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

Vadim Burwitz (MPE) on behalf of the working group

15th IACHEC Meeting, Pelham, Bavaria,

April 27, 2023

Working Group members

- Vadim Burwitz (chair, ROSAT, Chandra, XMM, eROSITA)
- Jelle Kaastra (Chandra, Modeling)
- Herman Marshall (Chandra)
- Norbert Schulz (Chandra)
- Jeremy Drake (Chandra)
- Steve Sembay (XMM EPIC-MOS)
- Jelle de Plaa (XMM RGS)
- Craig Markwardt (NICER)
- Vadim Burwitz (Chandra)
- Tadayasu Dotani (Suzaku)
- Eric Miller (Suzaku)
- Frank Haberl (eROSITA)
- Konrad Dennerl (XMM pnCCD, eROSITA)
- Michael Freyberg (XMM pnCCD, eROSITA)

Goals of the Working Group

- Identify and characterise WD and INs standard candle objects
  - **WDs:**
    - HZ43
    - Sirius B
    - GD153
  - **Objects**
    - RX J1856.5-3754 (Work horse Spectrum)
    - PSR B0656+14
    - 1RXS J214303.7+065419 (=RXJ2143) eROSITA

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

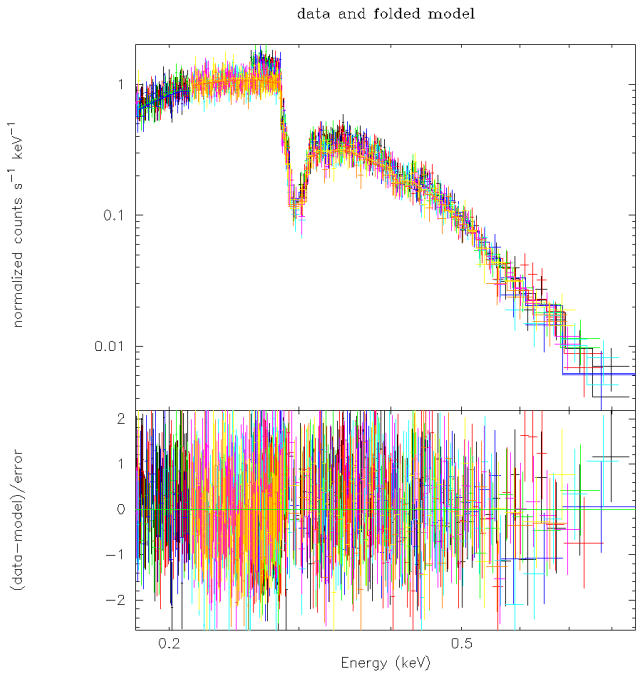
- ***Models***

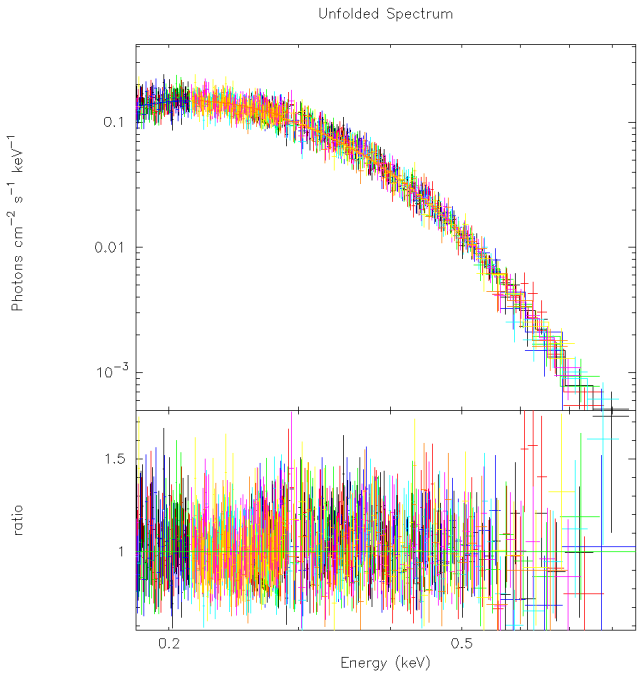
RX J1856.5-3754 based on the CHANDRA LETGS + HRCS Data

