

We study galaxy clusters as broad-band X-ray standard candles.

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Multi-Mission Study (MMS)

- Extension of cross-correlation bias analysis to other missions and instruments
- Begun in 2017, on hiatus 2019–2023
- Cluster sample criteria (flexible)
 - $kT > 6$ keV
 - $z < 0.1$
 - $>100,000$ cts in central 6 arcmin
 - center < 3 arcmin off-axis
- Action items for the Multi-Mission Study
 - Update compiled list of available clusters, ObsIDs, and t_{exp} for your mission that fulfill our criteria.
 - Most missions have supplied this information.

cluster	X	C	R	SW	SU
A85	☺	☺	☺	☹	☹
A119	☺	☺	☺	☹	☹
A399	☺	☺	☺	☹	☹
A401	☺	☺	☺	☺	☹
A478	☺	☺	☺	☹	☹
A754	?	☺	☹	☹	☹
A644	☺	☺	☺	☹	☹
A1413	☺	☺	☺	☹	☹
A1650	☺	☺	☹	☹	☹
A1651	☺	☺	☺	☺	☹
Coma	☺	☺	☺	☺	☺
A1689	☺	☺	☺	☹	☹
A1795	☺	☺	☺	☺	☺
A1914	☺	☺	☺	☹	☹
A2029	☺	☺	☺	☺	☺
A2065	☺	☺	☹	☹	☹
A2142	☺	☺	☺	☹	☹
A2163	?	?	☹	☹	☹
A2204	☺	☺	☺	☹	☹

X: XMM/EPIC

C: Chandra/ACIS

R: ROSAT/PSPC

SW: Swift/XRT

SU: Suzaku/XIS

A1835?

cluster	X	C	R	SW	SU
A2244	☺	☺	☺	☺	☺
A2255	☺	☺	☺	☹	☹
A2256	☺	☺	☺	☹	☺
A2319	☺	☺	☹	☹	☹
A3158	☺	☺	☹	☹	☹
A3266	?	☺	☹	☹	☹
A3391	☺	☺	☺	☹	☹
A3558	☺	☺	☹	☹	☹
A3571	☺	☺	☺	☹	☺
A3627	?	?	☺	☹	☺
A3667	?	☺	☺	☹	☺
A3827	☺	☺	☹	☹	☹
A3888	☺	☺	☺	☹	☹
Ophiu	☺	☺	☺	4ks	☺
Perse	☺	☺	☺	☺	☺
PKS0745	☺	☺	☺	☺	☺
RXCJ1504	?	?	?	☹	?
Triang	☺	☺	☺	☹	☺
ZwCl1215	☺	☺	☹	☹	☹

Multi-Mission Study (MMS)

IACHEC Clusters MMS Sample ☆ 📁 ☁

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Cluster	ObsID	ACIS-I exp(ks)	comments	Seq. no	exp(ks)	comments	ObsID	exp(ks)	comments	ObsID	exp(ks)	comments	ObsID	exp(ks)	comments	ObsID	exp(ks)	comments	ObsID	exp(ks)	comr	
A1795	Many	15		97820101	67		800012010	13		70660003002	99	another OBSID, 50 ks										
A2029	6160	10		551780301	47		804024010	8		70660001002	98											
A2199	10748	41		723801101	57		801056010	25		70660004002	84	another OBSID, 53 ks										
Perseus	11714	40		305780101	125		103004020	50	2009, representative	90202046004	28	2 additional OBSIDs, 20 ks				N0100201ss	40	Cycles 1+5+7	96396	40		
A85	15173	43																				

Mission

XMM-Newton
 Chandra ACIS
 Suzaku XIS
 NuSTAR
 Swift
 AstroSat
 HXMT
 EP FXT
 NICER
 eROSITA
 XRISM Xtend
 ROSAT

Contact

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 Craig Markwardt
 Michael Freyberg
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 ?

