Status of the White dwarf (WD) and Isolated Neutron Star (INS) Working Group

Vadim Burwitz (MPE) on behalf of the working group

IACHEC Virtual Spring Meeting,

May 19, 2021

Presentations during Working group

- The wiki page (last updated 2019)
- Chandra ACIS → Herman Marshall
- Chandra LETG → Vadim Burwitz
- eROSITA → Frank Haberl

IACHEC WD + INS Wiki page

https://wikis.mit.edu/confluence/display/iachec/White+Dwarfs+and+Isolated+Neutron+Stars

Übersicht › IACHEC › … › White Dwarfs and Isolated Neutron Stars Durchsuchen Anmelden Suchen

White Dwarfs and Isolated Neutron Stars

Extras

4 Hinzugefügt von Eric D Miller, zuletzt bearbeitet von Vadim Burwitz am May 21, 2019 22:58 (Änderung anzeigen)

Working Group

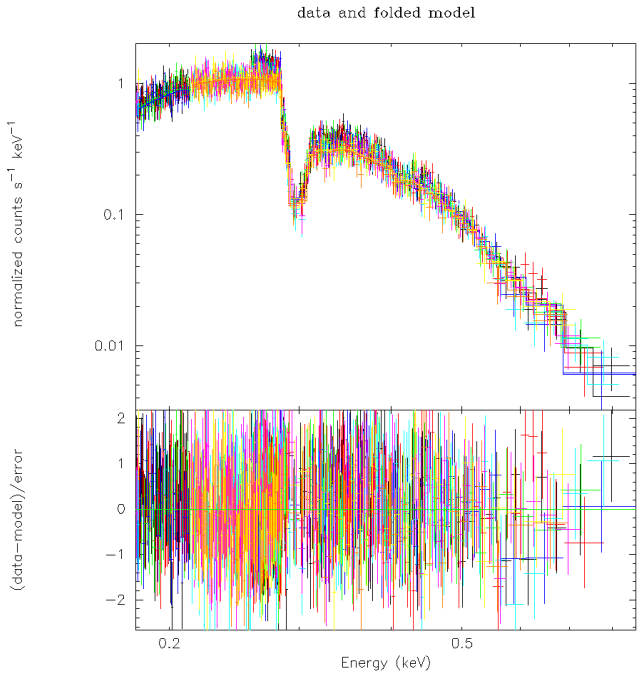
- ***Models***

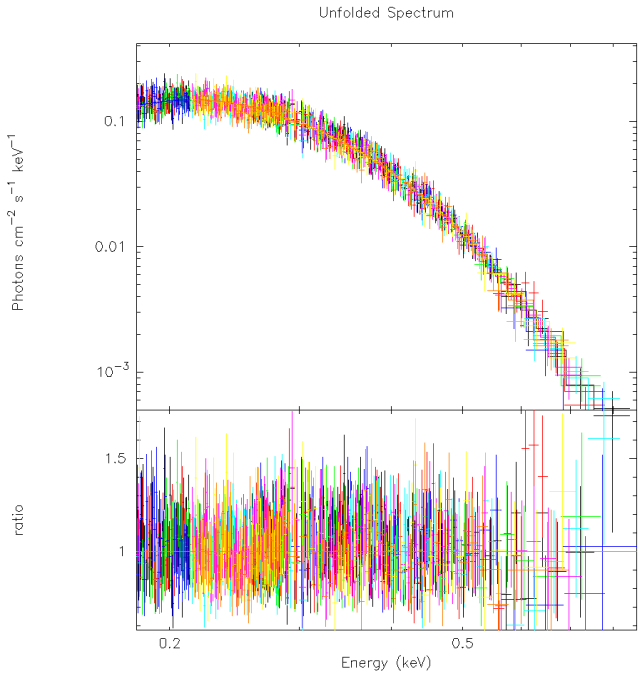
RX J1856.5-3754 based on the CHANDRA LETGS + HRCS Data

delchisqr = 1 (= 1 sigma for 1 parameter)

- ***tbabs*bbodyrad***
  chiqs = 692.6
  dof =1251
  chired = 0.55367
  nh = (7.24 +/- 0.34) * 1e19 cm-2
  kT = (62.38 +/- 0.38) eV
  norm = (1.580 +/- 0.064) * 1e5

- ***phabs*bbodyrad***
  chiqs = 696.0
  dof =1251
  chired = 0.55636
  nh = (7.37 +/- 0.35) * 1e19 cm-2
  kT = (62.43 +/- 0.38) eV
  norm = (1.576 +/- 0.065) * 1e5



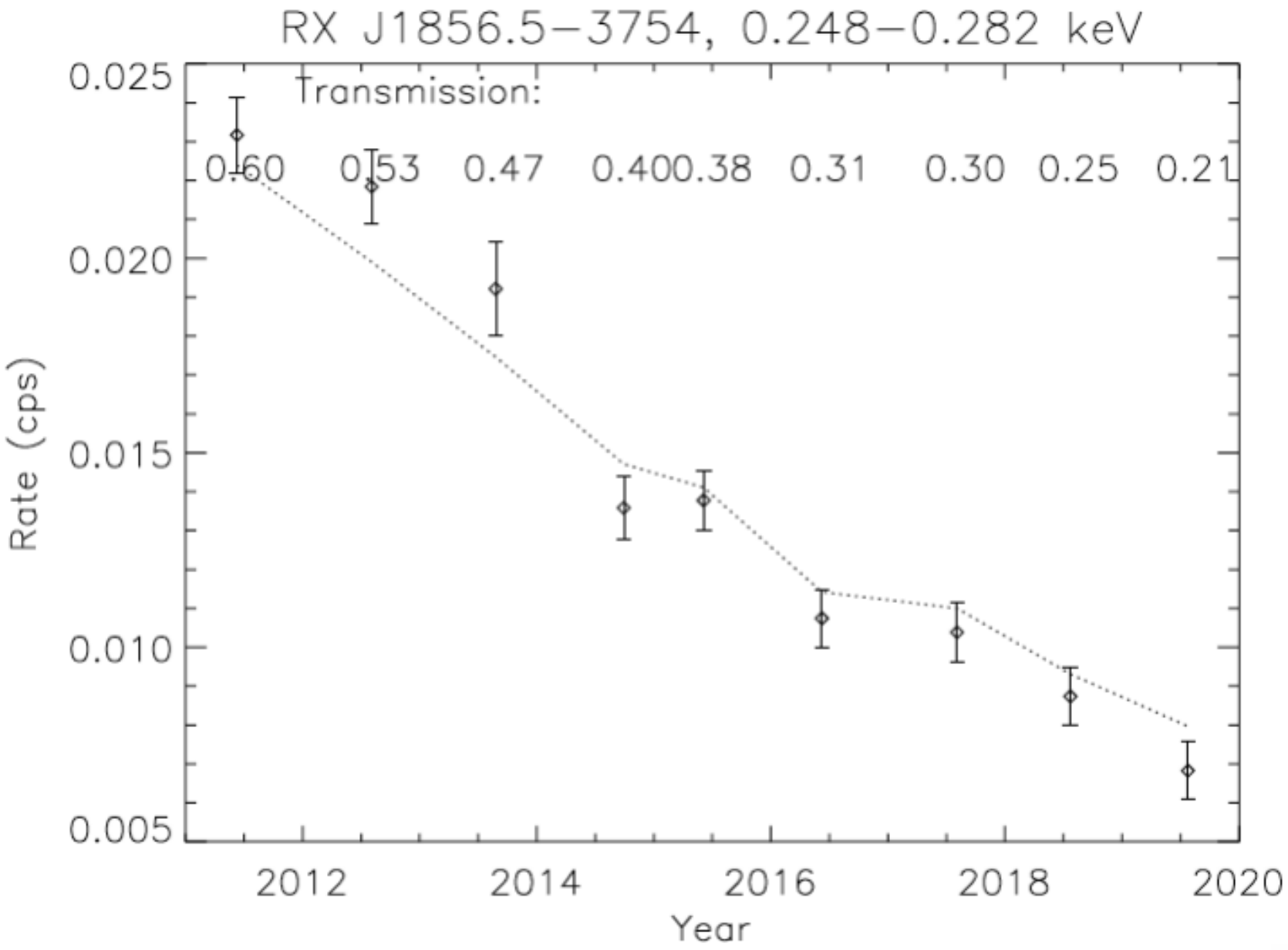


Chandra

RX J1856.5–3754

(= RXJ1856)