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



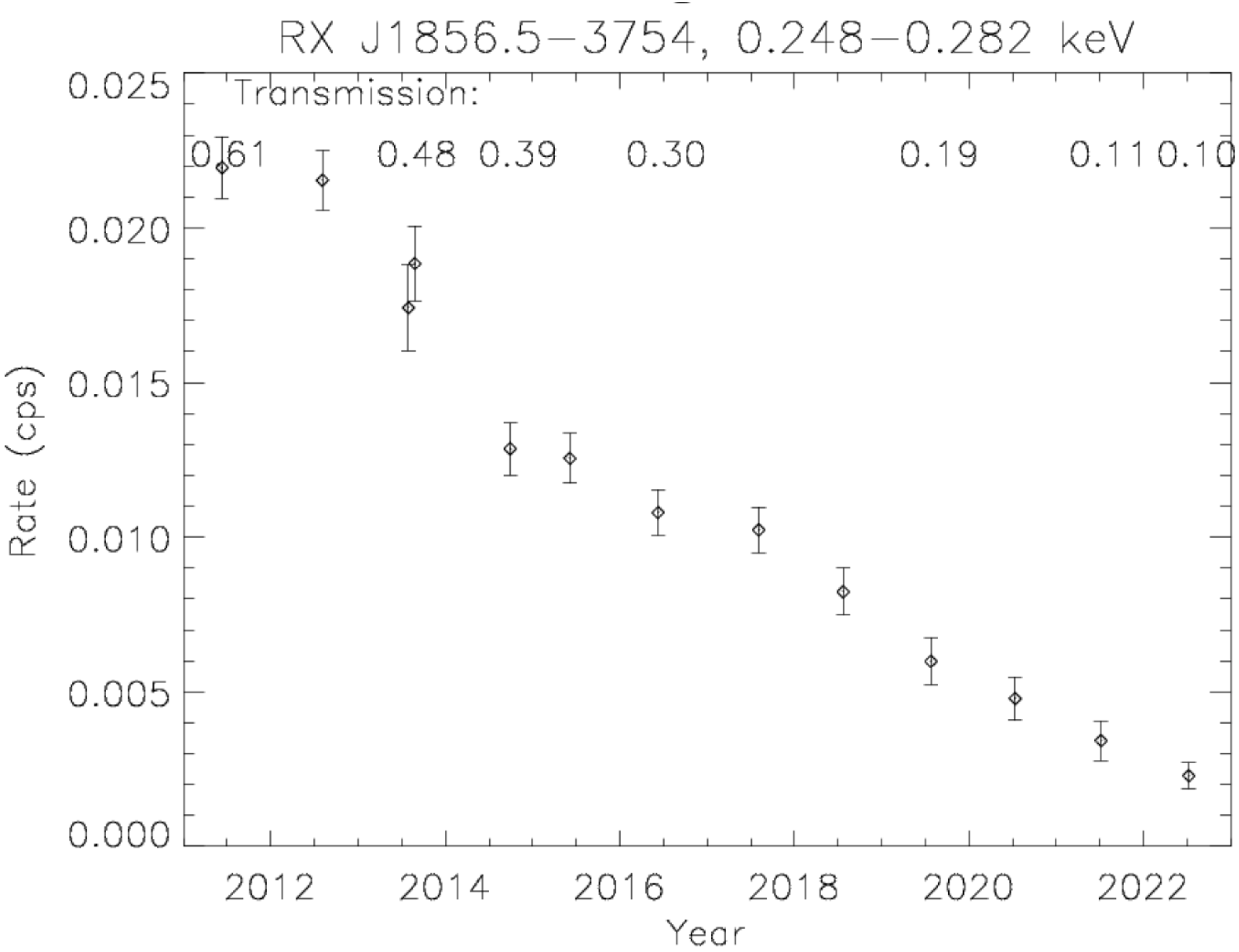


Chandra

RX J1856.5–3754

(= RXJ1856)

Monitoring ACIS



Chandra

RX J1856.5–3754
(= RXJ1856)

LETGS Data

DATA
taken over 20 years

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

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

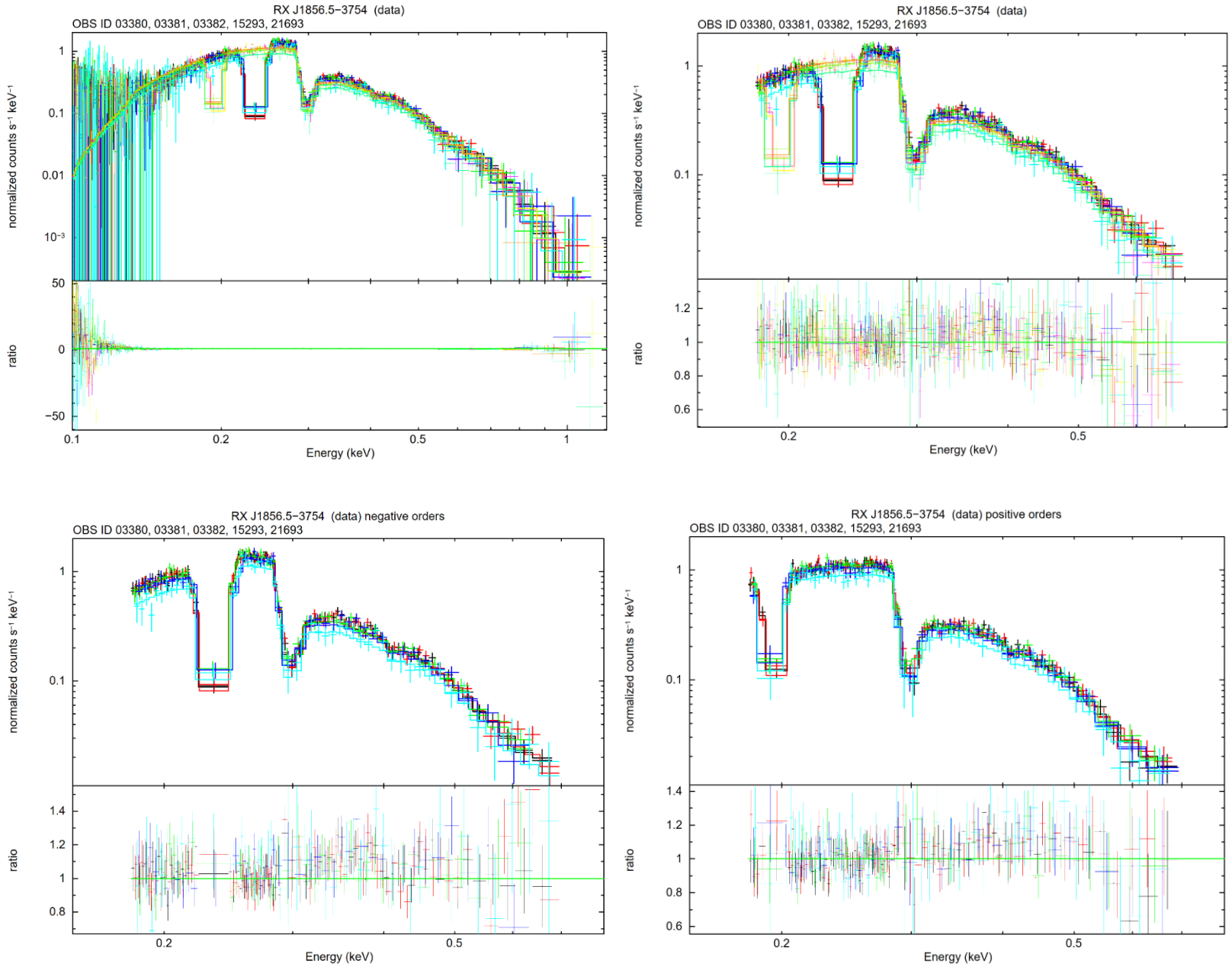
RX J1856.5–3754

(= RXJ1856)

