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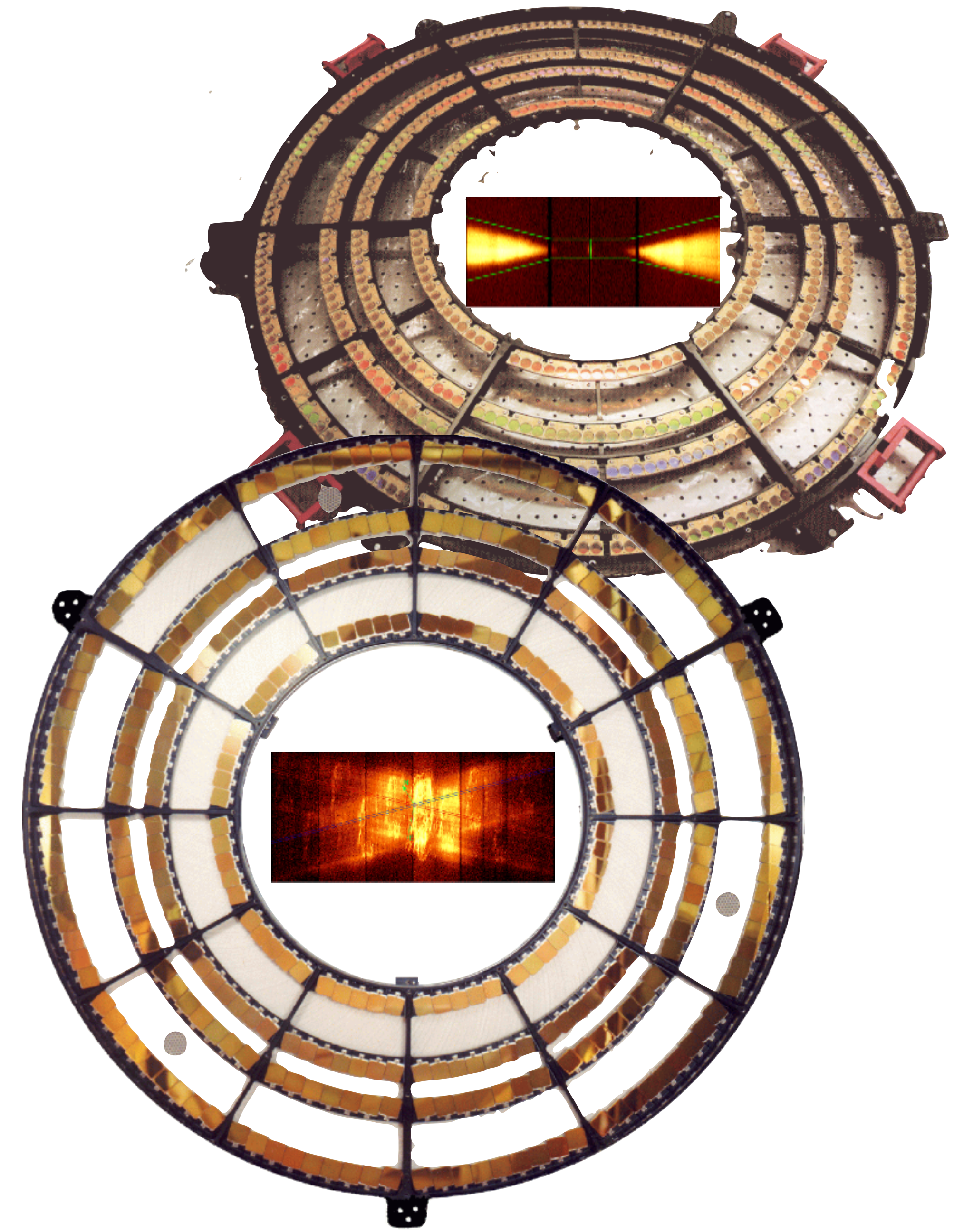
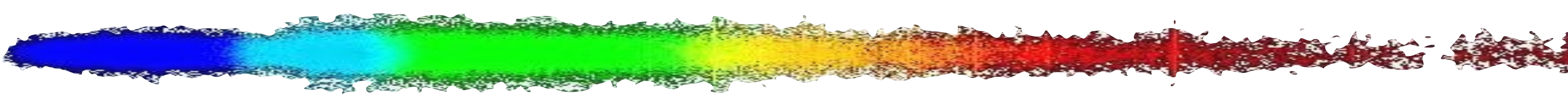
H/LETG — Status



