PTF Help

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Palomar Transient Factory (PTF) Image Service: Overview

The Palomar Transient Factory Image Service is the repository for all image data collected by PTF and processed by IPAC.

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History and Background

The PTF Telescope and Camera

The [Palomar Transient Factory (PTF)](#) ⬚ was a synoptic sky survey that was carried out on the [48-inch Oschin Schmidt Telescope](#) ⬚ at Palomar Observatory, which is the same telescope as used for the well-known [POSS](#) ⬚ survey in the 1950s.

The PTF camera was formerly the CFHT-12k camera and has been substantially modified for its new mission, most notably through the use of a mechanical cryo-cooler instead of liquid nitrogen, a new image flattener, and electronics modifications. The camera has 11 functional 2048x4096 CCDs, with a roughly 1 arcsecond per pixel plate scale, yielding a total area per exposure of just over 7 square degrees. A shutter provides accurate exposure timing. A filter exchanger mechanism allows up to two filters to be used. Typically, these are R and g-band; an additional set of H-alpha filters are also in use.

The camera saw first light at Palomar on December 13, 2008 and was in routine operations from mid-2009 to 2017. Since 2017, the survey has been operating as [ZTF](#) ⬚.

PTF Survey Design, Achieved Performance, and Processing

Unlike many previous sky surveys, PTF did not use a raster scan of the sky. A typical night consists of several complex interlocking programs, with different cadences. The most typical is the 5-day cadence: two exposures are taken roughly one hour apart, and then repeated again five days later. This program was primarily aimed at transient science such as SNe. Other cadences were much higher with daily repeats, and target nearby galaxies. Such programs are also aimed at stellar science. Finally, certain regions of the sky (such as Orion) are subject to extremely high cadence observations and are observed essentially continuously.

Under ideal conditions, the spatial resolution was roughly 2 arcseconds; under typical site conditions, this varied from 2 to 3 arcseconds. Exposure times for regular survey data were 1 minute. Under dark conditions, this produced a typical limiting g-band magnitude of 21.5 (AB) and R-band of 20.6 (AB).

Data flow immediately to LBL and IPAC through the San Diego Super-Computing Center. LBL provided real-time image subtraction and detection, and was the discovery engine for transients in the data. IPAC performed high-fidelity reduction and calibration of the data, and maintains a repository for all image data as

well as catalog access.

For More Information

More information on the PTF survey can be found at the project home page ⧉. In particular, please see the page on Data Release 3 ⧉, the page on Data Release 2 ⧉, and the documentation page ⧉.

Also see The Palomar Transient Factory: System Overview, Performance and First Results, Law et al., 2009, PASP, 121, 1395 ⧉.

Terminology

The PTF Image Service contains all image data available from PTF, subject to the requirement that it has been actually both processed and deposited in the archive (these are separate operations). Image data products are separated into three basic types:

Level 0

> Raw data. This is received from the observatory as a multi-extension FITS file containing all 12 CCDs. At this time, no Level 0 data are publicly available; all Level 0 data are proprietary. If you have proprietary access to these data, you must log in to be able to download these data.

Level 1

> Processed data corresponding to the original single CCD exposures. These individual image files are sometimes simply referred to as "single exposure", "processed images", or even sometimes "frameproc." Level-1 data can consist of calibrated FITS images, mask images, and calibrated photometric catalogs in binary FITS table format.

Level 2

> Products derived from combining the Level 1 data, such as deep sky coadded data and the catalogs derived from such data. The coadded mosaic is sometimes referred to as the "Level-2 Coadd", or "coadded image", or even "reference image". Level-1 data can consist of calibrated FITS images and calibrated photometric catalogs in binary FITS table format.

If you have proprietary access to any particular data you know are there, you must log in to be able to download these data.

Catalog data products currently can be downloaded with the images, not separately from within this interface. If you want to overlay the catalog on the images and interact with it using the tools found here, download the data (including the catalog), convert the catalog to IPAC table format, go to the catalogs tab, and upload the catalog from your own disk.

Searching

Several search options are provided, which are documented in more detail here.

Searching by position is the most popular search, and you can also search in "batch mode" by uploading a table.

In the search pane, from the options on the left, you can also search by PTF Field ID, or Solar System Object/Orbit.
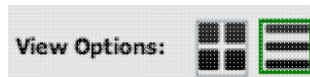
Results

The search results appear in two "panes" (like "window panes"). You can grab and drag the division between the two panes to change their relative sizes.

The left pane of the search results contains a table that includes one line per observation. Each line includes basic information about all the PTF images which fulfill your initial search critera. The listed FITS images can be downloaded by checking the box at the beginning of each row (or the box at the top of the column of boxes to select all) and clicking "Prepare download". (See the section on downloads for more information.)

The right pane of the search results contains three tabs that enable exploration of the data returned by your search. Click on a row in the left pane and the contents of the right pane change. The "Image Preview" enables an interaction with the real FITS Image corresponding to that green row. See the section on visualization for more information. The 'Coverage' tab shows the current image in context with the other images returned by your search, overlaid on an IRAS image as a background image. You can also manipulate that image; see the section on visualization for more information. The 'Details' tab shows the details of the selected image.
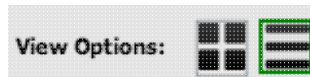
Above the right pane, there are icons that look like this: You can choose to view your results in either "Table View" or "Grid View". "Table View" lists the available observations in table format in the results pane and only displays the images associated with the currently selected image set (highlighted in green in the results pane table). Alternatively, "Grid View" simply displays all of the images of the search results. Note also that, in the "grid view", the "select all" checkbox appears not on the top of a

column, but in the upper right, under the expand icon:

When in 'grid view', it may be helpful to change the right hand panel to have the 'Details' (rather than the 'Image Preview') tab in the foreground to allow you to quickly assess the properties of the selected image.

NOTE THAT the Level 2 Coadded (reference) images are oriented North-up, and the Level 1 images (individual exposures) are North-down.

Results: Columns

When you do a search for images, a table is returned with information about the images (image metadata) meeting your search criteria that allows you to decide which images you want to download.

Columns that are returned for a Level 1 image search include the following:

expid	Exposure database ID
obsdate	Observation UT date/time YYYY-MM-DD HH:MM:SS.SSS
crval1	Reference position RA (FK5 J2000) at crpix1,crpix2
crval2	Reference position Dec (FK5 J2000) at crpix1,crpix2
filter	Filter name
ccdid	CCD number (0...11)
ptffield	PTF field number

seeing	Seeing FWHM
airmass	Telescope airmass
moonillf	Moon illuminated fraction
moonesb	Moon excess in sky brightness in V-band
photcalflag	Flag for whether image has been photometrically calibrated (0=NO, 1=YES)
infobits	Info bit flags
nid	Night database ID
fieldid	Field database ID
ptfpid	Project name
pfilename	Processed-image filename
afilename1	Ancillary filename
afilename2	Ancillary filename
afilename3	Ancillary filename
afilename4	PSF-fitting catalog
rfilename	Raw-image filename
obsmjd	Observation UT modified Julian date (obsdate)
ptfprpi	Principal investigator
filtersl	Filter changer slot number
moonra	Moon J2000.0 R.A.
moondec	Moon J2000.0 Dec.
moonphas	Moon phase angle
moonalt	Moon altitude
ra1	R.A. of image corner #1
dec1	Dec. of image corner #1
ra2	R.A. of image corner #2
dec2	Dec. of image corner #2
ra3	R.A. of image corner #3
dec3	Dec. of image corner #3
ra4	R.A. of image corner #4
dec4	Dec. of image corner #4
gain	Gain of detector
readnoi	Read noise of detector
darkcur	Dark current of detector at 150K
ipac_gid	IPAC Group ID
ipac_pub_date	UTC date exposure becomes public

Columns that are returned for a Level 2 image search include the following:

rfid	Reference-image database ID

ra	ICRS right ascension at image center
dec	ICRS declination at image center
fid	Filter database ID
ppid	Reference-image-pipeline database ID
ccdid	CCD number (0..11)
ptffield	PTF field number
filename	Reference-image filename
version	Reference-image database version
ra1	R.A. of image corner #1
dec1	Dec. of image corner #1
ra2	R.A. of image corner #2
dec2	Dec. of image corner #2
ra3	R.A. of image corner #3
dec3	Dec. of image corner #3
ra4	R.A. of image corner #4
dec4	Dec. of image corner #4
datara1	R.A. of non-blank image corner #1
datadec1	Dec. of non-blank image corner #1
datara2	R.A. of non-blank image corner #2
datadec2	Dec. of non-blank image corner #2
datara3	R.A. of non-blank image corner #3
datadec3	Dec. of non-blank image corner #3
datara4	R.A. of non-blank image corner #4
datadec4	Dec. of non-blank image corner #4
rawpsffilename	Reference-image raw-PSF-file filename
psfgridfilename	Reference-image PSF-grid-file filename
psfds9regfilename	Reference-image PSF-fit-catalog-DS9-region-file filename
depthfilename	Reference-image depth-of-coverage image filename
uncfilename	Reference-image uncertainty-image filename
sexrfcatfilename	Reference-image SExtractor catalog filename
psfrfcatfilename	Reference-image PSF-fit catalog filename
ipac_gid	IPAC Group ID
ipac_pub_date	UTC date exposure becomes public