LETGS 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



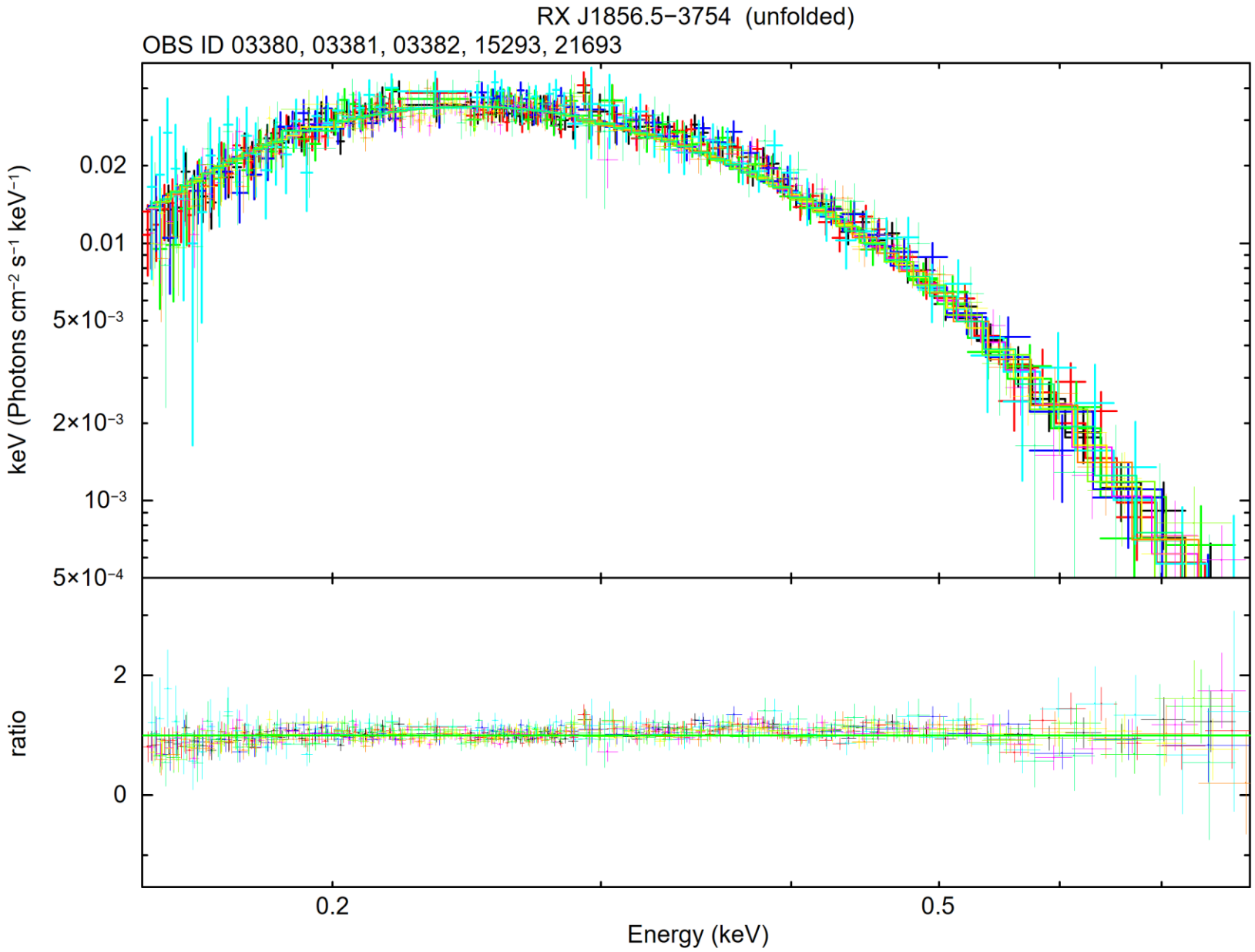
Vadim Burwitz

Chandra

RX J1856.5–3754
(= RXJ1856)

