



HEASARC

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

Introduction and overview of services

by **Antara Basu-Zych** representing the team:

Director: (pending); **Project Scientist:** Lorella Angellini; **Chief Archive Scientist :** Tess Jaffe; **Data Scientist:** Brian Powell;
Archive Scientists: Mike Corcoran, Keith Arnaud, Antara Basu-Zych, Abdu Zoghbi, Steve Sturone; **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, Pan Chai, Matt Elliot, Jesse Allen, James Keiser, Range Killingsworth; **Bibliographer:** Doug van Orsow.

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

How familiar are you with the HEASARC?

First time I am hearing about this

0%

I've heard of the HEASARC but not very sure what they do

0%

I'm pretty familiar with the HEASARC


0%

I use the HEASARC regularly

0%

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

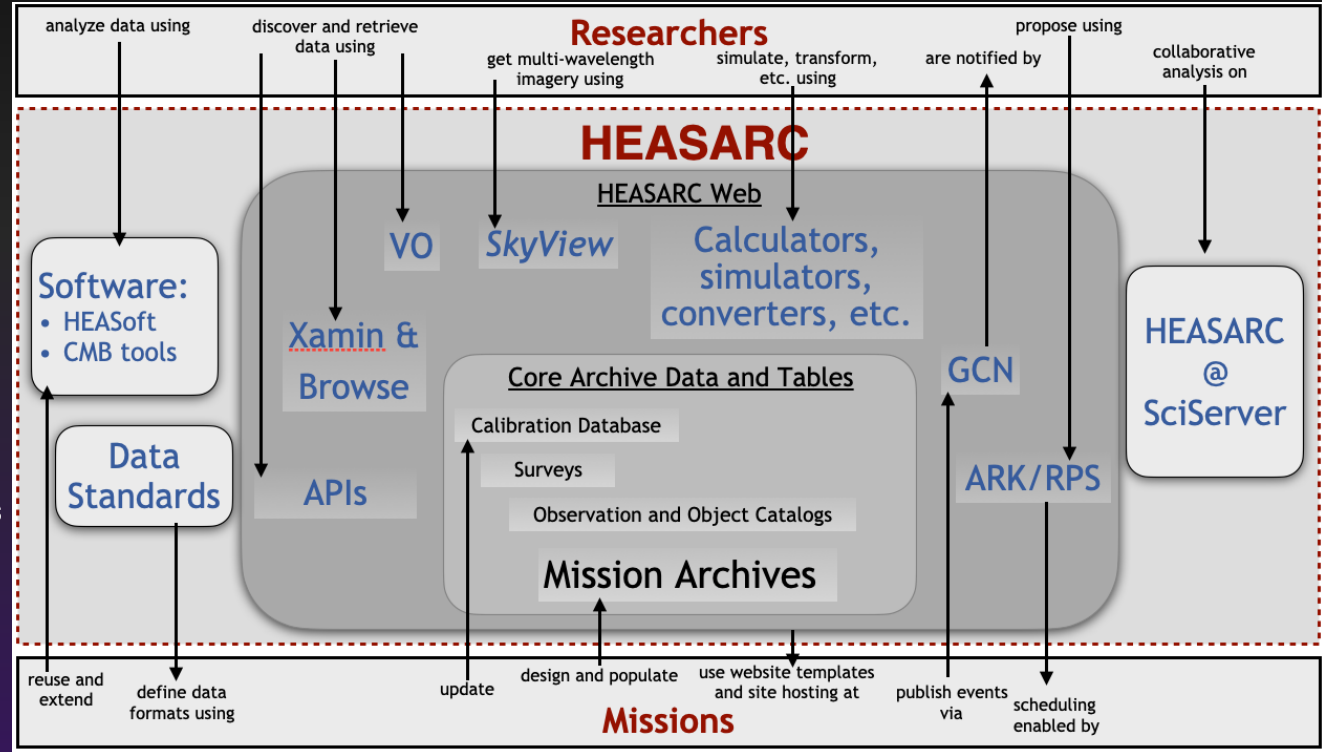


To achieve great things, two things are needed; a plan, and not quite enough time.

