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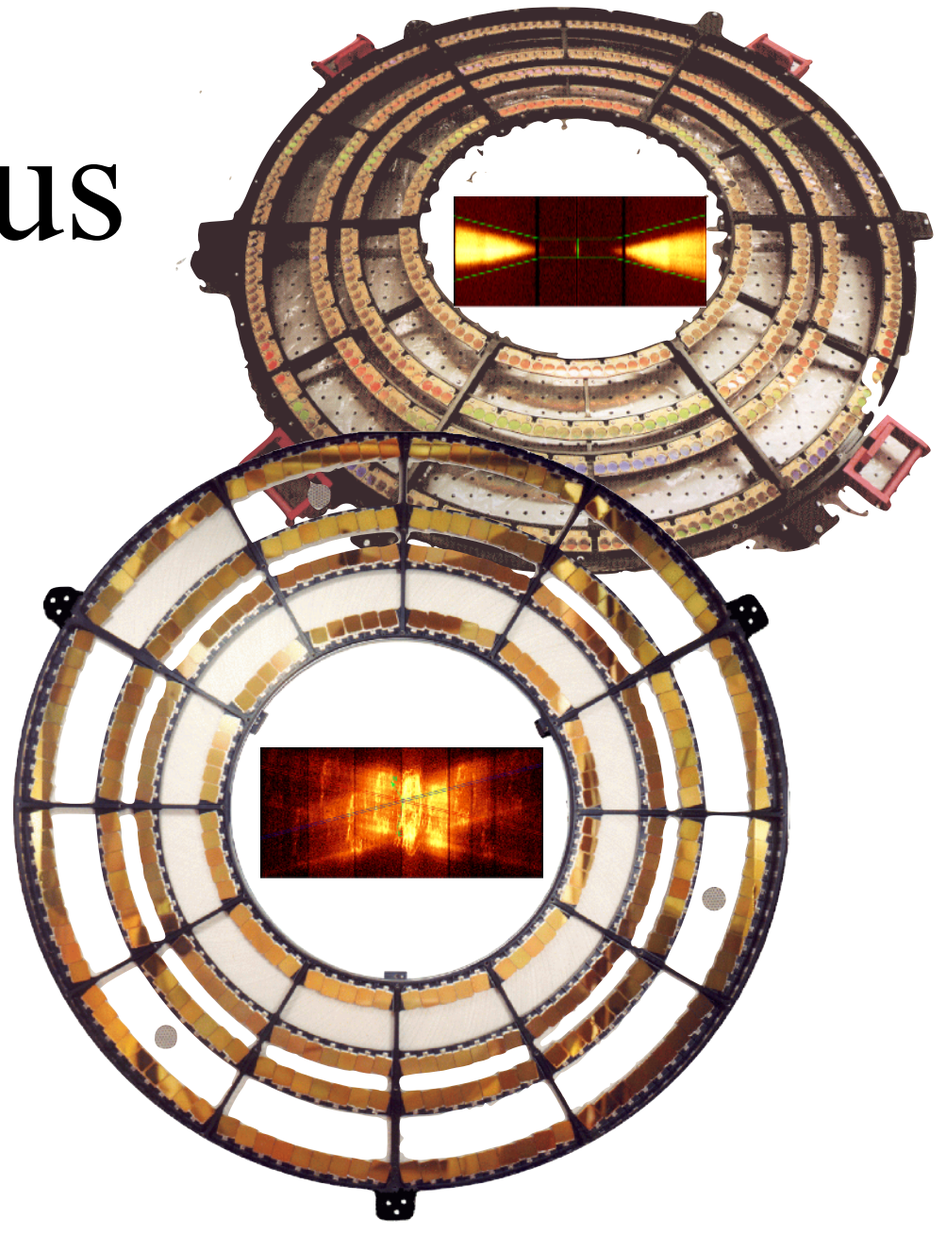
HETG/LETG — Status

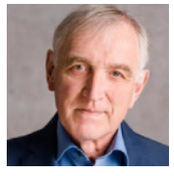
Chandra Quarterly Review No. 52
17 November 2021

David Huenemoerder
dph@space.mit.edu
(https://space.mit.edu/HETG/#reports)

