

# Status of the XMM-Newton Science Archive

**XMM-Newton Users' Group Meeting #23**

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# Status of XMM-Newton Science Archive

## CONTENT

### 1. XSA Current Content

- ODF/PPS Products and ancillary information
- Catalogues: 4XMM, OM, Slew

### 2. New features: Implementation, on-going and new projects

- Web Interface
- Direct Access
- TAP Queries
- Astroquery

### 3. The 4XMM-DR11 and 4XMM-DR11s catalogues

- Ingestion and improvements
- Future ingestions

### 4. Other projects

### 5. Future projects

### 6. Summary

# Status of XMM-Newton Science Archive

## XSA CURRENT CONTENT

**XSA-14.0**

16 August 2021

**XSA-14.1**

21 December 2021

**XSA-14.2**

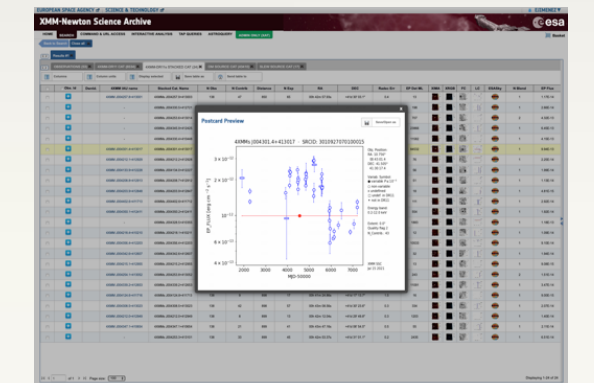
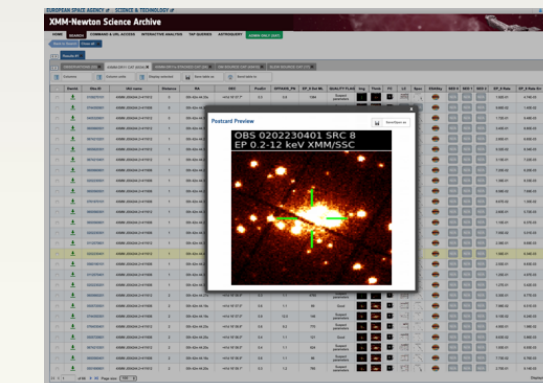
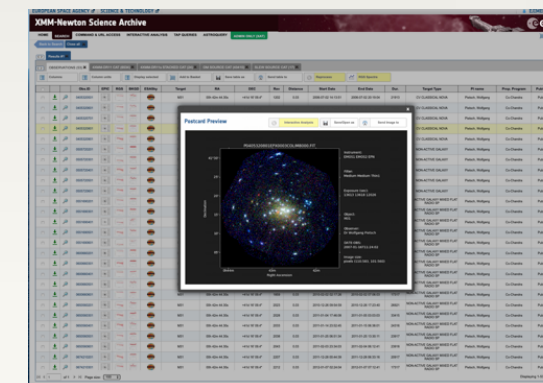
26 April 2022

**Astroquery-o.4.6**

19 January 2022

|                                | XSA-13.1<br>12 April 21 | XSA-14.2<br>26 April 22 |
|--------------------------------|-------------------------|-------------------------|
| <b>Pointed Observations</b>    | 14,340                  | <b>14,962</b>           |
| <b>EPIC PPS sources</b>        | 957,300                 | <b>1,002,161</b>        |
| <b>OM PPS Sources</b>          | 12,706,000              | <b>13,033,588</b>       |
| <b>Slew Survey PPS Sources</b> | ~63,000                 | <b>78,489</b>           |
| <b>Slew Observations</b>       | ~4,800                  | <b>4,971</b>            |
| <b>Radiation Monitor Files</b> | Up to Rev 3000          | <b>Up to Rev 4079</b>   |
| <b>Proposals</b>               | 4,095                   | <b>4,251</b>            |

The screenshot shows the XMM-Newton Science Archive interface. At the top, it says 'EUROPEAN SPACE AGENCY' and 'SCIENCE & TECHNOLOGY'. The main header is 'XMM-Newton Science Archive'. Below the header are navigation tabs: HOME, SEARCH, COMMAND & URL ACCESS, INTERACTIVE ANALYSIS, TAP QUERIES, ASTROQUERY, and ADMIN ONLY (KAT). A search bar is visible with 'Back to Search' and 'Close all' buttons. The main content area shows 'Results #1' and a table of observations. The table has columns for Obs.ID, EPIC, RGS, BKGD, ESASky, Target, RA, DEC, Rev, Start Date, End Date, and Dur. The first row shows Obs.ID 0000110101, Target XTE J0421+960, RA 04h 19m 42.09s, DEC +96d 59' 56.0", Rev 310, Start Date 2001-08-19 07:05:23, End Date 2001-08-19 16:13:56, and Dur 32913. The table is paginated, showing '1 of 150' and 'Page size: 100'. At the bottom, it says 'Displaying 1-100 of 14962' and 'COPYRIGHT © EUROPEAN SPACE AGENCY. ALL RIGHTS RESERVED. V3A.2.0-OPER [26-04-2022]'.



# Status of XMM-Newton Science Archive

## XSA CURRENT CONTENT

|  | XSA-13.1<br>12 April 21 | XSA-14.2<br>26 April 22 |
|--|-------------------------|-------------------------|
| <b>4XMM Catalogue of Serendipitous Sources</b> | 849,991                 | <b>895,415</b>          |
| <b>4XMM EPIC Stacked Catalogue</b>             | 333,812                 | <b>358,809</b>          |
| <b>OM Sources Catalogue (OM-SUSS5.0)</b>       | 8,863,922               | <b>8,863,922</b>        |
| <b>Clean Slew Survey Catalogue (XMMSL2)</b>    | 72,352                  | <b>72,352</b>           |

### DOWNLOAD FULL XMM-NEWTON CATALOGUES AND DATASETS

Alongside all XMM-Newton scientific data products and observation-related information, high-level catalogues and a multiwavelength datasets can be accessed through the XSA or downloaded from the links below:

|   |   |  |
|---|---|--|
| <b>4XMM-DR11</b> XMM-Newton <b>New</b><br>Serendipitous Source Catalogue      | Download the FITS table<br>Download the CSV table   | Documentation and watchouts<br>(by the SSC consortium)   |
| Slim version of the <b>New</b><br><b>4XMM-DR11</b> catalogue                  | Download the FITS table<br>Download the CSV table   | Documentation and watchouts<br>(by the SSC consortium)   |
| <b>4XMM-DR11s</b> <b>New</b><br>Stacked Catalogue                             | Download the FITS table<br>Download the stacked sources FITS table<br>Download the stacked observations FITS table                | Documentation<br>(Maintained by the SSC consortium)  |
| <b>XMM-DR11 SEDs</b> <b>New</b>   | Download all SED FITS files   | Documentation:<br>Webb et al. 2020A&A...641A.136W<br>(sect 9.1 and Table 4)  |
| <b>4XMM-DR9 Multi-Object Coverage maps (MOC) Fits Files</b>                   | Download MOCs for individual observations<br>Download the whole 4XMM-DR9 field MOC  | Documentation<br>(Maintained by the SSC consortium)  |
| The XMM-Newton <b>Slew Survey</b><br><b>XMMSL2</b> Source Catalogue           | Download the FITS table (FULL)<br>Download the FITS table (CLEAN)   | Documentation  |
| <b>XMM-OM-SUSS5</b><br>XMM-Newton Serendipitous<br>UV Source Survey Catalogue | Download the FITS table<br>Download the FITS table (SLIM version)   | Documentation and watchouts  |
| <b>XMM-Newton OM</b> Bright Sources<br>Catalogue                              | Download the FITS table   | Documentation  |
| <b>Spectral Fit Catalogues</b>  | 3XMM-DR7 spectral fit catalogue XMMFITCAT<br>3XMM-DR6 photo Z catalogue XMMPZCAT<br>3XMM-DR6 spectral fit Z catalogue XMMFITCAT-Z | Documentation<br>(Carried out by an ESA-PRODEX<br>funded collaboration between<br>European institutes and the SSC) |

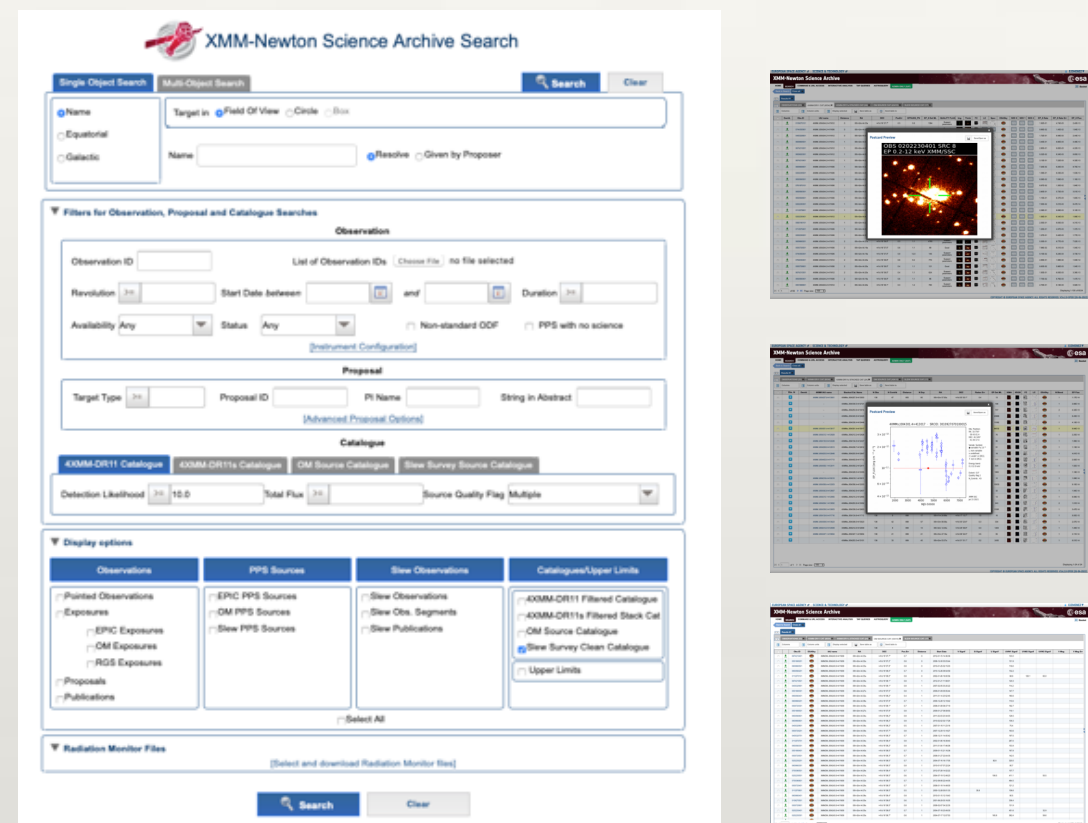
Alongside the XSA, are also distributed through: :

- The IRAP catalogue server
- XCAT-DB at the Observatoire Astronomique de Strasbourg
- HEASARC

# Status of XMM-Newton Science Archive

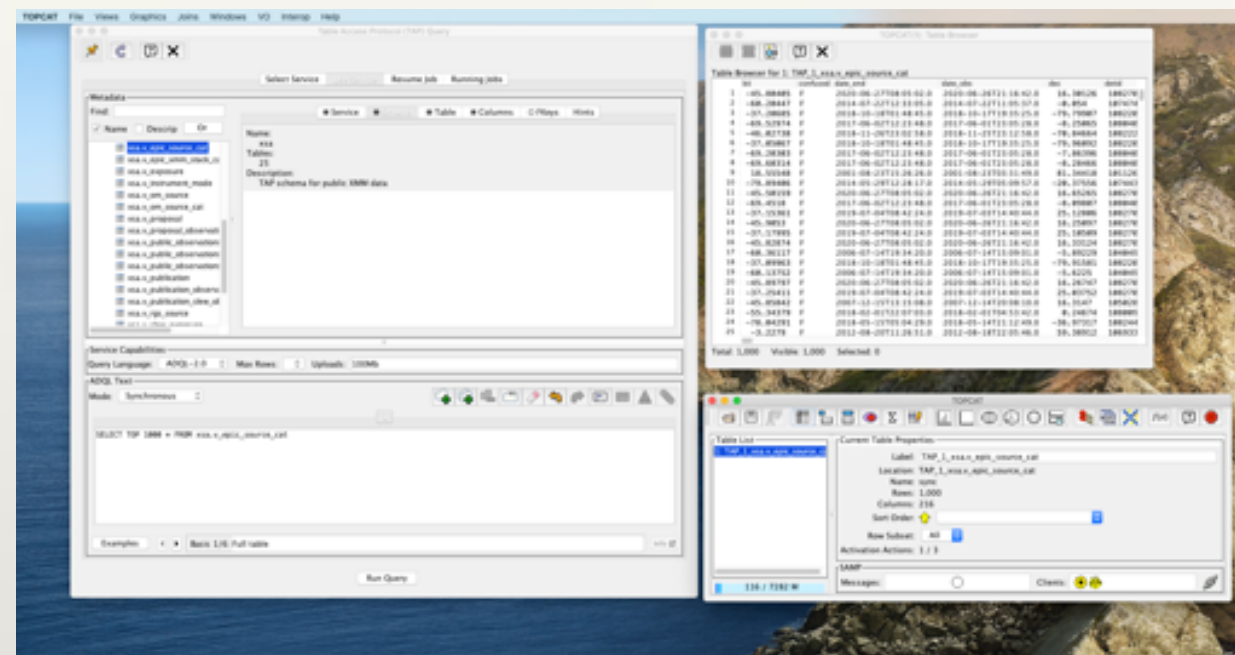
## XSA NEW FEATURES

### Web Interface



- ❖ User Friendly
- ❖ Visual
- ❖ Flexible
- ❖ Complete (but filtered) in content and features

