First results on V 0332+53 in outburst

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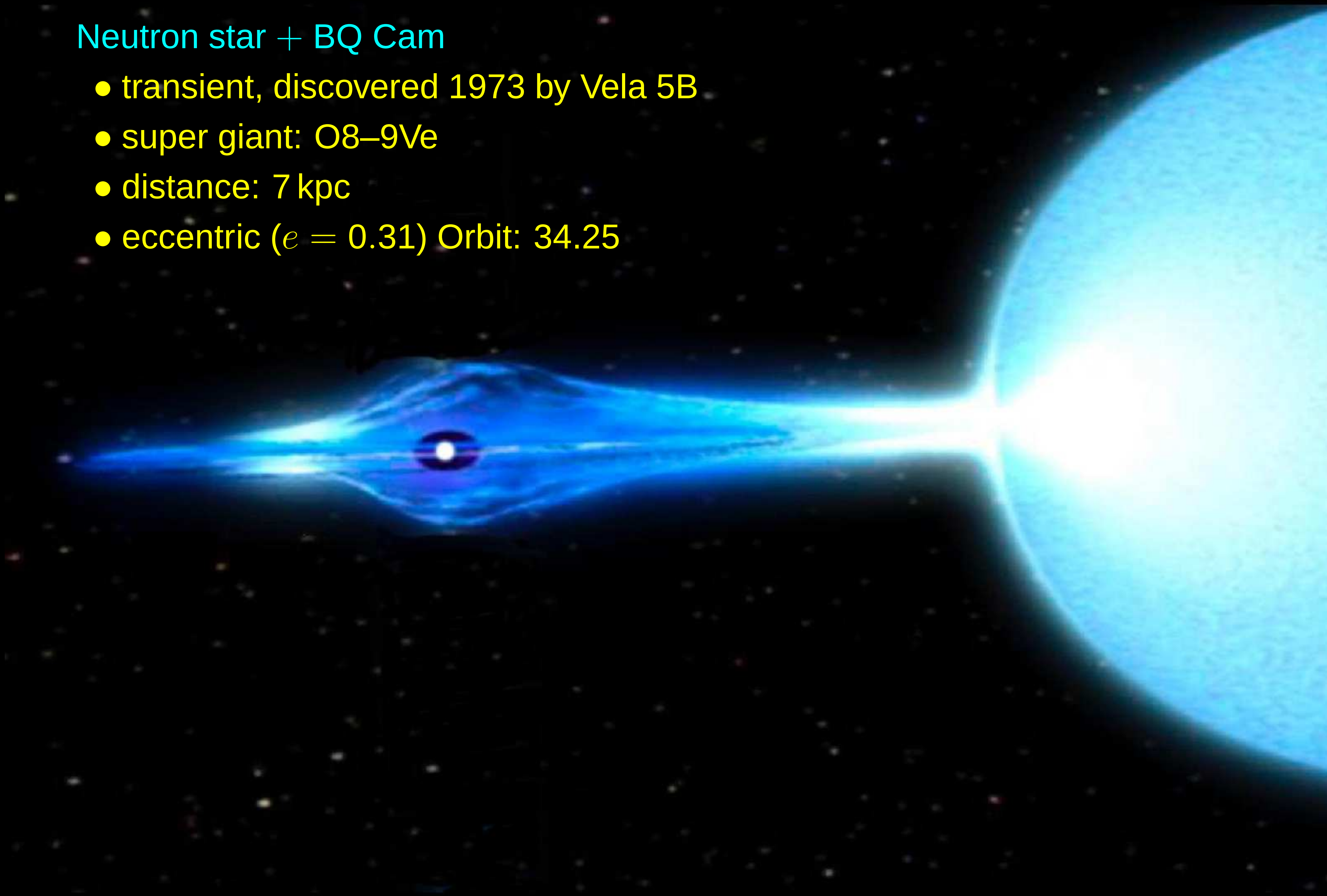
Neutron star + BQ Cam

- transient, discovered 1973 by Vela 5B
- super giant: O8–9Ve
- distance: 7 kpc
- eccentric ($e = 0.31$) Orbit: 34.25



