

**NRC-CNRC**

*Herzberg Institute  
of Astrophysics*

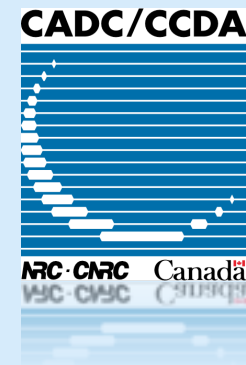


# Canadian Astronomy Data Centre

Séverin Gaudet

David Schade

Canadian Astronomy Data Centre



National Research  
Council Canada

Conseil national  
de recherches Canada

Canada

# Data Activities in Astronomy

- Features of the astronomy data landscape
  - Multi-wavelength datasets are increasingly important scientifically
  - More large, homogeneous survey datasets are being produced
  - **Open data policies**
    - With pre-defined proprietary periods
  - Good IT infrastructure
  - Standards for data interoperability
    - Common file formats
    - Virtual Observatory project
  - Immersed in a world of remarkable technical capabilities

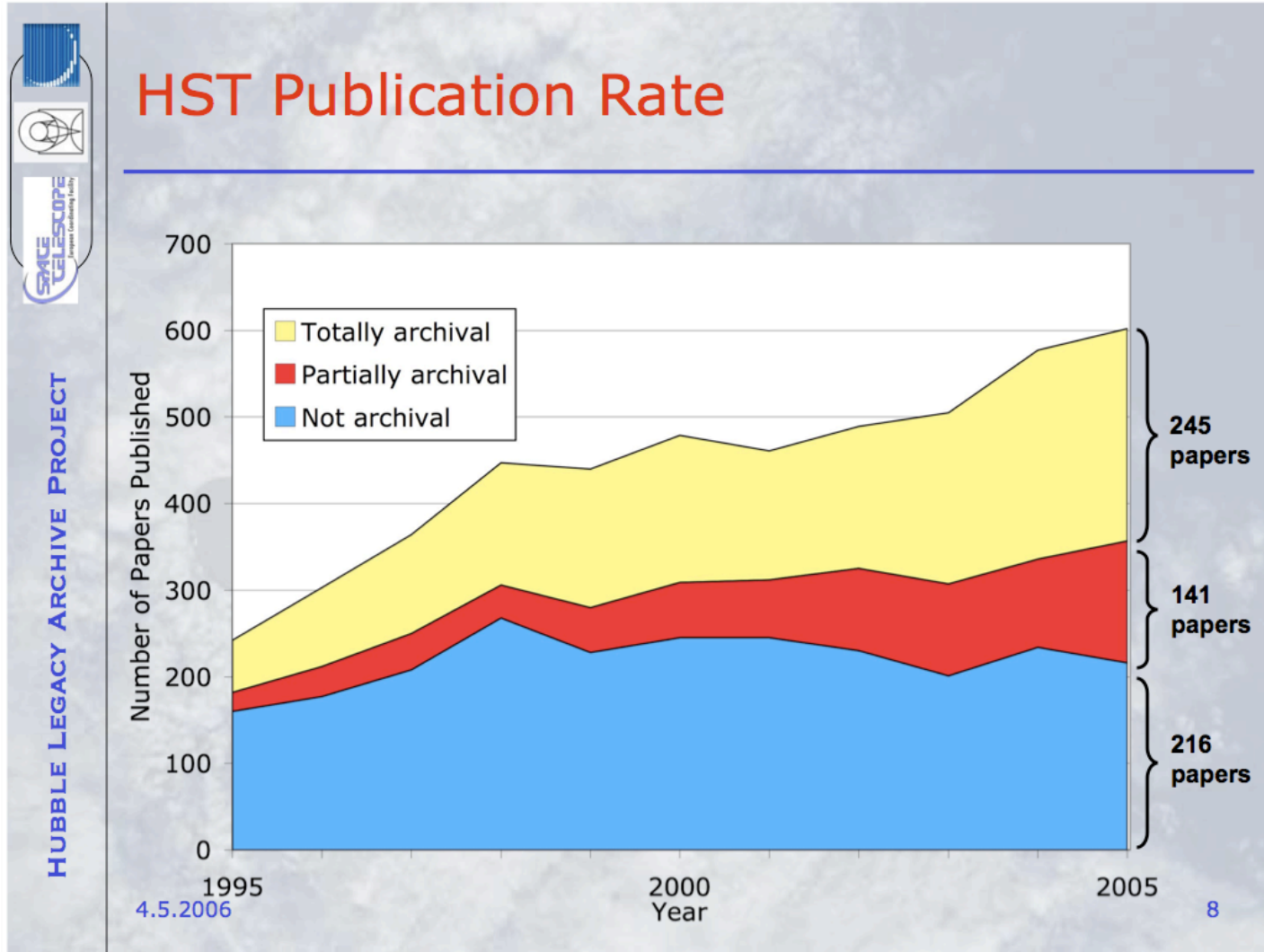


## The Data Benchmark

- Since 1990, the Hubble Space Telescope Science Archive has set the standard
  - Mandated by NASA, supported by ESA and CSA
  - Public data policy
  - Accessibility
  - Processed products
- In 2005, the papers based on archival data exceeded PI papers



# The Data Benchmark



**NRC-CNRC**

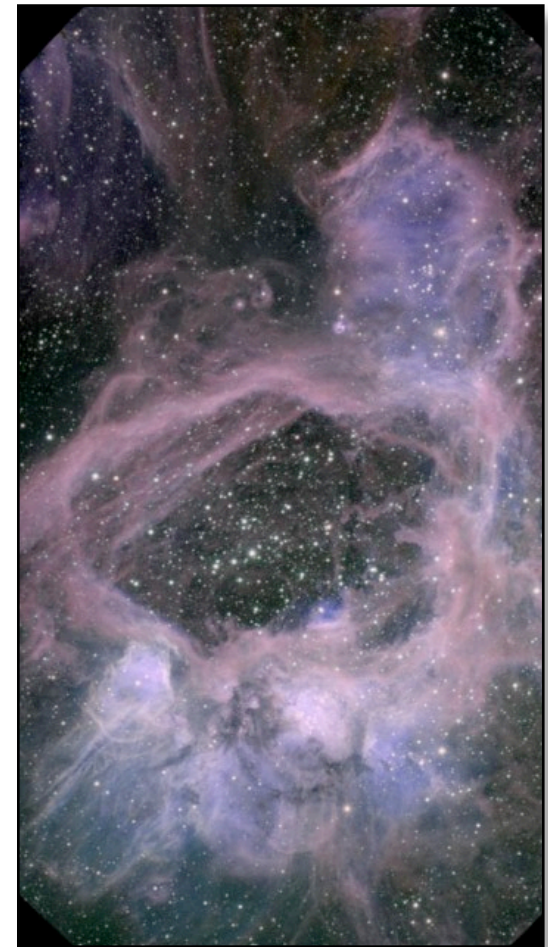
Herzberg Institute  
of Astrophysics

# International Virtual Observatory Alliance



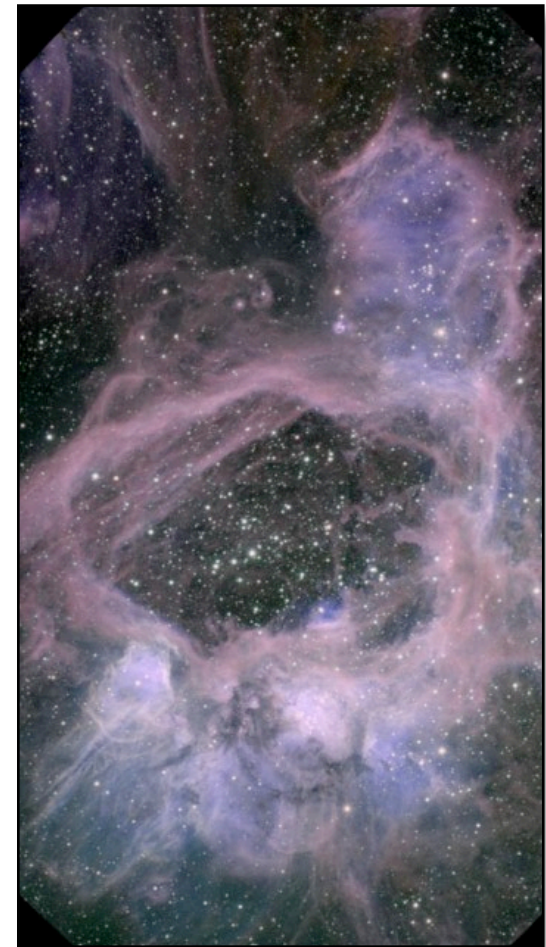
# Activities of a Data Centre

- Data curation (paraphrased from Wikipedia)
  - *The process of identification and **organisation** of objects in a collection in order to **further knowledge**. Includes **verification** and **additions** to the existing metadata for objects. The process of examining, testing and selecting **metadata** to go in a collection **database**.*



# Activities of a Data Centre

- Data curation (paraphrased from Wikipedia)
  - *The process of identification and **organisation** of objects in a collection in order to **further knowledge**. Includes **verification** and **additions** to the existing metadata for objects. The process of examining, testing and selecting **metadata** to go in a collection **database**.*
- Activities
  - Data transfer and ingestion
  - Data modelling and characterisation
  - Data processing
  - Data discovery
  - Data distribution
  - Data preservation



**NRC-CNRC**

*Herzberg Institute  
of Astrophysics*

# Canadian Astronomy Data Centre

- Created in 1986 following a CASCA resolution in 1985
  - Original mandate: to serve Hubble Space Telescope data
  - Original name: the Canadian Space Astronomy Data Centre
- Supported in part by the Canadian Space Agency since mid '90s
- Now a national facility serving many of Canada's major telescopes