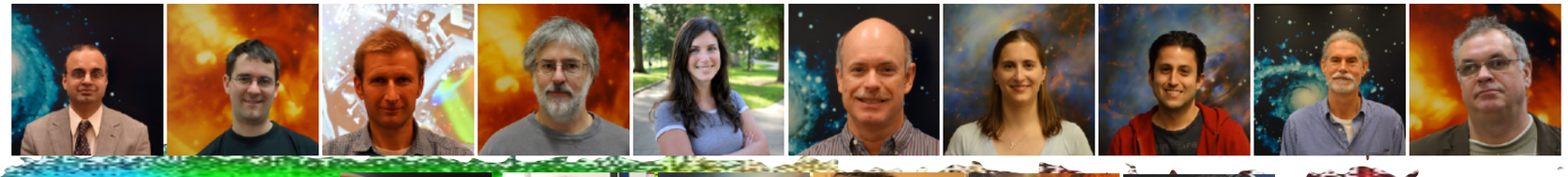


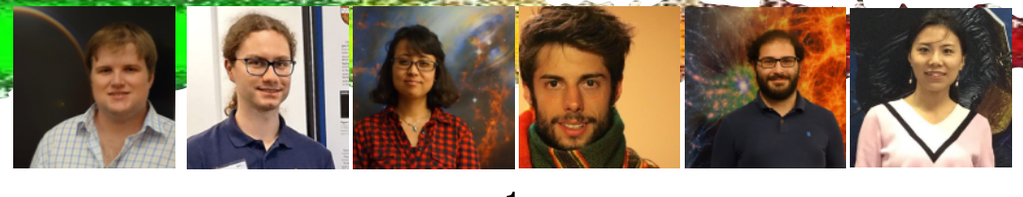
HETG IPI: Prof. C.R. Canizares
MIT Kavli Institute

LETG IPIs: Dr. Peter Predehl
Max Planck Institute



Dr. Jelle Kaastra
SRON





HETG GTO Science Program

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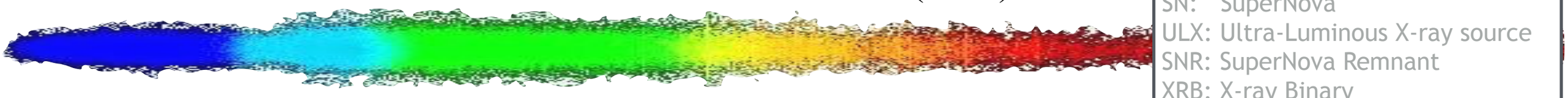
Proposal **Cycle 22**:

★Stars:	ρ Oph A	0/200 ks	Winds of OB stars; magnetic confinement
★AGN:	Mrk 335	82 ks	Jets, disks, outflows, variability (w/NuSTAR, NICER).
★AGN:	NGC 1365	295 ks	Seyfert 1.8 galaxy; outflow, variability.
★BH:	SS 433	210 ks	Stellar mass black hole; relativistic jets, variability
★NS:	Terzan 5 X-2	0/200 ks	Neutron Star outburst (TOO)
★NS:	Cen X-4	0/60 ks	Neutron Star outburst (TOO)
★NS:	4U 1820-30	175 ks	Neutron Star outburst; gravitational redshift, NS radius (TOO)
★ISM:	GX 3+1	0/100 ks	Silicon K-edge structure and variability
★ISM:	GX 17+2	28/100 ks	Silicon gas-to-dust ratio (part of ISM survey)
★XRB:	4U 1626-67	0/60 ks	Ultra-compact binary; monitor disk line shapes

Proposal **Cycle 23**:

★Stars:	π Aqr	0/100 ks	Winds of the hottest stars
★AGN:	Circinus Galaxy	0/70 ks	Emission lines, morphology, variability (IXPE-coordinated)
★XRB:	Cen X-3	0/62 ks	Eclipsing X-ray pulsar; accretion
★XRB:	4U 1629-67	0/90 ks	Ultra-compact binary; monitor Fe lines.
★XRB:	GX 1+4	0/90 ks	Low-mass XRB; accretion, Compton shoulder study.
★ISM:	GX 340+0	0/150 ks	Cosmic dust composition
★ULX/NS:	M33 X-8	0/92 ks	Pulsar wind outflow, absorption
★ULX:	LMC/SMC X-?	0/70 ks	Accretion disk outbursts (TOO)
★NS:	Terzan 5 X-2	0/200 ks	Neutron Star outburst (TOO)