Monitoring ACIS



Herman Marshall

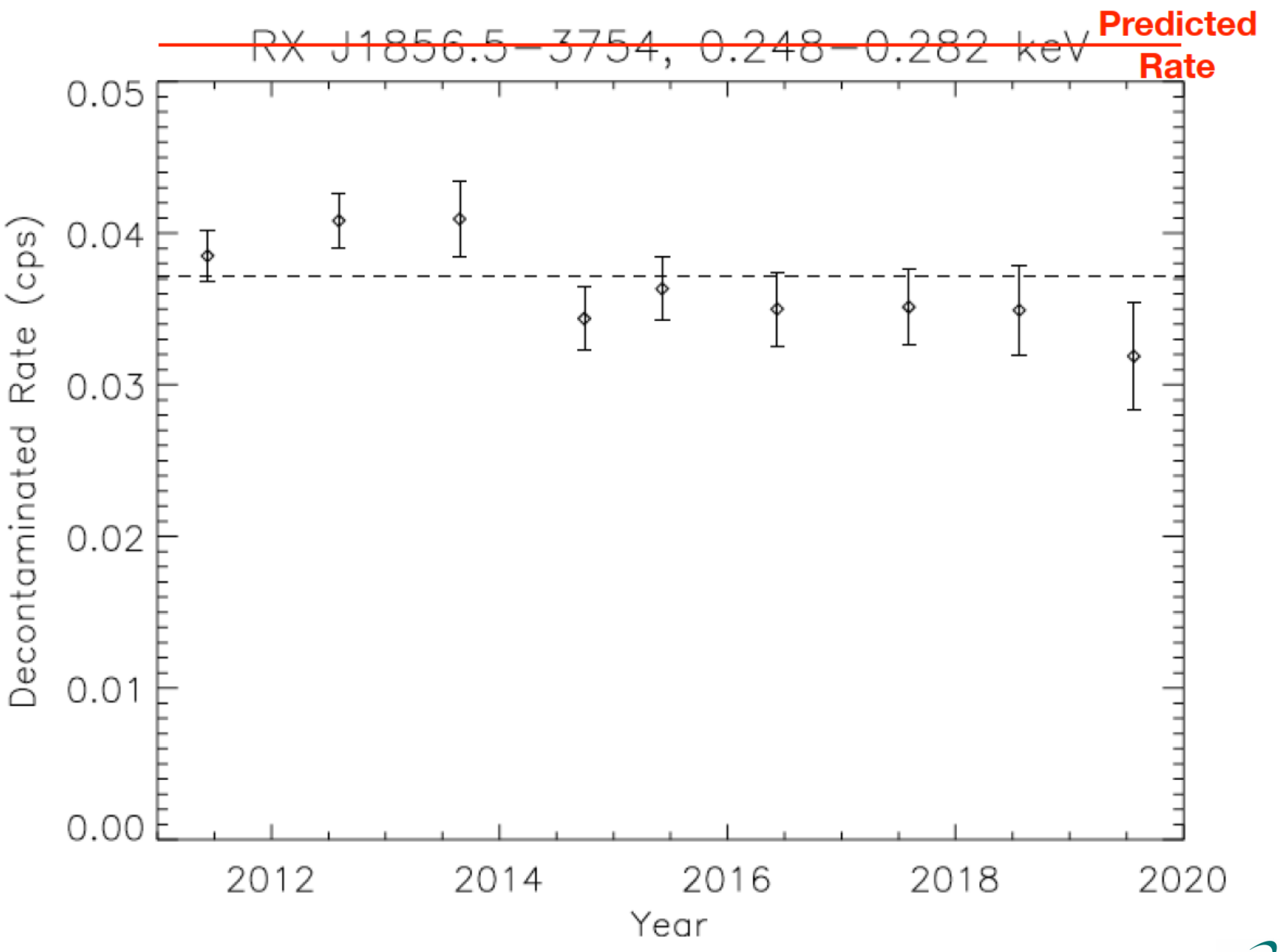
Chandra

RX J1856.5–3754

(= RXJ1856)

ACIS

Contamination Corrected



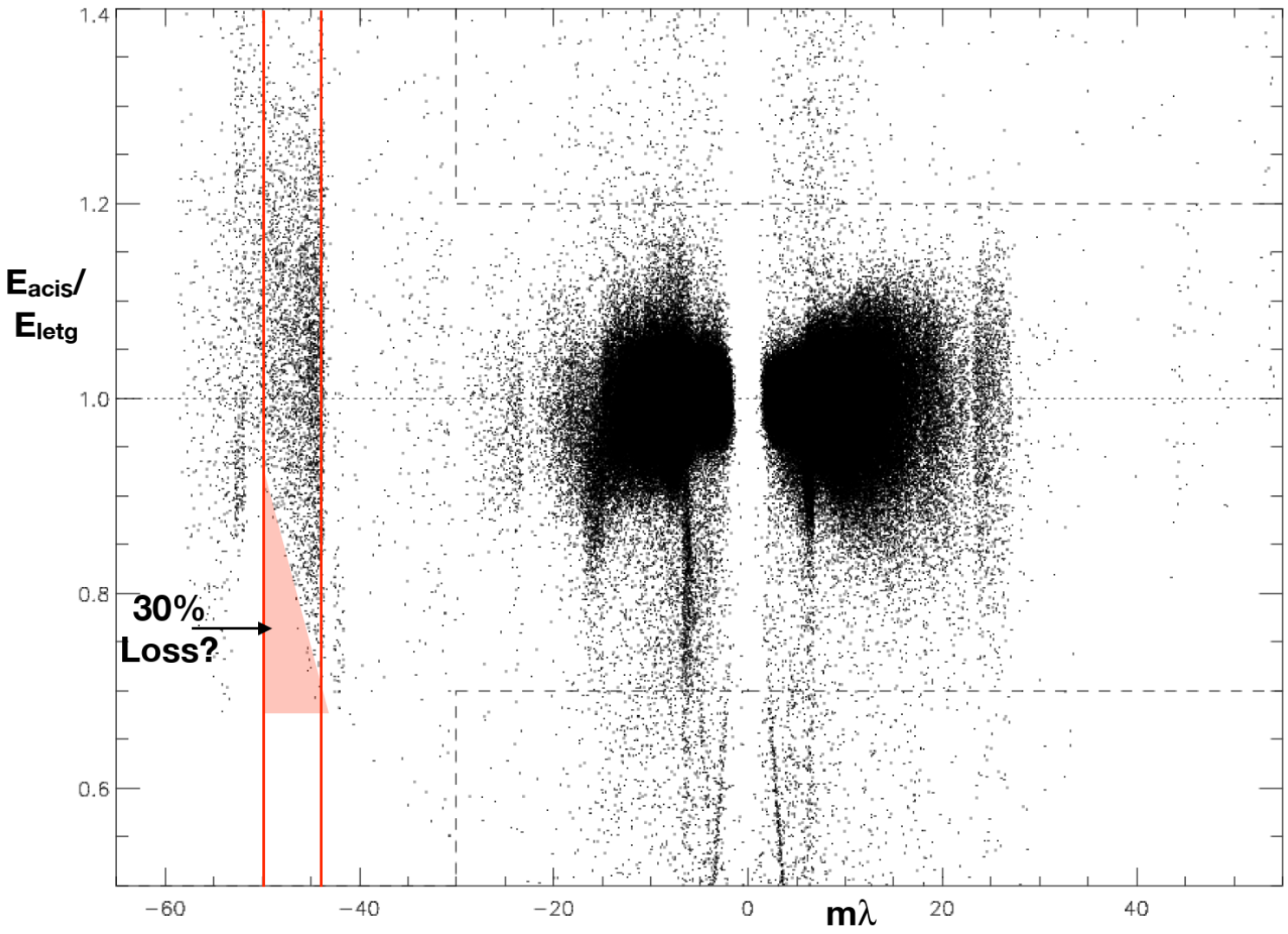
Herman Marshall

Chandra

RX J1856.5–3754

(= RXJ1856)