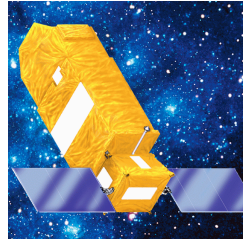




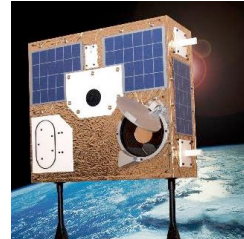
# Canadian Astronomy Data Centre



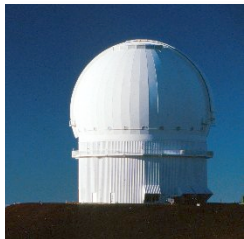
**HST**



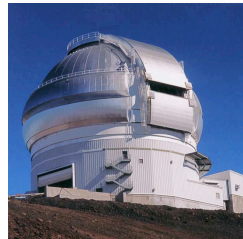
**FUSE**



**MOST**



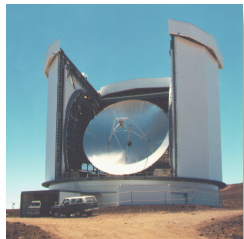
**CFHT**



**Gemini N**



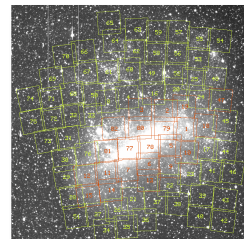
**Gemini S**



**JCMT**



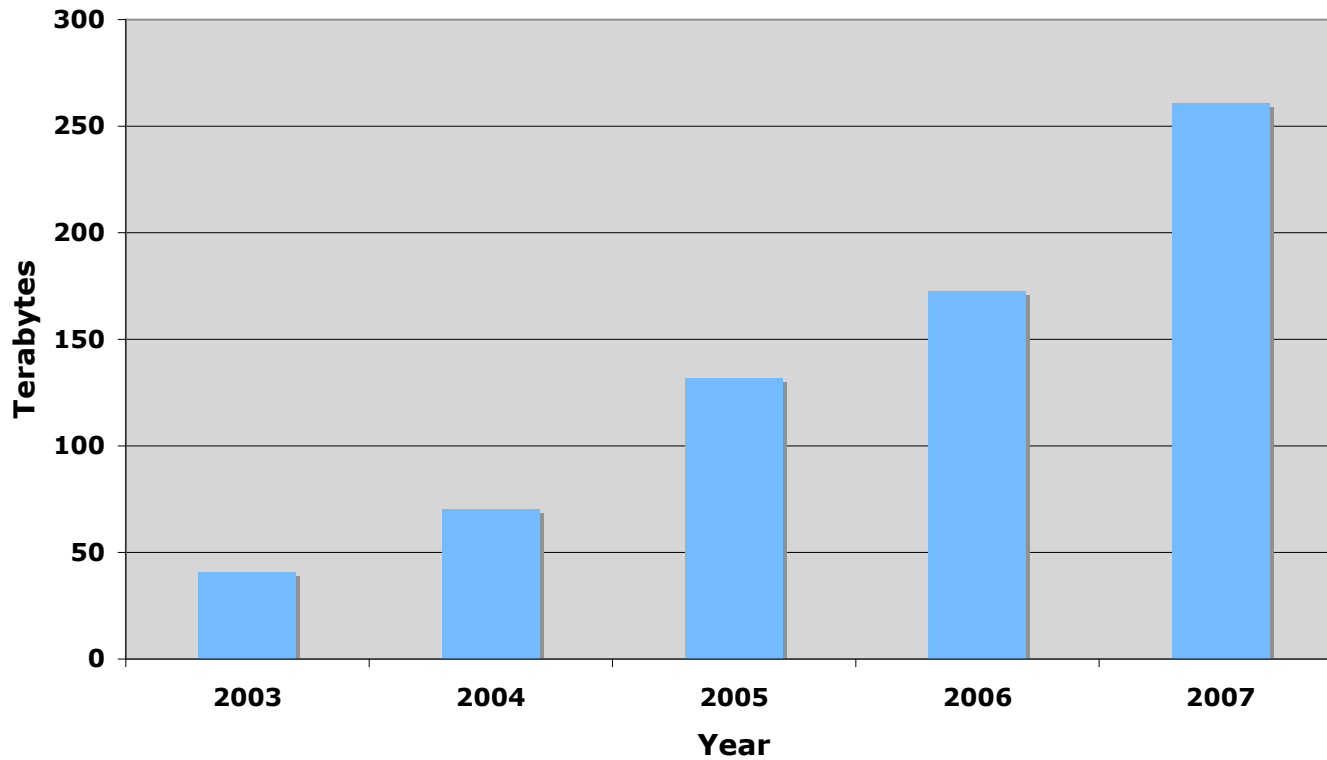
**CGPS**



**MACHO**

- Heterogeneous collection:
  - *multiple missions and facilities*
  - *multiple wavelengths*
- Pointed and survey observations
- Many different archive data models

# Growth in CADC Collections



- In 2007: > 80TB
- 8 major sources of data
- Network transfer only

# Current Collection

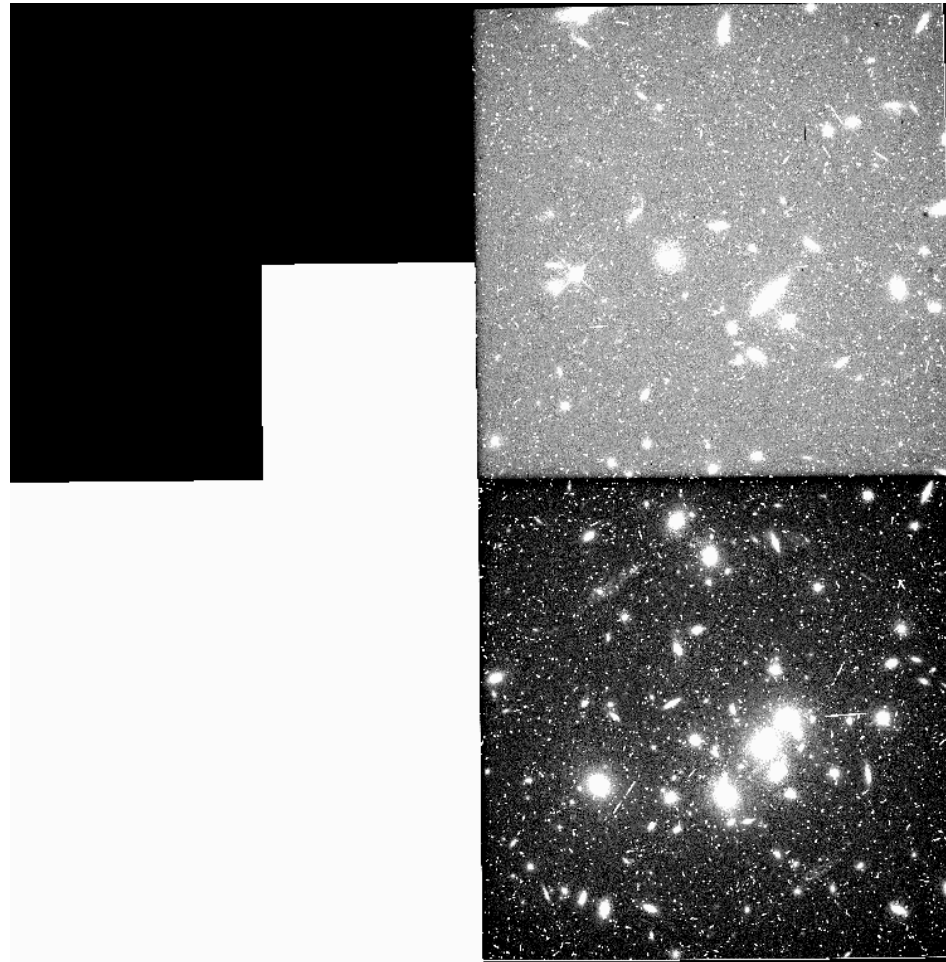
2008-01-11

<i>Archive</i>	<i>Number of Files</i>	<i>Number of GB</i>
BLAST	19	1
CFHT	1,946,588	174,950
DSS	7,268,759	952
FUSE	3,433,858	2,709
GEMINI	1,689,389	5,676
GPS	2,074	80
HST	12,785,565	59,314
IRIS	1,720	2
JCMT	740,652	1,364
MACHO	2,066,319	15,230
MOST	327	11
<b>Total</b>	<b>29,964,423</b>	<b>260,486</b>

- Two compressed copies on disk at HIA
- One compressed copy on tape at UVic

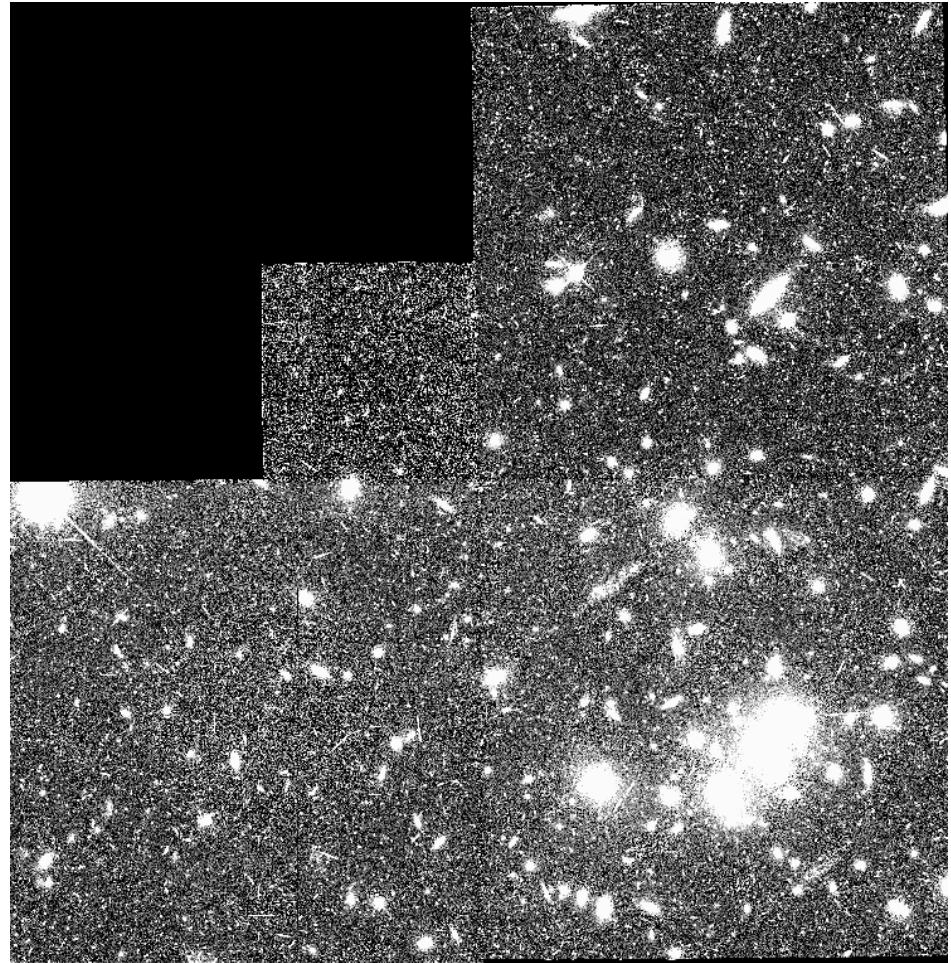
# Activities – Data Processing

- Data processing
  - Removing instrument and telescope signatures
  - Combining multiple images
  - Useable science products
  - Processing close to the data
  