Results: Filtering

Filters can provide a powerful tool for weeding down search results to the observations you want. Near the top

of the search results window, there is this icon: Click on this icon in order to start the process of adding filters. A text entry box appears above each of the current catalog columns, with a small version of the filter

icon corresponding to that row on the far left. You can type operators and values in these boxes -- hit return after typing or click in another box to implement the filter. For fields with a limited set of choices, instead of a text entry box, a filter icon will appear; click on it to select from the available choices. For example, in the Level 1 data, the column "filter" corresponds to the filter that was used. To limit your search results to just the one filter, and find the "fid" column. Above that column, there is a funnel icon. Click on that, and it will give you a choice of limiting your results to one of the values that appear in your results. You can select 1 or more than 1; the options change to reflect the actual data you have listed. (If your search results contain only R band filters, then you won't have an option to select g band filters.) Similer filtering capability exists for any column in the results.

Filters can be used in combination - on the Level 1 results, for example, you could also add "seeing < 2.0" to further restrict results to only the best data. Note that the filters are logically "AND"ed together -- that is, if you impose logically inconsistent restrictions such as "seeing > 2.5" and "seeing &lt 1", no data will result, because no data are (can be) both less than 1 and greater than 2.5 at the same time.

The available logical operators are :

- = which means 'equal to' (exactly!), e.g., the parameter on which you are querying (the column headers as shown) is exactly equal to this value you are specifying.
- > which means 'greater than'
- < which mean 'less than'
- != which means 'not equal to' (exactly!)
- >= which means 'greater than or equal to'
- <= which means 'less than or equal to'
- IN which means 'included within this list', e.g., the parameter on which you are querying is included within the list you are specifying (if the column filter is free-form text, type "value1,value2" and it will give you rows that have value1 or value2).
- LIKE which means 'resembles the text that is entered', e.g., the text resembles the text that you type in the box.

After you impose a filter, then the "filters" icon on the top right of the catalog pane has changed to remind you that there has been a filter applied, in this case just one filter: . To clear the filters, click on the cancel filters icon (which also appears after you impose filters): .

Visualization

PTF images found by the search are displayed to the right of the search result table. If a single position search was used, this position will be highlighted in a blue circle in the images shown under "Image Preview" or "Coverage". There is an image toolbar, with zoom and stretch features, among others, that appears near the top of the browser window.

The "Image Preview" tab shows the FITS image corresponding to the selected row in the left pane; the "Coverage" tab shows the location of each of the images which fulfill the search as an overlay on an IRAS 100 micron image. Note that only the images shown on the current search page are shown; the coverage corresponding to the currently selected (highlighted) row is also highlighted in the coverage visualization. If several images were taken at exactly the same location, there may appear to be only one polygon shown on the image; click on different rows on the left to highlight the polygon in the image on the right corresponding to that image.

See the visualization section for more on visualization.

You can also interact with a variety of catalogs through this interface. See the catalogs section for more information on interacting with catalogs and images.

Downloading Data

After deciding what data to download, click on the corresponding checkbox(es) on the left side, and click "Prepare Download" to begin the packaging and data download process. (To 'select all', click on the checkbox on the top of the column of checkboxes.) The download then gets passed to a background job for packaging. See the section on downloads for more information.

User login

The PTF Image Service can remember you when you return. See the user registration section for more information.

Getting more help

The "Help" blue tab leads you into this online help, as does "PTF Help" from under the "Help" in the IRSA menu on the top of the PTF page. You can also download a PDF version of this manual; look at the top of the help window. You can submit questions to the IRSA Help Desk ⊠.

Basic Features and Functions in PTF Image Service

The contents of this file essentially follow the menu options (e.g., basically the blue tabs across the top, under the IRSA menu).

Searches	History	Help	Catalogs		Background Monitor

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Searching by Position

Searching the archive is straightforward -- the most common search is a search by position for a cone search. You may enter a target name, and have NED or Simbad or the PTF name resolver resolve the target name into coordinates. Alternatively, you may enter coordinates directly. These coordinates can be in decimal degrees or in hh:mm:ss dd:mm:ss format. By default, it assumes you are working in J2000 coordinates; you can also specify galactic, ecliptic, or B1950 coordinates as follows:

- '46.53, -0.251 gal' means 46.53, -0.251 degrees in galactic coordinates
- '12.7, +4.3 ecl' means 12.7, +4.3 degrees in ecliptic coordinates
- '19h17m 11d58m b1950' means 19h17m 11d58m in B1950 coordinates

As you are completing a valid coordinate entry, it echoes back to you what it thinks you are entering. Look right below the box in which you are typing the coordinates to see it dynamically change.

You can specify exactly which kind of search type (region intersection) you would like, e.g., :

- *Images returned contain the target requested* (default)
- *Images cover the entire search region requested* -- an option appears so that you can specify the search region, which is limited to a square where you specify the length of a side
- *Image is entirely enclosed by the search region requested* -- an option appears so that you can specify the search region, which is limited to a square where you specify the length of a side, and the returned image size option (below) is removed as not relevant to this kind of search
- *Any pixel in the image overlaps the search region requested* -- an option appears so that you can specify the search region, which is limited to a square where you specify the length of a side, and the returned image size option (below) is removed as not relevant to this kind of search

You can specify the image size you want to retrieve; you can leave it blank to return the full images. You may enter the image size in arcseconds, arcminutes, or degrees; just change the drop-down option accordingly. **Caution:** pick your units from the drop-down first, and then enter a number; if you enter a number and then select from the drop-down, it will convert your number from the old units to the new units. There are both upper

and lower limits to your search radius; it will tell you if you request something too big or too small.

You can choose to retrieve only the most centered image containing your target, or any image containing your target.

You can specify additional optional constraints. Click on the grey triangle or grey bar to reveal these options. You can specify the PTF Field ID(s) or the CCD ID(s) you want. To search for more than one at a time, enter a list separated by semicolons (;).

The search window can be retrieved after a search by clicking on the blue "Searches" tab near the top left.

Searching by Position in Batch Mode

The position search can also be executed in "batch mode" for a list of objects given in a file - select the Multi-Object tab from the search page. The file must be in IPAC table file ⬚ format, which is ASCII text with headers explaining the type of data in each column, separated by vertical bars. A sample input file looks like this:

```
|               ra|                dec|
|           double|             double|
|              deg|                deg|
 266.461876096161  -28.9303475510113
 317.385694084404  -41.1537816217576
 267.210580557307  -27.7929408211594
 229.172700517754    0.2598861324350
 299.510225672473  -38.7735055243326
 213.945501950887   13.3596597685085
 262.341432853080  -23.7518928284717
 271.202769466020  -21.7274227022229
 291.167629785682  -29.2569222675305
 272.336516119634  -20.2761650442889
 237.391628608612    2.5906013137112
```

Please use the IPAC table validator ⬚ to check and reformat your input table before the table upload. If the table upload search still does not work properly, try the following :

- No hyphens allowed in column names, or filename!
- Column names should be all in lower case
- No empty lines at the end of the input file.

Please note that the maximum number of targets that can be requested in a batch search is 1000.

Searching by PTF Field ID

In the search pane, from the options on the left, you can also search by PTF Field ID. If you know your PTF field ID, you can search on one or more than one via the first option on this search page. A list of them should be separated by semi-colons (;).

In the second box, you can (optionally) specify an additional constraint of the CCD ID for your search. The CCDs are numbered between 0 and 11. You can specify more than one; just separate them in the list with semi-colons (;).

Searching by Solar System Object/Orbit

In the search pane, from the options on the left, you can also search by Solar System Object/Orbit.

By selecting this option, the first tab you see (the default tab) is to search by "Object Name". You can first select, under "Object Type" whether your object is an astroid or comet, then enter the Object Name. You can specify how finely or coarsely the ephemeris is calculated in time steps (in units of days), and the search region over which the search should be conducted.

The next search tab option is "MPC Input". MPC is Minor Planet Center, and you can enter the MPC 1-line input in the blank provided. Here, too, you need to specify if your object is an asteroid or comet.

