

Optical / Infrared Databases and Catalogs

ASTR 288C: Lecture 2

Astronomical Databases

Database is a collection of structured data stored electronically, with an interface enabling the data to be searched.

Most public astronomical data available on the Web



Astronomical Databases

Some popular optical and infrared databases/interfaces:

SIMBAD

NED (deferred to Lecture 3)

STScI DSS (optical)

POSS1 "B", "R"

POSS2 / UKSTU "B", "R", "I"

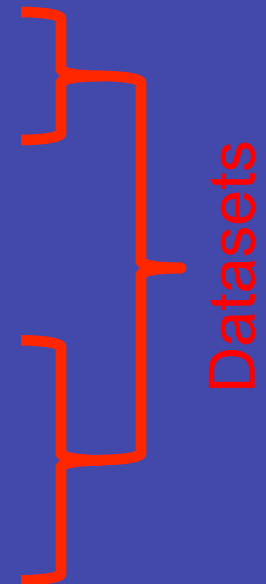
Gator (infrared)

2MASS 1.2 – 2.2 μm (J,H,K)

Spitzer 3.6 – 160 μm

IRAS 12 – 100 μm

ADS (deferred to Lecture 7)



SIMBAD

<http://simbad.u-strasbg.fr/simbad/>

The screenshot shows the SIMBAD Astronomical Database website. At the top, there is a navigation bar with logos for CDS, SIMBAD, Vizier, Aladin, Catalogs, Dictionary, Biblio, Tutorials, and Developers. Below this is a main menu with three columns: Queries, Documentation, and Information. The Queries column includes links for basic search, by identifier, by coordinates, by criteria, reference query, scripts, and options. The Documentation column includes links for User's guide, Query by urls, Nomenclature Dictionary, Object types, List of journals, Measurement description, and Spectral type coding. The Information column includes links for Presentation and Acknowledgment, and a Release section for SIMBAD4 1.161 - 07-Sep-2010. Below the main menu are four content boxes: Content, Statistics, Acknowledgment, and Basic search. The Content box describes the database's scope and query capabilities. The Statistics box shows the number of objects, identifiers, bibliographic references, and citations as of 2010.09.12. The Acknowledgment box provides a template for thanking the database. The Basic search box contains a search input field and buttons for SIMBAD search, clear, and help, along with a link to install the search tool bar.

Queries	Documentation	Information
basic search	User's guide	Presentation
by identifier	Query by urls	Acknowledgment
by coordinates	Nomenclature Dictionary	
by criteria	Object types	
reference query	List of journals	
scripts	Measurement description	
options	Spectral type coding	
		Release: SIMBAD4 1.161 - 07-Sep-2010

Content	Statistics
The SIMBAD astronomical database provides basic data, cross-identifications, bibliography and measurements for astronomical objects outside the solar system.	Simbad contains on 2010.09.12
SIMBAD can be queried by object name, coordinates and various criteria. Lists of objects and scripts can be submitted.	4,872,459 objects
Links to some other on-line services are also provided.	14,012,940 identifiers
	245,234 bibliographic references
	7,313,260 citations of objects in papers

Acknowledgment	Basic search
If the Simbad database was helpful for your research work, the following acknowledgment would be appreciated: <i>This research has made use of the SIMBAD database, operated at CDS, Strasbourg, France</i>	<input type="text"/> identifier, coordinates (radius=10 arcmin), or bibcode <input type="button" value="SIMBAD search"/> <input type="button" value="clear"/> help Install the Simbad basic search in your tool bar

SIMBAD

<http://simbad.u-strasbg.fr/simbad/>

Queries

- [basic search](#)
- [by identifier](#)
- [by coordinates](#)
- [by criteria](#)
- [reference query](#)
- [scripts](#)
- [options](#)

Documentation

- [User's guide](#)
- [Nomenclature Dictionary](#)
- [Object types](#)
- [List of journals](#)
- [Measurement description](#)
- [Spectral type coding](#)

Information

- [Presentation](#)
- [Acknowledgment](#)

Release:
SIMBAD4 1.161 - 07-Sep-2010

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Basic search

identifier, coordinates (radius=10 arcmin), or bibcode

[help](#)

[Install the Simbad basic search in your tool bar](#)

Search by:

- Identifier
- Coordinates
- Criteria

SIMBAD

<http://simbad.u-strasbg.fr/simbad/>

Queries

- [basic search](#)
- [by identifier](#)
- [by coordinates](#)
- [by criteria](#)
- [reference query](#)
- [scripts](#)
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Documentation

- [User's guide](#)
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Basic search

identifier, coordinates (radius=10 arcmin), or bibcode

[help](#)

[Install the Simbad basic search in your tool bar](#)

Search by:
Identifier

SIMBAD

The screenshot shows the SIMBAD website interface. On the left, a sidebar menu titled "Queries" lists search methods: basic search, by identifier (highlighted with a red arrow), by coordinates, by criteria, reference query, scripts, and options. The main content area is titled "SIMBAD: Query by identifiers" and includes navigation links for other query modes: Identifier query, Coordinate query, Criteria query, Reference query, Basic query, Script submission, Output options, and Help. A section titled "Query an identifier" contains an input field for "Identifier:" with "IC 5146" entered, a dropdown menu set to "only this object", and a radius field set to "2 arc min". Below this is a table with search statistics:

4,872,459	objects
14,012,940	identifiers
245,234	bibliographic references
7,313,260	citations of objects in papers

At the bottom, there is an "Acknowledgment" section and a "Basic search" section with a search input field and buttons for "SIMBAD search", "clear", and "help".

Search by:
Identifier

IC 5146

SIMBAD

The image shows a screenshot of the SIMBAD website interface. The main page is titled "SIMBAD: Query by identifiers" and features a search bar with the URL "http://simbad.u-strasbg.fr/simbad/sim-fid". A red arrow points to the "by identifier" option in the "Queries" sidebar. The "Identifier" input field is circled in red and contains the text "IC 5146". Below the search bar, there are options to "submit id" and "clear".

The "Acknowledgment" section states: "If the Simbad database was helpful for your research work, the following acknowledgment would be appreciated: This research has made use of the SIMBAD database, operated at CDS, Strasbourg, France".

The "Basic search" section includes a table with the following data:

4,872,459	objects
14,012,940	identifiers
245,234	bibliographic
7,313,260	citations of ob

The "SIMBAD query result" window shows the following information for IC 5146:

Object query : IC 5146
 Available data : Basic data Identifiers Plot & images Bibliography Measurements External archives Notes

Basic data :
IC 5146 -- Open (galactic) Cluster (query around) with radius 2 arcmin

Other object types: C1* (C,C1) , OpC (OCISM) , HII (LBH) , ISM (Min)
 ICRS coord. (ep=2000) : 21 53 32 +47 16.1 (~) [18000 18000 178] E ~
 FK5 coord. (cp=2000 cq=2000) : 21 53 32 +47 16.1 (~) [18000 18000 0] E ~
 FK4 coord. (cp=1950 cq=1950) : 21 51 36 +47 01.9 (~) [18000 18000 90] E ~
 Gal coord. (cp=2000) : 094.402 -05.508 (~) [18000 18000 98] E ~
 Proper motions *mas/yr* [error ellipse]: 2.31 -0.93 [0.13 0.12 90] C 2003ARep...47...61
 Fluxes (2) : B 7.82 [~] E ~
 V 7.2 [~] D ~

essential notes: • cluster embedded in nebula

Identifiers (10):
 IC 5146 LBH 424 NAME COCOON NEBULA OC1 213.0
 C 2151+470 LBH 094.43-05.58 OCISM 43
 C1 Collinder 470 HII 2-70 OC1 213

Plots and Images: radius 10 arcmin

References (183 between 1850 and 2010)
 Simbad bibliographic survey began in 1950 for stars (at least bright stars) and in 1983 for all other objects (outside the solar system).

SIMBAD

<http://simbad.u-strasbg.fr/simbad/>

Queries

- [basic search](#)
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- [Presentation](#)
- [Acknowledgment](#)

Release:
SIMBAD4 1.161 - 07-Sep-2010

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Basic search

identifier, coordinates (radius=10 arcmin), or bibcode

[help](#)

[Install the Simbad basic search in your tool bar](#)

Search by:
Coordinates

SIMBAD

The screenshot displays the SIMBAD website interface. At the top, there is a navigation bar with logos for CDS, SIMBAD, Vizier, Aladin, Catalogs, Dictionary, Biblio, Tutorials, and Developers. Below this is a header section titled "SIMBAD: Query by coordinates" with a menu of options: "other query modes", "Identifier query", "Coordinate query", "Criteria query", "Reference query", "Basic query", "Script submission", "Output options", and "Help".

