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

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XSA CURRENT CONTENT

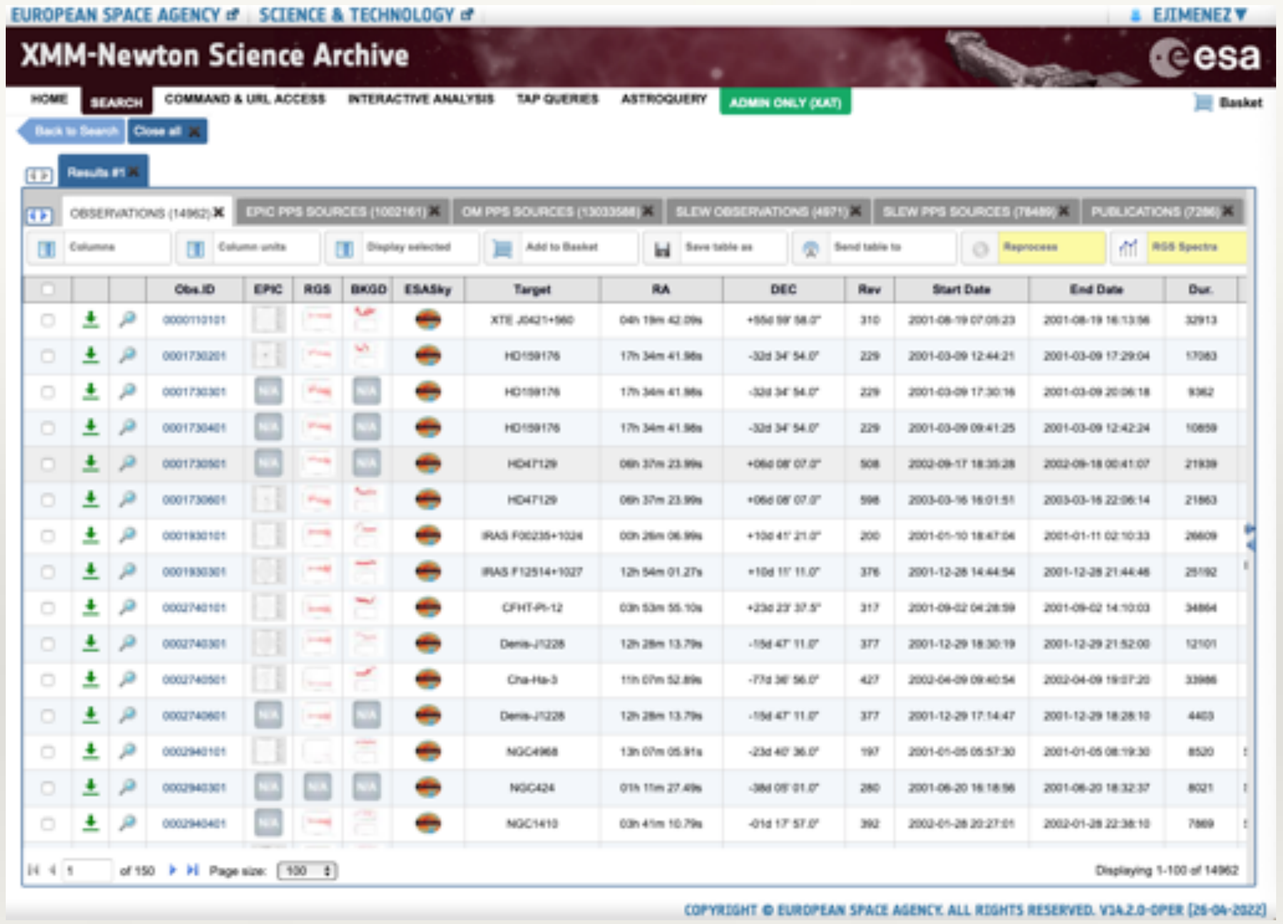
XSA-14.0
16 August 2021

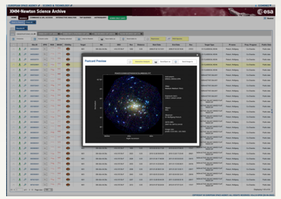
XSA-14.1
21 December 2021

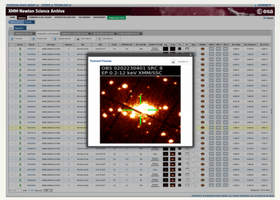
XSA-14.2
26 April 2022

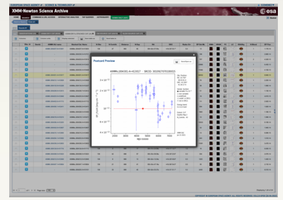
Astroquery-0.4.6
19 January 2022

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









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XSA CURRENT CONTENT

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

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:

