Mem. S.A.It. Vol. 75, 561

Memorie della

XMM-Newton Multiwavelength Calibrations

B. Chen, N. Schartel, M. G. F. Kirsch, M. J. S. Smith, B. Altieri and A. M. T. Pollock

ESA Villafranca Satellite Tracking Station, Apartado 50727, 28080 Madrid, Spain e-mail: bchen@xmm.vilspa.esa.es

Abstract. In this article we identify candidates for suitable X-ray calibration targets that can be used to help calibrate the X-ray instruments. For a given object, assuming the same mechanism is operating over the optical/UV and X-ray energy bands, we can use optical/UV data to fix the parameters of Spectral Energy Distribution (SED), and then use the known SED to compare with the measured X-ray fluxes. We illustrate this with the hot white dwarf G191-B2B and the BL Lac object PKS 2155-304.

Key words. Calibration – Hot white dwarfs – PKS2155-304

1. Introduction

XMM-Newton is an X-ray space observatory, which also has a coaligned 30 cm optical/UV telescope called the Optical Monitor (OM). Extensive calibration works are in progress for each instrument, and there seem to be still some cross calibration issues to solve (Section 2).

In this article, we demonstrate that hot white dwarfs (Section 3) can help us to calibrate the low energy channels ($< \sim 1.0$ kev), and the BL Lac object PKS2155 -304 (Section 4) can be used to monitor the instrument performance for in-flight calibration over almost all of the X-ray energy band.

2. *XMM-Newton* cross-calibration

RXJ1856, the brightest isolated neutron star in X-rays, has been observed with *XMM-Newton*. The top panel of Fig. 1 shows simultaneous fits to pn, MOS, RGS1/RGS2 data. In general, the agreement is quite good between pn and MOS, however, there is a systematic trend between EPIC and RGS. The measured flux for RGS in the energy range 0.3 - 1.0 kev is 4.7 $\times 10^{-12}$ erg/cm^2/s, smaller than that measured for pn (8.0×10^{-12} erg/cm^2/s) and MOS (7.6 $\times 10^{-12}$ erg/cm^2/s). Similar results have been found from other two isolated neutron stars (RXJ0720 and RXJ0806).

3. G191-B2B

The complete SED of hot white dwarfs from optical wavelengths to X-rays can be modelled by a pure hydrogen model atmosphere. The physical parameters have been well determined from optical observations. Fig. 2 shows the complete SED, The normalization factor has been constrained by the OM data, thus fixing the complete SED over a very wide energy range. Therefore we can use it to help calibrate EPIC cameras. The detailed results from

Send offprint requests to: Bing Chen
Correspondence to: ESA/Vilspa, 28080, Madrid, Spain

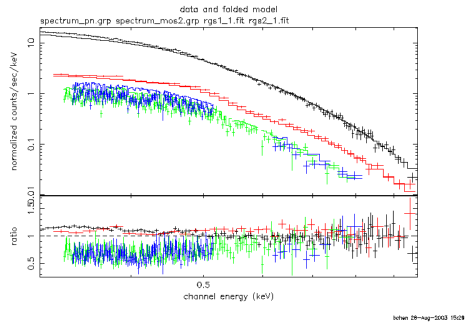

Fig. 1. The top panel shows the countrate spectra of RXJ1856 obtained with *XMM-Newton* with simultaneous fits to pn (Black), MOS (Red), RGS1/RGS2 (Blue/Green) data.

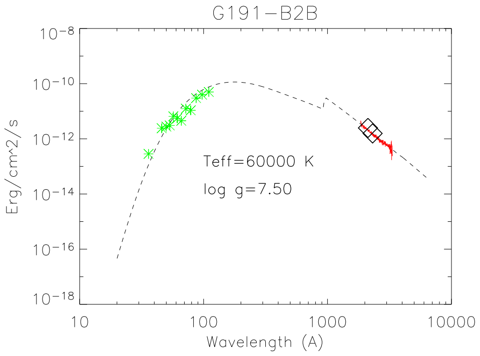

Fig. 2. The overall SED of white dwarf G191-B2B altogether with the OM (black squares), IUE (red), and XMM pn (green).

two OM calibration sources (G191-B2B and GD153) will be reported elsewhere.

4. PKS 2155-304

The BL Lacertae object PKS 2155-304 has been monitored intensively in a frenquency range from optical to X-rays. Fig. 3 shows the overall SED from simultaneous X-ray, optical

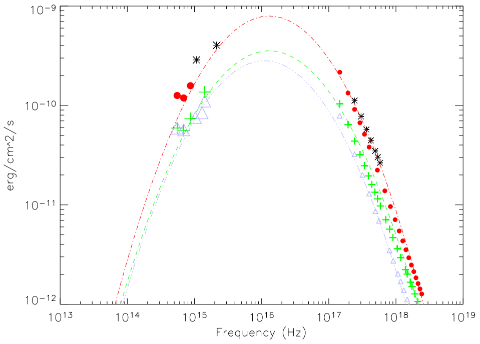

Fig. 3. Simultaneous X-ray (at the right-hand side) and optical/UV SED of PKS 2155-304. Three *XMM* observations from Rev. 362, 450, 545 are plotted as blue triangles, green crosses, and red circles respectively. The black asterisks are from the intensive multiwavelength monitoring campaign in Nov. 1991 with ROSAT and IUE.

and UV observations. The source is variable, but the X-ray, UV, and optical light curves are well-correlated, arguing for a common origin of the optical through X-ray emission. OM data can be used to define the emission state of the source and constrain the model parameters. Once the model parameters are fixed, we can use the SED in the X-rays to monitor the EPIC performance for in-flight calibration purposes.

5. Conclusions

In this article we propose to use hot white dwarfs and the BL lac object PKS 2155-304 to get absolute flux calibrations of the X-ary instruments with the help of OM data. Work is still underway.

Acknowledgements. Thanks to *XMM-Newton* SOC science support team members, especially Leo Metcalfe for his support.