The main content area is divided into two columns. The left column, titled "Queries", contains a list of search methods: "basic search", "by identifier", "by coordinates" (highlighted with a red arrow), "by criteria", "reference query", "scripts", and "options". The right column, titled "Enter coordinates:", contains a form for inputting coordinates. It includes a text input field, a list of allowed coordinate formats (e.g., "20 54 05.689 +37 01 17.38", "10:12:45.3-45:17:50", "15h17m-11d10m", "15h17+89d15", "275d11m15.6954s+17d59m59.876s", "12.34567h-17.87654d", "350.123456d-17.33333d <=> 350.123456 -17.33333"), and fields for "define the input" (system: FK5, epoch: 2000, equinox: 2000), "or choose" (a predefined frame), and "define a radius" (2 arc min). There are "submit query" and "clear" buttons.

Below the coordinate input section is a section titled "Query a list of coordinates" with a text input field and a "Choose File" button. Below that is a section titled "Content" with text describing the SIMBAD database and its capabilities. At the bottom, there are sections for "Acknowledgment" (with a sample acknowledgment text) and "Basic search" (with a search input field and "SIMBAD search", "clear", and "help" buttons).

Search by:
Coordinates

SIMBAD

<http://simbad.u-strasbg.fr/simbad/>

Queries

- [basic search](#)
- [by identifier](#)
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Basic search

identifier, coordinates (radius=10 arcmin), or bibcode

[help](#)

[Install the Simbad basic search in your tool bar](#)

Search by:
Criteria

SIMBAD

SIMBAD: Query by criteria

other query Identifier Coordinate Criteria Reference Basic Script Output Help
modes : query query query query query submission options

Enter a search expression:

$ra > 328.0193 \ \& \ ra < 328.7191 \ \& \ dec > 47.0194 \ \& \ dec < 47.4940$

Criteria queries may require some time, especially if they are complex or involve a large number of objects. Please, wait for their completion if it is the case.

Example:
 $ra > 15 \ \& \ ra < 30 \ \& \ dec > 70 \ \& \ (cat = 'PPM' \ | \ cat = 'HIP') \ \& \ mes = 'ROT' \ \& \ ubv.v \leq 10.0$

Return :
 object count
 display objects
 get references from the selected objects

Enter the name of an ASCII file containing a search expression:
Choose File no file selected
submit file clear

Search by:
Criteria

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identifier, coordinat

SIMBAD

[Install the Simbad basic search in your tool bar](#)

SIMBAD

The image displays the SIMBAD website interface. On the left, a sidebar contains navigation links: **Queries** (basic search, by identifier, by coordinates, **by criteria**, reference query), **scripts**, and **options**. A red arrow points to the 'by criteria' link. The main content area features a search form with the text 'Enter a search expression' and a red oval around the input field. Below the search form are buttons for 'submit query', 'clear', 'Choose File', and 'submit file'. The right side of the image shows a 'SIMBAD query result' page for the query: `ra > 328.0193 & ra < 328.7191 & dec > 47.0194 & dec < 47.4940`. The page indicates 785 objects were found and displays a table of results.

N	Identifier	Otype	ICRS (2000) RA	ICRS (2000) DEC	Sp type	#ref 1850 - 2010	#notes
1	BD+46 3474	*iC	21 53 28.845	+47 15 59.90	B1V	39	0
2	HD 208362	*	21 54 36.7179	+47 09 19.132	F0	11	0
3	V* V1577 Cyg	Or*	21 52 30.76	+47 14 06.4	K1	7	0
4	EM* LkHA 236	Em*	21 52 31.67	+47 13 45.2	G	5	0
5	EM* LkHA 237	Em*	21 52 32.78	+47 14 09.7	~	5	0
6	EM* LkHA 238	Em*	21 52 34.57	+47 14 40.7	~	4	0
7	EM* LkHA 239	Em*	21 52 36.59	+47 14 36.8	K7	5	0
8	EM* LkHA 240	Em*	21 52 42.73	+47 12 09.1	K7	4	0
9	EM* LkHA 241	Em*	21 53 07.56	+47 24 44.2	~	3	0
10	EM* LkHA 242	Em*	21 53 20.36	+47 12 58.0	K7	5	0
11	EM* LkHA 243	Em*	21 53 23.06	+47 14 08.7	K7	5	0
12	EM* LkHA 244	Em*	21 53 27.33	+47 14 50.5	~	4	0
13	EM* LkHA 245	Em*	21 53 30.31	+47 13 13.8	K0	13	0
14	EM* LkHA 246	Em*	21 53 31	+47 16.1	~	3	0
15	EM* LkHA 247	Em*	21 53 36.15	+47 18 36.1	K6	5	0
16	EM* LkHA 248	Em*	21 53 38.21	+47 14 59.0	K5	5	0
17	EM* LkHA 249	Em*	21 53 39.49	+47 16 41.5	~	4	0
18	EM* LkHA 250	Em*	21 53 40.05	+47 15 26.1	~	5	0
19	EM* LkHA 251	Em*	21 53 41.87	+47 17 50.3	~	4	0
20	EM* LkHA 252	Em*	21 53 42.06	+47 15 53.3	K6	5	0
21	EM* LkHA 253	Em*	21 53 42.52	+47 18 24.9	~	4	0
22	EM* LkHA 254	Em*	21 53 46.52	+47 14 35.7	K6	5	0
23	EM* LkHA 255	Em*	21 54 00.32	+47 25 22.1	~	3	0
24	EM* LkHA 257	Em*	21 54 18.77	+47 12 09.7	B5	36	0
25	IC 5146	OpC	21 53 32	+47 16.1	~	183	2
26	SH 2-125	HII	21 53 30	+47 21.2	~	32	1
27	2MASS J21532585+4716248	*	21 53 25.85	+47 16 24.9	~	2	0
28	IRAS 21512+4701	IR	21 53 13.4	+47 16 02	~	2	0
29	IRAS 21504+4652	IR	21 52 22.0	+47 06 15	~	0	0
30	IRAS 21511+4649	IR	21 53 02.1	+47 03 20	~	0	0

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STScI DSS

http://stdatu.stsci.edu/cgi-bin/dss_form

The STScI Digitized Sky Survey

NOTE: To obtain target coordinates for HST Phase 2 proposals, select the HST Phase 2 (GSC2) survey option.

[[New!](#) | [Help](#) | [FAQ](#) | [@](#) | [Acknowledging DSS](#) | [Other DSS Sites](#) | [CASG](#) | [Archive](#) | [STScI](#)]

Get an Object's Coordinates

Object name

Get coordinates from [SIMBAD](#) [NED](#)

Retrieve an Image

Retrieve from

- POSS2/UKSTU Red
- POSS2/UKSTU Blue
- POSS2/UKSTU IR
- POSS1 Red
- POSS1 Blue
- Quick-V
- HST Phase 2 (GSC2)

[\(detailed information about the Surveys\)](#)

RA **Dec**

Height (max: 60.0) **Width** (max: 60.0) arcminutes

File format **Compression (FITS only)**

Save file to disk (instead of displaying)

HST Field of View Overlay (1st generation GIF only):

Roll angle (V3):

STScI DSS

http://stdatu.stsci.edu/cgi-bin/dss_form

IC 5146: POSS2 “Red”

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Get an Object's Coordinates

Object name GET COORDINATES Clear

Get coordinates from SIMBAD NED

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- HST Phase 2 (GSC2)

(detailed information about the Surveys)

RA Dec J2000

Height (max: 60.0) Width (max: 60.0) arcminutes

File format Compression (FITS only)

Save file to disk (instead of displaying)

HST Field of View Overlay (1st generation GIF only):

Roll angle (V3):

RETRIEVE IMAGE Reset values to defaults



Dec. ↑

← RA

28.5' x 28.5'
field centered on
21h 53m 28.4s +47° 15' 23" (J2000)

STScI DSS

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Get an Object's Coordinates

Object name GET COORDINATES Clear

Get coordinates from SIMBAD NED

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- POSS2/UKSTU Red
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(detailed information about the Surveys)