Chandra Quarterly Review No. 43
26 April 2017

David Huenemoerder
dph@space.mit.edu

HETG IPI: Prof. C.R. Canizares
MIT Kavli Institute



Ongoing HETG Team Activities Summary

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HETG/ACIS-S Performance (November 2016 — March 2017);   540 ks

- 12 HETG observations on 8 targets (5/7 GO/GTO observations)
- 1 HETG Cal observation (HETG/HRC-I Capella) [feasibility study for O VII]

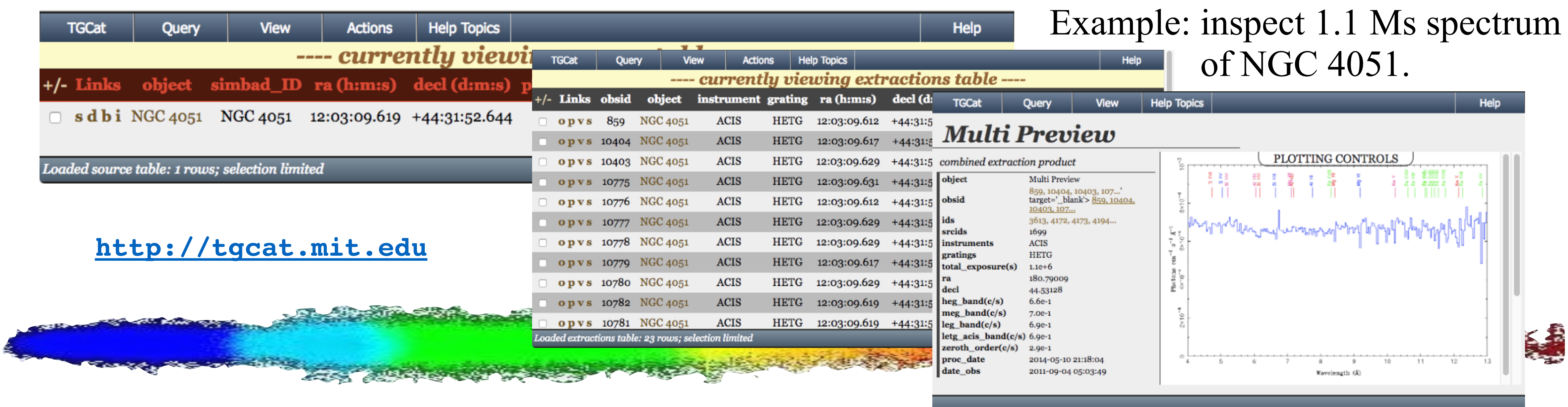
LETG Performance (November 2016 — March 2017); 730 ks

- 18 LETG/HRC-S observations, 7 targets (18/0 GO/GTO)
- 1 LETG/HRC-S Cal observation
- 0 LETG/ACIS-S
- 3 LETG/ACIS-S Cal observations, 1 target

Grating performance is nominal.

TGCat has 1729 extractions for 461 objects (+59/+19 since last report)
Total volume: 400 GB

Example: inspect 1.1 Ms spectrum of NGC 4051.



http://tgcat.mit.edu

HETG Team Activities

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GTO Science Program, HETG/ACIS-S

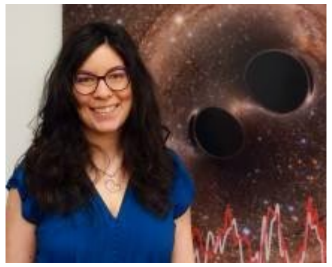
Cycle 17:

★ Hot star + NS:	Vela X-1	180 ks	clumpy winds; phase 0.15 — 0.45 (2/3 observed)
★ XRB:	SMC X-1	100 ks	TOO; pulsar, high state, emis/abs lines (observed)
★ AGN:	NGC 3227	150 ks	Seyfert; warm absorber, soft excess (observed; +*NuSTAR*)
★ Hot Star:	WR 25	90 ks	colliding winds, near periastron (observed)
★ LMXB:	GX 3+1	130 ks	resolve broad lines (2/5 observed)

Cycle 18:

★ULX/BH:	NGC 1313 X-1	500 ks	Ultra-luminous source outflow: absorption, emission lines
★NS/BH:	GRS 1915+105	100 ks	Black hole accretion, line variability (2/4 observed)
★XRB:	4U 1626-67	50 ks	Neutron star accretion; Fe K absorption variability
★NS:	Terzan 5 X-2	200 ks	TOO (10%); Neutron Star Equation of State
★LIGO/GW:	GW2017nnnn	300 ks	TOO (10%); Gravitational wave transient

Postdoc status/activities:



Dr. Rozenn Boissay, started 1 Feb 2017 (Ph.D. U. Geneva, May 2016)
Dr. Paul Hemphill, started 15 Oct 2016 (Ph.D. UCSD, August 2016) [partial GTO support]

GTO Science Program

Cycle 17:
★ AGN (Kaastra/SRON) NGC 7469 237 ks Outflow dynamics (observed; HETG/ACIS)

Cycle 18:
★ AGN (Kaastra/SRON) IC 4329a 175 ks Neutral, warm absorbers (HETG/ACIS)
★ Stars (Predehl/MPE) Proxima Cen 175 ks Reference spectrum of an old M-dwarf (LETG/HRC)

Reports on an HETG Line Spread Function Problem…

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Monthly Notices of the ROYAL ASTRONOMICAL SOCIETY
MNRAS **463**, L108–L111 (2016) doi:10.1093/mnrasl/slw164
Advance Access publication 2016 August 19

The intrinsic line width of the Fe K α line of AGN

Jiren Liu★
National Astronomical Observatories, 20A Datun Road, Beijing 100012, China

Accepted 2016 August 15. Received 2016 August 2; in original form 2016 July 1

ABSTRACT
X-ray fluorescent lines are unique features of the reflection spectrum of the cold torus when irradiated by the central AGN. Their intrinsic line widths can be used to probe the line-emitting region. The line widths of the Fe K α line measured from the first-order *Chandra* High Energy Grating (HEG) spectra are 3–5 times larger than those measured with the Si K α line for Circinus, Mrk 3, and NGC 1068. Because the observed Si K α and Fe K α lines are not necessarily coming from the same physical region, it is uncertain whether the line widths of the Fe K α line are overestimated or not. We measured the intrinsic line widths of the Fe K α line of several nearby bright AGN using the second- and third-order *Chandra* HEG spectra, whose spectral resolutions are better than the first-order data. We found the measured widths are all smaller than those from the first-order data. The results clearly show that the widths of the Fe K α line measured from the first-order HEG data are overestimated. It indicates that the Fe K α lines of the studied sources are originating from regions around the

We found the measured widths are all smaller than those from the first-order data. The results clearly show that the widths of the Fe K α line measured from the first-order HEG data are overestimated.

… *are greatly exaggerated.*

<http://cxc.harvard.edu/newsletters/news_24/marshall.pdf>

Spring 2017 CXC Newsletter

HETGS Update

Herman Marshall

The High Energy Transmission Grating Spectrometer [HETGS, 1] is essentially unchanged since launch. The grating efficiencies were updated in 2011 to bring the high and medium energy grating spectra into better agreement

physical coordinates x on the detector for wavelength λ and remembering the grating equation mλ = P sin α = Px/R (for small dispersion angles) gives

$$\sigma_x^2 = \sigma_i^2 + (Rm\lambda/Pc)^2\sigma_v^2 + (F\sigma_\theta)^2 \quad (1)$$

where m is the grating order, P is the grating period, R is the Rowland distance of the HETGS, and F is the focal length of the HRMA.

