FLIX
Sensitivity estimator

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FLIX: Flux Limits from Images from XMM-Newton

Goal

• Produce estimates of the detection threshold of the X-ray flux at a given point in the sky where no source was detected in the 4XMM survey.

• Replace and update existing FLIX sensitivity estimator

• Modern web application with simple and intuitive user interface.

• Ability to handle large user requests through files
**FLIX: Flux Limits from Images from XMM-Newton using DR7 data**

FLIX is an upper limit server for XMM-Newton data, provided by the XMM-Newton Survey Science Centre at the University of Leicester. It is based on 3XMM Data Release 7 data provided by the XMM-Newton Survey Science Centre Consortium.

**New:** a portable version of FLIX called PFLIX is now available to run on your own computer, it downloads the data it needs from ESAC. See [details here and download the `pflix_source.f90`](#). (Note: use a right-click and choose save-as on most browsers).

- The ECFs (energy conversion factors) for bands 1-5, 8, and 9 are taken from the [catalogue documentation](#) (except for the pseudo-bands 6 and 7 which just take the appropriate arithmetic mean, so are probably inaccurate).
- The FITS file has a set of additional columns providing the ECF value used, so that the count-rate upper-limit may be computed from the flux upper-limit.
- The latest version (2023 March 8) includes the data processing date for each observation.

What FLIX does: if you provide a position of interest on the sky (or a text file with a list of positions) FLIX scans the public data products from XMM-Newton to determine whether each point was observed. If so FLIX:

- Estimates an upper limit to the X-ray flux at that point in various energy bands,
- Provides a crude estimate of the actual flux within a circle centred on that point,
- Scans the [3XMM catalogue](#) listing any detections within 2 arc-minutes, and extracts a thumbnail X-ray image centred on the point.

Results are returned in the form of HTML tables and as a downloadable FITS file. For further information on input and outputs, see the online [FLIX help file](#).

<table>
<thead>
<tr>
<th>Enter either: RA and DEC of point of interest</th>
<th>For example: 12:34:56 -12:34:56 optional identifier</th>
</tr>
</thead>
<tbody>
<tr>
<td>Or: Text file with one position per line:</td>
<td>Choisir le fichier, aucun fichier sélectionné</td>
</tr>
</tbody>
</table>

**Detection likelihood threshold for upper-limits** 10.0 (default 10.0 means 4-sigma, see [help](#) for more details)

**Radius of circle [arcsec] for the flux estimation** 30.0

<table>
<thead>
<tr>
<th>For HTML output: select energy bands for upper-limits</th>
<th>And select energy bands for encircled flux and error</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.2-0.5 keV 0.5-1.0 keV 1.0-2.0 keV 2.0-4.5 keV 4.5-12 keV</td>
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</tr>
<tr>
<td>band 1 band 2 band 3 band 4 band 5</td>
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</tr>
<tr>
<td>band 6 band 7</td>
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</tr>
<tr>
<td>band 8</td>
<td>band 8</td>
</tr>
<tr>
<td>band 9</td>
<td>band 9</td>
</tr>
</tbody>
</table>

**Thumbnail images:** none 2 4 8 16 (arcmins)

**Image overlays:** none circle at specified position also 3XMM sources and SRCID numbers

**Show nearest field centre when position is not in field-of-view** yes no

(Note: FLIX may take several seconds per source position, please be patient).

This version writes a row to the FITS file even if there are no data from XMM-Newton for the specified position, so that for a list of N positions, there will be at least N rows in the FITS file produced. The FITS file now includes columns...
Sensitivity estimate based on algorithm from Carrera et al. (2007)

- Uses exposure and background maps together with empirical relationship between observed count rates of detected sources and expected Poisson count rate

- Additionally: computes estimate of actual (background subtracted) flux as measured from XMM images

- Soon: sensitivity estimates based on stacked catalogue and data products
THE FLIX INTERFACE

http://flix.irap.omp.eu/

Will be open source

THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION’S HORIZON 2020 RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT NO 101004168
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FLIX

Sensitivity Estimator

Link to observation in XSA

[Image of FLIX interface]

Query coordinates:
12h33m34.1904s -10d10m26.598s

Detection maximum likelihood threshold: 10
Radius of circle for flux estimation (arcsec): 30

Nearest sources in XMM catalogue:
- 208301909010018 (15.91")
- 208301909010078 (31.01")
- 208301909010026 (75.09")
- 208301909010121 (82.56")
- 208301909010119 (91.35")
- 2083019090101010 (103.04")

Average detection threshold - band 8: 5.1e-15 erg/cm²/s
Average encircled flux - band 8: 7.7e-14 erg/cm²/s

Observations of this field at different epochs

<table>
<thead>
<tr>
<th>Obsid</th>
<th>Date Obs</th>
<th>Axis Offset (arcmin)</th>
<th>Instrument</th>
<th>Filter</th>
<th>Exposure (sec)</th>
<th>Detection Threshold - band 8 (erg/cm²/s)</th>
<th>Encircled Flux - band 8 (erg/cm²/s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0830190901</td>
<td>2018-06-22</td>
<td>0.0</td>
<td>M1</td>
<td>Thin1</td>
<td>56935</td>
<td>6.28e-15</td>
<td>8.00e-14 ± 5.68e-15</td>
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<td></td>
<td></td>
<td></td>
<td>M2</td>
<td>Thin1</td>
<td>59942</td>
<td>5.53e-15</td>
<td>6.96e-14 ± 5.38e-15</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>PN</td>
<td>Thin1</td>
<td>47339</td>
<td>3.48e-15</td>
<td>8.06e-14 ± 3.39e-15</td>
</tr>
</tbody>
</table>

Download full results as: FITS

More bands

http://xmm-catalogue.irap.omp.eu

Link to info for each source in XSA
FLIX

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Query coordinates: 12h33m34.1904s -10d10m26.598s

Detection maximum likelihood threshold: 10
Radius of circle for flux estimation: 30''

Nearest sources in XMM catalogue:
- 208301909010018 (15.91°)
- 208301909010078 (31.01°)
- 208301909010026 (70.6°)
- 208301909010121 (92.56°)
- 208301909010119 (91.35°)
- 208301909010101 (103.04°)

Average detection threshold - band 8: 5.1e-15 erg/cm2/s
Average encircled flux - band 8: 7.7e-14 erg/cm2/s

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Detection threshold in other energy bands

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<tr>
<th>Inst</th>
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<th>Band 2</th>
<th>Band 3</th>
<th>Band 4</th>
<th>Band 5</th>
<th>Band 6</th>
<th>Band 7</th>
<th>Band 8</th>
</tr>
</thead>
<tbody>
<tr>
<td>M1</td>
<td>1.44e-15</td>
<td>1.31e-15</td>
<td>1.66e-15</td>
<td>3.65e-15</td>
<td>2.96e-14</td>
<td>2.43e-15</td>
<td>1.14e-14</td>
<td>3.35e-15</td>
</tr>
<tr>
<td>M2</td>
<td>1.23e-15</td>
<td>1.17e-15</td>
<td>1.44e-15</td>
<td>3.25e-15</td>
<td>2.61e-14</td>
<td>2.25e-15</td>
<td>1.03e-14</td>
<td>2.90e-15</td>
</tr>
<tr>
<td>PN</td>
<td>5.87e-16</td>
<td>5.37e-16</td>
<td>5.24e-16</td>
<td>2.97e-15</td>
<td>1.61e-14</td>
<td>1.17e-14</td>
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THANK YOU