ACIS / LETG
selection range



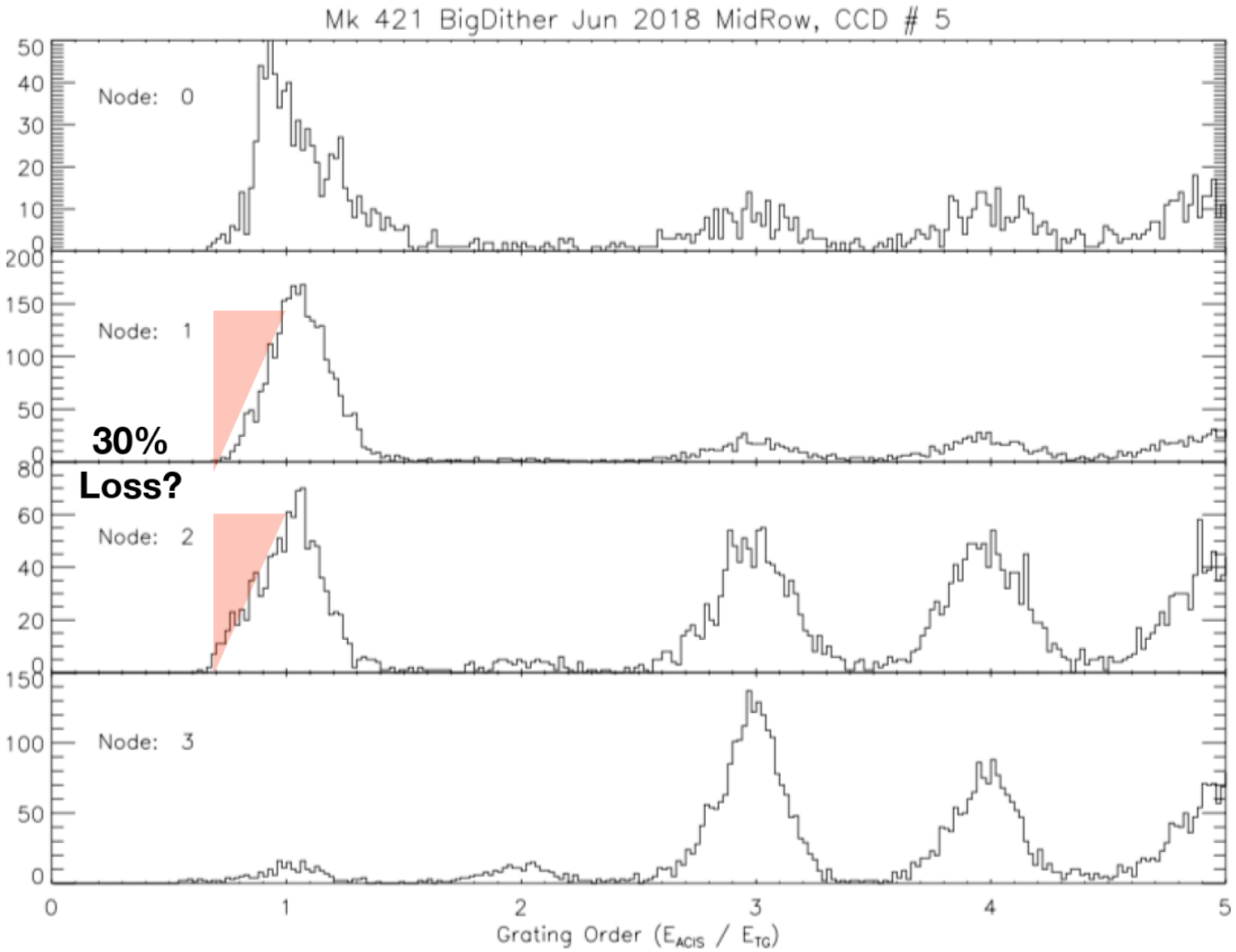
Herman Marshall

Chandra

RX J1856.5–3754

(= RXJ1856)

ACIS energy selection



Herman Marshall

Chandra

RX J1856.5–3754

(= RXJ1856)

ACIS Summary

- Source tracks 44-50 Å (0.248-0.262 keV) throughput
- ACIS contaminant reduces count rate now by x5
- Contaminant model is undercorrecting in 2017-19 by 15% compared to 2012-14
- Absolute count rate is 30% less than expected; due to PHA losses due to event threshold?
- Count rate is low, comparable to background — time to increase exposure?

Chandra

RX J1856.5–3754
(= RXJ1856)

LETGS Data

Epoch [#]	Sequence [#]	Obs ID [#]	Exposure [ksec]	Start Date [YYYY-MM-DD]	Start Time [HH:MM:SS]
1	500000	00113	56,5	2000-03-10	07:55:12
2	500285	03380	168,9	2001-10-10	05:06:28
		03381	172,5	2001-10-12	19:19:26
		03382	103,4	2001-10-08	08:18:49
		03399	10,6	2001-10-15	11:47:06
3	502023	15293	93,4	2013-06-12	14:29:49
	590518	14418	31,5	2013-10-01	05:03:34
4	503147	21693	84,0	2019-06-13	23:56:06
		21896	24,3	2019-07-15	06:15:27
		22282	17,7	2019-07-18	15:23:52
		22283	33,9	2019-07-20	14:36:13
		22284	17,3	2019-07-21	16:24:53

Chandra

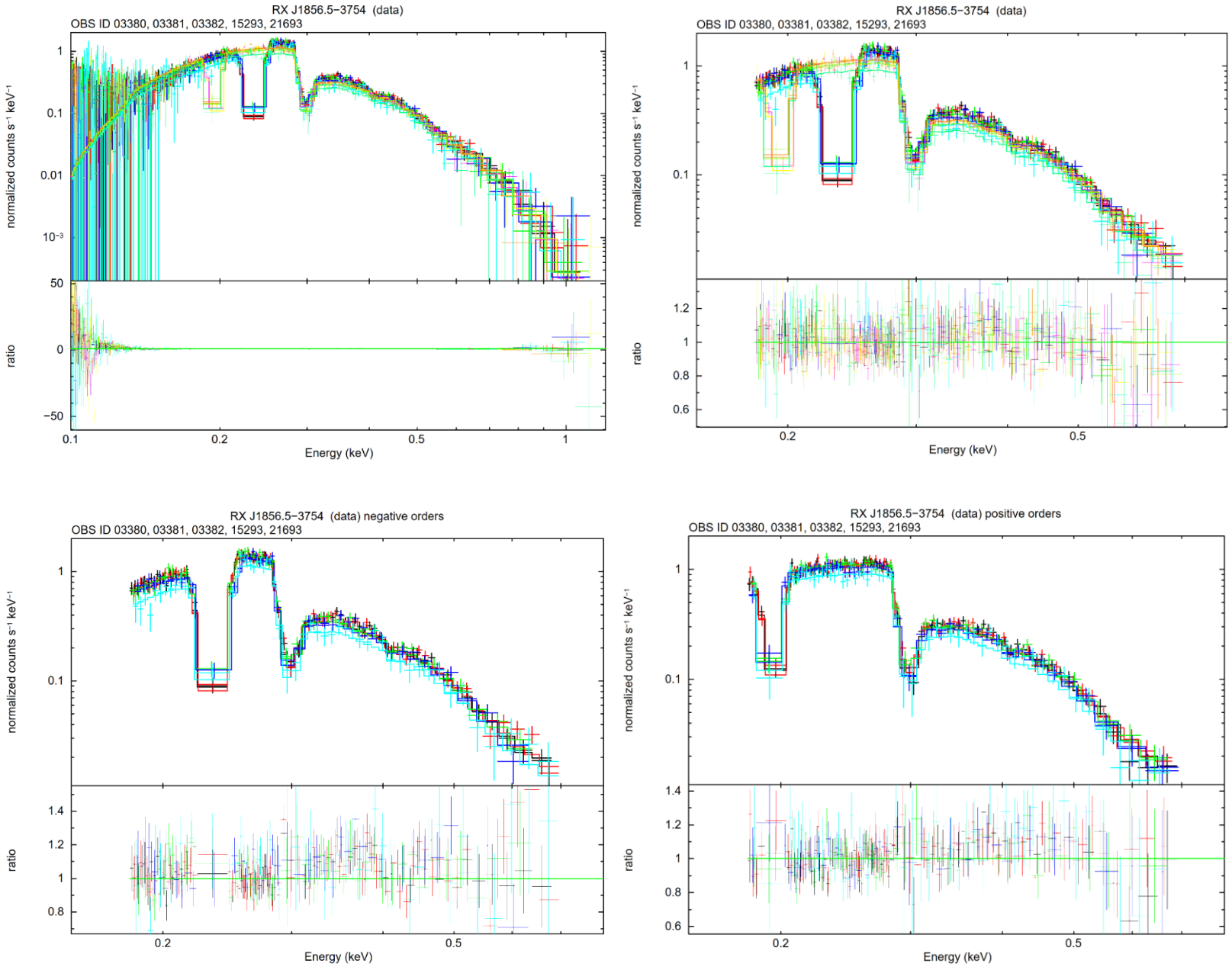
RX J1856.5–3754

(= RXJ1856)

