XMM-Newton — Chandra
Blazar
Flux Comparison
Blazar Sample
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Objective: Comparison of XMM-Newton — Chandra fluxes in various bands.

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16 coordinated XMM-Newton / Chandra observations, resulting in 31 strictly simultaneous GTIs for flux comparison.
Analysis Details (I)
Data reduction:
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Energy bands are those used in the XMM-Newton Cross Cal Archive:
• 0.15 – 0.33 keV (Lower EPIC bound – Lower RGS bound)
• 0.33 – 0.54 keV (Up to the O-edge)
• 0.54 – 0.85 keV (O-VII, O-VIII)
• 0.85 – 1.50 keV (Ne-IX, Ne-X)
• 1.50 – 4.00 keV
• 4.00 – 10.0 keV
Analysis Details (II)
Normalise fluxes within simultaneous exposures (GTIs) to compare instruments across observations:

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- Chandra instrument configurations vary from exposure to exposure
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» Use as benchmark the Joint Fit Flux of all instruments in use in a particular exposure.
Results
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With results presented at the previous IACHEC (April ’09):

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Main changes which affect flux comparisons:

- **Calibration**: ACIS Contamination Model and HRC-S QE upgrades.
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Results

Flux Method: II

Version:
SAS9.0 – CIAO4.2/CALDB4.2.0

Targets:
3C273
H1426+428
Mkn421
Mkn590
PKS2155-304
Results

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Version:
SAS9.0 - CIAO4.2/CALDB4.2.0

Targets:
3C273
H1426+428
Mkn421
Mkn590
PKS2155-304
Results

Flux Method: II
Version:
SAS6.0 - CIA04.2/CALDB4.2.0
Targets:
3C273
H1426+428
Mkn421
Mkn590
PKS2155–304
0.15 – 0.33 keV

Relative Flux, 0.15 - 0.33 keV Band

Flux Method: II

Version: SAS9.0 - CIAO4.2/CALDB4.2.0 ISIS

Targets:
- 3C273
- H1426+428
- Mrk421
- PKS2155-304
0.33 - 0.54 keV  New

Relative Flux, 0.33 - 0.54 keV Band

Flux Method: II

Version:
SAS9.0 - CIAO4.2/CALDB4.2.0 ISIS

Targets:
3C273
H1426+428
Mkn421
PKS2155-304
0.33 – 0.54 keV  New

Relative Flux, 0.33 - 0.54 keV Band

Flux Method: II
Version: SAS9.0 - CIA04.2/CALDB4.2.0 ISIS
Relative Flux, 0.54 - 0.85 keV Band

Flux Method: II

Version:
SAS8.0 - CIAO4.1/CALDB4.1.1 ISIS

Targets:
3C273
H1426+428
Mrk421
PKS2155-304
0.54 - 0.85 keV    New

Relative Flux, 0.54 - 0.85 keV Band

Flux Method: II

Version: SAS9.0 - CIAO4.2/CALDB4.2.0 ISIS

Targets:
3C273
H1426+428
Mkn421
PKS2155-304
Relative Flux, 0.85 - 1.50 keV Band

Flux Method: II

Version:
SAS8.0 – CIAO4.1/CALDB4.1.1 ISIS

Targets:
3C273
H1426+428
Mkn421
PKS2155–304

XMM-Newton
Michael Smith, ESAC

0.85 - 1.50 keV
Old
0.85 - 1.50 keV  New

Relative Flux, 0.85 - 1.50 keV Band

Flux Method: II

Version:
SAS9.0 - CIAO4.2/CALDB4.2.0 ISIS

Targets:
3C273
H1426+428
Mrk421
PKS2155-304
Relative Flux, 1.50 - 4.00 keV Band

Flux Method: II

Version:
SAS8.0 - CIAO4.1/CALDB4.1.1 ISIS

Targets:
3C273
H1426+428
Mrk421
PKS2155-304
1.50 – 4.00 keV

Relative Flux, 1.50 – 4.00 keV Band

PN
M1
M2
R1
R2
ACISS-LEG
ACISS-MEG
ACISS-HEG
HRCS-LEG
HRCS-LEG

Flux Method: II

Version:
SAS9.0 – CIAO4.2/CALDB4.2.0 ISIS

Targets:
3C273
H1426+428
Mrk421
PKS2155–304
4.00 - 10.0 keV  Old

Relative Flux, 4.00 - 10.00 keV Band

Flux Method: II

Version:
SAS6.0 - CIAO4.1/CALDB4.1.1 ISIS

Targets:
3C273
H1426+428
Mkn421
PKS2155-304"
4.00 – 10.0 keV

Relative Flux, 4.00 - 10.00 keV Band

Normalized to Combined

Flux Method: II

Version:
SA59.0 – CIA04.2/CALDB4.2.0 ISIS

Targets:
3C273
HC26+428
Mkn421
PKS2155–304
Mean Relative Flux

Mean Relative Flux per Energy Band

Flux Method: II

Version:
SAS9.0 - CIAO4.2/CALDB4.2.0 ISIS
Mean Relative Flux

Mean Relative Flux per Energy Band

Flux Method: II

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Mean Relative Flux per Energy Band

Flux Method: II
Version: SA59.0 - CIA04.2/CALDB4.2.0 ISIS
ACIS-S Spectra in 0.33-0.54 keV (I)

Relative Phl, 0.33 - 0.54 keV Band

Flux Method: II
Version: SAS9.0 - CIAO4.2/CALDB4.2.0 ISIS
Targets: 3C273
H1426+428
Mkn421
PKS2155−304
ACIS-S Spectra in 0.33-0.54 keV (II)

Relative norm, 0.33 - 0.54 keV Band

Flux Method: II

Version:
SAS9.0 - CIAO4.2/CALDB4.2.0 ISIS

Targets:
3C273
H1426+428
Mkn421
PKS2155-304
ACIS-S Spectra in 0.33-0.54 keV (III)
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0.33 - 0.54 keV Band
PKS21E5-304 0124930301/3188 (Rev 0362)
PN/SW/1M N1/SW/1K M2/SW/MD R1-1 R2-1 ACISS/LEG-1 ACISS/LEG+1

Counts / s / keV

Epic Ratio

ROS Ratio

LEO Ratio

Energy (keV)

-1 Order
Conclusions

HRC-S LETG

Huge improvement with new Chandra calibration; still a trend:
• from 5 - 10% flux deficit w.r.t. EPIC below 0.33 keV
• to 10 - 20% excess above 1.5 keV
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ACIS contaminant model has greatly improved situation in 0.33 - 0.54 keV band: fluxes mostly well within ± 10%, however May 2009 data show 15% deficit.
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ACIS-S LETG & HETG

Above 0.54 keV, an excess of 0 - 10% w.r.t. PN, better agreement with MOS fluxes.