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

Vadim Burwitz (MPE) on behalf of the working group

IACHEC #14,

May 23, 2019

Shonan Village, Japan

Presentations during Working group

11:00 → 12:00 **Working Groups III: 1: White Dwarfs** — Room 1&2 ()

Convener: Vadim Burwitz

- **11:00** — **INs and WDs Working Group** — 20m
  Speaker: Vadim Burwitz
  VB_INs_and_WDs_v...

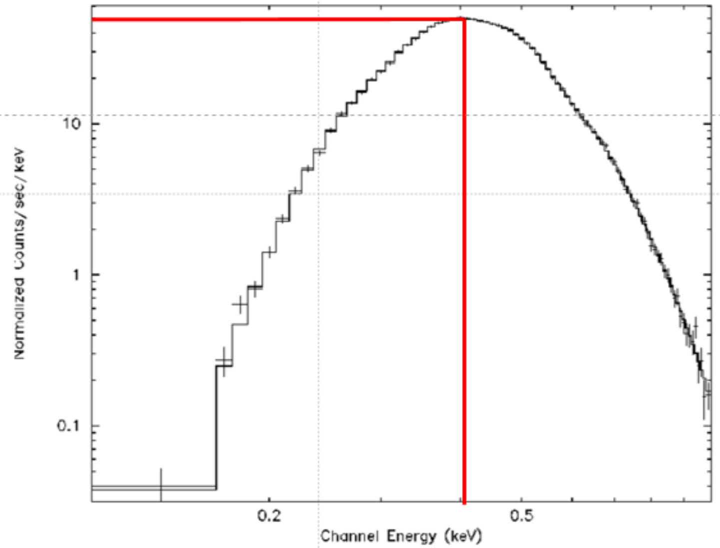
- **11:20** — **Universal detection of high-temperature emission in X-ray Isolated Neutron Stars** — 20m
  Speaker: Tomokage Yoneyama (Osaka University)
  iachec2019_190520...

- **11:40** — **RX J1856.5-3754: Reaching consistency between Chandra LETG and XMM-Newton/EPIC-pn** — 20m
  Speaker: Konrad Dennerl
  IACHEC2019_RXJ1...

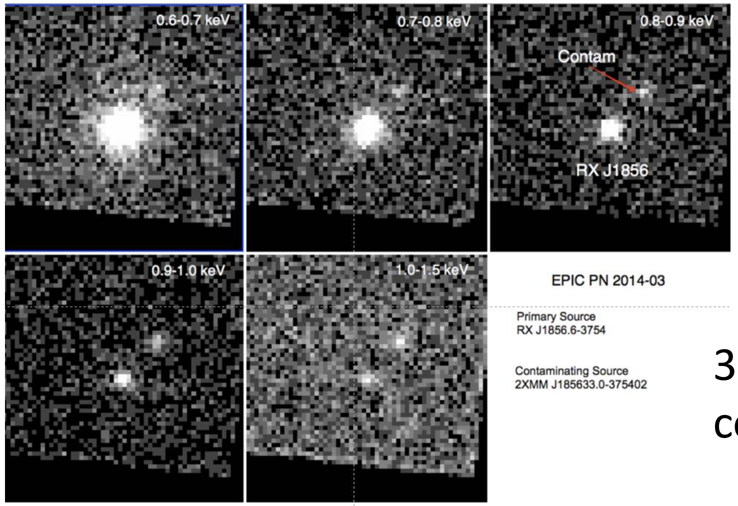
NICER prediction + Measurements

RXJ1856 and NICER

Model (VB) predicted countrate
→ 13cts/s 0.1 -1.0 keV all detectors (FPMs)
0.24 cts/s per FPM