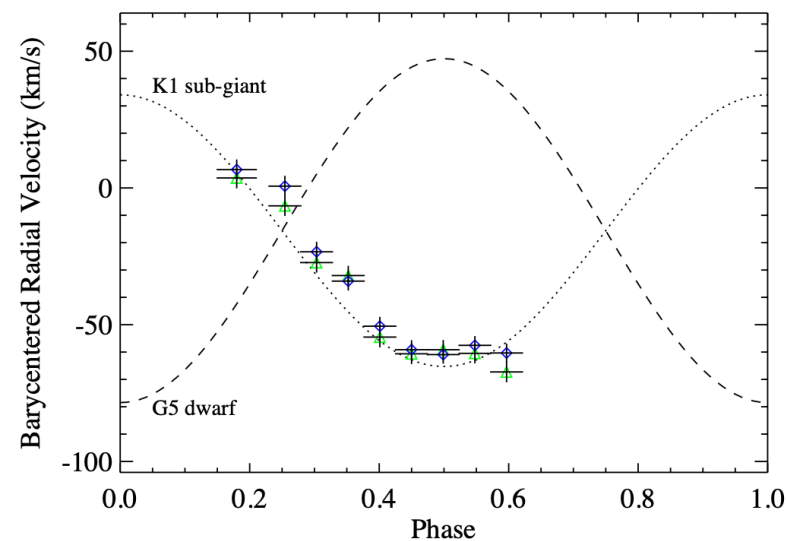
Future plans

- Review eROSITA+XMM+Chandra cluster temperature comparison: Migkas+2024, <https://ui.adsabs.harvard.edu/abs/2024arXiv240117297M>
- Collect data, extract spectra and responses (by mid-July).
- Focus on providing data for Calstats WG concordance effort.

HR 1099 observation



- Observation plan
 - 100 ksec in normal (HiRes) mode
 - 100 ksec in forced MidRes mode
 - Both with Fe55 FW and MXS (primary and redundant due to GVC)
- We expect:
 - 100–200 counts in Si, S, Ar lines at 1.8–3.1 keV
 - 1000s of counts in Cr, Mn, Cu calibration lines at 5.4–8 keV
 - Sufficient to constrain gain energy- and grade-dependence to < 1 eV



Chandra HETGS from 1999
Bozzo et al. 2024

- HR 1099 lines are narrow with well-behaved LoS velocity
- Chandra HETGS DDT 30-ksec observation will pin the binary phase
- XMM RGS observation on March 1 will provide good leverage on the binary phase

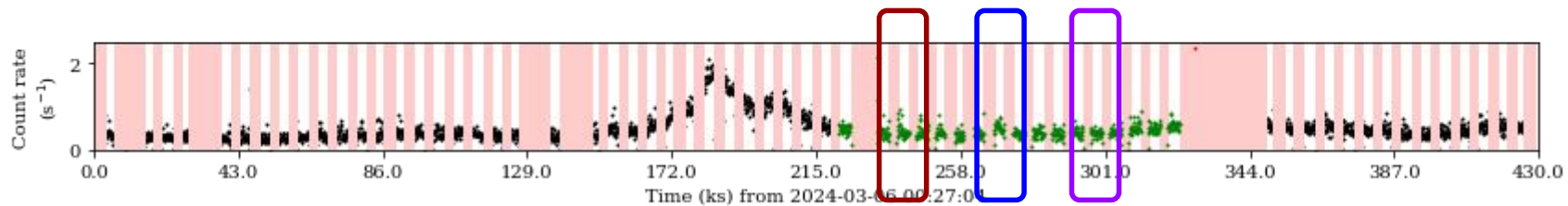
Chandra HETG analysis



Simultaneous HETG observation

obsid	Grating	Detector	obs_start	obs_end	Exposure (s)
29278	HETG	ACIS	2024-03-08T18:01:31	2024-03-08T21:35:11	10560
29315	HETG	ACIS	2024-03-09T01:58:11	2024-03-09T05:22:56	10060
29316	HETG	ACIS	2024-03-09T09:12:40	2024-03-09T12:27:51	9560

<XRISM obs> From: 2024-03-06T00:27:04 To:2024-03-10T23:33:56



29278 29315 29316

Could be nice reference for forced mid-res cal results