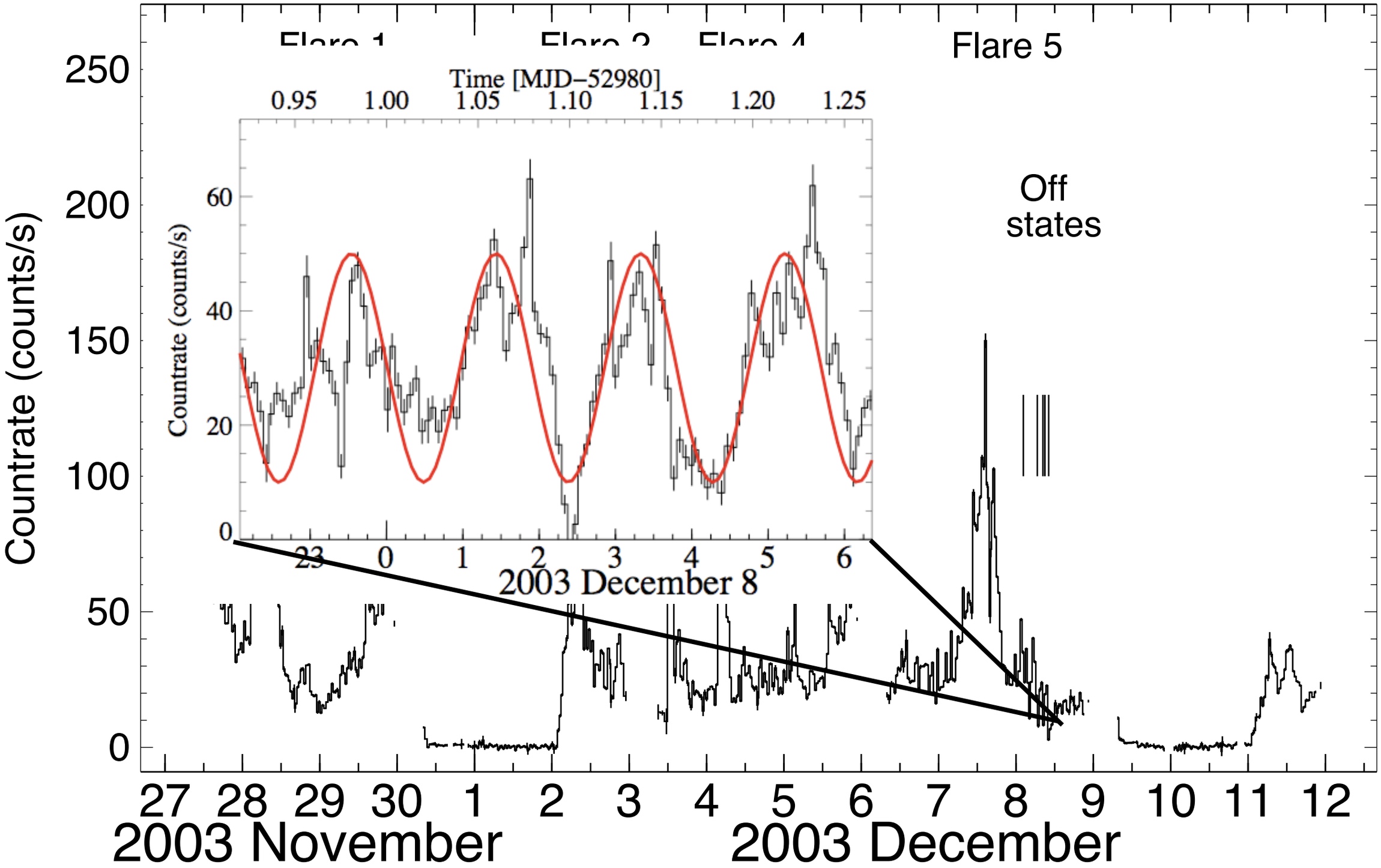
Vela X-1


Flare 1
Flare 2
Flare 3
Flare 4
Flare 5
Off states
Countrate (counts/s)
250
200
150
100
50
0
27 28 29 30 1 2 3 4 5 6 7 8 9 10 11 12
2003 November
2003 December

