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The XMM-Newton serendipitous survey.

VII. The third XMM-Newton serendipitous source catalogue.

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Mission_Name: XMM

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Abstract:

Thanks to the large collecting area ($3\text{x}\sim 1500\text{cm}^2$ at 1.5keV) and wide field of view ($30'$ across in full field mode) of the X-ray cameras on board the European Space Agency X-ray observatory XMM-Newton, each individual pointing can result in the detection of hundreds of X-ray sources, most of which are newly discovered. Recently, many improvements in the XMM-Newton data reduction algorithms have been made. These include enhanced source characterisation and reduced spurious source detections, refined astrometric precision of sources, greater net sensitivity for source detection and the extraction of spectra and time series for fainter sources, with better signal-to-noise. Further, almost 50% more observations are in the public domain compared to 2XMMi-DR3, allowing the XMM-Newton Survey Science Centre (XMM-SSC) to produce a much larger and better quality X-ray source catalogue. The XMM-SSC has developed a pipeline to reduce the XMM-Newton data automatically and using improved calibration a new catalogue version has been made from XMM-Newton data made public by 2013 Dec. 31 (13 years of data). Manual screening ensures the highest data quality. This catalogue is known as 3XMM. In the latest release, 3XMM-DR5, there are 565962 X-ray detections comprising 396910 unique X-ray sources. For the 133000 brightest sources, spectra and lightcurves are provided. For all detections, the positions on the sky, a measure of the detection quality, and an evaluation of variability is provided, along with the fluxes and count rates in 7 X-ray energy bands, the total 0.2-12keV band counts, and four hardness ratios. To identify the detections, a cross correlation with 228 catalogues is also provided for each X-ray detection. 3XMM-DR5 is the largest X-ray source catalogue ever produced. Thanks to the large array of data products, it is an excellent resource in which to find new and extreme objects.

Description:

The 3XMM-DR5 catalogue is the third generation catalog of serendipitous X-ray sources from the European Space Agency's (ESA) XMM-Newton observatory, and has been created by the XMM-Newton Survey Science Centre (SSC) on behalf of ESA. The catalog has 354 more observations and 34701 more detections than the preceding 3XMM-DR4 catalog, which was made public in July 2013.

The history of the versions can be summarized as:

Name	DR#	Designation	Year	Cat.	#Sources
2XMMp	0	2XMMp-DR0	2006		
2XMM	1	2XMM-DR1	2007	IX/39	191870
2XMMi	2	2XMMi-DR2	2008	IX/40	221012
2XMMi-DR3	3	2XMMi-DR3	2010	IX/41	262902
3XMM-DR4	4	3XMM	2013	IX/44	372728
3XMM-DR5	5	3XMM	2016	IX/46	396910

The production and content of the 3XMM catalogue is described in the the 3XMM-DR4 User Guide at

http://xmmssc.irap.omp.eu/Catalogue/3XMM-DR5/3XMM-DR5_Catalogue_User_Guide.html

The "slim" version of the catalogue (file "xmm3r5s.dat") contains one row per unique source, while the the main catalogue has one row per detection. This slim version includes 44 columns, essentially those containing information about the unique sources, while the full catalogue (file "xmm3r5.fit") describes all detections with 323 columns. The slim version also contains a column with links to the summary pages in the IRAP catalogue archive.

In the case of sources with multiple detections the summary page of the best detection is selected (i.e., the detection with the largest exposure time, summed over all cameras), and the summary page gives cross-links to the other detections.

A separate file "summary.dat" contains the key details about the observations used in the construction of the 3XMM-DR5 catalogue.

File Summary:

FileName	Lrec1	Records	Explanations
ReadMe	80	.	This file
xmm3r5s.dat	459	396910	The 3XMM-DR5 Catalog, "slim" version
summary.dat	135	7781	List of observations
xmm3r5.fit	2880	287949	Full 3XMM-DR5 Catalog (565962 detections)

See also:

<http://xmmssc-www.star.le.ac.uk/Catalogue> : XMM-Newton Home Page
http://xmmssc.irap.omp.eu/Catalogue/3XMM-DR5/3XMM_DR5.html : 3XMM Home Page
<http://xmmssc-www.star.le.ac.uk/> : XMM-Newton Survey Science Centre, University of Leicester
<http://xmm.vilspa.esa.es/> : XMM-Newton Science Operations Centre
<http://xcatdb.u-strasbg.fr/xcat-db/> : XCAT-DB at SSC institute, Strasbourg
[J/A+A/493/339](#) : XMM-Newton serendipitous Survey V. (Watson+, 2009)
[B/xmm](#) : XMM-Newton Observation Log (XMM-Newton Science Operation Center)

Byte-by-byte Description of file: [xmm3r5s.dat](#)