LETGS Data

Top: Spectra showing the data obtained with the LETGS (top panels) and ratio of data to model (bottom panels). (left) shows the data selected for the spectral fit, free of higher orders and (right) a wider region that shows the higher order contribution (< 0.18keV) and low flux region (> 0.7 keV)

Bottom: Same spectra as above but separated in negative (left) and positive (right) orders for clarity with the same model parameters as in Figure 3



Vadim Burwitz

Chandra

RX J1856.5–3754
(= RXJ1856)

LETGS Data

Fit #1 corresponds to the Fit on the wiki page.

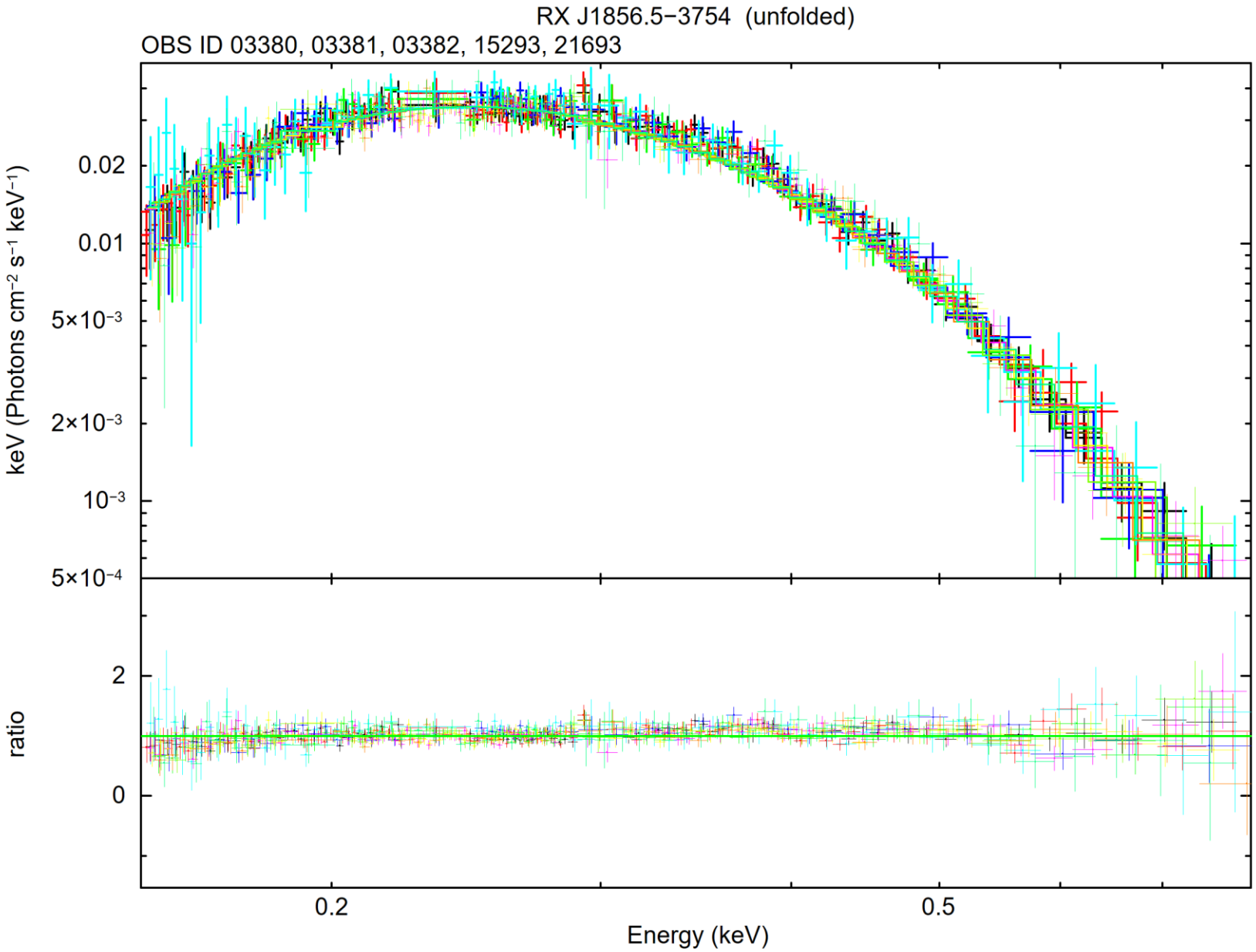
Fit [#]	NH [10^{-19} cm^{-2}]	kT_{bb} [eV]	Normx [$\times 10^5$]	d.o.f.	χ^2	Exp. [ksec]	Obs IDs
1	7.24±0.34	62.38±0.38	1.580±0.064	1251	0.556	538	03382, 03381, 03381, 15933
2	7.35±0.29	62.42±0.37	1.493±0.056	2550	0.540	622	03382, 03381, 03381, 15933, 21693
3	7.20±1.12	64.53±1.39	1.348±0.187	211	0.494	56	Epoch 1
4	7.18±0.41	63.56±0.41	1.456±0.061	1771	0.554	455	Epoch 2
5	8.01±0.70	62.27±0.88	1.490±0.052	491	0.414	125	Epoch 3
6	8.52±0.94	62.31±1.13	1.786±0.210	895	0.363	177	Epoch 4
7	7.38±0.28	62.35±0.34	1.490±0.052	3382	0.487	814	All

Chandra

RX J1856.5–3754
(= RXJ1856)

LETGS

Unfolded Spectra with best blackbody fit to the LETGS spectra using the same parameters fit #2



Vadim Burwitz

eROSITA Calibration observations of the INSs RX J1856.5–3754 and 1RXS J214303.7+065419

Frank Haberl

eROSITA

RX J1856.5–3754
(= RXJ1856)