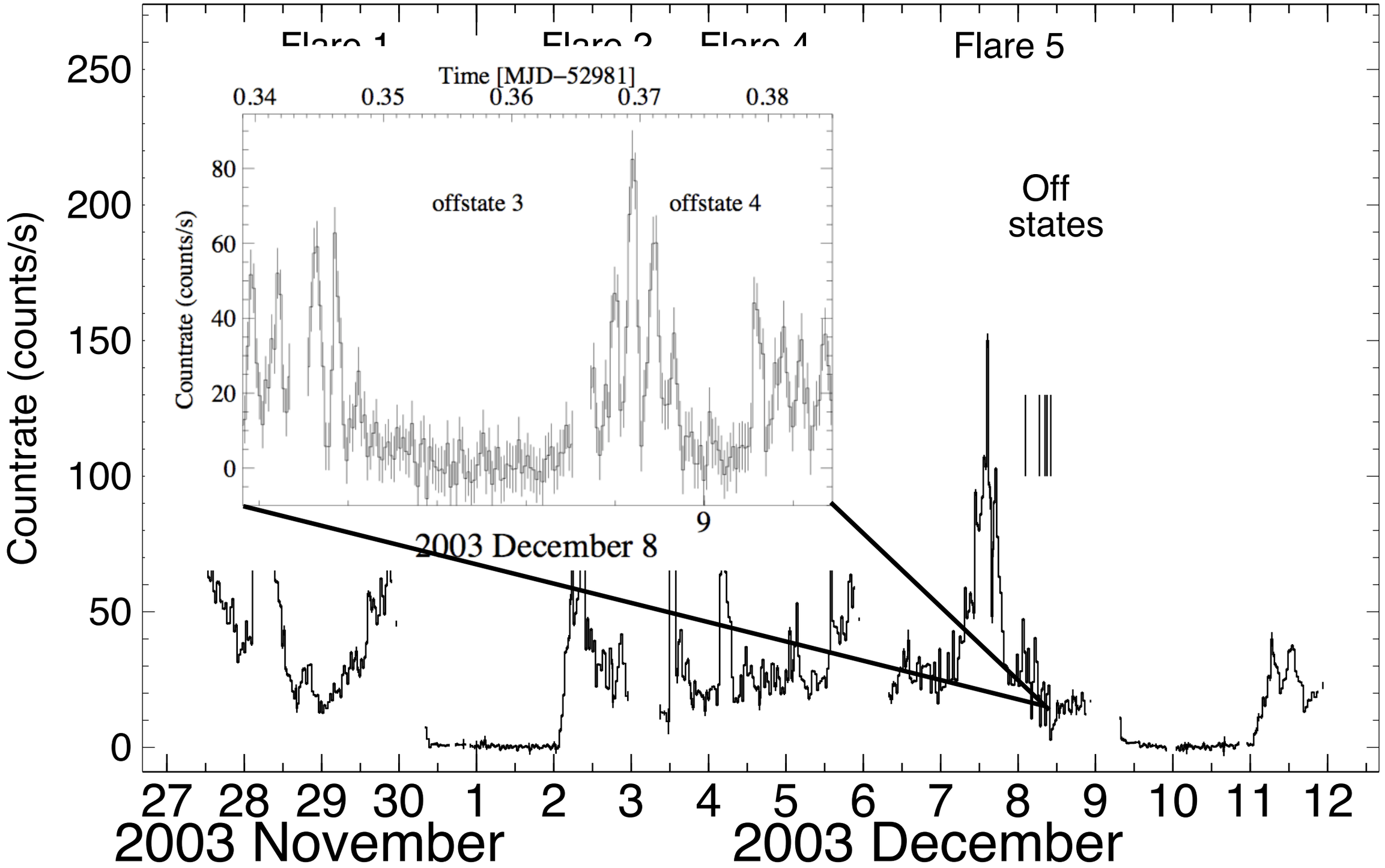
Vela X-1


Flare 1
Flare 2
Flare 3
Flare 4
Flare 5
Countrate (counts/s)
250
200
150
100
50
0
27 28 29 30 1 2 3 4 5 6 7 8 9 10 11 12
2003 November
2003 December
Time [MJD−52976]
0.54 0.55 0.56 0.57 0.58
600
400
200
0
13
14
2003 December 3

Vela X-1


Flare 1
Flare 2
Flare 4
Flare 5
Off states
Countrate (counts/s)
250
200
150
100
50
0
Time [MJD−52980]
0.95
1.00
1.05
1.10
1.15
1.20
1.25
Countrate (counts/s)
60
40
20
0
23
0
1
2
3
4
5
6
2003 December 8
27
28
29
30
1
2
3
4
5
6
7
8
9
10
11
12
2003 November
2003 December

Vela X-1

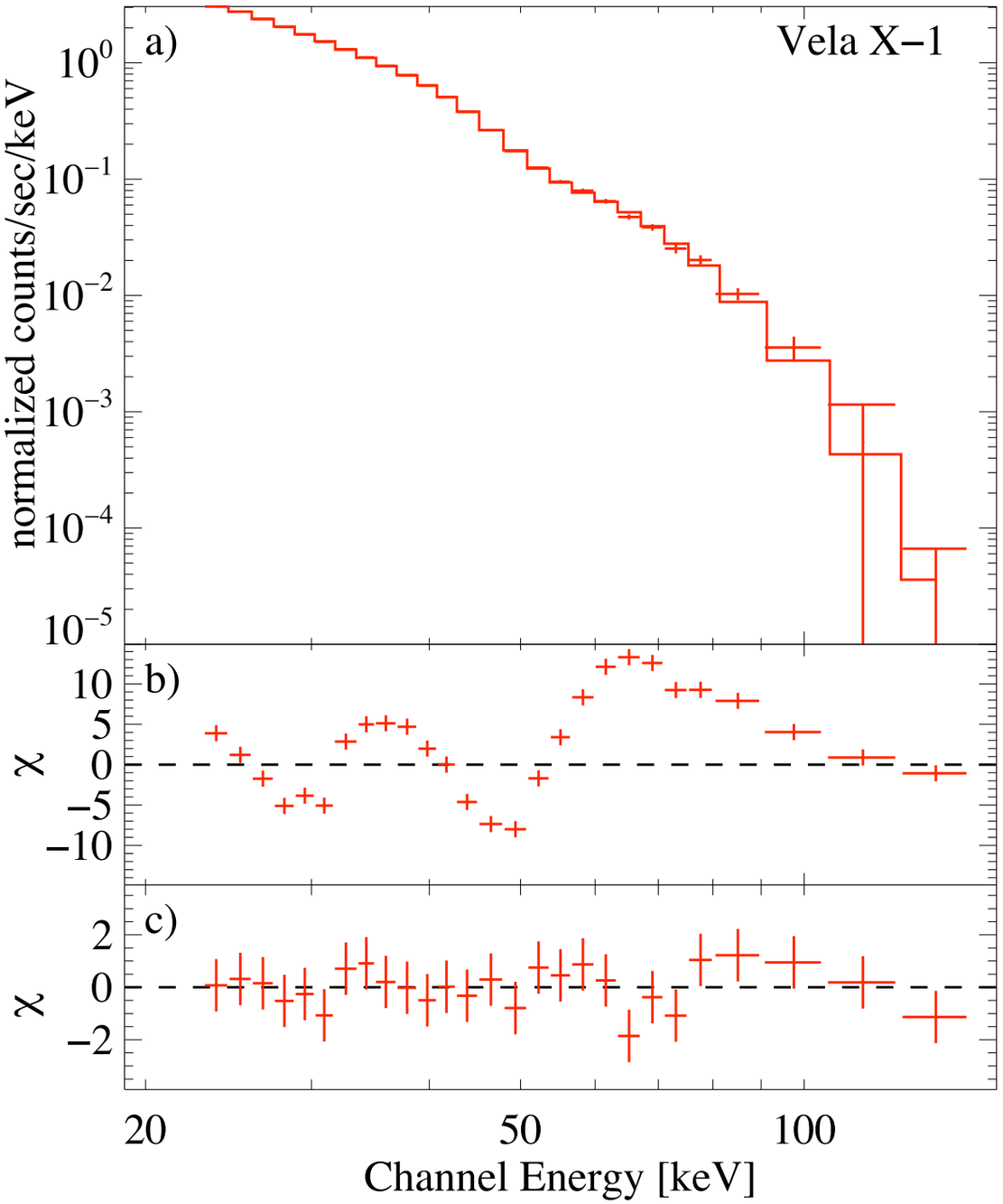

Flare 1
Flare 2
Flare 4
Flare 5
Off states
Time [MJD−52981]
0.34
0.35
0.36
0.37
0.38
offstate 3
offstate 4
Countrate (counts/s)
80
60
40
20
0
9
2003 December 8
Countrate (counts/s)
250
200
150
100
50
0
27
28
29
30
1
2
3
4
5
6
7
8
9
10
11
12
2003 November
2003 December

Vela X-1

- no JEM-X data
- spectral model:
  Powerlaw x FDCut

$$I_{\mathrm{cont}}(E) \propto E^{-\Gamma} \times \frac{1}{\exp\left(\frac{E-E_{\mathrm{cut}}}{E_{\mathrm{fold}}}\right)+1}$$