– Leonard Bernstein

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
 - Helpdesks



HEASARC home

Info on different ways to access the archive

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

Go to mission support for XRISM

Quick archive search, e.g., "hitomi crab"

National Aeronautics and Space Administration
Goddard Space Flight Center
Sciences and Exploration

GO Search HEASARC website [Advanced Search]

HEASARC Quick Links
Quick Links

HEASARC Home Observatories **Archive** Calibration **Software** **Tools** Students/Teachers/Public

NASA's HEASARC
High Energy Astrophysics Science Archive Research Center

About the HEASARC Resources for Scientists Feedback, FAQ & Help Desk Archive Your Data at the HEASARC Site Map Other Archives

Active Guest Observer Facilities/Science Centers

AstroSat	FIRST/Cube
CALET	Chandra
Fermi	INTEGRAL
IXPE	MAXI
NICER	NuSTAR
SRG eROSITA /ART-XC	Swift
TESS	XL-Calibur
XMM-Newton	XRISM

Historic Guest Observer Facilities/Science Centers

AGILE	ASCA
BeppoSAX	CGRO
COBE	EUVE
GALEX	HaloSat
Hilomi	HETE-2
LPF DRS	ROSAT
RXTE	Suzaku
WMAP	

Virtual Observatory/Cloud Computing

HEASARC in the VO	IVOA
NAVO	HEASARC in the Cloud

NASA Archives

ADS	EOSDIS
ExoArchive	HORIZONS
IRSA	KOA
LAMBDA	MAST
NED	NSSDCA
PDS	SDAC
SPDF	SSC

The High Energy Astrophysics Science Archive Research Center (HEASARC) is the primary archive for NASA's (and other space agencies') missions studying electromagnetic radiation from extremely energetic cosmic phenomena ranging from black holes to the Big Bang. Since its merger with the Legacy Archive for Microwave Background Data Analysis (LAMBDA) in 2008, the HEASARC archive contains data obtained by high-energy astronomy missions observing in the extreme-ultraviolet (EUV), X-ray, and gamma-ray bands, as well as data from space missions, balloons, and ground-based facilities that have studied the relic cosmic microwave background (CMB) radiation in the sub-mm, mm and cm bands.

The HEASARC is a member of the [NASA Astronomical Virtual Observatories \(NAVO\)](#) where we work with other NASA archives to ensure comprehensive and consistent VO access to NASA mission datasets. Users may now query the HEASARC's catalogs using VO-enabled services and specialized tools. [This page](#) describes how to get to the HEASARC VO-enabled services and provides information on other HEASARC VO activities.

HEASARC Picture of the Week

APOD: Astronomy Picture of the Day

More Images

Latest News

- [Swift SC and BAT CALDB updated](#) (12 Mar 2024)
The Swift SC caldb has been updated to version 20240308, and the Swift BAT caldb has been updated to version 20230607. [IXPE Quick Start Guide Updated](#) (12 Mar 2024)
The IXPE [Observation](#) guide has been updated to include the use of the [ixpecalcar](#) tool to generate observation specific response files.
- [Xamin New Interface Released](#) (07 Mar 2024)
Xamin has a [new, easier-to-use interface](#). Please give it a try. Feedback welcome. The "classic" interface is still available.
- [NuSTAR Caldb Update](#) (29 Feb 2024)
The NuSTAR FPM caldb was updated to version 20240229. This release includes a new clock correction file, v177, and a new gain and arf. Please see the [release notes](#) for more details.
- [IXPE Caldb Updated](#) (29 Feb 2024)
The IXPE Caldb has been updated for the XRT (version 20231201) and the GPD (version 20240125). Please see the [release notes](#) for details. Downloads are available from the [IXPE Calibration page](#). Users can also access the HEASARC IXPE caldb via [remote access](#).
- [IXPE Viewing Tool Updated](#) (29 Feb 2024)
The Sun angle constraint has been updated in the Viewing tool for the IXPE mission.

