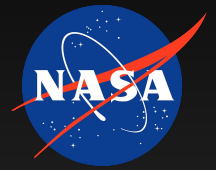


HEASARC

https://heasarc.gsfc.nasa.gov/

Introduction and overview of services for
The PhysCOS Early Career Workshop Sept 23, 2025

by **Tess Jaffe** representing the team:

Director: pending, **Software Team Lead** Andy Ptak filling in along with **Chief Archive Scientist** Tess Jaffe; **Data Scientist:** Brian Powell; **Archive Scientists:** Mike Corcoran, Keith Arnaud, Antara Basu-Zych, Abdu Zoghbi, Steve Sturner; **Database administrator:** Ed Sabol; **System and web administrator**: Mike Arida; **HEASoft lead:** Bryan Irby; **Web and analysis software developers**: Meredith Gibb, Michael Preciado, Kristin Rutkowski, Duy Nguyen, Craig Gordon, Jesse Allen, James Runge, Kristen Killingsworth.

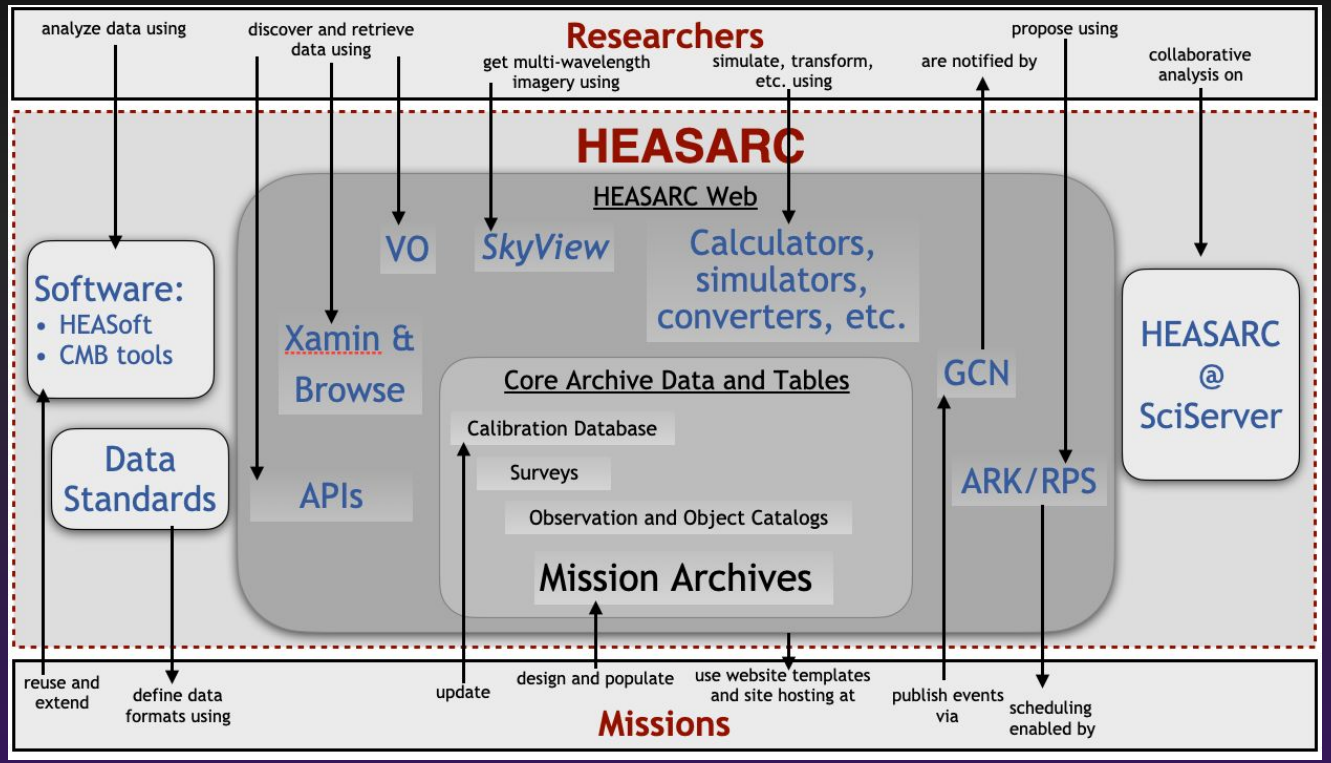
(Plus **LAMBDA team for CMB related data and tools**, Tom Essinger-Hileman, Science Lead)