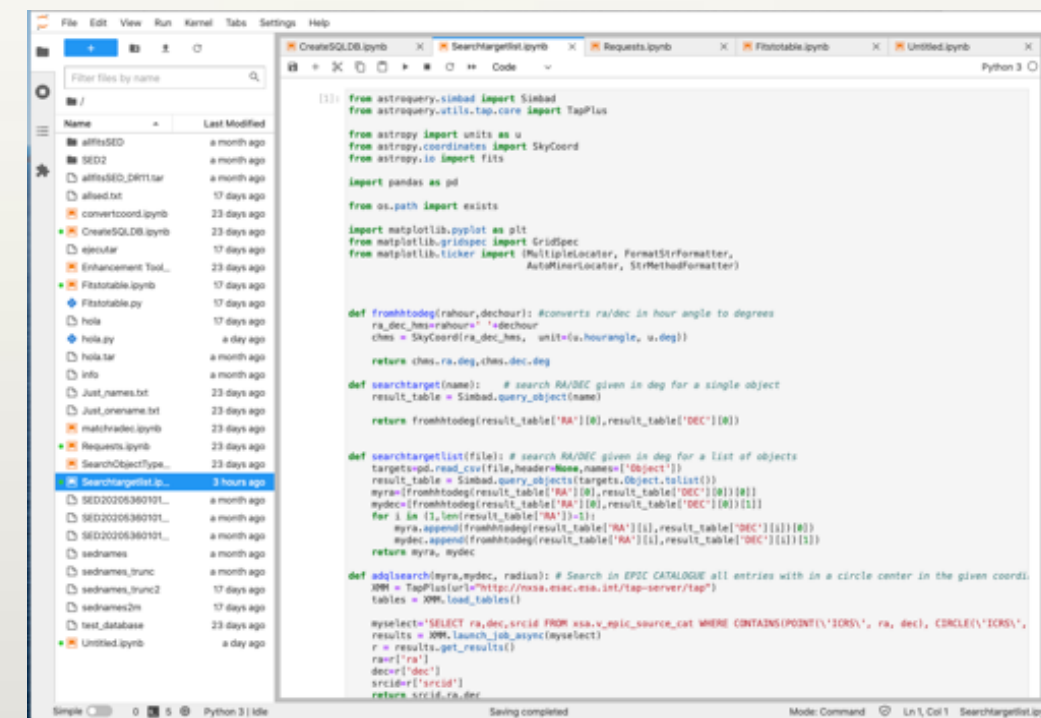
### TAP queries



- ❖ Base on ADQL Language
- ❖ Useful to search content information (some limits applied in the web interface are not applied here)
- ❖ NO ODF/PPS or products download

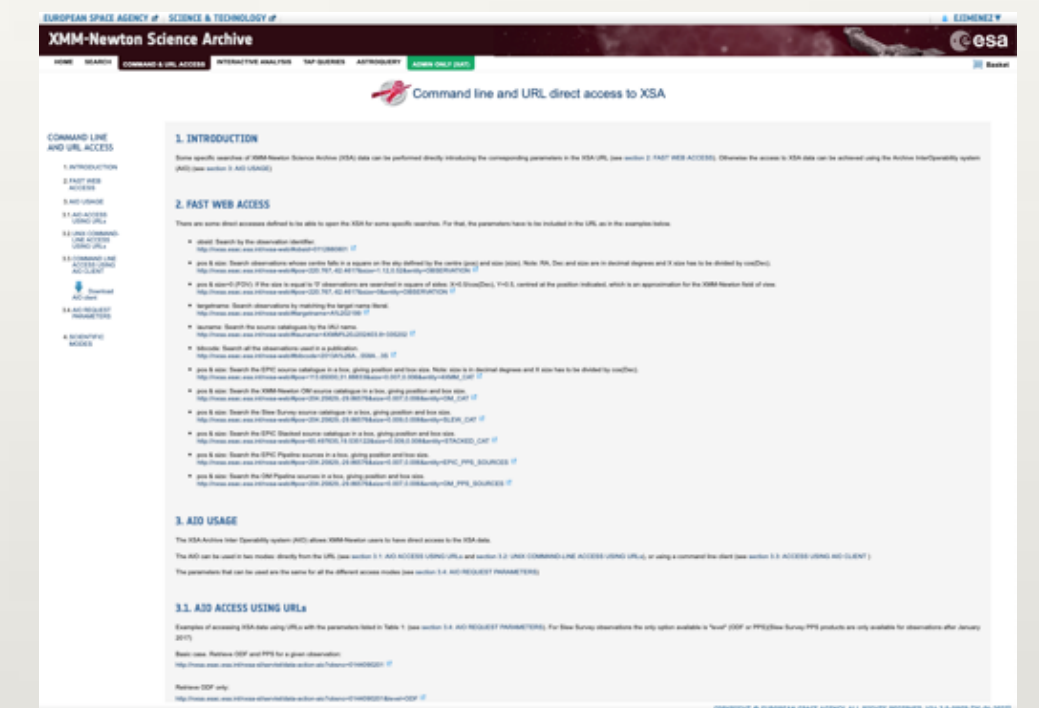
### Astroquery

[astroquery.esa.xmm\\_newton](http://astroquery.esa.xmm_newton)



- ❖ Based on python
- ❖ In fast development although many features need to be implemented as the access to products.
- ❖ Use of TAP queries

### Direct access



- ❖ Fast access
- ❖ Command line: scriptable
- ❖ Data can be download but not all products are available

# Status of XMM-Newton Science Archive

## XSA NEW FEATURES **Web Interface**

### NEW Interface FEATURES

- Searches of list of positions now accept several formats and units:  
RA&DEC, Galactic
- Security improvement: implement of HTTPS
- List of ODF search improvements (In progress)
- Save Upper Limit searches in ASCII, CSV, VOTable (In progress)
- **Long term interface migration**