RA Dec J2000

Height (max: 60.0) Width (max: 60.0) arcminutes

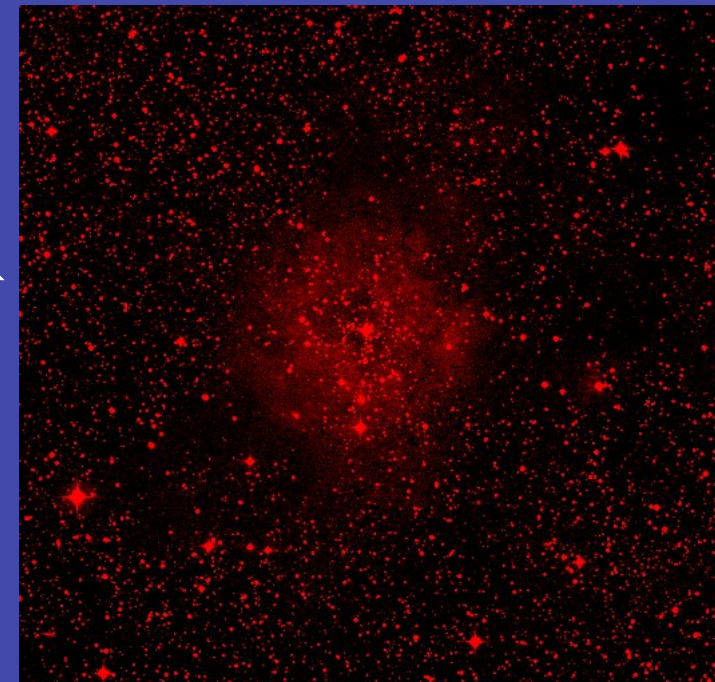
File format Compression (FITS only)

Save file to disk (instead of displaying)

HST Field of View Overlay (1st generation GIF only):

Roll angle (V3):

RETRIEVE IMAGE Reset values to defaults



Dec. ↑

← RA

28.5' x 28.5'
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IC 5146: POSS2 BRI

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Get an Object's Coordinates

Object name GET COORDINATES Clear

Get coordinates from SIMBAD NED

Retrieve an Image

Retrieve from

- POSS2/UKSTU Red
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(detailed information about the Surveys)

RA Dec J2000

Height (max: 60.0) Width (max: 60.0) arcminutes

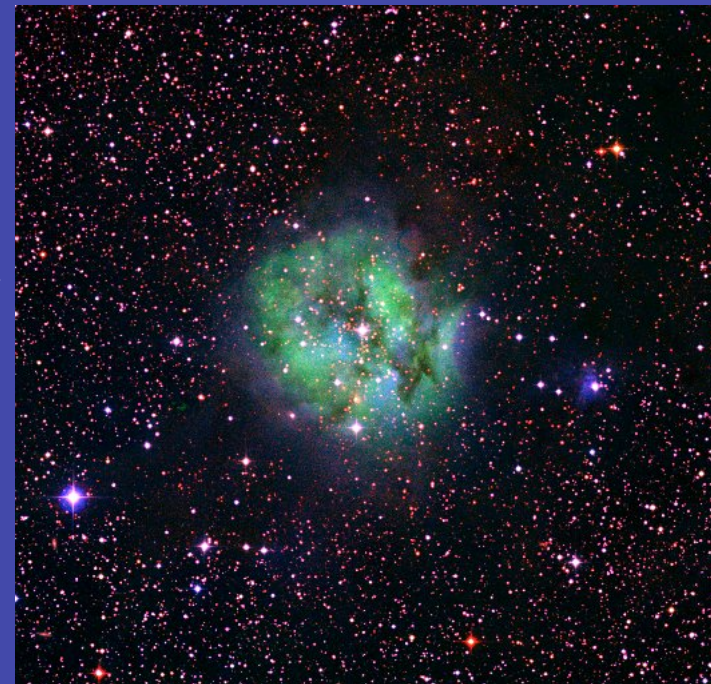
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Save file to disk (instead of displaying)

HST Field of View Overlay (1st generation GIF only):

Roll angle (V3):

RETRIEVE IMAGE Reset values to defaults



Dec. ↑

← RA

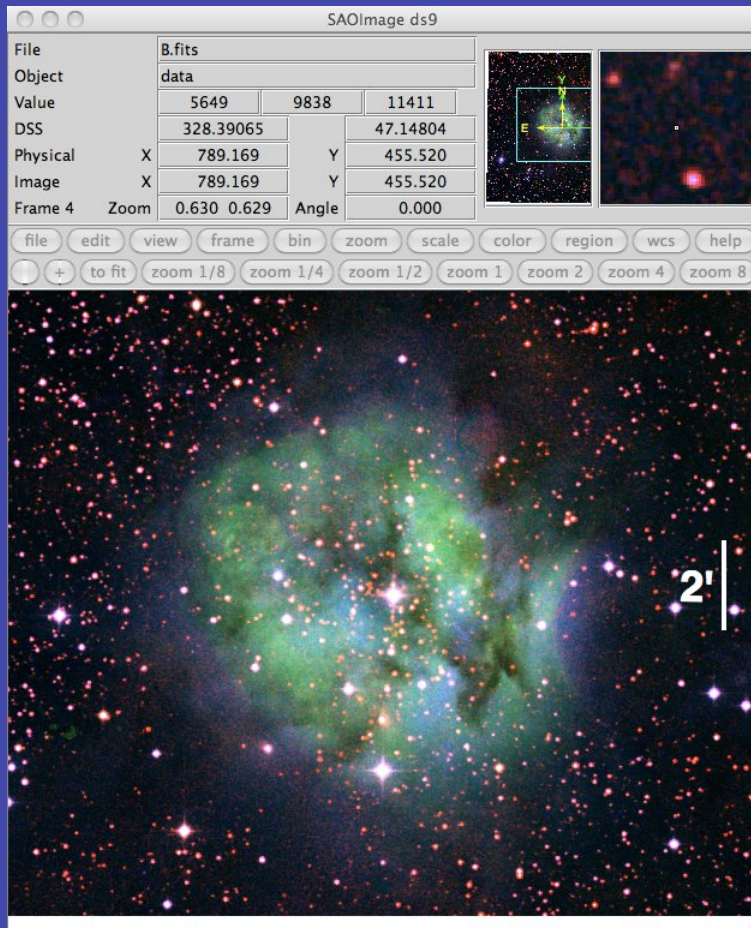
28.5' x 28.5'
field centered on
21h 53m 28.4s +47° 15' 23" (J2000)

Astronomical Image Format: FITS Files and ds9

<http://hea-www.harvard.edu/RD/ds9>

FITS = Flexible Image Transport System

SAOImage ds9 is a common viewer



```
B.fits
SIMPLE = T /FITS: Compliance
BITPIX = 16 /FITS: I*2 Data
NAXIS = 2 /FITS: 2-D Image Data
NAXIS1 = 1677 /FITS: X Dimension
NAXIS2 = 1677 /FITS: Y Dimension
EXTEND = T /FITS: File can contain extensions
DATE = '2010-09-13' /FITS: Creation Date
ORIGIN = 'STScI/MAST' /GSSS: STScI Digitized Sky Survey
SURVEY = 'POSSII-J' /GSSS: Sky Survey
REGION = 'XJ288' /GSSS: Region Name
PLATEID = 'A01M' /GSSS: Plate ID
SCANNUM = '01' /GSSS: Scan Number
DSCNDNUM = '00' /GSSS: Descendant Number
TELESCID = 3 /GSSS: Telescope ID
BANDPASS = 18 /GSSS: Bandpass Code
COPYRIGHT = 'Caltech/Palomar' /GSSS: Copyright Holder
SITELAT = 33.356 /Observatory: Latitude
SITELONG = 116.863 /Observatory: Longitude
TELESCOP = 'Oschin Schmidt - D' /Observatory: Telescope
INSTRUME = 'Photographic Plate' /Detector: Photographic Plate
EMULSION = 'IIIaJ' /Detector: Emulsion
FILTER = 'GG395' /Detector: Filter
PLTSCALE = 67.20 /Detector: Plate Scale arcsec per mm
PLTSIZEX = 355.000 /Detector: Plate X Dimension mm
PLTSIZEY = 355.000 /Detector: Plate Y Dimension mm
PLATERA = 329.536590000 /Observation: Field centre RA degrees
PLATEDEC = 45.2342220000 /Observation: Field centre Dec degrees
PLTLABEL = 'S302524' /Observation: Plate Label
DATE-OBS = '1989-07-10T09:42:00' /Observation: Date/Time
EXPOSURE = 40.0 /Observation: Exposure Minutes
PLTGRADE = 'A' /Observation: Plate Grade
OBSHA = 1.11667 /Observation: Hour Angle
OBSZD = 17.5194 /Observation: Zenith Distance
AIRMASS = 1.04853 /Observation: Airmass
REFBETA = 62.59357900000 /Observation: Refraction Coeff
REFBETAP = -0.0820000000000 /Observation: Refraction Coeff
REFK1 = -36302.1430000 /Observation: Refraction Coeff
REFK2 = -41113.4780000 /Observation: Refraction Coeff
CNPIX1 = 13510 /Scan: X Corner
CNPIX2 = 17831 /Scan: Y Corner
```

Header

Image

The Data!