HEASARC: High Energy Astrophysics Science Archive Research Center

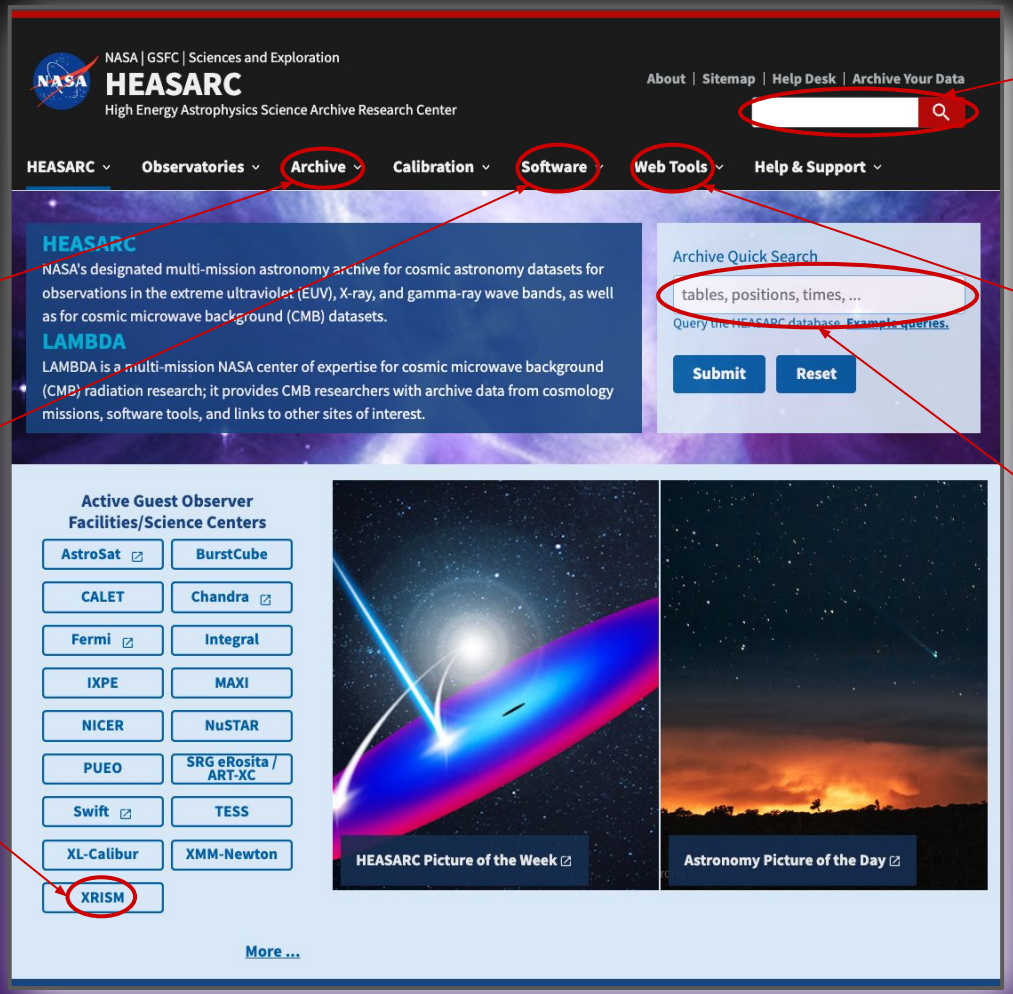
- Overview
  - Tour of HEASARC for a scientist end user
- Data discovery
  - Live demo of a few science workflows
- SciServer and JS9
  - Demo of the environment and tools
- Heasoftpy
  - Intro to Ftools analysis through Python with NICER example

Overview

- Website
- Data archive
  - /FTP area
  - Xamin and Browse
  - Bibliographic data
  - APIs
- Software
  - HEASoft, Caldb
- Platforms
  - (past) Hera
  - (present) SciServer
  - (future) Fornax
- Proposal and science tools
  - ARK/RPS
  - WebPIMMS
  - SkyView
  - Viewing
- Community
  - News feed
  - Calendars



HEASARC home



Search the website

Info on different ways to access the archive

Info on analysis software (HEASoft, PIMMS, etc.)