LETGS

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



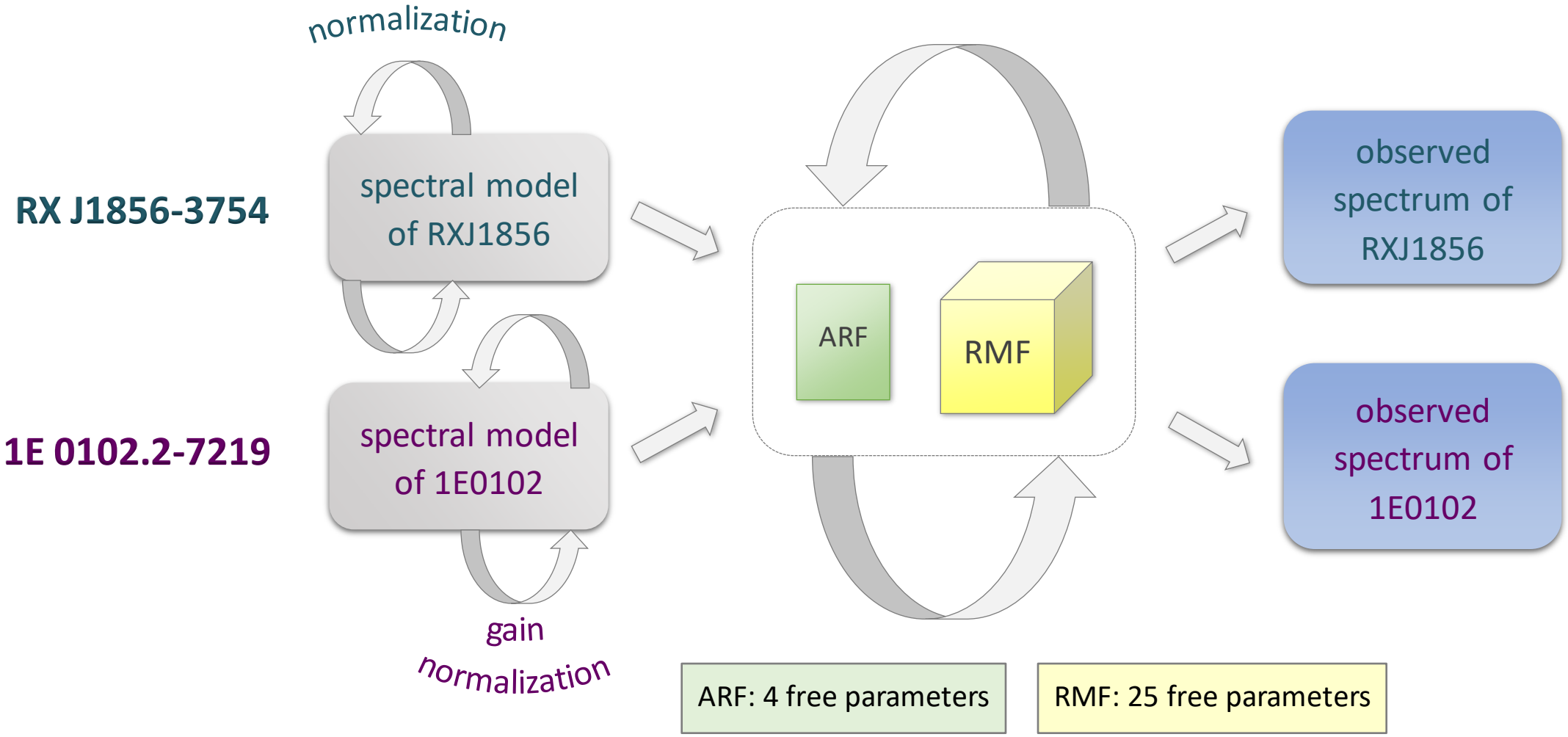
Vadim Burwitz

eROSITA Calibration observations of the INSs RX J1856.5–3754

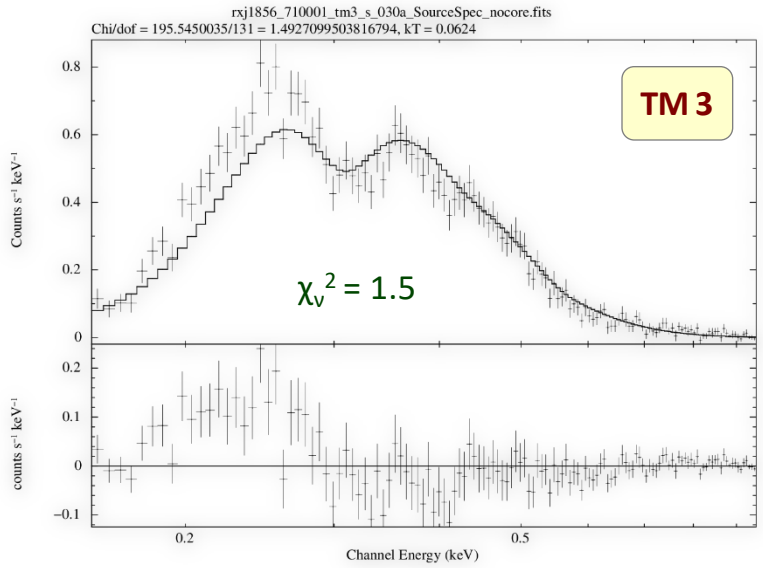
Konrad Dennerl

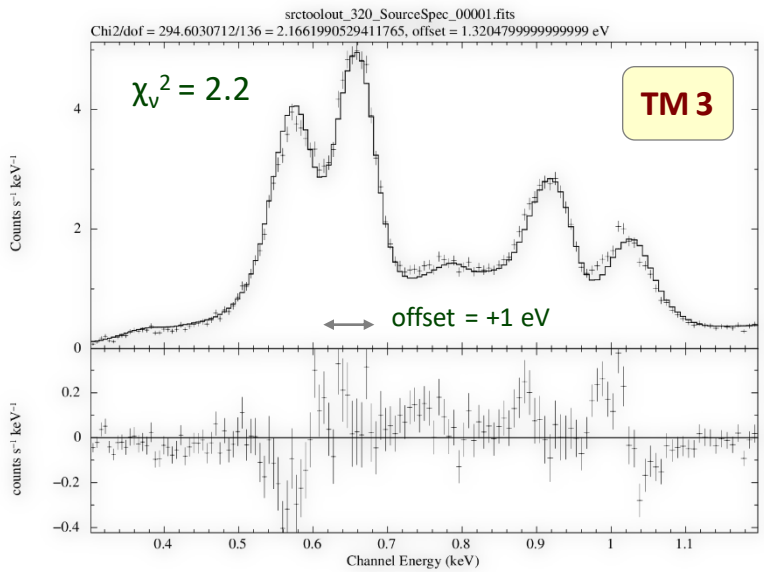
General properties of the ARF and RMF

ARF: „Ancillary Response File“, RMF: „Redistribution Matrix File“



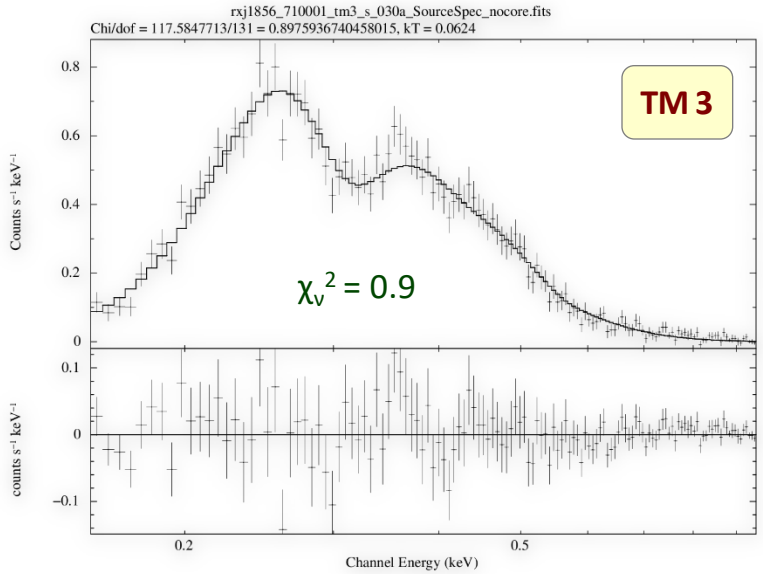
„Fitting“ the RMF and ARF

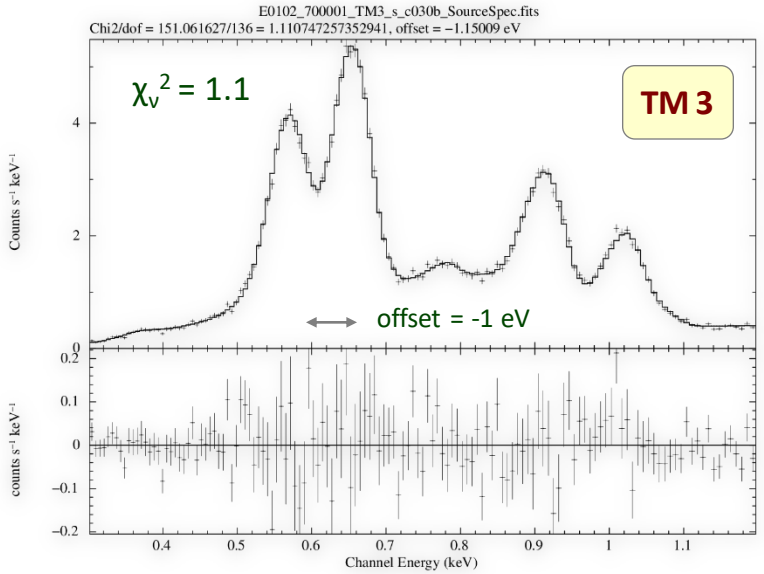