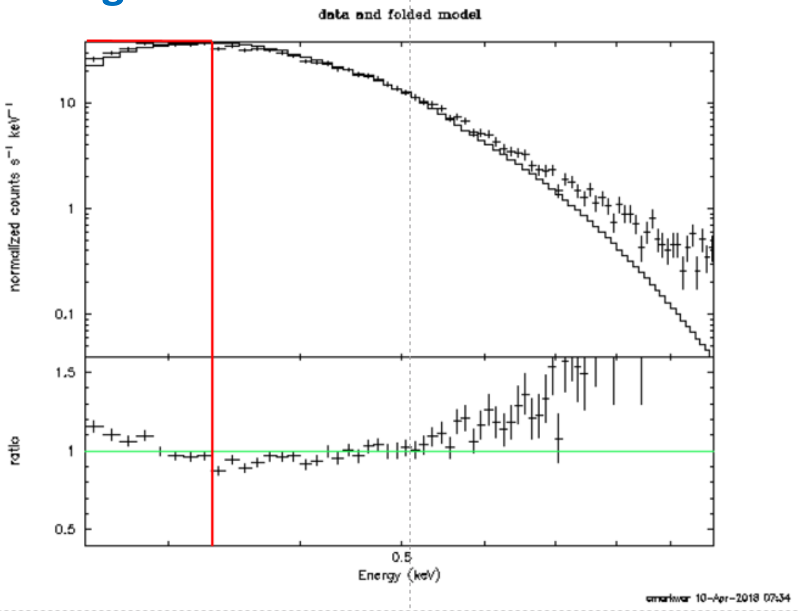
Summary iNS and WDs WG, IACHEC #13, Avigliano Umbro, Italy, April 10, 2018



38“ distant contaminator

from talk by Kenji Hamaguchi on “Current Status of NICER calibration” IACHEC #14 Session I May 20,2019