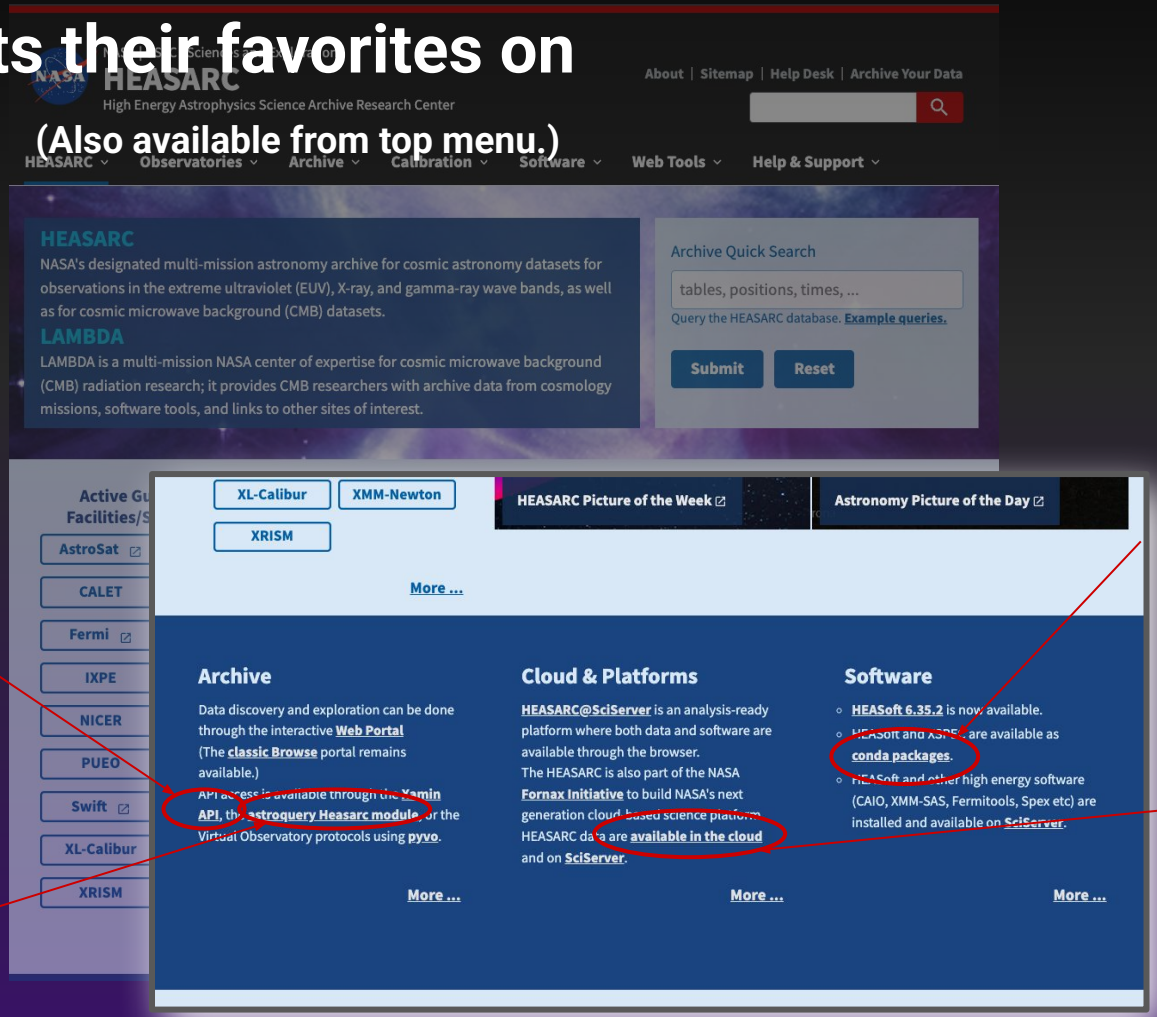
Go to mission support for XRISM

Info on web tools like calculators, converters, etc.

Quick archive search, e.g., “hitomi crab”

Everybody wants their favorites on the home page.

(Also available from top menu.)



