

# NASA's HEASARC

High Energy Astrophysics Science Archive Research Center

# HEASARC

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

Introduction and overview of services

by Tess Jaffe representing the team:

Alan Smale – **Director**;

Lorella Angellini – **Project Scientist**;

Tess Jaffe – **Chief Archive Scientist**;

Brian Powel – **Data Scientist**;

Mike Corcoran, Keith Arnaud, Antara Basu-Zych, Abdu Zoghbi, Steve Sturmer – **Archive Scientists**

Ed Sabol – **Database administrator and web tools team lead**;

Phil Newman, Steve Fantasia, Mike Arida – **system and web administrators**;

Bryan Irby – **HEASoft lead**;

Meredith Gibb, Carina Kan, Michael Preciado, Kristin Rutkowski, Craig Gordon, Pan Chai, Matt Elliot, Jesse Allen, James Runge

– **web and analysis software developers**;

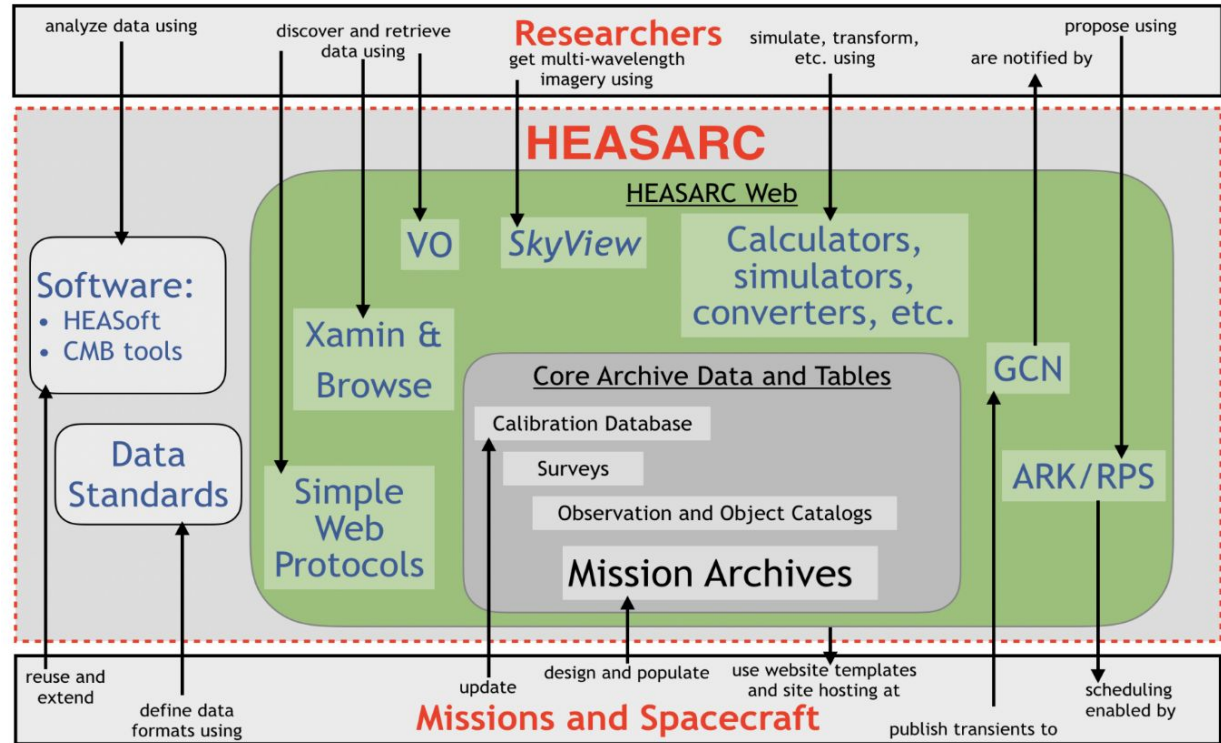
Doug van Orsow – **Bibliographer**;

JD Myers – **website curator**.