Xamin Quick Search [Xamin](#) [Browse](#)

Tables, positions, times,

Submit Reset

Enter positions, times, missions, ... to query the HEASARC database.

Try [ROSAT 3c273 1d](#) to get ROSAT data within one degree of 3c273 or [chanmaster bil-80 status/archived](#) to get archived Chandra Observations

What is this?

HEASARC News
[Upcoming Dates & Deadlines](#)
[Upcoming Astronomy Meetings](#)

General Tools

- Bibliography
- Coordinate Converter
- Energy Converter
- FITS File Verifier
- nH Column Density
- Time/Date Converter
- X-Ray Background
- X-Ray Source Finder

Multi-Mission Tools

- SciServer
- Hera
- RPS
- Timeline Tool
- Viewing
- WebPIMMS
- WebSpec

Info on web tools like calculators, converters, etc.

News items

Note: Currently working on redesign and modernization.
Stay tuned!

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



XAMIN SEARCH

Clear/reset: Tables Target/Constraints Options All | Session Options Help

Quick search nicer 'cen a'

Quick Search: Tables, positions, times,

Query examples

Full-sky viewer

Product Cart: 0 row(s)

Send query

Current selections:

View: Pan, zoom and shift/click to set query region

Search Constraints

Target: Name or coordin

Radius: Search radius

Upload your own table of target coordinates in VOTable or TDAT format (<50MB)

Select file to upload Clear for new upload

Observation epoch (ISO, MJD or JD)

From: Instant or start of range

To: End of time range

Bibcode (i.e., find datasets associated with a particular publication)

ADS bibcode: YYYYjjjjvvvvppppA

Search for tables matching the above constraints, or select a table.

More detailed demo coming up.

Find tables

Search constraints

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

Matches in HEASARC Catalogs

Available Tables

Table Parameters & Constraints

Results

Data Products Cart

Bibliographic links: from ADS to HEASARC



QUICK FIELD: Author First Author Abstract Year Fulltext All Search Terms

← Back to results

grs1915+105 rxte

X-Ray Spectral Analysis of the Steady States of GRS1915+105

Show affiliations

Peris, Charith S.; Remillard, Ronald A.; Steiner, James F.; Vrtilak, Saeqa D.; Varnière, Peggy; Rodriguez, Jerome; Pooley, Guy

We report on the X-ray spectral behavior within the steady states of GRS1915+105. Our work is based on the full data set of the source obtained using the Proportional Counter Array (PCA) on the Rossi X-ray Timing Explorer (RXTE) and 15 GHz radio data obtained using the Ryle Telescope. The steady observations within the X-ray regions in the color-color diagram and we refer to these regions as steady-state significant curvature in the coronal component in both the soft and hard data

FULL TEXT SOURCES

Publisher
arXiv

DATA PRODUCTS

SIMBAD (17)
CDS (1)

HEASARC (1)

Go straight from ADS to browse the data products on HEASARC

NASA XAMIN SEARCH

Clear/reset: Tables TargetConstraints Options All Session Options Help

Quick Search: Tables, positions, times, ... Query examples Product Cart: 0 rows

Current selections: table=xtmaster

To: End of time range

Bibcode (i.e., find datasets associated with a particular publication)
ADS 2016ApJ...822...60P
bibcode:

Search for tables matching the above constraints, or select a table.