Pixels

“Metadata”

Astrometry

Filter, etc.

Astronomical Image Format: FITS Files and ds9

Header

```
B.fits
SIMPLE = T /FITS: Compliance
BITPIX = 16 /FITS: I*2 Data
NAXIS = 2 /FITS: 2-D Image Data
NAXIS1 = 1677 /FITS: X Dimension
NAXIS2 = 1677 /FITS: Y Dimension
EXTEND = T /FITS: File can contain extensions
DATE = '2010-09-13' /FITS: Creation Date
ORIGIN = 'STSCI/MAST' /GSSS: STSci Digitized Sky Survey
SURVEY = 'POSSII-J' /GSSS: Sky Survey
REGION = 'XJ288' /GSSS: Region Name
PLATEID = 'A01M' /GSSS: Plate ID
SCANNUM = '01' /GSSS: Scan Number
DSCNDNUM = '00' /GSSS: Descendant Number
TELESCID = 3 /GSSS: Telescope ID
BANDPASS = 18 /GSSS: Bandpass Code
COPRGRH = 'Caltech/Palomar' /GSSS: Copyright Holder
SITELAT = 33.356 /Observatory: Latitude
SITELONG = 116.863 /Observatory: Longitude
TELESCOP = 'Oschin Schmidt - D' /Observatory: Telescope
INSTRUME = 'Photographic Plate' /Detector: Photographic Plate
EMULSION = 'IIIaJ' /Detector: Emulsion
FILTER = 'GG395' /Detector: Filter
PLTSCALE = 67.20 /Detector: Plate Scale arcsec per mm
PLTSIZEX = 355.000 /Detector: Plate X Dimension mm
PLTSIZEY = 355.000 /Detector: Plate Y Dimension mm
PLATE_RA = 329.536590000 /Observation: Field centre RA degrees
PLATE_DEC = 45.234222000 /Observation: Field centre Dec degrees
PLTLABEL = 'SJ02524' /Observation: Plate Label
DATE-OBS = '1989-07-10T09:42:00' /Observation: Date/Time
EXPOSURE = 40.0 /Observation: Exposure Minutes
PLTGRADE = 'A' /Observation: Plate Grade
OBSHA = 1.11667 /Observation: Hour Angle
OBSZD = 17.5194 /Observation: Zenith Distance
AIRMASS = 1.04853 /Observation: Airmass
REFBETA = 62.5935790000 /Observation: Refraction Coeff
REFBETAP = -0.0820000000000 /Observation: Refraction Coeff
REFK1 = -36302.1430000 /Observation: Refraction Coeff
REFK2 = -41113.4780000 /Observation: Refraction Coeff
CNPIX1 = 13510 /Scan: X Corner
CNPIX2 = 17831 /Scan: Y Corner
```

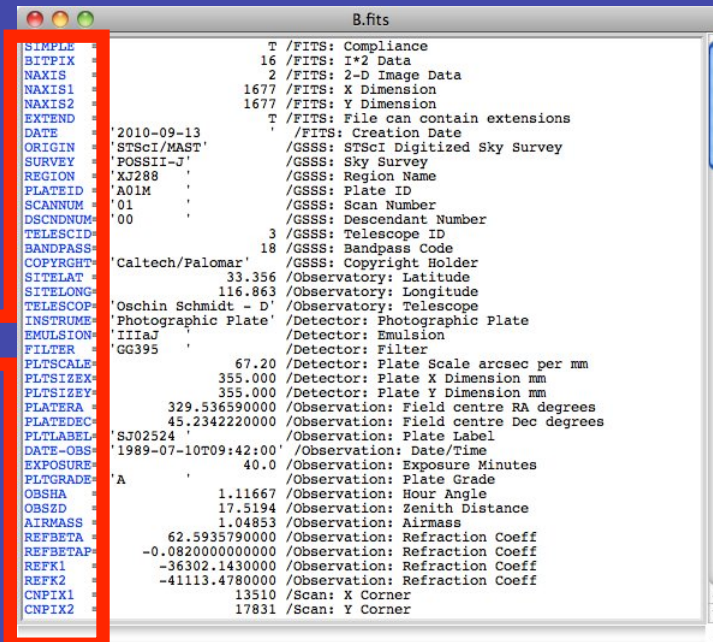
Astronomical Image Format: FITS Files and ds9

Header

FILTER

Keywords

Each limited to 8 characters



```
B.fits
SIMPLE          T /FITS: Compliance
BITPIX         16 /FITS: I*2 Data
NAXIS          2 /FITS: 2-D Image Data
NAXIS1         1677 /FITS: X Dimension
NAXIS2         1677 /FITS: Y Dimension
EXTEND         T /FITS: File can contain extensions
DATE           '2010-09-13' /FITS: Creation Date
ORIGIN         'STSCI/MAST' /GSSS: STSci Digitized Sky Survey
SURVEY         'POSSII-J' /GSSS: Sky Survey
REGION         'XJ288' /GSSS: Region Name
PLATEID        'A01M' /GSSS: Plate ID
SCANNUM        '01' /GSSS: Scan Number
DSCNDNUM       '00' /GSSS: Descendant Number
TELESCID       3 /GSSS: Telescope ID
BANDPASS       18 /GSSS: Bandpass Code
COPRGRHPT      'Caltech/Palomar' /GSSS: Copyright Holder
SITELAT        33.356 /Observatory: Latitude
SITELONG       116.863 /Observatory: Longitude
TELESCOP       'Oschin Schmidt - D' /Observatory: Telescope
INSTRUME       'Photographic Plate' /Detector: Photographic Plate
EMULSION       'IIIaJ' /Detector: Emulsion
FILTER         'GG395' /Detector: Filter
PLTSCALE       67.20 /Detector: Plate Scale arcsec per mm
PLTSIZEX       355.000 /Detector: Plate X Dimension mm
PLTSIZEY       355.000 /Detector: Plate Y Dimension mm
PLATE_RA       329.536590000 /Observation: Field centre RA degrees
PLATE_DEC       45.234222000 /Observation: Field centre Dec degrees
PLATELABEL     'SJ02524' /Observation: Plate Label
DATE-OBS       '1989-07-10T09:42:00' /Observation: Date/Time
EXPOSURE       40.0 /Observation: Exposure Minutes
PLTGRADE       'A' /Observation: Plate Grade
OBSHA          1.11667 /Observation: Hour Angle
OBSZD          17.5194 /Observation: Zenith Distance
AIRMASS        1.04853 /Observation: Airmass
REFBETA        62.5935790000 /Observation: Refraction Coeff
REFREFAP       -0.0820000000000 /Observation: Refraction Coeff
REFR1          -36302.1430000 /Observation: Refraction Coeff
REFR2          -41113.4780000 /Observation: Refraction Coeff
CNPIX1         13510 /Scan: X Corner
CNPIX2         17831 /Scan: Y Corner
```

Astronomical Image Format: FITS Files and ds9

Header

FILTER 'GG395'

Keywords

Each limited to 8 characters

```
B.fits
SIMPLE          T      ITS: Compliance
BITPIX          16     ITS: I*2 Data
NAXIS           2      ITS: 2-D Image Data
NAXIS1          1677   ITS: X Dimension
NAXIS2          1677   ITS: Y Dimension
EXTEND          T      ITS: File can contain extensions
DATE            '2010-09-13'  FITS: Creation Date
ORIGIN          'STSCI/MAST'  SSS: STSci Digitized Sky Survey
SURVEY          'POSSII-J'    SSS: Sky Survey
REGION          'XJ288'      SSS: Region Name
PLATEID         'A01M'       SSS: Plate ID
SCANNUM         '01'        SSS: Scan Number
DSCNDNUM        '00'        SSS: Descendant Number
TELESCID        3         SSS: Telescope ID
BANDPASS        18        SSS: Bandpass Code
COPRGRHPT      'Caltech/Palomar'  SSS: Copyright Holder
SITELAT         33.356    bservatory: Latitude
SITELONG        116.863   bservatory: Longitude
TELESCOP        'Oschin Schmidt - D'  bservatory: Telescope
INSTRUME        'Photographic Plate'  etector: Photographic Plate
EMULSION        'IIIAJ'    etector: Emulsion
FILTER          'GG395'    etector: Filter
PLTSCALE        67.20     etector: Plate Scale arcsec per mm
PLTSIZEX        355.000   etector: Plate X Dimension mm
PLTSIZEY        355.000   etector: Plate Y Dimension mm
PLATEPA        329.536590000  bservation: Field centre RA degrees
PLATEDEC        45.2342220000  bservation: Field centre Dec degrees
PLTLABEL        'SJ02524'  bservation: Plate Label
DATE-OBS        '1989-07-10T09:42:00'  bservation: Date/Time
EXPOSURE        40.0     bservation: Exposure Minutes
PLTGRADE        'A'      bservation: Plate Grade
OBSHA           1.11667   bservation: Hour Angle
OBSZD           17.5194   bservation: Zenith Distance
AIRMASS         1.04853   bservation: Airmass
REFBETA         62.5935790000  bservation: Refraction Coeff
REFBETAP        -0.0820000000000  bservation: Refraction Coeff
REFK1           -36302.1430000  bservation: Refraction Coeff
REFK2           -41113.4780000  bservation: Refraction Coeff
CNPIX1          13510    can: X Corner
CNPIX2          17831    can: Y Corner
```