The last search tab option is "Manual Input". From this screen, you specify if your object is an asteroid or comet, and enter all the relevant ephemeris parameters.

For all three of these options, you also can specify the date range to search, and the returned image size.

Your Search History

The History menu option (blue tab at the top of the window, next to "Searches") gives you access to your own search history.

All of the single-position searches that you do for a given session with the PTF Image Service are remembered in the search history panel. A high-level summary of the search is also listed -- what kind of search it was, what parameters you used, etc.

You can resubmit the search (see buttons at top left of the search history tab), remove the search from your history, or mark the search as a favorite search to which you can return at a later time/date. However, in order to return to it during a different PTF Image Service session, you do need to be logged in when you save the search -- see the user registration section.)

Note that batch searches are not retained, even if you log in in an attempt to save them.

Getting Help

The "Help" blue tab leads you into this online help, as does "PTF Help" from under the "Help" in the IRSA menu on the top of the PTF Image Service page. You can also download a PDF version of this manual; look at the top of the help window.

You can submit questions to the IRSA Help Desk .

A set of frequently asked questions (FAQs) is here.

Found a bug? The known bugs and issues in this version of the PTF Image Service are listed here . If you think you have found a bug, before reporting it, please check this list, and read this online PTF Image Service help. It may be a "feature" we already know about. If you have found a new, real bug then please do contact us via the IRSA Help Desk . Please include your operating system version and your browser software and version. If you can, please also include any specific error message you may have gotten. (NB: In our testing, copying shortcuts worked on Windows and Linux; the command-C did not always work on Macs, but selecting and clicking the right mouse button often did when command-C did not.)

Catalogs -- Retrieving and using catalogs

(Note that catalogs are available via a blue tab that appears at the top of the page only after you have performed at least one search -- in essence, you need to have something on which to overlay the catalog before it will let you search.)

You can choose from any of a wide variety of catalogs (from IRSA or your own disk) to load in preparation for overlaying on your visualized data. You can also make plots from the catalogs.

By default, it remembers the most recent search you did and constructs a query that will cover the same area. You may change the search criteria and select catalogs based first on the "project" under which they are housed at IRSA, such as 2MASS, IRAS, WISE, MSX, etc. The options under the "category" and the specific clickable catalog on the right change according to the project you have selected. A short description is provided for each of the catalogs, with links for more information.; an example is here:

Click on "Search" to initiate the search. **NOTE THAT** the search may take a long time to return, especially if you have asked for a large catalog, and you may think that nothing has happened, but be patient and eventually it will either spin off to the background monitor, or return a tab directly.

Use large search radii with caution! Be sure you understand how many sources you are likely to retrieve. Searches that retrieve more rows will take a long time.

Once you have a catalog loaded, there is a tab containing the catalog that is added to the window pane on the left that contains the list of targets on which you searched. There are icons in the upper right of the browser window that denote "table view" (the default) or "plot view", which is a plot made from the catalog. You can change what is plotted; see the Catalogs section.

Once you have a catalog loaded, to return to the view where the image takes up as much of the screen as possible, let your mouse hover over the image and then click on this 'expand' icon in the upper right of the image: A similar expand icon can be found in the catalog window pane, or the catalog plotting pane, so that you can view those panes as large as possible.

For more information, please see the <u>Catalogs section</u>.

Downloads - Downloading data

After deciding which data to download, click the checkboxes to select specific data files to download (click the checkbox at the top of the column of checkboxes to 'select all'), and then click "Prepare Download" to begin the packaging and downloading process. A pop-up window will appear in order to define exactly what kinds of data you would like to have packaged up. Clicking "Prepare Download" in the pop-up initializes this packaging process.

The packaging process spins off into the <u>background monitor</u>, which keeps track of its progress and notifies you when the downloads are complete. You can monitor its progress by clicking on the background monitor link. You can choose to have an email sent to you to let you know when things are ready, even after the packaging process has started. If you have just a few zip files, you can click to download them, but especially if you have many files, you may want to have the PTF Image Service generate a <u>downloading script</u> for you to download them all automatically.

Note that **you** control where the data are saved on your disk through your browser; your browser may be configured to store all downloads in a particular location on your disk. Look for a "Downloads" folder or search for recently modified files.

For more information, please see the <u>Downloads section</u>.
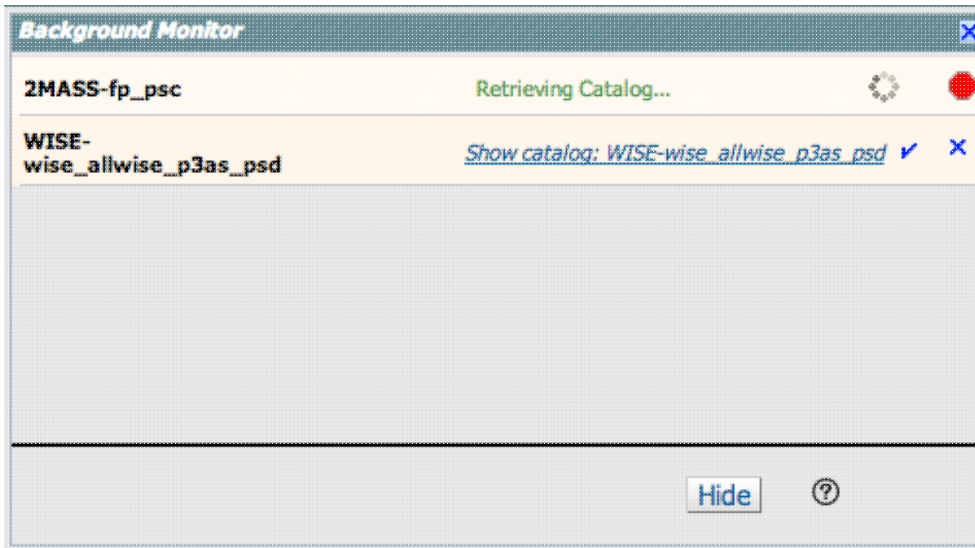
The Background Monitor

The Background Monitor appears as a blue tab (or button) in the upper right of your window to keep track of the data downloads you have requested. It actively changes to reflect what it is doing ("Preparing", etc., e.g.,:
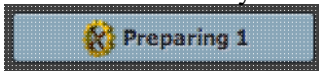
) Data packaging all goes to the Background Monitor; larger catalog requests are also sent to the Background Monitor. It also provides a <u>download script</u> (optional) if you have more than one package to download.

A pop-up window can be called up at any time by clicking the "Background Monitor" tab. You can watch your catalog being retrieved. It will update that window when the data are available for download and overlay on your image, providing a link for obtaining the data. It also keeps track of the downloads you have requested during the same session, and indicates with a checkmark those that you have already loaded. Remove them from the list by clicking on the blue 'x'.

To stop any query mid-way through, click on the little red octagon ("stop sign") that appears next to the query in the Background Monitor pop-up.

If you forgot to put in your email at the beginning, or if the packaging is taking longer than you expected, you can click on "Add email" from the lower right of the Background Monitor popup and add your email during the packaging process.

PTF Image Service: Visualization

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Visualization Overview

Once a search is complete, the images meeting your search criteria are shown on the left, and correspond to the results of the search on the right, one row per exposure id (expid) in Level 1 and one row per rfid in Level 2 (only available as proprietary data). Clicking on different rows on the left changes what is shown on the right. The overlaid blue circle is the search position you submitted.

You can overlay catalogs and add other layers to your image (such as 2MASS glint artifacts). Click on the blue "Catalogs" tab near the top of the page to initiate this process. See the catalogs section for more on catalogs, including how to make plots.

Note that the sky coverage of the displayed images overlaid on an IRAS 100 um map is shown under the 'coverage' tab.

Note that all the images that are displayed are FITS files, not JPGs or PNGs, so you can interact with them using the tools described below.

Basic FITS Viewer

All of the interactive image visualization tools work the same basic way, and here we describe these basic options, in roughly the order in which you might encounter them in the window.

Interactive exploration of the image with the mouse.
> Move your mouse over any image that is loaded into the viewer. Details about the image and, specifically, the pixel beneath your mouse cursor, appear along the top of the window with a variety of useful items. Some information is updated in real time (such as coordinates); some information (such as flux densities) is updated when you stop moving your mouse for a second or two. The image can be interactively investigated in this fashion.
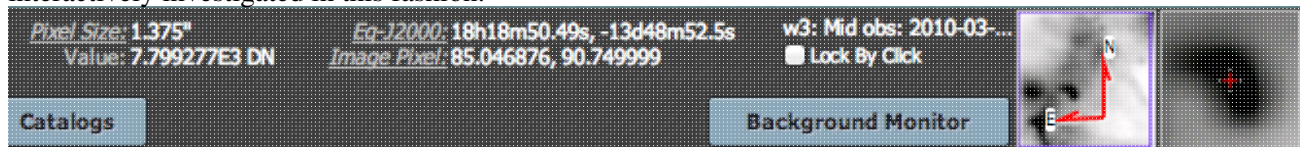
> You can make it 'stick' on a particular place on the image -- tick the "Lock by click" box and then click on the image at your desired location.

