Astronomical Archives in the era of Virtual Observatory:
promoting data access in all communities

Raffaele D'Abrusco

SAO/CXC

"**Data Archiving** is the result of practices and procedures that support the **collection**, long-term **preservation**, the **access** to and the **dissemination** of scientific and technical data and metadata"

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Chandra Data Archive

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“**Data Archiving** is th… nd
procedures th… g-term
pres… **dissemination**
o… nical data and metadata”

Public interfaces

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Chandra Data Archive

- Maintain the whole record of the mission, from **proposal** to **publication**
- Support all operations of the Chandra X-ray Center (CXC)
- Provide **access to all data** (and metadata) produced by Chandra to the **astronomical community**

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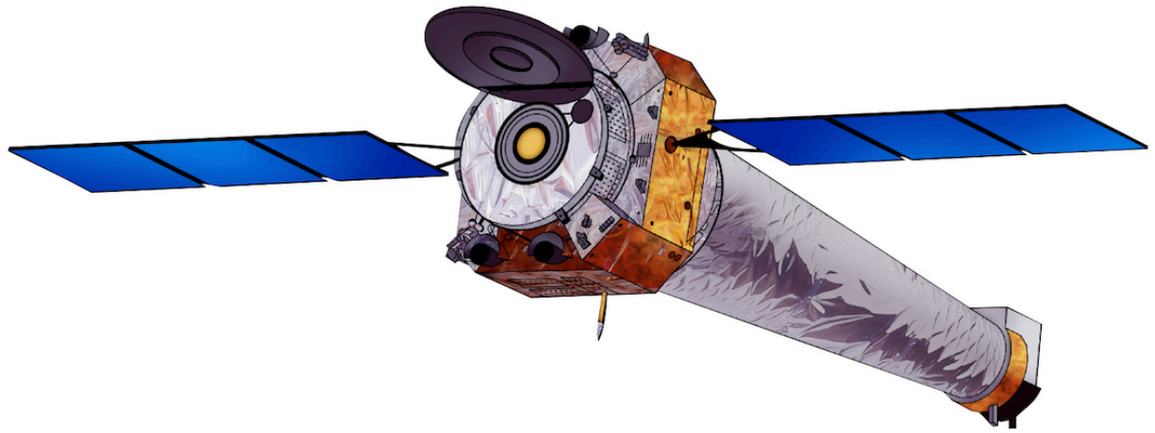
Chandra



- Chandra is an established observatory that has revolutionized our understanding of the high-energy Universe
- Unique observational properties (that will remain unique for a long time)
- Established synergies with X-ray and multi-wavelength observatories
- Large-ish, rich data archive, with ~16000 public observations

Mission archives data access interfaces needs to…

- … cater to the **anticipated data needs** of homogeneous communities of astronomers working in specific field
- … provide permanent storage - and access to - data that changed only in their **extensive properties**
- … crystallize a snapshot of the technology available at their inception (with little incentive/possibility to innovate)

Archives as instruments

By allowing re-use and new uses of archival data, archives facilitate the investigation of **regions of the observational parameter space** that can be otherwise impractical to access or inaccessible altogether.

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By allowing re-use and new uses of archival data, archives facilitate the investigation of **regions of the observational parameter space** that can be otherwise impractical to access or inaccessible altogether.

Archives needs to pursue the opportunity to act as **multipliers of the scientific output** of the mission

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Many communities

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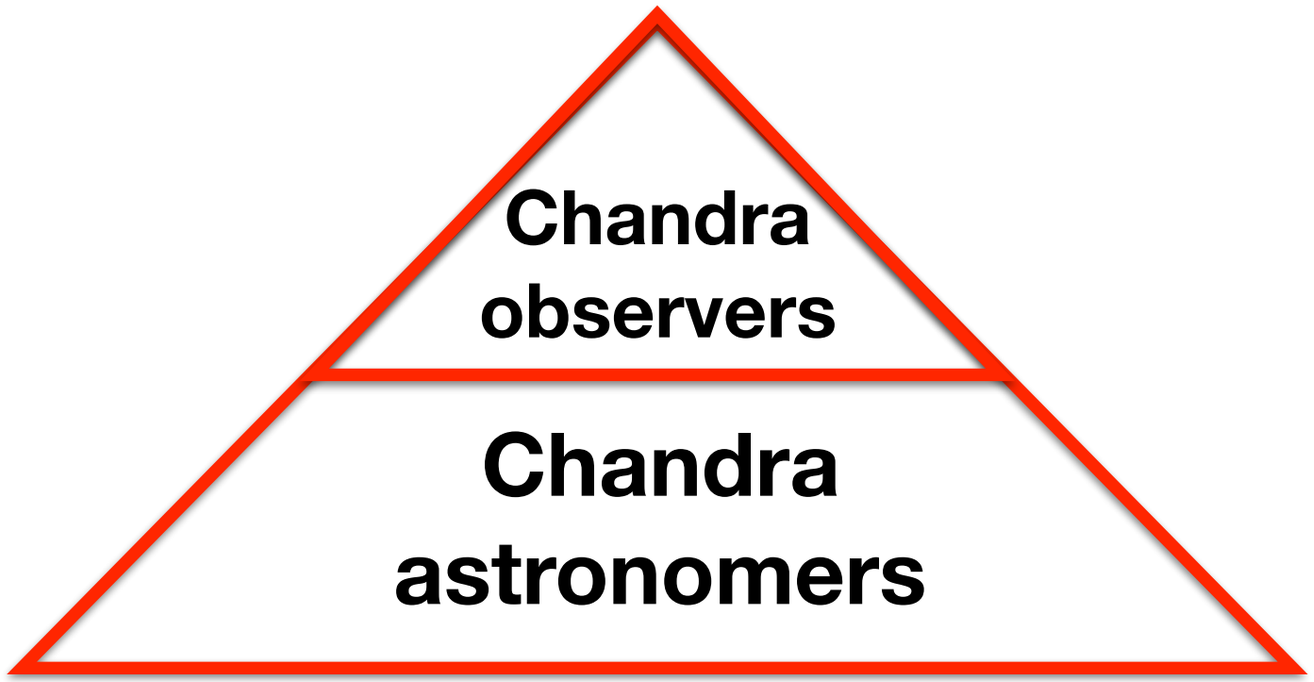
Many communities