AGN: Active Galactic Nucleus
BH: Black Hole
ISM: InterStellar Medium
NS: Neutron Star
SN: SuperNova
ULX: Ultra-Luminous X-ray source
SNR: SuperNova Remnant
XRB: X-ray Binary
LMXB: Low Mass XRB

LETG GTO Science Program

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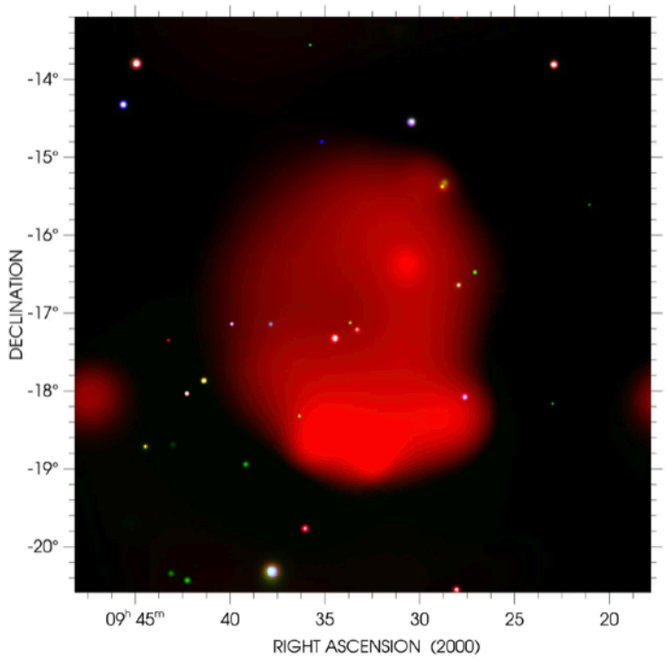
Proposal **Cycle 22**:

★ Stars (Predehl/MPE)	RX J0859.1+0537	60 ks	Accretion onto white dwarfs (LETG/HRC-S)
★ Stars (Predehl/MPE)	RX J1002.2-1925	0/48 ks	Accretion onto white dwarfs (LETG/HRC-S)
★ AGN (Predehl/MPE)	HSC J092120.56+000722.9	21 ks	Confirmation of faint z=6.56 eROSITA Quasar (ACIS-S)
★ AGN (Predehl/MPE)	2MASX J09325962+0405062	50 ks	Confirmation of eROSITA Compton-thick Seyfert (ACIS-S)
★ AGN (Kaastra/SRON)	MR 2251-178	62/175 ks	Galaxy outflows, absorption line density diagnostics (LETG/HRC-S)

Proposal **Cycle 23**:

★ Stars (Predehl/MPE)	LTT 1445A	0/50 ks	High energy environments of terrestrial exoplanets
★ Stars (Predehl/MPE)	L 168-9	0/25 ks	High energy environments of terrestrial exoplanets
★ SNR (Predehl/MPE)	Hoinga	0/60 ks	Distance determination
★ AGN (Predehl/MPE)	WISEA J202040.85-621509.3	0/30 ks	Confirm eRosita detection of a z=5.9 quasar
★ Galaxies (Kaastra/SRON)	Abell 141	0/175 ks	Intercluster temperatures, merger history



Hoinga: eRosita image; largest supernova remnant discovered in X-rays.