### NEW USER USAGE

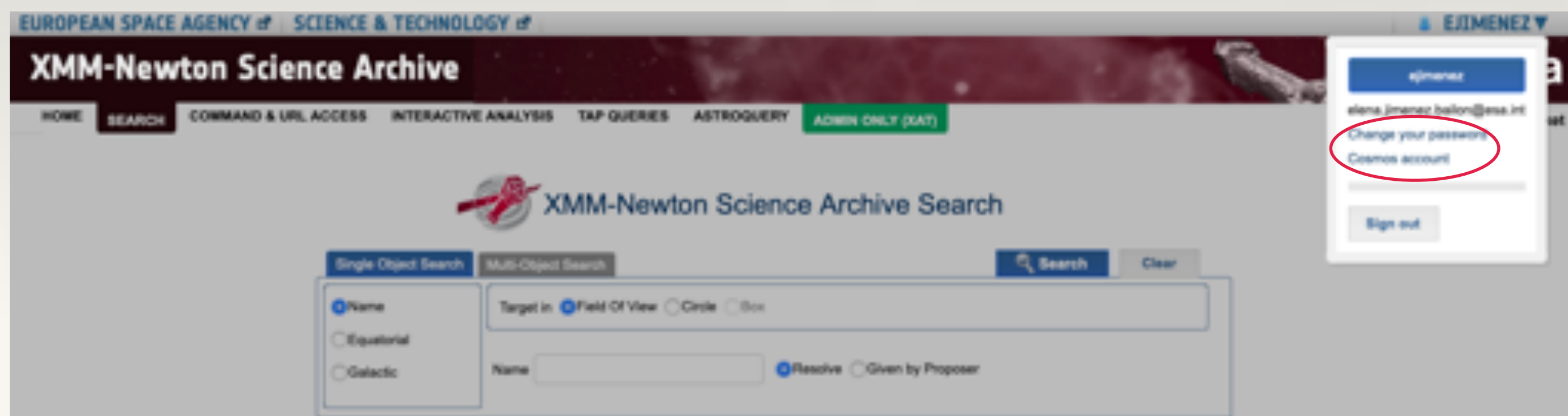
- Direct link to Cosmos account
- Errors in searches display in result panel

### NEW INFORMATION DISPLAYED

- Upper limits columns for fluxes and count rates information displayed

### NEW DATA INGESTED

- Mini-bulk reprocessed PN Burst/Timing observations ingestion
- New Radiation Monitor Files were added (up to revolution 4079)
- New publications ingestion (7,286, April 2022)
- 4XMM-DR12 & 4XMM-DR12s ingestion

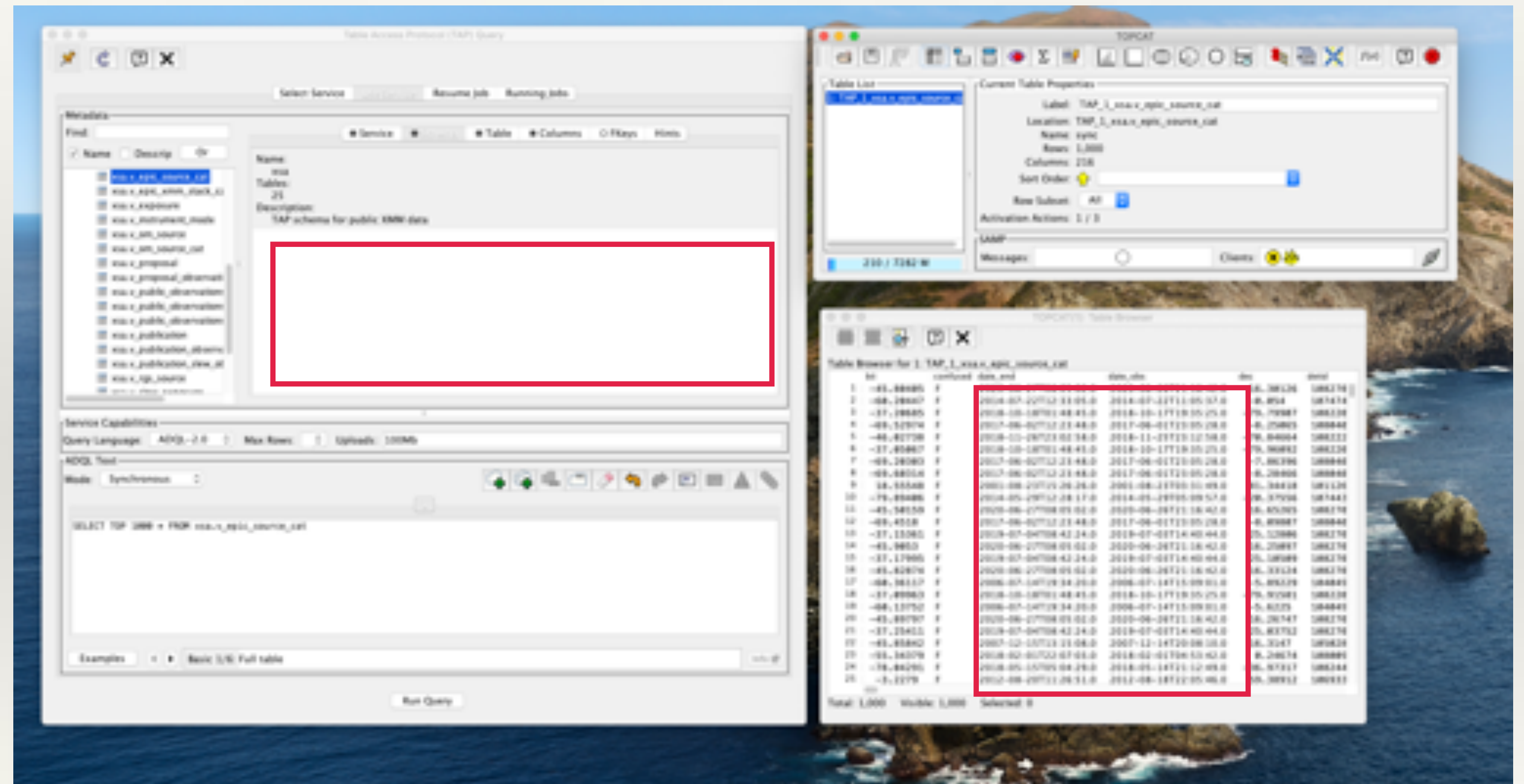


# Status of XMM-Newton Science Archive

## XSA NEW FEATURES Tap Queries

### NEW FEATURES

- Hide empty columns in TAP system
  - Display date in correct format
  - Display tables and columns descriptions
- (in progress)