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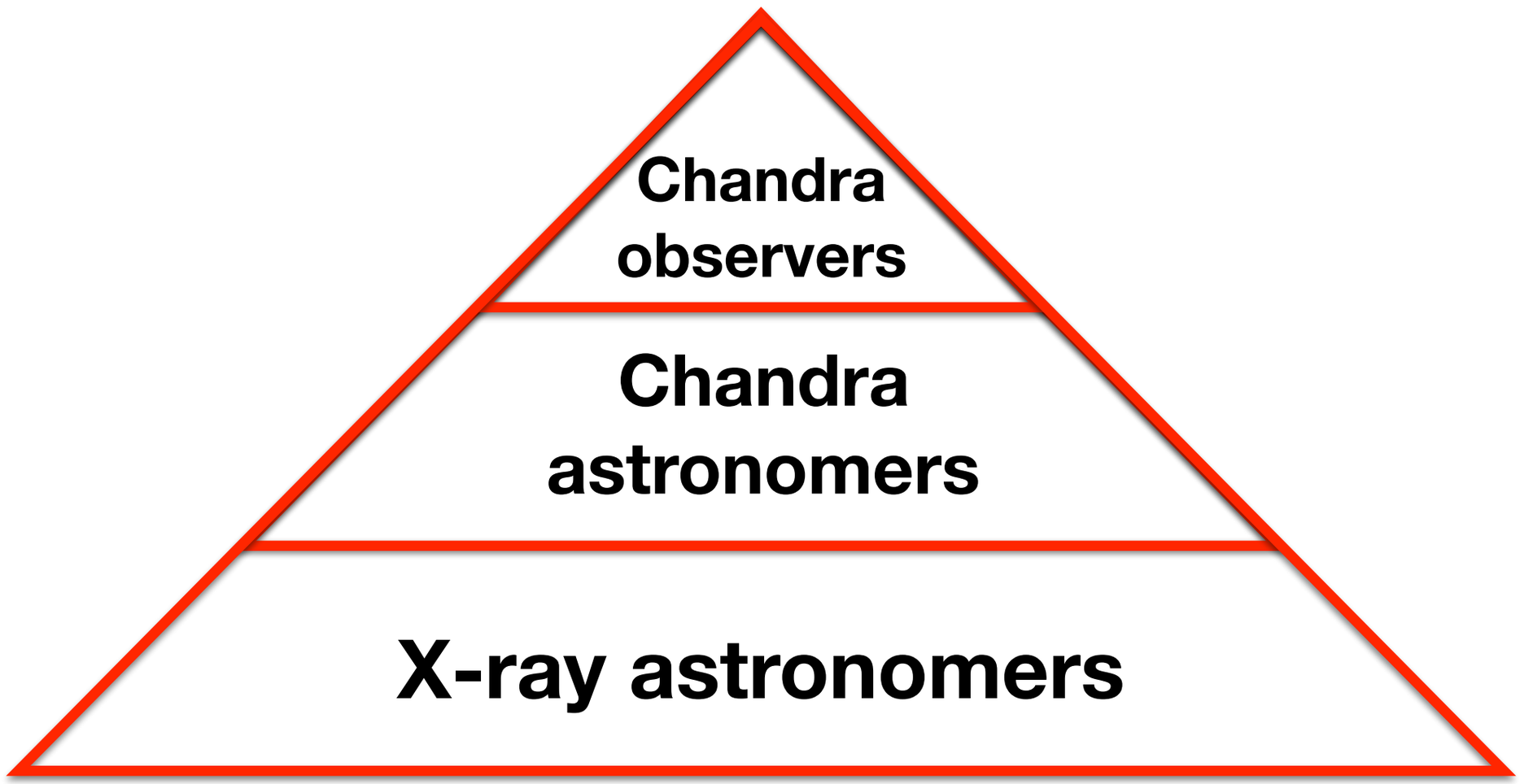
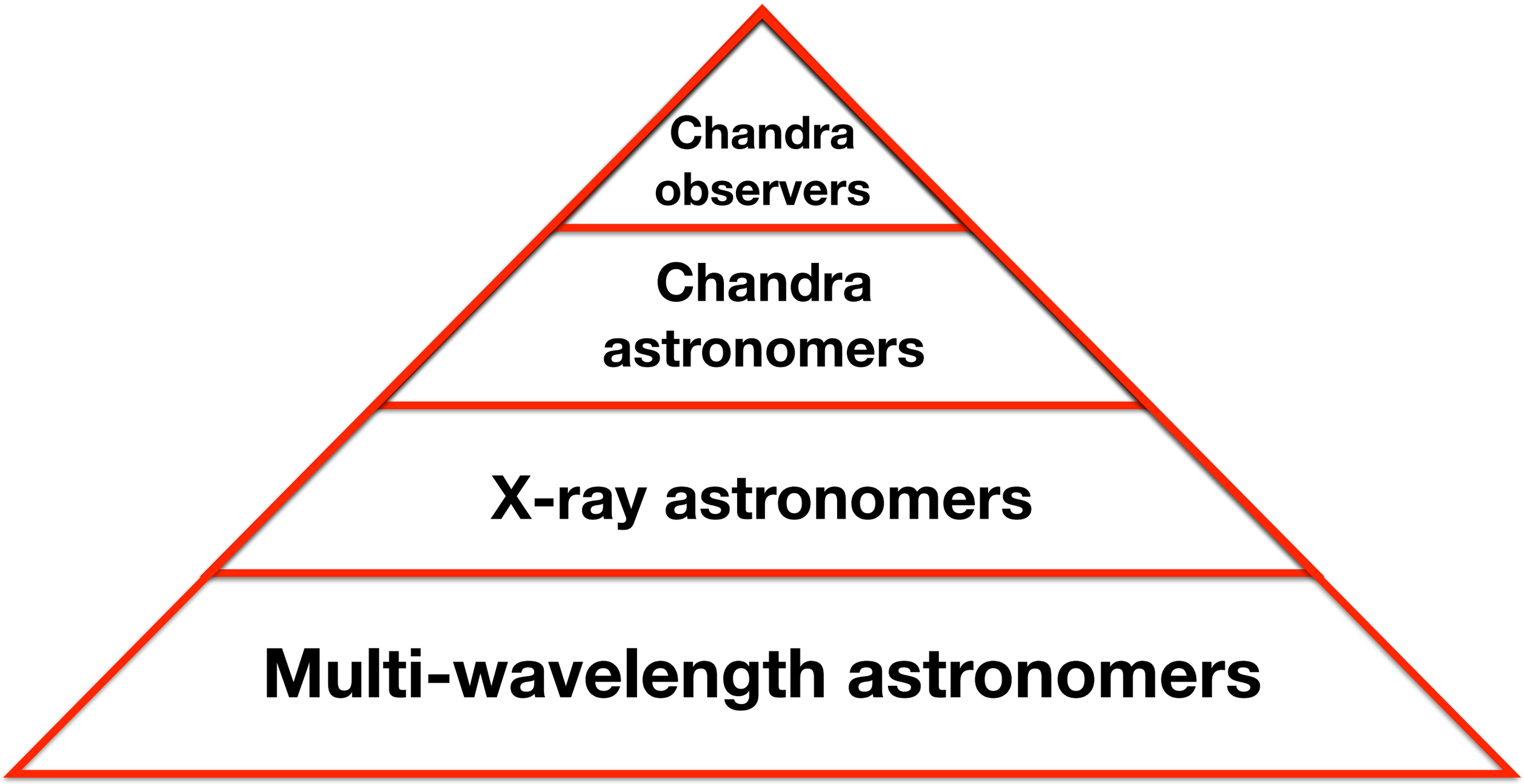
Many communities