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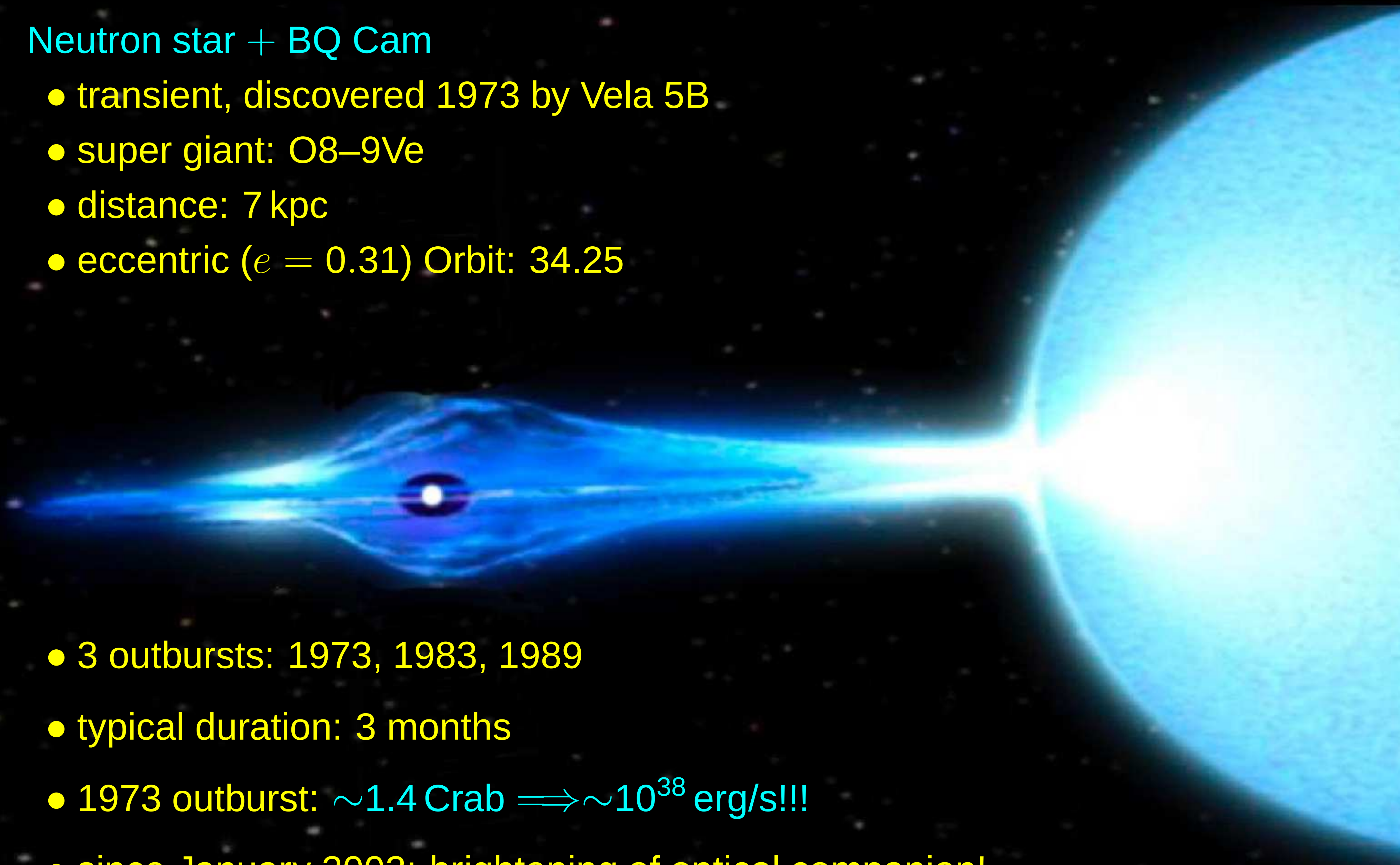


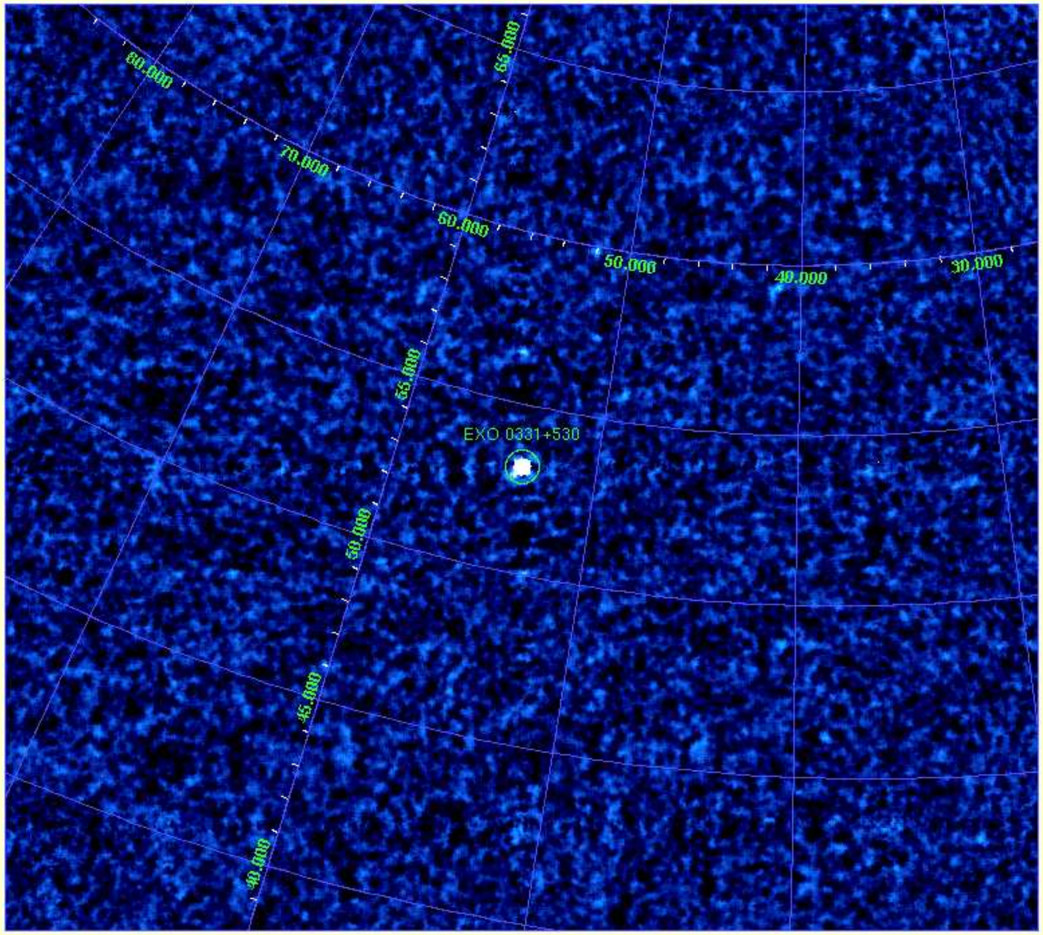
- 3 outbursts: 1973, 1983, 1989
- typical duration: 3 months
- 1973 outburst: $\sim$1.4 Crab $\Longrightarrow \sim 10^{38}$ erg/s!!!
- since January 2002: brightening of optical companion!
- new outburst began November 2004
- 3 CRSF reported by Coburn et al. (2005) in RXTE data

Observations, I

- TOO observation scheduled for January 7–10
- 30 ksec in staring
- 70 ksec in hexagonal

Observations, II

- TOO observation scheduled for January 7–10
- 30 ksec in staring
- 70 ksec in hexagonal



- analysis with OSA 4.2
- only V 0332+53 in FOV
- flux 20–60 keV: 550 mCrab
  $\Longrightarrow$consistent with *RXTE-ASM*
- PICsIT: —
- OMC: 15.4 $\pm$ 0.2
  $\Longrightarrow$consistent with simultaneous Earth-bound observation (ATEL #388)