Matches in HEASARC Catalogs

- Available Tables
- Table Parameters & Constraints: For xtmaster
- Results

Click to filter by product type Add Products to Cart: Highlighted Rows (1) All Rows

	obsid	prmb	status	pl_name	pl_frame	target_name	ra	dec	time
1	10408-01-36-00	104...	archived	TOO	PUBLIC	GRS1915+10	19 15 11.6	10 56 45	199
2	10408-01-37-00	104...	archived	TOO	PUBLIC	GRS1915+10	19 15 11.6	10 56 45	199
3	10408-01-38-00	104...	archived	TOO	PUBLIC	GRS1915+10	19 15 11.6	10 56 45	199
4	10408-01-40-00	104...	archived	TOO	PUBLIC	GRS1915+10	19 15 11.6	10 56 45	199
5	10408-01-41-00	104...	archived	TOO	PUBLIC	GRS1915+10	19 15 11.6	10 56 45	199
6	10408-01-42-00	104...	archived	TOO	PUBLIC	GRS1915+10	19 15 11.6	10 56 45	199
7	10408-01-43-00	104...	archived	TOO	PUBLIC	GRS1915+10	19 15 11.6	10 56 45	199
8	10408-01-44-00	104...	archived	TOO	PUBLIC	GRS1915+10	19 15 11.6	10 56 45	199
9	10408-01-45-00	104...	archived	TOO	PUBLIC	GRS1915+10	19 15 11.6	10 56 45	199
10	10417-01-01-00	104...	archived	TOO	PUBLIC	4U_1907+09	19 15 11.6	10 56 45	199
11	10417-01-01-01	104...	archived	TOO	PUBLIC	4U_1907+09	19 15 11.6	10 56 45	199

Query Modifier Bar Max. Rows: 100 All columns: Format: Grid Run query

Software

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

```
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()
```


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.

apps.sciserver.org/dockerm

Science through your browser!