Programmatic access to the archive

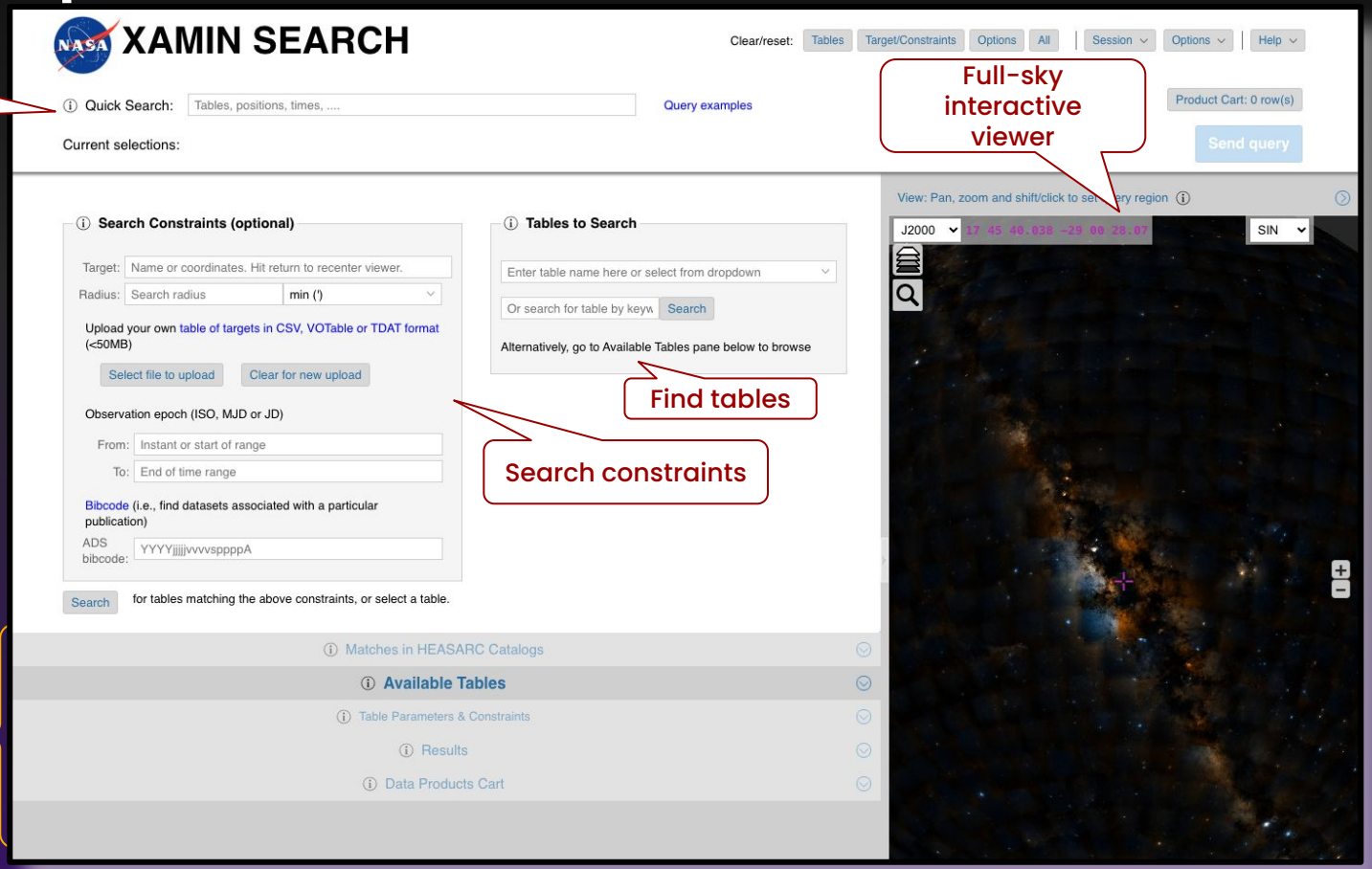
Astroquery.heasarc refreshed

Software now available in conda

Data now available in the cloud

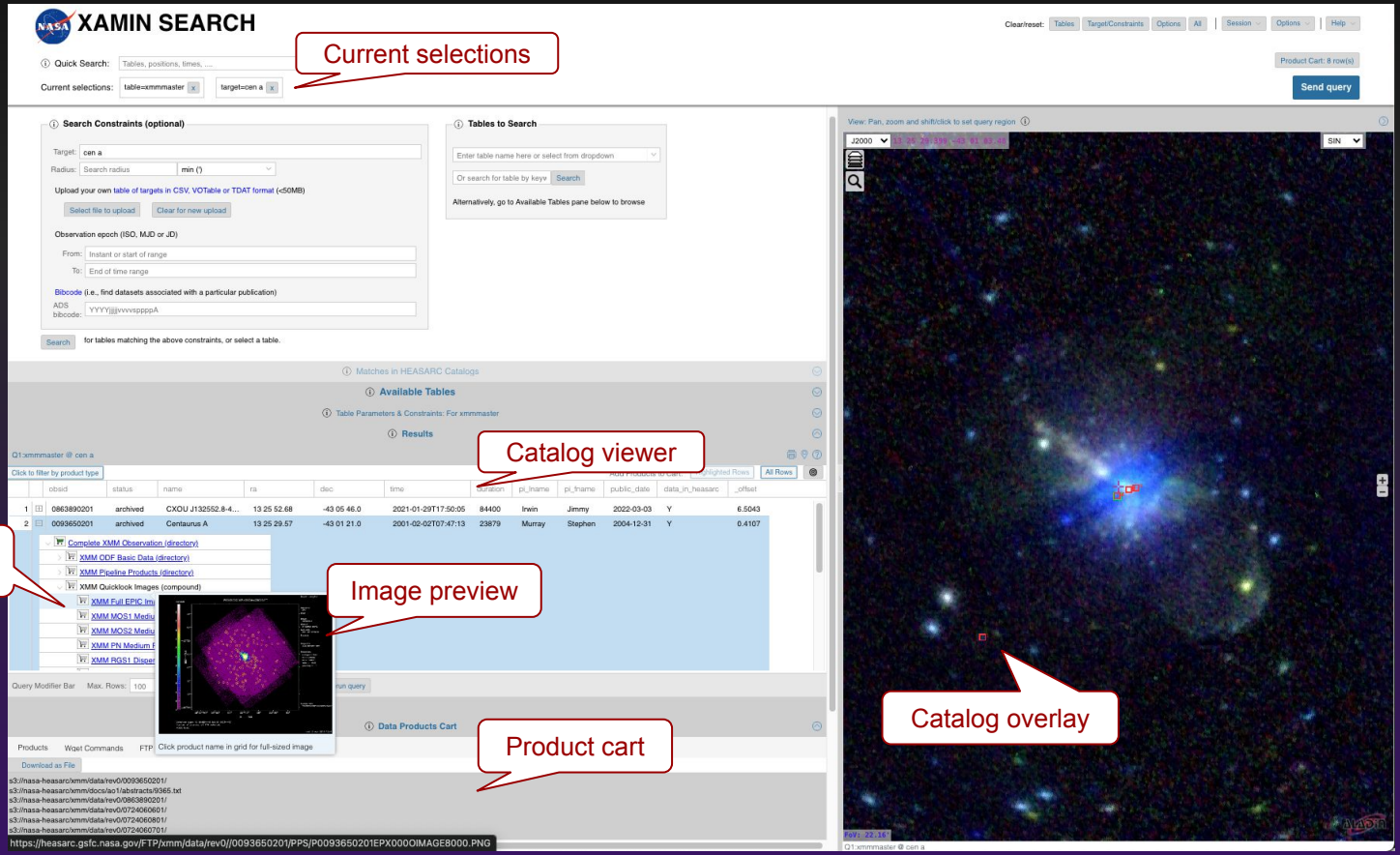
Interactive portal: https://heasarc.gsfc.nasa.gov/xamin/