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

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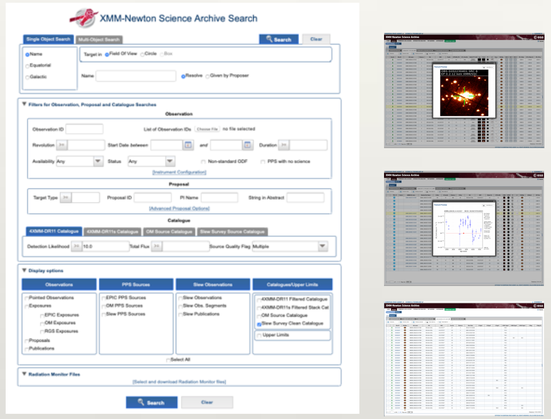
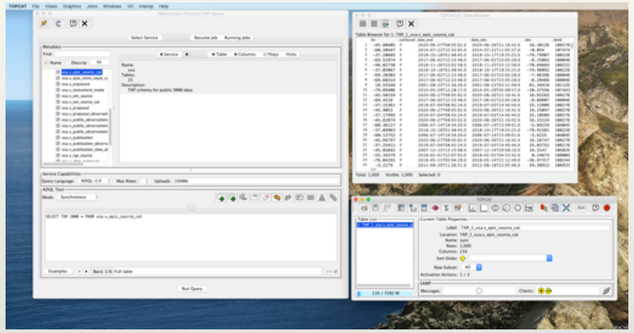
XSA NEW FEATURES

Web Interface



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

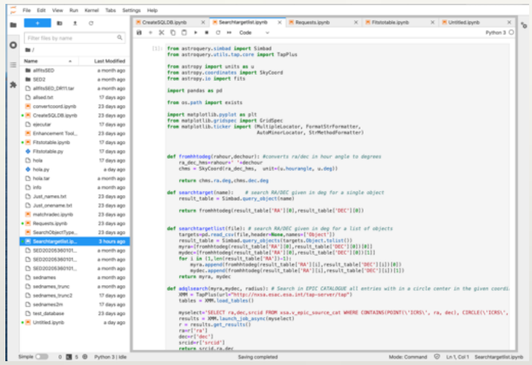
TAP queries



- 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

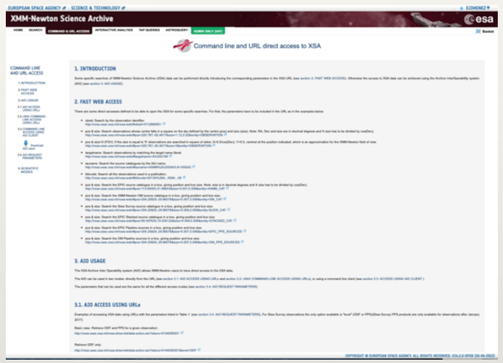
astroquery.esa.xmm_newton



```
from astroquery.simbad import Simbad
from astroquery.utils.tap.core import TapPlus

from astropy import units as u
from astropy.coordinates import SkyCoord
from astropy.io import fits

import pandas as pd

from os.path import exists

import matplotlib.pyplot as plt
from matplotlib.projections import GridSpec
from matplotlib.ticker import (MultipleLocator, FormatStrFormatter,
                               AutoMinorLocator, StrMethodFormatter)


def fromhhdeg(rahour,dechour): #converts ra/dec in hour angle to degrees
    ra_dec_hour=rahour+' '+dechour
    ches = SkyCoord(ra_dec_hms,  unit=(u.hourangle, u.deg))

    return ches.ra.deg,ches.dec.deg

def searchtarget(name): # search RA/DEC given in deg for a single object
    result_table = Simbad.query_object(name)

    return fromhhdeg(result_table['RA'][0],result_table['DEC'][0])


def searchtargetlist(file): # search RA/DEC given in deg for a list of objects
    targetlist=pd.read_csv(file,header=None,names=['Object'])
    result_table = Simbad.query_objects(targetlist['Object'])
    ra=fromhhdeg(result_table['RA'][0],result_table['DEC'][0])[0]
    dec=fromhhdeg(result_table['RA'][0],result_table['DEC'][0])[1]
    for i in [1,len(result_table['RA'])-1]:
        ra=ra.append(fromhhdeg(result_table['RA'][i],result_table['DEC'][i])[0])
        dec=dec.append(fromhhdeg(result_table['RA'][i],result_table['DEC'][i])[1])
    return ra, dec

def sql(ra,dec, radius): # Search in EPIC CATALOGUE all entries with in a circle center in the given coordi
    CMM = TapPlus(url="http://nxsa.esac.esa.int/tap-server/tap")
    tables = CMM.load_tables()

    myselect="SELECT ra,dec,srcid FROM xsa.v_epic_source_cat WHERE CONTAINS(POINT('ICRS',\
    results = CMM.launch_job_async(myselect)
    r = results.get_results()
    ra=r['ra']
    dec=r['dec']
    srcid=r['srcid']
    return srcid,ra,dec
```