- CRSF:
  53.2 keV σ=7.5keV
  τ=1.0



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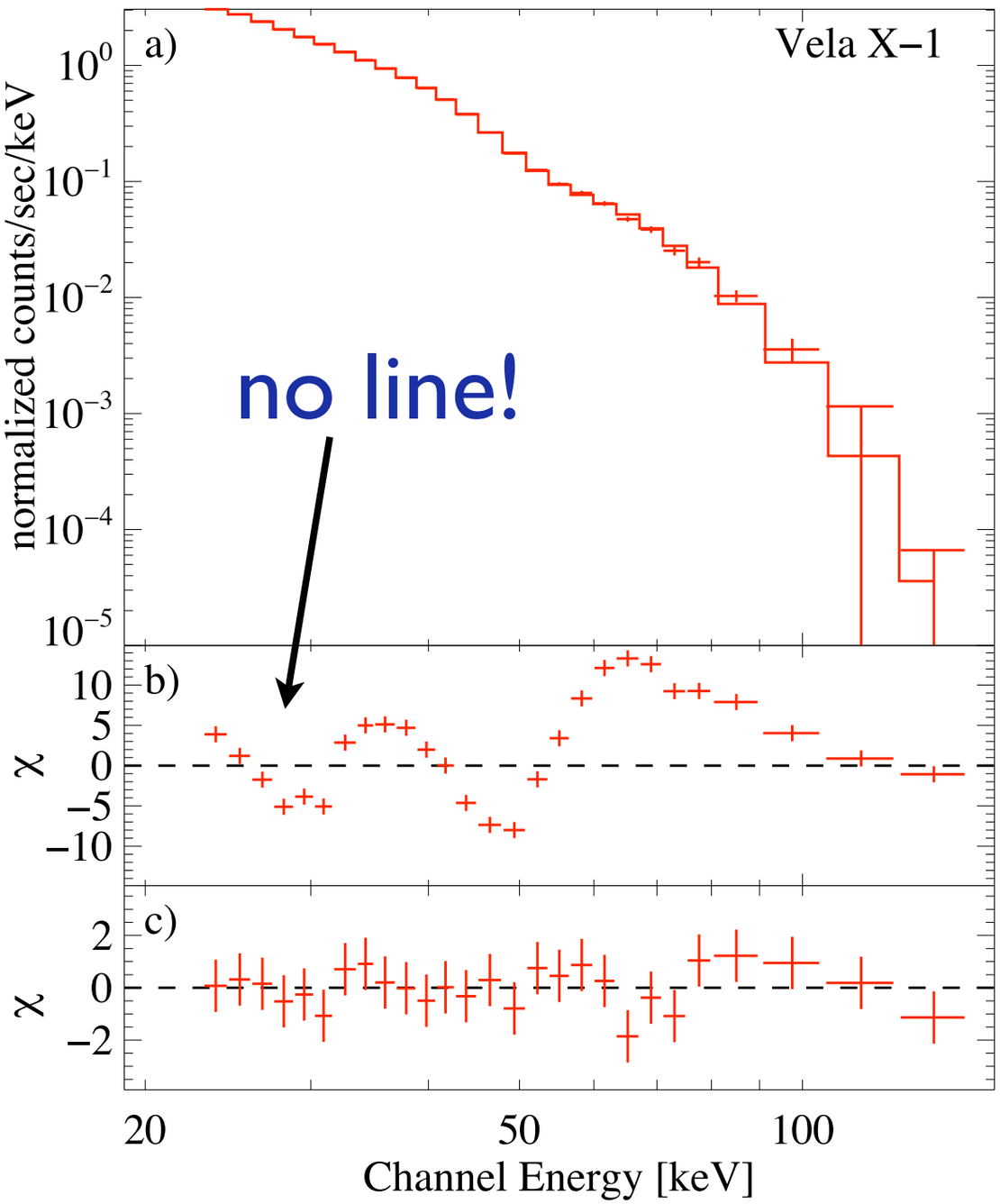
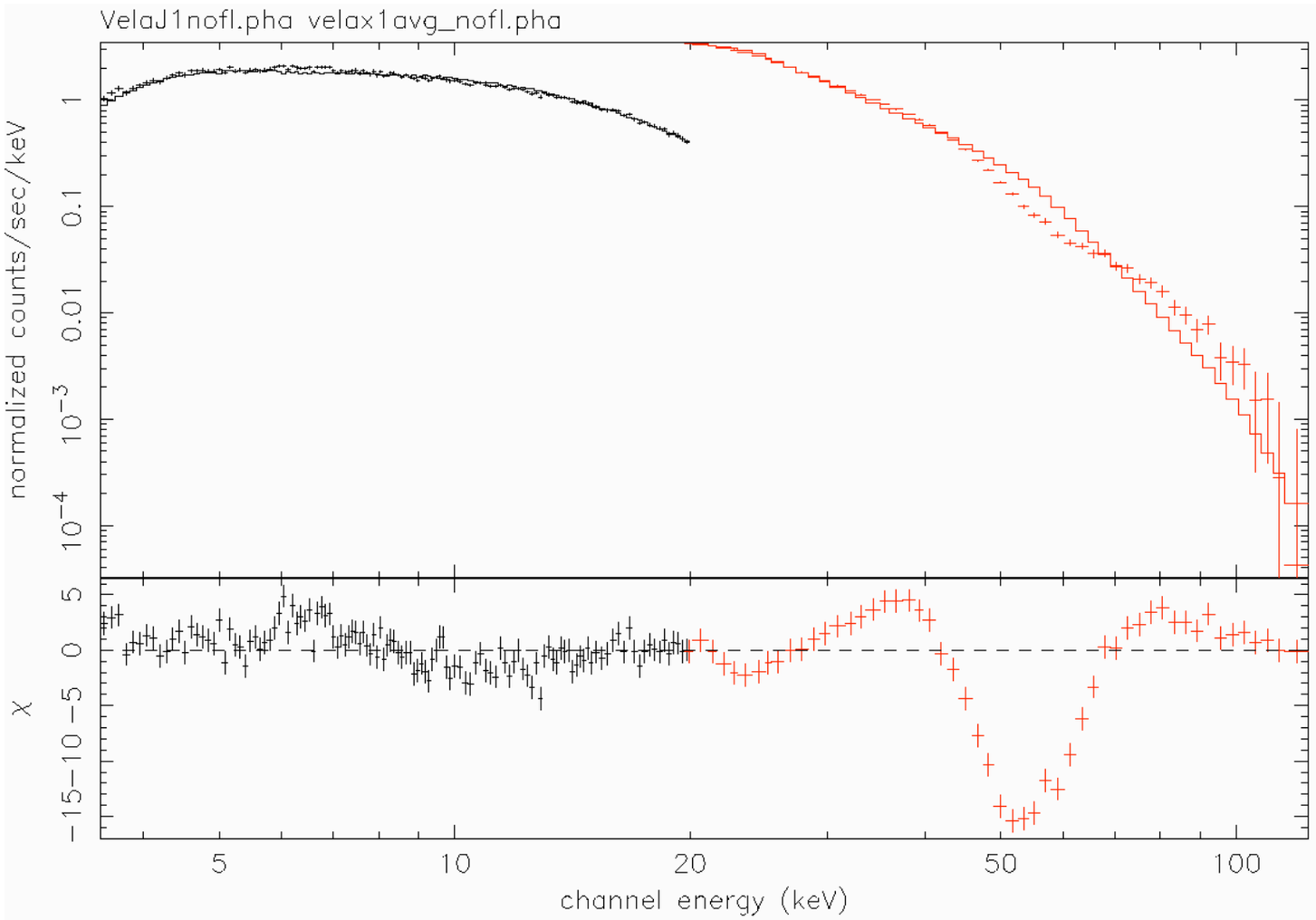


Vela X-1

- Schanne et al.:
  3 Msec private data
- JEM-X data!
- model: cutoffpl
- two CRSFs!
- E_1=27keV σ=12keV
  E_2=54keV σ=11keV
- seen by ISGRI and SPI