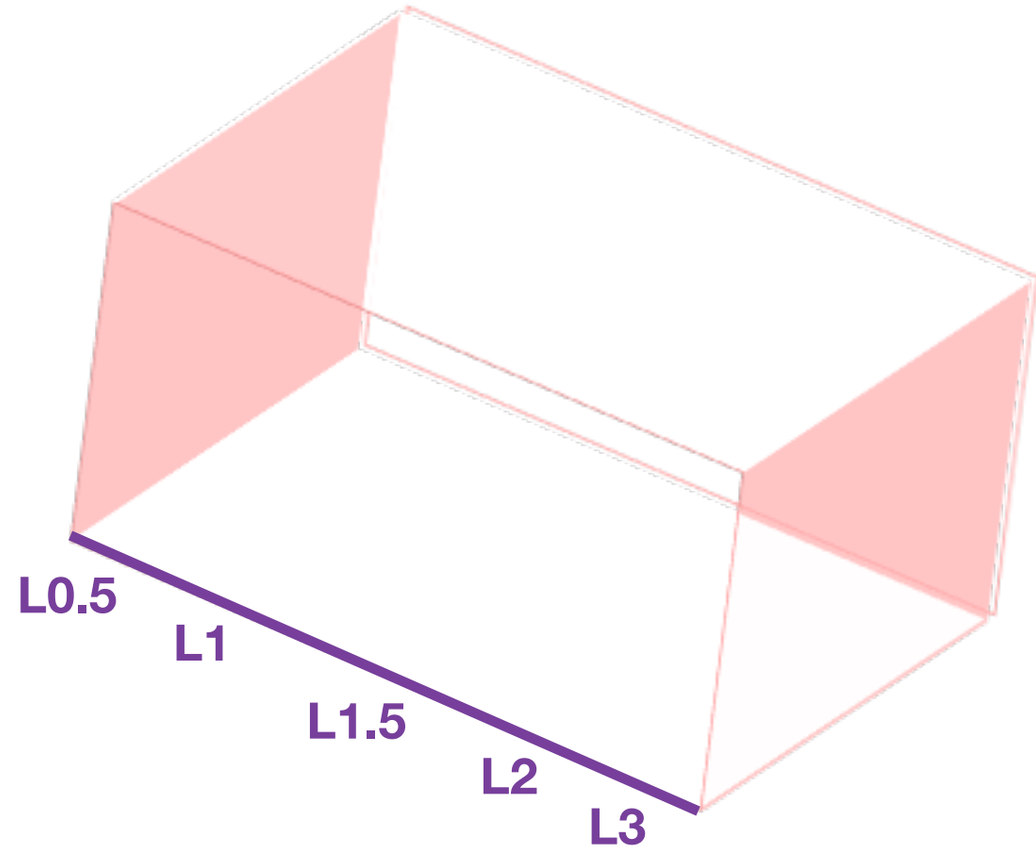


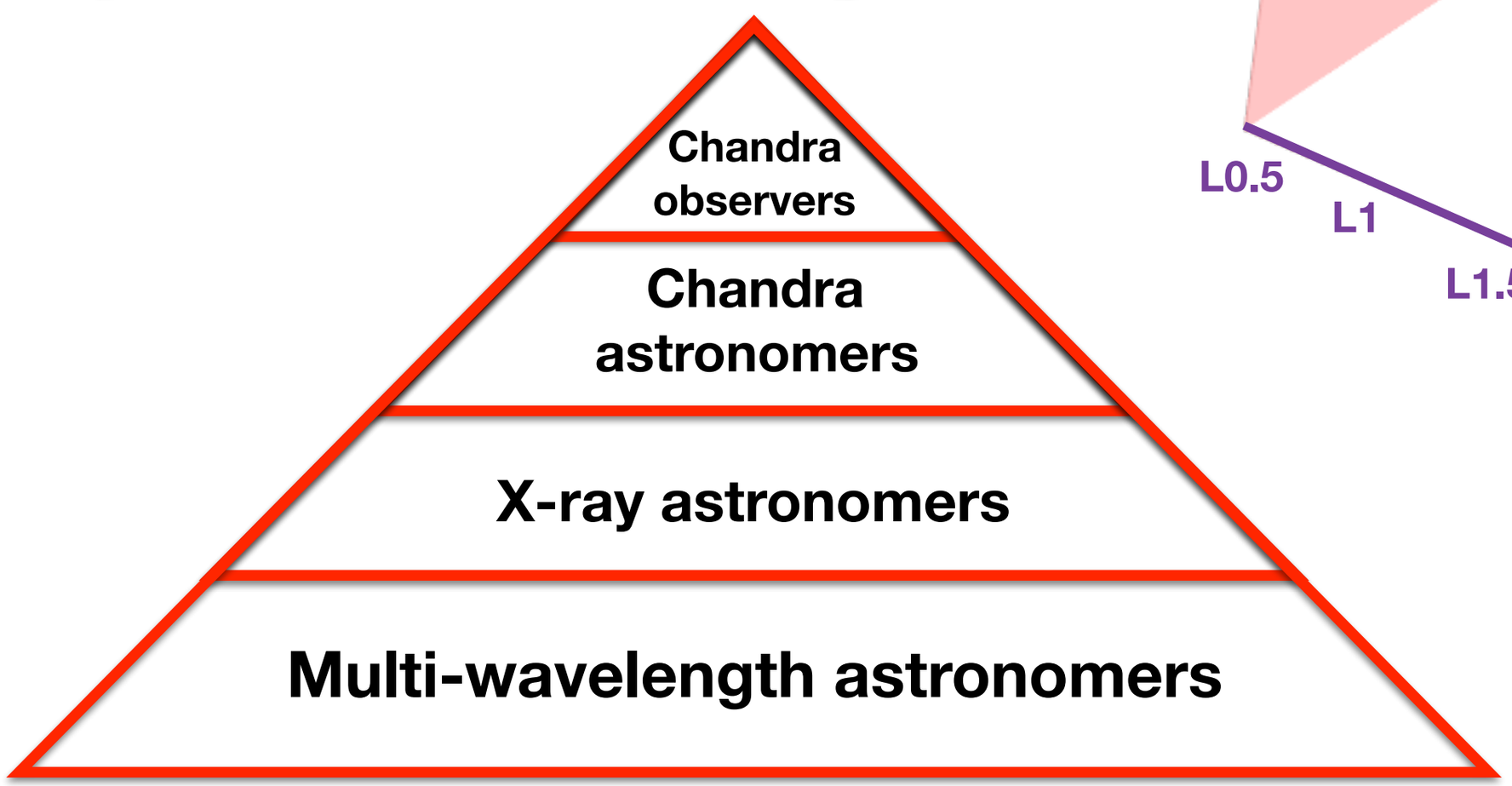
Many communities



Many communities & rich data

- **Processing level**





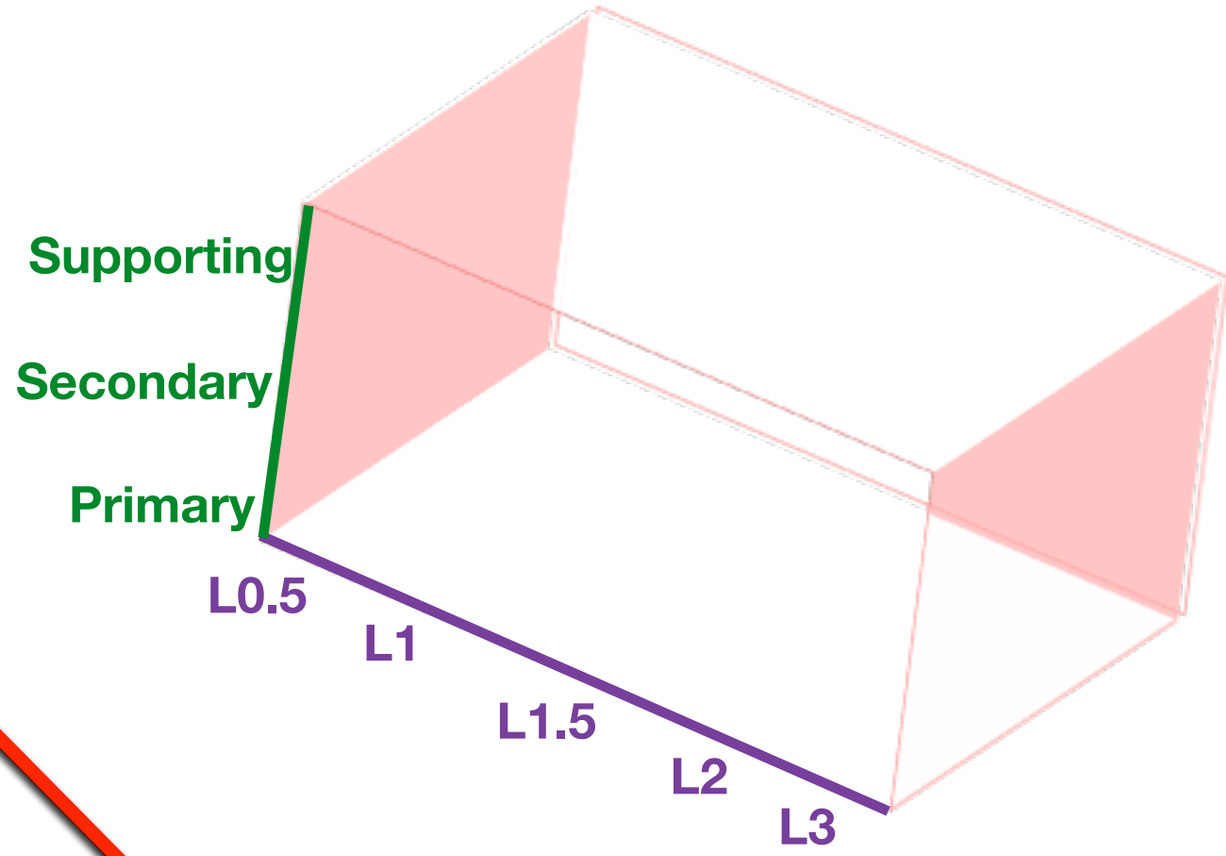
Chandra Data Archive

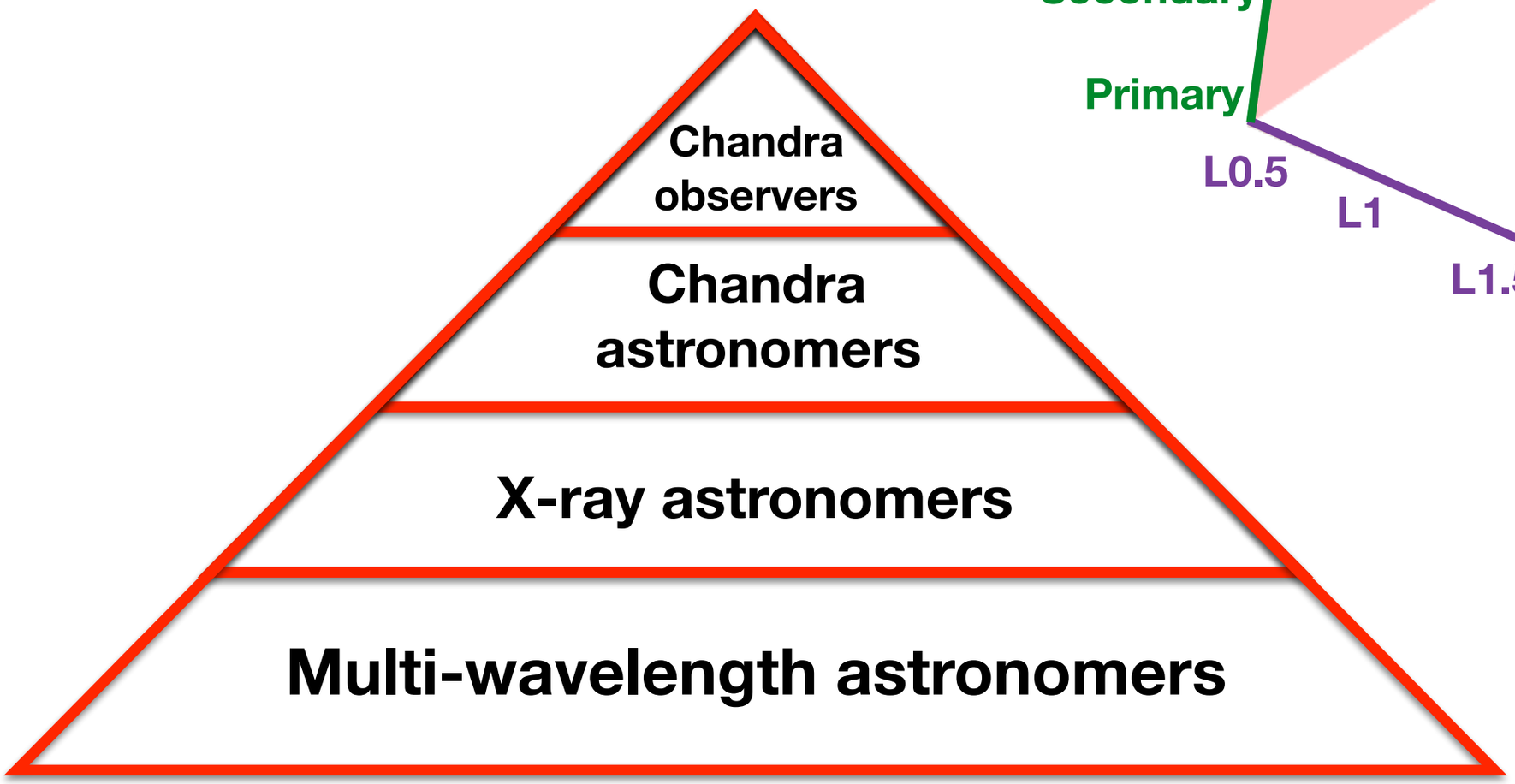
Many communities & rich data

- **Processing level**

vs

- **Functional category**





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Many communities & rich data