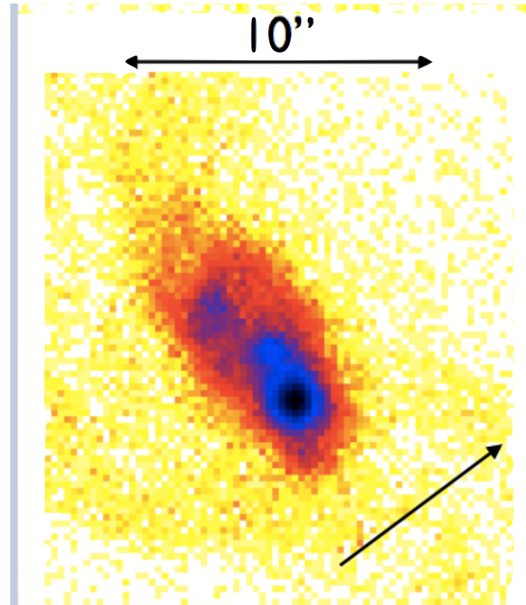


Figure 1: Images of the Circinus galaxy (above) and NGC 1068

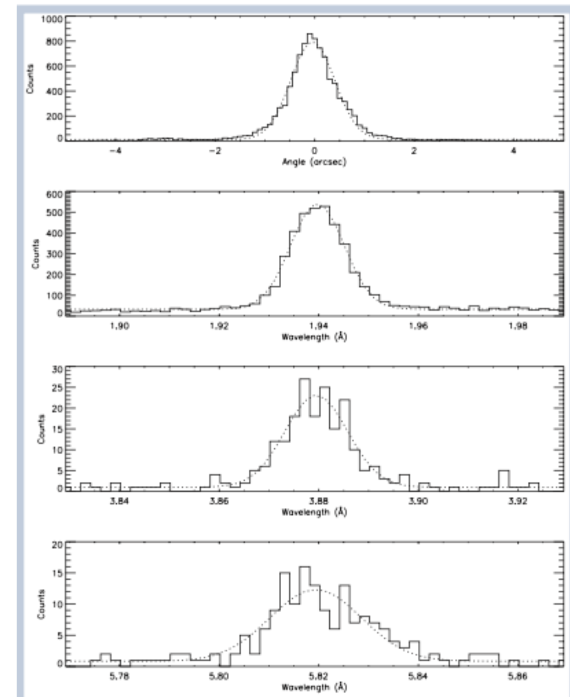
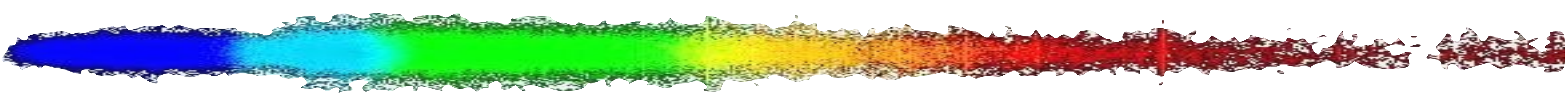


Figure 2: Average profiles taken from many HETGS observations of the Circinus galaxy. Top: Profile of zeroth order (5-6 keV) pro-

Issues:

- Extended source
- Doppler broadening
- *Of course you can measure smaller velocities in higher orders!*

Conclusion: ***there is no problem***. (See the *CXC Newsletter* for details.)



LETG/HRC-S Analysis Improvements

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<http://cxc.harvard.edu/newsletters/news_24/drake_letg.pdf>

Spring 2017 CXC Newsletter

LETG

Jeremy J. Drake for the LETG Team

Item 7

It's like painting the Forth Bridge. At least it used to be, until 2011 when the Forth Bridge painting was unsportingly declared finished for at least another 20 years. Completed ... a mar... River ...

a year. Whilst strict ceremonial protocol forbids disclosure of the full details of the list, excerpts read as follows:

7. Fix the LETG/HRC-S spectrum/gARF wavelength mismatches.

...

22. Verify that the malleable logarithmic casing surmounting the prefabulated amulite base-plate does

After weeks of cloistered deliberation and metaphorical black smoke (meeting rooms here having already been designed shortsightedly without chimneys), a candidate rises to the top and is studied and dealt with by the crack calibration team.

At first sight, Item 7 sounds quite grave and meritorious ... ranking. It actually refers to the problem that the ... spectrum at the very ends of each microchann... ...ent did not match expectations very well...