Schanne et al. (2007)

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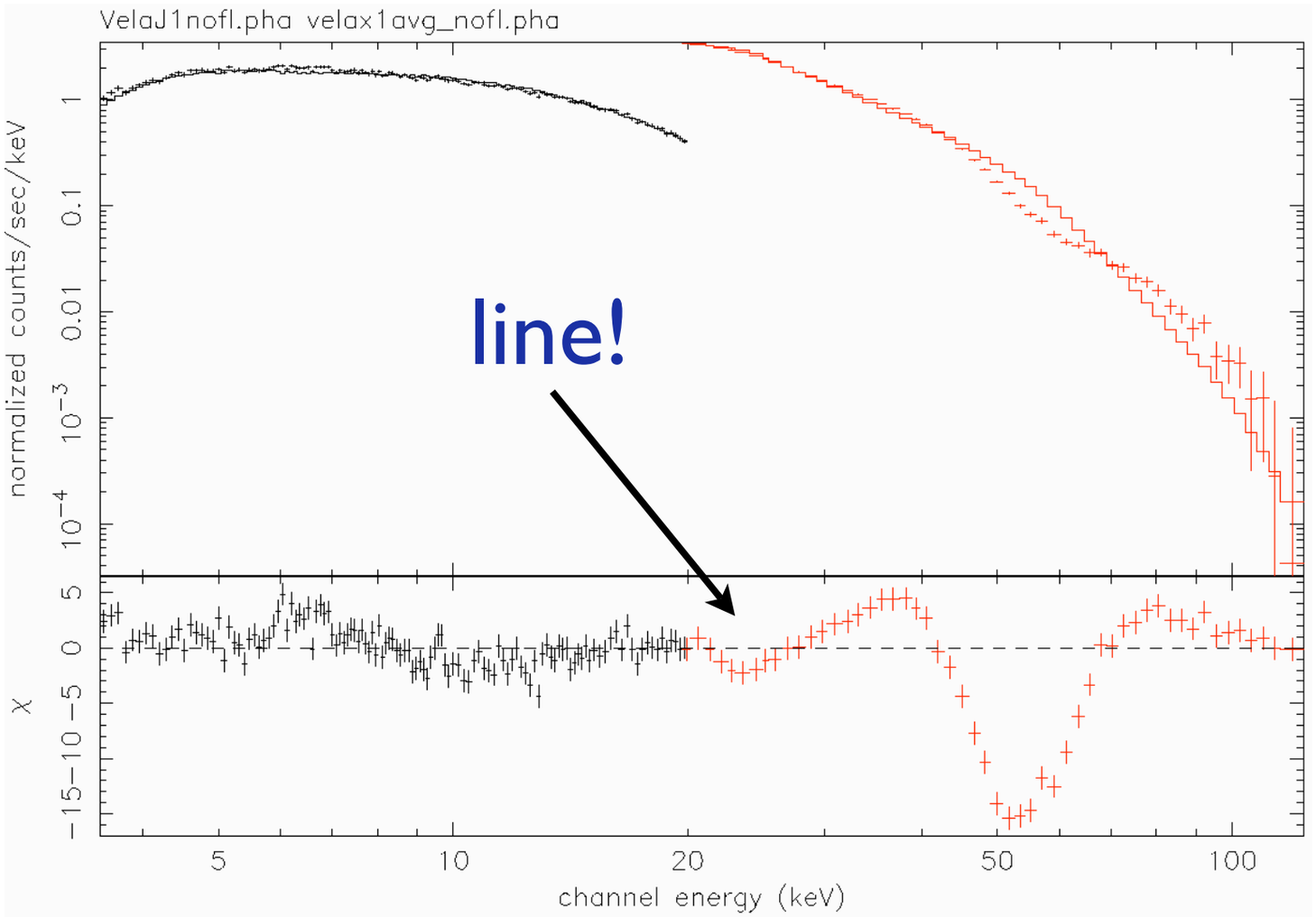
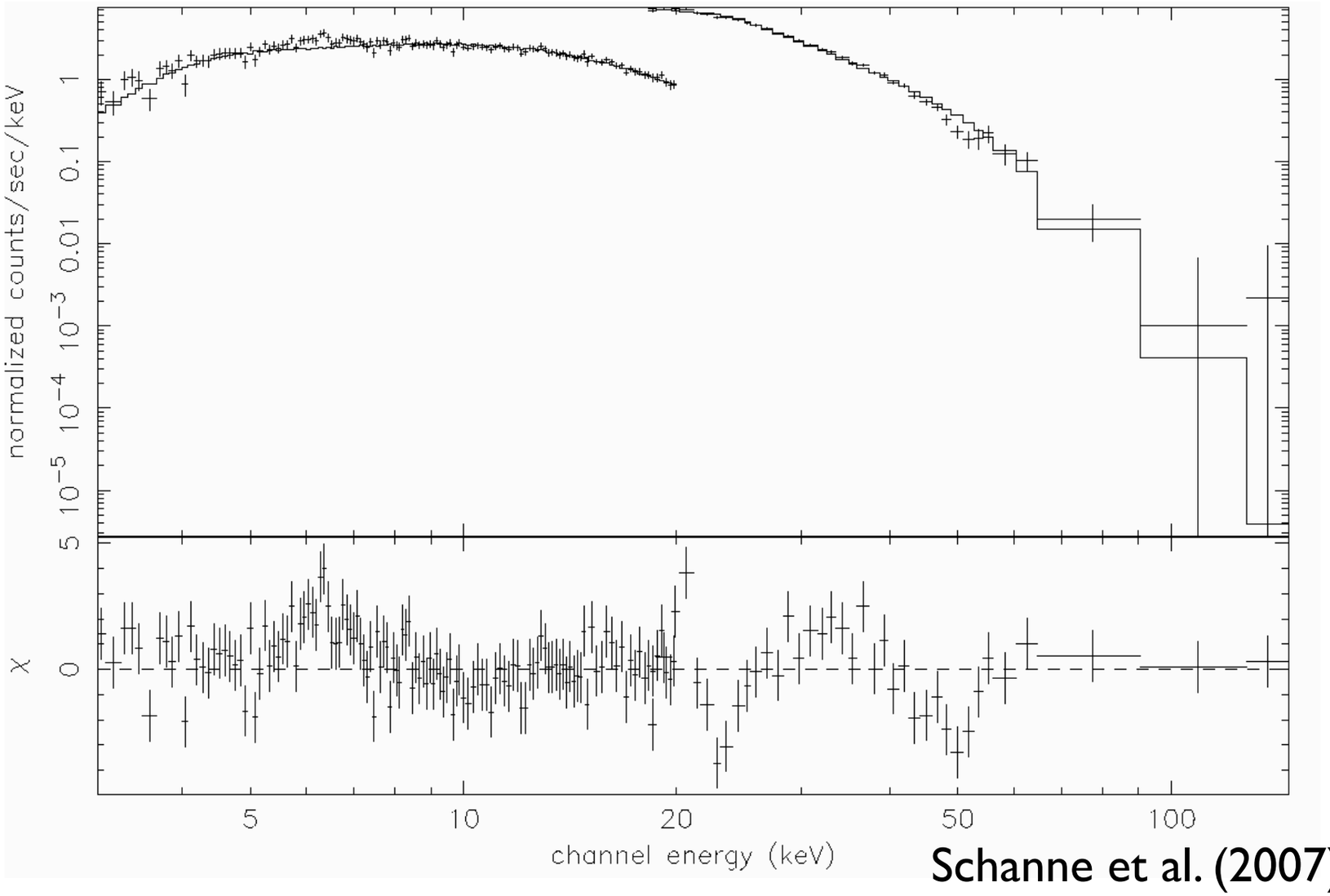


Schanne et al. (2007)

~25keV line is real!