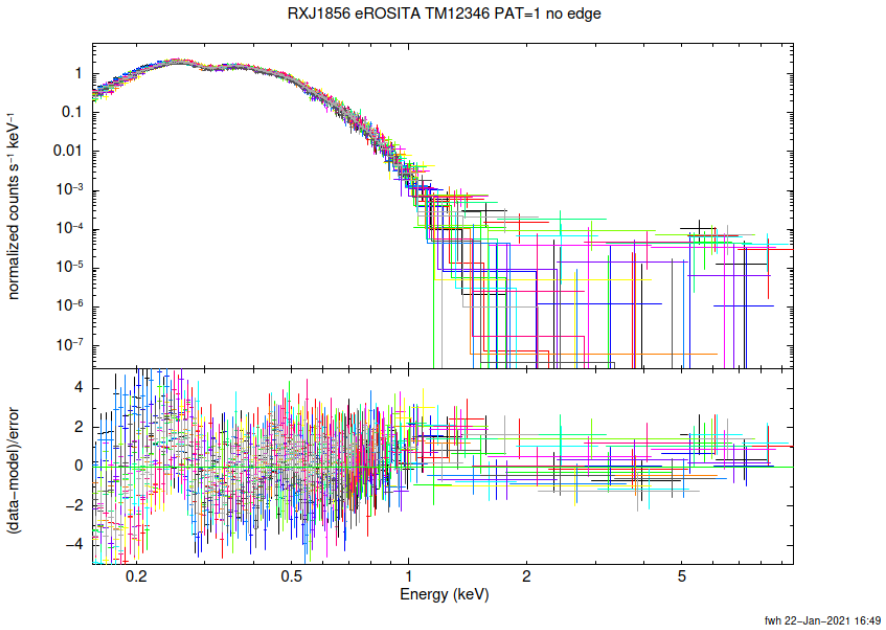
Standard blackbody model
No edge

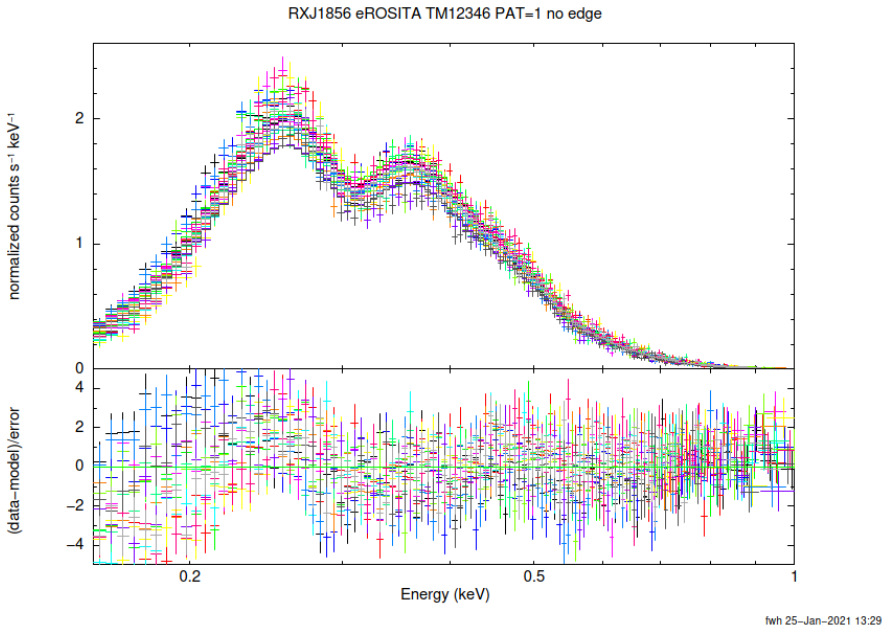
eROSITA spectra of RXJ1856 (from TM1, 2, 3, 4, 6 and observations 700008, 710001 and 720002), binned to a minimum of 20 cts/bin.

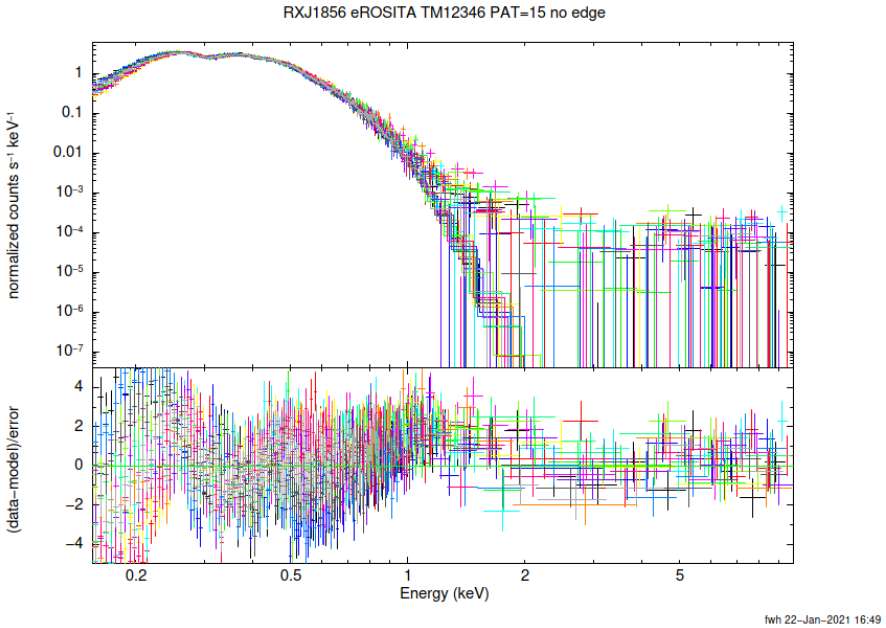
Top: using single-pixel events

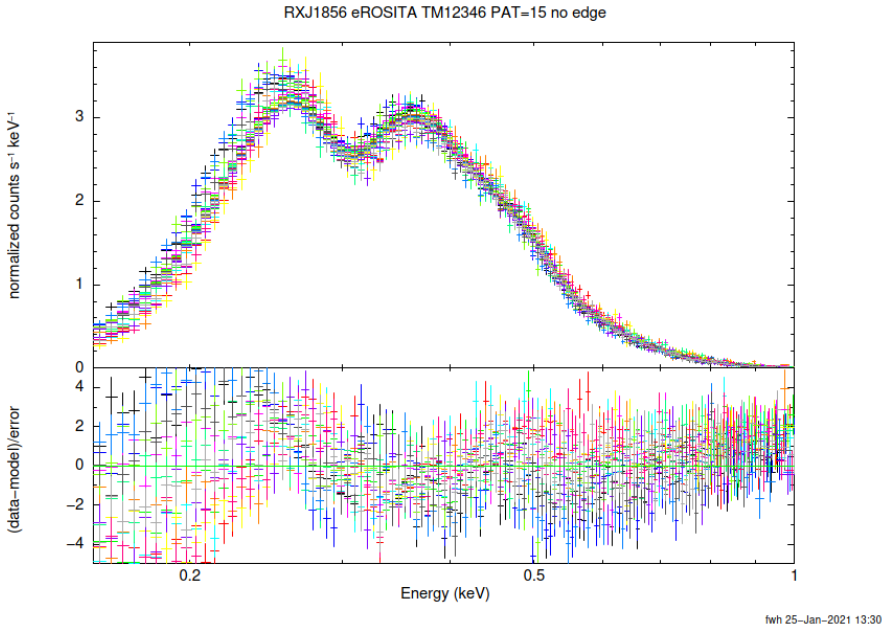
Bottom: using events from all valid patterns.

The panels on the left show the spectra over the whole covered energy band, on the right up to 1 keV in linear scale. The histograms indicate the best-fit model composed of an absorbed black-body model.









Frank Haberl

eROSITA

RX J1856.5–3754
(= RXJ1856)