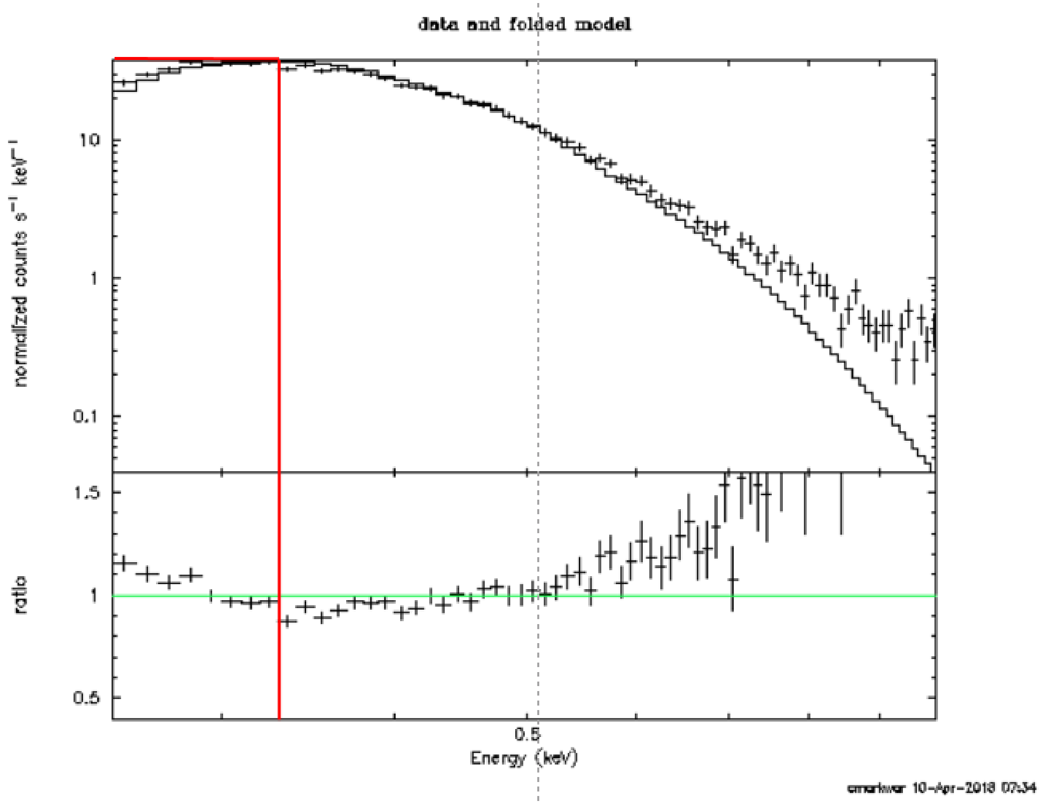
With input from Craig B .Markward



IACHEC #14, Shonan Village, Japan, May 21, 2019

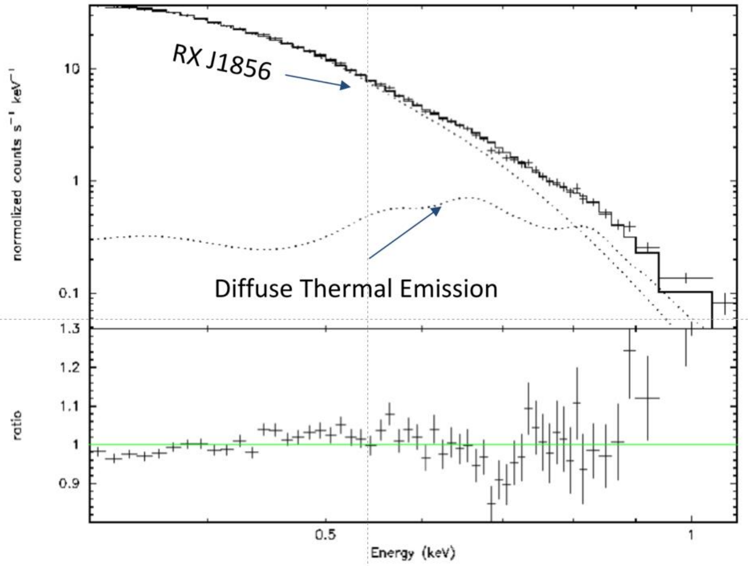
NICER Results

from talk by Kenji Hamaguchi on
“Current Status of NICER calibration”
IACHEC #14 Session I May 20,2019



IACHEC #14, Shonan Village, Japan, May 21, 2019

RX J1856 NICER Spectrum



Spectral shape fixed at IACHEC values (NICER norm 93%), diffuse emission is consistent with ROSAT levels.

The norm difference will probably be fixed after including the effect of misalignments between modules in response.

IACHEC #14, Shonan Village, Japan, May 21, 2019

Presentation by Tomokage Yoneyama:
Universal detection of high-temperature emission in X-ray Isolated Neutron Stars

Discovery of the "keV-excess" in J1856

Spectral fitting with known BB model (w/ optical comp.) ⇒ Significant excess around 1 keV

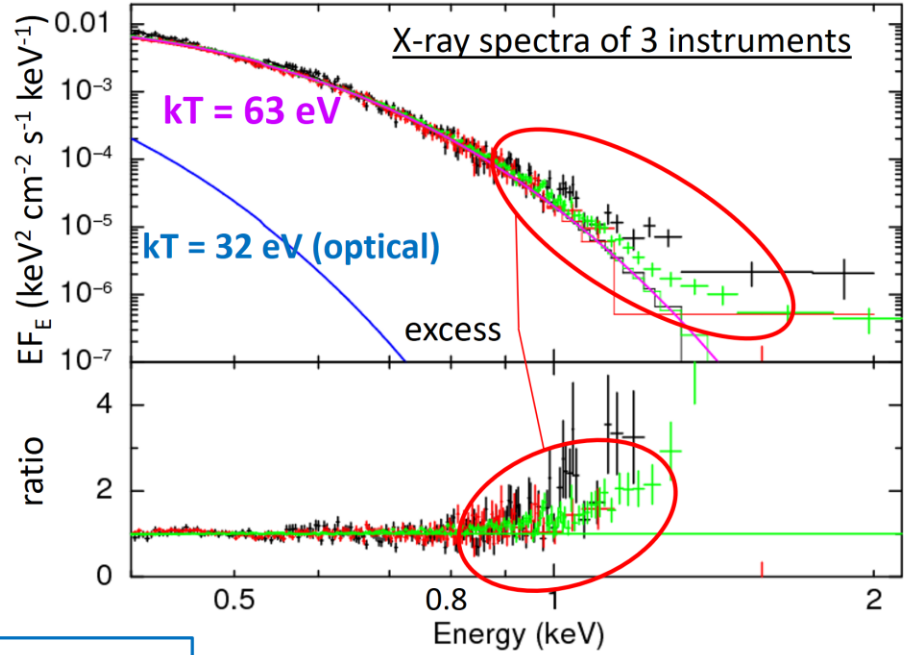
Suzaku

XIS1
Exposure: 450.4 ks
χ^2_r = 1.86 for 230 dof

XIS0+3
Exposure: 450.4 ks
χ^2_r = 1.41 for 239 dof

XMM-Newton

EPIC-pn
Exposure: 392.7 ks
χ^2_r = 3.06 for 147 dof



This doesn't originate to artifacts (e.g. BG, pile-up)
Yoneyama et al. 2017, PASJ