Vela X-1: flares

- spectra from flares only
- CRSFs found at consistent energies



Schanne et al. (2007)

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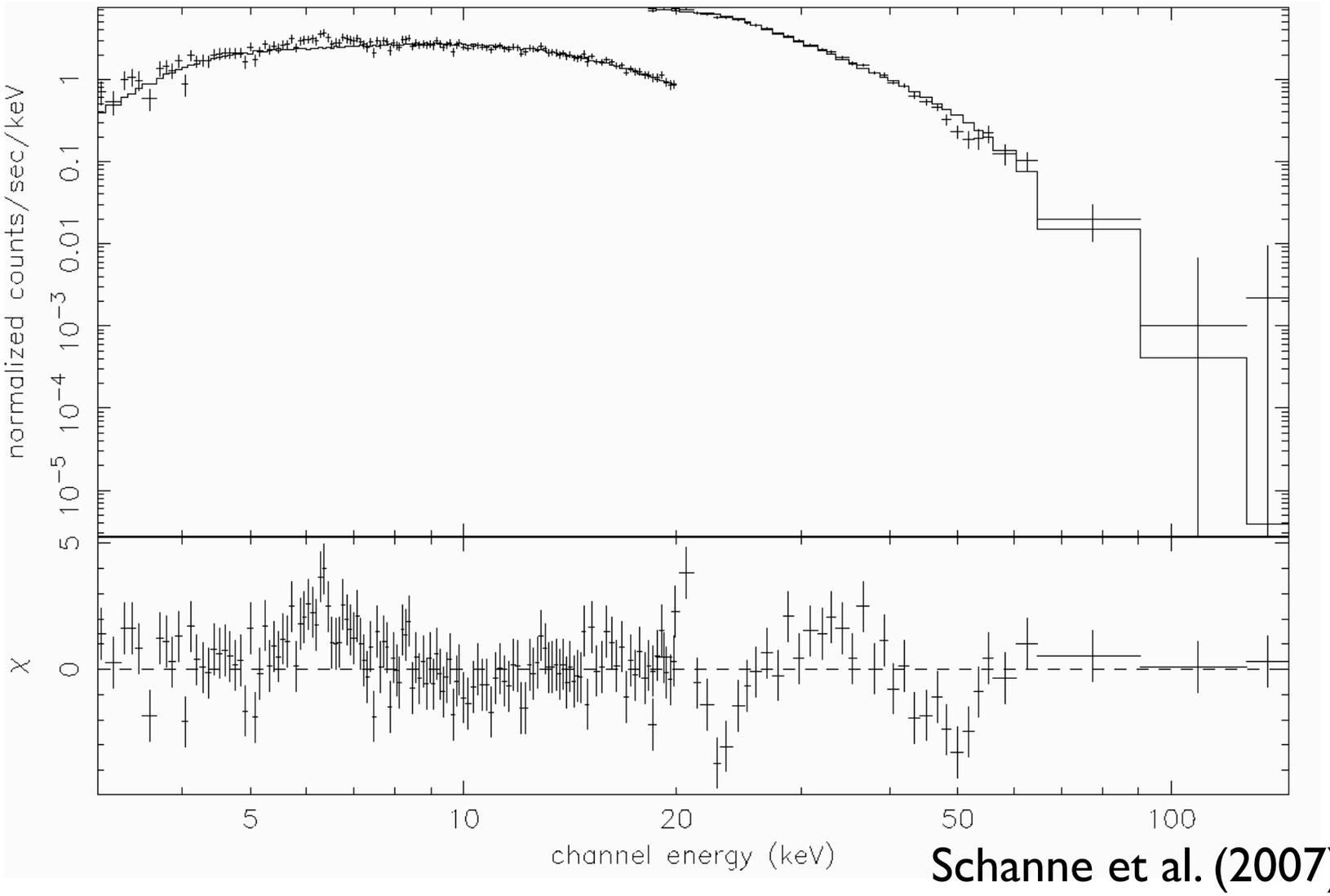
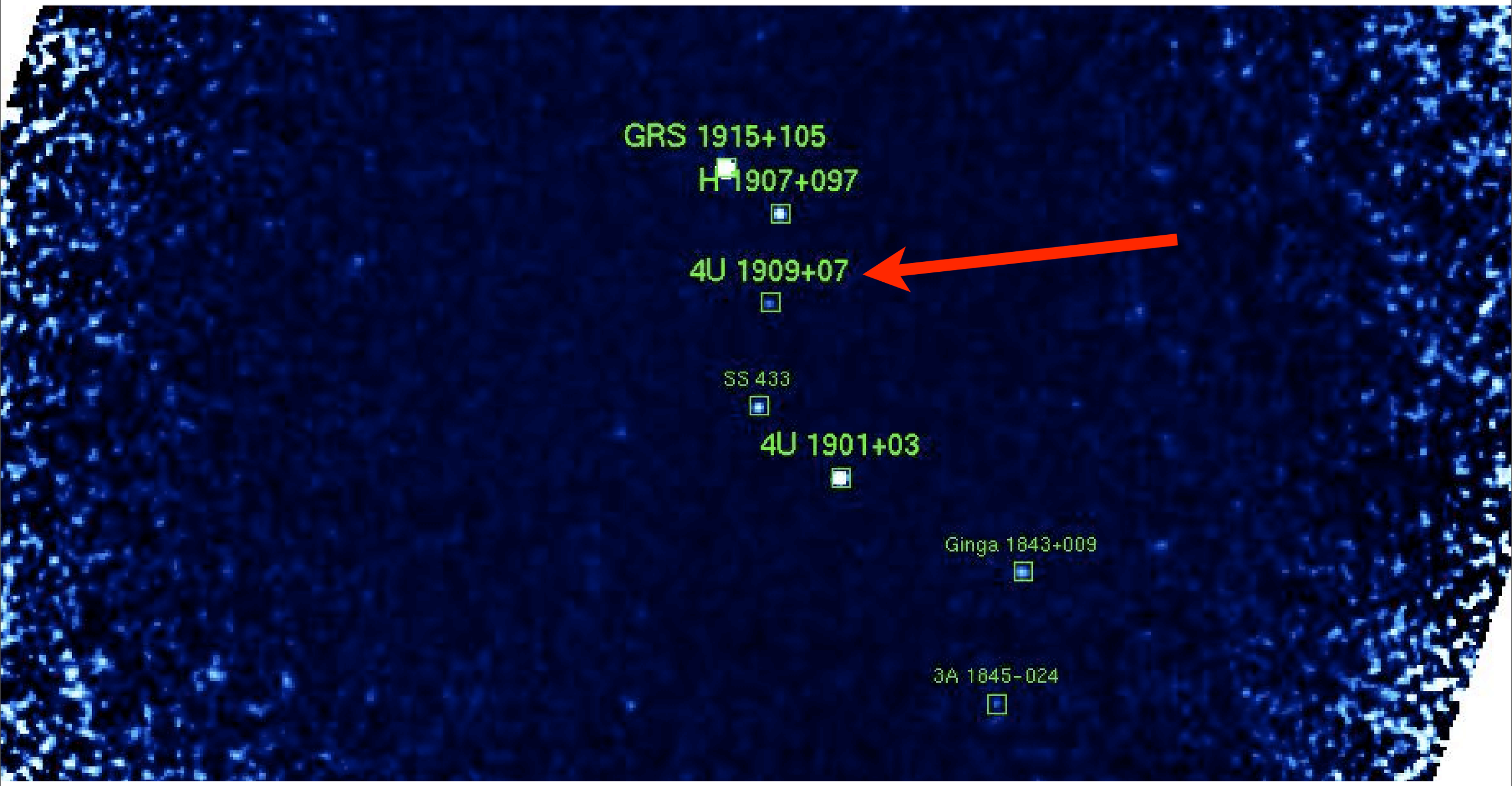