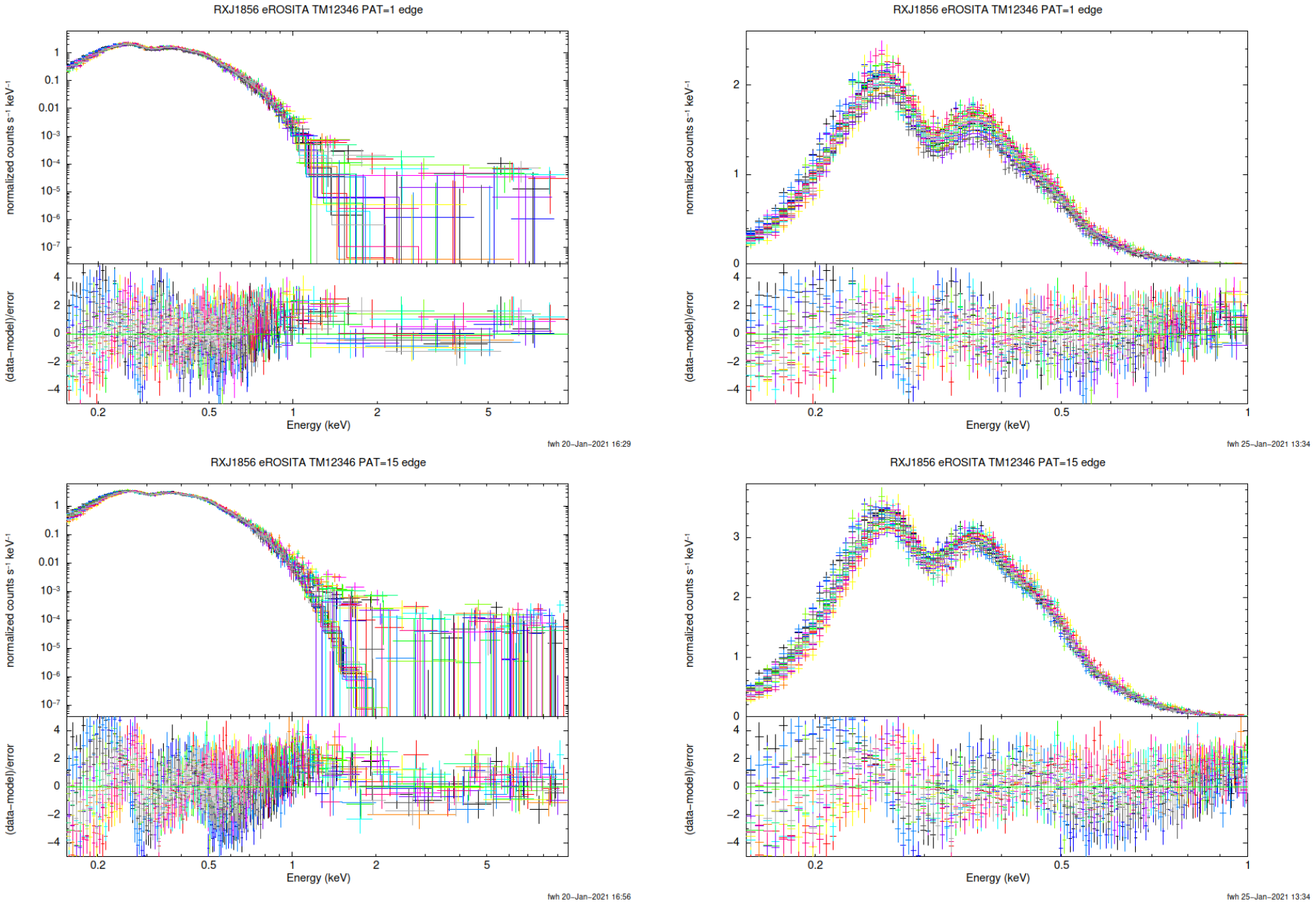
Standard blackbody model
Additional carbon edge

eROSITA spectra of RXJ1856 (from TM1, 2, 3, 4, 6 and observations 700008, 710001 and 720002), binned to a minimum of 20 cts/bin.

Top: using single-pixel events

Bottom: using events from all valid patterns.

The panels on the left show the spectra over the whole covered energy band, on the right up to 1 keV in linear scale. The histograms indicate the best-fit model composed of an absorbed black-body model with additional absorption edge (edge energy consistent with that of Carbon).



Frank Haberl

eROSITA

1RXS J214303.7+065419
(=RXJ2143)

Different Models

eROSITA single-pixel event spectra of RXJ2143 from observation 700198 (TM1, 2, 3, 4, 6), binned to a minimum of 20 cts/bin, fitted with different models.

From top left to bottom right:

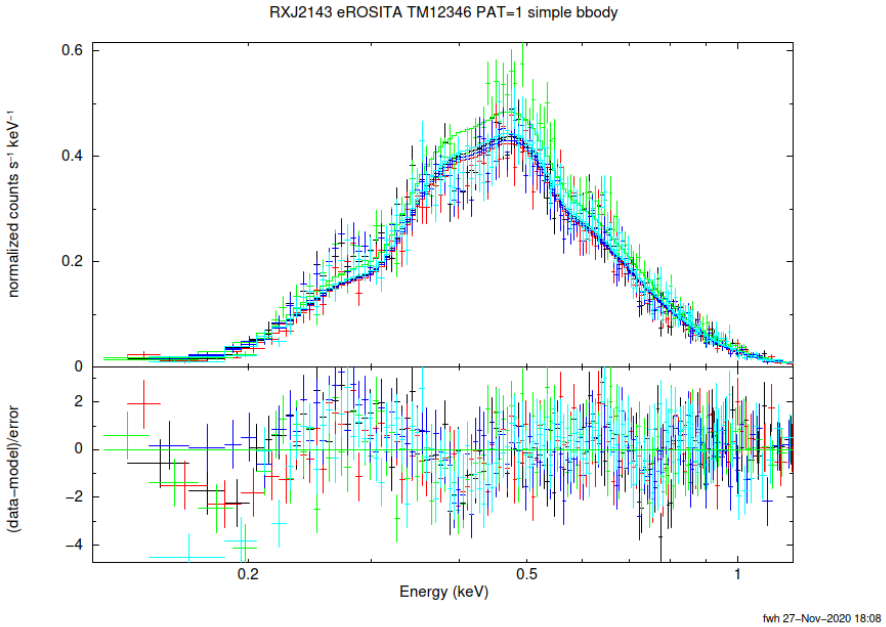
1) Simple absorbed black-body
TBabs*bbodyrad

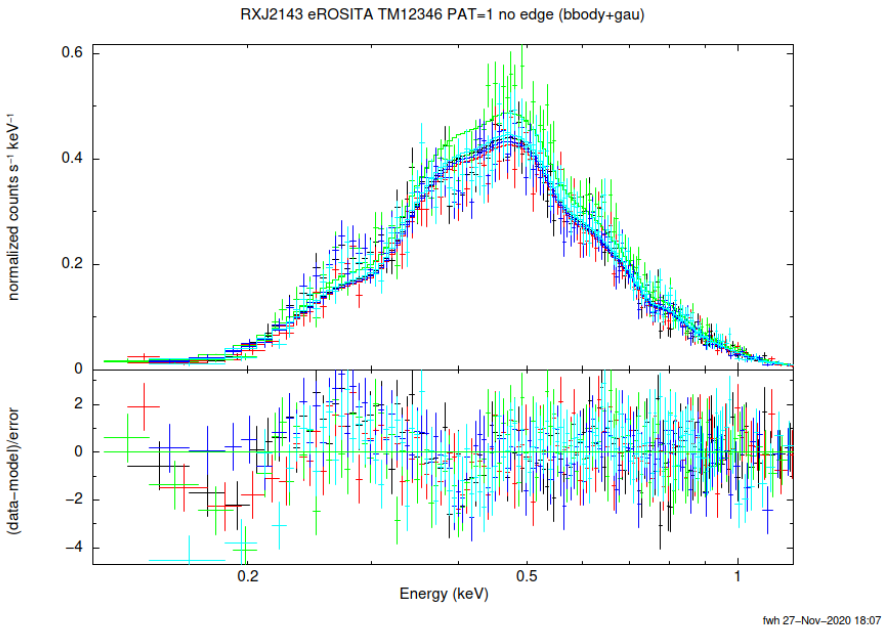
2) including a narrow absorption line (as known from XMM observations)
TBabs(gaussian + bbodyrad)

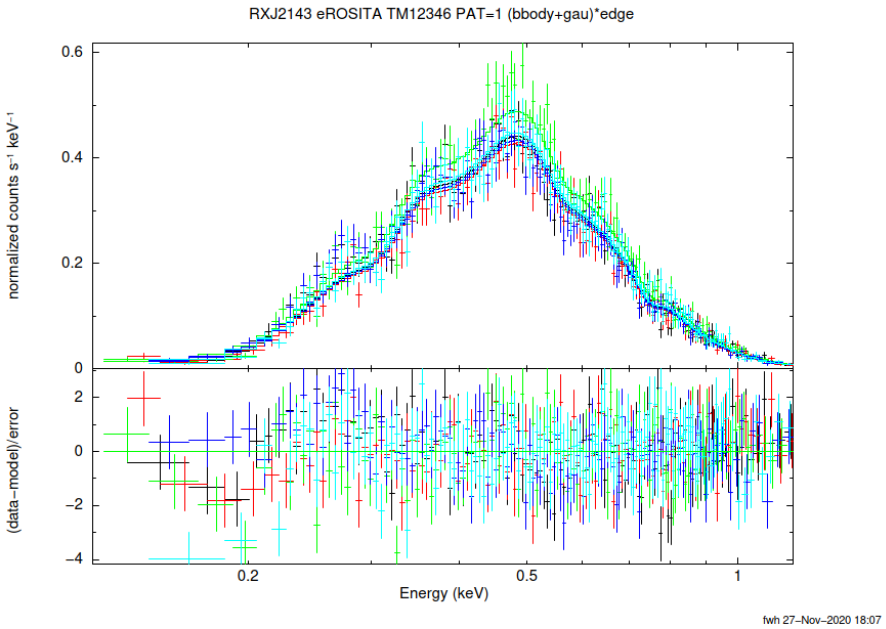
3) including a narrow absorption line and an absorption edge
TBabs*edge(gaussian + bbodyrad)