⇒ unknown component "**keV-excess**"

Presentation by Tomokage Yoneyama:

Universal detection of high-temperature emission in X-ray Isolated Neutron Stars

Summary

- XINSs have been considered to show single temperature blackbody emission
- We discovered the keV-excess in **all the 7 XINSs**
- Dual BB model (or BB+PL)reproduces the X-ray spectra
- Spectral shape are similar with Magnetars

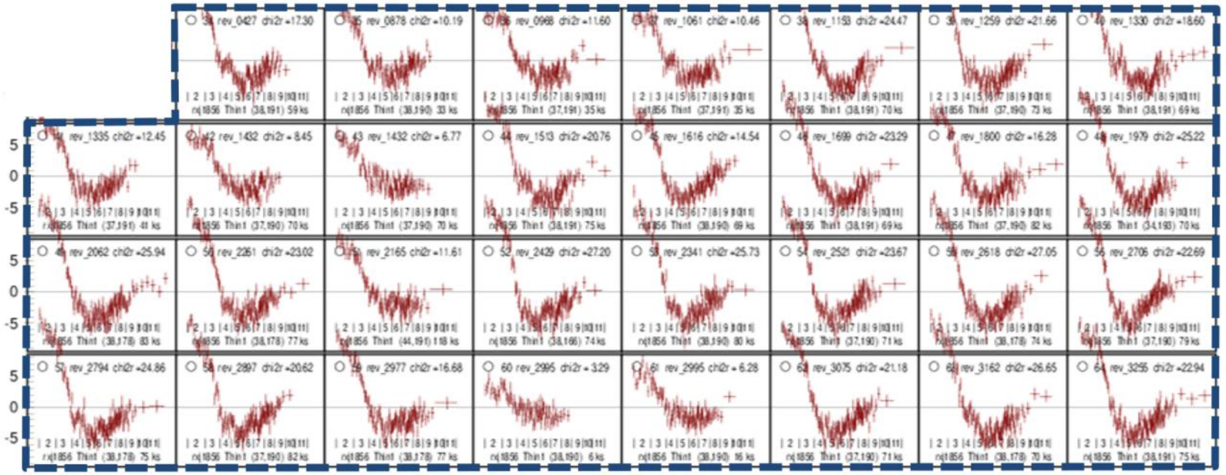
  ⇒ suggesting the same origin

  supporting the "worn out" hypothesis
- Origin of the keV-excess could not be uniform
- For two of XINSs, canonical polar cap can explain
- If so, we will be able to determine M-R of an XINS
- NICER observation is now going on
- Background estimation is complicated and difficult

Presentation by Konrad Dennerl:

RX J1856.5-3754: Reaching consistency between Chandra LETG and XMM-Newton/EPIC-pn

RX J1856: XMM-Newton/EPIC-pn



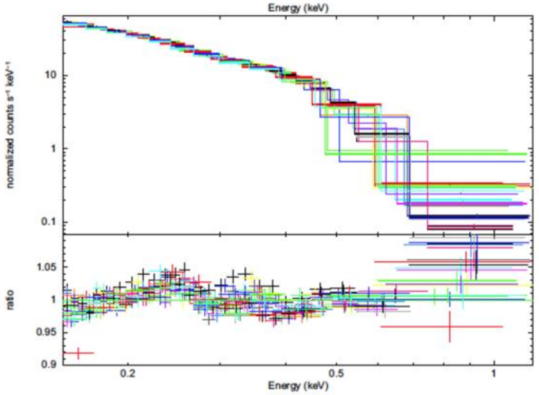
TBabs * bbodyrad

with **all parameters from Chandra**
(no free parameter!)