Schanne et al. (2007)

⇒ no change due to luminosity

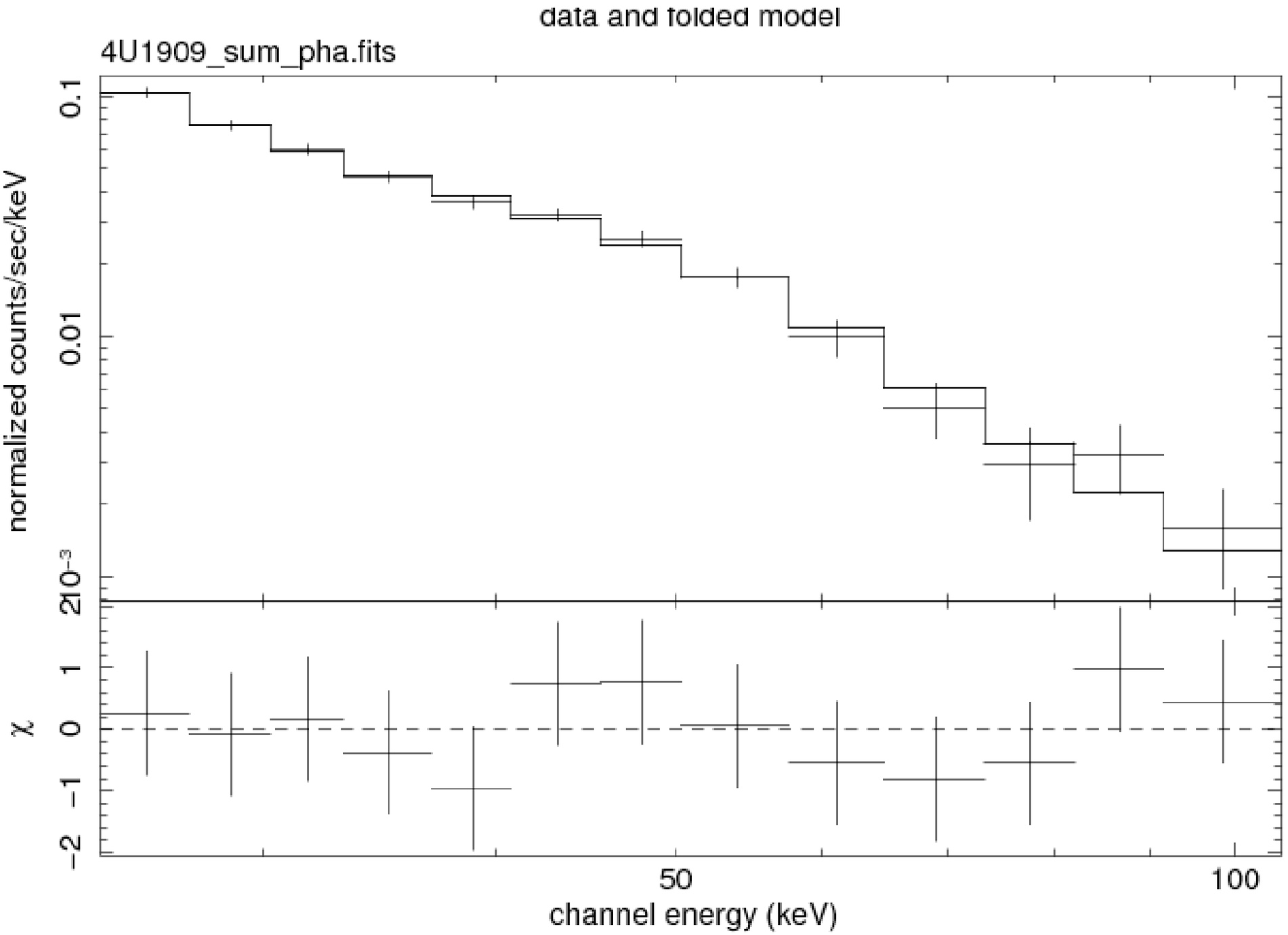
4U 1909+07


GRS 1915+105
H 1907+097
4U 1909+07
SS 433
4U 1901+03
Ginga 1843+009
3A 1845-024

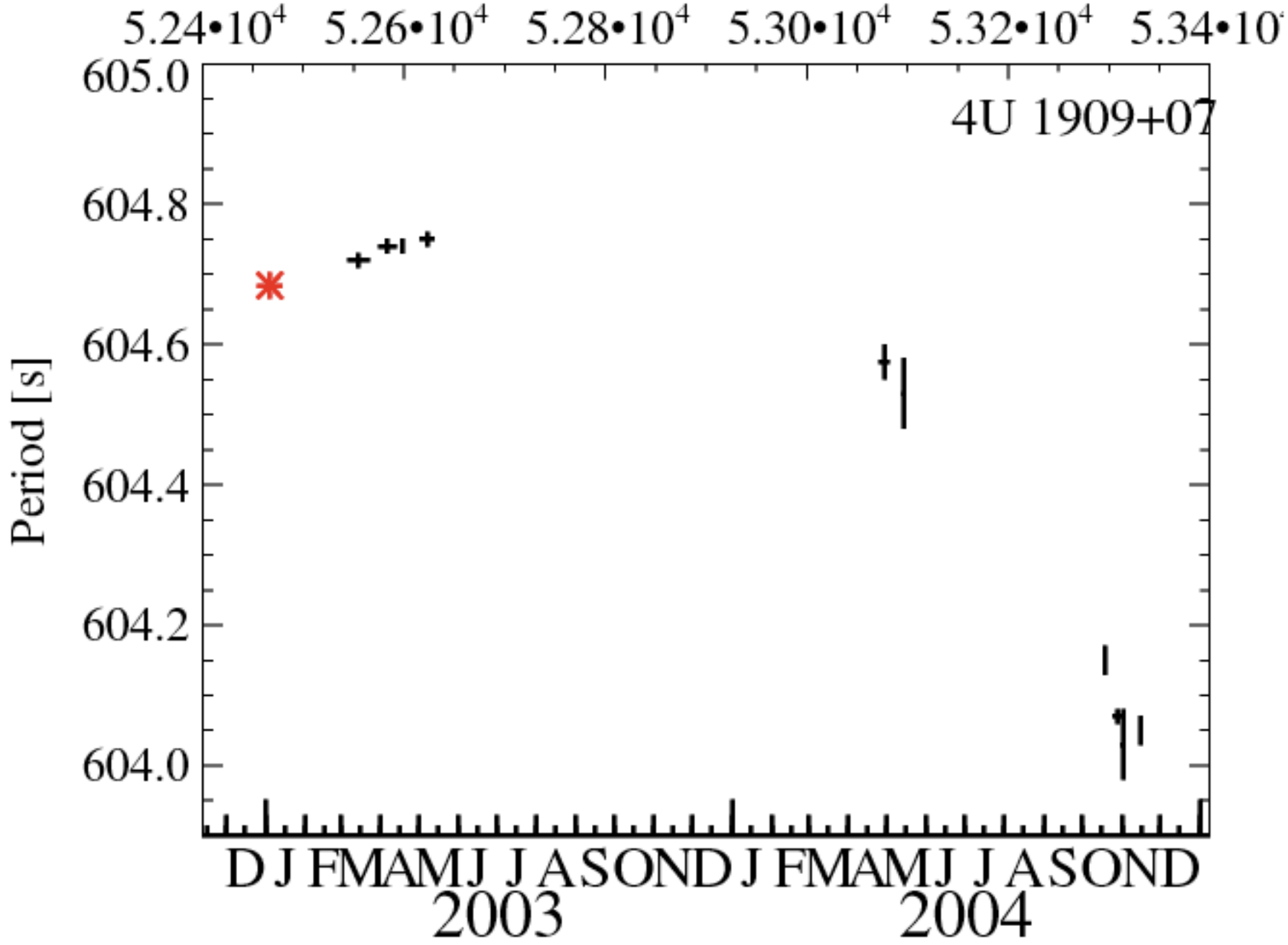
4U 1909+07