Size of HRC-I

AGN: Active Galactic Nucleus
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ISM: InterStellar Medium
NS: Neutron Star
SN: SuperNova
ULX: Ultra-Luminous X-ray source
SNR: SuperNova Remnant
XRB: X-ray Binary
LMXB: Low Mass XRB

Incomplete Grating Insertion Analysis

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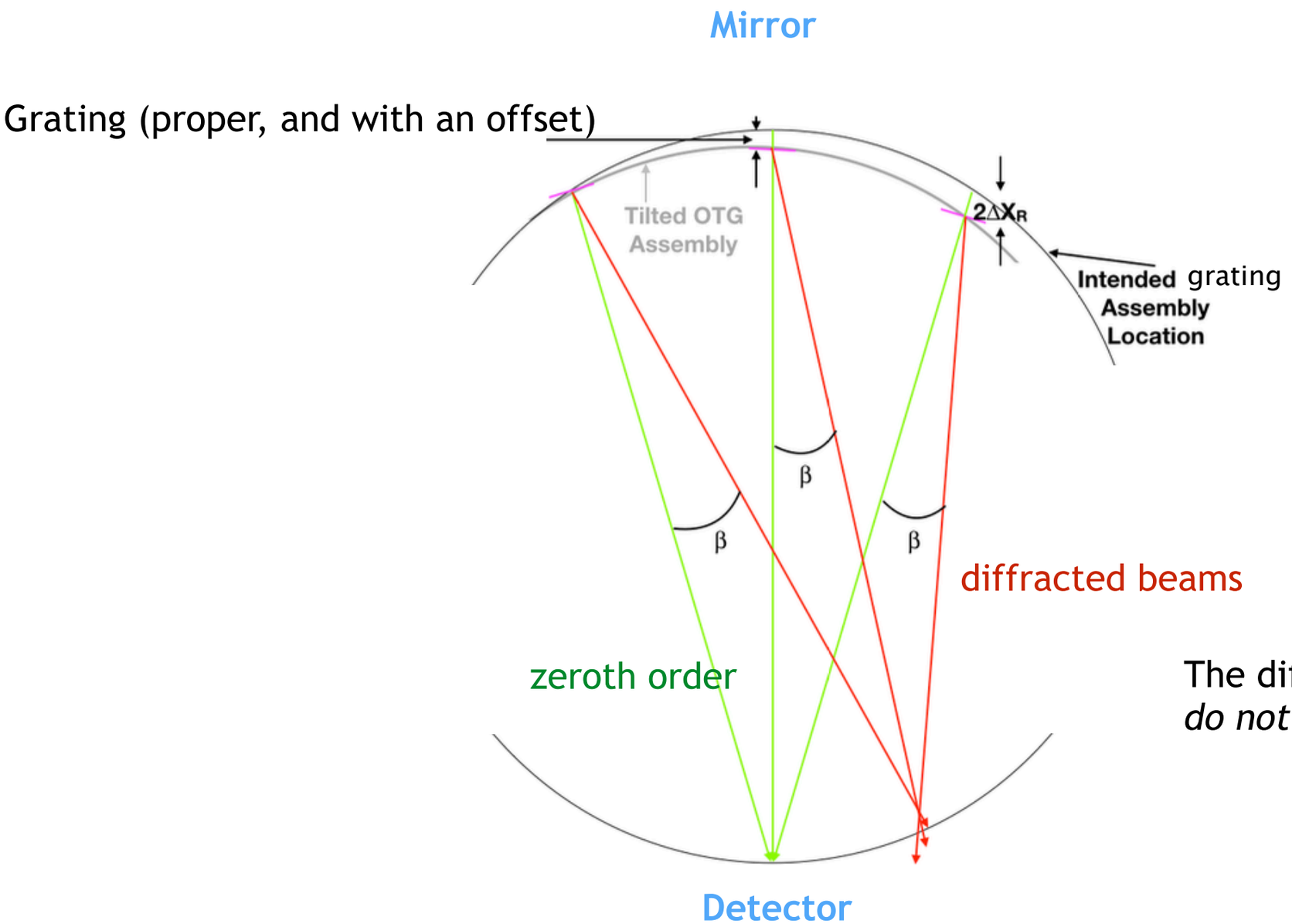
What if a grating did not fully insert? How could we tell?



Details in memo:

Effect of HETG Tilt on the Line Response Function

Herman Marshall
Chandra X-ray Center, MIT
September 16, 2021

The diffracted beams from an offset grating *do not converge to the same point*.