- 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

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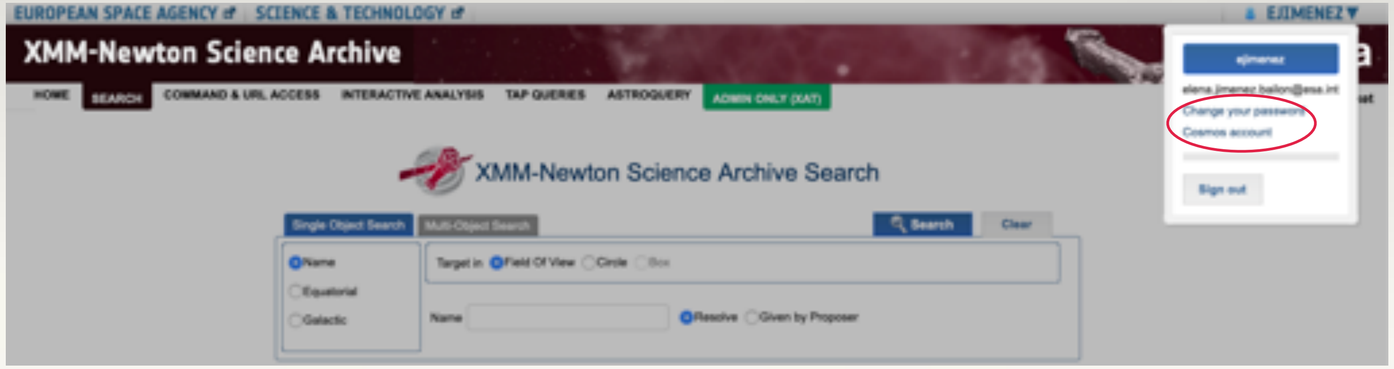
XSA NEW FEATURES Web Interface

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 ASCI, 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