Keyword Values

Unlimited number of characters

Astronomical Image Format: FITS Files and ds9

Header

FILTER 'GG395' **Detector: Filter**

Keywords

Each limited to 8 characters

```
B.fits
SIMPLE          T      FITS: Compliance
BITPIX         16      FITS: I*2 Data
NAXIS           2      FITS: 2-D Image Data
NAXIS1         1677    FITS: X Dimension
NAXIS2         1677    FITS: Y Dimension
EXTEND         T      FITS: File can contain extensions
DATE           '2010-09-13' FITS: Creation Date
ORIGIN         'STSCI/MAST' SSS: STSci Digitized Sky Survey
SURVEY         'POSSII-J'  SSS: Sky Survey
REGION        'XJ288'     SSS: Region Name
PLATEID        'A01M'     SSS: Plate ID
SCANNUM        '01'      SSS: Scan Number
DSCNDNUM       '00'      SSS: Descendant Number
TELESCID       '3'       SSS: Telescope ID
BANDPASS       '18'      SSS: Bandpass Code
COPRGRHPT      'Caltech/Palomar' SSS: Copyright Holder
SITELAT        33.356    bservatory: Latitude
SITELONG       116.863    bservatory: Longitude
TELESCOP       'Oschin Schmidt - D' bservatory: Telescope
INSTRUME       'Photographic Plate' etector: Photographic Plate
EMULSION       'IIIAJ'   etector: Emulsion
FILTER         'GG395'   etector: Filter
PLTSCALE       67.20     etector: Plate Scale arcsec per mm
PLTSIZEX       355.000   etector: Plate X Dimension mm
PLTSIZEY       355.000   etector: Plate Y Dimension mm
PLATEPA        329.536590000 bservation: Field centre RA degrees
PLATEDEC       45.2342220000 bservation: Field centre Dec degrees
PLTLABEL       'SJ02524' bservation: Plate Label
DATE-OBS       '1989-07-10T09:42:00' Observation: Date/Time
EXPOSURE       40.0     bservation: Exposure Minutes
PLTGRADE       'A'      bservation: Plate Grade
OBSHA         1.11667    bservation: Hour Angle
OBSZD         17.5194    bservation: Zenith Distance
AIRMASS        1.04853    bservation: Airmass
REFBETA        62.5935790000 bservation: Refraction Coeff
REFBETAP       -0.0820000000000 bservation: Refraction Coeff
REFK1          -36302.1430000 bservation: Refraction Coeff
REFK2          -41113.4780000 bservation: Refraction Coeff
CNPIX1         13510    can: X Corner
CNPIX2         17831    can: Y Corner
```

Keyword Comments

Unlimited number of characters

Keyword Values

Unlimited number of characters

Gator

<http://irsa.ipac.caltech.edu/applications/Gator>

NASA/IPAC's Catalog Search Engine for Infrared Data

The screenshot shows a web browser window titled "Gator Catalog List" with the URL <http://irsa.ipac.caltech.edu/applications/Gator/>. The page header features the NASA/IPAC Infrared Science Archive logo and the text "for NASA's Infrared and Submillimeter Data". A navigation menu includes links for Home, About, Holdings, Missions, Documentation, and Helpdesk. The main content area is titled "General Catalog Query Engine" and is powered by Gator. Below this, there are five buttons: Quick Guide, Tutorial, Catalog List, Process Monitor, and Program Interface. The "Catalog List" button is selected, displaying a table of IRSA catalogs. The table has a header "IRSA CATALOGS" with a "Select" button. The table lists the following catalogs:

IRSA CATALOGS	Select
<input checked="" type="radio"/> 2MASS (Two Micron All-Sky Survey)	
<input type="radio"/> IRAS (Infrared Astronomical Satellite)	
<input type="radio"/> Spitzer Space Telescope Legacy Science Programs	
<input type="radio"/> MSX (Midcourse Space Experiment)	
<input type="radio"/> COSMOS (Cosmic Evolution Survey)	
<input type="radio"/> DENIS (Deep Near Infrared Survey of the Southern Sky)	
<input type="radio"/> USNO (United States Naval Observatory)	
<input type="radio"/> BOLOCAM (Caltech Observational Cosmology Group GPS Catalog)	
<input type="radio"/> AKARI Infrared Astronomy Satellite	
<input type="radio"/> Project Internal (Password protected)	

A left sidebar contains a navigation menu with categories: Catalog Search (Basic, General), Image Services (Finder Charts, 2MASS Images, 2MASS Ext. Srcs., Mosaics, Cutouts), Inventories (Data Discovery, NVO Sky Coverage), and Tools (OASIS Visualizer, Montage, Image Validation, Object Lookup, QA Tools, Dust Extinction, Data Tags).

Gator

<http://irsa.ipac.caltech.edu/applications/Gator>

NASA/IPAC's Catalog Search Engine for Infrared Data

The screenshot shows the NASA/IPAC Infrared Science Archive website. The main heading is "NASA/IPAC Infrared Science Archive for NASA's Infrared and Submillimeter Data". Below this is a navigation menu with links for Home, About, Holdings, Missions, Documentation, and Helpdesk. The central section is titled "General Catalog Query Engine" and is powered by Gator. There are several buttons: Quick Guide, Tutorial, Catalog List, Process Monitor, and Program Interface. A list of survey options is displayed, with "2MASS (Two Micron All-Sky Survey)" selected and circled in red. Other options include IRAS, Spitzer, COSMOS, DENIS, USNO, BOLOCAM, AKARI, and Project Internal.

2MASS (1.2 – 2.2 μm)

Spitzer (3.6 – 160 μm)

IRAS (12 – 100 μm)

Gator

<http://irsa.ipac.caltech.edu/applications/Gator>

NASA/IPAC's Catalog Search Engine for Infrared Data

Gator Catalog List

<http://irsa.ipac.caltech.edu/applications/Gator/>

NASA/IPAC Infrared Science Archive
for NASA's Infrared and Submillimeter Data

Home About Holdings Missions Documentation Helpdesk

General Catalog Query Engine

powered by Gator

[Quick Guide](#) [Tutorial](#) [Catalog List](#) [Process Monitor](#) [Program Interface](#)

IRSA CATALOGS	Select
<input checked="" type="radio"/> 2MASS (Two Micron All-Sky Survey)	
<input type="radio"/> IRAS (Infrared Astronomical Satellite)	
<input type="radio"/> Spitzer Space Telescope Legacy Science Programs	
<input type="radio"/> MSX (Midcourse Space Experiment)	
<input type="radio"/> COSMOS (Cosmic Evolution Survey)	
<input type="radio"/> DENIS (Deep Near Infrared Survey of the Southern Sky)	
<input type="radio"/> USNO (United States Naval Observatory)	
<input type="radio"/> BOLOCAM (Caltech Observational Cosmology Group GPS Catalog)	
<input type="radio"/> AKARI Infrared Astronomy Satellite	
<input type="radio"/> Project Internal (Password protected)	

2MASS (1.2 – 2.2 μm)

Gator

NASA/IPAC Infrared Science Archive
for NASA's Infrared and Submillimeter Data

Home About Holdings Missions Documentation Helpdesk

General Catalog Query Engine

powered by Gator

[Quick Guide](#) [Tutorial](#) [Catalog List](#) [Process Monitor](#) [Program Interface](#)

CATALOG SELECTION: 2MASS

Selection	Descriptions	# Columns	# Rows	Information
<input checked="" type="radio"/>	2MASS All-Sky Point Source Catalog (PSC)	127	470992970	i
<input type="radio"/>	2MASS All-Sky Extended Source Catalog (XSC)	423	1647599	i
<input type="radio"/>	The 2MASS Large Galaxy Atlas	88	655	i
<input type="radio"/>	2MASS All-Sky Survey Scan Info Read Me!	68	59731	i
<input type="radio"/>	2MASS All-Sky Survey Atlas Image Info	134	1373813	i