RX J1856-3754

1E 0102.2-7219



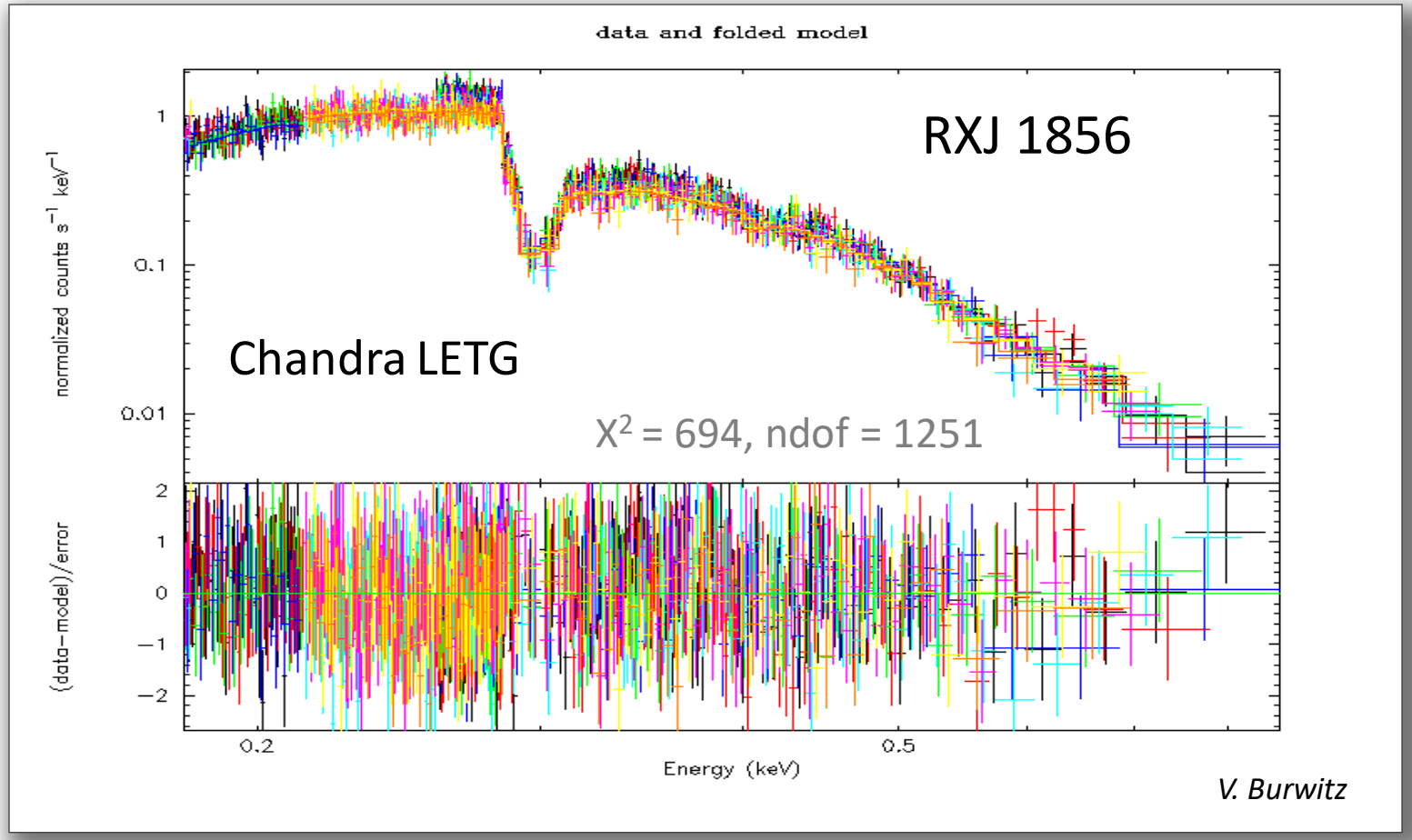


Method:

consider two sources with „reliable“ spectral models simultaneously:

RX J1856-3754
&
1E 0102.2-7219

RX J1856-3754: Chandra LETG



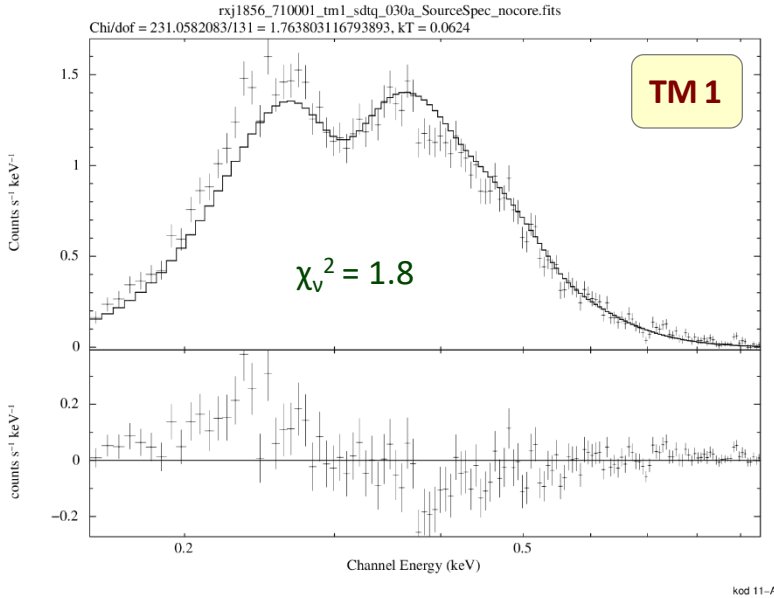
→ nH = (7.2 +/- 0.3) × 10^{19} cm^{-2}, kT = 62.4 +/- 0.4 eV, norm = (1.58 +/- 0.06) x 10^5 [tbabs * bbodyrad]

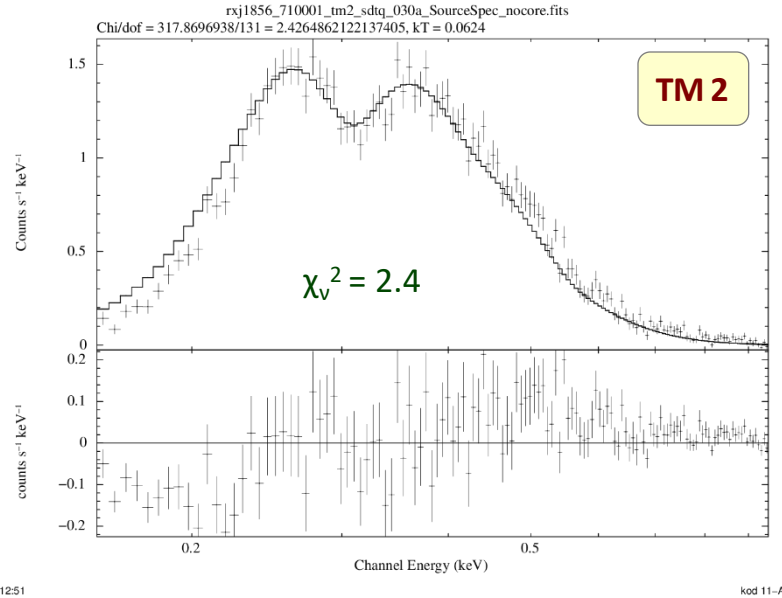
„before“

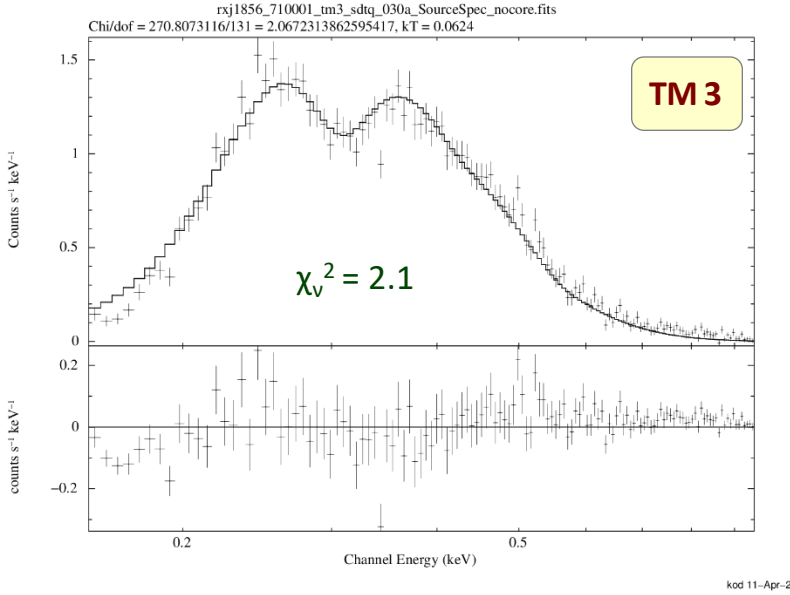
RX J1856-3754
2020 Apr 01-02
all valid patterns