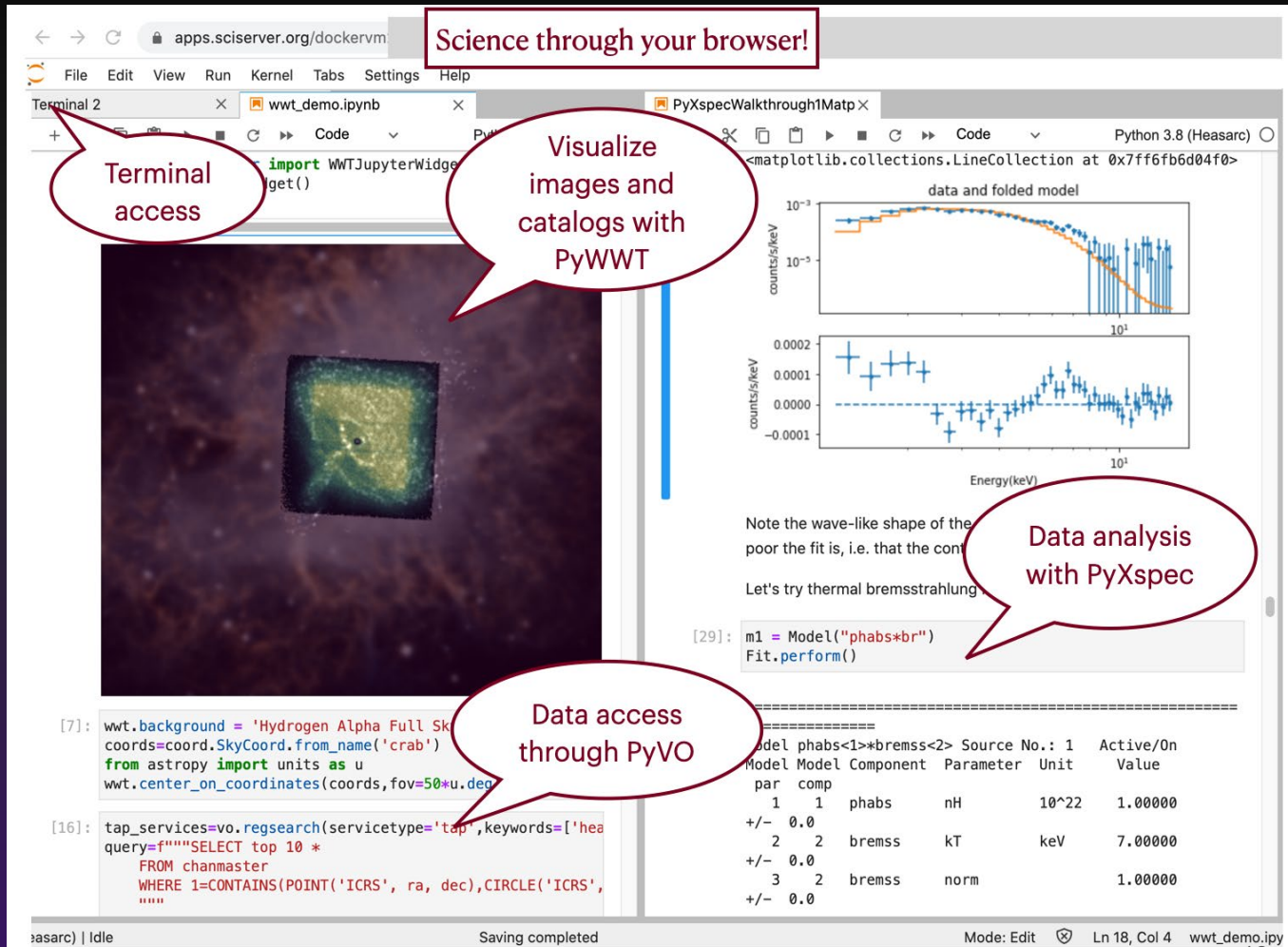
Terminal 2

Terminal access

Visualize images and catalogs with PyWWT

PyXspecWalkthrough1Matp

Python 3.8 (Heasarc)



data and folded model

counts/keV

Energy(keV)

Note the wave-like shape of the residuals, which indicates a poor fit is, i.e. that the component is not a simple thermal bremsstrahlung.

Let's try thermal bremsstrahlung.

[29]: `m1 = Model("phabs*br")`
`Fit.perform()`

[7]: `wwt.background = 'Hydrogen Alpha Full Sky'`
`coords=coord.SkyCoord.from_name('crab')`
`from astropy import units as u`
`wwt.center_on_coordinates(coords, fov=50*u.deg)`

[16]: `tap_services=vo.regsearch(servicetype='tap', keywords=['heasarc'])`
`query=f"""SELECT top 10 *`
`FROM chanmaster`
`WHERE 1=CONTAINS(POINT('ICRS', ra, dec),CIRCLE('ICRS',`
`ra, dec, radius))`
`"""`

Model	Model Component	Parameter	Unit	Value
1	1	phabs	nH	10 ²²
2	2	brems	kT	keV
3	2	brems	norm	1.00000

Mode: Edit Ln 18, Col 4 wwt_demo.ipynb

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

- [News](#)
 - [Subscribe via RSS](#)
- [Conference listings](#)
- [Proposal deadlines](#)
 - [Subscribe to our calendar!](#)
- [HEACIT](#)
 - [Community-run, HEASARC-supported HEACIT is on openastronomy.org](#)
- [Helpdesks](#)
 - [Mission-specific](#)
 - [Tool-specific](#)
 - [HEASoft](#)
 - [General](#)
- [APOD and](#)
- [Social](#)
 - [Facebook for Xspec](#)
 - [Astropy.slack.com channel 'pyvo' for Pythonic data access](#)
 - [GitHub \(HEASARC and NASA-NAVO organizations\)](#)
 - [Jupyter notebook tutorials Contributions encouraged!](#)
- [Workshops](#)
 - [Regular AAS workshops on accessing data through Python](#)
 - [HEAD meeting special session/workshop on HEASARC.](#)



