Test of the Background Estimator

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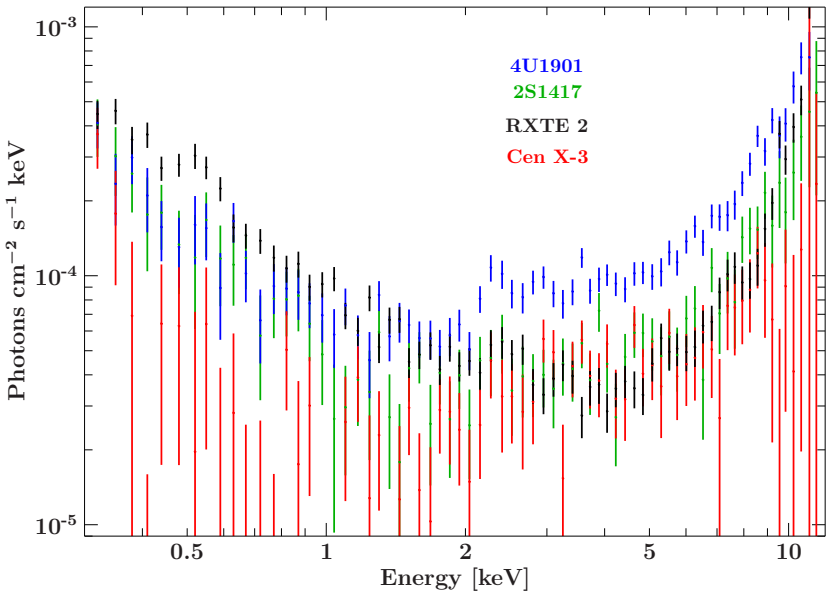

Figure 1: Estimated Background spectra of Cen X-3, 4U 1901+3 and 2S 1417 and the measured background BKGD_RXTE_2.

I tested the program "bkg_estimator.py" to estimate the NICER background on observations of Cen X-3, 4U 1901+03 and 2S1417-624. (ObsID 1034070104, 2200570104 and 1200130114)

The estimator consistently produced spectra similar to the reference observation of the background field BKGD_RXTE_2. A comparison of the background spectra is shown in Fig. 1. Since all those observations are dominated by the source spectra, these differences between the different backgrounds are insignificant.

During the observation of Cen X-3 several "flares" contaminated the spectrum while NICER passed close to the SAA. This led to a vastly increased background especially at higher energies (> 8 keV), as shown in Fig. 2. The

estimated background, however did not change significantly during that period as the space weather apparently stayed fairly constant.

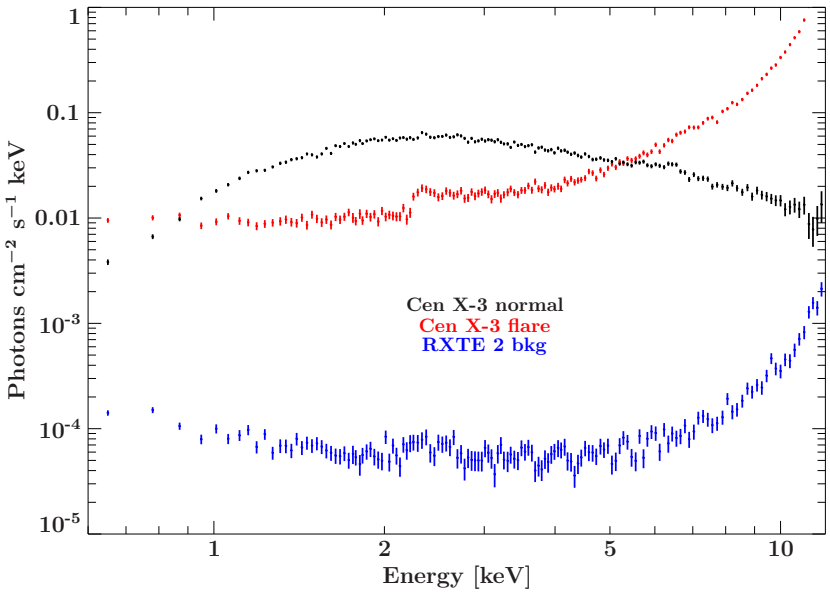

Figure 2: Plot of the NICER spectrum of Cen X-3 during a flare (red) and in normal state (black). The estimated background (which is basically the same in both cases) is shown in blue.

One minor issue:
For the observation of Cen X-4 and 4U 1901 sometimes no background events were found for certain combination of KP, COR and Sun_Angle. As a consequence the program breaks down with the following error message:

```
  File "/home/thalhammer/python/nicer/bkg/bkg_estimator.py", line 328,
  in mk_bkg_spec_evt
    print("     Source exposure = {0:.3f}; Background exposure = {1:.3f}"
    .format(sexpo, bexpototsa))
UnboundLocalError: local variable 'bexpototsa' referenced before assignment
```

Commenting out the *print* statement or assigning a value, e.g. zero, to *bexpototsa* in the preceding else statement solved that problem.