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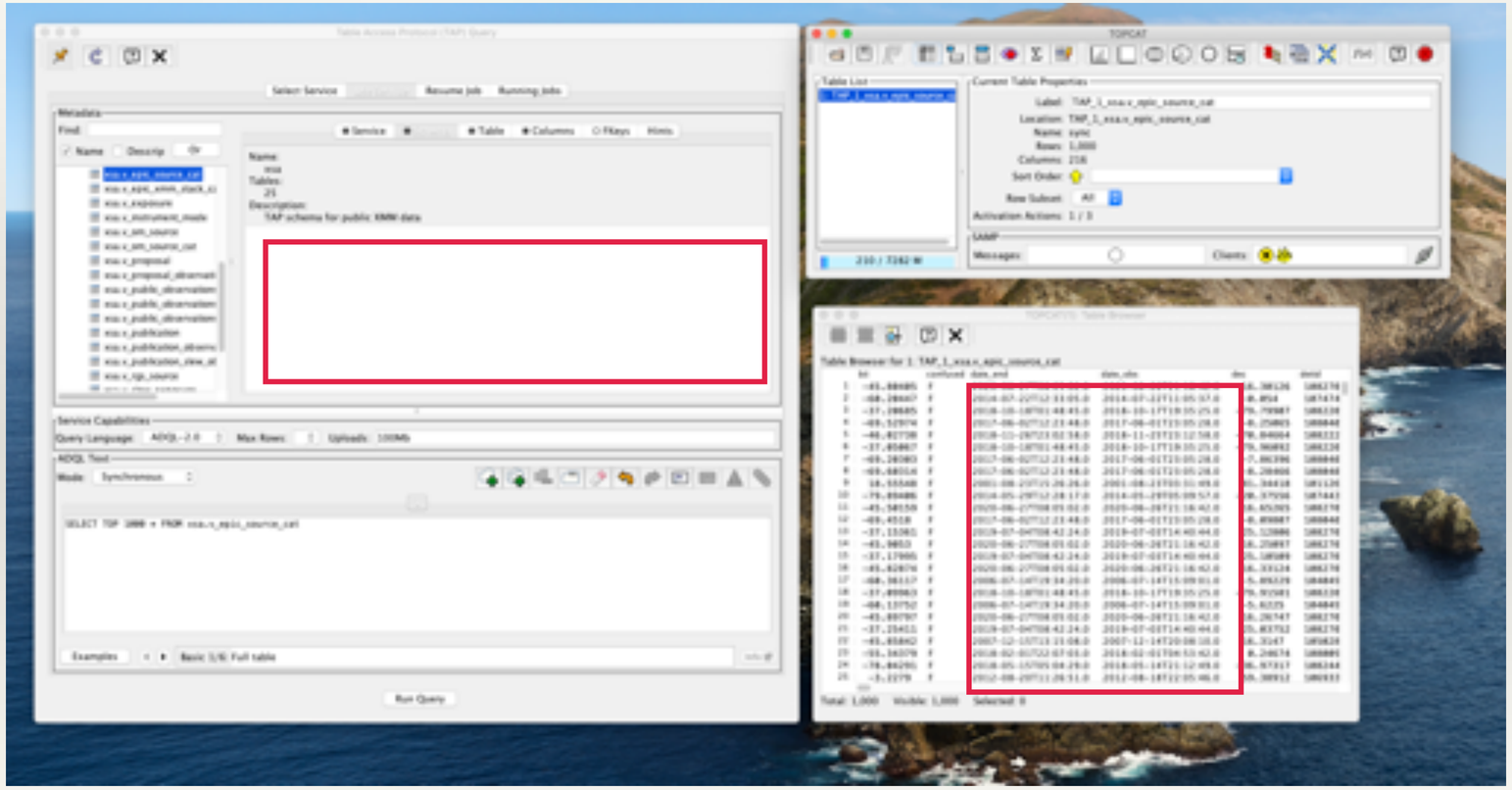
XSA NEW FEATURES Tap Queries

NEW FEATURES

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

  (in progress)