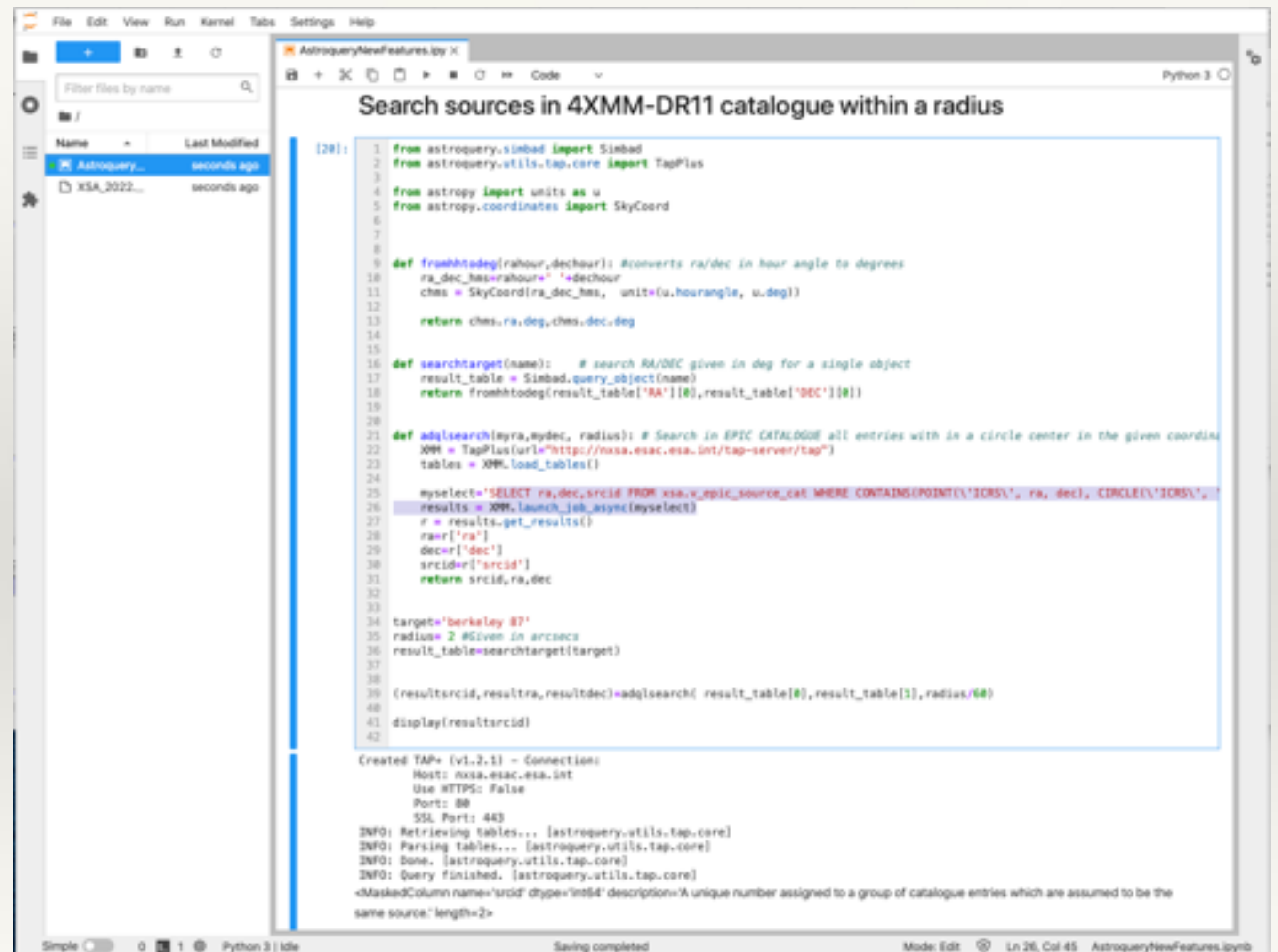
# Status of XMM-Newton Science Archive

**XSA NEW FEATURES** **Astroquery** [astroquery.esa.xmm\\_newton](http://astroquery.esa.xmm_newton)

## NEW FEATURES

[astroquery.esa.xmm\\_newton](http://astroquery.esa.xmm_newton)

- Function added to download proprietary data using `astroquery.esa.xmm_newton`
- Security improvement: implement of HTTPS
- Functions added to Astroquery module to allow download observations giving source name or coordinates:
  - `get_xmm_observations(source_name)`
  - `get_xmm_observations(ra,dec)`
- Download products of catalogues, upperlimits...



```
File Edit View Run Kernel Tabs Settings Help
AstroqueryNewFeatures.py X Python 3
Search sources in 4XMM-DR11 catalogue within a radius
[28]: 1 from astroquery.simbad import Simbad
2 from astroquery.utils.tap.core import TapPlus
3
4 from astropy import units as u
5 from astropy.coordinates import SkyCoord
6
7
8
9 def fromhstodeg(rahour,dechour): #converts ra/dec in hour angle to degrees
10     ra_dec_hms=rahour+' '+dechour
11     chs = SkyCoord(ra_dec_hms, unit=(u.hourangle, u.deg))
12
13     return chs.ra.deg,chs.dec.deg
14
15
16 def searchtarget(name): # search RA/DEC given in deg for a single object
17     result_table = Simbad.query_object(name)
18     return fromhstodeg(result_table['RA'][:,0],result_table['DEC'][:,0])
19
20
21 def adqlsearch(myra,mydec, radius): # Search in EPIC CATALOGUE all entries with in a circle center in the given coordina
22     XMM = TapPlus(url='http://xmm.esac.esa.int/tap-server/tap')
23     tables = XMM.load_tables()
24
25     myselect='SELECT ra,dec,srcid FROM xmm_v_epic_source_cat WHERE CONTAINS(POINT('J2000', ra, dec), CIRCLE('J2000',
26     results = XMM.launch_job_async(myselect)
27     r = results.get_results()
28     ra=r['ra']
29     dec=r['dec']
30     srcid=r['srcid']
31     return srcid,ra,dec
32
33
34 target='berkeley 87'
35 radius= 2 #Given in arcsecs
36 result_table=searchtarget(target)
37
38
39 (resultsrcid,resultra,resultdec)=adqlsearch( result_table[0],result_table[1],radius/60)
40
41 display(resultsrcid)
42
Created TAP+ (v1.2.1) - Connection:
Host: xmm.esac.esa.int
Use HTTPS: False
Port: 88
SSL Port: 443
INFO: Retrieving tables... [astroquery.utils.tap.core]
INFO: Parsing tables... [astroquery.utils.tap.core]
INFO: Done. [astroquery.utils.tap.core]
INFO: Query finished. [astroquery.utils.tap.core]
<MaskedColumn name='srcid' dtype='int64' description='A unique number assigned to a group of catalogue entries which are assumed to be the
same source.' length=2>
```



# Status of XMM-Newton Science Archive

**XSA NEW FEATURES** **Astroquery** [astroquery.esa.xmm\\_newton](http://astroquery.esa.xmm_newton)

**NEW FEATURES** [astroquery.esa.xmm\\_newton](http://astroquery.esa.xmm_newton)

**Recommendation 2021-06-10/07:** The UG recommends that the XSA enables queries that make use of the multi-wavelength information included in the catalogue