> The orientation of the image is given with a compass rose on the right, next to a zoomed-in view of the image under your cursor. If you can't see all of these two windows, enlarge your browser window slightly.

Finding out more about the displayed image.

> The results are grouped by survey. It indicates the [survey origin](#) and the date of observation (instrument, channel, and date in black, on the top of each image).

> Some of this information (like the title of the image) is also given in the interactive exploration region described immediately above. This region also includes additional information about the image (such as the pixel scale and orientation).

Visualization Tools -- Image Options

There is a toolbox along the top of the IRSA Viewer window:

from which you can select a variety of options, now described. Letting your mouse hover over any of these icons will result in a "tool tip" that appears in order to remind you what the icon does. This information is also dynamically updated just to the right of the toolbox itself.

 Saving the image.

> The diskette icon will allow you to save the current image as a FITS or PNG or Regions file to your local disk. Note that **you** control where the file is saved on your disk through your browser; your browser may be configured to store all downloads in a particular location on your disk.

> Saved FITS images will not save the color stretches or overlays; it will just save the underlying FITS image. Saved PNG files WILL include any overlays or annotations you have placed on the image, but will not include the underlying FITS image. Saved regions files will not save the underlying image, but will just save the overlays as a DS9 Regions file. See the [DS9 website](#) ⬚ for more information on the syntax of these DS9 region files.

> Note that you can save the original or a cropped version of the FITS file; see the select region icon below to crop, and then save the FITS image.
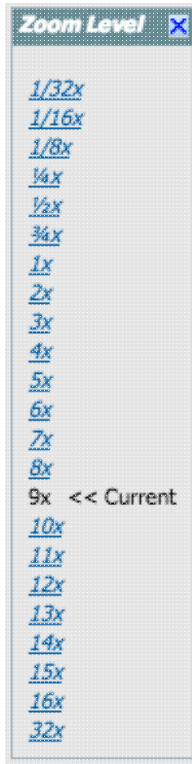
> Note also that if you [overlay a catalog](#) consisting of tens of thousands of sources, to save bandwidth, what is overlaid on your image at some locations may be a larger symbol representative of several sources at that location; if you save a regions file from the catalog overlay, then you will have fewer sources in the regions file than you have in the full catalog.

 Zooming in or out.

> Clicking on these magnifying glass icons zooms in or out of the image. The readout of how many times you are zoomed appears at the top of the visualization window.

> If you click zoom in or out rapidly, a pop-up window appears to allow you to more rapidly select the zoom level you want. Select the desired level, or click on the blue 'x' in the upper right to make the window go away. Here is an example:

Zoom Level ✕

1/32x
1/16x
1/8x
¼x
½x
¾x
1x
2x
3x
4x
5x
6x
7x
8x
9x << Current
10x
11x
12x
13x
14x
15x
16x
32x

Note that there is a maximum (or minimum) allowed zoom level. A notification will appear when you have reached the maximum (or minimum) allowed zoom level for a given image. To enlarge things more than that, please repeat your search to obtain new images with smaller (or larger) spatial extent.

Zooming to a 1-to-1 size.
Clicking this icon will zoom the image such that one pixel in the image is one pixel on your screen.

Fit image to screen or fill screen
These two icons are designed to maximize the available space in your browser window. The first one automatically picks a zoom level such that the image entirely fits within the available space. The second one automatically picks a zoom level such that the image fills as much of the available space as possible (e.g., it is zoomed such that short axis of the window is filled with the image, whether that short axis is left-right or up-down).

By default, the images that are returned are frequently but not always centered on your search target. Clicking on these icons let you see the whole image that is returned, whether or not it is centered on your target.

Changing the color table.
This icon enables you to change the color table of the displayed image. When you click the button, a drop-down menu appears with a wide variety of color table choices. Select your new color table from the options shown:

 Changing the color table stretch.

This icon enables you to change the color table stretch of the displayed image. When you click the button, a drop-down menu appears with a variety of choices. You can choose from a set of pre-selected options:
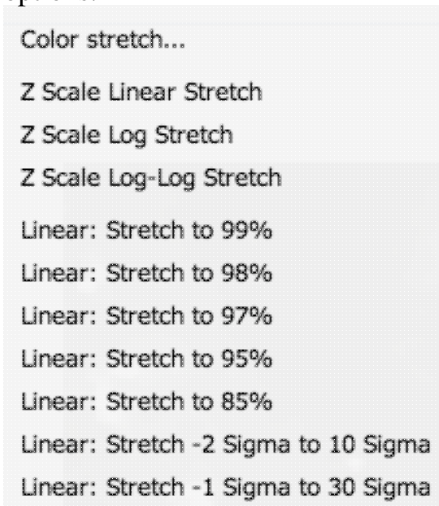
If you pick the first one, "color stretch", you can customize the stretch. A pop-up window appears with a histogram of the values in the image, and you can change the stretch type and range.

If you pick a color stretch from the pre-defined options, the pop-up window reflects this change. (Ex: pick 'Linear stretch to 99%'. Go back to "color stretch". Note that it has filled out the stretch type and ranges to reflect the current choice. Then -- either with the pop-up window still up or not -- go back and pick a different pre-defined stretch from the standard options. Note that the values in the pop-up change to reflect this current choice.)

Rotating the image to any angle
This feature allows you to rotate the image to any angle of your choice, in degrees. It will rotate the image counter-clockwise (to the left) from the current view, not necessarily the original image. For example, entering "45" in the rotation pop-up and hitting "rotate" will rotate the image 45 degrees counter-clockwise relative to its original orientation. Then selecting the icon again, and entering "180" in the pop-up (followed by hitting "rotate") will rotate the image an additional 180 degrees counter-clockwise. To exit the pop-up without making further changes, hit the blue 'x' in the upper right of the pop-up.

Rotating the image so that North is up.
Images retrieved from FinderChart are commonly already oriented such that North is up, or close to it. However, when interactively investigating images, or in certain situations, you could find yourself in a situation where North is not necessarily up. Clicking this icon will orient the selected image so that North is up.

Flipping the image on the y-axis.
Clicking on this icon flips the image on the y-axis.

Re-center the image.
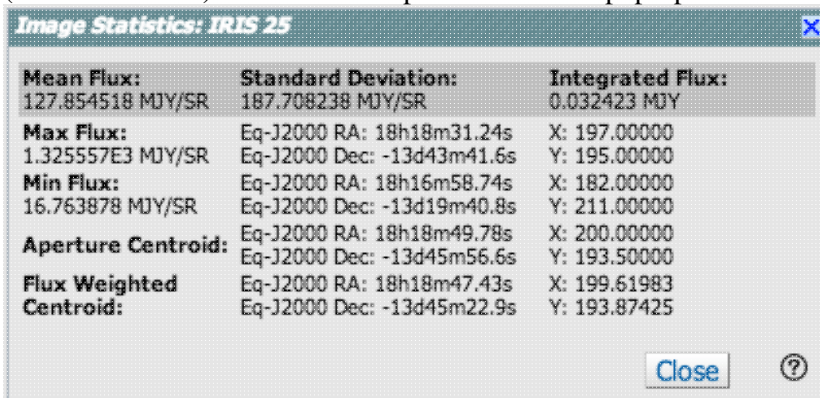Clicking this icon will re-center the image on the center of the last query, or on the center of the image.