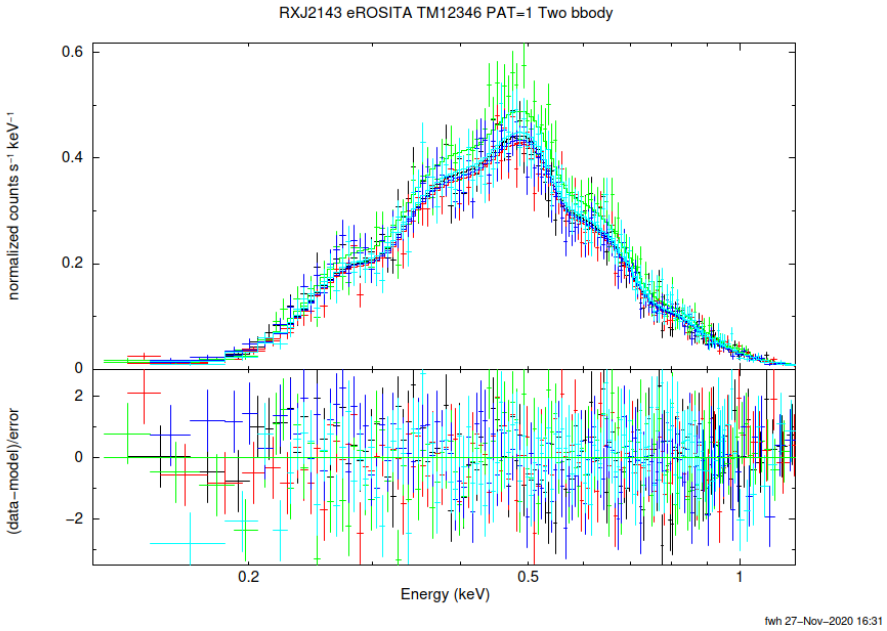
4) a two-temperature black body model (TBabs*gabs(bbodyrad + bbodyrad)).

In each case a constant factor was plied as free parameter to each spectrum.









Frank Haberl

eROSITA

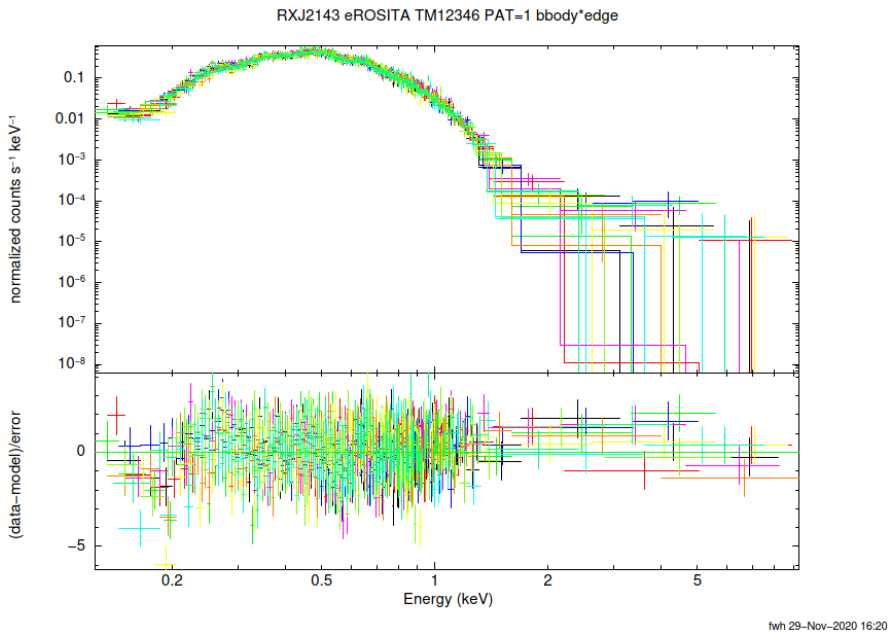
1RXS J214303.7+065419 (=RXJ2143)

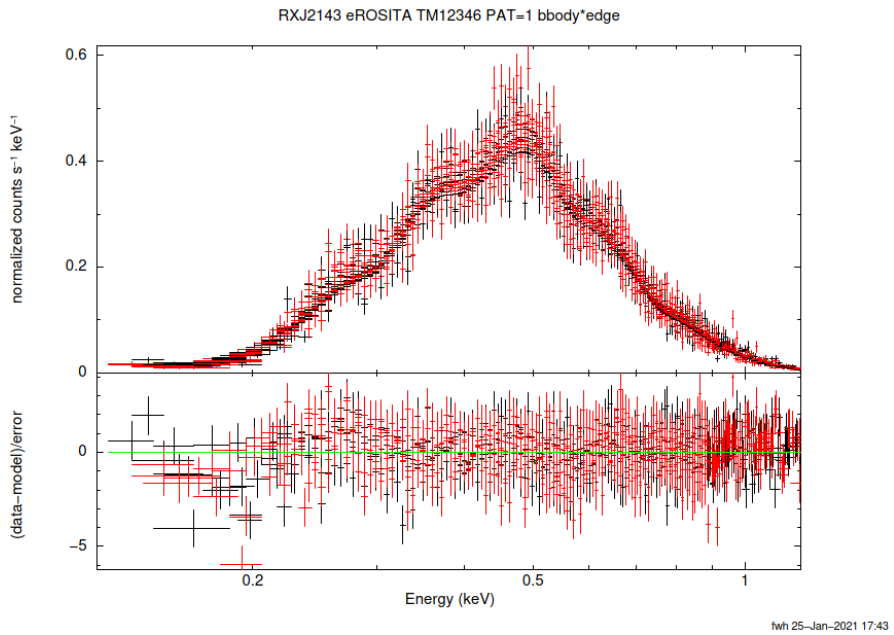
eROSITA single-pixel event spectra of RXJ2143 from observations 700198 and 720005 (TM1, 2, 3, 4, 6).

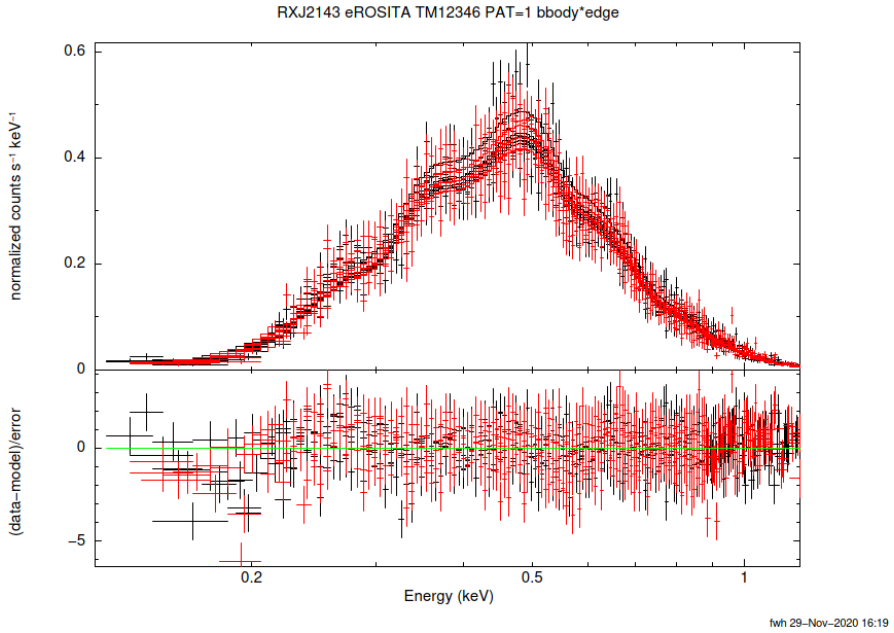
Top: Simultaneous fit to the 10 spectra with common NH and edge depth (logarithmic and linear scales).