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

# Overview

- Website
- Data archive
  - Xamin and Browse
  - Bibliographic data
  - APIs
- Software
  - HEASoft, Caldb
- Platforms
  - Hera -> SciServer
- Proposal and science tools
  - ARK/RPS
  - WebPIMMS SkyView
  - Viewing
- Community
  - News feed
  - Calendars
  - Helpdesks
- SPD-41a support



# HEASARC

## home

Info on different ways to access the archive

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

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**

AGILE	AstroSat
CALET	Chandra
Fermi	HaloSat
INTEGRAL	IXPE
MAXI	NICER
NuSTAR	SRC <i>or</i> ROSITA <i>or</i> ART-XC
Swift	TESS
XL-Calibur	XMM-Newton

**Historic Guest Observer Facilities/Science Centers**

ASCA	BeppoSAX
CGRO	COBE
EUVE	GALEX
Hitomi	HETE-2
LPF DRS	ROSAT
RXTE	Suzaku
WMAP	

**NASA Archives**

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

**Virtual Observatory Resources**

HEASARC in the VO	IVOA
NAVO	USVAO

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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.

**Latest News**

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  - NuSTAR Caldb Update (03 Feb 2023)  
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    - The Million Quasars Catalog (07 Feb 2023)  
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**Xamin Quick Search**

Query Parameters:  
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 **chamaster bil-80 status=archived** to get archived Chandra Observations data near the north galactic pole.

**Notes:** For more than one target or when using any qualifier other than a mission name, use quotes around targets that have embedded white space (e.g., "ar lac").

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
NEW SciServer
Hera
RPS
Timeline Tool
Viewing
WebPIMMS
WebSpec

Info on web tools like calculators, converters, etc.

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

# Interactive portal: Xamin

Source or location

Position: perseus cluster

Table name (start typing "hito")

Enter table name here or select below

Explore catalog contents

- ascamaster: ASCA Observations
- calchdmstr: CALET Charge Detector Observations
- calgbmmstr: CALET Gamma-Ray Burst Monitor Observations
- chanmaster: Chandra Observations
- cmbmaster: LAMBDA Experiments
- euvmaster: EUVE Observations
- halomaster: HaloSat Observations
- hitomaster: Hitomi Observations
- intscw: INTEGRAL Science Windows
- ixmaster: IXPE Master Table
- maximaster: MAXI Observations

Download products

Download As Tar File

<https://heasarc.gsfc.nasa.gov/xamin>  
Or to try out our NEW beta interface  
[https://heasarc.gsfc.nasa.gov/xamin\\_beta/](https://heasarc.gsfc.nasa.gov/xamin_beta/)


Visualize rows on sky

The screenshot displays the Xamin web interface. At the top, the 'Query Pane' includes a search bar for 'Query table[s]', a 'Find matches' button, and a 'Count matches in...' button. Below this, there are fields for 'Position' (set to 'perseus cluster'), 'Radius', 'Observation epoch', and 'Bibcode'. The 'Tables Explorer' section shows a list of available tables, with 'hitomaster' selected. The 'Product Explorer' window is open, displaying a table of data products for 'hitomaster @ perseus cluster'. The table has columns for 'name', 'obsid', 'ra', 'dec', 'time', 'exposure', and 'sxinfo'. The 'Data Products Cart' is also visible, showing a 'Download As Tar File' button. At the bottom right, a 'hitomaster Explorer' window shows a tree view of data products, with 'SXI Image' selected. A 'Visualize rows on sky' window is partially visible at the bottom right, showing a star field with a red square highlighting a specific row.

	name	obsid	ra	dec	time	exposure	sxinfo
1	Perseus_core	100040010	49.874...	41.483...	2016-02-24T02:11:37.82522	48723.99476	YY
2	Perseus_adjustment	100040060	49.951...	41.512...	2016-03-07T00:37:56.03687	45793.67852	YY
3	Perseus_core_adjustme...	100040020	49.931...	41.519...	2016-02-25T02:13:12.61764	97441.42291	YY
4	Perseus	100040040	49.932...	41.519...	2016-03-05T12:00:00.23128	68133.51563	YY
5	Perseus	100040030	49.932...	41.520...	2016-03-04T00:41:13.07993	72511.57813	YY
6	Perseus	100040050	49.932...	41.521...	2016-03-06T19:36:45.08005	5451.23438	YY