Incomplete Grating Insertion Analysis (cont'd)

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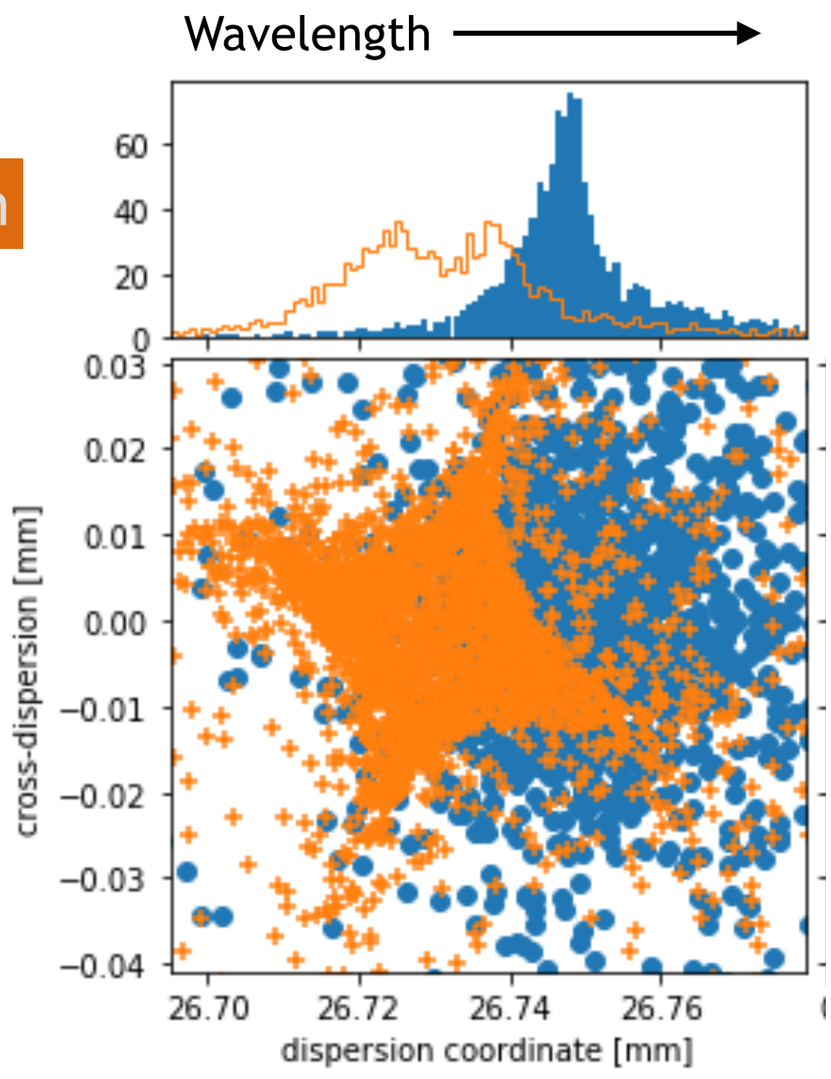
Ray-trace spot diagram and histograms for complete insertion, and for 1/2 degree offset:

Incomplete insertion

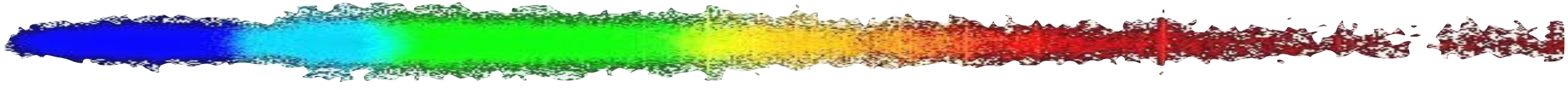


Proper insertion

Lines become broad and shifted to lower wavelengths

Effects become measurable for offsets greater than about 0.2 deg.

Ray-traces by Moritz Guenther.