nH == 7.25 10^{-19} cm^{-2}
kT == 62.4 eV
norm == 1.58 10^{5}

+ gain fit (offset)

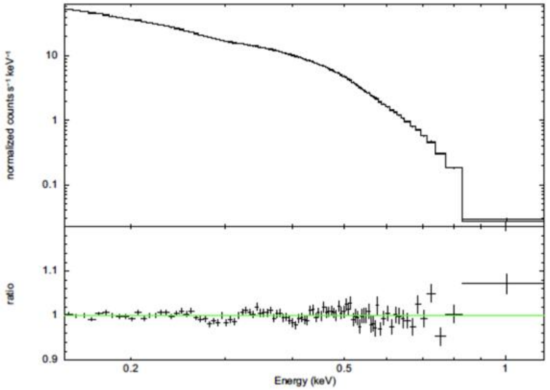
→ necessity to adopt significantly different parameters and/or to introduce a second component



Sartore et al. 2012, Fig. 1

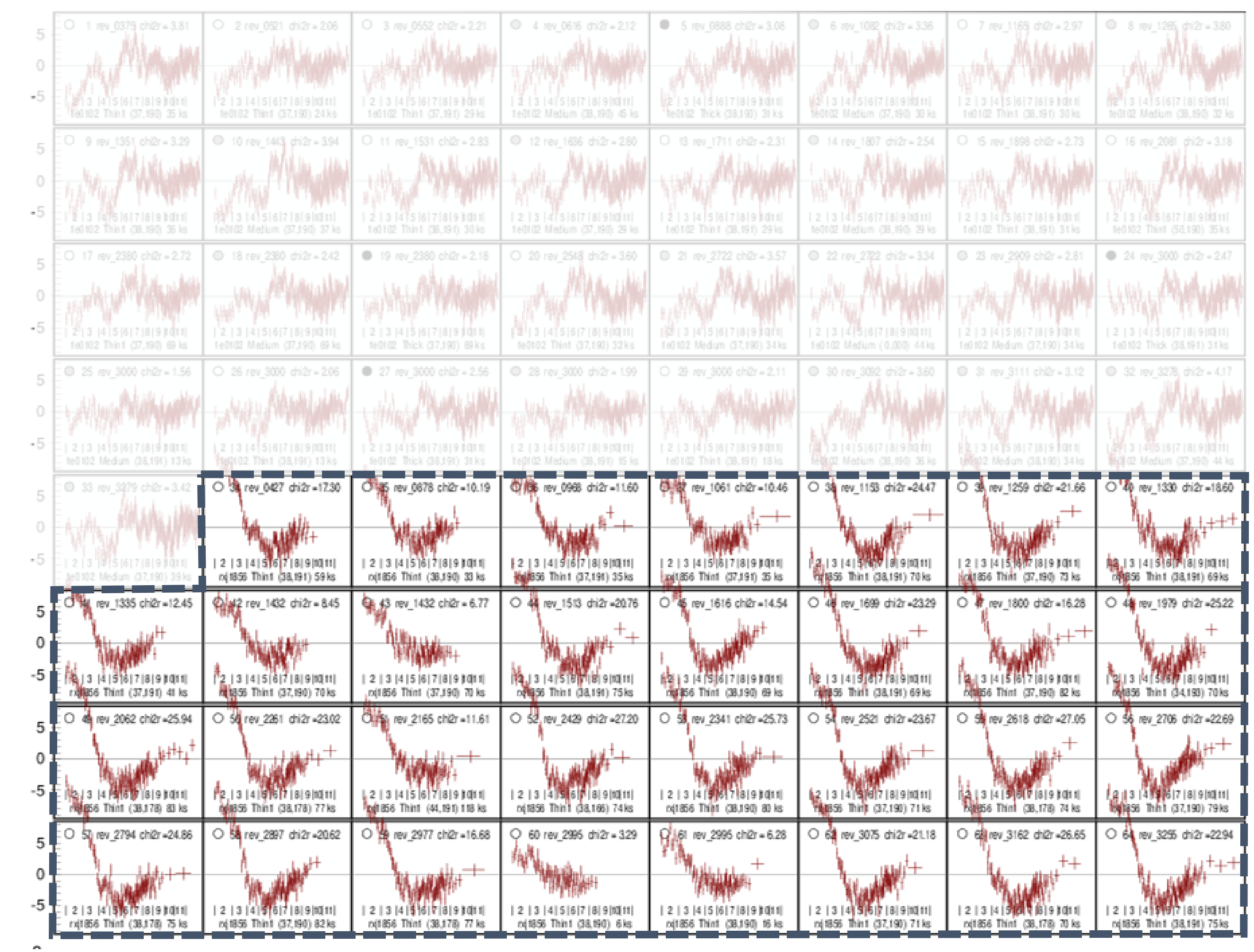
common single BB fit (phabs * bbodyrad) to singles within 0.15 – 1.2 ‚keV'
with all parameters free, using SAS v11.0
+ gain fit