- Examples:
  - HST WFPC2
  - HST ACS
  - CFHT Megacam



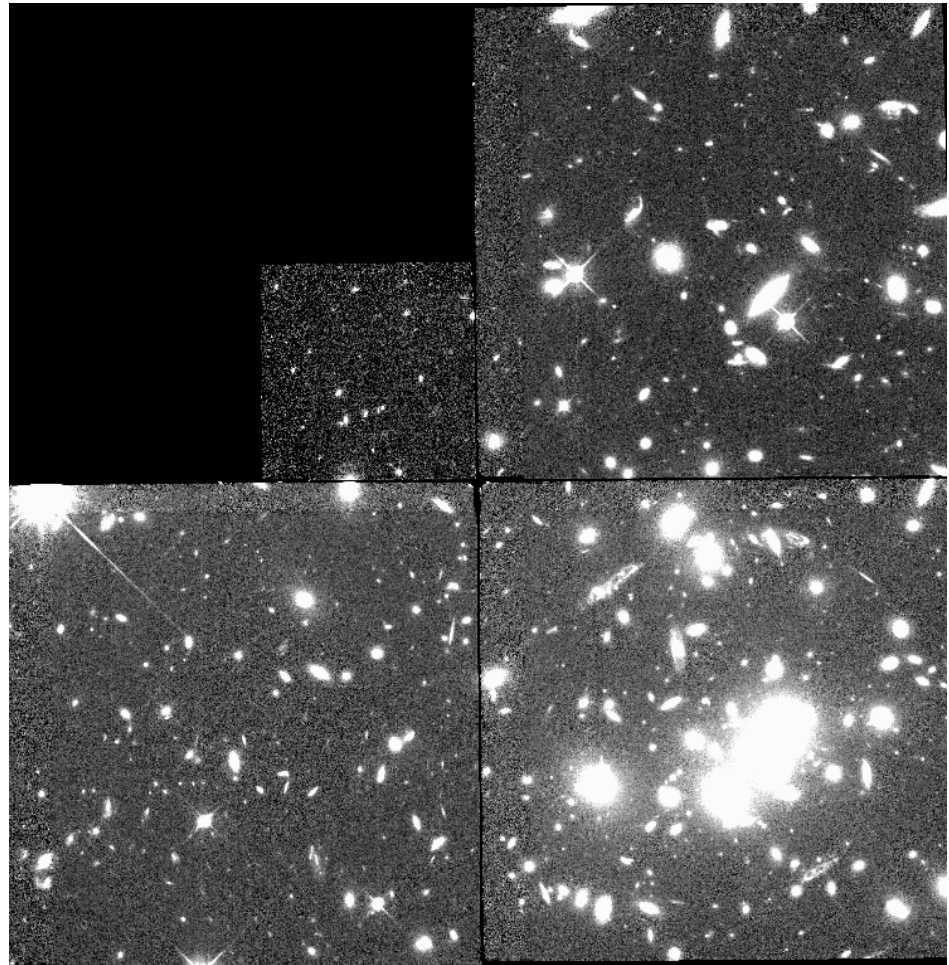
# Activities – Data Processing

- Data processing
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# Activities – Data Processing

- Data processing
  - Removing instrument and telescope signatures
  - Combining multiple images
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- Examples:
  - HST WFPC2
  - HST ACS
  - CFHT Megacam



# Activities – Data Discovery



## Hubble Space Telescope: Science

Here some explanation on the [WFPC2 B Associations](#)  
**ACS associations are now calibrated and assembled using release 2.7 (21 Oct 2005)**  
of [Multidrizzle](#)



[How to use this form?](#)

### Target Designation

**Target**  
**Target source**  Name resolver

**RA (J2000)**  
**lii**

**DEC (J2000)**  
**bii**

**Search Box**  00 10 00
 *(If Simbad name or coordinate is given)*

**SIMBAD target**  
**SIMBAD type**

**SIMBAD class**

### Exposure Information

**Release date**  
**Exposure time**

**Science category**  
**Start time**

**PI Name**  
**Proposal ID**

**Instrument Config**  
**Instrument** 

ACS  
 FOC  
 FOS  
 HRS  
 NICMOS

**FGS lock**  
**Dataset Name**

**Association type(WFPC2)**  
**# of members**

### Target Information

# Activities – Data Discovery

**CADC/CCDA**  
Hubble Space Telescope: Science  
Here some explanation on the [WFPC2 B Associations](#)  
**ACS associations are now calibrated and assembled using release 2.7 (21 Oct 2005)**

The HST Science Catalogue

HELP: HST NEW Science Exposures

Request Marked Datasets Reset MarkAll UnMarkAll

Mark for retrieval	More	Dataset Name	Exposure Time	Release Date	Instrument	Visualisation JAVA	Visualisation png	Target	RA(J2000)	DEC(J2000)	Asn Type	number members	Lite
<input type="checkbox"/>	<a href="#">M</a>	J61A01030	2590	01 Jan 2005	<a href="#">ACS</a>			Z-CMA	07 03 43.14	-11 33 06.0	-	1	<a href="#">J</a>
<input type="checkbox"/>	<a href="#">M</a>	J6M901010	2080	04 May 2003	<a href="#">ACS</a>			NGC3314-UP	10 37 12.81	-27 40 39.9	-	1	<a href="#">J</a>
<input type="checkbox"/>	<a href="#">M</a>	J6M901030	2160	04 May 2003	<a href="#">ACS</a>			NGC3314-UP	10 37 12.81	-27 40 39.9	-	1	<a href="#">J</a>
<input type="checkbox"/>	<a href="#">M</a>	J6M902030	2160	18 May 2003	<a href="#">ACS</a>			NGC3314-UP	10 37 12.81	-27 40 39.9	-	1	<a href="#">J</a>
<input type="checkbox"/>	<a href="#">M</a>	J8F655010	2040	29 May 2003	<a href="#">ACS</a>			GAL-CLUS-135410-1230	13 54 19.54	-12 30 15.8	-	1	<a href="#">J</a>
<input type="checkbox"/>	<a href="#">M</a>	J8F656010	2040	29 May 2003	<a href="#">ACS</a>			GAL-CLUS-135410-1230	13 54 19.56	-12 33 22.9	-	1	<a href="#">J</a>
<input type="checkbox"/>	<a href="#">M</a>	J8F659010	4080	28 May 2003	<a href="#">ACS</a>			GAL-CLUS-135410-1230	13 54 09.40	-12 30 59.2	-	1	<a href="#">J</a>
<input type="checkbox"/>	<a href="#">M</a>	J8F659020	3232	28 May 2003	<a href="#">ACS</a>			ANY	13 53 53.64	-12 31 57.9	-	1	<a href="#">J</a>
<input type="checkbox"/>	<a href="#">M</a>	J8F660010	4080	27 May 2003	<a href="#">ACS</a>			GAL-CLUS-135410-1230	13 54 09.39	-12 30 59.5	-	1	<a href="#">J</a>
<input type="checkbox"/>	<a href="#">M</a>	J8F658010	2040	01 Jun 2003	<a href="#">ACS</a>			GAL-CLUS-135410-1230	13 54 07.36	-12 30 11.2	-	1	<a href="#">J</a>
<input type="checkbox"/>	<a href="#">M</a>	J6M902010	2080	05 Jun 2003	<a href="#">ACS</a>			NGC3314-UP	10 37 12.81	-27 40 39.9	-	1	<a href="#">J</a>
<input type="checkbox"/>	<a href="#">M</a>	J8F657010	2040	09 Jun 2003	<a href="#">ACS</a>			GAL-CLUS-135410-1230	13 54 07.38	-12 33 16.5	-	1	<a href="#">J</a>
<input type="checkbox"/>	<a href="#">M</a>	J8D806B0Q	2560	01 Jul 2003	<a href="#">ACS</a>			GAL-122620+123425	12 26 20.10	+12 34 25.3	-	1	<a href="#">J</a>
<input type="checkbox"/>	<a href="#">M</a>	J8D806C0Q	2560	01 Jul 2003	<a href="#">ACS</a>			GAL-122620+123425	12 26 20.08	+12 34 25.2	-	1	<a href="#">J</a>
<input type="checkbox"/>	<a href="#">M</a>	J8D806D0Q	2560	01 Jul 2003	<a href="#">ACS</a>			GAL-122620+123425	12 26 20.10	+12 34 25.3	-	1	<a href="#">J</a>

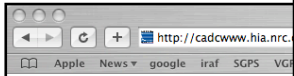
Go to "http://cadwww.hia.nrc.ca/hst/science\_help.html"



# Activities – Data Discovery



Here some  
**ACS associations are no**



Mark for retrieval	More	Dataset Name	EX
<input type="checkbox"/>	M	J61A01030	259
<input type="checkbox"/>	M	J6M901010	208
<input type="checkbox"/>	M	J6M901030	216
<input type="checkbox"/>	M	J6M902030	216
<input type="checkbox"/>	M	J8F655010	204
<input type="checkbox"/>	M	J8F656010	204
<input type="checkbox"/>	M	J8F659010	408
<input type="checkbox"/>	M	J8F659020	323
<input type="checkbox"/>	M	J8F660010	408
<input type="checkbox"/>	M	J8F658010	204
<input type="checkbox"/>	M	J6M902010	208
<input type="checkbox"/>	M	J8F657010	204
<input type="checkbox"/>	M	J8D806B0Q	256
<input type="checkbox"/>	M	J8D806CCQ	256
<input type="checkbox"/>	M	J8D806DUQ	256

http://cadwww.hia.nrc.ca/cadcbn/preview\_java/J6LA02YKQ/2600/CLEAR1:F814W

http://cadwww.hia.nrc.ca/cadcbn/preview\_java/J6LA02YKQ/2600/CLEAR1:F814W

**Hubble Space Telescope: Preview of :J6LA02YKQ**  
Exposure time: 2600 seconds Filter:F814W  
value=J6LA02YKQ\_PREV ACS image

Aladin

Load... Links... VOPlot... Help... Detach

J2000 Field: 13:25:14.02 -43:34:27.4 3.52"x3.53"

Zoom 2/3x

(c) ULP/CNRS 1999-2004 - Centre de Données astronomiques de Strasbourg

Go to "http://cadwww.hia.nrc.ca/hst/science\_help.html"

# Activities – Data Discovery

CADC/CCDA

Here some ACS associations are no

HELP: HST NEW

Mark for retrieval	More	Dataset Name	EX
<input type="checkbox"/>	M	J61A01030	259
<input type="checkbox"/>	M	J6M901010	208
<input type="checkbox"/>	M	J6M901030	216
<input type="checkbox"/>	M	J6M902030	216
<input type="checkbox"/>	M	J8F655010	204
<input type="checkbox"/>	M	J8F656010	204
<input type="checkbox"/>	M	J8F659010	408
<input type="checkbox"/>	M	J8F659020	323
<input type="checkbox"/>	M	J8F660010	408
<input type="checkbox"/>	M	J8F658010	204
<input type="checkbox"/>	M	J6M902010	208
<input type="checkbox"/>	M	J8F657010	204
<input type="checkbox"/>	M	J8D806B0Q	256
<input type="checkbox"/>	M	J8D806CCQ	256
<input type="checkbox"/>	M	J8D806D0Q	256

(c) ULP/CNRS 1999

Run SpecviewApplet

File Display Cplot Preferences Help

X axis: WAVELENGTH    Y axis: FLUX    1135.7122    -4.0008934E-14    Print

Grid on    Auto    S    F    M    L    U

Flux density (erg/s/cm\*\*2/Angstrom)

Wavelength (Angstrom)

PKS2155-304

5.0E-13

1200.0    1300.0    1400.0

Pan

Applet http://cadwww.hia.nrc.ca/cadbin/hstproxy?file\_id=Z0IW0108M\_PREV&mode=prev started

# Inter-archive Links

XMM-Newton Science Archive 3.6

File Print/Save Find Field Documentation Help

Query Specification Latest Results Shopping Basket Login/Register Logout Request Monitor

Not Logged In Idle

**esa** XMM-NEWTON SCIENCE ARCHIVE

Move Selected to Basket Move All to Basket Mark All Delete Selected Refresh List ALADIN