Science Highlights (published in the past 6 months) - 1

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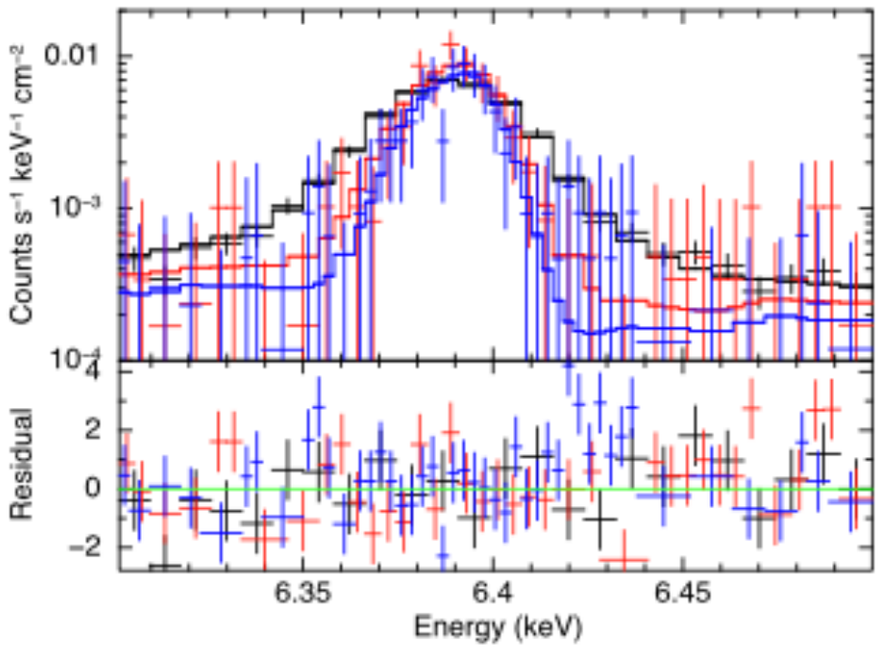
Extended sources, higher orders, spatial and spectral resolution:

THE ASTROPHYSICAL JOURNAL, 913:17 (17pp), 2021 May 20

X-Ray Constraint on the Location of the AGN Torus in the Circinus Galaxy

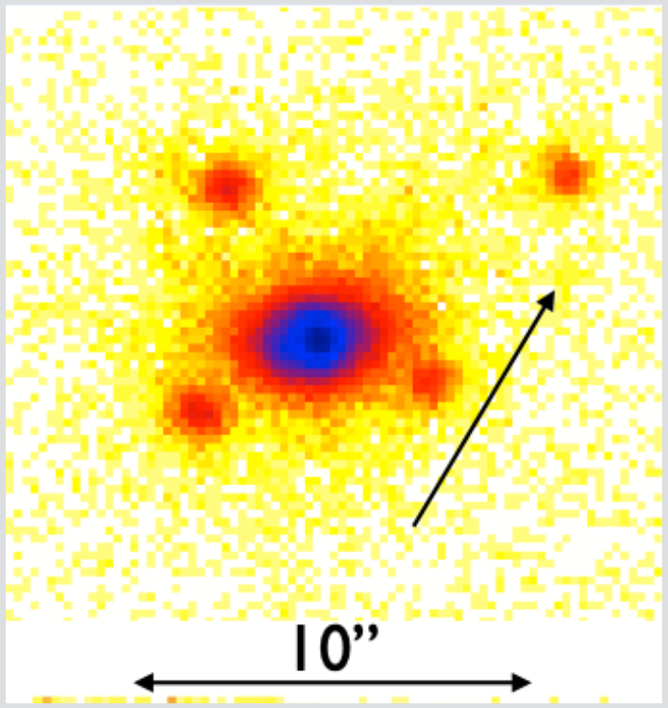
Ryosuke Uematsu[1], Yoshihiro Ueda[1], Atsushi Tanimoto[2], Taiki Kawamuro[3,4], Kenta Setoguchi[1], Shoji Ogawa[1], Satoshi Yamada[1], and Hirokazu Odaka[2,5]

Their Figure 6: HETG 1st, 2nd, & 3rd order fits, also accounting for spatial extent.



Fe K velocity widths give an inner radius to the accretion disk which is much smaller than that of dust emission.