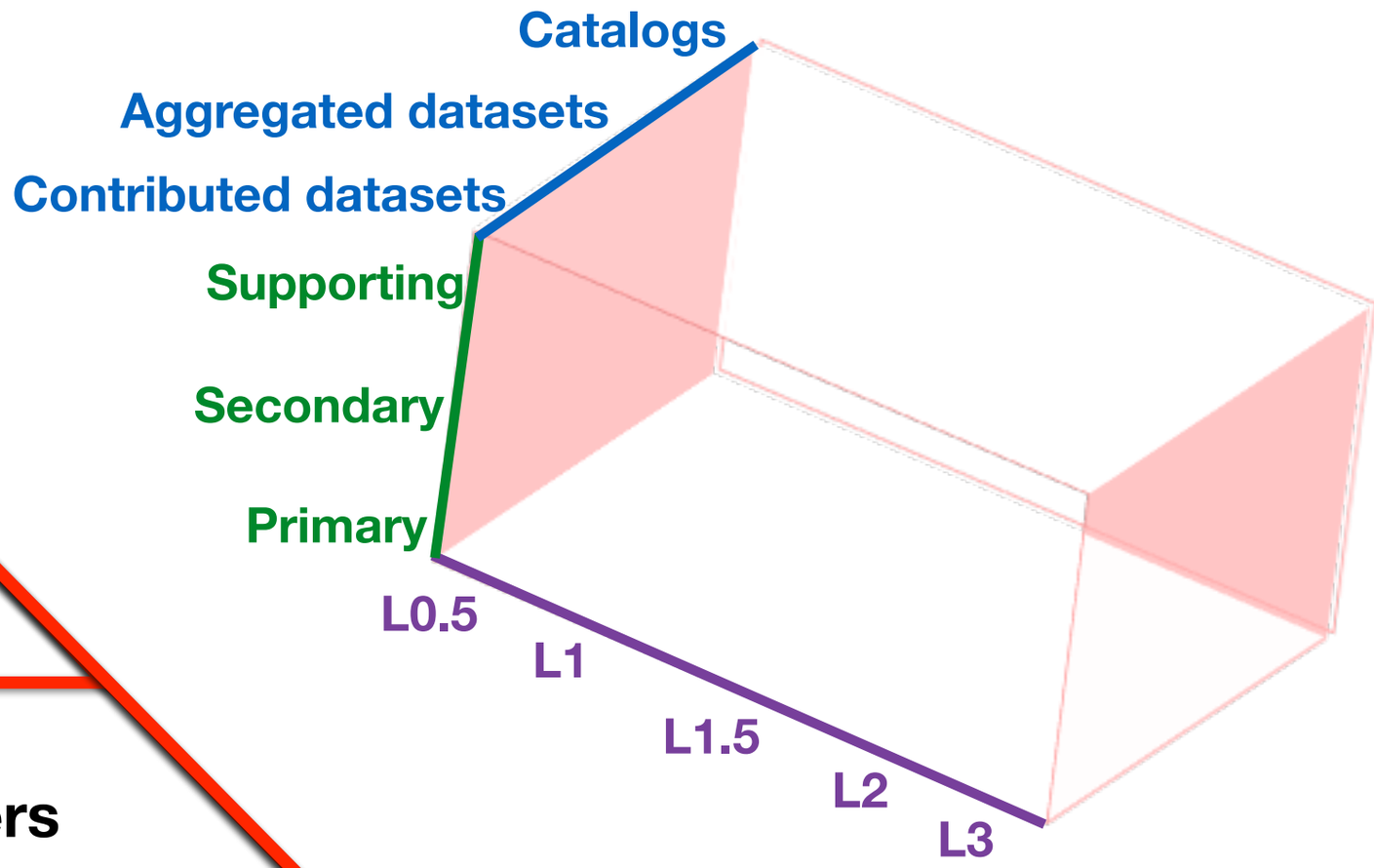
- **Processing level**

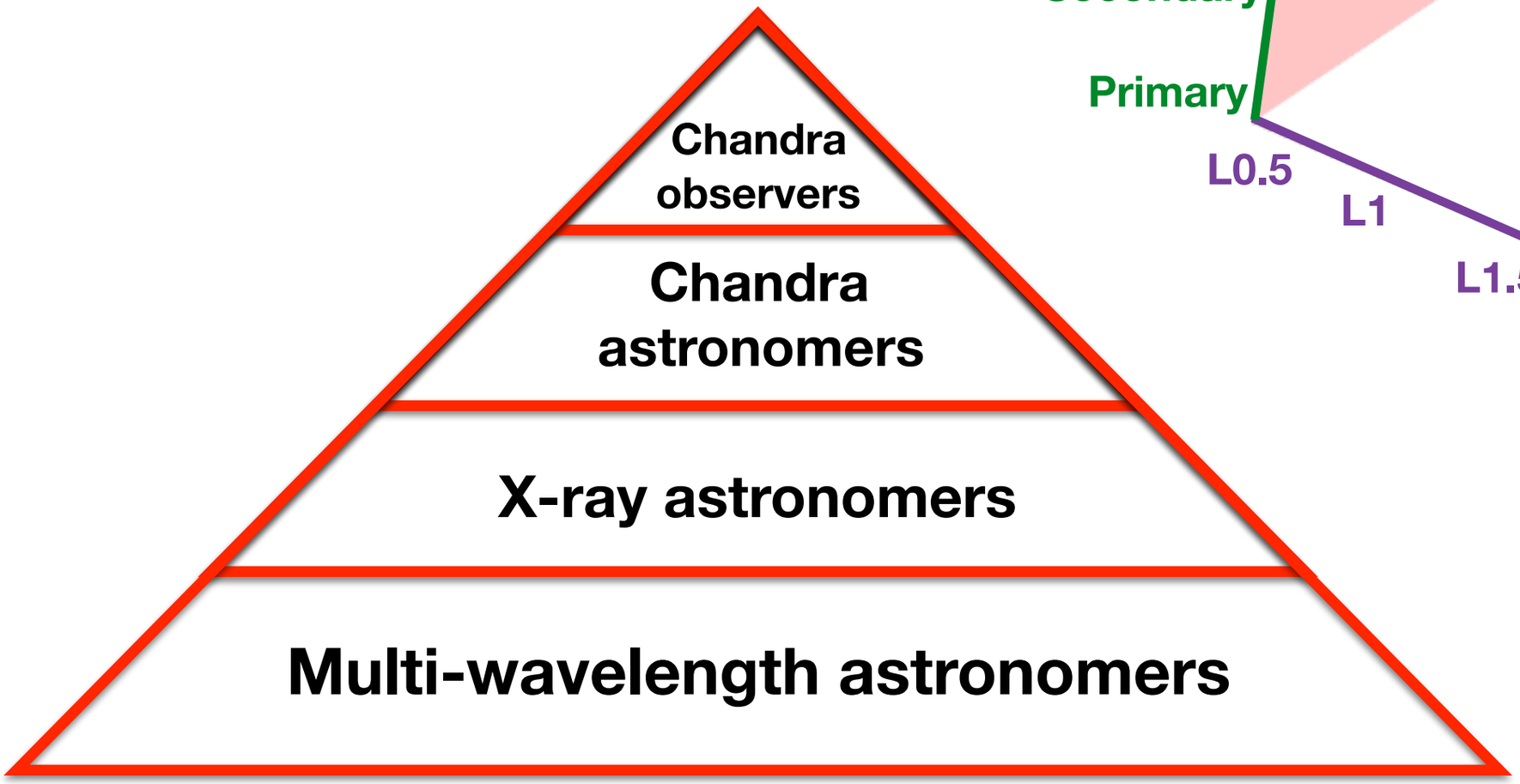
vs

- **Functional category**

vs

- **Added-value datasets**





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Chandra Data Archive

Interfaces reqs

- Common functionalities
  - -- **Data Discovery**
  - -- **Data Access**
  - -- **Data Exploration/Visualization**

- Search interfaces
  - -- “**Observers**” vs “**Chandra community**” vs “**General community**” access type
  - -- “**Observation-based**” vs “**Spatial-based**” vs “**Source-based**” search criteria
  - -- “**Single Observations”** vs “**Aggregated observations”** vs “**Scientifically-enhanced datasets”** focus

CDA interfaces

Chandra Data Archive

Chandra X-ray Center

Observation Search

New Search | Retrieval List | Help

Chandra Data Archive

Search | Reset

File Upload: Coordinates | Choose File | No file chosen

Cone Search

Target Name: NGC1399 | Resolve Name | RA/Long/l | Dec/Lat/b

Name Resolver: SIMBAD/NED | Coord System: Equatorial J2000 | Equinox: 2000 | Radius: 10 arcmin

Observation ID		Sequence Number		Proposal Number	
Proposal Title		PI Name		Observer Name	
Start Date		Public Release Date			
Exposure Time (ks)		Approved Time (ks)		Avg. Count Rate (hz)	

Status	Archived Observed Scheduled Unobserved Untriggered	Science Category	Solar System Stars and WD WD Binaries and CV BH and NS Binaries SN, SNR and Isolated NS	Type	ER GO GTO TOO DDT CAL	Observing Cycle	00 01 02 03 04
Instrument	ACIS ACIS-I ACIS-S HRC	Grating	None LETG HETG	Exposure Mode	ACIS TE ACIS CC HRC Timing	Joint Observatories	None HST NOAO NRAO NuSTAR

Proposal Cycle: 00 01 02 03 04 | Grid

Customize Output:

Sort Order: Status | ascending | descending

Display: Format: HTML | Row Limit: 50

Coord System: Equatorial J2000 | Equinox: 2000 | Format: Sexagesimal (hh/dd mm ss.ss)

For online support please contact the CXC Helpdesk.

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Proposal Title | PI Name

Start Date | Public Release Date

Exposure Time (ks) | Approved Time (ks)

Status: Archived, Observed, Scheduled, Unobserved, Untriggered

Science Category: Solar System, Stars and WD, WD Binaries and CV, BH and NS Binaries, SN, SNR and Isolated NS

Instrument: ACIS, ACIS-I, ACIS-S, HRC

Grating: None, LETG, HETG

Exposure Mode: ACIS TE, ACIS CC, HRC Timing

Customize Output:

Sort Order: Status — ascending — descending

Display: Format HTML — Row Limit 50

Coord System: Equatorial J2000 — Equinox 2000 — Format Sexagesimal (hh/dd mm ss.ss)

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Chandra Data Archive

Chandra Footprint Service

Sag A* — Search — Reset — Search Options

Examples: Eta Carinae, 10 45 03.591 -59 41 04.26 r=0.2d, 122,22,1741-1743,1739

Requires Firefox 3, Safari 4, or compatible browser

Footprints | Image Inventory | Preview Images/Download Data | Help | FAQ

*Sag A** RA =266.416826 Dec = -29.007797 r = 0.200000 [17:45:40.038 -29:00:28.07]

Instrument:

- ACIS-I
- ACIS-S
- HRC-I
- HRC-S

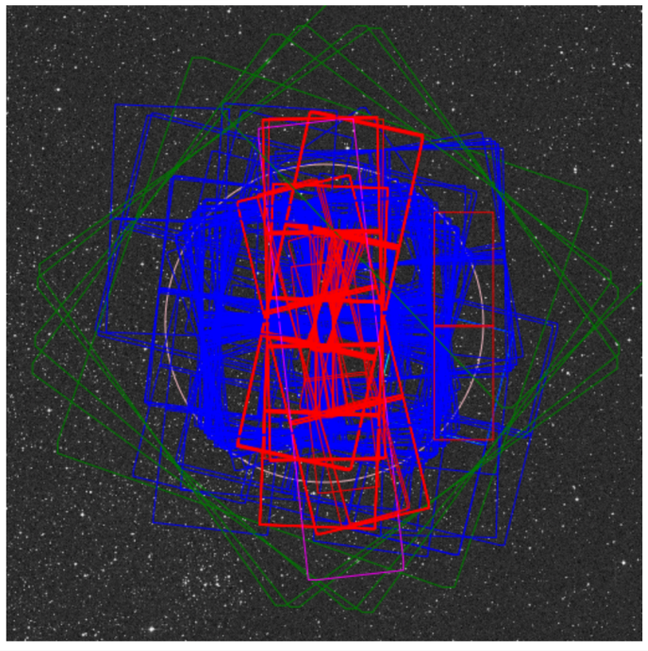
Footprints to display:

- All Public Observations
- CSC Coverage ?

Show DSS Image:

Get VOTable ?