Observations 15. Shown: 1st and each until and including 15th 25 in Page

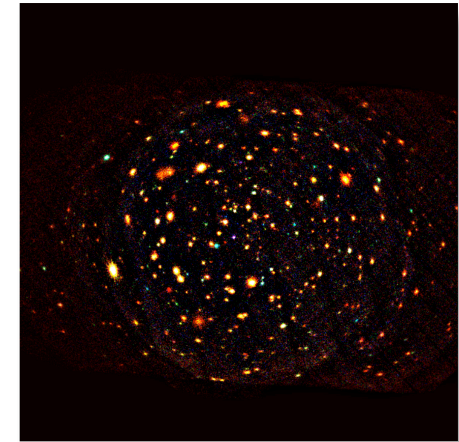
Search Centre: 10h52m06.90s +57d27'09.7" (J2000) Each One

Observations  Exposures  Sources

Observation Info  
Exposures info  
Proposal info  
Epic Image  
Bckg. Light Curve

Exposures	Sources	Observation ID	Object Name	RA (J2000)	Dec (J2000)	Distance (arcsec)	Observation Date	Time	Exposure (s)	PI	PI Title	EPN	Instrument	Filter	Mode	Background	Surveys	Calibration	Public Data	Quality Report	Gallery
143 Sources		0123700101	Lockman Hole	10h52m35.08s	+57d29'06.8"	255.73arcsec	2000-04-27	02:46:15.0	2000-04-27	21:37:20.0	67865	Fred Jansen Project Scientist	EPN FF(1) MOS1 FF(2) MOS2 FF(1) RGS1 SES(2) RGS2 SES(2) OM V(5) OM U(5) OM White(5) OM UV	X-ray Background and Surveys	Calibration	Public Data	Quality Report				
		0070					2000-05-02	17:51:01.0	2000-05-02	23:38:17.0	20836	Fred Jansen Project Scientist	EPN FF(1) MOS1 FF(1) MOS2 FF(1) RGS1 SES(1) RGS2 SES(1)	X-ray Background and Surveys	Calibration	Public Data	Quality Report				
		0123700401	Lockman Hole	10h52m42.32s	+57d28'36.2"	298.53arcsec	2000-05-05	08:49:54.0	2000-05-05	21:01:04.0	43870	Fred Jansen Project Scientist	EPN FF(2) MOS1 FF(2) MOS2 FF(2) RGS1 SES(2) RGS2 SES(2) OM White(4) OM UVW1(5) OM UVW2(5)	X-ray Background and Surveys	Calibration	Public Data	Quality Report				
		0074					2001-10-25	07:21:55.0	2001-10-26	06:44:46.0	84171	Xavier Barcons	EPN FF(1) MOS1 FF(1) MOS2 FF(1) RGS1 SES(1) RGS2 SES(1) OM U(5) OM B(5) OM UVW1(5) OM UVW2(5)	X-ray Background and Surveys	Calibration	Public Data	Quality Report				

Start of List Previous Next End of List



# Inter-archive Links

XMM-Newton Science

File Print/Save Find Field Documentation

Query Specification Latest Results Shopping Basket

Not Logged In

Move Selected to Basket Move All to Basket

Observations 15. Shown: 1st and each until and including 15th

Search Centre: 10h52m06.90s +57d27'09.7" (J2000)

Exposures	Sources	Observation ID	RA	Dec	Start Time	End Time
143 Sources	0123700101	Lockman Hole	10h52m35.08s	+57d29'06.8"	2000-04-27 02:46:15.0	2000-04-27 21:37:20.0
XID observations						
Details	Articles	EPN FF(1) MOS1 FF(2) MOS2 FF(1) RGS1 SES(2) RGS2				
Query Other Archives						
X-ray Background and Surveys						
Retrieve						

Exposures	Sources	Observation ID	RA	Dec	Start Time	End Time
0073	0123700401	Lockman Hole	10h52m42.00s	+57d27'09.7"	2000-05-02 17:51:01.0	2000-05-02 23:38:17.0
XID observations						
Details	Articles	EPN FF(1) MOS1 FF(1) MOS2 FF(1) RGS1 SES(1) RGS2				
Query Other Archives						
X-ray Background and Surveys						
Retrieve						

Exposures	Sources	Observation ID	RA	Dec	Start Time	End Time
0074	0123700901	Lockman Hole	10h52m41.00s	+57d27'09.7"	2000-05-05 08:49:54.0	2000-05-05 21:01:04.0
XID observations						
Details	Articles	EPN FF(2) MOS1 FF(2) MOS2 FF(2) RGS1 SES(2) RGS2				
Query Other Archives						
X-ray Background and Surveys						
Retrieve						

Exposures	Sources	Observation ID	RA	Dec	Start Time	End Time
0344	0022740101	Lockman Hole	10h52m51.00s	+57d27'09.7"	2001-10-25 07:21:55.0	2001-10-26 06:44:46.0
XID observations						
Details	Articles	EPN FF(1) MOS1 FF(1) MOS2 FF(1) RGS1 SES(1) RGS2 SES(1) OM U(5) OM B(5) OM UVWI(5) OM UVWJ(5)				
Query Other Archives						
X-ray Background and Surveys						
Retrieve						

Start of List Previous Next End of List

Query Other Archives

Lockman Hole: 10h52m35.08s +57d29'06.8"

Search Radius (arcmin): 10

**ESA Archives**

- ISO (IDA)
- Integral (ISDA)

**Source Catalogue Archives**

- Simbad
- Vizier
- NED
- RASS

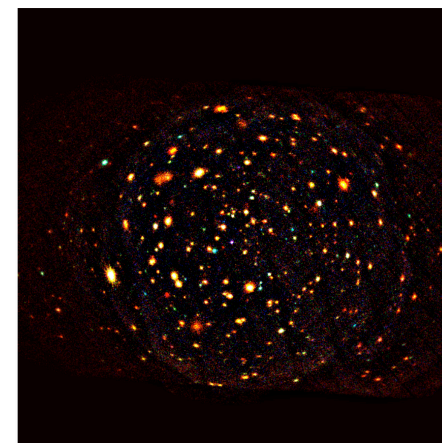
**Archives for radio-to-UV observatory data**

- IRAS
- MAST/HLSP
- Spitzer
- 2MASS
- MSX
- IUE
- ESO Archive Querator
- HST Imaging Products
- CFHT Imaging Products
- JCMT Imaging Products
- Gemini Imaging Products
- CGPS Imaging Products

**Archives for high-energy observatory data**

- BeppoSAX/NFI
- Chandra
- Ginga
- GRO
- Einstein
- EXOSAT
- ASCA

Search this observation in the selected Archives Close Reset



# Inter-archive Links

Query Other Archives

Lockman Hole: 10h52m35.08s +57d29'06.8"

Search Radius (arcmin): 10

ESA Archives

Quick Search

http://www.cadc.hia.nrc.gc.ca/QuickSearch/find?collection=HST&target=10:52:35.08,57:29:06.8,0.167

**CVO** Canadian Virtual Observatory

**Quick Search**  
Finds only well-calibrated, high-quality datasets from the CADC collection

Target: 10:52:35.08,57:29:06.8,0.167

(target name or RA DEC, radius optional)

Raw data will not be visible using the Quick Search tool. Please visit individual archives to access ALL data from ALL instruments.

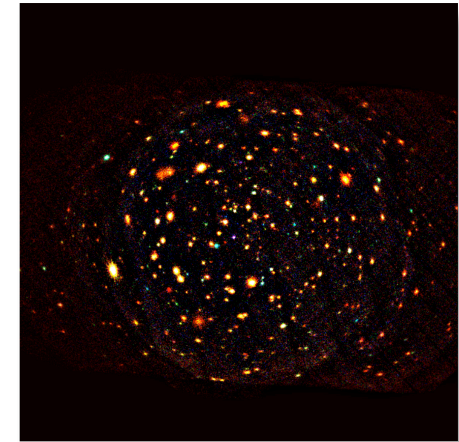
query: 163.1462 57.485 0.167 (degrees), HST  
result: 31 observations

download	collection	collectionID	RA	DEC	area (sq.deg)	pixel size (arcsec)	filter name	wavelength (m)	date (MJD)	exptime (s)
<input checked="" type="checkbox"/>	HST	J8S0C6010	10:52:04.4	+57:26:40.8	6.701E-3	0.05	F775W	7.764E-7	53122.66	1908.0
<input type="checkbox"/>	HST	J8S002010	10:52:04.4	+57:23:29.3	6.69E-3	0.05	F775W	7.764E-7	53130.92	2064.0
<input type="checkbox"/>	HST	J8S003010	10:51:43.9	+57:25:31.0	6.697E-3	0.05	F775W	7.764E-7	53122.72	2064.0
<input type="checkbox"/>	HST	J8S0A6010	10:52:30.0	+57:21:02.3	6.684E-3	0.05	F775W	7.764E-7	53122.52	1908.0
<input type="checkbox"/>	HST	J8S0B6010	10:52:28.1	+57:25:11.7	6.696E-3	0.05	F775W	7.764E-7	53122.59	1908.0
<input type="checkbox"/>	HST	J8H0F9R2Q	10:52:37.1	+57:32:53.0	6.422E-3	0.05	F775W	7.764E-7	52541.66	400.0
<input type="checkbox"/>	HST	J8H0F9RWQ	10:52:37.4	+57:32:59.4	6.422E-3	0.05	F775W	7.764E-7	52541.65	400.0
<input type="checkbox"/>	HST	J8HQATS6Q	10:52:37.3	+57:32:53.0	6.42E-3	0.05	F814W	8.333E-7	52541.73	500.0
<input type="checkbox"/>	HST	J8HQATS6Q	10:52:37.2	+57:32:54.0	6.42E-3	0.05	F814W	8.333E-7	52541.68	500.0
<input type="checkbox"/>	HST	J8HQATSJQ	10:52:37.5	+57:32:58.3	6.422E-3	0.05	G800L	8.25E-7	52541.74	500.0
<input type="checkbox"/>	HST	J8HQATT6Q	10:52:37.1	+57:32:51.0	6.422E-3	0.05	G800L	8.25E-7	52541.79	500.0
<input type="checkbox"/>	HST	J8HQATT1Q	10:52:37.4	+57:32:57.3	6.42E-3	0.05	F814W	8.333E-7	52541.79	487.0
<input type="checkbox"/>	HST	J8HQATSMQ	10:52:37.2	+57:32:52.0	6.422E-3	0.05	G800L	8.25E-7	52541.74	500.0
<input type="checkbox"/>	HST	J8HQATTFQ	10:52:36.9	+57:32:52.0	6.422E-3	0.05	G800L	8.25E-7	52541.81	500.0
<input type="checkbox"/>	HST	J8HQATTAQ	10:52:37.2	+57:32:58.4	6.422E-3	0.05	G800L	8.25E-7	52541.80	500.0
<input type="checkbox"/>	HST	J8AC001R	10:52:56.1	+57:32:21.9	2.664E-3	0.045E	F702W	6.04E-7	51472.76	2200.0

0344 2001-10-25 07:21:55.0 2001-10-26 06:44:46.0

EPN FF(1) MOS1 FF(1) MOS2 FF(1) RGS1 SES(1) RGS2 SES(1) OM U(5) OM B(5) OM UVW1(5) OM UVW2(5)

Start of List Previous Next End of List



# Inter-archive Links

Query Other Archives

Lockman Hole: 10h52m35.08s +57d29'06.8"

Search Radius (arcmin): 10

ESA Archives

Quick Search

http://www.cadc.hia.nrc.gc.ca/QuickSearch/find?collection=HST&target=10:52:35.08,57:29:06.8,0.167

**CVO** Canadian Virtual Observatory

**Quick Search**  
Finds only well-calibrated, high-quality datasets from the CADC collection

Target: 10:52:35.08,57:29:06.8,0.167

(target name or RA DEC, radius optional)

Raw data will not be visible using the Quick Search tool. Please visit individual archives to access ALL data from ALL instruments.