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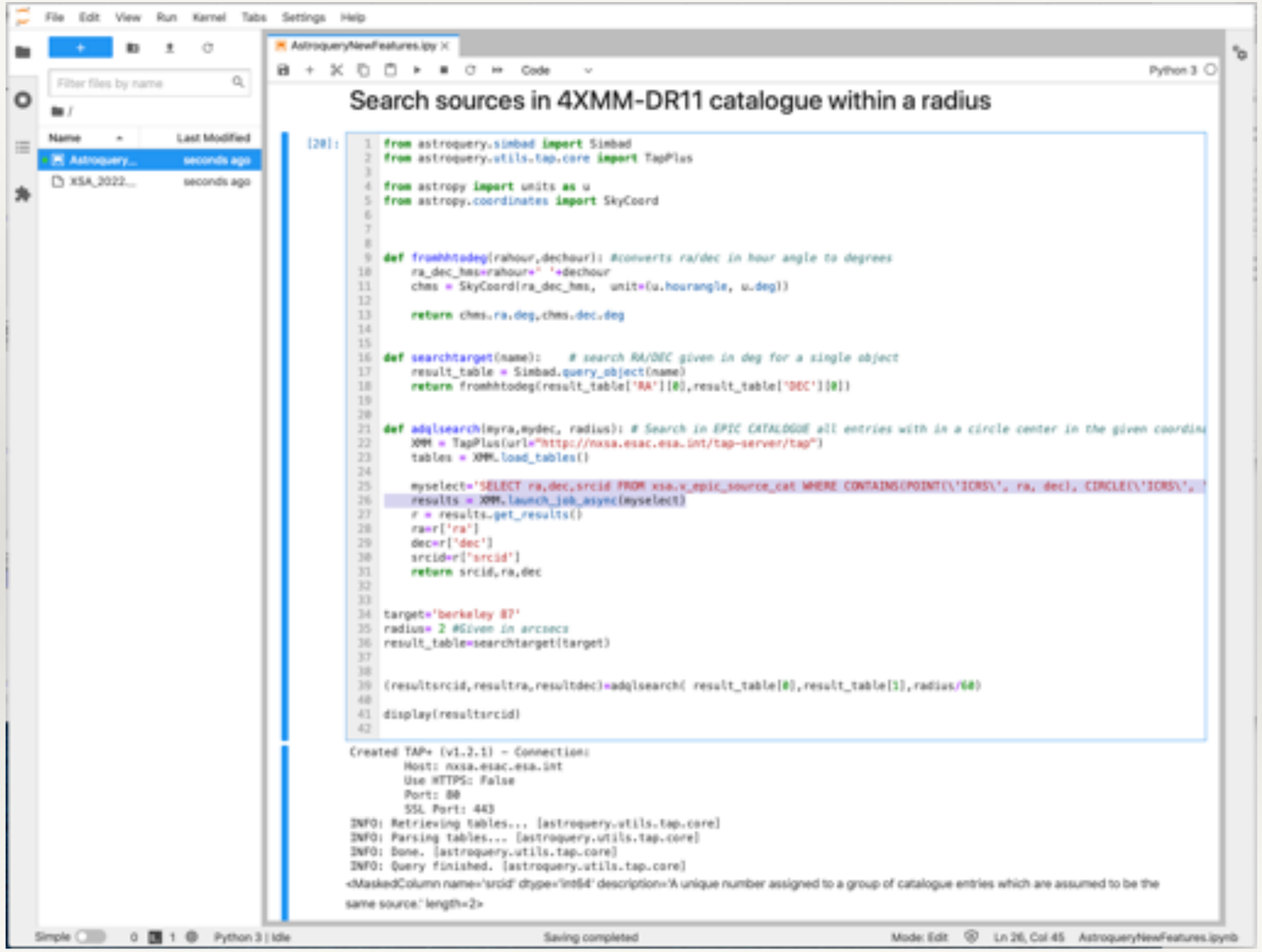
XSA NEW FEATURES **Astroquery** astroquery.esa.xmm_newton