Model:

cutoffpl



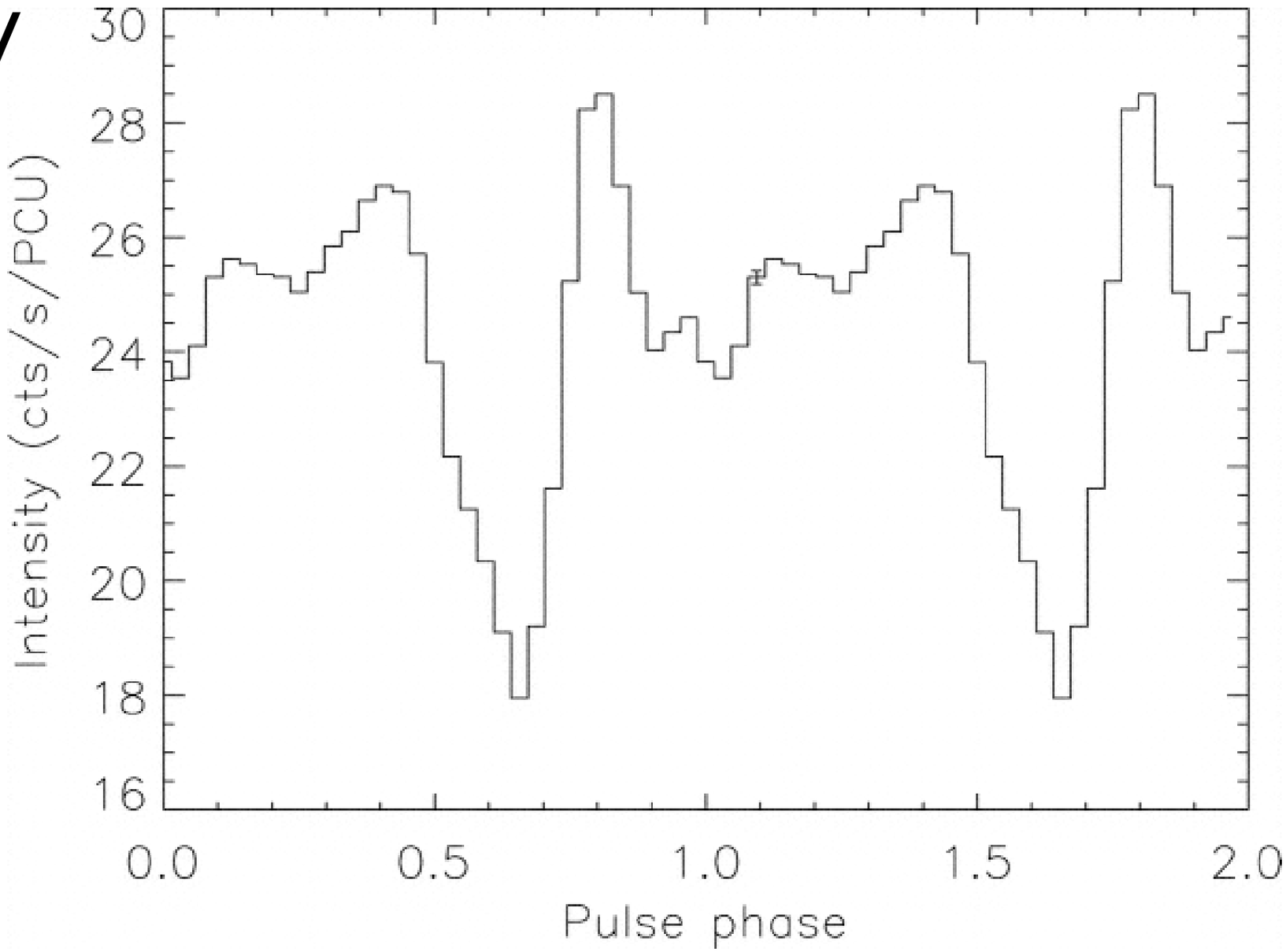
4U 1909+07


5.24•10^4
5.26•10^4
5.28•10^4
5.30•10^4
5.32•10^4
5.34•10
4U 1909+07
605.0
604.8
604.6
604.4
604.2
604.0
Period [s]
D J FMAMJ J ASOND J FMAMJ J ASOND
2003
2004