The screenshot shows the NASA's HEASARC website. At the top, there is a navigation bar with the NASA logo and the text "National Aeronautics and Space Administration" and "Goddard Space Flight Center". Below this is a search bar and a "HEASARC Quick Links" dropdown menu. The main content area features a large banner with the text "NASA's HEASARC High Energy Astrophysics Science Archive Research Center". Below the banner are several sections: "About the HEASARC", "Resources for Scientists", "Feedback, FAQ & Help Desk", "Archive Your Data at the HEASARC", "Site Map", and "Other Archives". On the left side, there is a table of "Active User Facilities/Science Centers" and "Historic Guest Observer Facilities/Science Centers". On the right side, there is a "Latest News" section with several news items, including "Viewing tool updated with JWST support", "Support for James Webb Space Telescope's Sun angle range has been added to the Viewing tool", "NuSTAR Caldb Update", "The NUSTAR FPM caldb has been updated to version 20230208", "The Million Quasars Catalog", and "APOD: Astronomy Picture of the Day". At the bottom, there is a "Xamin Quick Search" section with a search bar and a "Submit" button.

What are HEASARC services that you have used before? Or if you are new to HEASARC, what services might you be interested in using in future?

Nobody has responded yet.

Hang tight! Responses are coming in.

Xamin data discovery

- Let's do a live demo of <https://heasarc.gsfc.nasa.gov/xamin/>
- Can also do via Python
- Then same in

<https://heasarc.gsfc.nasa.gov/xamin/QueryServlet?help>

- [https://heasarc.gsfc.nasa.gov/xamin/QueryServlet?](https://heasarc.gsfc.nasa.gov/xamin/QueryServlet?position='229.7375,-57.3633'&radius=1&table=nicermastr&time=2024-03-01..2024-04-01&constraint='exposure>5000')
- [position='229.7375,-57.3633'](https://heasarc.gsfc.nasa.gov/xamin/QueryServlet?position='229.7375,-57.3633'&radius=1&table=nicermastr&time=2024-03-01..2024-04-01&constraint='exposure>5000')
- [&radius=1](https://heasarc.gsfc.nasa.gov/xamin/QueryServlet?position='229.7375,-57.3633'&radius=1&table=nicermastr&time=2024-03-01..2024-04-01&constraint='exposure>5000')
- [&table=nicermastr](https://heasarc.gsfc.nasa.gov/xamin/QueryServlet?position='229.7375,-57.3633'&radius=1&table=nicermastr&time=2024-03-01..2024-04-01&constraint='exposure>5000')
- [&time=2024-03-01..2024-04-01](https://heasarc.gsfc.nasa.gov/xamin/QueryServlet?position='229.7375,-57.3633'&radius=1&table=nicermastr&time=2024-03-01..2024-04-01&constraint='exposure>5000')
- [&constraint='exposure>5000'](https://heasarc.gsfc.nasa.gov/xamin/QueryServlet?position='229.7375,-57.3633'&radius=1&table=nicermastr&time=2024-03-01..2024-04-01&constraint='exposure>5000')