Circinus zeroth order (H.Marshall, 2017, Chandra News 24)



Science Highlights (published in the past 6 months) - 2

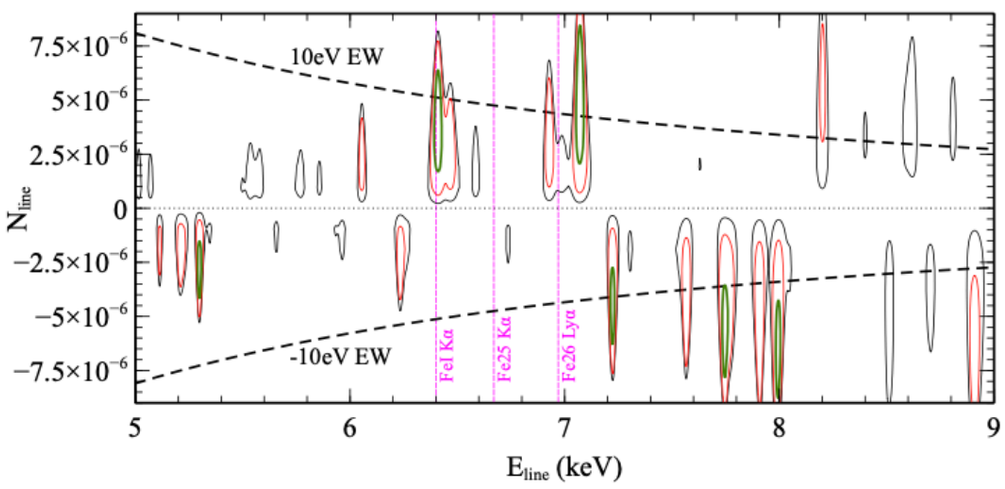
Blind searches for spectral features are becoming more common.

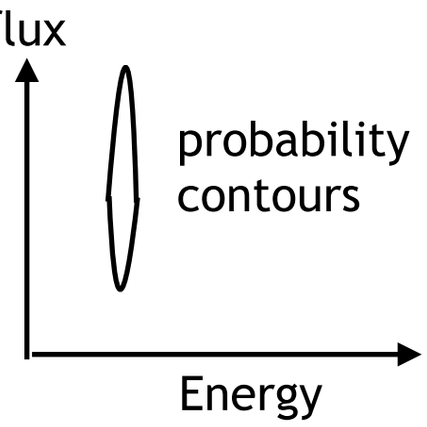
Put a feature in every resolution element and see if the statistic improves…

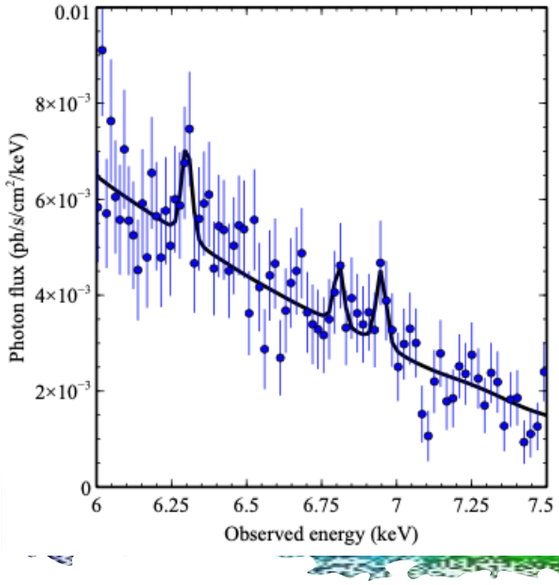
Probing the circumnuclear environment of NGC 1275 with high-resolution X-ray spectroscopy

MNRAS 507, 5613–5624 (2021)

Christopher S. Reynolds [1]★ Robyn N. Smith,[2] Andrew C. Fabian [1] Yasushi Fukazawa,[3] Erin A. Kara [4] Richard F. Mushotzky,[2] Hirofumi Noda,[5] Francesco Tombesi[2,6,7,8] and Sylvain Veilleux[2]