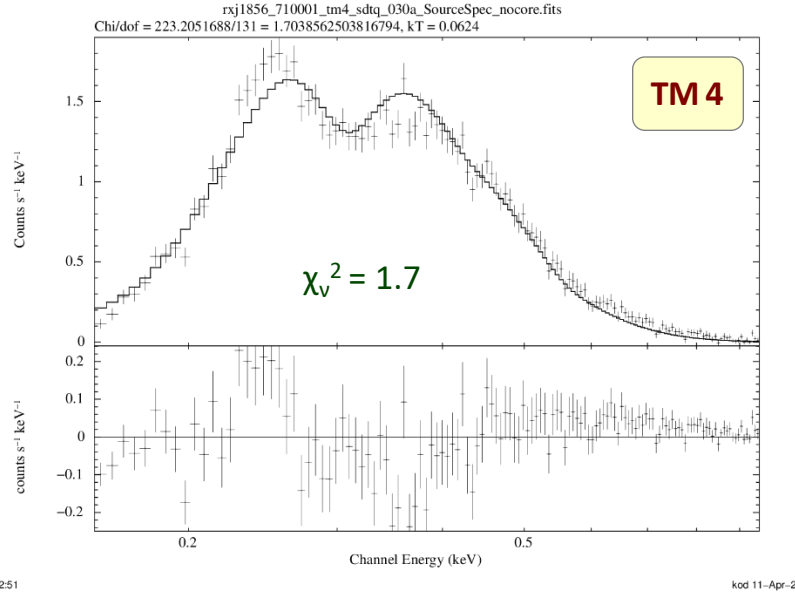
only 1 free parameter:
normalization
(4 central pixels ignored)

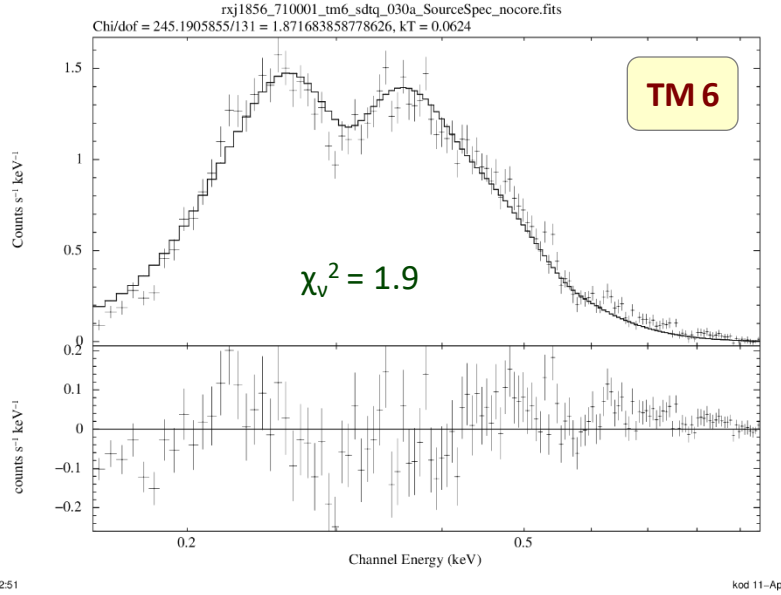
$nH = 7.25 \times 10^{19}$ cm^{-2}
kT = 62.4 eV
(Chandra LETG)