IRSA CATALOGS [Select](#)

- 2MASS (Two Micron All-Sky Survey)
- IRAS (Infrared Astronomical Satellite)
- Spitzer Space Telescope Legacy Science Programs
- MSX (Midcourse Space Experiment)
- COSMOS (Cosmic Evolution Survey)
- DENIS (Deep Near Infrared Survey of the Southern Sky)
- USNO (United States Naval Observatory)
- BOLOCAM (Caltech Observational Cosmology Group GPS Catalog)
- AKARI Infrared Astronomy Satellite
- Project Internal (Password protected)

2MASS (1.2 – 2.2 μm)
Point Source Catalog (PSC)

Gator

GATOR CATALOG LIST PAGE
<http://irsa.ipac.caltech.edu/cgi-bin/Gator/nph-dd>

NASA/IPAC Infrared Science Archive
 for NASA's Infrared and Submillimeter Data

Home About Holdings Missions Documentation Helpdesk

2MASS All-Sky Point Source Catalog (PSC)

powered by Gator

[Quick Guide](#)
[Tutorial](#)
[Catalog List](#)
[Process Monitor](#)
[Program Interface](#)

[Run Query](#)
[Reset Fields](#)

[Single Object Search](#)
 [Multi-Object Search](#)
 [All Sky Search](#)

SPATIAL CONSTRAINTS

[Coordinate or Object Name:](#)

Examples:
[M31](#) | [2MASS J18365633+3847012](#) | [19h17m32.00s +11d58m02.0s](#) |
[46.5377 -0.2518 ga](#) | [293.02082 +33.87038 ecl](#)

Search Method (choose one):

Cone: Radius PA Axial Ratio
(0 < Radius ≤ 3600 arcsec)

Box: Size: arcsec
(0 < Size ≤ 7200)

Polygon: Vertices:

GATOR CATALOG LIST PAGE
<http://irsa.ipac.caltech.edu/cgi-bin/Gator/nph-dd>

Table Output
 Source Counts Only (all-sky search only)

E-mail Address (optional):

[Run Query](#)
[Reset](#)

COLUMN CONSTRAINTS/OUTPUT COLUMN SELECTION

[Select All Columns](#)
[Clear All Selections](#)
[Reset](#)

Table Selection	Standard	Long Form	Sexagesimal Output	Yes	Calculate Colors	Yes	
Name	Description	Sel	Low Limit (include >=)	Up Limit (include <=)	Units	Indx	DBType
ra	right ascension (J2000 decimal deg)	<input checked="" type="checkbox"/>			deg		decimal(9,6)
dec	declination (J2000 decimal deg)	<input checked="" type="checkbox"/>			deg	X	decimal(8,6)
err_maj	major axis of 1-sigma error ellipse	<input type="checkbox"/>			arcsec		decimal(3,2)
err_min	minor axis of 1-sigma error ellipse	<input type="checkbox"/>			arcsec		decimal(3,2)
err_ang	angle of error ellipse major axis (E of N)	<input type="checkbox"/>			deg		smallint
designation	source designation formed from sexagesimal coordinates	<input checked="" type="checkbox"/>					char(17)
j_m	J band selected "default" magnitude	<input checked="" type="checkbox"/>			mag		decimal(5,3)
j_cmsig	corrected J band photometric uncertainty	<input type="checkbox"/>			mag		decimal(4,3)
j_msigcom	combined (total) J band photometric uncertainty	<input type="checkbox"/>			mag		decimal(4,3)
j_snr	J band "scan" signal-to-noise ratio	<input type="checkbox"/>					decimal(9,1)
h_m	H band selected "default" magnitude	<input checked="" type="checkbox"/>			mag		decimal(5,3)
h_cmsig	corrected H band photometric uncertainty	<input type="checkbox"/>			mag		decimal(4,3)
h_msigcom	combined (total) H band photometric uncertainty	<input type="checkbox"/>			mag		decimal(4,3)
h_snr	H band "scan" signal-to-noise ratio	<input type="checkbox"/>					decimal(9,1)
k_m	K band selected "default" magnitude	<input checked="" type="checkbox"/>			mag		decimal(5,3)
k_cmsig	corrected K band photometric uncertainty	<input type="checkbox"/>			mag		decimal(4,3)
k_msigcom	combined (total) K band photometric uncertainty	<input type="checkbox"/>			mag		decimal(4,3)
k_snr	K band "scan" signal-to-noise ratio	<input type="checkbox"/>					decimal(9,1)
ph_qual	flag indicating photometric quality of source	<input checked="" type="checkbox"/>					char(3)
rd_flg	source of JHK "default" mags (AKA "read flag")	<input type="checkbox"/>					char(3)
bl_flg	indicates # JHK components fit simultaneously to source	<input type="checkbox"/>					char(3)
cc_flg	indicates JHK artifact contamination and/or confusion	<input type="checkbox"/>					char(3)
ndet	number of >3-sig. ap. mag measurements, # possible (ijhkk)	<input type="checkbox"/>					char(6)
prox	distance in arcsec to nearest catalog point source	<input type="checkbox"/>			arcsec		decimal(4,1)
pxpa	angle (deg E of N) to nearest catalog point source	<input type="checkbox"/>			deg		decimal(5,3)
pxcentr	cntr of nearest catalog point source	<input type="checkbox"/>					integer
gal_contam	flag indicating if src is contaminated by extended source	<input type="checkbox"/>					smallint
mp_flg	src is positionally associated with an asteroid, comet, etc	<input type="checkbox"/>					smallint
jdate	julian date of source measurement to +/- 30 sec	<input type="checkbox"/>				jdate	decimal(11,4)

[ADDITIONAL CONSTRAINTS \(SQL\)](#)

2MASS (1.2 – 2.2 μm)
 Point Source Catalog (PSC)

Gator

Coordinates

21h53m28.4s +47d15m23s

Box Size

855 arcsec

The screenshot shows the Gator interface for the 2MASS All-Sky Point Source Catalog (PSC). The page title is "NASA/IPAC Infrared Science Archive for NASA's Infrared and Submillimeter Data". The main heading is "2MASS All-Sky Point Source Catalog (PSC) powered by Gator". There are navigation links for "Home", "About", "Holdings", "Missions", "Documentation", and "Helpdesk". A sidebar on the left contains various search and visualization tools. The main content area has a "SPATIAL CONSTRAINTS" section with a "Coordinate or Object Name" field containing "21h53m28.4s +47d15m23s" and a "Box" search method with a "Size" of "855 arcsec".

The screenshot shows the "GATOR CATALOG LIST PAGE" with a table of column constraints and output options. The table has columns for "Table Selection", "Description", "Sel", "Low Limit", "Up Limit", "Units", "Indx", and "DBType". The "Table Selection" column has radio buttons for "Table Output" (selected) and "Source Counts Only (all-sky search only)". The "Options" section includes an "E-mail Address (optional)" field and "Run Query" and "Reset" buttons. The "COLUMN CONSTRAINTS/OUTPUT COLUMN SELECTION" section has buttons for "Select All Columns", "Clear All Selections", and "Reset".