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*'
```

- 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.)

SciServer and JS9

Go to live demo. If internet not cooperative, go to backup SciServer video.

HEASARC @ Sciserver

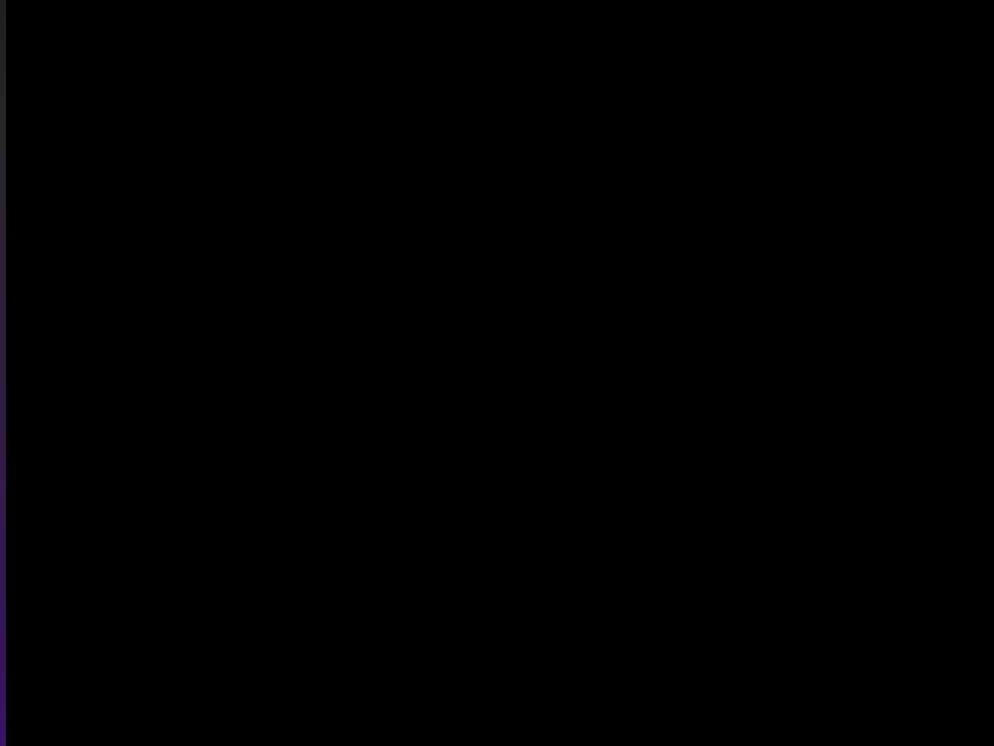
- Sciserver is a **jupyter-based science** platform hosted at JHU.
- **Open** to anyone.
- Heasoft and **all of HEASARC archive** is available 'locally'.
- **No** need to **install** anything
- **No** need to **download** anything
- Also includes: XMM SAS, Chandra CIAO, and Fermitools.
- **Tutorials**. 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)

HEASARC @ Sciserver

- Getting started with Sciserver:
 - Login
 - Create a container
 - Choose a software image
 - Select the data to be mounted (all of HEASARC data)
 - Access the Jupyter environment.

Sciserver Set up and Orientation:

Live demonstration: <https://apps.sciserver.org/dashboard/>



Sciserver: JS9

The screenshot displays the JupyterLab interface for the `sciserver_cookbooks` directory. The browser address bar shows `apps.sciserver.org/dockervm14/66be6bc7-ed0a-11ee-8b7c-5254001d4703/lab/tree/sciserver_cookbooks`. The interface includes a file browser on the left, a main workspace with a Launcher, and a bottom status bar.

File Browser (Left Panel):

Name	Last Modified
<code>_files</code>	2 days ago
<code>40201804...</code>	32 minutes ago
<code>spec</code>	29 minutes ago
<code>analysis-ix...</code>	2 days ago
<code>analysis-ni...</code>	28 minutes ago
<code>analysis-n...</code>	2 days ago
<code>analysis-rx...</code>	2 days ago
<code>analysis-rx...</code>	2 days ago
<code>analysis-rx...</code>	2 days ago
<code>analysis-rx...</code>	2 days ago
<code>CHANGES...</code>	2 days ago
<code>data-acce...</code>	2 days ago
<code>data-catal...</code>	2 days ago
<code>data-find...</code>	2 days ago
<code>introductio...</code>	34 minutes ago
<code>lc.fits</code>	28 minutes ago
<code>LICENSE</code>	2 days ago
<code>misc-jdavi...</code>	2 days ago
<code>misc-js9-d...</code>	2 minutes ago
<code>misc-wwt...</code>	2 days ago
<code>ngc1316.fits</code>	10 years ago
<code>pgplot.gif</code>	29 minutes ago
<code>quick-start...</code>	2 days ago
<code>README.md</code>	2 days ago

Launcher (Main Panel):

The Launcher is titled `sciserver_cookbooks` and contains three sections:

- Notebook:** A row of seven notebook icons with labels: (heasoft), (cliao), (fermi), (root) *, (spex), (xmmsas), and DS9.
- Console:** A single console icon labeled JS9.
- Other:** A row of six icons labeled: Terminal, Text File, WorldWide, Markdown File, Python File, and Show.

The bottom status bar shows `Simple`, `2` tabs, `2` kernels, and `main` as the active environment. The Launcher title bar shows `Launcher` and `0` notifications.

Heasoftpy and NICER analysis

https://docs.google.com/presentation/d/16lt_2e4z-Bh6dECGJJC4tKI8Qh-dzpZ4/edit?usp=drive_link&oid=115044030236622835103&rtpof=true&sd=true

Future:

- Website refresh
 - Incremental improvements for easier navigation.
 - Mobile friendly and more accessible!
- Platforms
 - More Python notebook tutorials for SciServer
 - AWS-based Fornax platform in the works.
- Cross-archive data discovery
 - See ESASky for example. Plan to make it easier in Xamin and other archives' portals.
 - NASA-wide cross-disciplinary metadata effort, TBD.
- Software sustainability
 - Make Heasoft more flexible to install and modernize older code.
 - Interoperate with other open-source software projects, e.g., new gamma-ray development by CTA et al.
 - Modern methods of installing software, e.g., conda.
 - Open source and collaborative development. Complicated but starting with <https://github.com/HEASARC/cfitsio>
 - Working on updating astroquery.heasarc and astroquery.skyview.
- Community outreach
 - Community surveys.
 - Workshops.
 - Social media? Where? HEACIT is on openastronomy.org

what else?

To follow up:

- Give us feedback on anything!
- Try out Xamin, SciServer, heasoftpy, etc. if you haven't already.



Find us at AAS
(Jan 2025: Washington D.C.):
demos and Q&A within the
NASA booth

antara.r.basu-zych@nasa.gov

Thank You!

Storage and files on SciServer

- **Exists outside container, backed up, quota'd**
- Exists outside container, not backed up, not quota'd, may disappear
- *Exists only inside container, saved with stopped container but dies when container deleted*

Storage (file system)