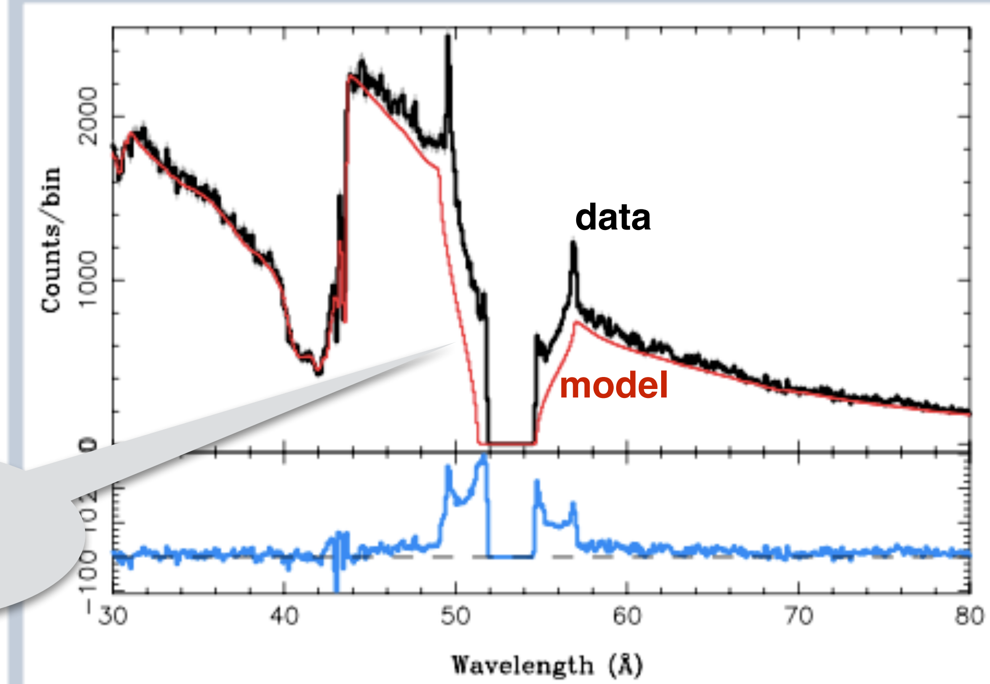


Figure 1: Illustration of residuals around the negative order plate gap in single power law fits to observed spectra of the blazar Mkn 421 ObsID 4149 (Figure courtesy David Huenemoerder).

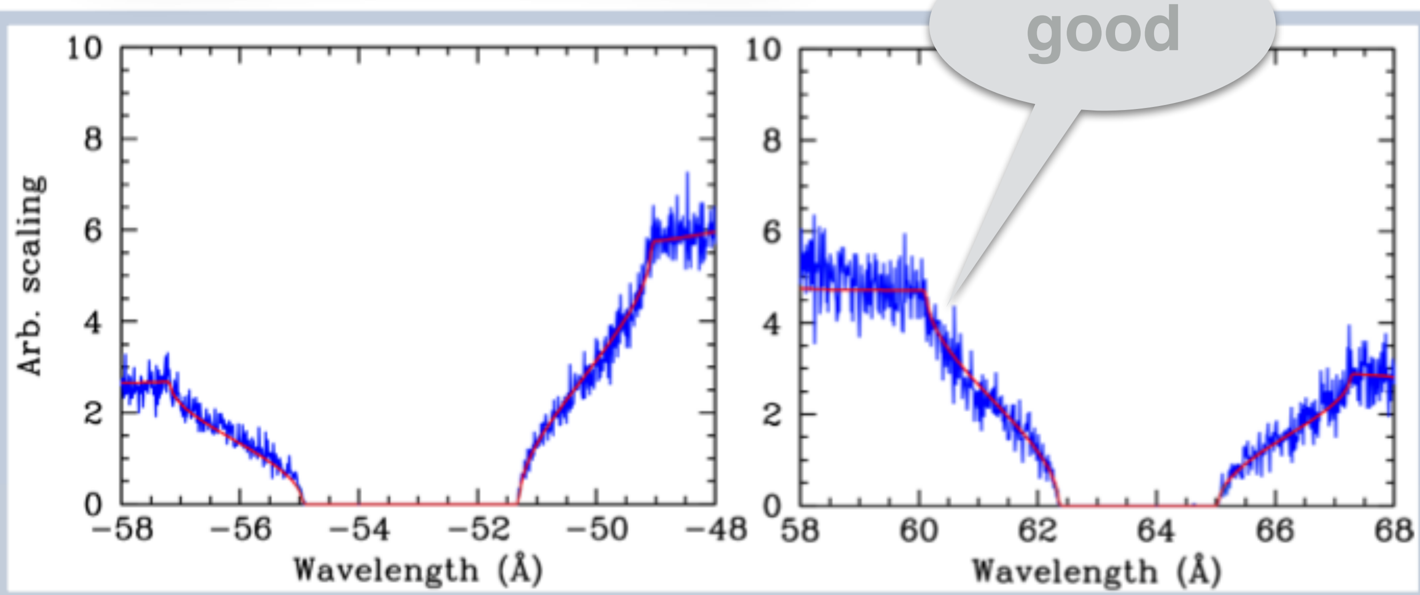
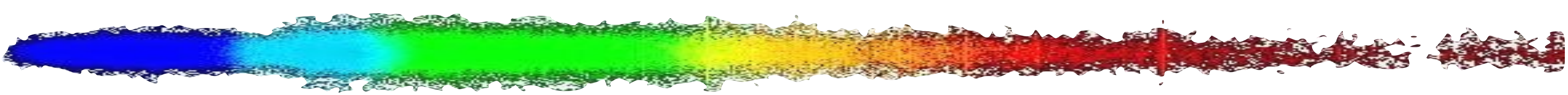