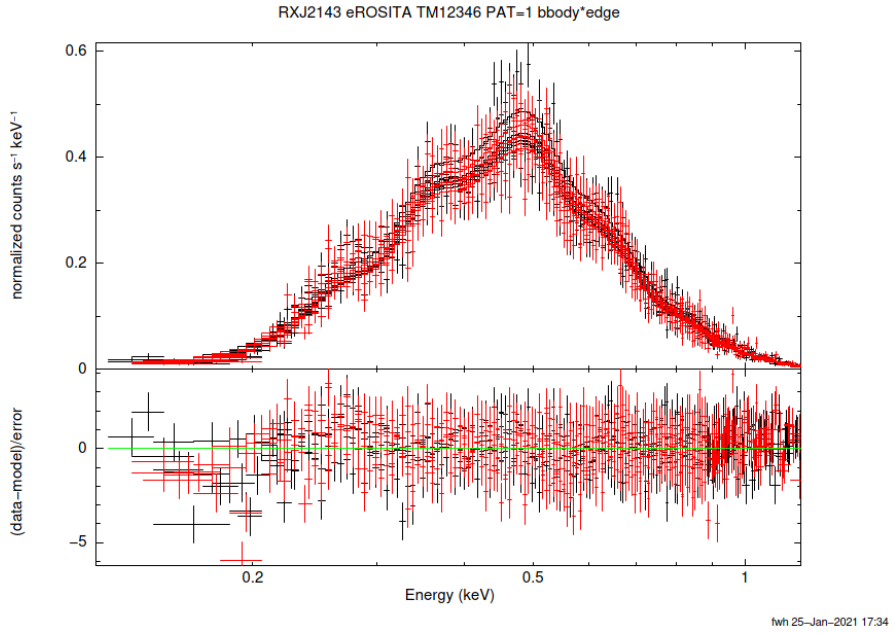
Bottom left: Same model fit, but with two NH values free in the fit, one for the spectra of the first and one for the spectra of the second observation.

Bottom right: Similarly, two values for the edge depth. For the spectra plotted in linear scale, black indicates spectra from observation 700198 and red those from observation 720005.









eROSITA

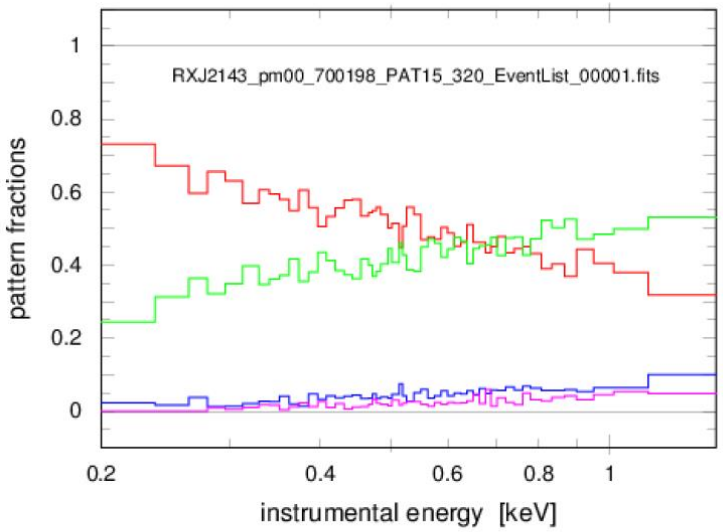
1RXS J214303.7+065419
(=RXJ2143)

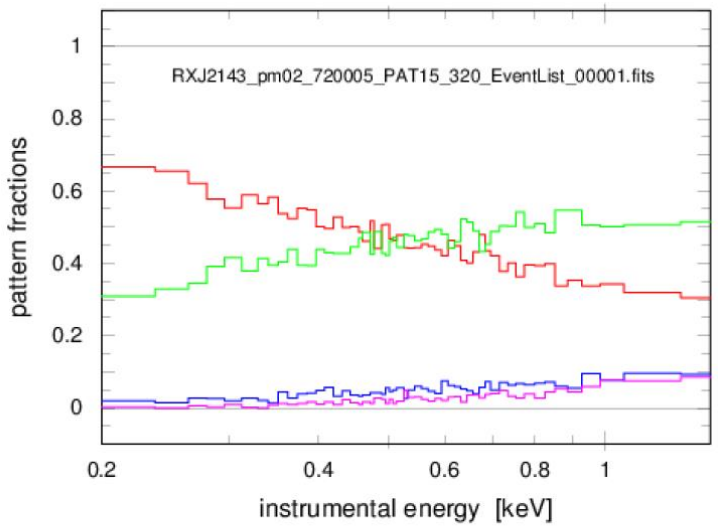
Pattern Fractions

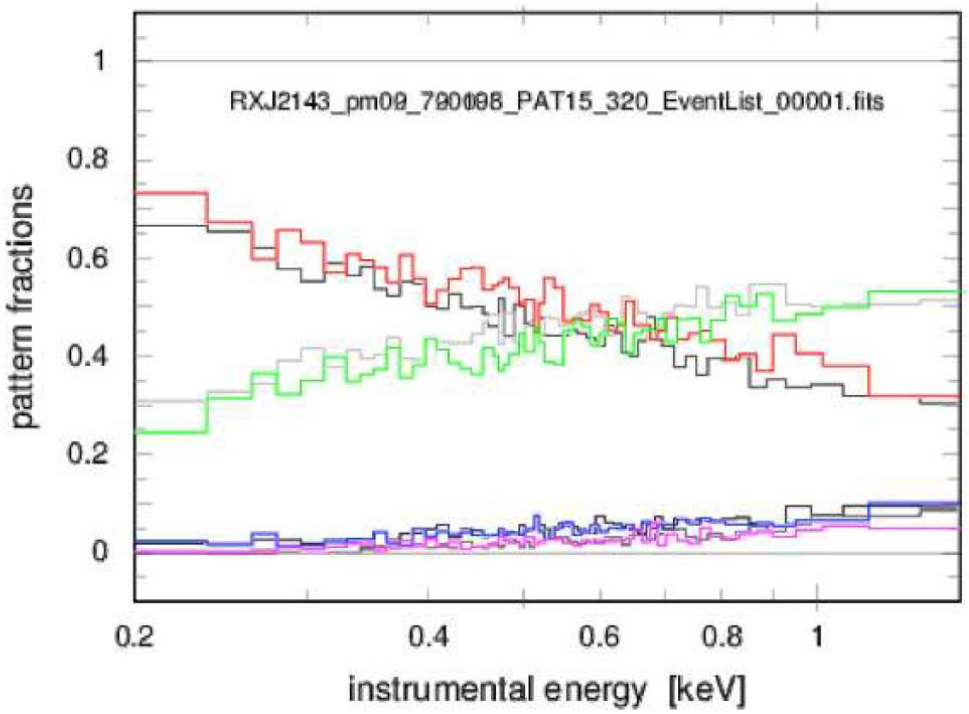
Comparison of pattern fractions for the observations of RXJ2143 with TM3.

The top panels show the pattern fractions for the two observations separately.

The bottom panel is a superposition of the two.







Frank Haberl

eROSITA

Summary

- Track contamination after larger orbital manuevres
  → no cumulative effect detectable

- RXJ1856 requires an additional absorption edge
  → feature in all spectra
  energy consistent with C-edge
  calibration?

- Single events → good spectra
  flux varies between TMs and observations
  (sub-pixel position of source)
  → work ongoing

- All valid events → More consistent fluxes

Frank Haberl

Status of INS and WD Working Group

- Isolated Neutron Stars
  - ACIS – update using RXJ1856 presented by Herman
  - Summary of 20 years of LETGS observations of RXJ1856
  - Status of eROSITA RXJ1856 and RXJ2143 calibration shown
- Work to do!!
  - Follow the new calibration measurements as the come in
  - Further investigate the hard X-ray tail seen in XMM and Chandra?
  - Check for a high energy tail in eROSITA
- WDs
  - No updates this time round