→ $n_H = (5.84 \pm 0.04) \times 10^{19}$ cm^{-2}
→ kT = 61.30 ± 0.04 eV



Sartore et al. 2012, Fig. 5

Residuals obtained with xmmsas RMF



spectral model:

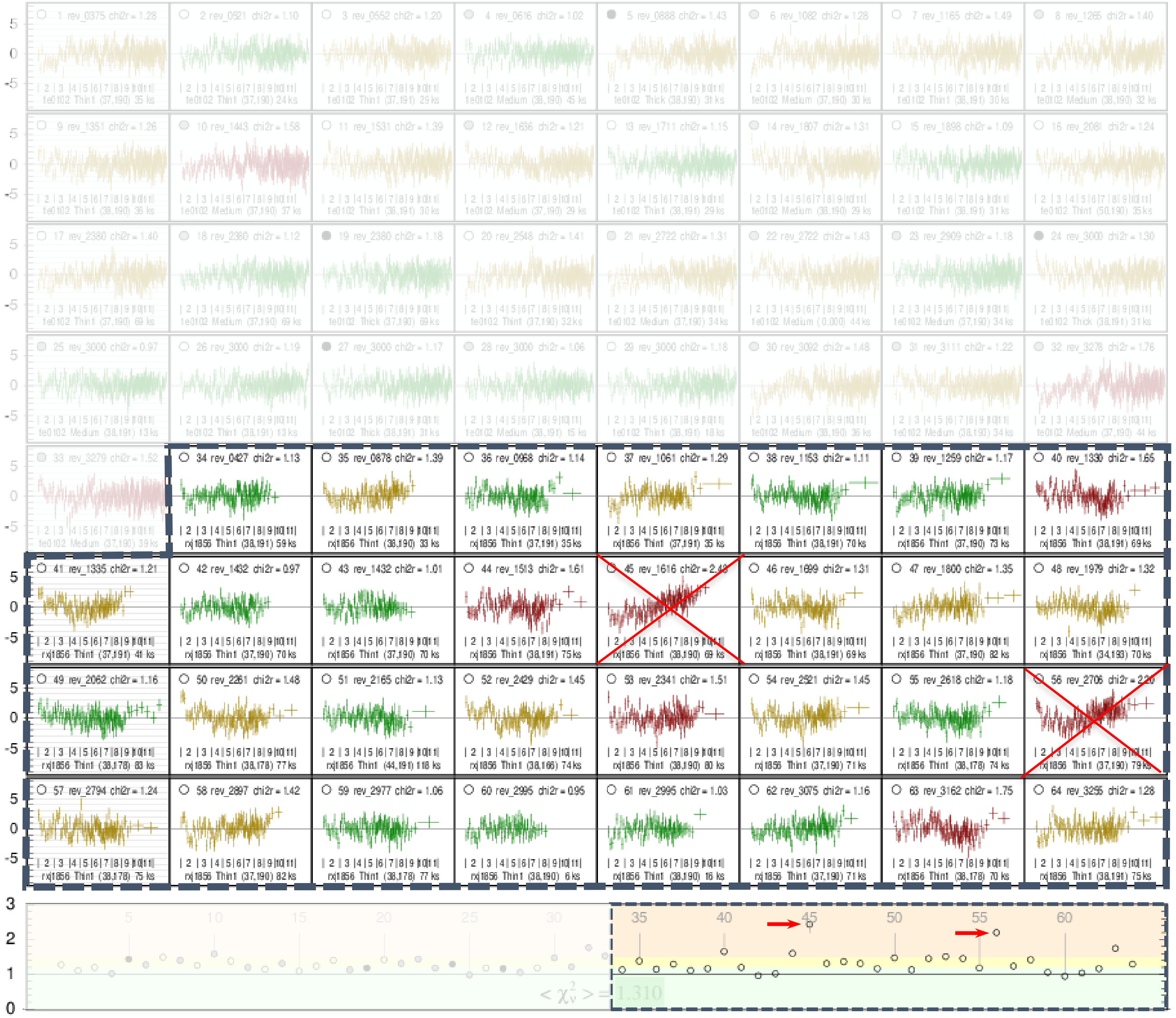
RX J1856
TBabs * bbodyrad

with **all parameters from Chandra**
(no free parameter!)

nH == 7.25 10^{-19} cm^{-2}
kT == 62.4 eV
norm == 1.58 10^{5}

+ gain fit (offset)

Residuals obtained with parameterized RMF