Figure 2: Comparison of data in the vicinity of the negative order plate gap with an effective area computed using revised QEU and badpix files. No spectral model is included and data have been arbitrarily scaled to match the count rate levels in the vicinity of the gap (Figure courtesy Brad Wargelin).

Problems in computing the dithered response at HRC-S micro-channel plate gaps (above) have been fixed (left) through adjustments to the Quantum Efficiency Uniformity and Bad Pixel maps in the Calibration Database.



Silicon Edge Survey using HETGS

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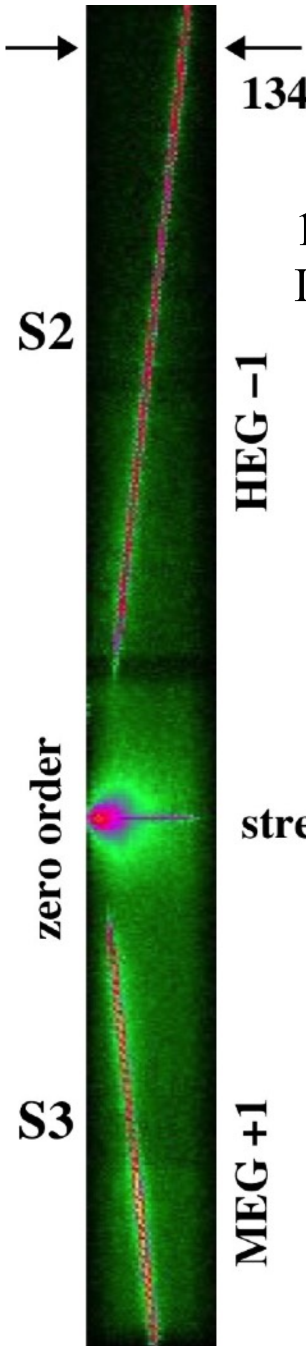
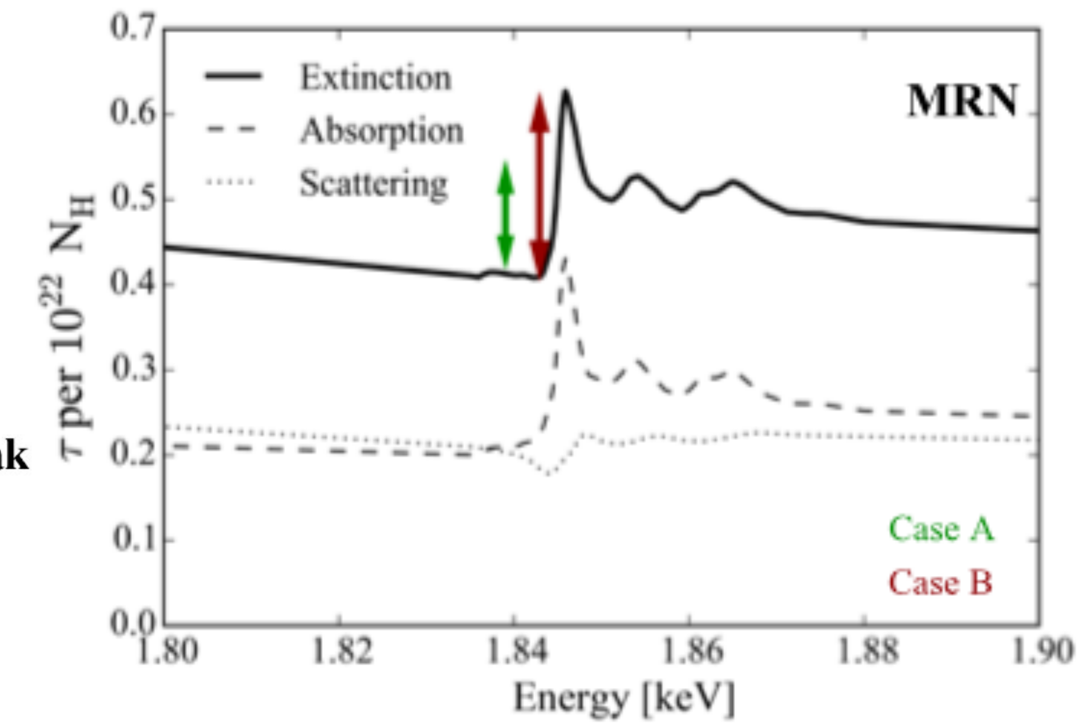
The Astrophysical Journal, 827:49 (13pp), 2016 August 10