Selecting a region.
When you click this icon, at first, nothing seems to happen. (There is a notice with brief instructions that appears on the lower left of your browser window.) You can now click and drag in the image,

selecting a box on the image. This box can be resized by grabbing and dragging the corners of the box. You can make a new box right away by holding down the shift key and clicking and dragging to select a new box. When you have selected a region of the image, additional icons appear above the image:

Options: 冚 Σ ✔ ⅋ These icons will allow you to (from left to right) crop the image to the selected region, obtain statistics on the region, select the catalog sources overlaid on the image within the region, or filter the overlaid catalog down to the enclosed sources. (The last two options will only appear if you have a catalog overlaid.) You can save the cropped FITS image via the save icon (described above). The statistics option results in a pop-up that looks something like this:

Image Statistics: IRIS 25			✕
Mean Flux: 127.854518 MJY/SR	**Standard Deviation:** 187.708238 MJY/SR	**Integrated Flux:** 0.032423 MJY	
Max Flux: 1.325557E3 MJY/SR	Eq-J2000 RA: 18h18m31.24s Eq-J2000 Dec: -13d43m41.6s	X: 197.00000 Y: 195.00000	
Min Flux: 16.763878 MJY/SR	Eq-J2000 RA: 18h16m58.74s Eq-J2000 Dec: -13d19m40.8s	X: 182.00000 Y: 211.00000	
Aperture Centroid:	Eq-J2000 RA: 18h18m49.78s Eq-J2000 Dec: -13d45m56.6s	X: 200.00000 Y: 193.50000	
Flux Weighted Centroid:	Eq-J2000 RA: 18h18m47.43s Eq-J2000 Dec: -13d45m22.9s	X: 199.61983 Y: 193.87425	

Close ⊘

Selecting sources highlights them in the catalog list. When you impose a filter, the filters icon changes

above the catalog to indicate that there is a filter applied (in this case just one filter:). To clear the

filters, click on the cancel filters icon (which also appears after you impose filters): .

Measuring a distance.

When you click this icon, at first, nothing seems to happen. However, you can now click and drag to draw a line on the image, and the length of the line is displayed (in the middle of the line). The units for the measured distance (and the color of the overlay) can be changed from the "layers" icon (described below). You can calculate the difference in RA and Dec separately via the layers icon as well; find the layer associated with the distance measurement and tick the "offset calculation" box. When it displays the offset calculation, it will give you the angle in degrees in one corner, and the length of the line segment in the RA and Dec directions, in the units you have specified.

Put a marker on the image.

When you click this icon, you can now mark a position in the image. A red circle appears that can be resized and dragged (or click to move it) to any location in the image. You can change the color of the marker (and add a label to it) via the "layers" icon (described below).

Show the directions of North and East

When you click this icon, arrows appear on the image showing which direction is North and which is East.

Add a coordinate grid.

Click on this icon to overlay a coordinate grid on the image. Click it again to remove it. Customize the units of the grid (to, e.g., Galactic coordinates) via the "layers" icon (described below).

Read in a DS9 Regions file

When you click this icon, you get a pop-up window from which you can read in a DS9 regions file from your local disk. See the **DS9 website** ⬀ for more information on the syntax of these DS9 region files. The supported regions are text, circle, box, polygon, line, and annulus. To make this window go away

without doing anything, click on the blue 'x' in the upper right of the pop-up.

Viewing/changing the layers on the image.
If you've been following along by trying these various options, you now have an image with a lot of annotations on it. The number that appears in blue over the layers icon tells you at any given time how many layers you have on the currently selected image. If you click this icon, you will get a pop-up window with a list of all the layers you have on top of the image. From the pop-up, you can turn layers off and on, at minimum, but you can often also change exactly what is displayed and what colors get used for it. To add new things, though, you need to go to other options within the toolbar. Here is an example of a well-populated layers pop-up.
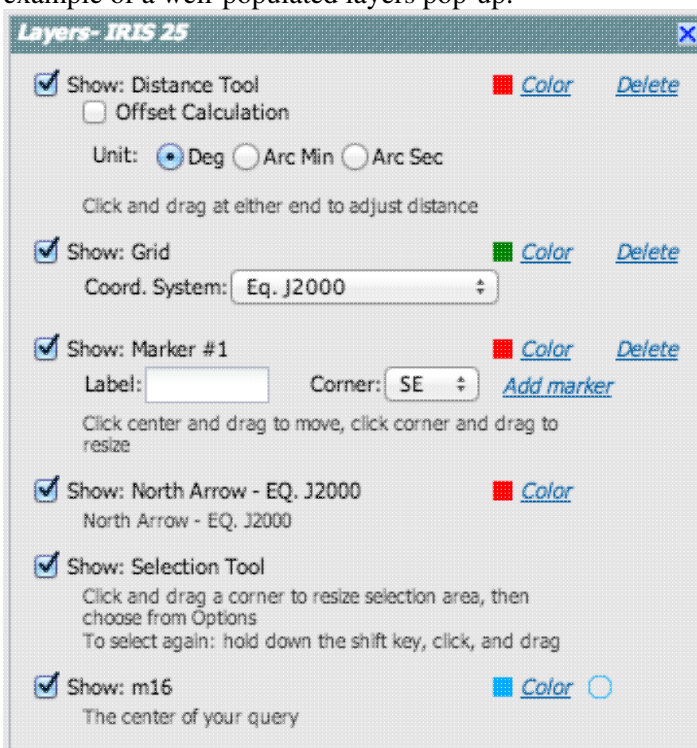
To change colors of a layer, click on the 'colors' link to be taken to a new pop-up from which you can select a new color. To delete a layer, click on 'delete'. Some layers appear do not have that option; to remove that layer, click on the corresponding icon from which you added that feature. To make this pop-up window go away, click on the blue 'x' in the upper right of the pop-up.

Restoring everything to the defaults
If you've played around a lot with the image, you may want to undo everything you've done. Click this button to restore everything to their original default values. Some layers may persist; remove them via the layers icon described above.

Viewing the FITS header.
This icon will display a pop-up window with the FITS header of the background image. If you click on the columns of the FITS header in the pop-up, it will sort the keywords alphabetically by that column. This is useful for finding individual keywords in particularly densely populated FITS headers. Click the header again to sort in reverse-alphabetical order, and a third time to return to the default order. Here is an example of a sorted FITS header. Note that the first column is the original order of the keywords. To make it go away, click on the blue 'x' in the upper right of the pop-up.

#	Keyword ▲	Value	Comments
~~5~~	~~CRVAL1~~	~~274.57407856305115~~	
13	CRVAL2	-13.71250704610818	
19	CRVAL3	2.50000000000E-05	WAVELENGTH IN METERS
11	CTYPE1	RA---TAN	
15	CTYPE2	DEC--TAN	
21	CTYPE3	LAMBDA	
23	DATAMAX	13749.9	MJY/SR
24	DATAMIN	0.975368	MJY/SR
29	DATEIRIS	04/12/06	IRIS MAP CREATION DATE (YY/MM/DD)
28	DATEISSA	92/03/24	ISSA MAP CREATION DATE (YY/MM/DD)
34	DESTRIPE	T	Wavelet/Fourier Destriping
7	EQUINOX	2000.0	
6	EXTEND	T	Extensions are permitted
27	INSTRUME	IRIS	Improved Reprocessing of the IRAS Survey
2	NAXIS	2	# OF AXES
3	NAXIS1	277	
4	NAXIS2	275	

FITS Header: IRIS 25 — Pixel Size: 90"   File Size: 304K

Getting help.
    Clicking on this icon takes you to this help page.

The visualization toolbar associated with the image displayed in the coverage pane contains two additional icons that appear near the middle of the toolbar:

Select a new image.
    Clicking on this icon allows you to select a background image from a variety of surveys, e.g. 2MASS, DSS, etc.

Breaking out of the pane (and going back)

By default, the search results are broken up into panes. For some purposes, it is useful to view the images (or the table) as large as possible. On the upper right of either the image pane (or the table pane), there is an expand icon   . Clicking on it will expand the images (or table) into a larger window, with the selected image appearing first. From this view (with the images), you now have some additional options that appear near the top of the new window.

Close   **PTF Image** .087x
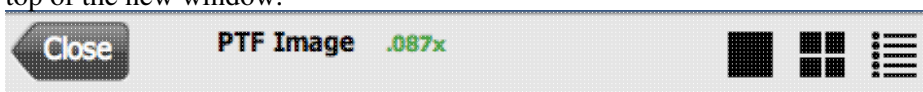
The large "Close" arrow at the left enables you to return back to the pane view. This arrow is always available in these expanded views.

Next, the currently displayed band (sometimes using abbreviations) and magnification factor is shown. Zoom in or out using the visualization toolbox described above.

Next, there is a cluster of icons that portray (in icon form) the different views you can have of the images you have loaded. The first icon (the big square) denotes "show one image at a time." The second icon (the cluster of four squares) denotes "show smaller images of all the images I have loaded, but still take up the whole browser window with the set" (as opposed to going back to the window panes). Depending on what you have been doing in your session to this point, you may have more than one image loaded, plus a plot from the catalog. Perhaps you wish to see, e.g., just two of the images tiled? Click on the last, blue "list" icon in this cluster to bring up a pop-up window:
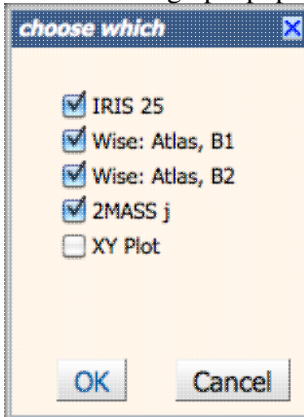
This popup window lists all of the images you have loaded, and if you uncheck the corresponding box, that image, while it is still loaded, will not be shown if you, say, scroll through the images, or look at them in tiled mode.