```
user1
  persistent
  my_usr1_vol_X
mloewenstein
  persistent
  XRISM-wkshp
user3
...
...
```

Temporary (file system)

```
user1
  scratch
  jobXtempSpace
user2
  scratch
user3
...
```

Container 1

```
/home/idies/
  file1.txt
  miniconda3
  fooPy v X.x
workspace
sciserver_cookbooks
Storage
  user1
    persistent/foo/bar
  mloewenstein
    XRISM-wkshp
Temporary
  user 1
    scratch
```

User1 created a container

- chose to mount XRISM-wkshp
- chose *not* to mount my_usr1_vol_X;
- pip installs version X.x inside container;
- creates foo/bar under persistent
- creates file1.txt in \$HOME inside container;
- **Copy files from XRISM-wkshp into foo/bar to work on your own copy!**

Storage and files on SciServer

- **Exists outside container, backed up, quota'd**
- **Exists outside container, not backed up, not quota'd, may disappear**
- *Exists only inside container, saved with stopped container but dies when container deleted*

Storage (file system)

```
user1
  Persistent
  my_usr1_vol_X
user2
  persistent
  project_Y_shared_space
user3
...
...
```

Temporary (file system)

```
user1
  scratch
  jobXtempSpace
user2
  scratch
user3
...
...
```

Container 2

```
/home/idies/
  miniconda3
  fooPy v Y.y
workspace
  sciserver_cookbooks
Storage
  user1
  persistent/foo/bar
  my_usr1_vol_X
Temporary
  user1
  scratch
  jobXtempSpace
```

User1 creates a container

- (maybe from the same base image, maybe not);
- chose to mount my_usr1_vol_X;
- chose to mount jobXtempSpace;
- pip installs version Y.y;
- note that file 1.txt created in container 1 is NOT in HOME of container 2 because it was not put in the storage area.