Si K EDGE STRUCTURE AND VARIABILITY IN GALACTIC X-RAY BINARIES

Norbert S. Schulz, Lia Corrales, and Claude R. Canizares



11 objects, 45 observations, mix of GO, GTO, timed- and CC-modes.
Issues: instrumental Si edges, pileup, halos — all dealt with.



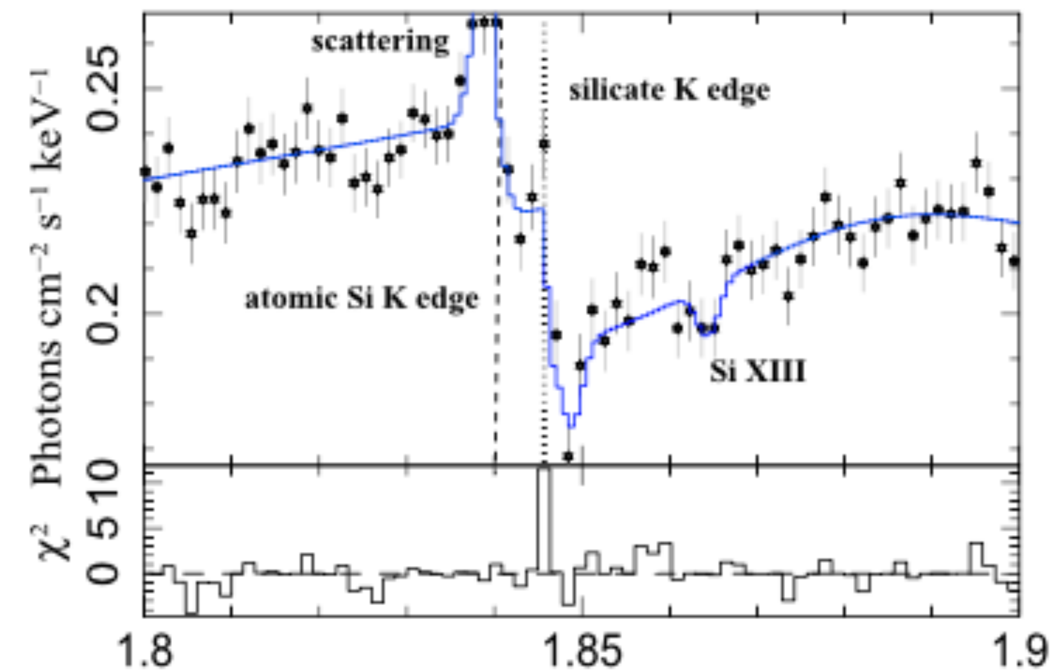


Figure 9. Observed Si K edge in GX 3+1 that sums up the HEG first orders of Obsids 2745, 16307, and 16492 with a total exposure of about 120 ks. Marked are the contributions from scattering (see Figure 3), a possible atomic Si K edge at 1.840 keV, a silicate edge at 1.845 keV, and a weak absorption line from ionized Si XIII.

Much structure — scattering is important; grain-size distribution matters; evidence for silicates and atomic Si; in some sources, structure is variable.