4U 1909+07

3.7-17 keV

PCA

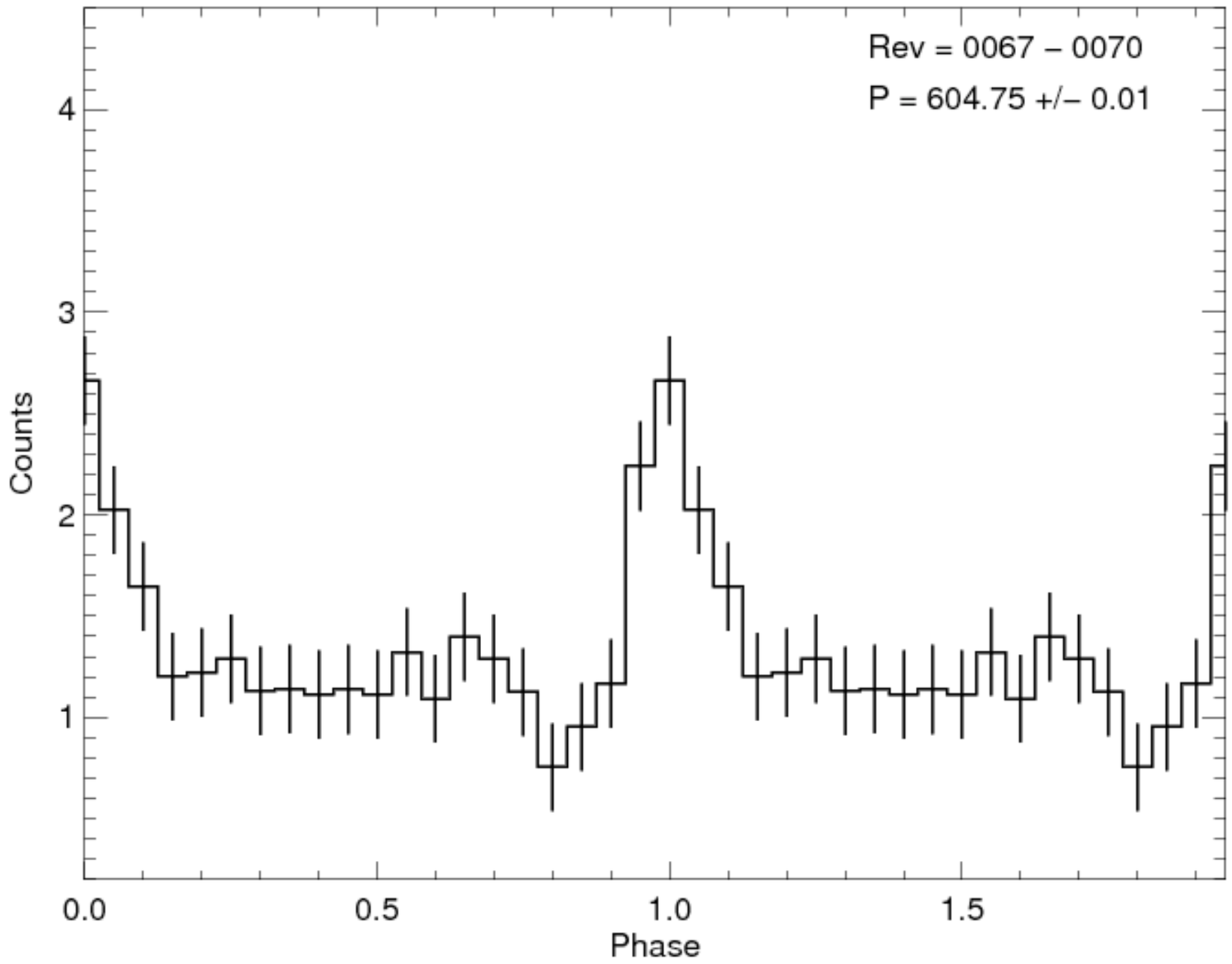


Levine et al. (2004)

4U 1909+07

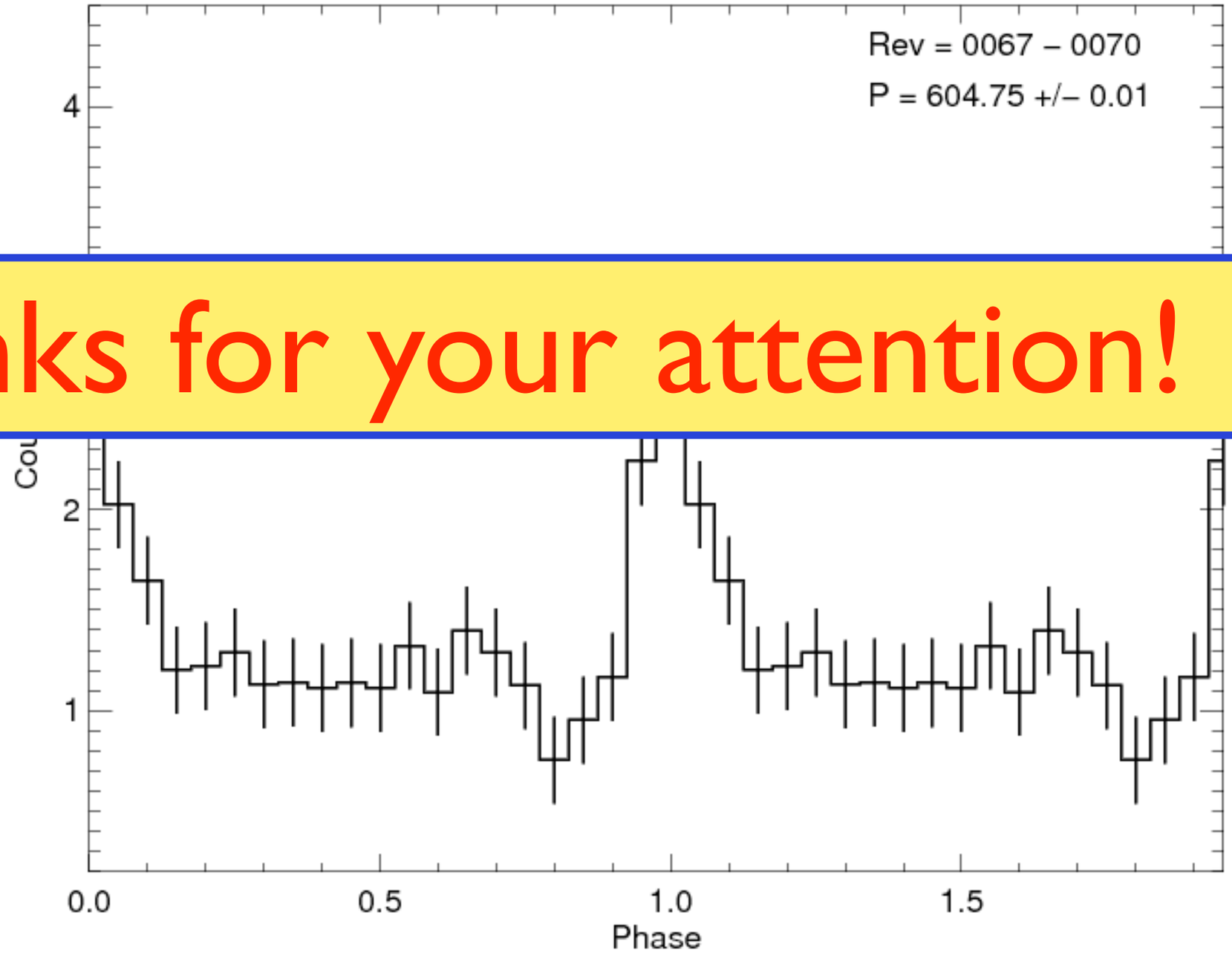
20-40 keV

ISGRI



4U 1909+07

20-40 keV



Thanks for your attention!