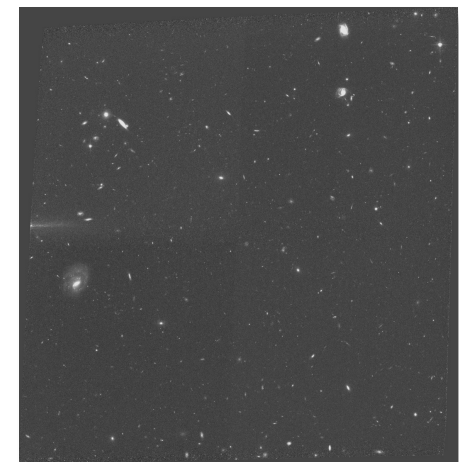
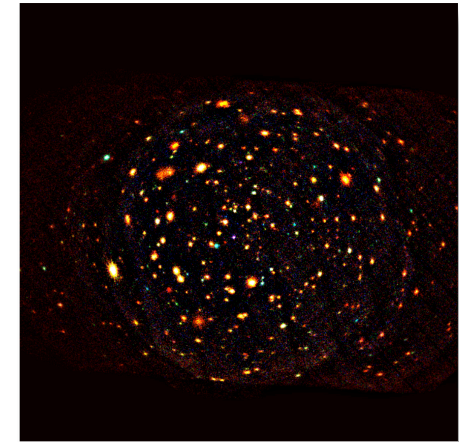
query: 163.1462 57.485 0.167 (degrees), HST  
result: 31 observations

download	collection	collectionID	RA	DEC	area (sq.deg)	pixel size (arcsec)	filter name	wavelength (m)	date (MJD)	exptime (s)
<input checked="" type="checkbox"/>	HST	J8S0C6010	10:52:04.4	+57:26:40.8	6.701E-3	0.05	F775W	7.764E-7	53122.66	1908.0
<input type="checkbox"/>	HST	J8S0O2010	10:52:04.4	+57:23:29.3	6.69E-3	0.05	F775W	7.764E-7	53130.92	2064.0
<input type="checkbox"/>	HST	J8S0O3010	10:51:43.9	+57:25:31.0	6.697E-3	0.05	F775W	7.764E-7	53122.72	2064.0
<input type="checkbox"/>	HST	J8S0A6010	10:52:30.0	+57:21:02.3	6.684E-3	0.05	F775W	7.764E-7	53122.52	1908.0
<input type="checkbox"/>	HST	J8S0B6010	10:52:28.1	+57:25:11.7	6.696E-3	0.05	F775W	7.764E-7	53122.59	1908.0
<input type="checkbox"/>	HST	J8H0F9R2Q	10:52:37.1	+57:32:53.0	6.422E-3	0.05	F775W	7.764E-7	52541.66	400.0
<input type="checkbox"/>	HST	J8H0F9RWQ	10:52:37.4	+57:32:59.4	6.422E-3	0.05	F775W	7.764E-7	52541.65	400.0
<input type="checkbox"/>	HST	J8HQATS6Q	10:52:37.3	+57:32:53.0	6.42E-3	0.05	F814W	8.333E-7	52541.73	500.0
<input type="checkbox"/>	HST	J8HQATS6Q	10:52:37.2	+57:32:54.0	6.42E-3	0.05	F814W	8.333E-7	52541.68	500.0
<input type="checkbox"/>	HST	J8HQATSJQ	10:52:37.5	+57:32:58.3	6.422E-3	0.05	G800L	8.25E-7	52541.74	500.0
<input type="checkbox"/>	HST	J8HQATT6Q	10:52:37.1	+57:32:51.0	6.422E-3	0.05	G800L	8.25E-7	52541.79	500.0
<input type="checkbox"/>	HST	J8HQATT1Q	10:52:37.4	+57:32:57.3	6.42E-3	0.05	F814W	8.333E-7	52541.79	487.0
<input type="checkbox"/>	HST	J8HQATSMQ	10:52:37.2	+57:32:52.0	6.422E-3	0.05	G800L	8.25E-7	52541.74	500.0
<input type="checkbox"/>	HST	J8HQATTFQ	10:52:36.9	+57:32:52.0	6.422E-3	0.05	G800L	8.25E-7	52541.81	500.0
<input type="checkbox"/>	HST	J8HQATTAQ	10:52:37.2	+57:32:58.4	6.422E-3	0.05	G800L	8.25E-7	52541.80	500.0
<input type="checkbox"/>	HST	J8AC001R	10:52:56.1	+57:32:21.9	2.664E-3	0.045E	F702W	6.04E-7	51472.76	2200.0

0344 2001-10-25 07:21:55.0 2001-10-26 06:44:46.0

EPN FF(1) MOS1 FF(1) MOS2 FF(1) RGS1 SES(1) RGS2 SES(1) OM U(5) OM B(5) OM UVW1(5) OM UVW2(5) OM UVW3(5) OM UVW4(5) OM UVW5(5) OM UVW6(5) OM UVW7(5) OM UVW8(5) OM UVW9(5) OM UVW10(5) OM UVW11(5) OM UVW12(5) OM UVW13(5) OM UVW14(5) OM UVW15(5) OM UVW16(5) OM UVW17(5) OM UVW18(5) OM UVW19(5) OM UVW20(5) OM UVW21(5) OM UVW22(5) OM UVW23(5) OM UVW24(5) OM UVW25(5) OM UVW26(5) OM UVW27(5) OM UVW28(5) OM UVW29(5) OM UVW30(5) OM UVW31(5) OM UVW32(5) OM UVW33(5) OM UVW34(5) OM UVW35(5) OM UVW36(5) OM UVW37(5) OM UVW38(5) OM UVW39(5) OM UVW40(5) OM UVW41(5) OM UVW42(5) OM UVW43(5) OM UVW44(5) OM UVW45(5) OM UVW46(5) OM UVW47(5) OM UVW48(5) OM UVW49(5) OM UVW50(5) OM UVW51(5) OM UVW52(5) OM UVW53(5) OM UVW54(5) OM UVW55(5) OM UVW56(5) OM UVW57(5) OM UVW58(5) OM UVW59(5) OM UVW60(5) OM UVW61(5) OM UVW62(5) OM UVW63(5) OM UVW64(5) OM UVW65(5) OM UVW66(5) OM UVW67(5) OM UVW68(5) OM UVW69(5) OM UVW70(5) OM UVW71(5) OM UVW72(5) OM UVW73(5) OM UVW74(5) OM UVW75(5) OM UVW76(5) OM UVW77(5) OM UVW78(5) OM UVW79(5) OM UVW80(5) OM UVW81(5) OM UVW82(5) OM UVW83(5) OM UVW84(5) OM UVW85(5) OM UVW86(5) OM UVW87(5) OM UVW88(5) OM UVW89(5) OM UVW90(5) OM UVW91(5) OM UVW92(5) OM UVW93(5) OM UVW94(5) OM UVW95(5) OM UVW96(5) OM UVW97(5) OM UVW98(5) OM UVW99(5) OM UVW100(5)

Start of List Previous Next End of List



# Activities – Data Distribution

- Data distribution
  - Select and download
  - Direct programmatic access
  - Asynchronous retrieval

The screenshot shows the 'GSA Science Data Query' interface. At the top, it identifies 'The Canadian Astronomy Data Centre' and 'Herzberg Institute of Astrophysics'. The main heading is 'Gemini Science Archive'. Below this is a navigation menu with 'Home', 'GSA Queries', 'GSA Help', 'Related Links', and 'Credits'. The central section is titled 'GSA Science Data Query' and prompts the user to 'Enter your desired qualifiers in the fields below and click the Search button.' It includes a search bar with 'Search', 'Display All', and 'Reset' buttons. Below the search bar, there is a section for 'Retrieval Options' with 'Order by' set to 'No Sorting' and 'Return' set to '50 rows'. The 'Target Information' section contains several fields: 'Target Name' (m31), 'RA (J2000)', 'DEC (J2000)', 'Galactic Longitude', 'Science Category' (Any), and 'Target Category'. The 'Observation Constraints' section includes 'Data Superset Name', 'Original File Name', 'Science Program', 'RA (2000) Max', and 'RA (2000) Min'. The browser's address bar shows the URL: http://www1.cadc-ccda.hia-ihp.nrc-cnrc.gc.ca/cadcbn/gsa/wdbi.cgi/.

# Activities – Data Distribution

- Data distribution
  - Select and download
  - Direct programmatic access
  - Asynchronous retrieval

The screenshot shows the Gemini Science Archive (GSA) website interface. At the top, it says "The Canadian Astronomy Data Centre Herzberg Institute of Astrophysics". Below that is the "Gemini Science Archive" logo and navigation links: Home, GSA Queries, GSA Help, Related Links, Credits. A search bar shows the query: "NED m31 00 42 44.3 +41 16 08.5". Below the search bar are buttons for "Download Datasets with Cal.", "Download Datasets", "Save Datasets", "MarkAll", and "UnMarkAll".

Mark	Target Name	RA (J2000)	DEC (J2000)	Observing Logs	Exposure Time	UT Date	All Program Obs.	Processed Calibration Files	Nightly Raw Calibration Files	Instrument
<input checked="" type="checkbox"/>	M31	00 42 45.90	+41 16 19.0	Unavailable	10.0	Jun 20 2001 1:42PM	List		Cal. Files	Hokupaa+QUIRC
<input checked="" type="checkbox"/>	M31 (NGC 224)	00 42 44.30	+41 16 09.1	Obs_Logs	0.2	Nov 2 2003 8:55AM	List		Cal. Files	NIRI
<input checked="" type="checkbox"/>	M31 (NGC 224)	00 42 44.30	+41 16 09.1	Obs_Logs	0.2	Nov 2 2003 7:32AM	List		Cal. Files	NIRI
<input checked="" type="checkbox"/>	M31 (NGC 224)	00 42 44.30	+41 16 09.1	Obs_Logs	0.2	Nov 2 2003 8:58AM	List		Cal. Files	NIRI
<input type="checkbox"/>	M31	00 42 45.90	+41 16 19.0	Unavailable	10.0	Jun 20 2001 1:37PM	List		Cal. Files	Hokupaa+QUIRC
<input type="checkbox"/>	M31	00 42 45.90	+41 16 19.0	Unavailable	10.0	Jun 20 2001 1:52PM	List		Cal. Files	Hokupaa+QUIRC
<input checked="" type="checkbox"/>	M31 Nucleus South	00 42 44.30	+41 16 03.4	Obs_Logs	0.4	Sep 6 2005 3:21PM	List		Cal. Files	NIRI
<input checked="" type="checkbox"/>	M31 Nucleus South	00 42 44.30	+41 16 03.4	Obs_Logs	0.4	Sep 4 2005 10:19AM	List		Cal. Files	NIRI
<input type="checkbox"/>	M31	00 42 45.90	+41 16 19.0	Unavailable	10.0	Jun 20 2001 1:53PM	List		Cal. Files	Hokupaa+QUIRC
<input type="checkbox"/>	M31	00 42 45.90	+41 16 19.0	Unavailable	10.0	Jun 20 2001 1:38PM	List		Cal. Files	Hokupaa+QUIRC
<input type="checkbox"/>	M31 Nucleus South	00 42 44.30	+41 16 03.4	Obs_Logs	0.8	Sep 3 2005 9:19AM	List		Cal. Files	NIRI
<input type="checkbox"/>	M31 Nucleus South	00 42 44.30	+41 16 03.4	Obs_Logs	0.4	Sep 6 2005 3:27PM	List		Cal. Files	NIRI
<input type="checkbox"/>	M31	00 42 45.90	+41 16 19.0	Unavailable	10.0	Jun 20 2001 1:40PM	List		Cal. Files	Hokupaa+QUIRC
<input type="checkbox"/>	M31 (NGC 224)	00 42 44.30	+41 16 09.1	Obs_Logs	0.2	Nov 2 2003 9:10AM	List		Cal. Files	NIRI
<input type="checkbox"/>	M31 Nucleus South	00 42 44.30	+41 16 03.4	Obs_Logs	0.4	Sep 4 2005 9:01AM	List		Cal. Files	NIRI