Table Selection	Description	Sel	Low Limit (include >=)	Up Limit (include <=)	Units	Indx	DBType
<input checked="" type="checkbox"/>	ra right ascension (J2000 decimal deg)	<input checked="" type="checkbox"/>			deg		decimal(9,6)
<input checked="" type="checkbox"/>	dec declination (J2000 decimal deg)	<input checked="" type="checkbox"/>			deg	X	decimal(8,6)
<input type="checkbox"/>	err_maj major axis of 1-sigma error ellipse	<input type="checkbox"/>			arcsec		decimal(3,2)
<input type="checkbox"/>	err_min minor axis of 1-sigma error ellipse	<input type="checkbox"/>			arcsec		decimal(3,2)
<input type="checkbox"/>	err_ang angle of error ellipse major axis (E of N)	<input type="checkbox"/>			deg		smallint
<input checked="" type="checkbox"/>	designation source designation formed from sexagesimal coordinates	<input checked="" type="checkbox"/>					char(17)
<input checked="" type="checkbox"/>	j_m J band selected "default" magnitude	<input checked="" type="checkbox"/>			mag		decimal(5,3)
<input type="checkbox"/>	j_cmsig corrected J band photometric uncertainty	<input type="checkbox"/>			mag		decimal(4,3)
<input type="checkbox"/>	j_msigcom combined (total) J band photometric uncertainty	<input type="checkbox"/>			mag		decimal(4,3)
<input type="checkbox"/>	j_snr J band "scan" signal-to-noise ratio	<input type="checkbox"/>					decimal(9,1)
<input checked="" type="checkbox"/>	h_m H band selected "default" magnitude	<input checked="" type="checkbox"/>			mag		decimal(5,3)
<input type="checkbox"/>	h_cmsig corrected H band photometric uncertainty	<input type="checkbox"/>			mag		decimal(4,3)
<input type="checkbox"/>	h_msigcom combined (total) H band photometric uncertainty	<input type="checkbox"/>			mag		decimal(4,3)
<input type="checkbox"/>	h_snr H band "scan" signal-to-noise ratio	<input type="checkbox"/>					decimal(9,1)
<input checked="" type="checkbox"/>	k_m K band selected "default" magnitude	<input checked="" type="checkbox"/>			mag		decimal(5,3)
<input type="checkbox"/>	k_cmsig corrected K band photometric uncertainty	<input type="checkbox"/>			mag		decimal(4,3)
<input type="checkbox"/>	k_msigcom combined (total) K band photometric uncertainty	<input type="checkbox"/>			mag		decimal(4,3)
<input type="checkbox"/>	k_snr K band "scan" signal-to-noise ratio	<input type="checkbox"/>					decimal(9,1)
<input checked="" type="checkbox"/>	ph_qual flag indicating photometric quality of source	<input checked="" type="checkbox"/>					char(3)
<input type="checkbox"/>	rd_flg source of JHK "default" mags (AKA "read flag")	<input type="checkbox"/>					char(3)
<input type="checkbox"/>	bl_flg indicates # JHK components fit simultaneously to source	<input type="checkbox"/>					char(3)
<input type="checkbox"/>	cc_flg indicates JHK artifact contamination and/or confusion	<input type="checkbox"/>					char(3)
<input type="checkbox"/>	ndet number of >3-sig. ap. mag measurements, # possible (ijhkk)	<input type="checkbox"/>					char(6)
<input type="checkbox"/>	prox distance in arcsec to nearest catalog point source	<input type="checkbox"/>			arcsec		decimal(4,1)
<input type="checkbox"/>	pxpa angle (deg E of N) to nearest catalog point source	<input type="checkbox"/>			deg		decimal(5,3)
<input type="checkbox"/>	pxcentr cntr of nearest catalog point source	<input type="checkbox"/>					integer
<input type="checkbox"/>	gal_contam flag indicating if src is contaminated by extended source	<input type="checkbox"/>					smallint
<input type="checkbox"/>	mp_flg src is positionally associated with an asteroid, comet, etc	<input type="checkbox"/>					smallint
<input type="checkbox"/>	jdate julian date of source measurement to +/- 30 sec	<input type="checkbox"/>			jdate		decimal(11,4)

2MASS (1.2 – 2.2 μm)
Point Source Catalog (PSC)

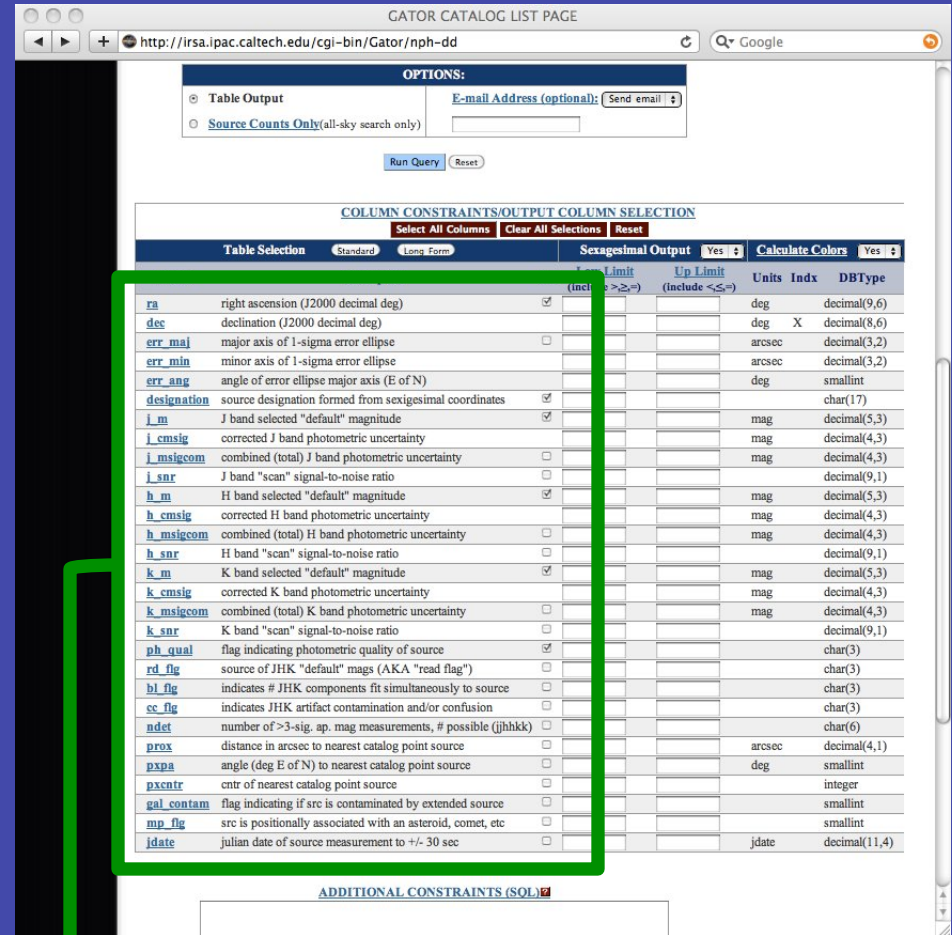
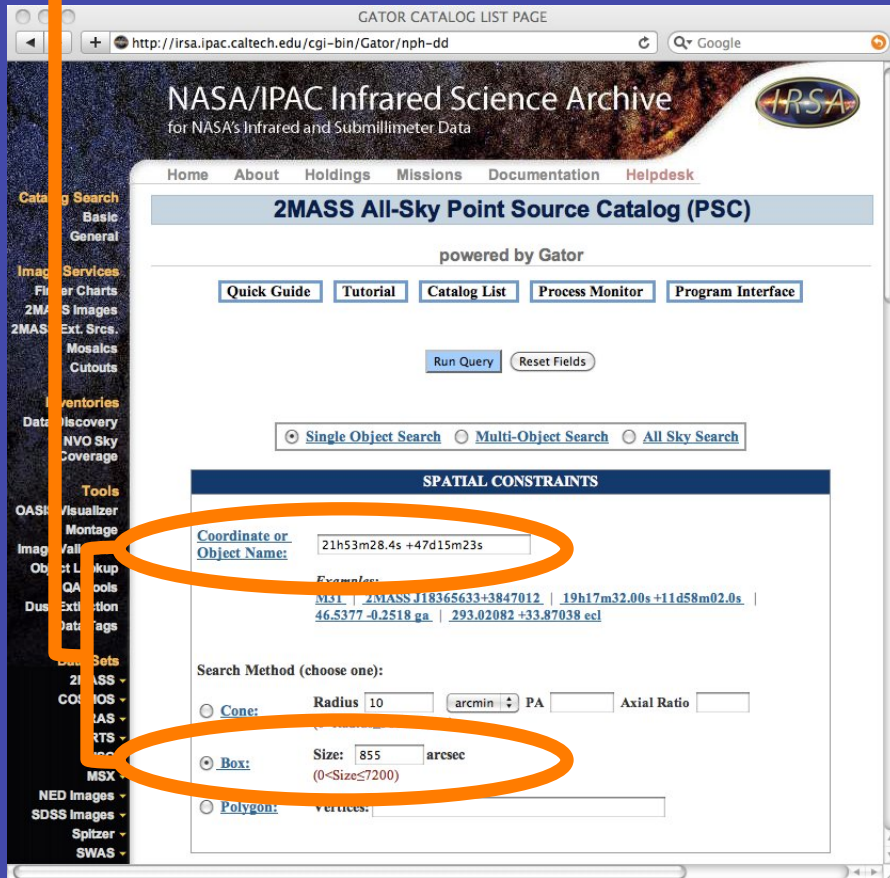
Gator