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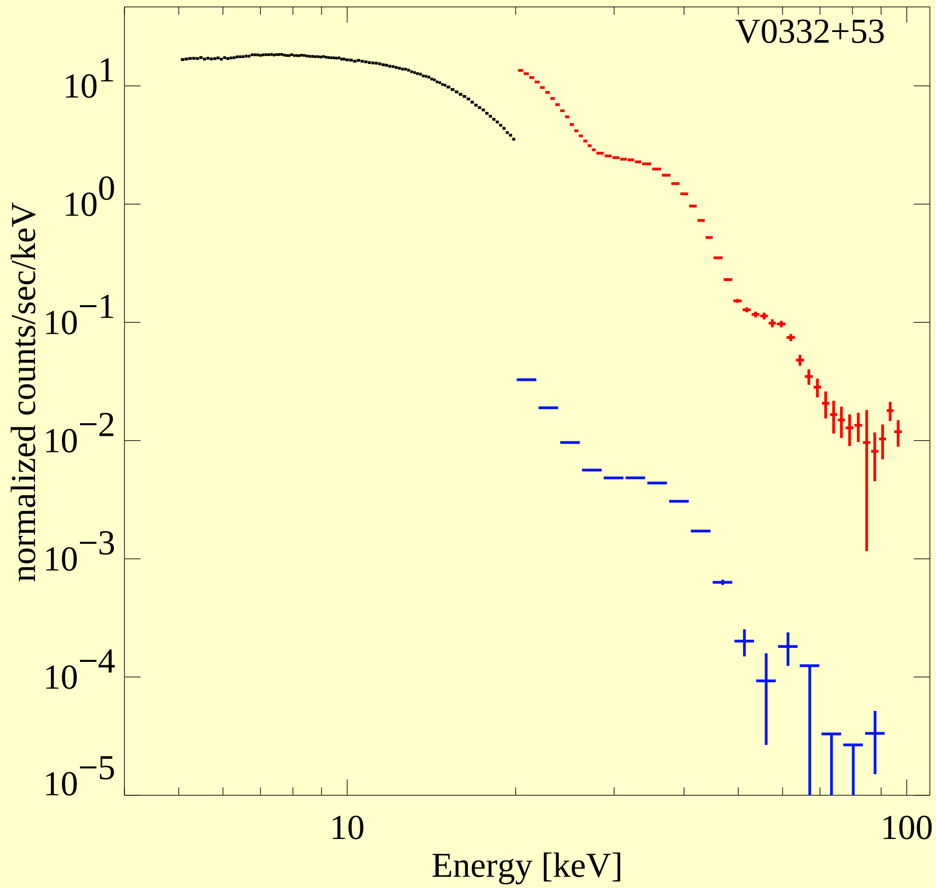
Spectrum, I

Joint spectrum of JEM-X, ISGRI, and SPI

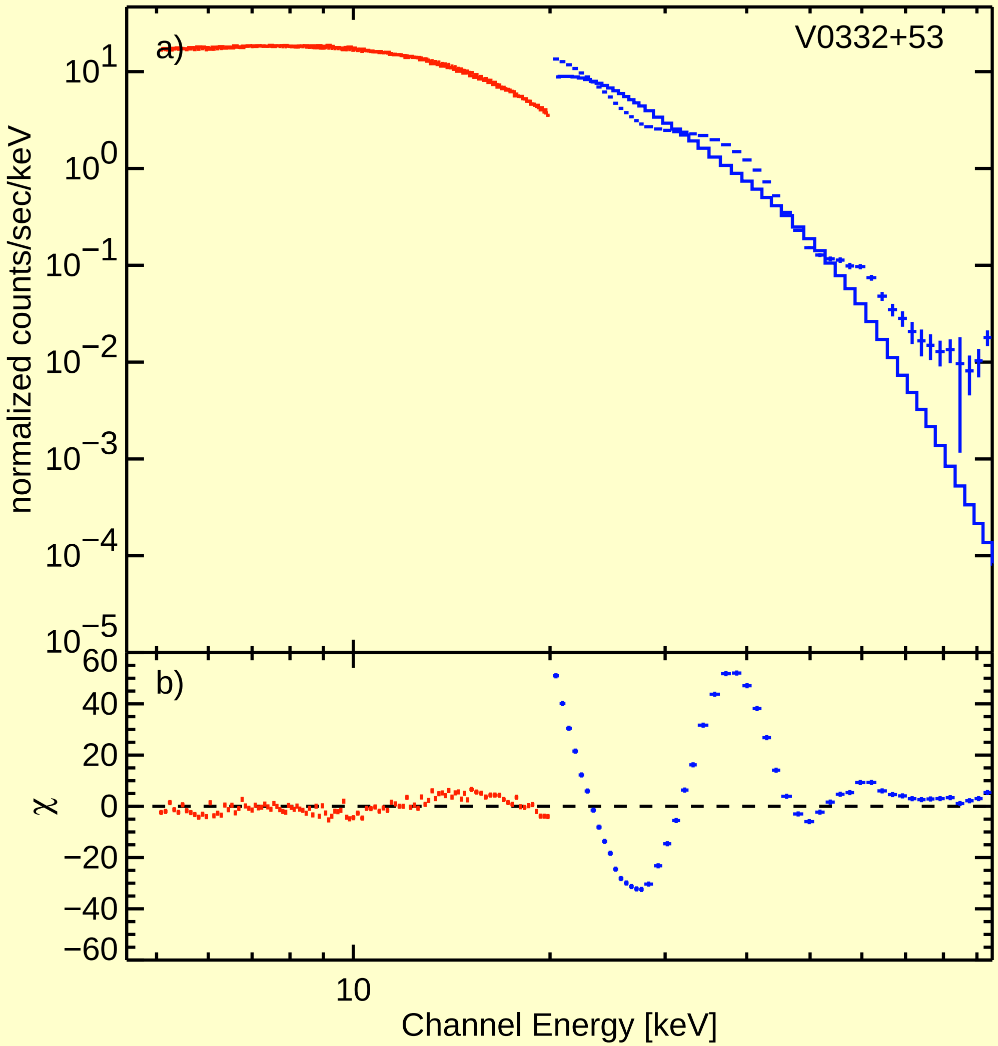
2 Lines clearly detected by eye



no CRSFs

Model:
cutoffpl

- E_{Cut} = 6 keV
- no N_{H}
- χ^2 = 9246 (164)