spectral model:

RX J1856

TBabs * bbodyrad

with **all parameters from Chandra**
(no free parameter!)

nH == 7.25 10^{-19} cm^{-2}
kT == 62.4 eV
norm == 1.58 10^{5}

+ gain fit (offset)

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

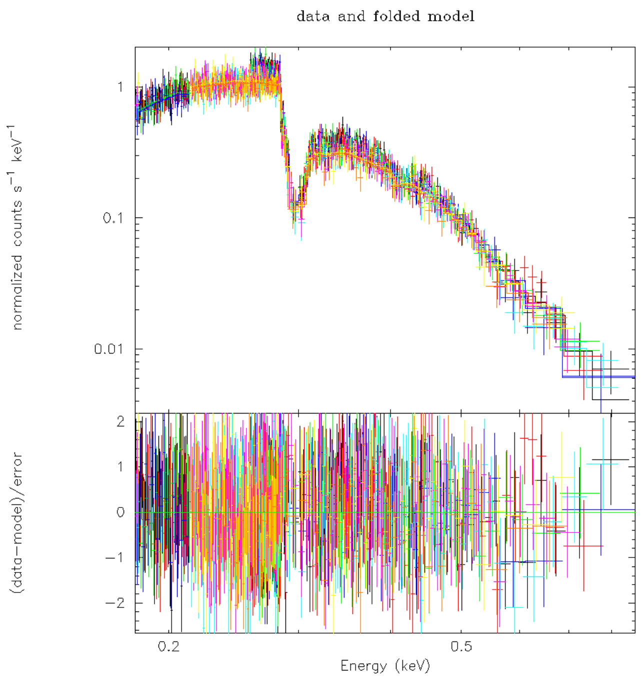
- ***Models***

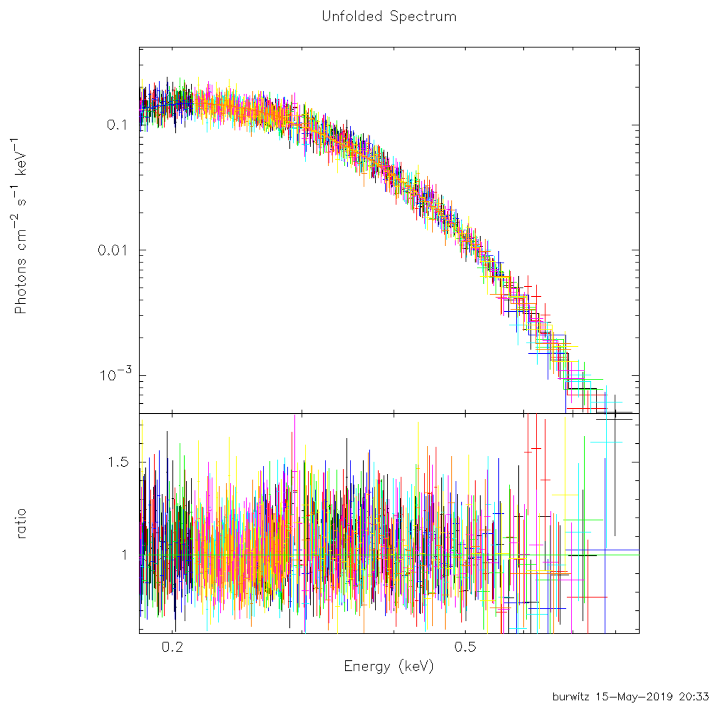
RX J1856.5-3754 based on the CHANDRA LETGS + HRCS Data