# Activities – Data Distribution

- Data distribution
  - Select and download
  - Direct programmatic access
  - Asynchronous retrieval

The screenshot displays the GSA Science Data Query interface. A download manager window is open, showing the progress of several file downloads. The files listed are:

- 01jun20\_362.fits.gz (1359KB, 135.0KB/sec) (complete)
- N20031102S0154.fits.gz (745KB, 124.0KB/sec) (complete)
- N20031102S0081.fits.gz (283KB, 94.0KB/sec)
- GEMINI/N20031102S0157 (Queued)
- GEMINI/01JUN20\_359 (Queued)

The interface also includes a table of observation data and a 'Credits' section.

Mark	Target	RA	DEC	Filter	Seeing	Obs. Date	Obs. Time	Obs. Status	Obs. Log	Instrument
<input checked="" type="checkbox"/>	M31	00 42 45.90	+41 16 19.0	Unavailable	10.0	Jun 20 2001 1:40PM		List		Hokupaa+QUIRC
<input checked="" type="checkbox"/>	M31 (NGC 224)	00 42 44.30	+41 16 09.1	Obs_Logs	0.2	Nov 2 2003 9:10AM		List		NIRI
<input checked="" type="checkbox"/>	M31 Nucleus South	00 42 44.30	+41 16 03.4	Obs_Logs	0.4	Sep 4 2005 9:01AM		List		NIRI

## Activities – Data Distribution

- Data distribution
  - Select and download
  - Direct programmatic access
  - Asynchronous retrieval

### Retrieve an HST ACS drizzle image

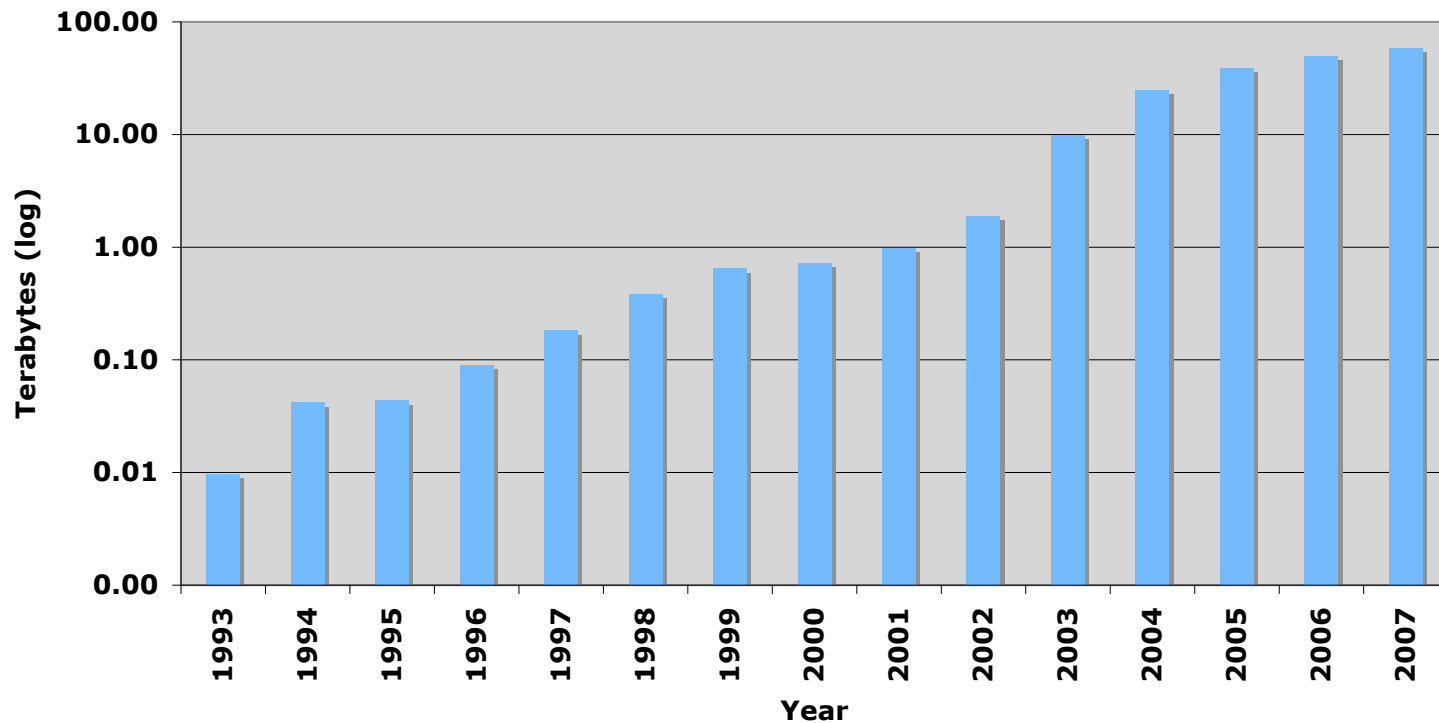
```
curl -g -o J8OZ02010_DRZ.fits.gz http://www.cadc.hia.nrc.gc.ca/  
anonProxy/getData?archive=HST&file\_id=J8OZ02010\_DRZ
```

### Retrieve extension 10 of a proprietary CFHT12K image

```
curl -g -u username:password -o 687344o_10.fits.gz http://  
www.cadc.hia.nrc.gc.ca/authProxy/getData?  
archive=CFHT&file\_id=687344o&cutout=\[10\]
```

# CADC Data Distribution

- In 2007: > 1 million files, > 58 TB
- Provided data and services to > 2500 distinct hosts worldwide
- Network distribution only



**NRC-CNRC**

*Herzberg Institute  
of Astrophysics*

# CADC Data Flows



★ Users in 87 countries

# International Virtual Observatory Alliance

- **Mission:** To facilitate the international coordination and collaboration ... to enable the international utilization of astronomical archives as an integrated and interoperating virtual observatory.
- Formed in 2002
- **A culture of data sharing**



# International Virtual Observatory Alliance

- Developing:
  - Data models
  - Data query and access protocols
  - Service discovery
  - Tools
- Data centres bear the cost of implementation
- Benefit from world-wide development efforts

DataScope Query

http://heasarc.gsfc.nasa.gov/cgi-bin/vo/datascope/init.pl

**NVO**  
NATIONAL VIRTUAL OBSERVATORY

**VO DataScope Query**

Hosted by:  
HEASARC  
NASA/GSFC

[NVO Home](#) | [Help](#) | [VO Tools and Services](#) | [NVO Feedback](#)

**Query VO resources for a given region of a sky**

**Note:** DataScope V2.1 released March 26, 2007 (many cosmetic changes and some bug fixes)

What do we know about a given point or region in the sky?  
To find out, just enter a target or position. The NVO DataScope will show you the results from hundreds of resources.

Position:   
Use a target name (e.g., 3c273) or position (e.g., 10 10 10.1, 20 20 20.2)

Size:  (in degrees, max is 2)

Run query:

Skip cache?  Refresh registry?

Do not add to list of recent queries?

Some recent queries:

- 10 10 10.1, 20 20 20.2 (0.25)
- UGC 8573 (0.25)
- NGC 5044 (1.0)
- 299.60, 35.189 (0.1333)
- 149.69, 27.800 (0.54)

Positions may be entered in decimal (dd.f, sdd.f) or sexagesimal (hh mm ss.f, dd mm ss.ss.f) notation or as targets recognized by NED or SIMBAD.

The Size should be entered in decimal degrees.

Use the Skip cache flag to ensure that you get the latest results from all services.

The Refresh registry flag queries the VO registry to get the latest services. The registry is normally queried every hour.

By default the last few queries anyone has made are shown at the bottom of the page but there is a checkbox to keep your query from being recorded on this list.

NSF NASA IVOA

Developed with the support of the National Science Foundation under Cooperative Agreement AST0122449 with The Johns Hopkins University.

The NVO is a member of the International Virtual Observatory Alliance.

# VO Tools

The screenshot displays the AstroScope web interface. On the left, there is a search panel with the following fields and options:

- 1. Search**
- Position or Object Name: IRAS02229+6208
- Search Radius (degs/"): 0.100000
- Radio buttons:  Degrees,  Sexagesimal
- Checkboxes:  Images,  Spectra,  Catalogues
- Buttons: Halt

**2. Navigate**

- Go To Top
- Clear selection

**3. Process**

- View spectr... (with eesa vo logo)
- Save

The main area shows a radial search results visualization. A central node labeled "Images" is connected to numerous astronomical data sources:

- Digitized Sky Survey 2 - Red
- Digitized Sky Survey 2
- Digitized Sky Survey 2 - Blue
- Digitized Sky Survey 1 - Blue
- Digitized Sky Survey 1 - Red
- Digitized Sky Survey 1 - Yellow
- Spectra
- Catalogues
- CADC/JCMT SIA service (CVO logo)
- CADC/HST SIA service (CVO logo)
- CADC/CFHT SIA service (CVO logo)
- XMM-Newton Archive
- INT WFS: whole-CCD images (with INT logo)
- Two Micron All Sky Survey
- 850 MHz Survey/CB6
- Hubble Space Telescope Scrapbook
- NVSS
- ROSAT All-Sky X-ray Survey
- ADIL: NCSA Astronomy Digital Image (with ADIL logo)
- The IRAS Galaxy Atlas
- Westerbourg Northern Sky
- SkyView Virtual Observatory
- The IRAS Sky Survey Atlas
- The Mid-Infrared Galaxy Atlas
- 2MASS Large Galaxy Atlas
- 2MASS All-Sky Quicklook
- The Midcourse Space
- The NASA/IPAC Extragalactic
- The MAST Image Scrapbook

At the top of the main area, there are tabs for "Radial", "Hyperbolic", and "Services".

# VO Tools

The CADC Home Page  
<http://www1.cadc-ccda.hia-ihp.nrc-cnrc.gc.ca/cadc/>

**CADC/CCDA**

## Canadian Astronomy Data Centre

If you have used CADC facilities for your research, please include the following acknowledgment:

This research used the facilities of the Canadian Astronomy Data Centre operated by the National Research Council of Canada with the support of the Canadian Space Agency.