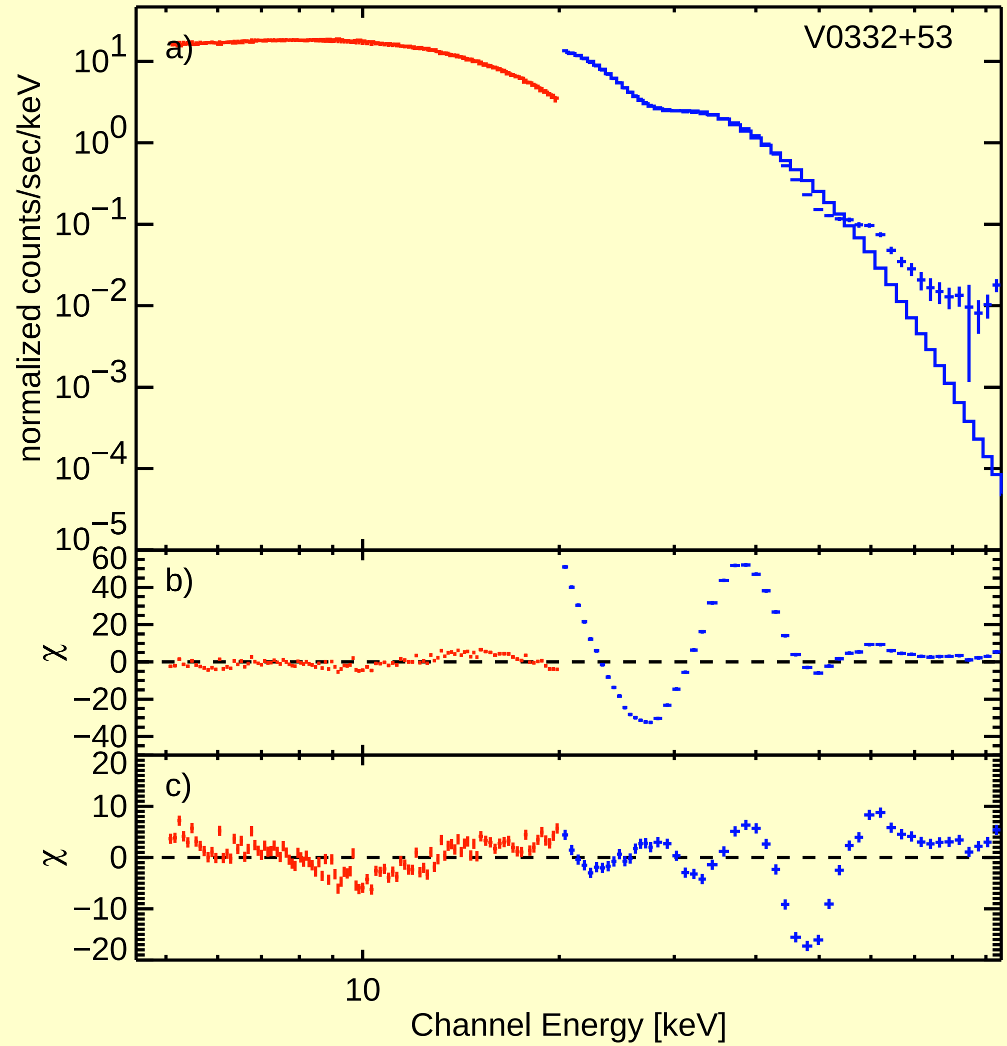
Spectrum, III

1 CRSF

Model:

cutoffpl $+$ 1 Gaussian

- $E_C = 26.5\,\mathrm{keV}$
- $\sigma_{\mathrm{Cyc}} = 3.1\,\mathrm{keV}$
- $\tau_{\mathrm{Cyc}} = 1.4$
- $\chi^2 = 1336$ (161)