RA 266.865 DEC -28.6594 Search Radius (deg): 0.2



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CDA interfaces

Chandra Data Archive

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Observation Search

New Search | Retrieval List | Help

Search | Reset

File Upload | Coordinates | Choose File | No file chosen

Cone Search

Target Name: NGC1399 | Resolve Name | RA/Long/l

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Observation ID | Sequence Number

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Instrume

Customize Out

Sort Order

Display

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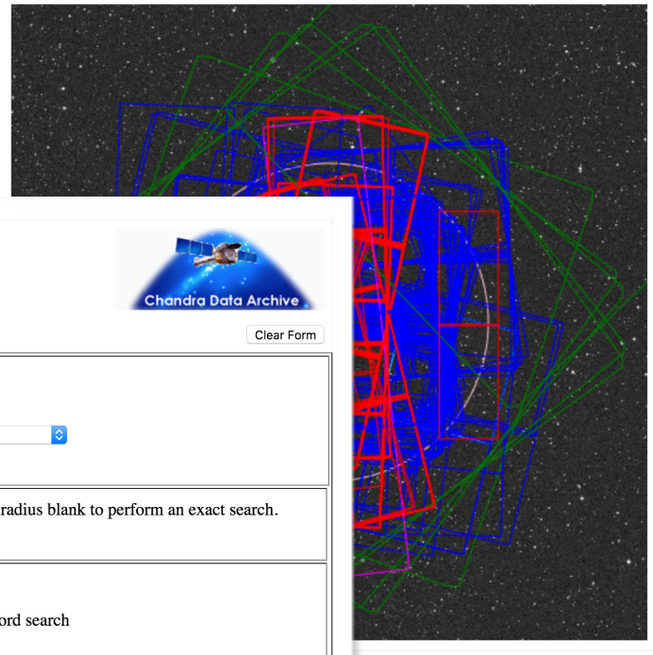

Chandra Bibliography Search

Search | Clear Form

You may enter multiple objects, obsids or bibcodes. Separate each with a comma.

Object | Observation ID

Resolve Object with SIMBAD | Resolve Name | Chandra Data Set: none

ADS Bibcode

This option performs a cone search. Coordinates should be entered in decimal degrees or in the format HH MM SS.SS for RA and DD MM SS.SS for Dec. Leave radius blank to perform an exact search.

Coordinate Search | RA: | Dec: | Radius: 10 arcmin

Keyword Search: and / or | List of standard keywords

Type each keyword on a new line

Or click below to use standard keyword search

Standard Keyword Search

Select 'yes' to include in selection, 'no' to exclude from selection, or 'N/A' to ignore in selection.

Instrument: and / or; N/A ACIS; N/A HRC; N/A HETG; N/A LETG; N/A HRMA; N/A PCAD

Publication Form: N/A erratum; N/A article; N/A data; N/A memo; N/A abstract

Publication Type: N/A multimedia; N/A circular; N/A thesis; N/A on-line data catalogue; N/A review; N/A government publication; N/A proceedings

Category: N/A 1. presents specific observations; N/A 2. refers to published results; N/A 3. predicts Chandra results; N/A 4. instrumentation, software, or operations

Associated Subjects: and / or; N/A multi-wavelength; N/A theory; N/A follow-up

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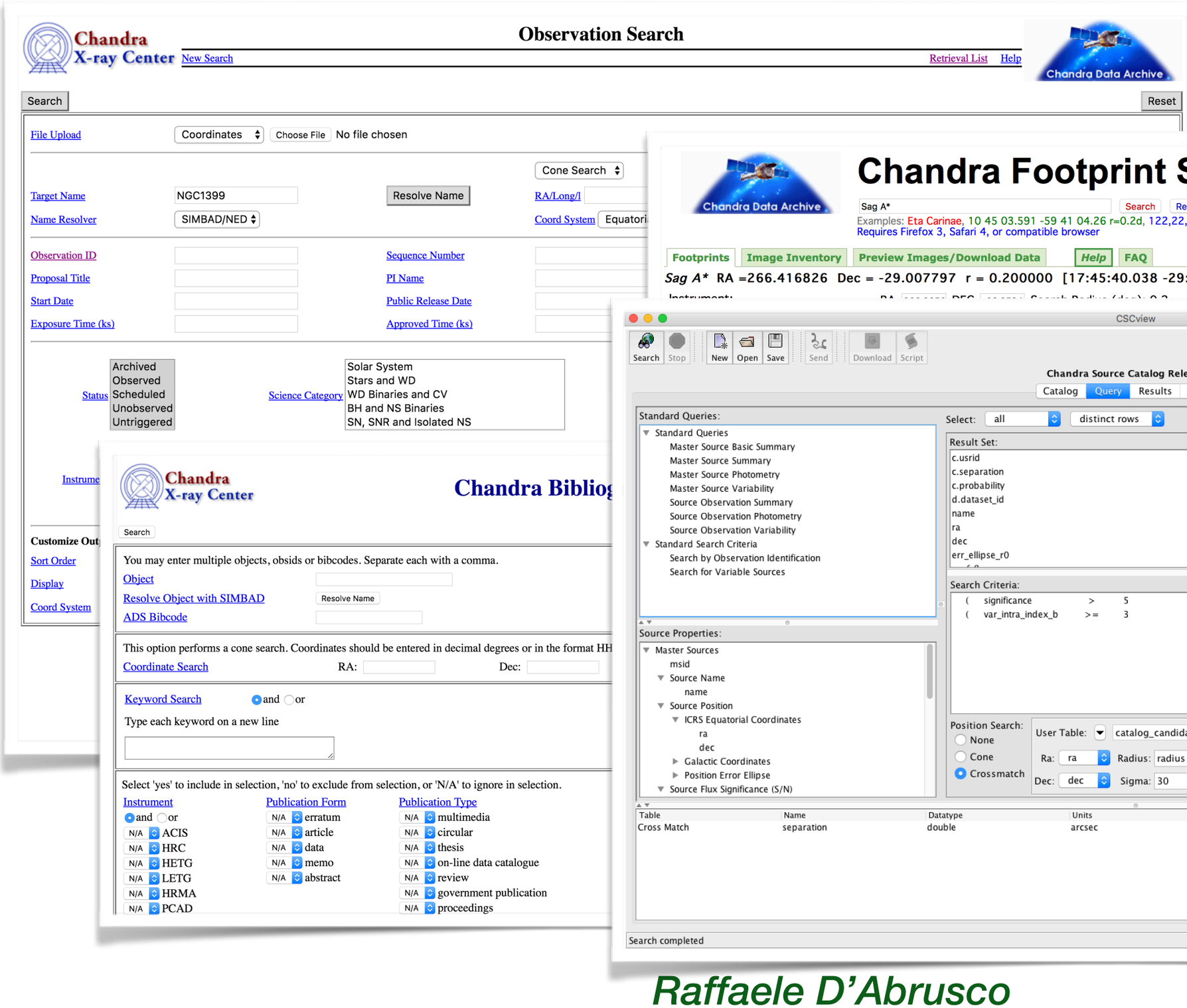
CDA interfaces