HST Archive   Gemini Archive   JCMT Archive   CFHT Archive

CGPS Archive   FUSE Archive   WFCPC Associations   **CVO** Canadian Virtual Observatory

Canadian Virtual Observatory  
<http://www1.cadc-ccda.hia-ihp.nrc-cnrc.gc.ca/cvo/>

**CVO** Canadian Virtual Observatory

CVO | Community | Reports | Links

If you have used CADC facilities for your research, please include the following acknowledgment:

This research used the facilities of the Canadian Astronomy Data Centre operated by the National Research Council of Canada with the support of the Canadian Space Agency.

### Observation Catalog Exploration Tools (Octet)

[Launch Octet](#)  
[details](#)

With Octet, CVO has developed advanced observation query capabilities to help users fully exploit the broad wavelength coverage of our collections. We have also included data from select external collections to increase wavelength coverage from radio (FIRST) to X-ray (RASS).

#### System Requirements

Java Runtime Environment (JRE) version 1.4 or later  
Java Webstart

NOTE: You will be prompted to accept certificates from both CADC and CDS (Aladin is bundled). You must accept these certificates for the application to work properly.

<http://www.cadc.hia.nrc.gc.ca>

<http://www.cadc.hia.nrc.gc.ca/cvo/>

**Octet**





Octet

File Library Help



Queries

	query	count
<input checked="" type="checkbox"/>	radio	29155
<input checked="" type="checkbox"/>	millimeter	5551
<input checked="" type="checkbox"/>	infrared	16620
<input checked="" type="checkbox"/>	optical	58358
<input checked="" type="checkbox"/>	uv	19751
<input checked="" type="checkbox"/>	xray	15039



Query Editor

	condition	count	cumulative
<input checked="" type="checkbox"/>	energy		



Condition Editor

Energy

from  GHz

to  GHz

inters...



View shapes View images Retrieve  Enable cutouts  Show grid

More detail Detach

	collection	collectionID	RA	DEC	area (sq.deg)	pixel size (arcsec)	filter name	wavelength (m)	date (MJD)	e
association 41			09:51:25.2	+26:34:58.1	1.736E-3					
association 72			08:48:38.1	+44:53:04.8	2.34E-3					
association 73			09:21:08.0	+45:39:21.8	3.438E-3					
association 75			01:09:58.1	-02:26:29.6	4.377E-3					
association 84			10:46:44.3	+11:49:59.1	5.186E-3					
association 85			10:43:54.7	+11:41:53.3	2.159E-3					
association 108			09:17:19.3	+42:00:11.7	1.925E-3					
association 126			15:44:51.6	+59:02:00.0	7.153E-3					
association 128			15:16:46.3	+56:16:31.7	2.691E-3					
association 132			15:35:17.1	+57:51:46.7	2.921E-3					
association 141			11:49:07.7	+27:02:00.8	1.605E-3					
association 156			10:05:31.4	+00:04:22.0	3.094E-3					
association 157			10:15:36.7	+00:24:38.3	1.428E-3					
association 160			10:00:57.9	+55:04:50.8	7.123E-3					
association 162			09:33:57.5	+55:14:31.1	7.405E-3					
association 164			10:22:48.1	+57:16:53.4	1.609E0					
association 166			09:42:37.7	+58:51:38.0	3.14E-3					
association 171			10:33:36.6	+54:30:05.9	5.933E-3					
association 172			10:32:51.9	+54:19:36.9	2.443E-3					
association 191			11:10:45.9	+28:43:56.1	3.942E-3					
association 197			10:32:40.4	+55:24:05.1	8.041E-1					
association 262			16:43:26.7	+17:17:16.6	2.175E-3					
association 278			09:51:58.5	-00:01:57.6	1.903E-3					
association 279			09:55:00.1	-01:30:04.4	2.593E-3					
association 333			10:49:43.6	+33:04:03.3	2.171E-3					

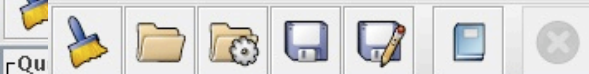
Octet

Octet

File



File Library Help



Queries

	query	count
<input checked="" type="checkbox"/>	radio	29155
<input checked="" type="checkbox"/>	millimeter	5551
<input checked="" type="checkbox"/>	infrared	16620
<input checked="" type="checkbox"/>	optical	58358
<input checked="" type="checkbox"/>	uv	19751
<input checked="" type="checkbox"/>	xray	15039



Query Editor

	condition	count	cumulative
<input checked="" type="checkbox"/>	energy		



Condition Editor

**Energy**

from

to

inters...



View shapes View images Retrieve  Enable cutouts  Show grid

More detail Detach

	collection	collectionID	RA	DEC	area (sq.deg)	pixel size (arcsec)	filter name	wavelength (m)	date (MJD)	e)
association 41			09:51:25.2	+26:34:58.1	1.736E-3					
infrared			10:00:49.7	+29:42:18.9	1.77E2					
50974	IRIS	I318B1H0.fits	10:00:49.7	+29:42:18.9	1.77E2	90	IRAS_12mic	1.2E-5		
50975	IRIS	I318B2H0.fits	10:00:49.7	+29:42:18.9	1.77E2	90	IRAS_25mic	2.5E-5		
50976	IRIS	I318B3H0.fits	10:00:49.7	+29:42:18.9	1.77E2	90	IRAS_60mic	6E-5		
50977	IRIS	I318B4H0.fits	10:00:49.7	+29:42:18.9	1.77E2	90	IRAS_100...	1E-4		
millimeter			10:00:49.7	+29:42:18.9	1.77E2					
50977	IRIS	I318B4H0.fits	10:00:49.7	+29:42:18.9	1.77E2	90	IRAS_100...	1E-4		
optical			09:51:25.2	+26:34:58.1	1.736E-3					
1750	HST	J8NW02050	09:51:22.6	+26:35:14.1	7.174E-5	0.025	F555W	5.346E-7	52918.99	
1751	HST	J8NW02060	09:51:22.6	+26:35:14.1	7.174E-5	0.025	F625W	6.318E-7	52918.99	
1752	HST	J8NW02070	09:51:22.6	+26:35:14.1	7.174E-5	0.025	F814W	8.333E-7	52918.99	
6892	HST	J8NW02040	09:51:22.6	+26:35:14.1	7.174E-5	0.025	F435W	4.297E-7	52918.99	
7142	HST	J8NW02010	09:51:22.6	+26:35:14.1	7.174E-5	0.025	F220W	2.29E-7	52918.98	
7143	HST	J8NW02030	09:51:22.6	+26:35:14.1	7.174E-5	0.025	F330W	3.354E-7	52918.98	
7235	HST	J8NW02020	09:51:22.6	+26:35:14.1	7.174E-5	0.025	F250W	2.696E-7	52918.98	
35935	HST	U46R4001B	09:51:25.1	+26:34:55.5	1.599E-3	0.0995	F555W	5.202E-7	51460.01	
40374	HST	USEU0701B	09:51:25.3	+26:35:00.7	1.601E-3	0.0995	F814W	8.203E-7	51493.14	
radio			09:50:59.9	+26:32:42.6	5.017E-1					
59060	FIRST	09510+26326E	09:50:59.9	+26:32:42.6	5.017E-1	1.8	1.4Ghz ba...	2.14E-1		
uv			09:52:39.2	+25:54:05.5	2.844E0					
7142	HST	J8NW02010	09:51:22.6	+26:35:14.1	7.174E-5	0.025	F220W	2.29E-7	52918.98	
7235	HST	J8NW02020	09:51:22.6	+26:35:14.1	7.174E-5	0.025	F250W	2.696E-7	52918.98	
94917	GALEX	AISCHV4_213_11...	09:52:39.2	+25:54:05.5	2.844E0	1.5	FUV	1.516E-7	53798.91	
94918	GALEX	AISCHV4_213_11...	09:52:39.2	+25:54:05.5	2.844E0	1.5	NUV	2.267E-7	53798.91	

Octet

Aladin v3.0 multiview

File Load... Save... Tools... Print... Help... Quit

Position J2000 Pixel 8 bits 35/255

ALADIN

Condition Editor

Energy

from 300 nm to 1000 nm

inters...

More detail Detach

name	wavelength (m)	date (MJD)	e)
12mic	1.2E-5		
25mic	2.5E-5		
60mic	6E-5		
100...	1E-4		
100...	1E-4		
W	5.346E-7	52918.99	
W	6.318E-7	52918.99	
W	8.333E-7	52918.99	
W	4.297E-7	52918.99	
W	2.29E-7	52918.98	
W	3.354E-7	52918.98	
W	2.696E-7	52918.98	
W	5.202E-7	51460.01	
W	8.203E-7	51493.14	
W	2.29E-7	52918.98	
W	2.696E-7	52918.98	
	1.516E-7	53798.91	
	2.267E-7	53798.91	

Multimission Archive at STScI (MAST)

Zoom 1/8x

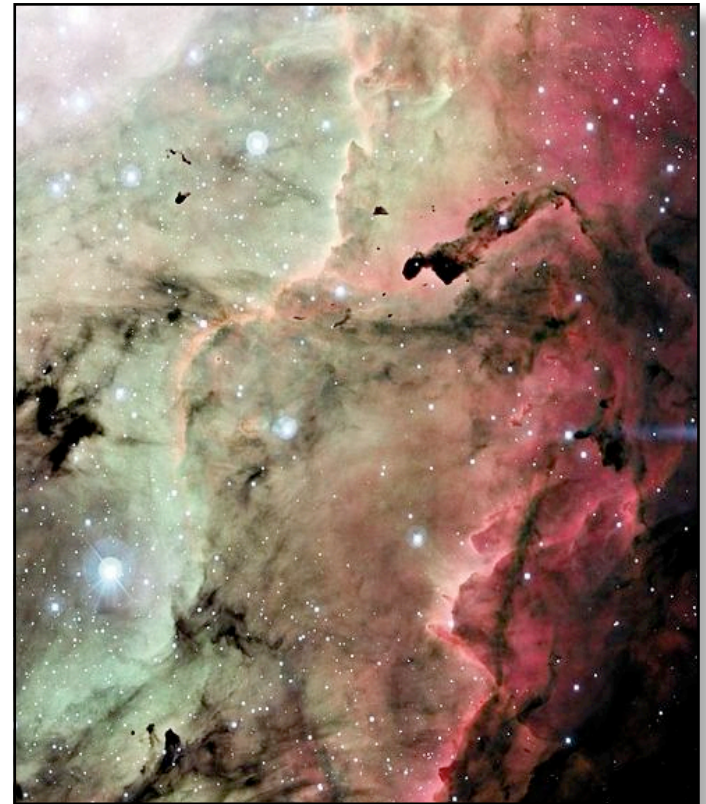
31.425" x 29.075"