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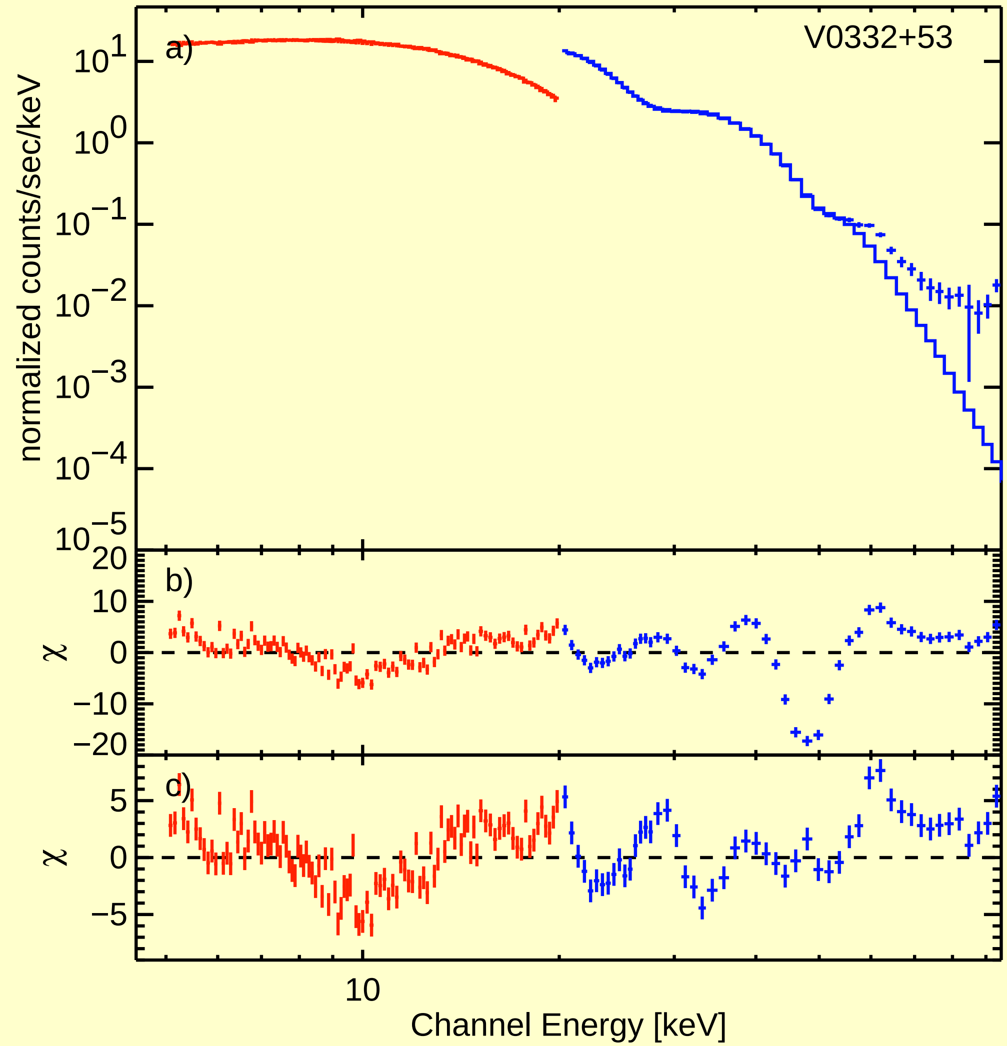
Spectrum, IV

2 CRSFs

Model:

cutoffpl $+$ 2 Gaussians

- E_{C} = 48.1 keV
- σ_{Cyc} = 2.1 keV
- τ_{Cyc} = 1.4
- $\chi^2 =$ 617.7 (158)



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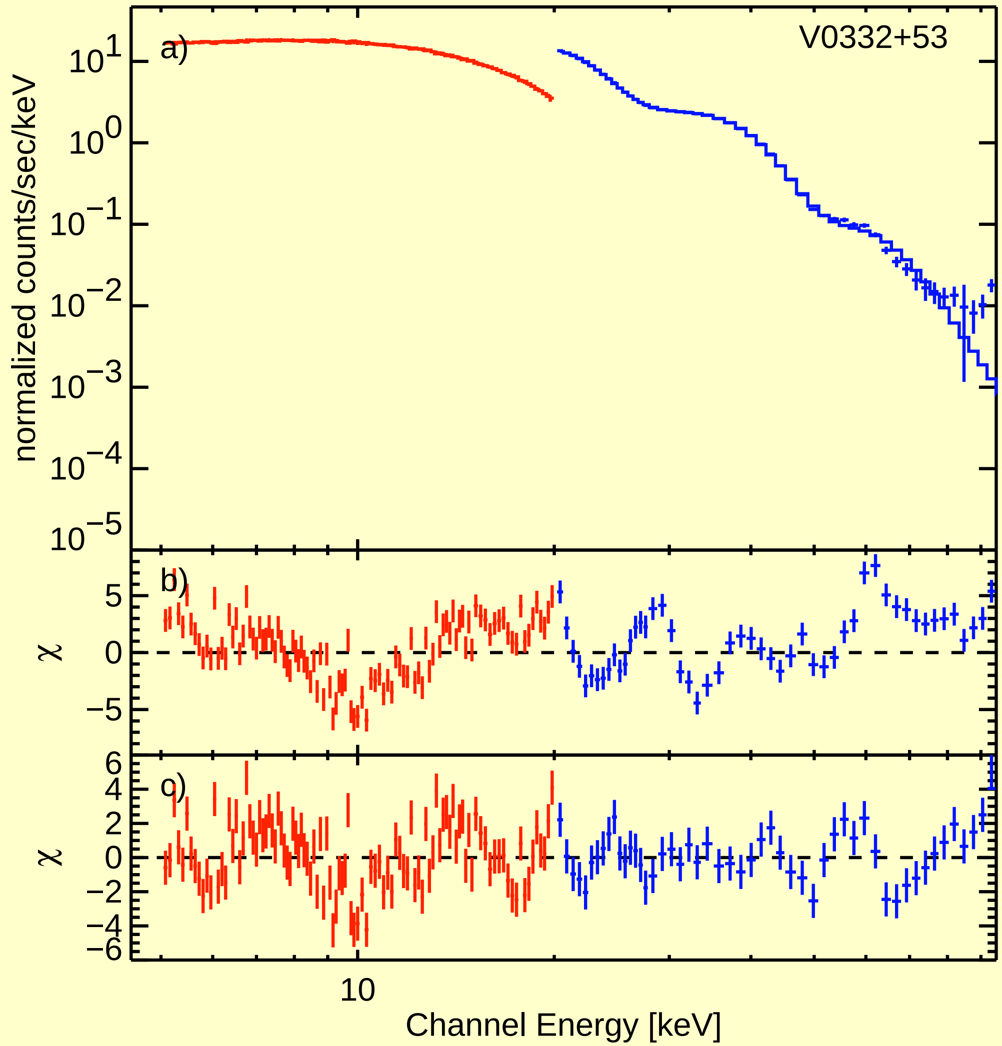
Spectrum, V

2 CRSFs

Model:

cutoffpl $+$ 3 Gaussians

- E_{C} = 29.6 keV
- σ_{Cyc} = 4.1 keV
- τ_{Cyc} = 1.0
- χ^2 = 249.4 (155)



