Cross-Calibration of XRISM Resolve and Xtend: II. Line Ratio and Continuum-Based Temperature Measurements

> Kazunori Suda, Ituki Aihara, Nie Runqi, Kyoko Matsushita, Shogo Kobayashi (Tokyo University of Science)

Continuum and Line-based Temperature

Cross-Calibration of XRISM Resolve and Xtend : I. Temperature Measurements in Nearby Galaxy Clusters

Broad band fitting (3-15 keV)



⇒Temperature mainly determined by Continuum shape.

In this presentation, Narrow band fitting (1 keV width around Fe Heα/Lyα) ⇒Line Ratio based Temperature

Compare narrow band fitting with broad band fitting

Perform gaussian fits to Fe Line
 ⇒Compare Fe Heα/Lyα Ratio
 with atomdb values
 considering fitting effect.

Line Ratio-based Temperature

Fe Lyα/Heα Line Ratios of simulated spectra incorporating AtomDB



• Two methods for Temperature focused on the Fe Heα & Lyα



Counts / s / keV

Sample Clusters for narrow-band fitting

	A2319	A3571	Perseus	PKS 0745-19
Redshift	0.05	0.04	0.02	0.10
Fitting Range	6-7 keV	6-7 keV	6-7 keV	5.65-6.65 keV
Number of observations	3	4	4	1
Cool Core?	NCC	Weak CC	CC	CC
A2319 ~ 9 keV ~ 9 keV 6 6 6 En Lyα/H	6.4 6.6 ergy (keV) eα ratio	¹ ¹ ¹ ¹ ¹ ¹ ¹ ¹ ¹ ¹	++++++++++++++++++++++++++++++++++++++	PKS 0745-19 - 6 keV

Narrow-Band Fitting: Method

- Conducted Narrow Band Fitting on 4 Nearby Clusters.
- Model: TBabs × bapec+NXB
- The NXB parameters
 ⇒fixed to the values obtained from the broad-band fitting.
- Abandance Table : lpgs
- Errors correspond to 1σ confidence levels.



Narrow-band Temperature (Resolve vs Xtend)



Narrow band Abundance (Resolve vs Xtend)



 The central obs of Perseus shows clearly Large deviation. (excluded from this plot)

 For 3 obs of Perseus & 4 obs of A3571, Consistent between Resolve and Xtend within 1σ.

deviation exceeding
10% for PKS0745-19
& 2obs of A2319.

Resolve Temperature (3-15 vs 6-7 keV)



Xtend Temperature (3-15 vs 6-7 keV)



 Consistent between Resolve and Xtend within 10%.

Outer observation,deviation might be due to background

Resolve Abundance (3-15 vs 6-7 keV)



Xtend Abundance (3-15 vs 6-7 keV)



Gaussian fitting for Line Ratio-based temperature

- Fitting Model : TBabs × bapec(mod.)+NXB+zgaussians
- Line components(Hea-z,w & Lya1,2) removed from bapec model



Compare Line Ratio-based temperatures with broad-band fitting

Line Ratio vs Continuum based Temperature



Resolve vs CCDs Temperature & Abundance (6-7 keV)

• Compare Resolve and Xtend results with Suzaku and XMM.



Summary

• Analyzed 4 nearby galaxy clusters (A2319, A3571, Perseus, PKS 0745-19) using XRISM (Resolve & Xtend).

• Cross-calibration focused on Fe Heα & Lyα lines via narrow-band (6-7 keV) and Gaussian fitting.

- Narrow-band (6-7 keV) fitting:
 - Resolve & Xtend temperatures consistent within 10% for 4 clusters.
 - Abundances generally consistent within 1σ, some deviations noted.
- Comparison with Broadband (3-15 keV) fitting:
 - Temperatures consistent within 2σ (Resolve) / 10% (Xtend).
 - Perseus outer regions: Broad-band temp. higher.

• Abundances show good agreement, larger deviations at low abundance (Xtend).

Gaussian fitting (Fe Heα & Lyα line ratios):

• Temperatures consistent with broadband results within 1σ for A2319 & PKS 0745-19.

Future work: More detailed multi-mission analysis.