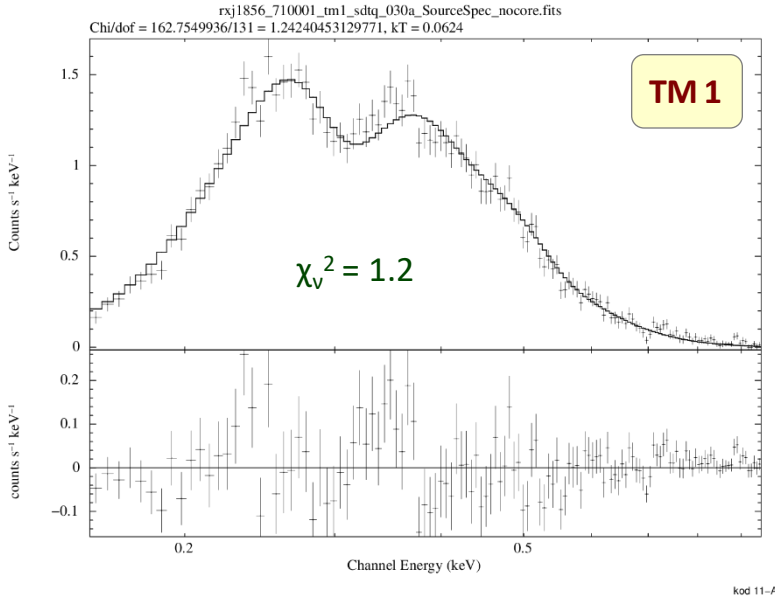


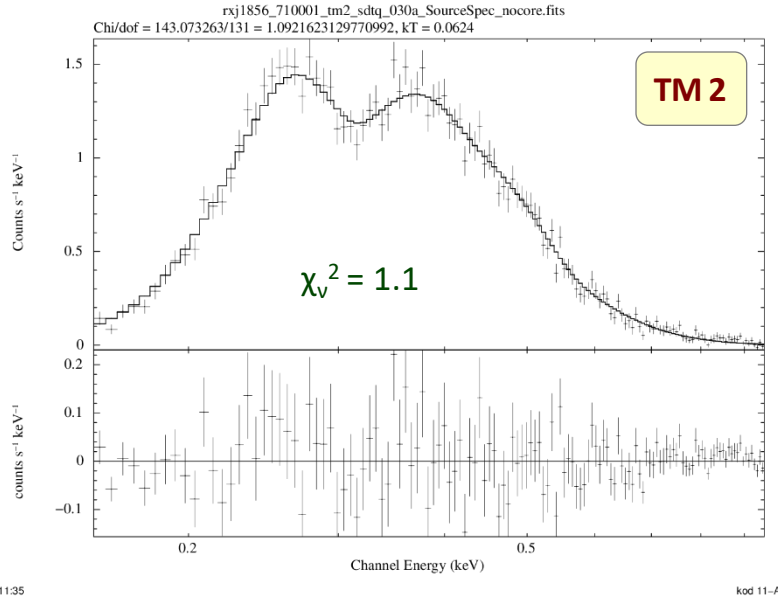




„after“

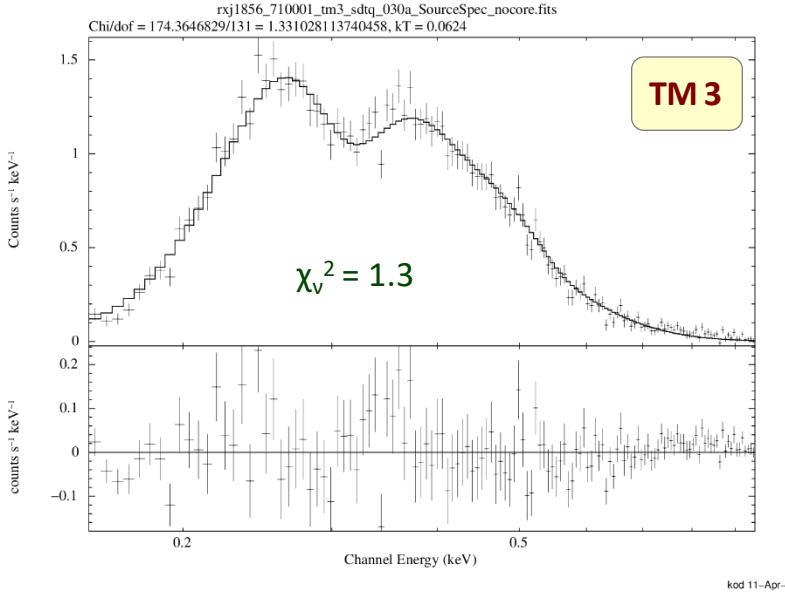
RX J1856-3754
2020 Apr 01-02
all valid patterns

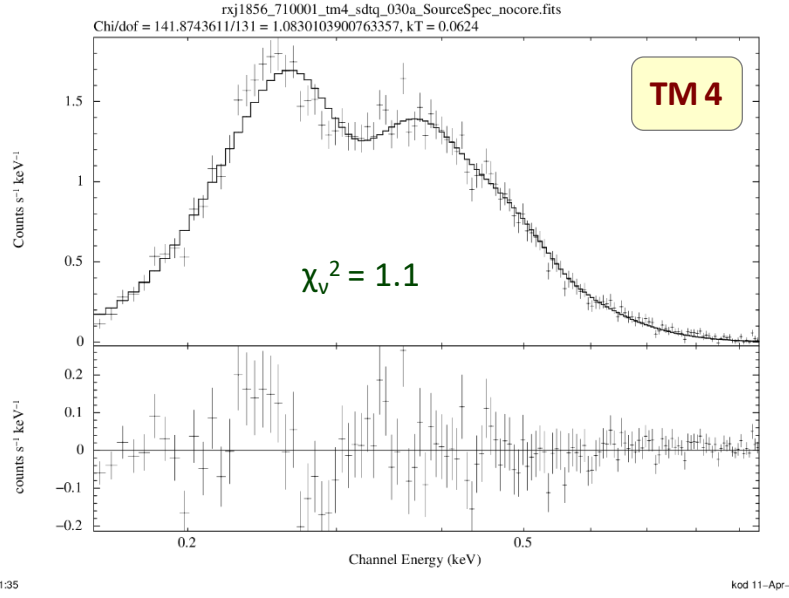


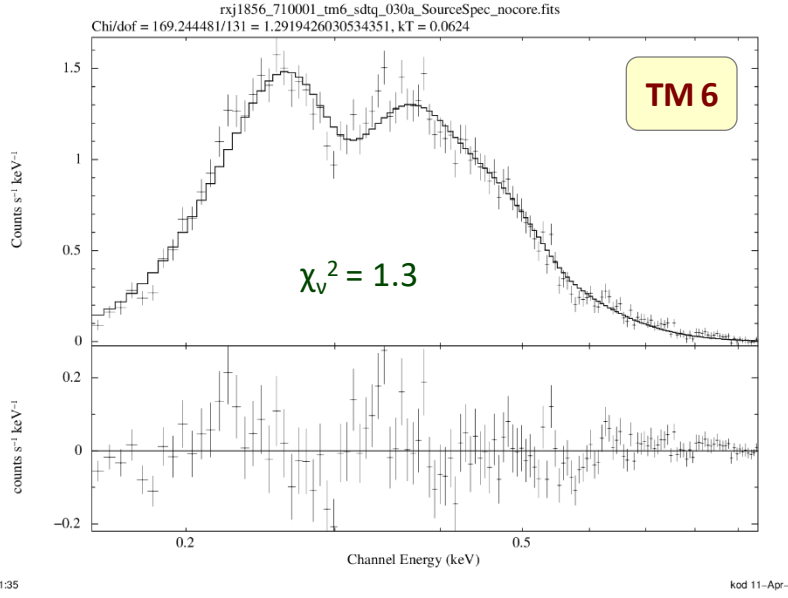


only 1 free parameter:
normalization
(4 central pixels ignored)

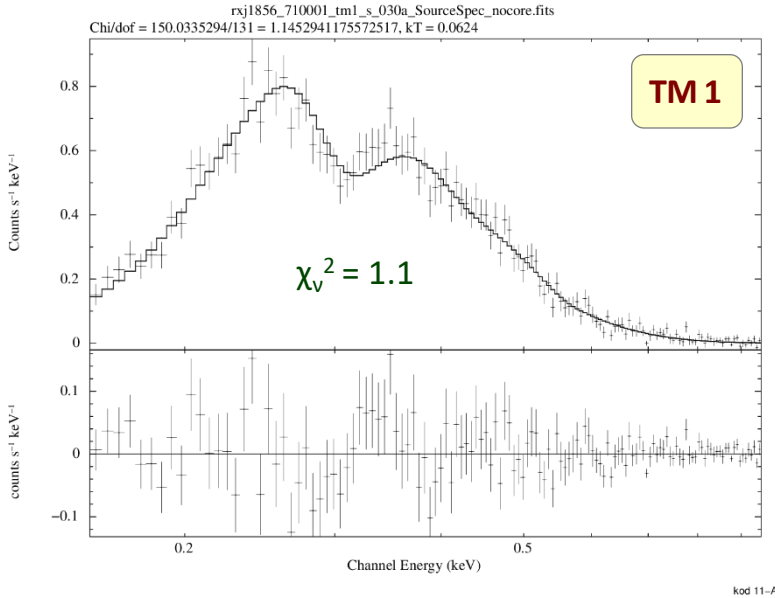
$nH = 7.25 \times 10^{19}$ cm^{-2}
kT = 62.4 eV
(Chandra LETG)