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





All Available Chandra LETG + HRC-S Observations

Chandra X-ray Center

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Chandra Data Archive

View Observation Information

Add Products to Retrieval List

- ☑ Primary package
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Select all | Unselect all

Select	Row	Seq Num	Obs ID	Instrument	Grating	Appr Exp	Exposure	Target Name	PI Name	RA	Dec	Status	Data Mode	Exp Mode	Avg Cnt Rate	Evt Cnt	Start Date	Public Release Date	Proposal
☐	1	500000	113	HRC-S	LETG	50.0	55.14	RX J1856.5-3754	Predehl	18 56 35.30	-37 54 34.40	archived			45.95	2533819	2000-03-10 07:54:08	2001-04-28 09:30:00	01500003
☐	2	500285	3380	HRC-S	LETG	170.0	164.7	RXJ1856.5-3754	Tananbaum	18 56 35.30	-37 54 34.40	archived			56.44	9295025	2001-10-10 05:05:24	2001-11-09 09:00:00	02508062
☐	3	500285	3381	HRC-S	LETG	170.0	169.31	RXJ1856.5-3754	Tananbaum	18 56 35.30	-37 54 34.40	archived			58.90	9972590	2001-10-12 19:18:22	2001-11-09 09:00:00	02508062
☐	4	500285	3382	HRC-S	LETG	100.5	97.72	RXJ1856.5-3754	Tananbaum	18 56 35.30	-37 54 34.40	archived			67.31	6577104	2001-10-08 08:17:45	2001-11-09 09:00:00	02508062
☐	5	500285	3399	HRC-S	LETG	9.5	9.25	RXJ1856.5-3754	Tananbaum	18 56 35.30	-37 54 34.40	archived			49.64	459240	2001-10-15 11:46:02	2001-11-09 09:00:00	02508062
☐	6	502023	15293	HRC-S	LETG	90.0	91.23	RX J1856.5-3754	Predehl	18 56 35.30	-37 54 34.40	archived			54.04	4929887	2013-06-12 14:28:42	2013-06-20 05:23:57	14500050
☐	7	590518	14418	HRC-S	LETG	30.0	29.96	RXJ1856.5-3754	Calibration	18 56 35.30	-37 54 34.60	archived			60.24	1804865	2013-10-01 05:02:27	2013-10-03 05:23:55	14500075
☐	8	503147	21693	HRC-S	LETG	86.0		RX J1856.5-3754	Predehl	18 56 35.30	-37 54 34.40	unobserved					2019-06-13 00:00:00		20501028
☐	9	503147	21896	HRC-S	LETG	86.0		RX J1856.5-3754	Predehl	18 56 35.30	-37 54 34.40	unobserved					2019-07-18 00:00:00		20501028

Two new GTO observations, each 86 ksec long, are planned for **June 13**, and **July 18** this year in the context of calibrating eROSITA

80 ksec **eROSITA** calibration observation planned **Sept. 13, 2019** for a June 20/21 Launch

Status of INs and WDs Working Group

- No work done on white dwarfs in the last year.

- Isolated Neutron Stars
  - NICER study of spectra triggered the search for an explanation to understand the hard component it sees: → possibly ¾ keV sky background contribution.
  - Tomokage Yoneyama : merged spectra EPIC-pn spectra of INs, and proposes a physical explanation of hard component
  - Konrad Dennerl: using Chandra LETGS RXJ1856 model and 1E0102 IACHEC model was able to determine a time dependant parametrised EPIC-pn RMF below 2 keV.
- Work to do!!
  - Check in more detail the source of the hard component in RXJ1856
- New observations → Chandra / eROSITA