NEW FEATURES

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…



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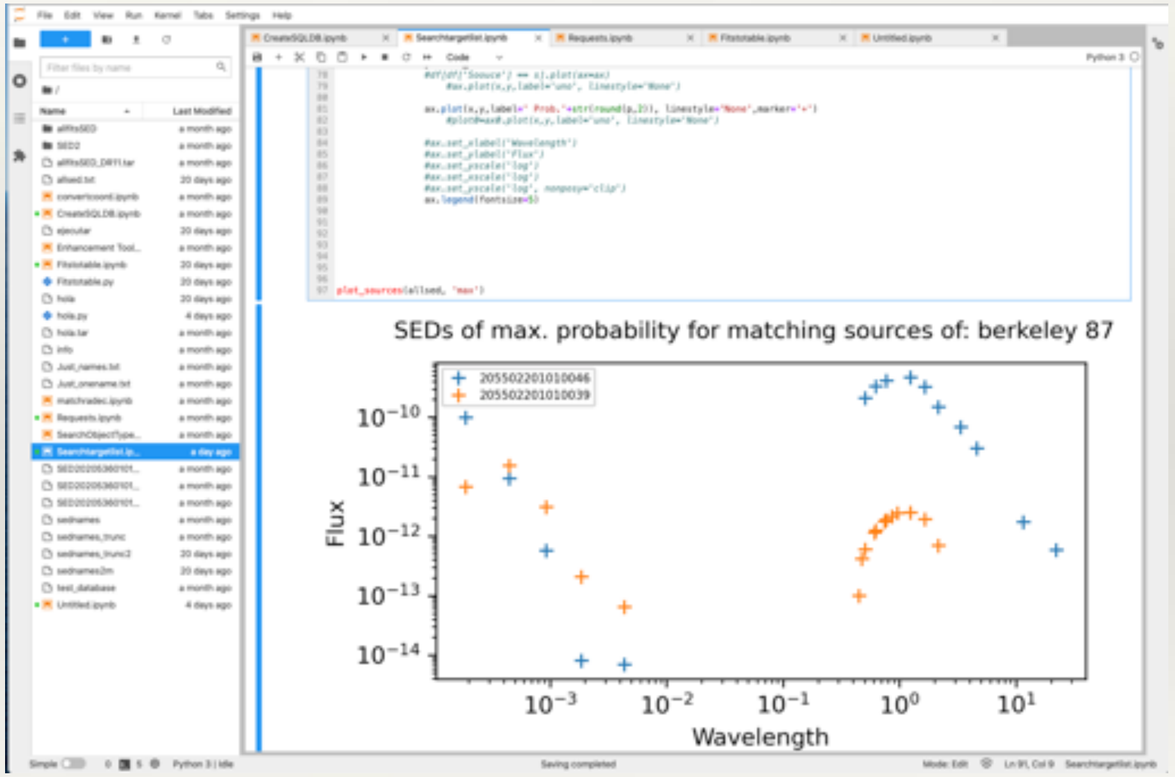
XSA NEW FEATURES Astroquery astroquery.esa.xmm_newton

NEW FEATURES 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

- **On-going project**
- 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.
- 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 ?)



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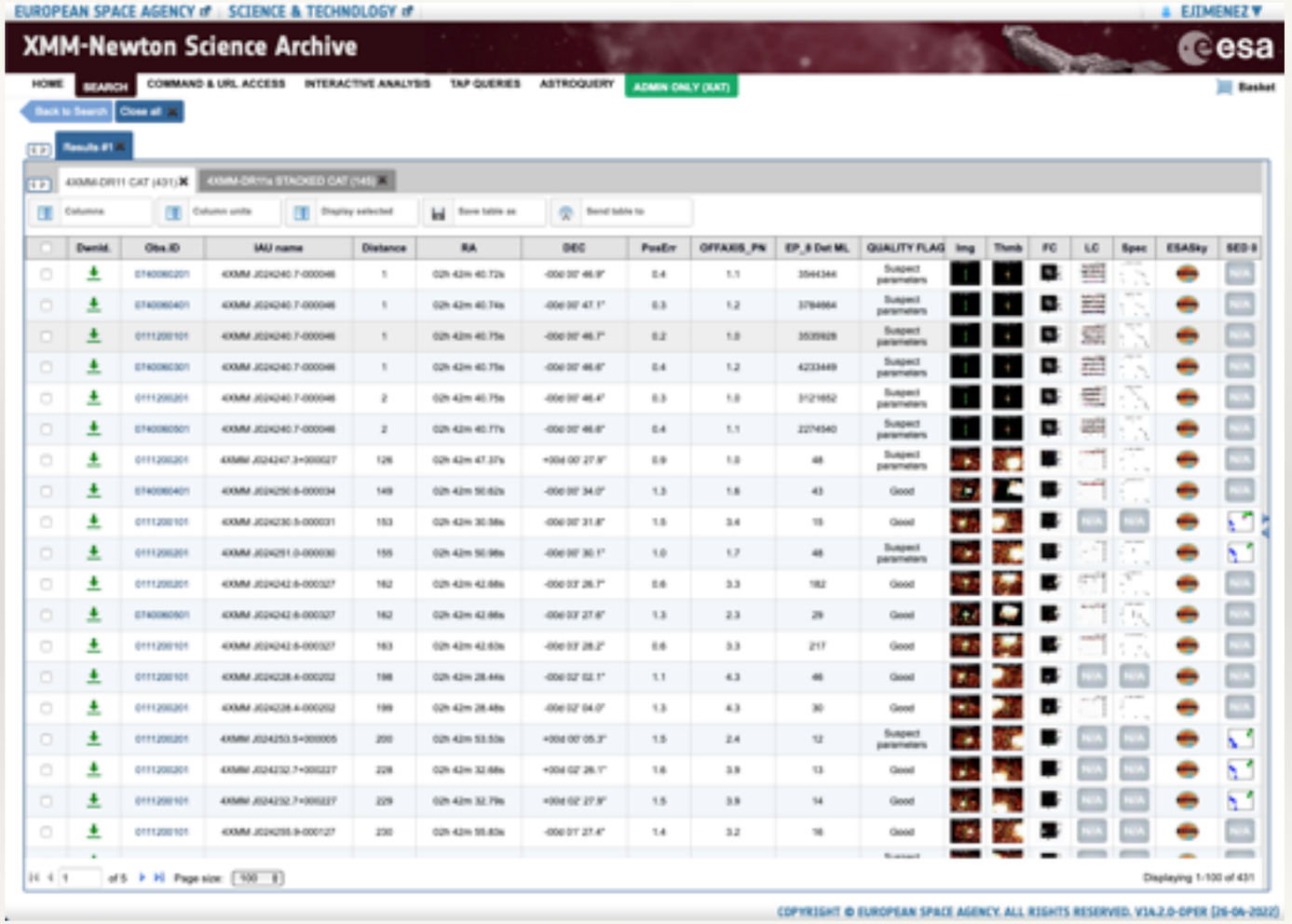
XSA NEW FEATURES 4XMM-DR12 & 4XMM-DR12S