Quick search: *nicer 'cen a'*

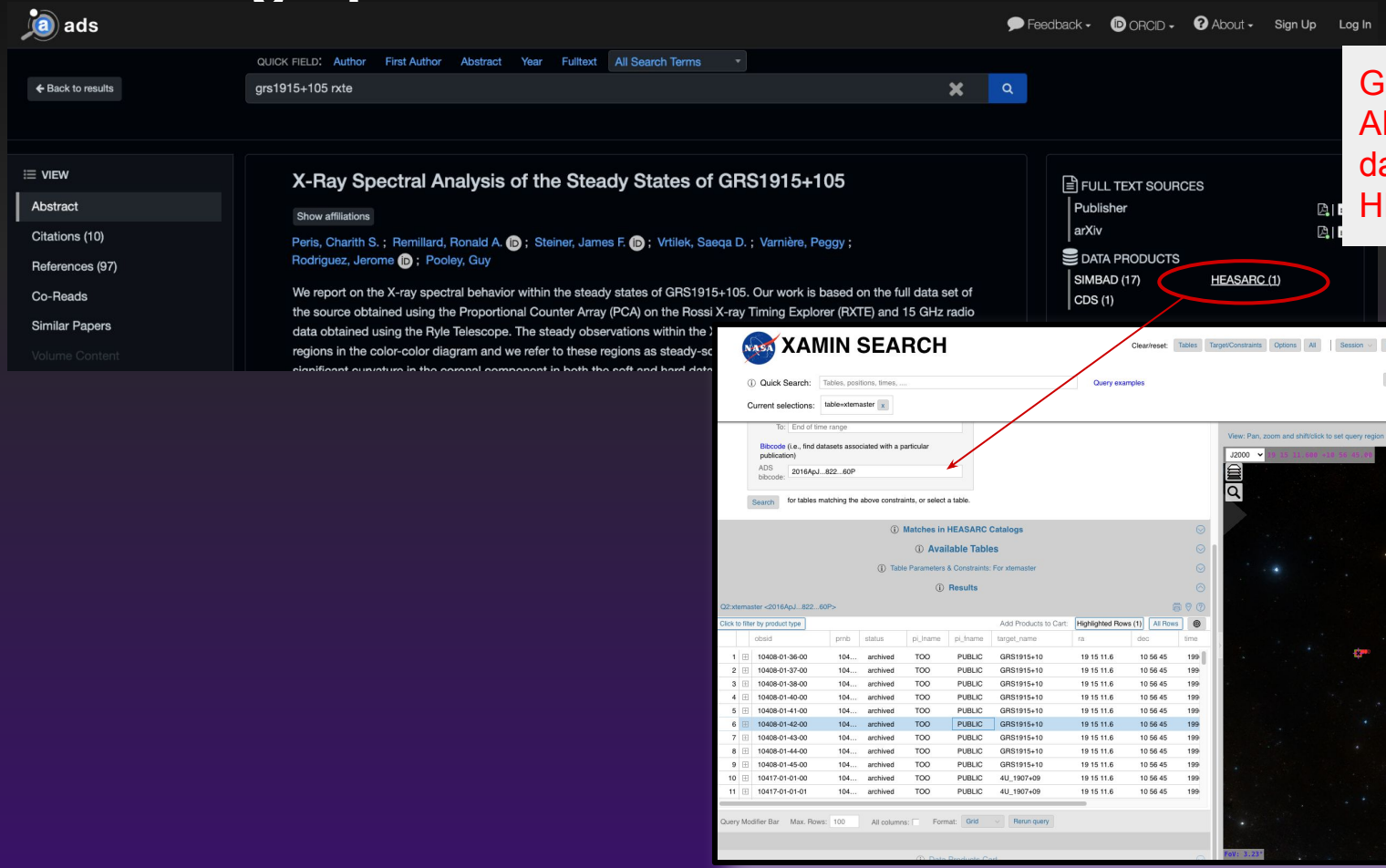


Explore catalog contents, specify detailed constraints, browse results, select data products, download data....

Interactive portal: https://heasarc.gsfc.nasa.gov/xamin/



Bibliographic links: from ADS to HEASARC



Go straight from ADS to browse the data products on HEASARC

Software

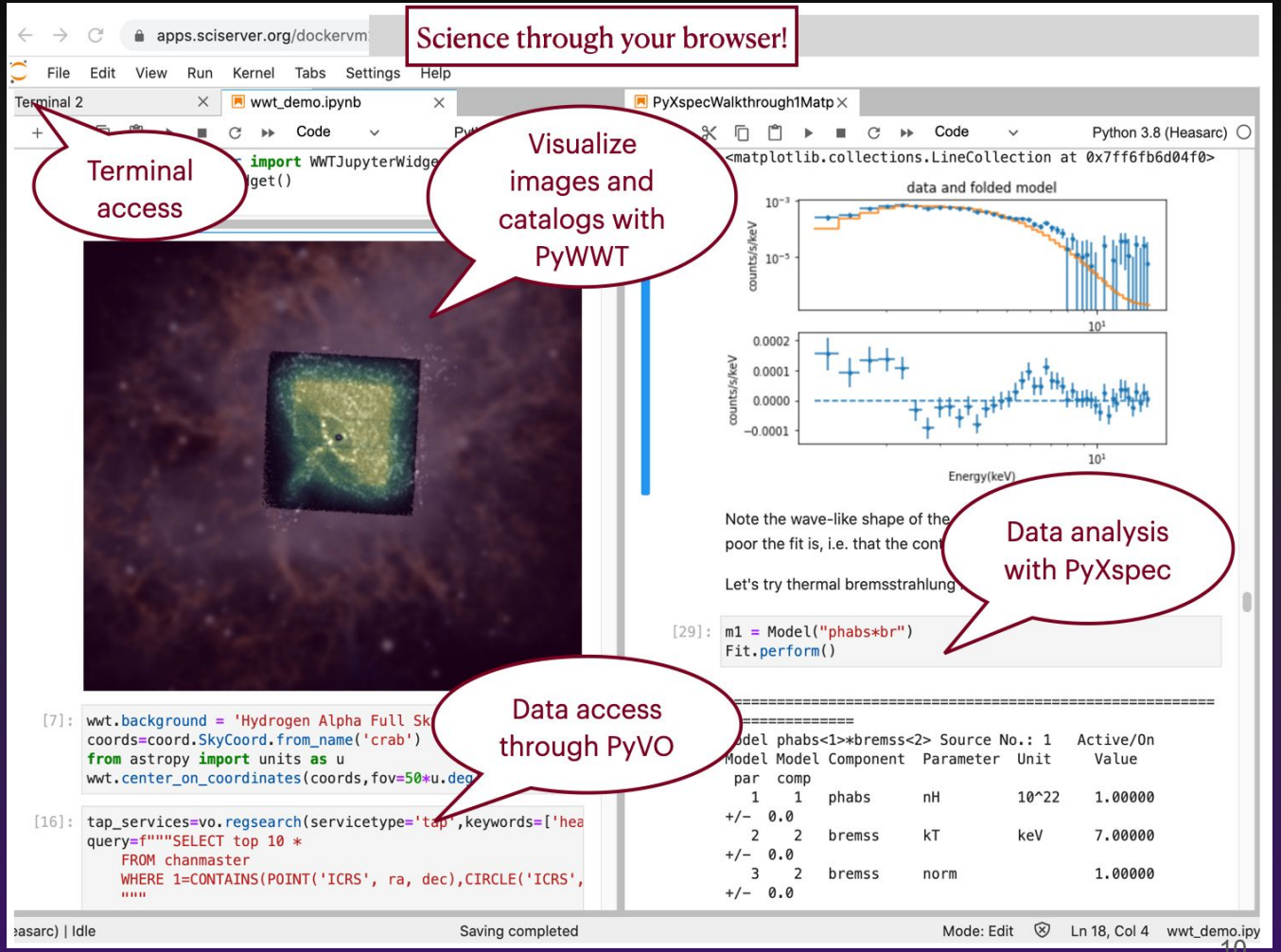
- HEASoft
  - Generic and mission-specific tools for high energy astrophysics data analysis
  - Use our Dockerfile or **conda install**
  - Or use our science platforms (see below)
- Astroquery.heasarc
  - Pythonic ways to find and download data.
- Heasoftpy
  - Script in Python
  - Share as Jupyter notebooks
  - Start from tutorials
- Caldb
  - Keep up-to-date with the latest calibration

```python
import heasoftpy as hsp
hsp.fdump(infile='input.fits', outfile='STDOUT', ...)

# or
params = {
    'infile': 'input.fits',
    'outfile': 'STDOUT',
    ...
}
hsp.fdump(params)

# or
fdump_task = hsp.HSPTask('fdump')
fdump_task(infile='input2.fits', outfile='STDOUT', ...)
hsp.fdump(fdump_task)

# or
fdump_task = hsp.HSPTask('fdump')
fdump_task.infile = 'input2.fits'
fdump_task.outfile = 'STDOUT'
... # other parameters
fdump_task()
```

```
>>> from astroquery.heasarc import Heasarc
>>> from astropy.coordinates import SkyCoord
>>> pos = SkyCoord.from_name('ngc 3516')
>>> tab = Heasarc.query_region(pos, catalog='nicermastr')
>>> tab = tab[tab['exposure'] > 0]
>>> links = Heasarc.locate_data(tab[:2])
>>> links['access_url'].pprint()
                                access_url
------------------------------------------------------------------------
https://heasarc.gsfc.nasa.gov/FTP/nicer/data/obs/2018_08//1100120101/
https://heasarc.gsfc.nasa.gov/FTP/nicer/data/obs/2018_08//1100120102/
```