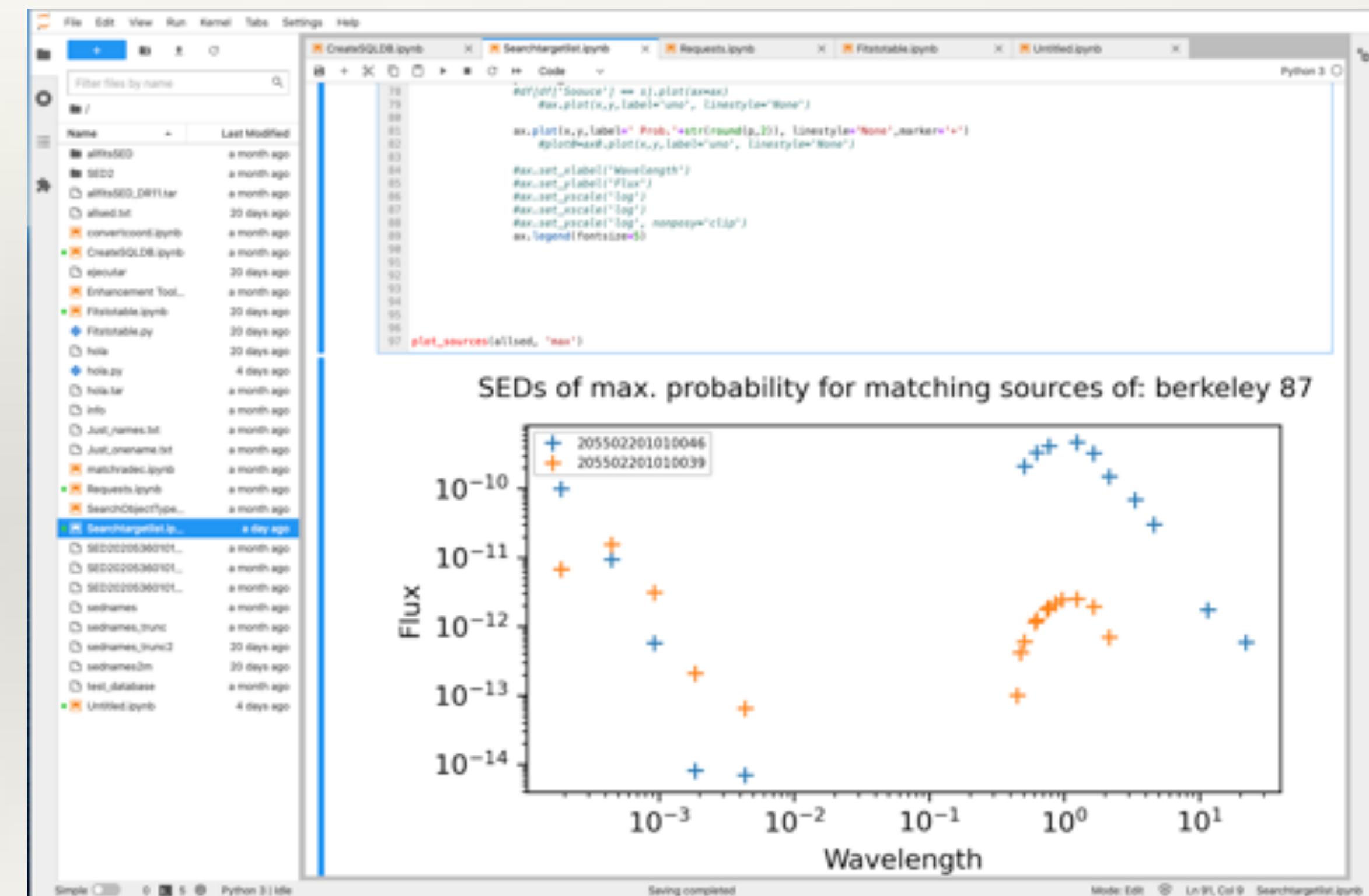
## o On-going project

### o Limited tests done using python (astroquery)

- ❖ Search target by name or coordinates and report sources in 4XMM-DR11 catalogue matching this target
- ❖ Display the multiwavelength data for each source
- ❖ Select, display and plot the highest probability matching sources
- ❖ Search 4XMM sources with different criteria: e.g. X-ray fluxes above/below certain value and combine them with other limits in other wavelengths given in SED.

### o Missing features:

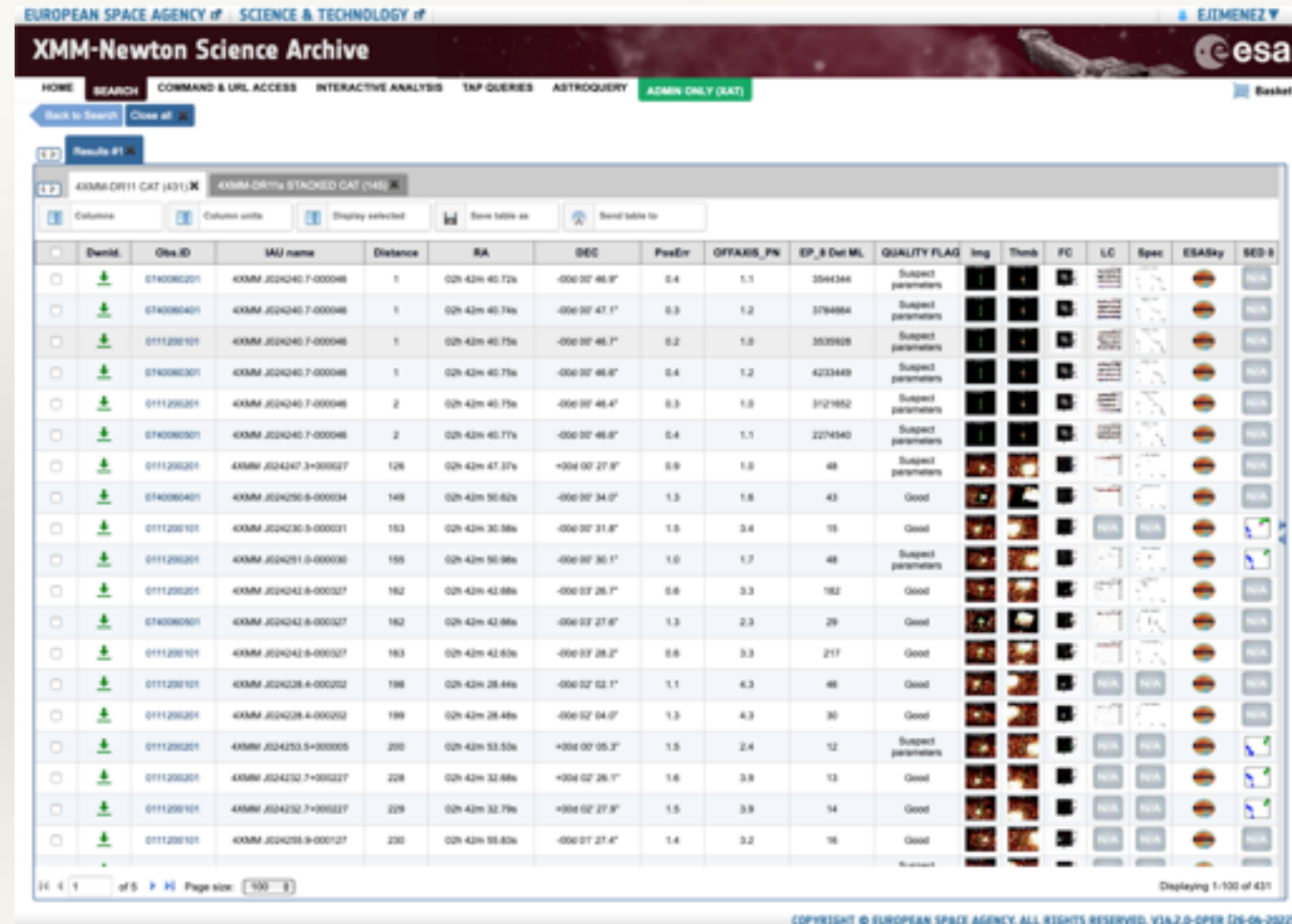
- ❖ Implement searches for list of objects/coordinates
- ❖ SED are at the moment en FITS format which makes difficult to test the data → USE ADQL searches?
- ❖ ... (Suggestions ?)