If you do have more than one image loaded, you may also have, on the top right of the image, a set of arrows, labels, and green/blue dots (which only appear when you are viewing one image at a time and have more than one image loaded).

These allow you to navigate through your set of images. The green dot inamongst the blue dots indicates where you are in the sequence of images, and the arrows and labels indicate which image is before or after the currently viewed image. Click on the arrows or the dots to move around in the sequence.

PTF Image Service: Catalogs

(Note that catalogs are available via a blue tab that appears at the top of the page only after you have performed at least one search -- you need to have something on which to overlay the catalog before it will let you search.)

You can choose from any of a wide variety of catalogs for overlaying on your [visualized data](#). Catalogs derived from the PTF products, however, come with your download, and are not directly available via this interface -- you need to download them to disk, convert them to IPAC table format, and then read them back in as your own catalog.

Contents of page/chapter:
+[Catalogs from IRSA](#) -- Overlaying catalogs from IRSA
+[Catalogs from disk](#) -- Overlaying your own catalogs
+[Catalogs from the VO](#) -- Overlaying catalogs obtained via the VO
+[Columns and filters](#) -- Interacting with catalogs
+[Plotting catalogs](#)
+[Examples of catalog plots](#)

Catalogs from IRSA

By clicking on the "Catalog" tab (which also looks like a button), a window appears with several options, as follows.

The target position is initially filled in by default with the current object with which you are working. If you would like to change the center of the search for purposes of the catalog search, click on "modify target" and enter the new information.

Next, you can tell it the region over which you want to search. You can customize the search for options beyond a cone search (e.g., a polygon search), and specify the size of the region over which you want to search. (The default radius is 500 arcsec.) **Caution**: pick your units from the drop-down first, and then enter a number; if you enter a number and then select from the drop-down, it will convert your number from the old units to the new units. There are both upper and lower limits to your search radius; it will tell you if you request something too big or too small. Note that these limits are survey-dependent.

You then need to specify the catalog you want to search. In order to help it give you a specific list of choices, you need to first tell it the project (default: 2MASS) and category (default: 2MASS All-Sky Release Database) and then, on the right, you can pick the catalog (default: 2MASS All-Sky Point Source Catalog). To change catalogs, first select the "project" under which they are housed at IRSA, such as 2MASS, IRAS, WISE, MSX, etc. The options under the "category" and the specific clickable catalog on the right change according to the project you have selected. A short description is provided for each of the catalogs, with links for more information (including definitions of the sometimes cryptic column names); an example is here:

You can also set restrictions on specific columns by clicking on "Set Column Restrictions" on the left hand side, under the "category" selection drop-down menu. A new window will open up with the available column names in the corresponding catalog, and you can choose what to display, and filter what is returned (for example, only return objects with values in column y that are greater than x). If you add more than one restriction, they are combined logically using an "AND" operators; be careful, because you can thus restrict data such that none of the catalog meets your criteria.

Power user tip: By default, this interface may show you fewer columns than are available in the full catalog. By clicking on "Set Column Restrictions" and selecting "long form" from the drop-down at the top of the pop-up window ("Please select long or short form display"), you can access the full range of available columns. In some cases, there are literally hundreds of columns that you can access!

Click on "Search" to initiate the search. It will load the catalog into a tab of its own. The catalog objects will also be overlaid on the images you have loaded. You can also make an x-y plot from the catalog (for more on the x-y plots, see below). The image and the catalog representations are interlinked -- clicking on a row in the table shows it on the image and vice versa.

To close the catalog search window without searching on a catalog, click on "Close" in the upper left.

On the speed of the catalog results...
>   If the catalog search is successful quickly, it will promptly return the results in a tab of its own.

>   **NOTE THAT** the search may take a long time to return, especially if you have asked for a large catalog, and you may think that nothing has happened, but be patient and eventually it will either spin off to the background monitor (from which you can load it into a tab), or return a tab directly.

>   Searches that take longer than a few seconds get spun off to the background monitor. If it does spin off to the background monitor, it will dynamically update to reflect its status, and will let you know when the catalog is ready to download or display. A popup appears asking if you want to load the catalog. Either click on the popup or explicitly open the background monitor and click on the catalog name to load it into a tab of its own.

Use large search radii with caution! Be sure you understand how many sources you are likely to retrieve. Searches that retrieve more rows will take longer. Searches that retrieve millions of rows will take quite a while.

Note that if you overlay a catalog consisting of tens of thousands of sources, to save bandwidth, what is overlaid on your image at some locations may be a larger symbol representative of several sources at that location; if you then save a regions file from the catalog overlay, then you will end up with fewer sources in the regions file than you have in the full catalog.

Loading your own catalogs

By clicking on the blue "Catalogs" tab, you are by default dropped into the interface for searching for catalogs at IRSA. However, you can pick another tab from the top left, "Load Catalog", to load your own catalog. **This is how to interact with the PTF catalogs - download them to disk, convert them to IPAC table format, and then upload them back again into the interface.**

Your catalog needs to be in IPAC table format ⬀, which is a varietal of plain text. IRSA has a table validator ⬀ which may be helpful, or you can download just about any catalog you find through IRSA, and copy that format.

Your table file MUST have RA and Dec values, and unless it is specified, it assumes J2000.

You can add a "SYMBOL" parameter to change the shape (X, SQUARE, CROSS, EMP_CROSS, DIAMOND, DOT) of catalog marks, e.g.:

```
\SYMBOL = X
```

You can add a "DEFAULT_COLOR" parameter to assign a CSS color name or a HEX value to catalog marks, e.g., either of these two:

```
\DEFAULT_COLOR = lightcyan
\DEFAULT_COLOR = #00FF00
```

You can find the CSS color code or the CSS color HEX values ⬀ online.

Catalogs from the VO -- Overlaying catalogs obtained via the VO

(VO= Virtual Observatory ⬀.)

By clicking on the blue "Catalogs" tab, you are by default dropped into the interface for searching for catalogs at IRSA. However, you can pick another tab from the top left, "VO Catalog", to search for and load catalogs from the VO.

As for the IRSA catalog search, the tool pre-fills the target position with the coordinates of the target with which you have been working. In this case, you are limited to a cone search, so the next option is the cone search radius. As usual, pick your units from the drop-down first, and then enter a number; if you enter a number and then select from the drop-down, it will convert your number from the old units to the new units. There are both upper and lower limits to your search radius; it will tell you if you request something too big or too small.

If you know your VO URL already, you can jump down to the Cone Search URL box and type or paste your URL into the box and hit search.

More commonly, however, users do not know *a priori* which URL to use. Type your desired keywords into the keywords box and click on "Search Registry". All of the URLs it finds for your keywords within the VO registry service are shown in the box. Locate the one you want to use, and click on "Use" on the far left of the corresponding row. The "Cone Search URL" is populated properly for that catalog. Click on "Search" to initiate the search.

The search results are then shown (and interacted with) in the same way as the other catalogs described here.

Example

Load the tool. Search on IC1396. Go to the catalogs tab. Choose "VO Catalog." It wants the root URL for a cone search. I click on "Find Astronomical Data Resources", which takes me here ☑. Search on IPHAS. Get this page ☑. Look for the complete catalog release (not just one associated with one specific study). The name of the catalog goes here ☑. Hit the [+] to expand it. There is one URL listed there, under "available endpoints for the standard interface." Copy that URL and paste it into the search form. The IRSA tool will append your coordinates and radius and return you a table.

Tips and Troubleshooting

Note that searching the VO means that you are using resources not specifically housed at IRSA, so servers may be down, or timeouts set, or limits on numbers of returned sources, etc., that are beyond our control. In most cases the solution is to specify as precise a search as possible. Here are the links to VO registries that we are using, just in case you want to do more flexible searches of the registry. The URL you enter into the box in FinderChart, though, must be a Cone Search base URL (not containing RA and Dec parameters, which are inserted into the URL by FinderChart in response to the search parameters you give it).

The master list of registries is <u>here</u> ⬚. You can also search the registries directly via that link (as opposed to via the IRSA tools).

Columns and filters -- Interacting with catalogs

After you have loaded a catalog, the objects in the catalog are overplotted on your images, and it appears as an additional tab on the left hand side window pane. Additional catalogs you load appear as additional tabs in this window pane. To see more of the columns (and see more of the options described shortly below), grab the divider between the two window panes and slide it right to widen the left hand pane until you can see the icon

that looks like this: .