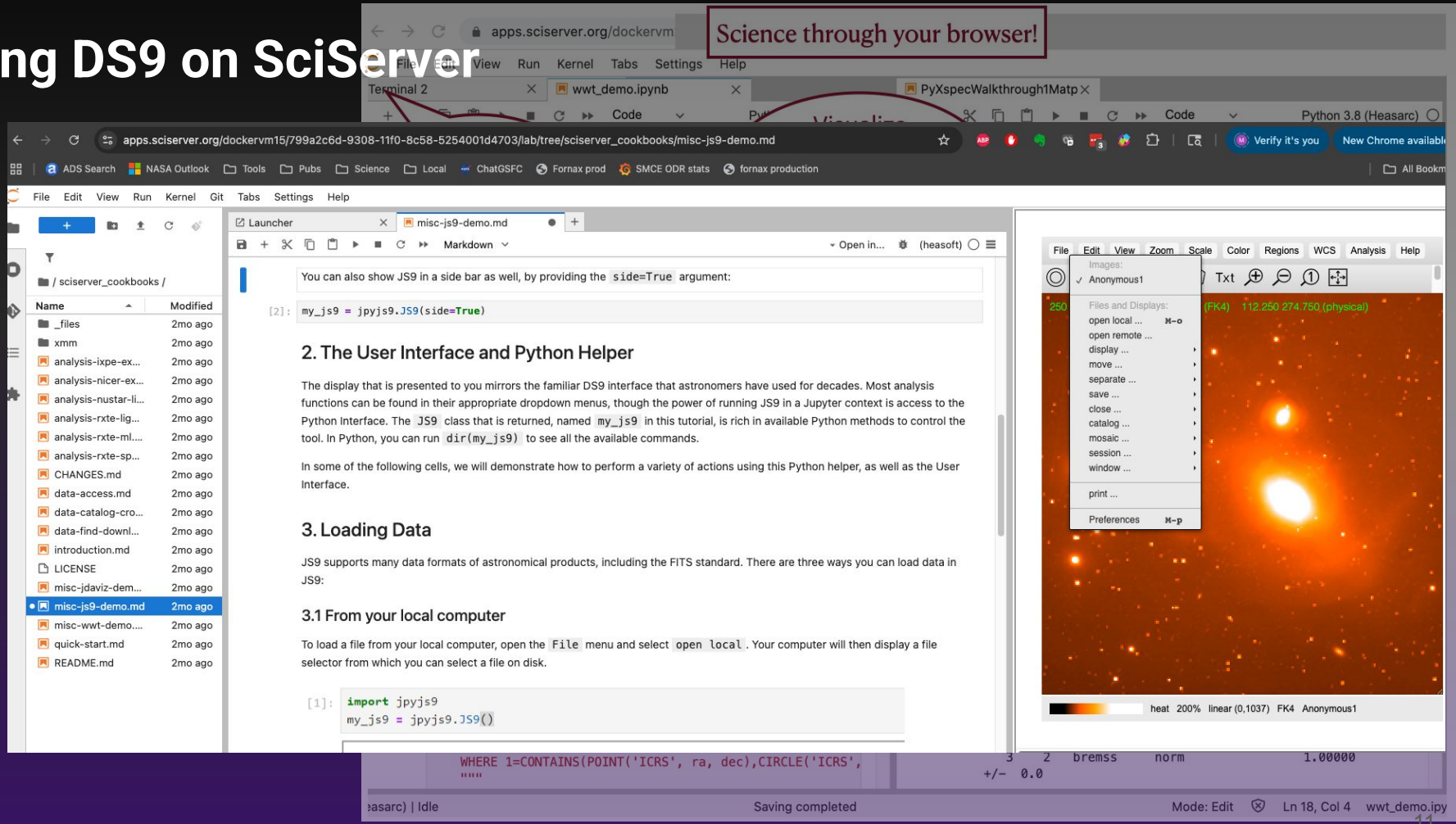
Science platform: SciServer

- Do science through your browser
  - No data downloads
  - No software builds
  - Just create an account and go.
- Replaces existing Hera interface.
- Coming soon to Amazon Web Services with more available data from beyond HEASARC.