# Status of XMM-Newton Science Archive

## XSA NEW FEATURES 4XMM-DR12 & 4XMM-DR12S

- Ingestion of 4XMM-DR11 & 4XMM-DR11s catalogues in **August 2021**
- Associated products ingestion: Finding charts, Spectra, Light Curves, images, SED, thumbnails, postcards, XCatDB...
- Empty columns removed in the web interface
- New columns showed: Distance from source to EPIC boresight
- Automate ingestion process for data and products for 4XMM-DR12 & 4XMM-DR12s catalogues



The screenshot displays the XMM-Newton Science Archive web interface. At the top, it features the ESA logo and navigation tabs: HOME, SEARCH, COMMAND & URL ACCESS, INTERACTIVE ANALYSIS, TAP QUERIES, ASTROQUERY, and ADMIN ONLY (XAT). Below the navigation, there are search filters and a table of results. The table has columns for: ObsID, ObsID, IAU name, Distance, RA, DEC, PosErr, OFFAXIS\_PN, EPIC Det ML, QUALITY FLAG, and several columns for product thumbnails (img, Thumb, FC, LC, Spec, ESASky, SED-B). The table shows 431 results for the 4XMM-DR11 CAT. The bottom of the page indicates 'Displaying 1-100 of 431'.

| ObsID      | ObsID      | IAU name              | Distance | RA             | DEC            | PosErr | OFFAXIS_PN | EPIC Det ML | QUALITY FLAG       | img | Thumb | FC | LC | Spec | ESASky | SED-B |
|------------|------------|-----------------------|----------|----------------|----------------|--------|------------|-------------|--------------------|-----|-------|----|----|------|--------|-------|
| 0140080201 | 0140080201 | 4XMM J024240.7-000048 | 1        | 02h 42m 40.72s | -00° 00' 48.9" | 0.4    | 1.1        | 3541346     | Suspect parameters |     |       |    |    |      |        |       |
| 0140080401 | 0140080401 | 4XMM J024240.7-000048 | 1        | 02h 42m 40.73s | -00° 00' 47.1" | 0.3    | 1.2        | 3784884     | Suspect parameters |     |       |    |    |      |        |       |
| 0111200101 | 0111200101 | 4XMM J024240.7-000048 | 1        | 02h 42m 40.75s | -00° 00' 46.1" | 0.2    | 1.0        | 3539828     | Suspect parameters |     |       |    |    |      |        |       |
| 0140080301 | 0140080301 | 4XMM J024240.7-000048 | 1        | 02h 42m 40.75s | -00° 00' 46.4" | 0.4    | 1.2        | 4233449     | Suspect parameters |     |       |    |    |      |        |       |
| 0111200201 | 0111200201 | 4XMM J024240.7-000048 | 2        | 02h 42m 40.75s | -00° 00' 46.4" | 0.3    | 1.0        | 3121852     | Suspect parameters |     |       |    |    |      |        |       |
| 0140080501 | 0140080501 | 4XMM J024240.7-000048 | 2        | 02h 42m 40.77s | -00° 00' 46.4" | 0.4    | 1.1        | 2274540     | Suspect parameters |     |       |    |    |      |        |       |
| 0111200301 | 0111200301 | 4XMM J024247.3+000027 | 126      | 02h 42m 47.37s | +00° 00' 27.9" | 0.9    | 1.0        | 48          | Suspect parameters |     |       |    |    |      |        |       |
| 0140080401 | 0140080401 | 4XMM J024250.5-000034 | 149      | 02h 42m 50.52s | -00° 00' 34.0" | 1.3    | 1.8        | 43          | Good               |     |       |    |    |      |        |       |
| 0111200101 | 0111200101 | 4XMM J024230.5-000031 | 153      | 02h 42m 30.58s | -00° 00' 31.8" | 1.0    | 3.4        | 18          | Good               |     |       |    |    |      |        |       |
| 0111200201 | 0111200201 | 4XMM J024251.0-000030 | 155      | 02h 42m 50.98s | -00° 00' 30.1" | 1.0    | 1.7        | 48          | Suspect parameters |     |       |    |    |      |        |       |
| 0111200301 | 0111200301 | 4XMM J024242.8-000027 | 162      | 02h 42m 42.88s | -00° 00' 26.1" | 0.6    | 3.3        | 182         | Good               |     |       |    |    |      |        |       |
| 0140080501 | 0140080501 | 4XMM J024242.8-000027 | 162      | 02h 42m 42.88s | -00° 00' 27.8" | 1.3    | 2.3        | 29          | Good               |     |       |    |    |      |        |       |
| 0111200101 | 0111200101 | 4XMM J024242.8-000027 | 163      | 02h 42m 42.88s | -00° 00' 26.2" | 0.6    | 3.3        | 217         | Good               |     |       |    |    |      |        |       |
| 0111200101 | 0111200101 | 4XMM J024238.4-000202 | 198      | 02h 42m 28.48s | -00° 02' 02.1" | 1.1    | 4.3        | 46          | Good               |     |       |    |    |      |        |       |
| 0111200201 | 0111200201 | 4XMM J024238.4-000202 | 199      | 02h 42m 28.48s | -00° 02' 04.0" | 1.3    | 4.3        | 30          | Good               |     |       |    |    |      |        |       |
| 0111200301 | 0111200301 | 4XMM J024253.5+000005 | 200      | 02h 42m 53.50s | +00° 00' 05.3" | 1.5    | 2.4        | 12          | Suspect parameters |     |       |    |    |      |        |       |
| 0111200201 | 0111200201 | 4XMM J024232.7+000227 | 228      | 02h 42m 32.78s | +00° 02' 26.1" | 1.6    | 3.9        | 13          | Good               |     |       |    |    |      |        |       |
| 0111200101 | 0111200101 | 4XMM J024232.7+000227 | 229      | 02h 42m 32.79s | +00° 02' 27.9" | 1.5    | 3.9        | 14          | Good               |     |       |    |    |      |        |       |
| 0111200101 | 0111200101 | 4XMM J024258.9-000127 | 230      | 02h 42m 58.82s | -00° 01' 27.4" | 1.4    | 3.2        | 16          | Good               |     |       |    |    |      |        |       |

