

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

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Clusters WG meeting



- 25 in-person, 3 on-line
 - 40% of attendees
 - interest remains in Clusters WG
- dormant since Nov 2021
- agenda
 - 09:00–09:30
Jukka Nevalainen, “XMM-Newton/EPIC effective area cross-calibration based on galaxy clusters”
 - 09:30–09:50
Further discussion of Monday's galaxy clusters plenary talks
 - 09:50–10:20
Status of Multi-Mission Study

Clusters WG meeting



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 - ~~09:00–09:30~~ **09:00–10:15**
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 - ~~09:30–09:50~~
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Status of Multi-Mission Study

J. Nevalainen, “XMM-Newton/EPIC effective area cross-calibration based on galaxy clusters”

- compare cluster fluxes in “independent” energy bins between EPIC pn, MOS1, MOS2

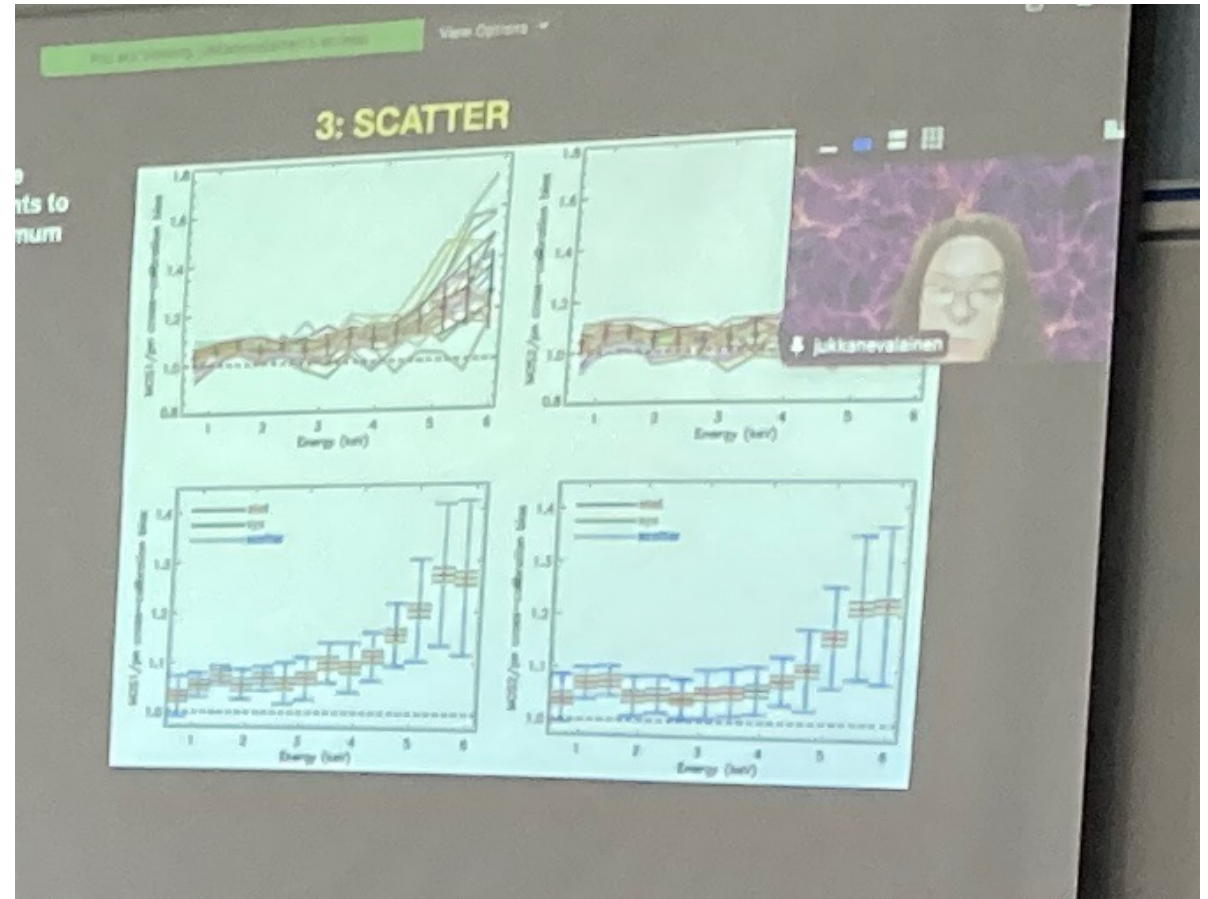
- pn spectrum modeled with spline

• Method 1:

$$R_{i/pn} = \frac{data_i}{model_{pn} \otimes resp_i} \times \frac{model_{pn} \otimes resp_{pn}}{data_{pn}}$$

- Method 2:
MOS to pn “bias” modeled with 4th order polynomial, parameter estimation done *before* RMF convolution

- results
 - large disagreement above 4 keV
 - large cluster-to-cluster scatter
- paper is in 2nd review



Multi-Mission Study (MMS)

- Extension of cross-correlation bias analysis to other missions and instruments
- Begun in 2017, on hiatus since 2019
- 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.
 → Ivan and Larry have supplied this information.
- Future plans
 - We have a path forward for the MMS. Need carrot/stick to continue Jukka's leadership.
 - (Eventually) provide data for Calstats WG concordance effort.

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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Navigation bar with zoom (75%), currency symbols, font settings (Helvetica, size 10), and alignment options.

	A	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T
1		Chandra ACIS-I			XMM-Newton MOS + pn			Suzaku XIS0,1,3			NuSTAR FPMA+B			Swift XRT		
2	Cluster	ObsID	ACIS-I exp(ks)	comments	Seq. no	exp(ks)	comments	ObsID	exp(ks)	comments	ObsID	exp(ks)	comments	ObsID	exp(ks)	comm
3	A478	6102	10													
4	Coma	13996	125													
5	A1795	Many	15													
6	A2029	6160	10													
7	A2199	10748	41													
8	Perseus	11714	40													
9	A85	15173	43													
10	A119	7918	49													
11	A399	3230	50													
12	A401	14024	140													
13	A754	577	40													
14	A644	24315	32													
15	A1413	--	--													
16	A1650	5823	40													
17	A1651	4185	10													
18	A1689	6930	80													
19	A1914	20026	32													
20	A2065	3182	50													

XMM-Newton
 Chandra ACIS
 Suzaku XIS
 NuSTAR
 Swift
 AstroSat
 HXMT
 NICER
 ROSAT

Ivan
 Larry
 Eric
 Dan
 Andy B
 Gulab
 Y. Chen
 Craig
 Kip or ?