# Xamin beta sneak peek

← → ↻ heasarc.gsfc.nasa.gov/xamin\_beta/

 XAMIN SEARCH Clear/reset: [Tables](#) [Target/Constraints](#) [Options](#) [All](#) | [Session](#) [Options](#) | [Help](#)

Current selections: [Send query](#)

Search constraints (optional)

Target:

Radius:  min (')

Upload your own [table of targets in CSV, VOTable or TDAT format](#)

Observation epoch (ISO, MJD or JD)

From:

To:

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

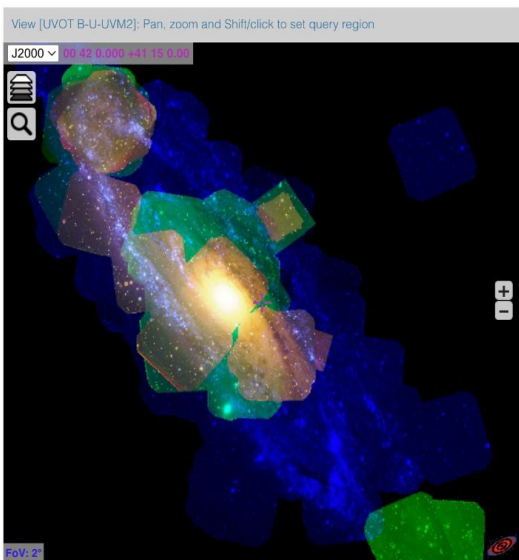
ADS  
bibcode:

for tables matching the above constraints or select a table below:

Tables to search

Or search for table by keyword

Alternatively, go to Available Tables pane below to browse



- Matches in HEASARC Catalogs
- Available Tables
- Table Parameters & Constraints: After selecting tables, click to select and add columns, add constraints, sort ...
- Results
- Data Products Cart

# Bibliographic links

The screenshot shows the ADS search results for the paper "X-Ray Spectral Analysis of the Steady States of GRS1915+105". The search query is "grs1915+105 rxte". The abstract is visible, mentioning authors like Peris, Charith S., and Remillard, Ronald A. On the right side, under "DATA PRODUCTS", the "HEASARC (1)" link is circled in red.

Go straight from ADS to browse the data products on HEASARC

And the reverse: from Xamin, you can get a list of linked bibcodes.

The screenshot shows the Xamin Web Interface. The search query is "2016ApJ...822...60P". The search results show a list of tables, with "xtemaster" selected. The "Product Explorer" window shows a list of data products with columns for obsid, prnb, status, pi\_ina..., pi\_fa..., target\_name, ra, dec, time, duration, and exposu... The table contains 10 rows of data.

	obsid	prnb	status	pi_ina...	pi_fa...	target_name	ra	dec	time	duration	exposu...
1	10408-01-36-00	10...	archived	TOO	PUBLIC	GRS1915+10	19 15 11.6	10 56 45	1996-09-27T23:58:07	17171.	5741.
2	10408-01-37-00	10...	archived	TOO	PUBLIC	GRS1915+10	19 15 11.6	10 56 45	1996-10-01T08:44:32	11026.	5991.
3	10408-01-38-00	10...	archived	TOO	PUBLIC	GRS1915+10	19 15 11.6	10 56 45	1996-10-07T05:39:49	20071.	11239.
4	10408-01-40-00	10...	archived	TOO	PUBLIC	GRS1915+10	19 15 11.6	10 56 45	1996-10-13T09:49:39	15615.	7896.
5	10408-01-41-00	10...	archived	TOO	PUBLIC	GRS1915+10	19 15 11.6	10 56 45	1996-10-15T15:00:50	27140.	9079.
6	10408-01-42-00	10...	archived	TOO	PUBLIC	GRS1915+10	19 15 11.6	10 56 45	1996-10-23T03:34:05	10791.	6946.
7	10408-01-43-00	10...	archived	TOO	PUBLIC	GRS1915+10	19 15 11.6	10 56 45	1996-10-23T11:45:28	24074.	9178.
8	10408-01-44-00	10...	archived	TOO	PUBLIC	GRS1915+10	19 15 11.6	10 56 45	1996-10-25T11:42:56	21878.	9419.
9	10408-01-45-00	10...	archived	TOO	PUBLIC	GRS1915+10	19 15 11.6	10 56 45	1996-10-29T11:52:07	20853.	10325.
10	10417-01-01-00	10...	archived	TOO	PUBLIC	GRS1915+10	19 15 11.6	10 56 45	1996-07-13T06:55:14	548.	null