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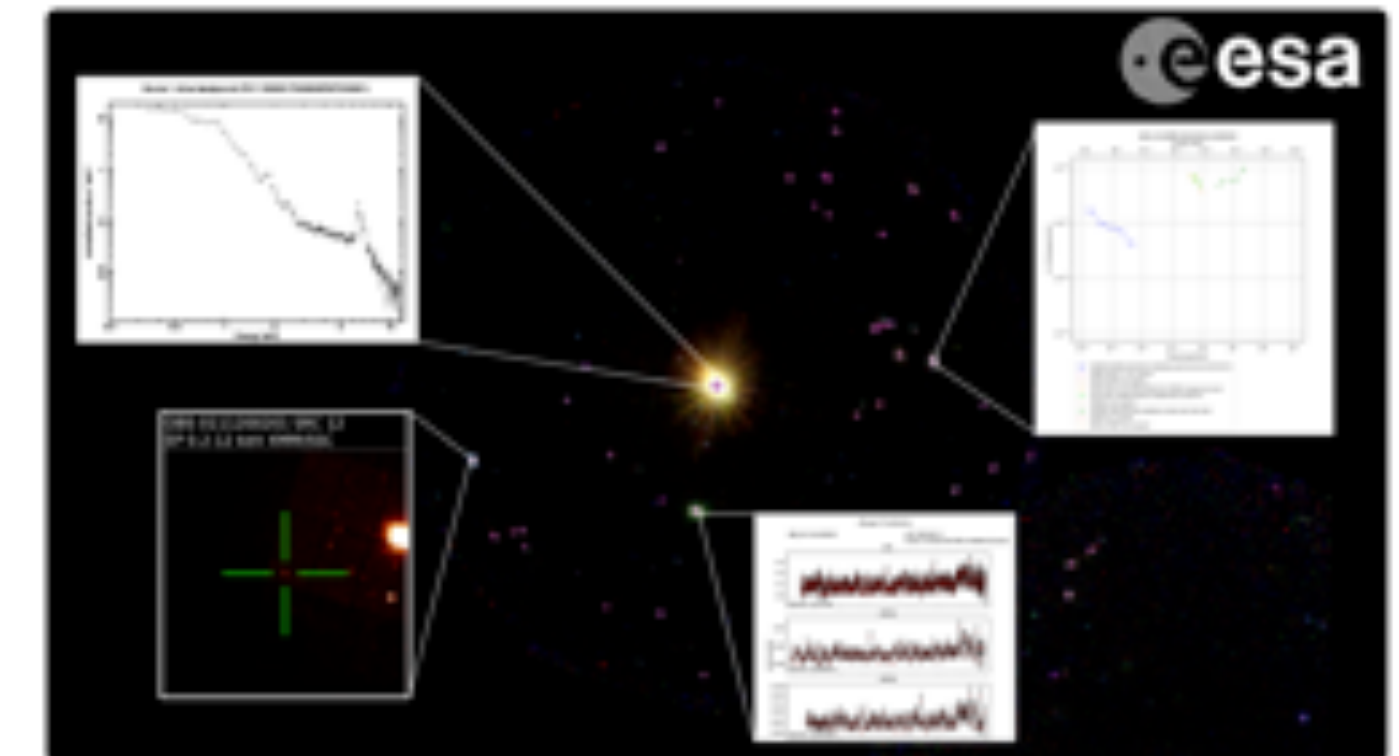
## OTHER PROJECTS

- Improvements on internal control XSA functioning:  
logs for PPS/ODF new version ingestion
- XSA in ESCD ESA Newsletter



## XMM-Newton Science Archive updates

By Peter Kretschmar (XMM-Newton Archive Scientist) & Elena Jiménez (XMM-Newton Support Archive Scientist, Quasar Science Resources for ESA)



The latest serendipitous source catalogues, provided by the [XMM-Newton Survey Science Centre](#) have been included in the [XMM-Newton Science Archive \(XSA\)](#) and ESASky: [Data Release 11 of the Fourth XMM-Newton Serendipitous Source catalogue \(4XMM-DR11\)](#), built from individual observations and the [4XMM-DR11s EPIC Stacked catalogue](#) built from overlapping observations to allow detection of even fainter objects. Based on one more year of data, the first catalogue now includes 895,415 detections, about 45,000 more than -DR10, relating to 602,543 individual sources; the second catalogue contains 358,809 unique sources, almost 23,000 more than the previous version. SED images, finding charts, lightcurves and spectra from these catalogues, together with other data in the 0.3–12 keV energy band are available via the XSA web interface and the Table Access Protocol. The above image displays the ESASky view of the active galaxy NGC1068 XMM-Newton observations. Brightest sources from the 4XMM-DR11 catalogue and several scientific products are also shown in the picture.

Image: ESA/ESA

Have a look!

<https://esdcnews.esac.esa.int/news/2022-03/#XSA>

# Status of XMM-Newton Science Archive

## FUTURE PLANS

- ★ FINISH AUTOMATISATION OF THE 4XMM (AND EXTEND IT TO OM & Slew) CATALOGUES INGESTION
  - INGEST 4XMM-DR12 & 4XMM-DR12s (foreseen for June 2022)
  - IMPROVEMENTS FOR ASTROQUERY (& TAP, access from the web)
  - MULTIWAVELENGTH SEARCHES
  - Create an International Virtual Observatory View for XMM-Newton Science Archive
  - Ingest OM-SUSS-6.0 catalogue: not before December 2022
  - XSA web interface migration

# Status of XMM-Newton Science Archive

## SUMMARY

### Current period

- Operations have run smoothly
- **4XMM-DR11 and DR11s catalogues** and related products (SED, FC Spectra...) were ingested to be available for AO21 proposal submission
- Main goals of the period were related to **automatisation** of internal processes. Extended to next period

### For next period

- Operational system maintenance and improvements
- ★ Automatic ingestion of 4XMM-DR12 and 4XMM-DR12s catalogues and products
- Possible ingestion of the OM-SUSS-6.0
- Implement multiwavelength searches
- Develop astroquery.esa.xmm\_newton (module & tutorials)
- Long term interface migration