Bytes	Format	Units	Label	Explanations
1- 15	I15	---	Source	[200001101010001/207019812010095] (SRCID) Unique source index
17- 20	A4	---	---	[3XMM]
22- 37	A16	---	3XMM	(IAUNAME) Unique source name (JHHMMSS.s+DDMMSS)
39- 47	F9.5	deg	RAdeg	(SC_RA) Mean source right ascension (ICRS)
49- 57	F9.5	deg	DEdeg	(SC_DEC) Mean source declination (ICRS)
59- 63	F5.2	arcsec	ePos	[0.03/20] (SC_POSERR) Mean error on position
65- 73	E9.3	---	srcML	(SC_DETM_L) Source detection likelihood (2)
75- 85	E11.5	mW/m2	Flux1	(SC_EP1_FLUX) Mean flux in 0.2-0.5keV band
87- 95	E9.3	mW/m2	e_Flux1	(SC_EP1_FLUXERR) Mean error on Flux1
97-107	E11.5	mW/m2	Flux2	(SC_EP2_FLUX) Mean flux in 0.5-1.0keV band
109-117	E9.3	mW/m2	e_Flux2	(SC_EP2_FLUXERR) Mean error on Flux2
119-129	E11.5	mW/m2	Flux3	(SC_EP3_FLUX) Mean flux in 1.0-2.0keV band
131-139	E9.3	mW/m2	e_Flux3	(SC_EP3_FLUXERR) Mean error on Flux3
141-151	E11.5	mW/m2	Flux4	(SC_EP4_FLUX) Mean flux in 2.0-4.5keV band
153-161	E9.3	mW/m2	e_Flux4	(SC_EP4_FLUXERR) Mean error on Flux4
163-173	E11.5	mW/m2	Flux5	(SC_EP5_FLUX) Mean flux in 4.5-12keV band
175-183	E9.3	mW/m2	e_Flux5	(SC_EP5_FLUXERR) Mean error on Flux5
185-195	E11.5	mW/m2	Flux8	(SC_EP8_FLUX) Mean flux in 0.2-12keV band
197-205	E9.3	mW/m2	e_Flux8	(SC_EP8_FLUXERR) Mean error on Flux8
207-217	E11.5	mW/m2	Flux9	? (SC_EP9_FLUX) Mean flux in 0.5-4.5keV band
219-227	E9.3	mW/m2	e_Flux9	? (SC_EP9_FLUXERR) Mean error on Flux9
229-239	E11.5	mW/m2	F8min	(SC_EP8_FMIN) Minimum flux in 0.5-4.5keV band
241-249	E9.3	mW/m2	e_F8min	(SC_EP8_FMINERR) Mean error on F8min
251-261	E11.5	mW/m2	F8max	(SC_EP8_FMAX) Maximum flux in 0.5-4.5keV band
263-271	E9.3	mW/m2	e_F8max	(SC_EP8_FMAXERR) Mean error on F8max
273-278	F6.3	---	HR1	[-1/1]? (SC_HR1) Hardness ratio, bands 1,2 (1)
280-285	F6.3	---	e_HR1	? (SC_HR1ERR) Mean error on HR1
287-292	F6.3	---	HR2	[-1/1]? (SC_HR2) Hardness ratio, bands 2,3 (1)
294-299	F6.3	---	e_HR2	? (SC_HR2ERR) Mean error on HR2
301-306	F6.3	---	HR3	[-1/1]? (SC_HR3) Hardness ratio, bands 3,4 (1)
308-313	F6.3	---	e_HR3	? (SC_HR3ERR) Mean error on HR3
315-320	F6.3	---	HR4	[-1/1]? (SC_HR4) Hardness ratio, bands 4,5 (1)
322-327	F6.3	---	e_HR4	? (SC_HR4ERR) Mean error on HR4
329-333	F5.1	arcsec	ext	(SC_EXTENT) Total band extent
335-343	E9.3	---	extML	(SC_EXTML) Detection likelihood of the extended source (3)
345-350	F6.3	---	Cst	[0/1]? (SC_CHI2PROB) Constant probability (4)
352	I1	---	V	[0/1] (SC_VARFLAG) Variability flag (V=1)
354	I1	---	S	[0/4] (SC_SUMFLAG) summary flag, 0=best (5)
356-365	F10.4	d	MJD0	[51577/56332] (MJD_FIRST) Date of first observation (MJD)
367-376	F10.4	d	MJD1	[51577/56333] (MJD_LAST) Date of last observation (MJD)
378-387	F10.6	---	Fvar	? (SC_FVAR) fractional excess variance of the unique source (6)
389-399	F11.6	---	e_Fvar	? (SC_FVARERR) Mean error on Fvar
401-402	I2	---	Nd	[1/48] (N_DETECTIONS) Number of detections
404	I1	---	c	[0/1] (CONFUSED) Confusion flag (7)
406-459	A54	---	uIRAP	(WEBPAGE_URL) URL for details at IRAP

Note (1): The hardness ratio is defined as $(F2-F1)/(F2+F1)$ if F2 is the flux in the harder band (the hardness ratio is therefore -1 for softest sources and +1 for hardest sources).

