The eROSITA background

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1. Introduction

The eROSITA background has been simulated based on photon and high-energy particle spectral components. The cosmic diffuse photon X-ray background has been adopted from Lumb et al. (2011, http://arxiv.org/abs/astro-ph/0204147) and the high-energy particle background, which does not interact with the mirror system has been calculated by Tenzer et al. (Geant4 simulation studies of the eROSITA detector background, Proceedings of SPIE, 7742, 2010). The expected background count rate has been compared with XMM-Newton observations, which might provide the best test for the X-ray background for eROSITA around the Lagrangian point L2 before real X-ray background data will become available. The comparison of the eROSITA background model with XMM-Newton is described in Section 3. In addition, the count rate plots available at http://xmm.vilspa.esa.es/external/xmm_sw_cal/background/bs_countrate.shtml#14, give an estimate of the to-be-expected scatter of the eROSITA background in 'low background' periods. Deviations from the mean value by factors of about 2 to 3 might occur.

2. Spectral components included in the eROSITA background simulations

2.1 The photon X-ray background

The currently best available model for the diffuse overall photon cosmic X-ray background is that of Lumb et al. (2011, http://arxiv.org/abs/astro-ph/0204147). The extragalactic unresolved background emission is modeled with a photon index of 1.42 and a normalization of 9.03 photons keV^{-1} cm^{-2} s^{-1} sr^{-1}. The optically thin background emission from the Milky Way is modeled with two mekal models with temperatures of kT_1 of 0.204 keV and kT_2 of 0.074 keV with normalizations of 7.59 and 116 photons keV^{-1} cm^{-2} s^{-1} sr$^{-1,}$, respectively. The values are listed in Table 3 of Lumb et al. (2011). A Galactic foreground absorption of 1.7×10^{20} cm^{-2} has been assumed.

2.2. The high energy particle background

The high energy particle background has been modeled by C. Tenzer et al. (2010) with and a normalization of 1151 counts keV^{-1} s^{-1} sr^{-1} and a flat spectral energy distribution with a photon index of 0.0.

3. Comparison of the the eROSITA background model with XMM-Newton

Table 1 I shows the comparison between the observed XMM-Newton count rate for the medium filter (without particle background, c.f. Read and Ponman, A&A 409, 395, 2003, Table 7) and the simulated photon plus particle eROSITA background count rates. The overall diffuse cosmic photon X-ray emission from the Lumb et al. (2011) model is in good agreement with the observations obtained by XMM-Newton. At energies above 5 keV the high energy particle background dominates the spectral energy distribution.

Table 1
Comparison of the XMM-Newton photon background with the eROSITA photon background

Energy band [keV]	0.2-0.5	0.5-2.0	2.0-4.5	4.5-7.5	7.5-12.0
simulated photon+particle count rate [10^{-3} cts s^{-1} $arcmin^{-2}$]	1.83	2.19	0.36	0.31	0.44
simulated particle count rate [10^{-3} cts s^{-1} $arcmin^{-2}$]	0.028	0.15	0.24	0.29	0.44
XMM PN fm observed count rate [10^{-3} cts s^{-1} $arcmin^{-2}$]	1.13+-0.50	2.04+-0.94	0.72+-0.36	0.64+-0.36	0.68+-0.48

4. The simulated mean eROSITA background model

Based on the spectral model parameters described above and the comparison with XMM-Newton, the mean eROSITA background count rate model is shown in Fig. 1.

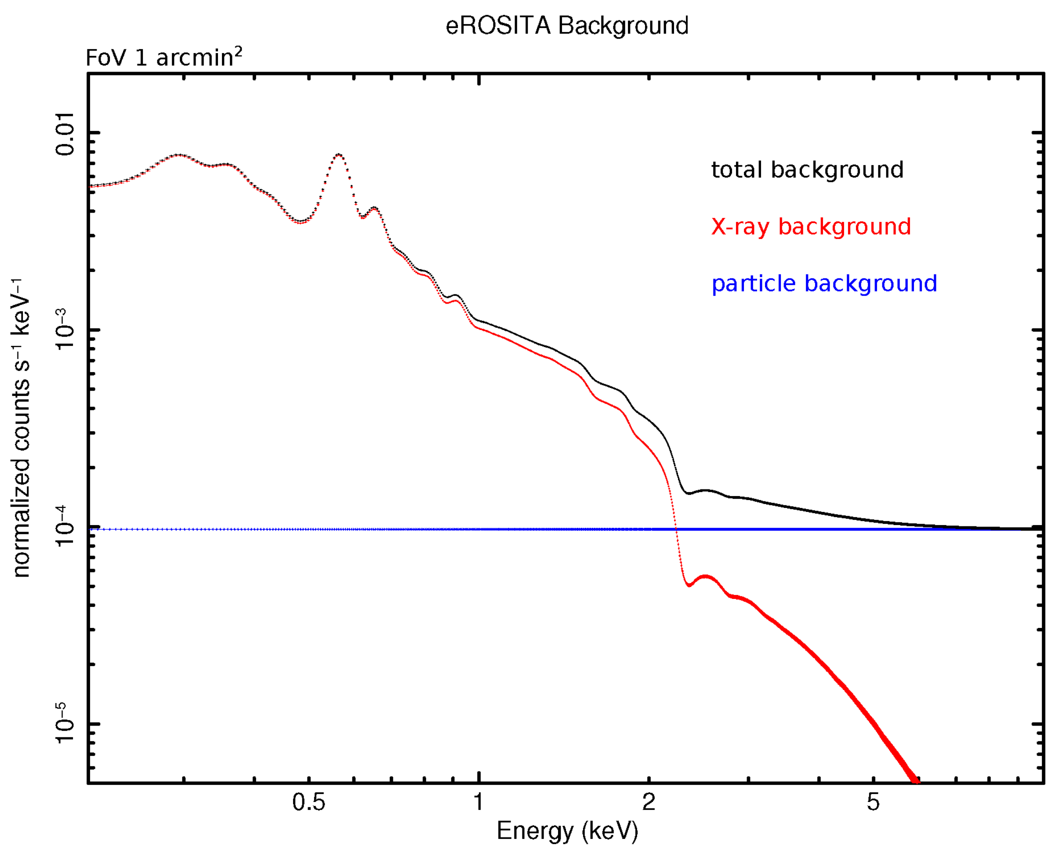

Fig. 1: eROSITA background model

In Table 2 the eROSITA background count rates values in the presently defined standard energy bands are listed.

TABLE 2
eROSITA photon and particle background count rates for different energy bands

Energy band [keV]	0.2-0.5	0.5-1.0	1.0-2.0	2.0-4.0	4.0-8.0	2.0-7.0	2.0-10.0
simulated photon+particle count rate [10^{-3} cts s^{-1} $arcmin^{-2}$]	1.83	1.50	0.68	0.31	0.42	0.62	0.92