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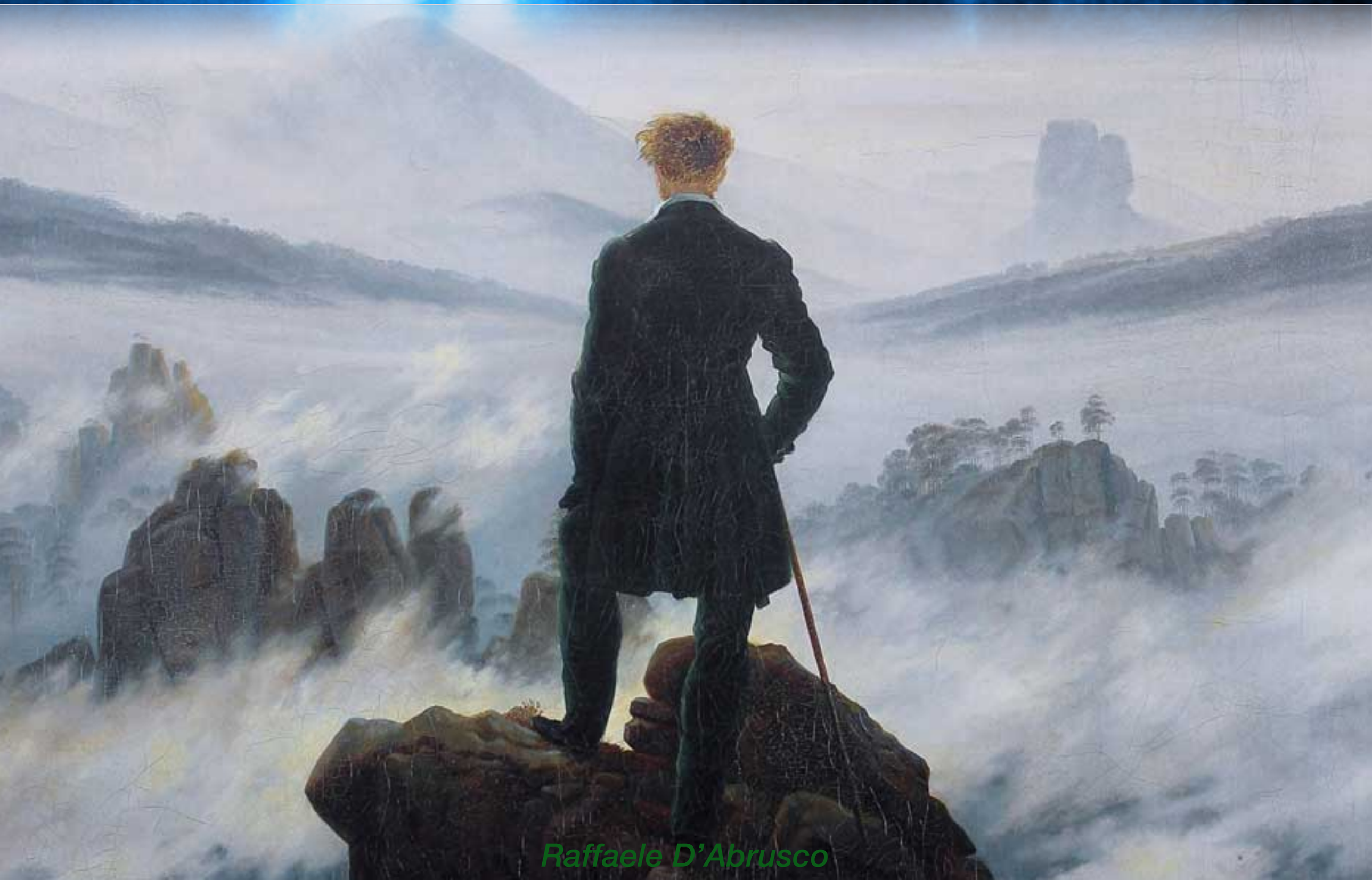

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Bold statement

Should mission archives keep developing comprehensive public interfaces at all?

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Bold statement

Should mi… …eloping
comp… …aces at all?

Ideally, no!

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Bold statement

Should mis… …oping
… …terfaces at all?

Eventually, not anymore!