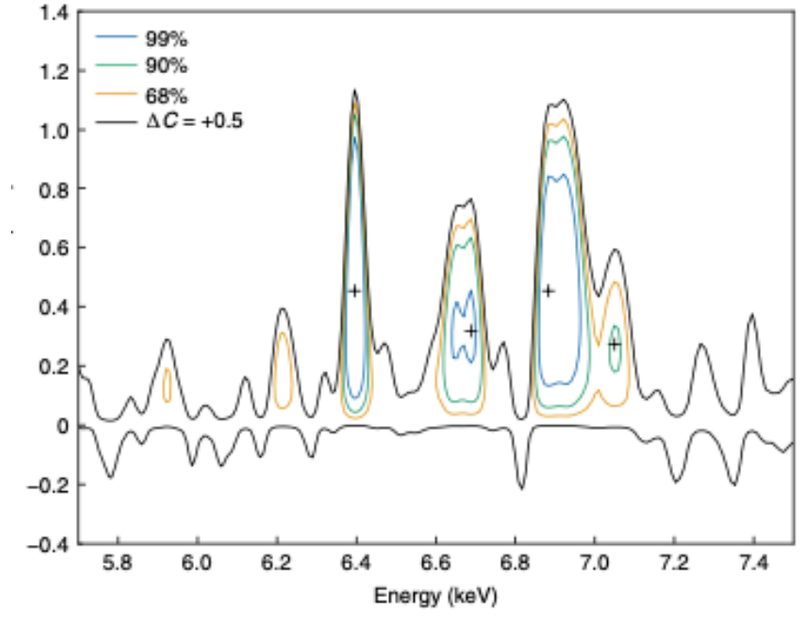


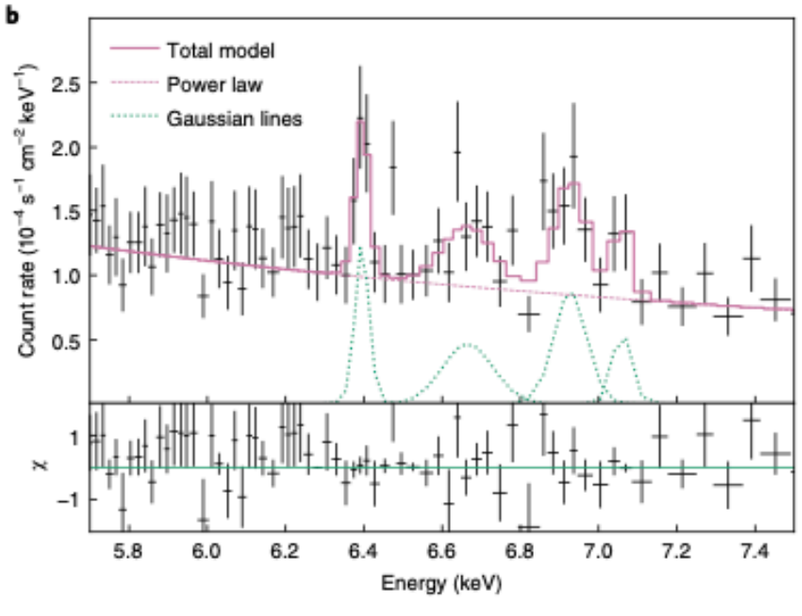
Result: no significant absorption in NGC 1275 — if like other AGN, would have found them.

LETTERS
https://doi.org/10.1038/s41550-021-01394-0
nature astronomy

An energetic hot wind from the low-luminosity active galactic nucleus M81*

Fangzheng Shi [1,2], Zhiyuan Li [1,2]✉, Feng Yuan [3,4]✉ and Bocheng Zhu [3,4]





Science Highlights (HETG GTO, Cycle 21, *in progress*)

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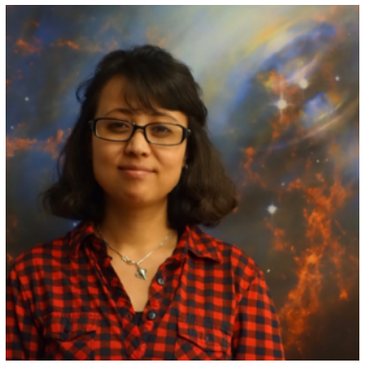
Pragati Pradhan
(MIT Postdoc)



IGR J16318-4848

Highly absorbed, High Mass X-ray Binary

(N_H ~ 10^{24} cm^{-2})

Narrow lines
-> likely from compact region

Weak/missing Compton shoulder
-> geometry, or composition

(Analysis underway, in conjunction with HETG zeroth order and NuSTAR spectra.)

250 ks HEG spectrum