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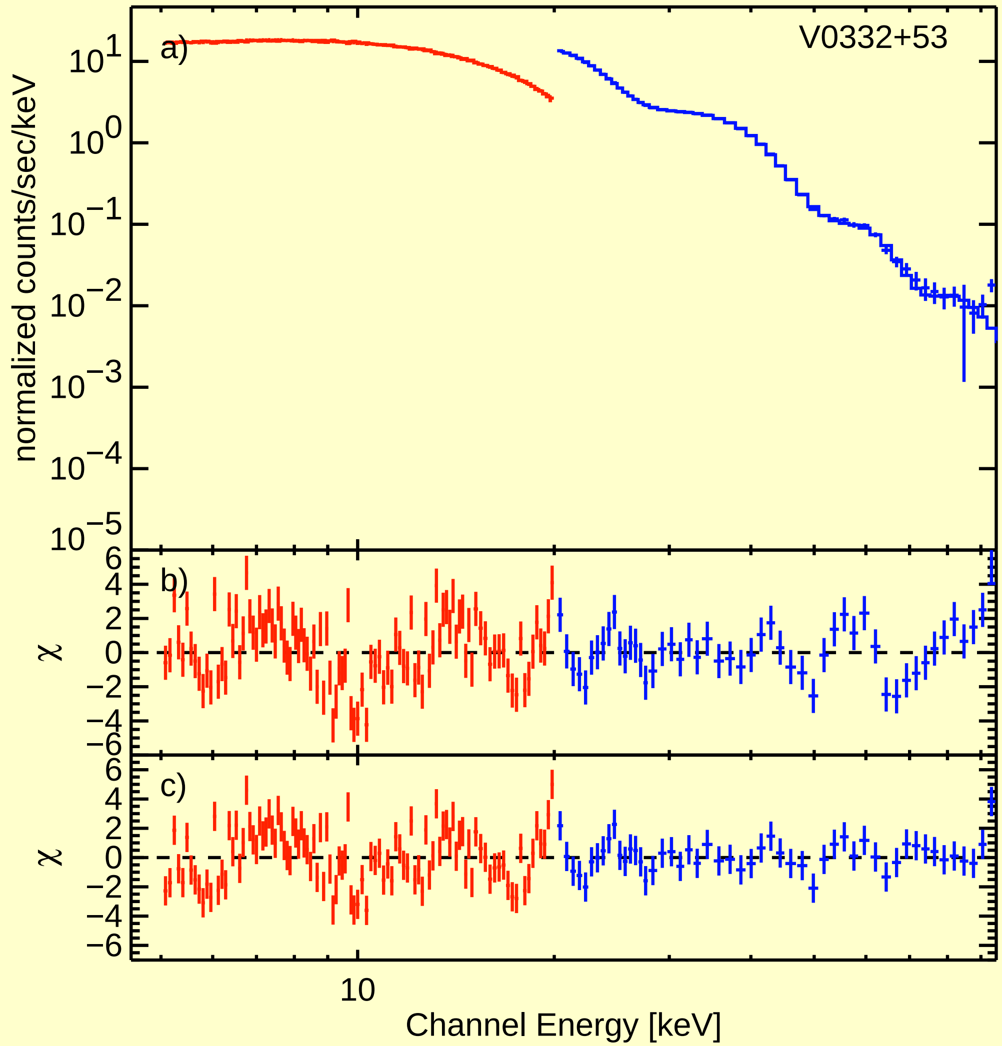
Spectrum, VI

3 CRSFs

Model:

cutoffpl $+$ 4 Gaussians

- E_C = 71.4 keV
- σ_Cyc = 5.5 keV
- τ_Cyc = 1.7
- χ^2 = 194.5 (152)



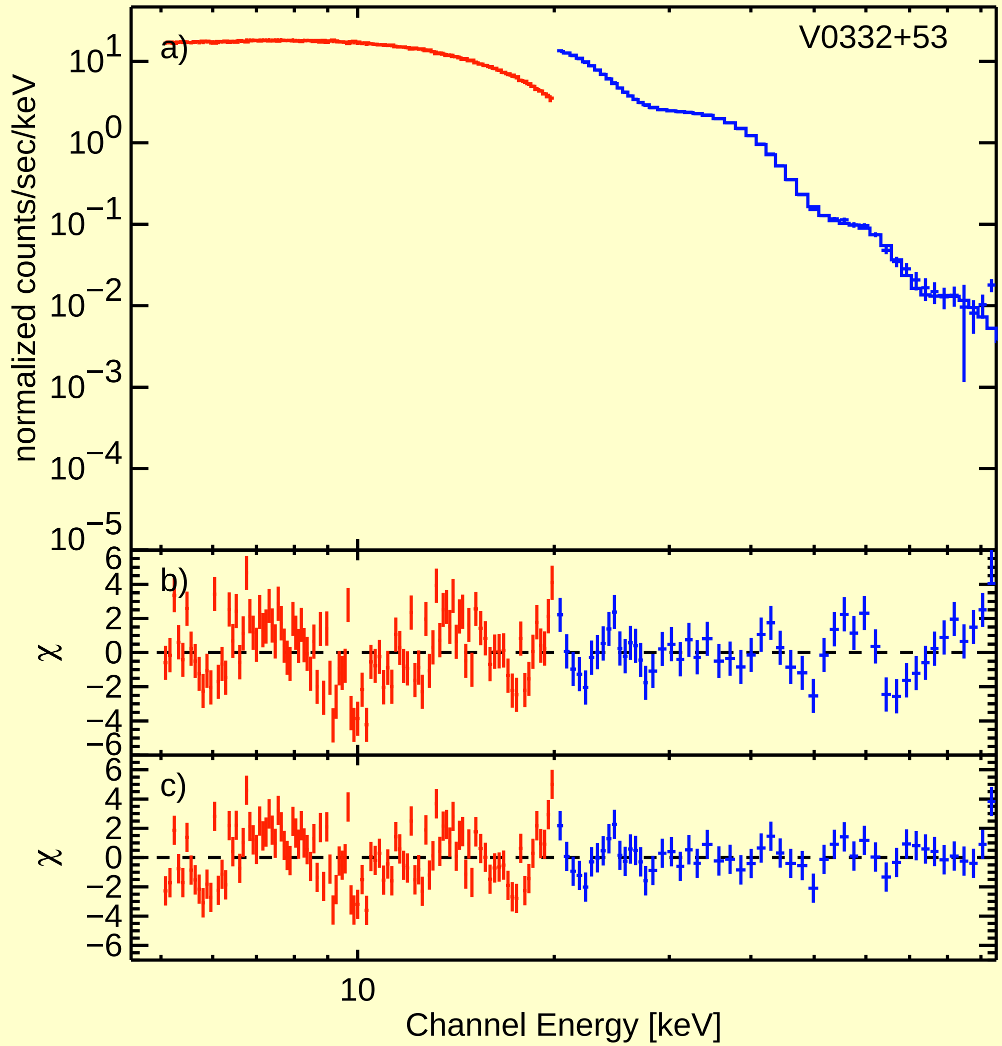
Spectrum, VII

3 CRSFs

Model:

cutoffpl $+$ 4 Gaussians

- E_C = 71.4 keV
- σ_Cyc = 5.5 keV
- τ_Cyc = 1.7
- χ^2 = 194.5 (152)
- E_C = 24.9 keV, (29.0 keV), 50.5 keV, 71.7 keV



Pulse Period

Determination of the pulse period:

$\Longrightarrow$binary orbit correction required!

But: ephemeris too old, uncertainties too large!

Determination of new ephemeris not trivial

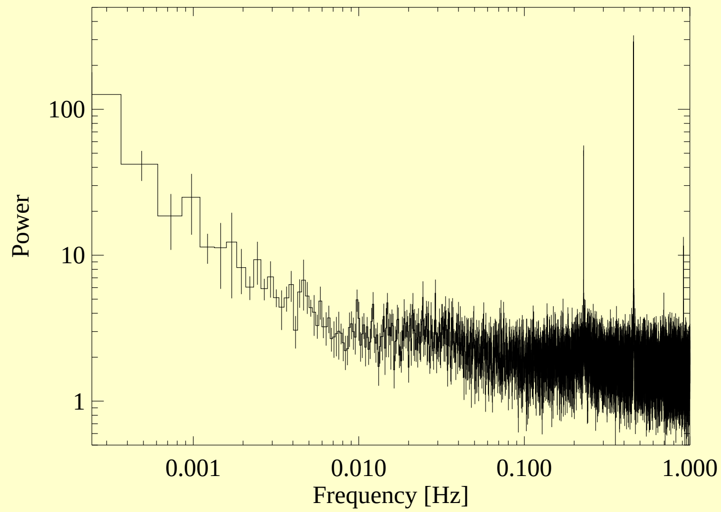
$\Longrightarrow$new orbital period: 34.297 d, but solution not unique.

$\Longrightarrow$more observations required.

$\Longrightarrow$second *INTEGRAL* TOO and RXTE data!

Period without binary correction:

P_{Pulse}=4.375 s, unchanged from 1983!



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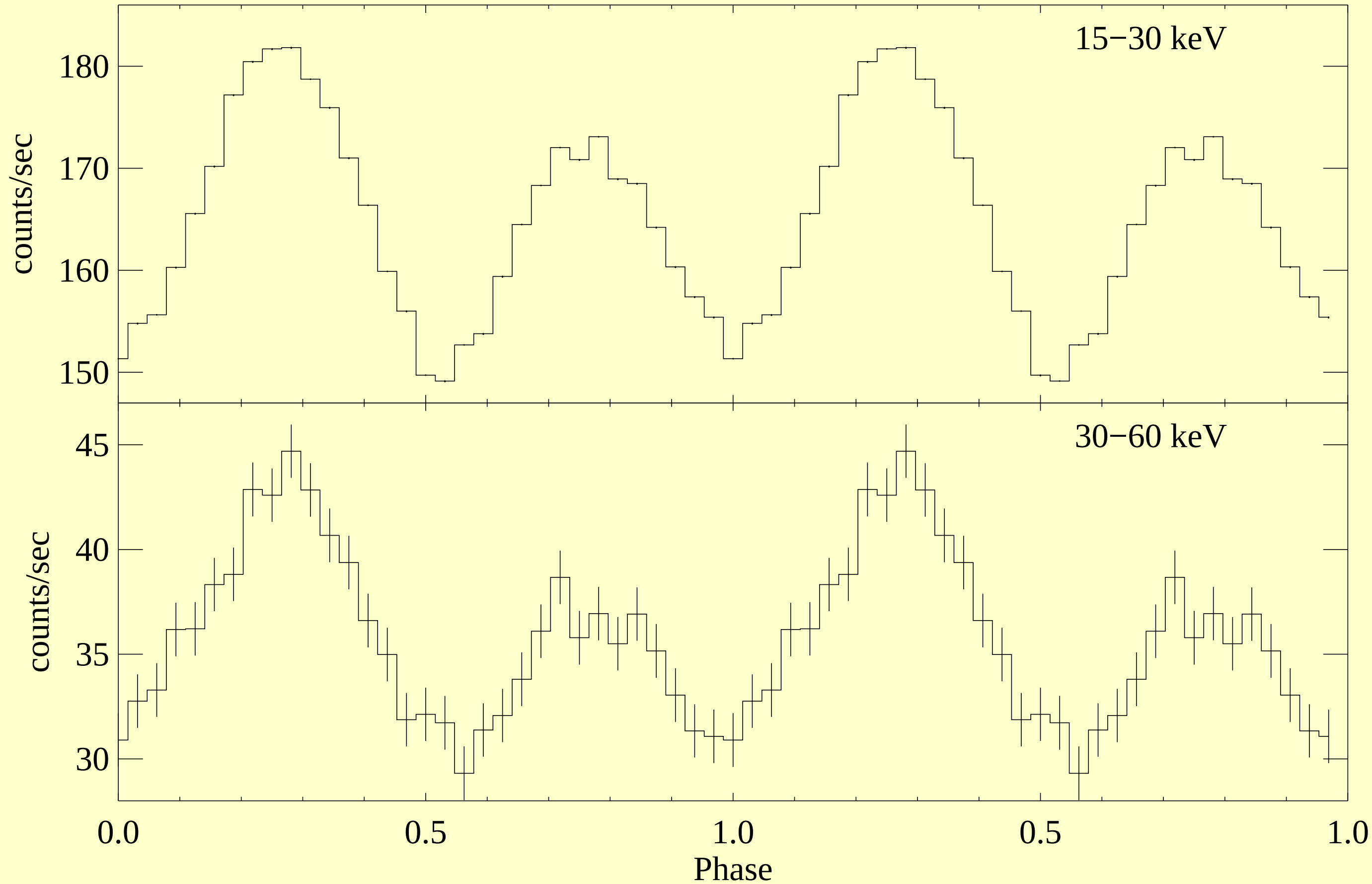
Energy resolved Pulse Profiles, I