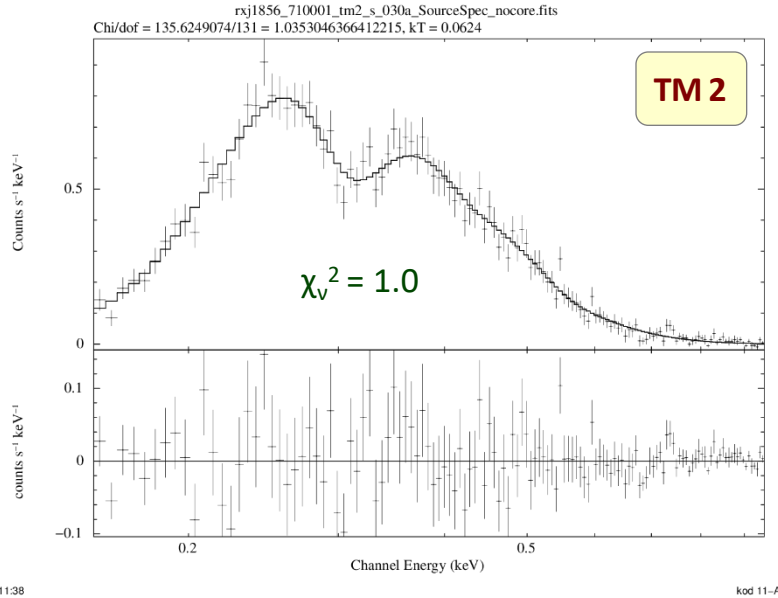






„after“

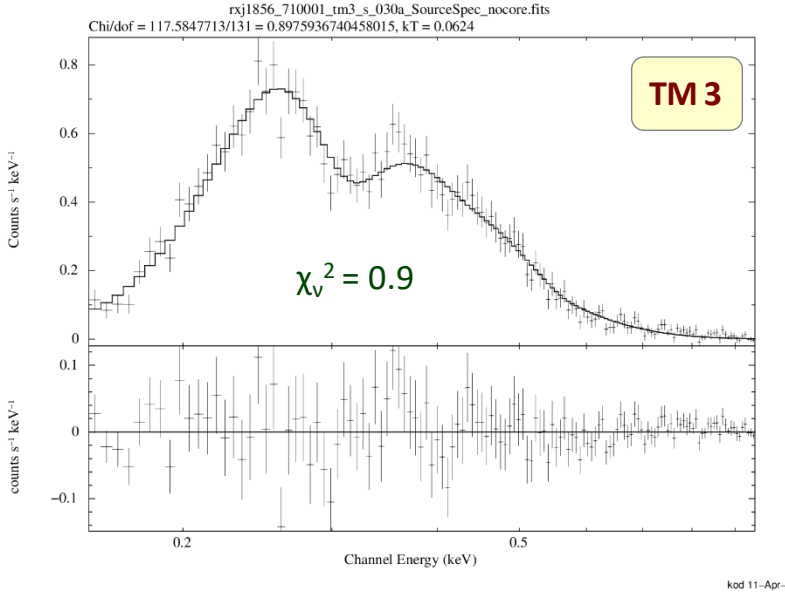


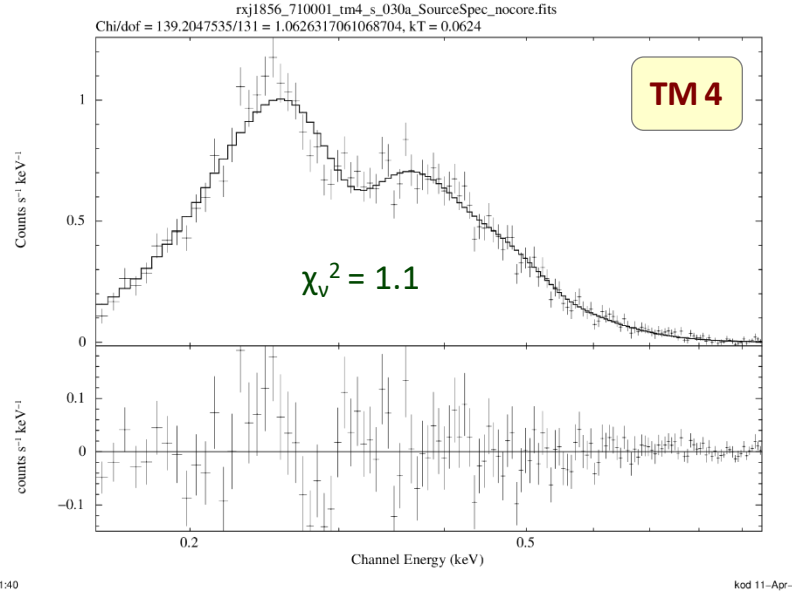


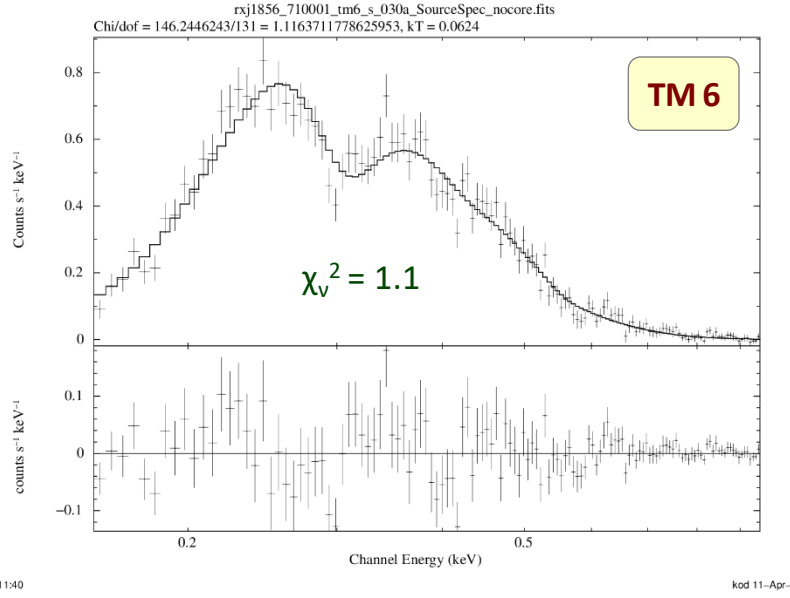
RX J1856-3754
2020 Apr 01-02
single pixel events

only 1 free parameter:
normalization
(4 central pixels ignored)

nH = 7.25 × 10^{19} cm^{-2}
kT = 62.4 eV
(Chandra LETG)







eROSITA

Summary

- Track contamination after larger orbital manuevres
  → no cumulative effect detectable
- RXJ1856 matches Chandra LETG
  → norm free, shape fixed to LETG
- Single events & all valid patterns → good spectral fits
  flux varies between TMs and observations
  → work ongoing

Status of INS and WD Working Group

- Isolated Neutron Stars
  - ACIS – contsmination update using RXJ1856 presented by Herman
  - Reminder of 20 years of LETGS observations of RXJ1856
  - Status of eROSITA RXJ1856 calibration shown
    → differs only in normalisation from LETGS (Pile up!)
- 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