# Command-line access and APIs:

- 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, you can use the Xamin [command-line java tool](#) to run queries:

```
runquery table=rosmaster,ascamaster constraint='a.exposure>b.sis_exposure'
```

- In a Python session or notebook, you can use PyVO following examples on our [website](#):

```
>>> print(example['QUERY'])
SELECT * FROM rosmaster WHERE exposure > 10000 AND 1=CONTAINS(POINT('ICRS', ra, dec),CIRCLE('ICRS', 50, -85, 1))
>>> result=example.execute()
```

__row	seq_id	ra	dec	l1	b1	instrument	filter	site	exposure	requested_exposure	fits_type	start_time
		degree	degree	degree	degree				s	s		n
object	object	float64	float64	float64	float64	object	object	object	int32	int32	object	float
1	RH202299A01	49.3200	-85.5400	299.8517	-30.6815	HRI	N	MPE	43683	70000	RDF_3_6	50324.74253472
2	RH202299N00	49.3200	-85.5400	299.8517	-30.6815	HRI	N	MPE	36146	70000	RDF_4_2	50174.49619212

# 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
- Astro-update
  - Keep your other astronomy software up to date

```
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.

<https://Sciserver.org>

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

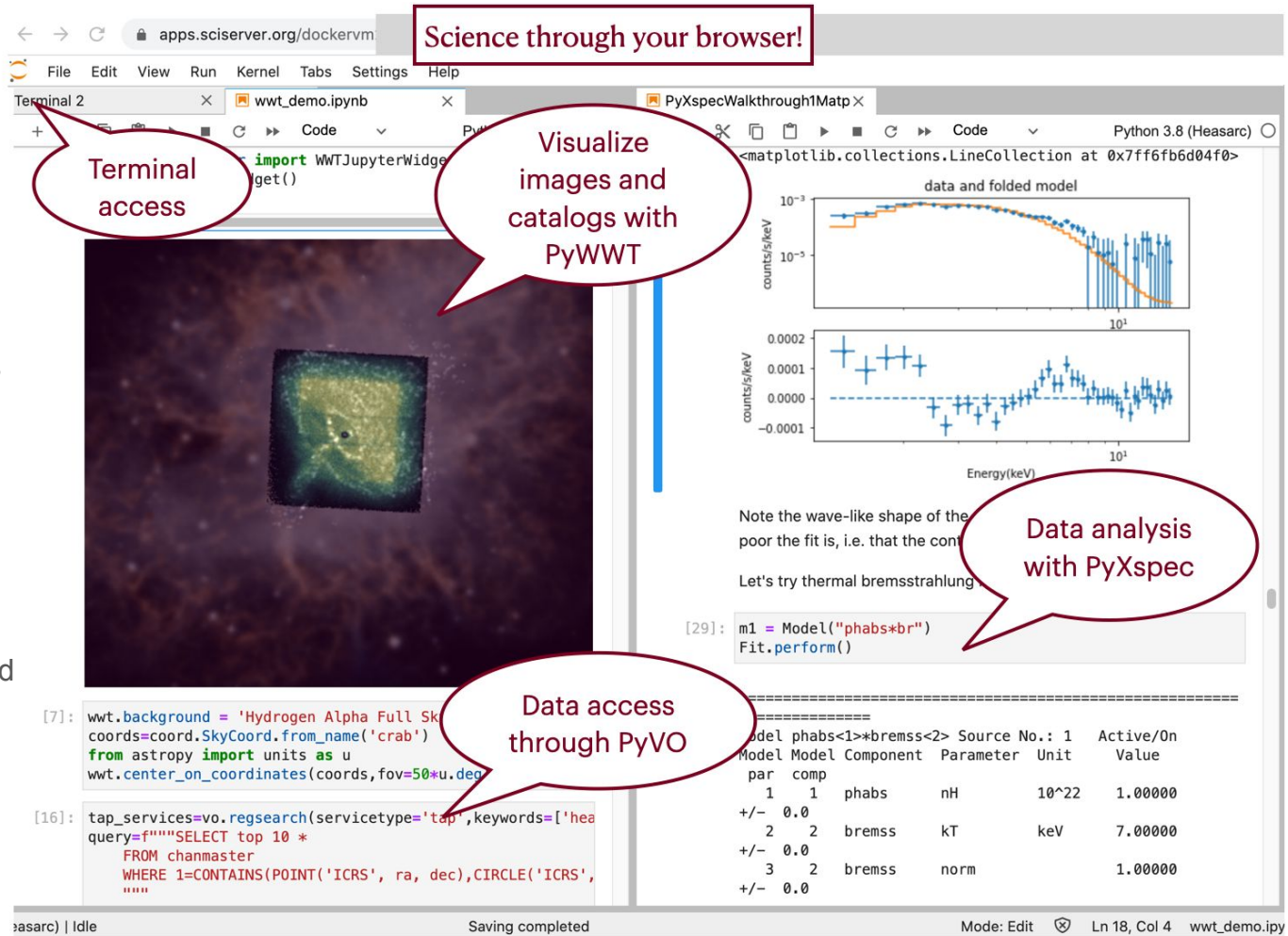
Science through your browser!

Terminal access

Visualize images and catalogs with PyWWT

Data analysis with PyXspec

Data access through PyVO



The screenshot displays the SciServer web interface. At the top, a terminal window shows code for accessing data from the HEASARC archive. Below the terminal, a PyWWT visualization shows a galaxy image with a green and blue color map. To the right, a PyXspec plot shows the data and a folded model fit. The plot has two panels: the top panel shows counts/s/keV vs Energy (keV) on a log scale, and the bottom panel shows residuals. A table of fit parameters is visible at the bottom right.