(c)1999-2005 ULP/CNRS - Centre de Données astronomiques de Strasbourg

12 planes, 12 views, 30M

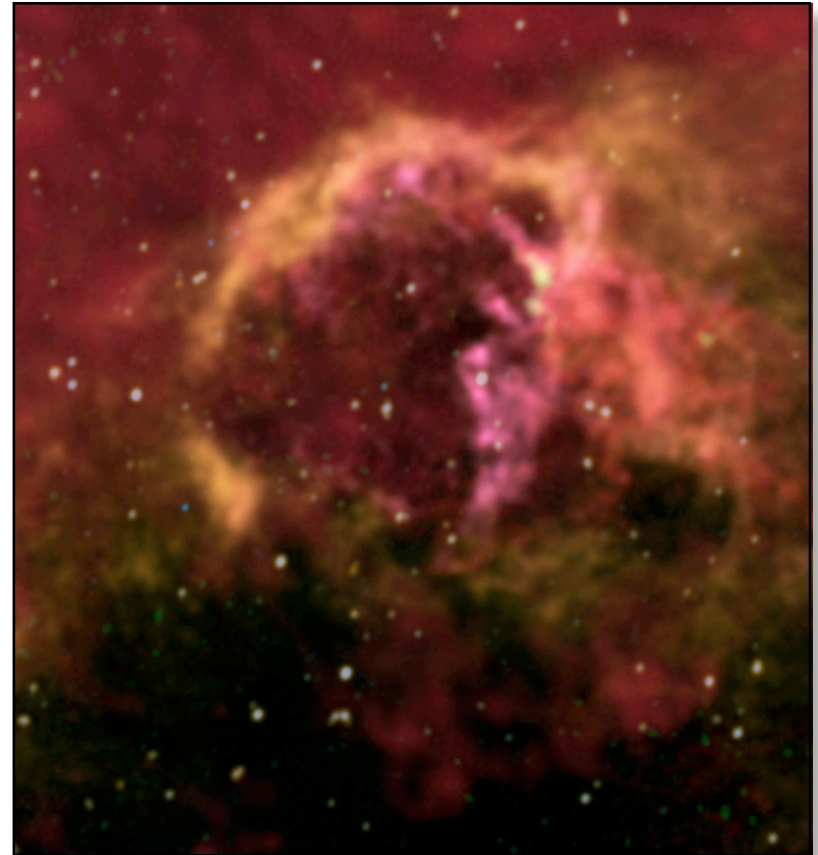
# Lessons Learned

- Archives are not just a technological exercise:
  - they are science projects!
- Multidisciplinary team necessary
- Enable the user to find relevant data
- Well described reliable data
- Good interfaces with data providers
- Good interfaces with user communities
- End-to-end data management is part of the whole mission design
  - retro-fitting is not fun!



# Managing Change

- Change is driven by ...
  - Data providers (telescopes)
  - User community
  - Funding agencies
- and by ...
  - Enabling technologies
  - Virtual Observatory



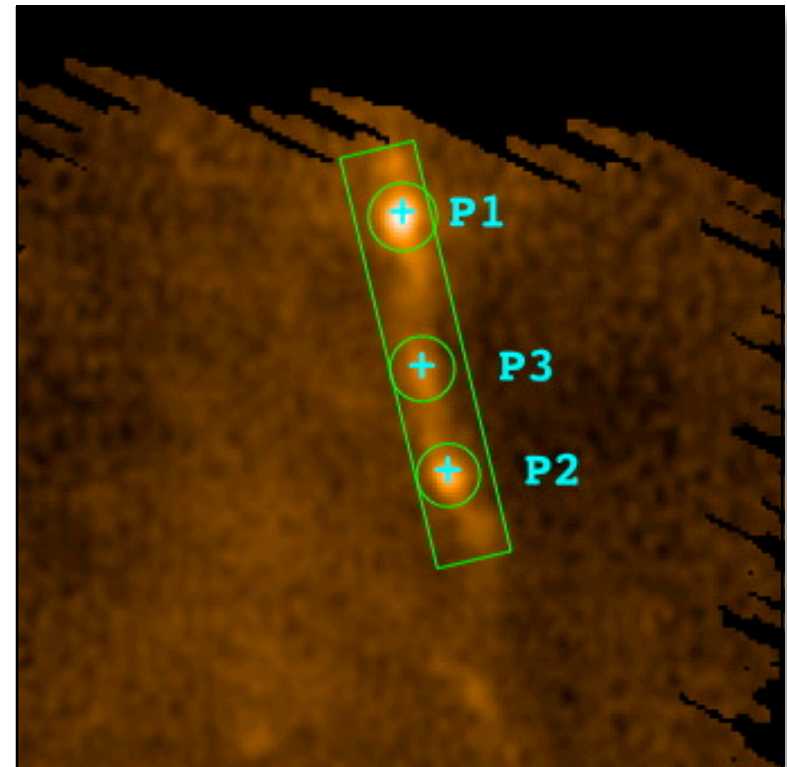
# The Changing Role... Data Providers

- More services
  - Data distribution
  - Processing
  - Data management
- Quality of service
  - 24x7 availability
  - Robust infrastructure
  - Fail-over systems



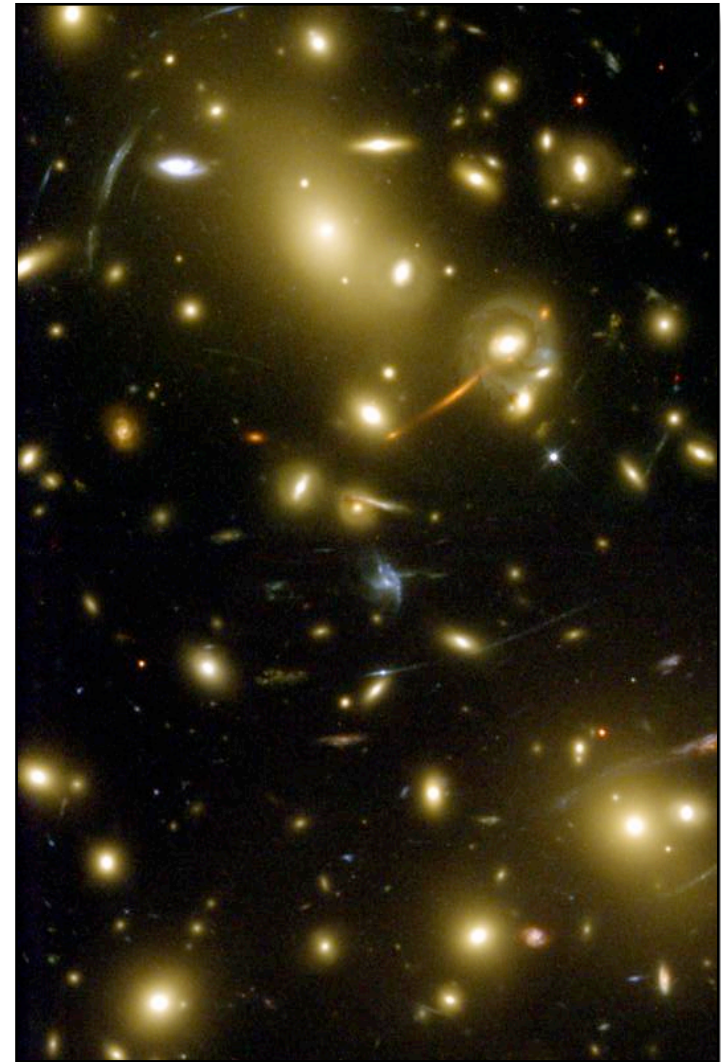
# The Changing Role... User Community

- Improved access
  - Anonymous access to public data
  - Authenticated access to proprietary data
  - Direct programmatic access
  - An extension of the user's storage
  - User defined processing
- Quality of service
  - 24x7 availability
  - Robust infrastructure
  - Fail-over systems
- Community projects

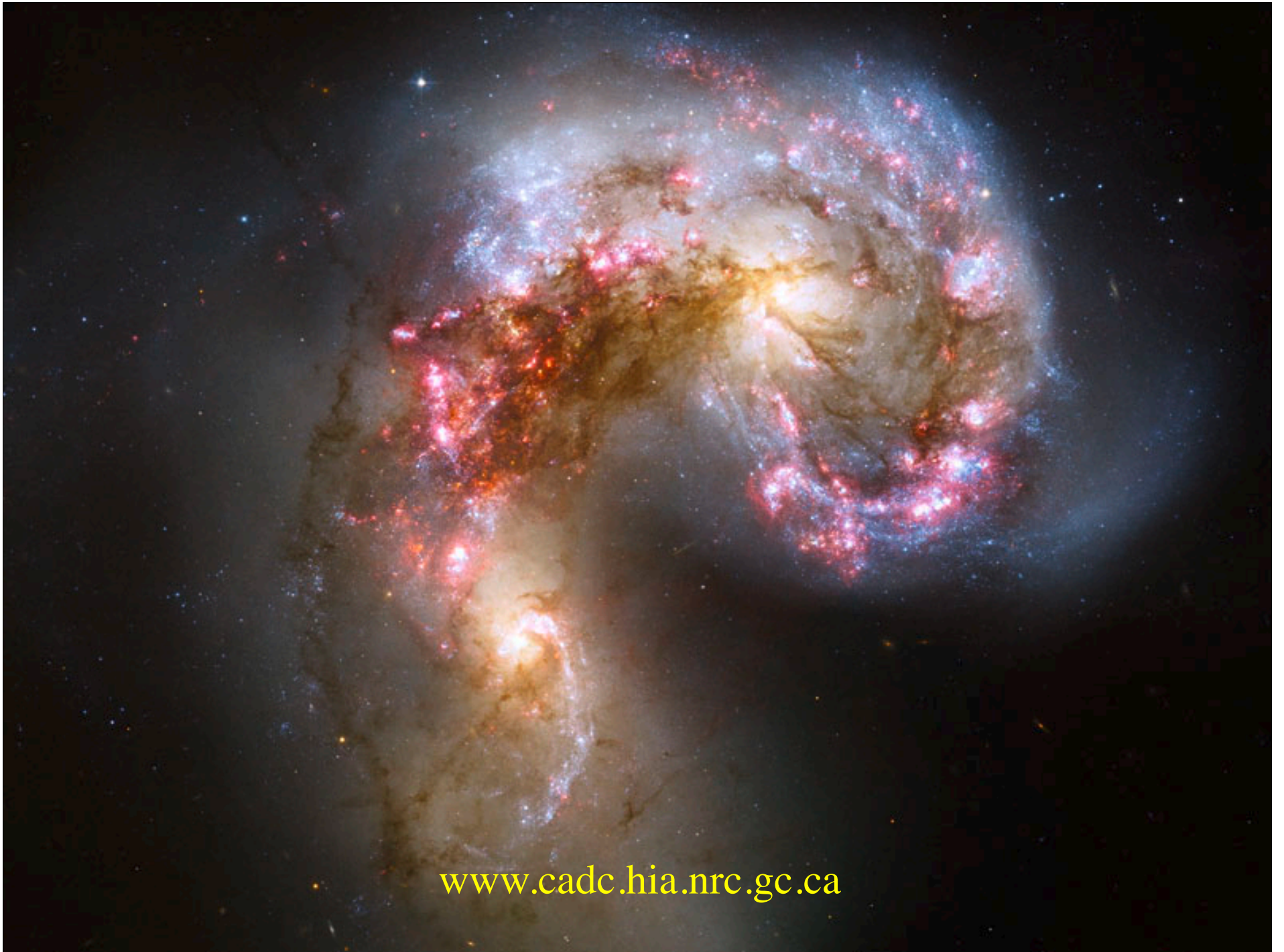


# Challenges

- The evolving data centre role
- The Virtual Observatory
- Continuous improvement of services to the user community
- Promotion and training
- Maintaining and fostering international collaborations
- Technology
- New missions (e.g. JWST, UVIT, ...)
- Knowledge retention
- The “last network mile”
- Funding agencies







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