The energy bands are:

- 1 = 0.2 - 0.5 keV (narrow band)
- 2 = 0.5 - 1.0 keV (narrow band)
- 3 = 1.0 - 2.0 keV (narrow band)
- 4 = 2.0 - 4.5 keV (narrow band)
- 5 = 4.5 - 12.0 keV (narrow band)
- 6 = 0.2 - 2.0 keV = soft broad band, no images made
- 7 = 2.0 - 12.0 keV = hard broad band, no images made
- 8 = 0.2 - 12.0 keV = total band
- 9 = 0.5 - 4.5 keV = XID band

Note (2): defined as the maximum of the likelihoods of all detections of this source.

Note (3): defined as the average of the extent likelihoods of all detections of this source.

Note (4): χ^2 probability that the unique source as detected by any of the observations is constant, that is, the minimum value of the EPIC probabilities in each detection.

Note (5): the summary flag of the source is derived from the EPIC flag, and is assigned the following values:

- 0 = good: none of the EPIC flags was set.
- 1 = source parameters may be affected: at least one of the EPIC warning flags was set, but no possible-spurious detection flag is set.
- 2 = possibly spurious source: at least one of the possible-spurious detection flags was set but not the manual flag
- 3 = source located in a area where spurious detection may occur.
- 4 = source located in a area where spurious detection may occur and is possibly spurious.

Note (6): The fractional excess variance of the unique source. It is the value corresponding to the exposure and instrument that shows the lowest probability of being constant.

Note (7): This flag (1=true, 0=false) signifies that the 3- σ error circle of a detection within this unique source overlaps the 3- σ error circle of a nearby unique source. As such, it is an indicator of possible confusion (uncertainty) about the assignment of detections between sources.

Byte-by-byte Description of file: [summary.dat](#)

Bytes	Format	Units	Label	Explanations
1- 4	I04	---	Rev	[28/2412] (REVOLUT) Satellite revolution number
6- 15	I010	---	ObsID	(OBS_ID) XMM Observation number (Cat. B/xmm)
17- 19	I03	---	iODF	[1/10] (ODF_VERS) Data File (ODF) number
21- 29	F9.5	deg	RAdeg	(RA) field Right Ascension (J2000)
31- 39	F9.5	deg	DEdeg	(DEC) field Declination (J2000)
41- 68	A28	---	Target	(TARGET) name
70	I1	---	Q	[0/5] (OBS_CLASS) Observations quality (1) .
72- 74	I3	---	Nd	[2/731] (NDET) Number of detections in field
76- 78	I3	---	Ng	[0/391] (NDETG00D) Number of good detections in field
80	I1	---	Np	[1/3]? (PN_NEXP) Number of PN exposures merged
82- 84	A3	---	f.PN	(PN_FILT) Filter of the PN exposure(s) (2) .
86- 90	A5	---	m.PN	(PN_MODE) Mode of the PN exposure(s) (3) .
92- 97	I6	s	t.PN	?=--- (PN_TEXP) Total PN exposure time
99	I1	---	N1	[1/5]? (M1_NEXP) Number of M1 exposures merged
101-103	A3	---	f.M1	(M1_FILT) Filter of the M1 exposure(s) (2) .
105-109	A5	---	m.M1	(M1_MODE) Mode of the M1 exposures (3) .
111-116	I6	s	t.M1	?=--- (M1_TEXP) Total M1 exposure time
118	I1	---	N2	[1/5]? (M2_NEXP) Number of M2 exposures merged
120-122	A3	---	f.M2	(M2_FILT) Filter of the M2 exposure(s) (2) .
124-128	A5	---	m.M2	(M2_MODE) Mode of the M2 exposures (3) .
130-135	I6	s	t.M2	?=--- (M2_TEXP) Total M2 exposure time

Note (1): Quality classification of the whole observation based on the area flagged as bad in the manual flagging process

Note (2): EPIC camera filters of catalogue observations:
Med=MEDIUM, Tn1=THIN1, Tn2=THIN2, Tck=THICK, Opn=OPEN,

Note (3): MOS modes:

- PFW = Prime Full Window
- PPW2 = Prime Partial W2
- PPW3 = Prime Partial W3
- PPW4 = Prime Partial W4
- PPW5 = Prime Partial W5
- FU = Fast Uncompressed
- FC = Fast Compressed
- PPRFS = Prime Partial Refreshed Frame Store

History:

From http://xmmssc.irap.omp.eu/Catalogue/3XMM-DR5/3XMM_DR5.html

(End) Mickael Coriat [IRAP - Toulouse], Patricia Vannier [CDS] 08-Feb-2016

The document above follows the rules of the [Standard Description for Astronomical Catalogues](#); from this documentation it is possible to generate *f77* program to load files [into arrays](#) or [line by line](#)