https://heasarc.gsfc.nasa.gov/docs/sciserver/

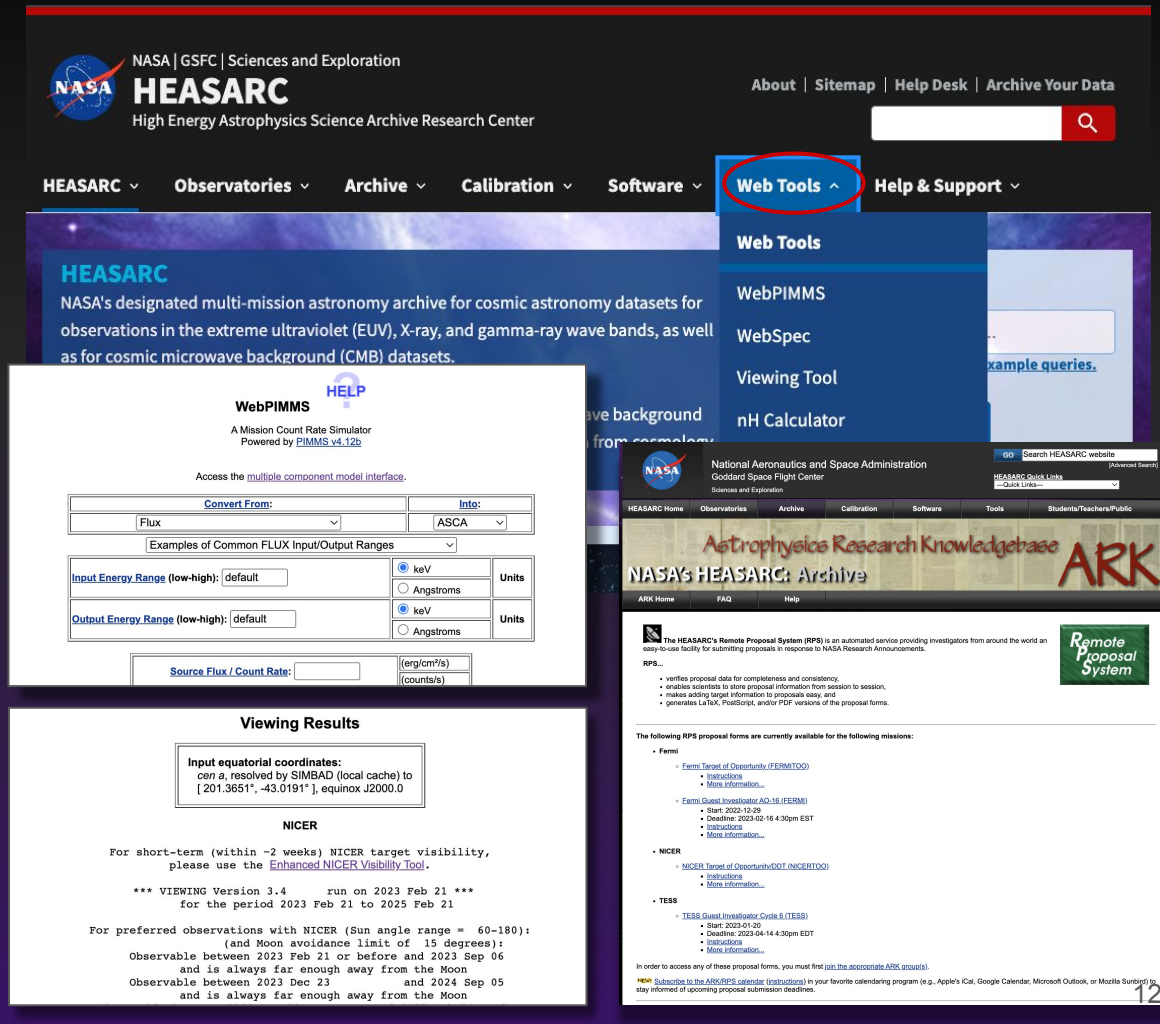
Using DS9 on SciServer



https://heasarc.gsfc.nasa.gov/docs/sciserver/

Mission proposal support

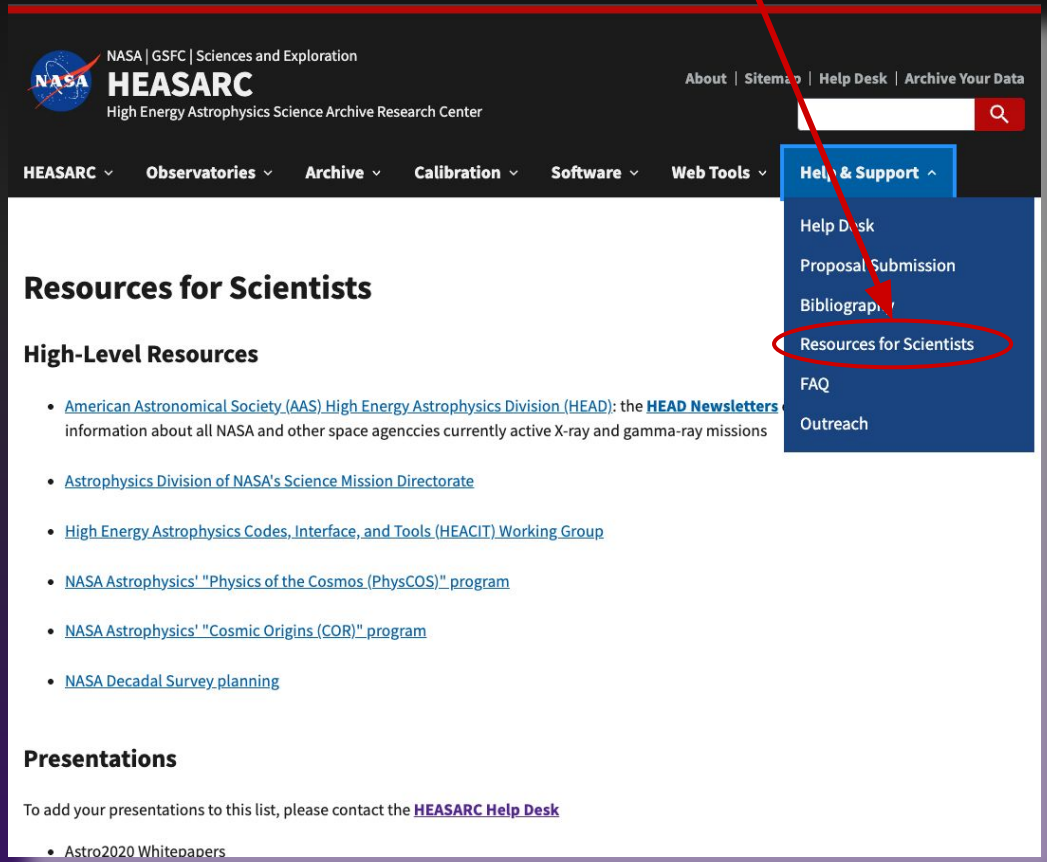
- ARK/RPS
  - Standard proposal submission system for HEA missions
- (Web)PIMMS
  - Portable, Interactive, Multi-Mission Simulator
  - i.e., what S/N will I get for my source?
- Viewing
  - When can which instruments see my source?



Community

- HEACIT
  - Community-run, HEASARC-supported
  - HEACIT is on openastronomy.org
- HEASwF
  - Working group exploring options for software modernization
- Helpdesks
  - Mission-specific
  - Tool-specific
  - HEASoft
  - General
- Social
  - Facebook for Xspec
  - Astropy.slack.com channels
  - GitHub HEASARC organizations
    - Jupyter notebook tutorials
      Contributions encouraged!
- Workshops
  - Demos at AAS high energy booth
  - HEAD meeting special sessions/workshops

Communities and other resources



On the horizon

- Fornax Initiative to extend SciServer capabilities into the cloud with more compute and more NASA Astrophysics datasets.
- Improved graphical user interface data portal.
- Improved API and Python interfaces.
- HEASoft modernization exploration.

backup

Programmatic data access

- If you know what you want and where it is already (e.g., from the web portal), you can use our download script

```
download_wget.pl https://heasarc.gsfc.nasa.gov/FTP/nicer/data/obs/2018_01/1050020180/
```

- To find things on the command line, you can use the Xamin java tool (which calls the API) to run queries:

```