The table is shown exactly as it appears in the database, with all columns as defined for that catalog. To understand what each column is, please see the documentation associated with that catalog (available via the catalog searching popup window, see figure below, or by navigating through the IRSA website.)
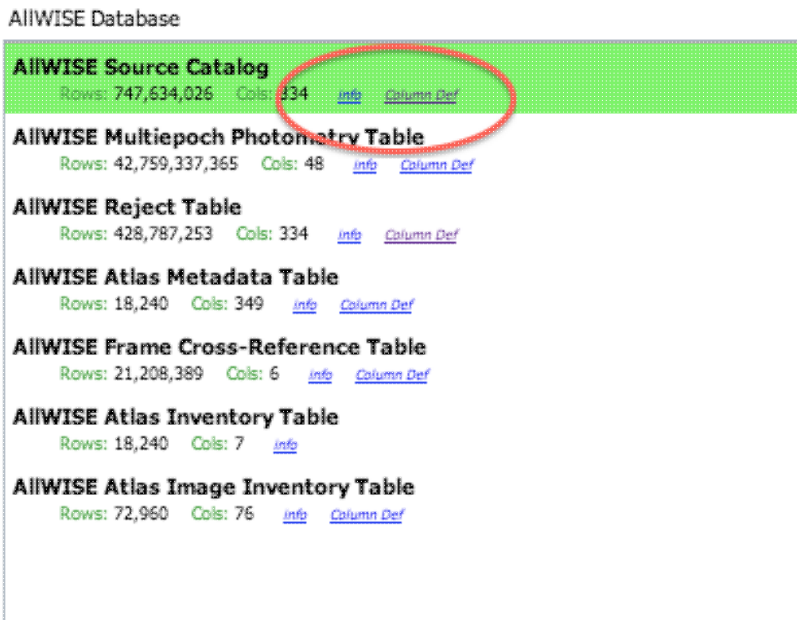
The tab (and table) name itself is the name of the catalog file as stored on the system at IRSA; it is a little cryptic, but the first few words should make it clear whether it is WISE, 2MASS, etc. To remove the tab, click on the blue "X".

Immediately below the tab name, there are several symbols:
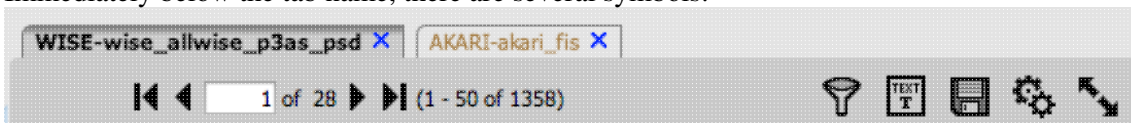
which we now describe.

The first thing to notice is that only the first 50 rows of the retrieved catalog are displayed in the table. In the example, there are 1358 sources that were retrieved as part of the search. The black arrows plus the page number allow you to navigate among these 'pages' of 50 sources each. Note that the entire set of results (not just the 50 rows you are currently viewing) can be sorted alphabetically by clicking on any column's name. (Note also that in the plotting and overlay features described below, all the sources in the catalog are plotted on the images you have, not just the 50 shown in the first page.)

Going from left to right along the top of the catalog tab, the next icon represents a filter: ▽ Filters are a *very* powerful way of exploring the catalog data. Click on this icon in order to start the process of adding filters. A text entry box appears above each of the current catalog columns, with a small version of the filter icon corresponding to that row on the far left. You can type operators and values in these boxes -- hit return after typing or click in another box to implement the filter. For fields with a limited set of choices, instead of a text entry box, a filter icon will appear; click on it to select from the available choices. As an example, to show only those sources with declination above a certain value (say, 31 degrees), type "> 31" in the box above the "dec" column. Or, if you have retrieved a WISE catalog and would like to only view the objects with a W1 (3.4 micron) profile-fitted magnitude less than 6 magnitudes, above the 'w1mpro' column, type "< 6" in the form.

Note that the filters are logically "AND"ed together -- it will impose this AND that AND this other restriction. You can relatively easily restrict things such that no data are left; if that is the case, you will get "There are no data to display." You can then cancel all the filters at once via the cancel filters icon (⊘), or remove them individually by hand by editing the filter boxes at the top of each column, just as you did to impose the filters.

The available logical operators are :

- = which means 'equal to' (exactly!), e.g., the parameter on which you are querying (the column headers as shown) is exactly equal to this value you are specifying.
- > which means 'greater than'
- < which mean 'less than'
- != which means 'not equal to' (exactly!)
- >= which means 'greater than or equal to'
- <= which means 'less than or equal to'
- IN which means 'included within this list', e.g., the parameter on which you are querying (such as "Bandpass") is included within the list you are specifying (if the column filter is free-form text, type "value1,value2" and it will give you rows that have value1 or value2).
- LIKE which means 'resembles the text that is entered', e.g., the text resembles the text that you type in the box.

The next icon is 🔤 -- clicking on this changes the table display into a text display. The icon then changes to ▦ -- click this again to return to the default table view.

The next icon is 💾 which is "Save" -- this is how you may save the whole catalog (*NOTE: the WHOLE TABLE, not just the rows shown*) to your own local disk. It will save it as an IPAC table file ◹, which is basically ASCII text with headers explaining the type of data in each column, separated by vertical bars. By default, the file is called "GatorQuery.tbl" because, under the hood, the software is talking to the IRSA General Catalog Query Engine ◹, powered by Gator.

The next to last option on the top of the catalog tab is this: ⚙ . Clicking on this icon brings up options for the table, e.g., how many rows are displayed per page, and which columns are shown. By default, all columns are shown. The default page size is 50 rows. Note that expanding the page size to numbers much greater than 50 may result in a substantial performance degradation (e.g., your browser will appear to freeze or not appear to be doing anything while it manages and renders the large table).

Note also that if you resize columns, and then go and add new columns, the original columns are resized back to their defaults after the new columns are added.

Finally, when your mouse is in the catalog window pane, you see this as the last option on the top of the catalog tab: ⬈ . Clicking on this expands the catalog window pane to take up the entire browser window. To return to the prior view, click on "Close" in the upper left.

You can also interactively impose filters from [plots you make](#) from the catalog - see the next section.

Plotting catalogs

You can plot your catalog after it has loaded. The plots are another view of the catalog; by default, the catalog comes up in 'table' view, and you can swap back and forth between the 'table' and 'plot' view. After you have loaded a catalog, these icons appear in the upper right, just above the image results pane:
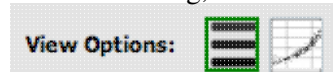
 The first one is table view, and the second is plot view. The current view is boxed in green. Click on the icon to change views. If you do not see this icon, make sure that a catalog tab is in the foreground of the target list pane. To see more of the catalog while still viewing images, click and drag the slider between the panes to enlarge the plot window pane.

To obtain a full-screen view of your plot, click on the expand icon in the upper right of the window pane when your mouse is in the window: ⬈ . To return to the prior view, click the "Close" arrow in the upper left.

The plotting tool, by default, starts with RA and Dec plotted. Note that it does so strictly mathematically correctly -- that is, RA increases to the right (the reverse of astronomical convention). To change what is plotted, click on the gears icon in the upper left of the plot window: ⚙ . Configuration options then appear to the left of the plot. You can choose a single column to plot against another column -- if you have loaded a WISE catalog, you could plot w1snr vs. w1mpro. You can start typing a column name into the X and Y boxes, and it will help provide you viable options from the column headings. Alternatively, you can click on the "Cols" link to bring up a pop-up window with all the columns for that catalog listed. NOTE THAT you must type in the column name *exactly matching* the column headings as displayed. By default, it echoes the x and y labels and units from the original table, but you can change this by clicking on the triangles below each entry box (e.g., make the label "SNR in WISE-1" rather than the more cryptic column header "w1snr").