Coordinates

21h53m28.4s +47d15m23s

Box Size

855 arcsec

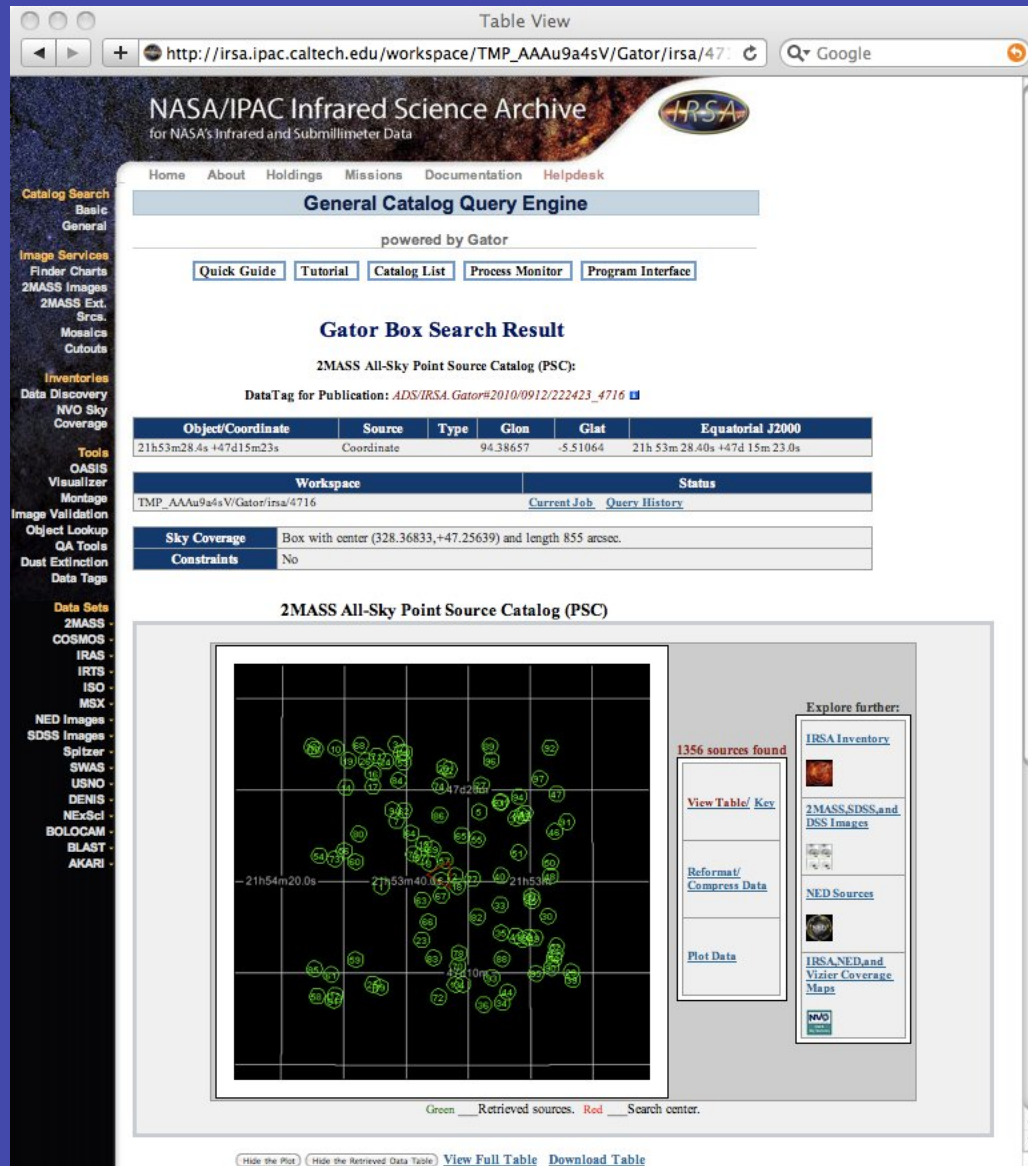


2MASS (1.2 – 2.2 μm)

Point Source Catalog (PSC)

Catalog Output Selections

Gator



Quick View of Results

Figure showing distribution of first 100 sources in returned catalog

2MASS (1.2 – 2.2 μm)
Point Source Catalog (PSC)

Gator

Returned Catalog

Header

Data

```
http://irsa.ipac.caltech.edu/work/TMP_AAu9a4sV/Gator/irsa/4716/fp_2mass.fp_psc4716.tbl
http://irsa.ipac.caltech.edu/work/TMP_AAu9a4sV/Gator/irsa/4716/fp_2mass.fp_psc4716.tbl

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\DATETIME= '2010-09-12 22:24:23'
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\EQUINOX = 'J2000'
\SKYAREA = 'box with center (328.36833,+47.25639) and length 855 arcsec.'
\SQL = 'WHERE (no constraints)'
\SQL = 'SELECT (13 column names follow in next row.)'
\
\ ra (deg)
\ __ right ascension (J2000 decimal deg)
\ dec (deg)
\ __ declination (J2000 decimal deg)
\ designation
\ __ source designation formed from sexagesimal coordinates
\ j_m (mag)
\ __ J band selected "default" magnitude
\ j_cmsig (mag)
\ __ corrected J band photometric uncertainty
\ h_m (mag)
\ __ H band selected "default" magnitude
\ h_cmsig (mag)
\ __ corrected H band photometric uncertainty
\ k_m (mag)
\ __ K band selected "default" magnitude
\ k_cmsig (mag)
\ __ corrected K band photometric uncertainty
\ ph_qual
\ __ flag indicating photometric quality of source
\ rd_flg
\ __ source of JHK "default" mags (AKA "read flag")
\
\ j_h -> Reference: Input column(s): j_m, h_m, k_m, rd_flg
\ h_k -> Reference: Input column(s): j_m, h_m, k_m, rd_flg
\ j_k -> Reference: Input column(s): j_m, h_m, k_m, rd_flg
\
\ ra | dec | clon | clat | designation | j_m | j_cmsig | h_m | h_cmsig | k_m | k_cmsig | ph_qual | rd_flg | j_h | h_k | j_k
\ double | double | char | char | char | double | double | double | double | double | double | char | char | double | double | double
\ null | null | null | null | null | null | null | null | null | null | null | null | null | - | - | -
328.449523 | 47.245842 | 21h53m47.89s | 47d14m45.03s | 21534788+4714450 | .539 | 0.026 | 11.706 | 0.041 | 13.218 | 0.038 | AAA | 222 | 0.8330 | 0.4880 | 1.3210
328.350556 | 47.255409 | 21h53m24.13s | 47d15m19.47s | 21532413+4715194 | .735 | 0.046 | 11.775 | 0.044 | 13.473 | 0.046 | AAA | 222 | 0.9600 | 0.3020 | 1.2620
328.430584 | 47.375164 | 21h53m43.34s | 47d22m30.59s | 21534334+4722305 | .496 | 0.042 | 11.637 | 0.042 | 12.343 | 0.036 | AAA | 222 | 0.8590 | 0.2940 | 1.1530
328.340958 | 47.156769 | 21h53m21.83s | 47d09m24.37s | 21532182+4709243 | .354 | 0.140 | 11.631 | 0.135 | 14.845 | null | BBU | 220 | 0.7230 | - | -
328.318493 | 47.313736 | 21h53m16.44s | 47d18m49.45s | 21531643+4718494 | .430 | 0.135 | 11.256 | 0.101 | 14.815 | 0.113 | BAB | 222 | 1.1740 | 0.4410 | 1.6150
328.369579 | 47.251614 | 21h53m28.70s | 47d15m05.81s | 21532869+4715058 | .237 | 0.064 | 13.450 | 0.064 | 13.450 | 0.046 | AAA | 222 | 1.3100 | 0.7870 | 2.0970
328.429193 | 47.305763 | 21h53m43.01s | 47d18m20.75s | 21534300+4718207 | .364 | 0.035 | 13.243 | 0.037 | 12.739 | 0.037 | AAA | 222 | 1.1210 | 0.5040 | 1.6250
328.385091 | 47.266865 | 21h53m32.42s | 47d16m00.71s | 21533242+4716007 | .927 | 0.102 | 14.611 | 0.072 | 13.691 | 0.065 | AAE | 222 | 1.3160 | 0.9200 | 2.2360
328.434820 | 47.315205 | 21h53m44.36s | 47d18m54.74s | 21534435+4718547 | .423 | 0.064 | 14.565 | 0.056 | 14.216 | 0.074 | AAA | 222 | 0.8580 | 0.3490 | 1.2070
328.510927 | 47.371391 | 21h54m02.62s | 47d22m17.01s | 21540262+4722170 | .536 | 0.059 | 14.944 | 0.074 | 14.712 | 0.113 | AAB | 222 | 0.5920 | 0.2320 | 0.8240
328.418740 | 47.367592 | 21h53m40.50s | 47d22m03.33s | 21534049+4722033 | .854 | 0.081 | 15.259 | 0.094 | 14.768 | 0.122 | AAB | 222 | 0.5950 | 0.4910 | 1.0860
```