- 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
- Automatise ingestion process for data and products for 4XMM-DR12 & 4XMM-DR12s catalogues



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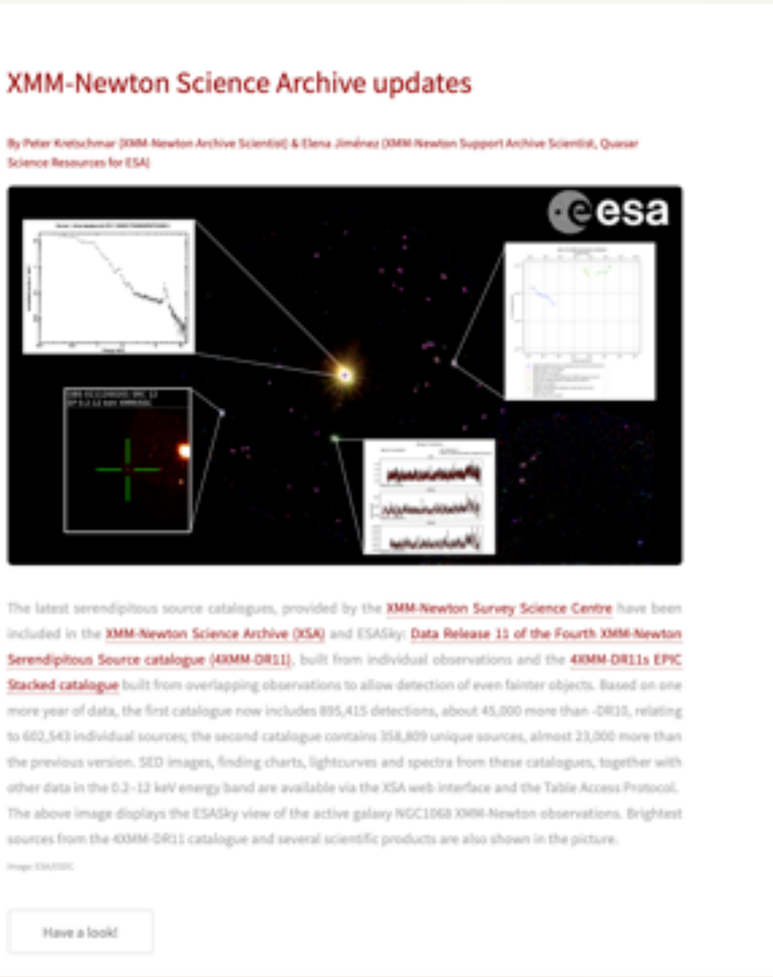
OTHER PROJECTS

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



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

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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