```
[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=['hea
      query=f""""SELECT top 10 *
          FROM chanmaster
          WHERE 1=CONTAINS(POINT('ICRS', ra, dec),CIRCLE('ICRS',
          """"

=====
Model phabs<1>*bremss<2> Source No.: 1 Active/On
Model Model Component Parameter Unit Value
par comp
1 1 phabs nH 10^22 1.00000
+/- 0.0
2 2 bremss kT keV 7.00000
+/- 0.0
3 2 bremss norm 1.00000
+/- 0.0
```

Mode: Edit | Ln 18, Col 4 | wwt\_demo.ipynb

# 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
- [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](#)
- Workshops
  - Regular AAS workshops on accessing data through Python
  - **Upcoming HEAD meeting special session/workshop on HEASARC!**



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EUVE	GALEX
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HEASARC Picture of the Week

[More Images](#)

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[What is this?](#)

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

# Open science support

## SCIENCE MISSION DIRECTORATE POLICY Scientific Information Policy for the Science Mission Directorate

SMD Policy Document SPD-41a

September 26, 2022

- NASA recently updated its Scientific Information Policy, i.e., [SPD41a](#):
  - new requirements on data and software release from future NASA-funded research;
  - Implementation details still TBD.
- 2023 is NASA's Year of [Open Science](#).
- HEASARC is learning how to help our community follow the new rules and best practices.



### OPEN (TRANSPARENT) SCIENCE

scientific process and results should be visible, accessible, and understandable



### OPEN (INCLUSIVE) SCIENCE

process and participants should welcome participation by and collaboration with diverse people and organizations

### OPEN (ACCESSIBLE) SCIENCE

data, tools, software, documentation, and publications should be accessible to all (FAIR)



### OPEN (REPRODUCIBLE) SCIENCE

scientific process and results should be open such that they are reproducible by members of the community



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

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Active Guest Observer Facilities/Science Centers Latest News

Where to go for help

## To follow up:

- Give us feedback on anything!
- Try out Xamin, SciServer, heasoftpy, etc. if you haven't already.
- Contact us from our feedback form
- Come to our special session / workshop at HEAD in Hawai'i next month for hands-on interactive help.

And

- Talk to us today!

backup

# 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
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
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 file1.txt created in container 1 is NOT in HOME of container 2 because it was not put in the storage area.