XMM-Newton — Chandra Blazar Flux Comparison

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Featureless spectra over 0.1 – 10.0 keV

Bright:
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Highly variable, even within observation timescale:
- require XMM / Chandra / … coordinated observations
- simultaneous GTIs across instruments
- normalise fluxes to compare between observations
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21 XMM-Newton observations coordinated with Chandra:
- 36 strictly simultaneous GTIs for flux comparison

Instruments being compared are:
- EPIC, RGS, ACISS-L/HETG, HRCS-LETG
Energy bands:

- 0.15 – 0.33 keV (Lower EPIC - Lower RGS bound)
- 0.33 – 0.54 keV (Up to the O-edge)
- 0.54 – 0.85 keV
- 0.80 – 1.20 keV  O-VII/VIII , Ne-IX/X
- 1.20 – 1.50 keV
- 1.50 – 1.82 keV (Up to the Si-edge)
- 1.82 – 2.20 keV (Up to the Au-edge)
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- Spectral fitting: model consists of:
  - multiple independent power laws
  - absorption with nH fixed
    - PKS 2155-304: $1.42 \times 10^{20}$ cm$^{-2}$
    - 3C 273: $1.79 \times 10^{20}$ cm$^{-2}$
    - H 1426+428: $1.36 \times 10^{20}$ cm$^{-2}$
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Per simultaneous exposure:
- fit each instrument independently
- determine band fluxes from resulting best fits.
Normalise fluxes within simultaneous exposures (GTIs) to compare instruments across observations:

- Preferably use the same reference across all GTIs and bands. However, no instrument fulfills condition in every case:
  - PN & MOS: Timing Mode exposures not included in analysis;
  - RGS: no data in the lower or higher bands;
  - Chandra instrument configurations vary from exposure to exposure.
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- For 36 simultaneous exposures: a total of 215 spectral fits.

Data reduction:
- SAS 13.5 + CCFs as of April 2014
- CIAO 4.6.1 + CALDB 4.6.1
Systematic uncertainties:

- **Pile-up:**
  - EPIC requires excision of PSF core: use source extraction annuli.
  - Per observation: for both MOSs use the largest common outer radius within window, and a common inner radius.
  - However, radii vary from observation to observation, and are generally different from the PN radii.
  - Differing annuli may introduce systematic uncertainties due to imperfect EE correction and RMF weighting.
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- **PN background:**
  - Extracted from regions within the small window: some degree of source contamination.
Mean ratio of PN fluxes derived with **CLOSED filter background** to those using **observational background**
Mean Normalised Fluxes

![Mean Normalised Flux per Energy Band](image)

Flux Method: III
Version: SAS13.5.0 - C4A04.6.1CALDB4.6.1
Mean Normalised Fluxes

2XMM, On-Axis
(Read et al. 2014)
Mean Normalised Fluxes
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The graph shows the mean normalised flux per energy band for different energy levels. The data includes PN, M1, M2, R1, and R2 normalisation methods. The flux methods and versions are indicated in the figure.