- no binary orbit correction possible
  $\Longrightarrow$ create pulse profiles only over short time period
- use data from Rev. 274 (20ksec)
- Period: $P_{\mathrm{Pulse}} = 4.3749\,\mathrm{s}$

ISGRI



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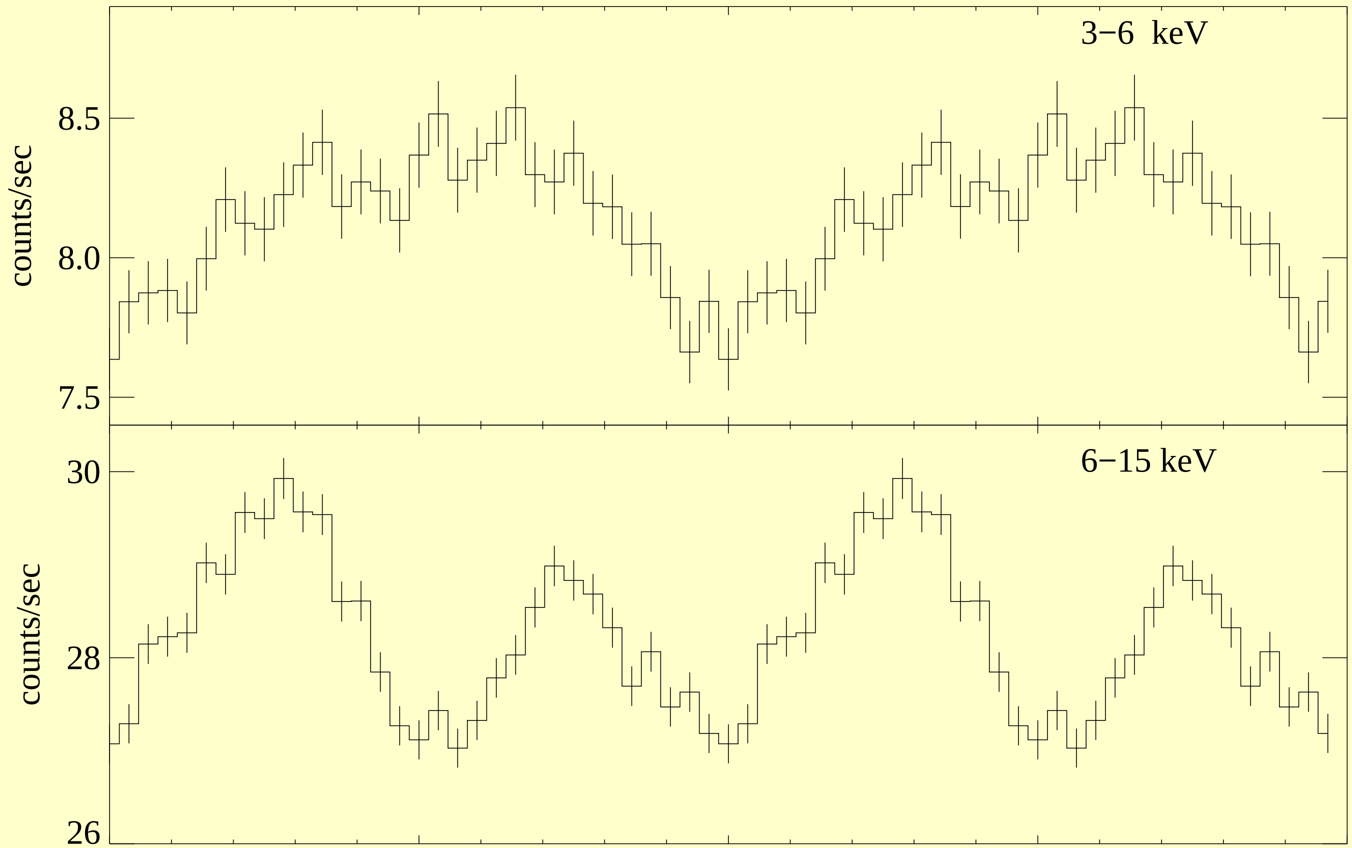
Energy resolved Pulse Profiles, II

- no binary orbit correction possible

  $\Longrightarrow$create pulse profiles only over short time period
- use data from Rev. 274 (20ksec)
- Period: $P_{Pulse} = 4.3749\,s$

JEM-X



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Conclusions, I

- 3 CRSFs detected — line energies very similar to RXTE
- fundamental energy: $\sim$25 keV $\Longrightarrow B = 2.7 \times 10^{12}$ G
- fundamental line has non-Gaussian shape
- pulse profile is energy dependent

$\Longrightarrow$ submitted to A&A Letters

Conclusions, II

- 3 CRSFs detected — line energies very similar to RXTE
- fundamental energy: $\sim$25 keV $\Longrightarrow B = 2.7 \times 10^{12}$ G
- fundamental line has non-Gaussian shape
- pulse profile is energy dependent

$\Longrightarrow$submitted to A&A Letters

next steps:

- new determination of the orbit
- pulse phase resolved spectroscopy
- comparison with Monte Carlo simulations of Araya & Harding (1999)

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Conclusions, III

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- fundamental energy: $\sim$25 keV $\Longrightarrow B = 2.7 \times 10^{12}$ G
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Thank you for your attention!