> runquery position='cen a' table=chanmaster time=2018-01-01..2019-01-01 products
filterstring='*/*evt*'
```

- Pythonic access via Astroquery.heasarc is now updated and maintained by us.

```
>>>
```

- For API access, you can use
  - the Xamin API: https://heasarc.gsfc.nasa.gov/xamin/QueryServlet?help
  - The VO APIs: https://heasarc.gsfc.nasa.gov/navo/summary/navo_services.html
    - A good Python VO client is PyVO: https://nasa-navo.github.io/navo-workshop/

HEASARC data in the cloud

Most HEASARC data now on AWS in a free S3 bucket

- E.g., a file that on HEASARC is available at
  - `https://heasarc.gsfc.nasa.gov/FTP/chandra/data/byobsid/5/4475/`
- can also be found at
  - `s3://nasa-heasarc/chandra/data/byobsid/5/4475/`
- Or
  - `https://nasa-heasarc.s3.amazonaws.com/chandra/data/byobsid/5/4475/`
- Access via HTTPS or AWS CLI or Python boto3 library etc. See our Python tutorial for some access options. It looks a bit like this:

```
s3_url = url.replace("https://heasarc.gsfc.nasa.gov/FTP/",
                     "https://nasa-heasarc.s3.amazonaws.com/")
hdul = fits.open(s3_url)
```

(FYI: each mission is currently sync'd to AWS weekly. Let us know if you need things faster and we'll see what we can do.)

HEASARC @ Sciserver

- Sciserver is a jupyter-based science platform hosted at JHU.
- Open to anyone.
- Heasoft and all of HEASARC archive is available ‘locally’.
- No need to install anything
- No need to download anything
- Also includes: XMM SAS, Chandra CIAO, and Fermitools.
- Tutorials. Also on github.com/HEASARC/sciserver_cookbooks
- File-sharing.
- Run Batch jobs.
- Great for students too (data+software ready to go and easy to share code, etc)