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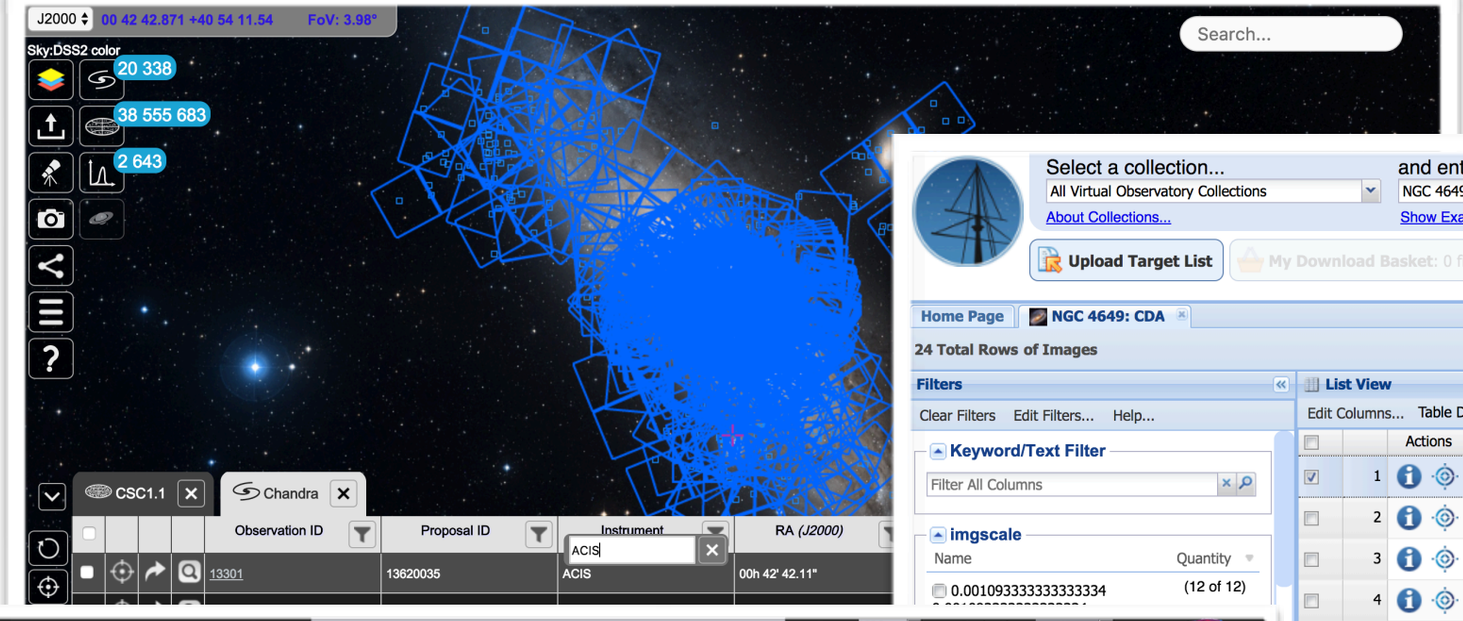
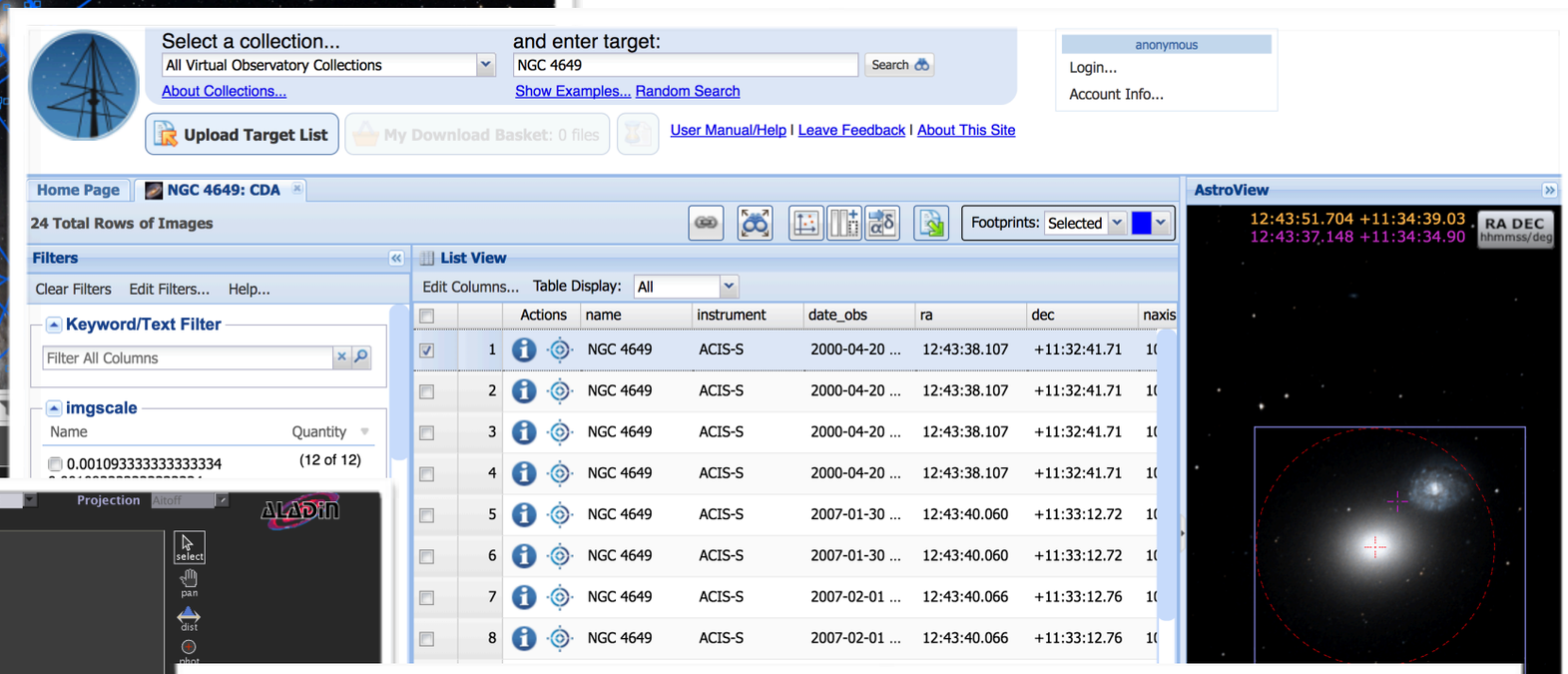
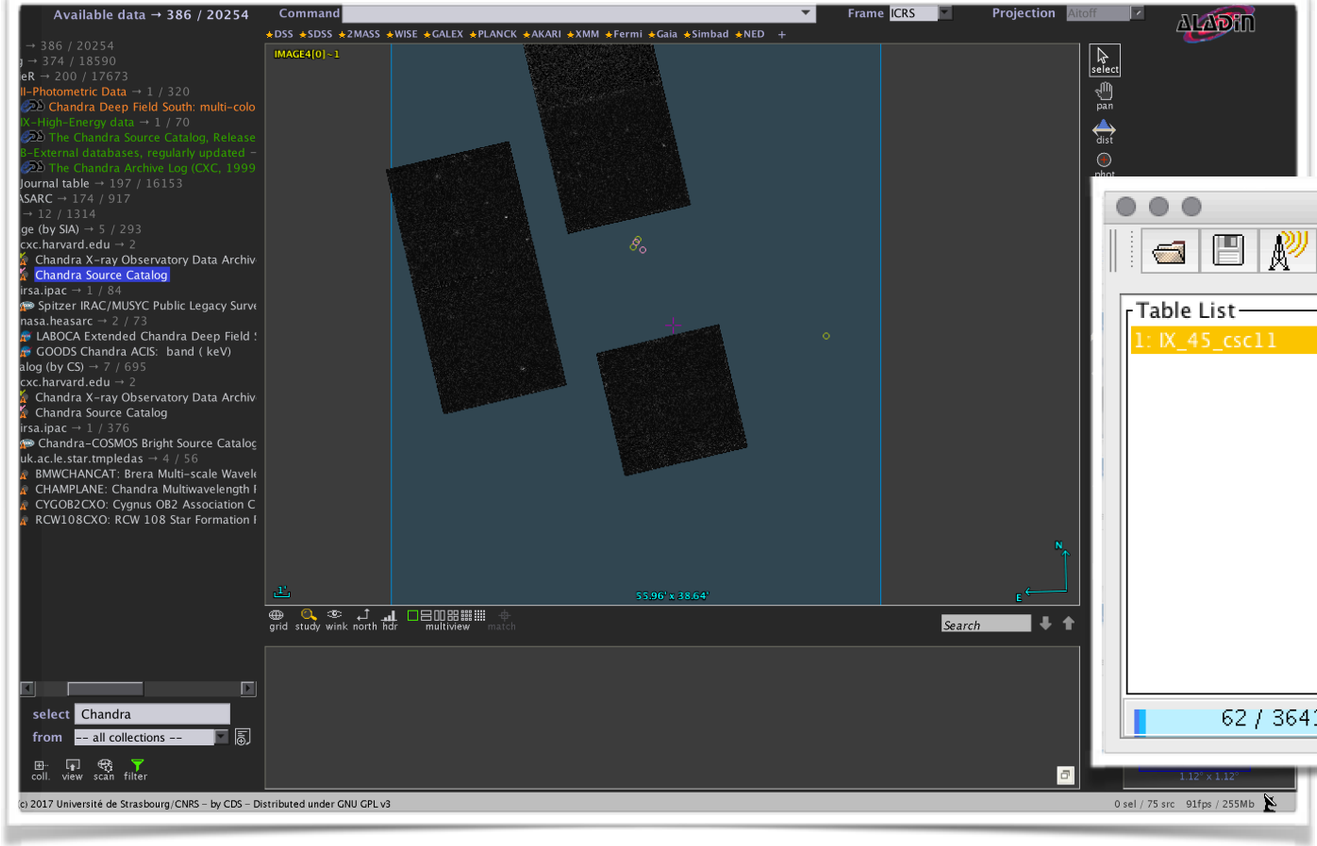
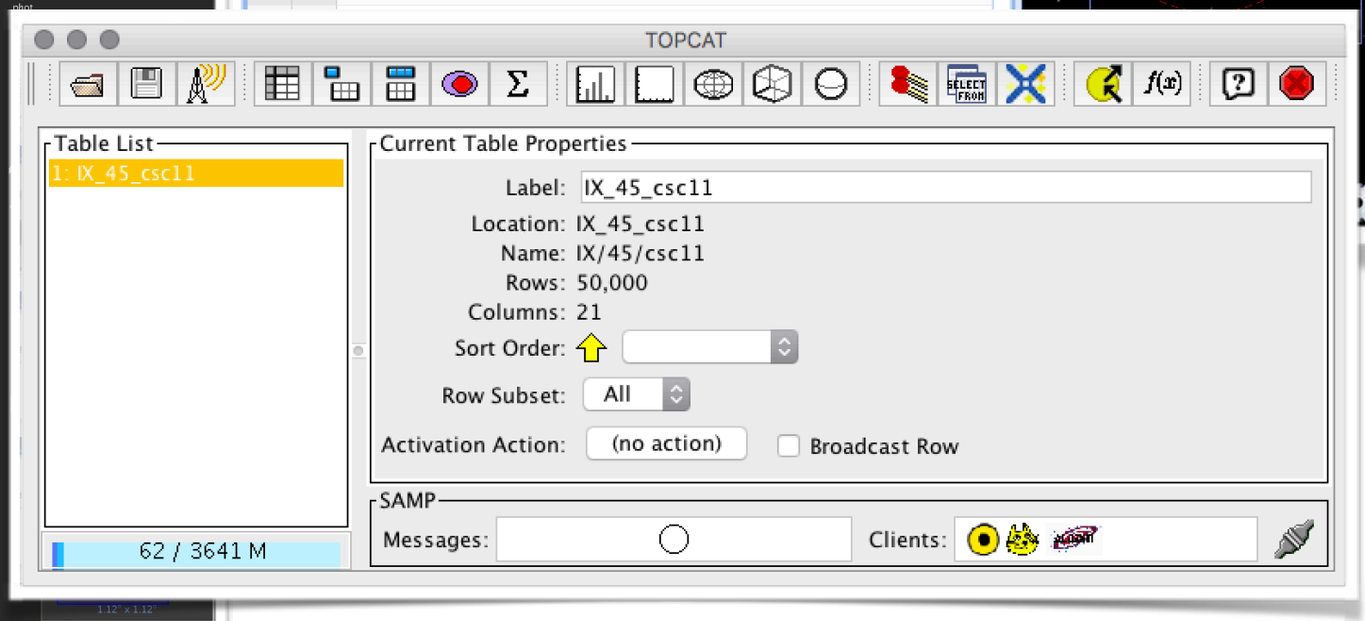
External interfaces









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Chandra Data Archive

Mission archives should invest in the creation of a distributed, collaborative, interoperable, decentralized, rich data environment, where **astronomers are free to choose their favorite tool to *consume* any data**.

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Mission archives should invest in the creation of a distributed, collaborative, interoperable, decentralized, rich data environment, where **astronomers are free to choose their favorite tool to *consume* any data**.

Thanks to the **Virtual Observatory**, and its standards, protocols and services, we are **very close*** to achieve this scenario

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***very close**: we need to 1) re-absorb ad hoc arrangements in place with some external interfaces into IVOA *orthodoxy*, and 2) define and adopt comprehensive, granular usage reporting mechanism

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- ✓ Cone Search
- ✓ SIAP
- ✓ TAP
- ✓ HiPS, MOC

→

- **Chandra archival observations**
- Contributed datasets
- Literature-data links
- **Chandra source catalog**

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Embrace the Future

- Changes in the scientific needs of our community drive changes in the data needs, that is difficult to capture and model

- Mission archives are embracing and pursuing their new roles as multipliers of the scientific return of their missions

- **Mission Archives** should/will take full advantage of the power of VO, embrace their roles of **global gatekeepers of their data holdings** and benefit from the ever-growing network of public interfaces, that can **collectively** address the data needs of the communities much better than any in-house interface.

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