You can also do simple mathematical manipulations. For example, if you have loaded a WISE catalog, you can plot w1mpro vs. w1mpro-w4mpro. However, note that as of this version, the axes are from min to max in the strict mathematical definition of the term, so in this example, the fainter W1 objects are at the top of the plot. As a workaround for this, plot -w1mpro vs. w1mpro-w4mpro to get the axes aligned in the way you are expecting such that brighter objects are at the top of the plot.
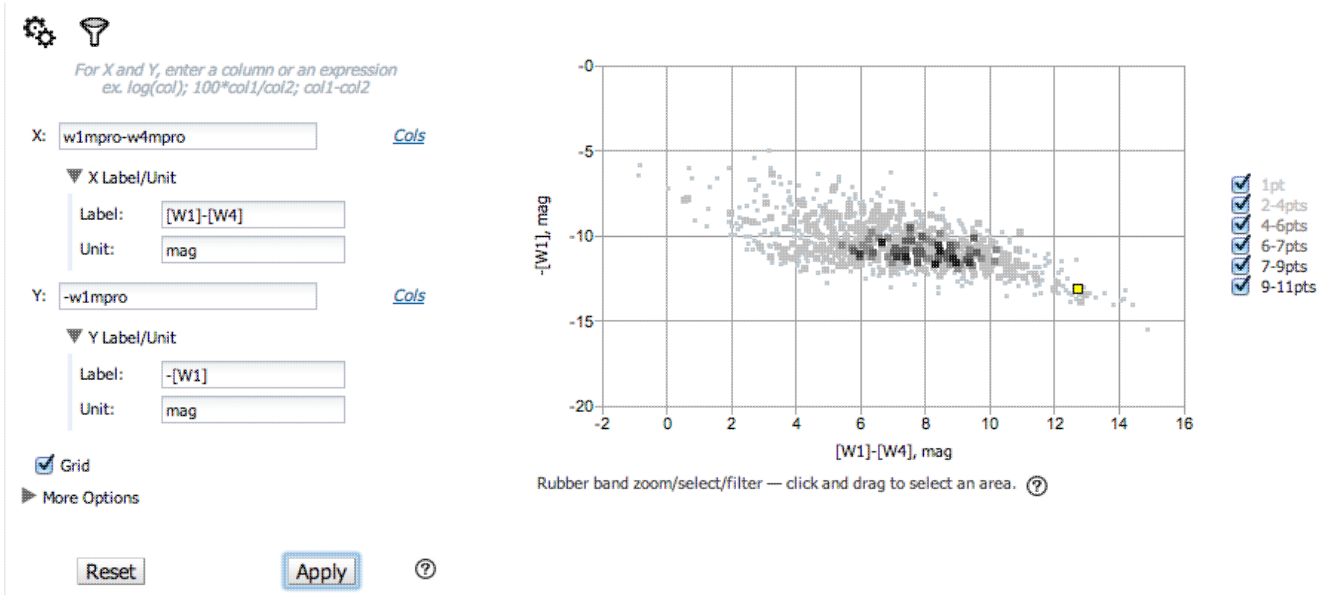
Note that the plot symbols are shades of grey corresponding to how many points are represented at that location in the plot. The lightest shade of grey (and smallest points) represent one point in the plot at that location, and the darkest shades of grey (and the largest points) represent many more points in the plot at that location. Put your mouse over any of the points to find out more about what is represented at that location.

You can add or remove the gridlines via the "Grid" checkbox. If you have zoomed in enough such that there are just black boxes -- one object per point -- you can change the plot style such that the points are connected or unconnected.

You can also **restrict what data are plotted** in any of several different ways. You can set limits based on the "more options" (click on the triangle next to "more options") on the lower left of the plotting window pane, or you can use a rubber band zoom, as follows. Click and drag in a sub-region of the plot. The icons in the upper right of the plot change corresponding to what you can do, in this case to these: . They are, from left to right: zoom in on the region you have selected, select the objects in the catalog, filter the catalog to leave only those objects, or expand the plot to take up the whole browser screen. If you click on the zoom icon, then the plot axes change to encompass just the sources you have selected. If you click on the select icon, then the plot symbols corresponding to your selection change shape and color, the corresponding objects overplotted on the image in the image window pane change color, and (if you change back to the table view of the catalog), the rows (corresponding to those sources) in the catalog are highlighted. If you click on the filter icon, then the catalog view is filtered down, restricted to just those sources you have selected, and the filter notes in the upper left of the plot window (and in the table view of the catalog) change to remind you that you have a filter applied. Only those sources that pass the filter are shown overlaid on the image(s). (This is the behavior of 'filter', as opposed to 'select'; the former restricts what is shown, the latter just highlights the objects.) For more on filters, see the filter section.

If you move your mouse over any of the points, you will get a pop-up telling you the values corresponding to the point under your cursor. If you click on any of the points, the object(s) corresponding to that point will be highlighted in the overlays in the images shown, and highlighted in the catalog table view of the catalog. This works the other way too - click on a row in the catalog, or an object in the images, and the object will be highlighted in the plot or the catalog or the image.

If you have a very large catalog or many points in a particular location of the plot, the tool will rebin the points in the plot such that displaying the plot is faster. The plot symbols are shades of grey corresponding to how many points are represented at that location in the plot. Put your mouse over any of the points to find out more about what is represented at that location. It will tell you how many catalog rows correspond to that point, and clicking on it will highlight all of the corresponding rows in the table view and the image overlays. In order to have the tool plot one point per row, you need to zoom in or otherwise restrict the data such that there are 'few enough' points represented in the plot. If there is just one point in the plot that needs to be rebinned, all of the points will be a small point.

Want to save a plot to file? At this time, the best way to do that is a screen snapshot. On a Mac, this is accomplished via holding down command, then shift, then 4, then let go and your mouse cursor changes. Hit the space bar to select the window over which your mouse is hovering. Your mouse cursor changes again, and hit the mouse button. A snapshot is then saved to your Desktop, tagged with the date and time.

Once you have made an x-y plot, the plot is then effectively treated as another 'image' in the stack of images you have loaded into the tool. In the [Visualization section], it describes various features, including blinking images, and removing images from the blink sequence. If, after you make a plot, you want to blink or tile some of the FITS images, you will need to remove the plot from the image sequence, as described in the [Visualization section].

Examples of catalog plots

Example: Plotting IRAS and WISE catalogs in a PTF region

Here, we will perform a search on a region where there is an IRAS point source, find that source, get the WISE catalog for the region, and make a plot to identify that source and a possible optical counterpart to it.

1. Search on 19:24:57.6 +46:34:16. All the default parameters for the search are ok.
2. After it returns, select any row in the results and inspect the image in the "Image Preview" on the right. For this example, I am using expid 79893. Which object is likely to be a candidate counterpart to the IRAS source? It's not at all obvious. The center of the search is the blue circle.
3. Where is the location of the IRAS source? Click on the blue "catalogs" tab. By default, it is set to cover a region similar to your original search (you can change that, but you don't need to for this example). Select Project=IRAS on the left. Select the IRAS Point Source Catalog (not the Faint Source Catalog) on the right. Click "Search."
4. You may have to wait a few minutes for the catalog to be returned. It will ask you if you want to load the results. Say yes.
5. It should find only one source, at the position we searched on. (In this case, not a coincidence!) Click on the 'layers' icon, and turn the IRAS PSC overlay off and on by clicking on the tickbox for it, and watch the symbol come and go on the image accordingly. However, this is not particularly helping with respect to what the bright IR counterpart might be in this optical image. Leave this catalog turned off for now.
6. WISE should have also seen this object. Let's get a WISE catalog to overlay it. Go back and click on the 'Catalogs' blue tab. This time, pick WISE from the left and the AllWISE Source Catalog from the right. Click "Search"
7. It may take a few seconds to load and display this catalog. (It will ask you if you want to load the results. Say yes.) You should now have many sources overplotted on the image. If you click on any source overplotted in the image, it is highlighted in the table (and vice versa), but we still don't know which one is bright and red enough to be seen in IRAS. Let's make a plot to see if we can tease out which things are bright in the IR.

8. In the upper right of the browser window (just above the image window pane), there is this display:
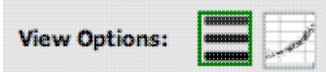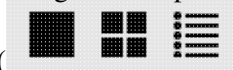
View Options: [icons] . By default, the catalog is shown as a table. Click on the plot icon (far right) to view the plot.

9. The plot comes up with an RA/Dec plot by default. Two things to note: (1) RA is increasing to the right, not the left, because it is plotting strictly mathematically min-to-max. (2) Each point represents more than one row of the catalog. Mouse over or click on a point to see how many rows are

represented:
```
ra = 325.4706 deg
dec = 57.4528 deg
point represents 36 rows
```

10. Click on the expand [icon] icon in the upper right of the plot window. Click on the one-image-at-a-time icon in the expanded view if necessary ([icons]).

11. Click on the gear [icon] icon in the upper left of the plot window.

12. Enter in the x box: w1mpro-w4mpro. This is WISE-1 profile-fitted measurement in magnitudes minus WISE-4 profile-fitted measurement in magnitudes,or [W1]-[W4].

13. Click on the triangle next to "X label/unit", and enter "[W1]-[W4]" for the label. Enter "mag" for the unit.

14. Enter in the y box: -w1mpro (the minus sign is important to put the bright objects at the top of the plot, but note that the numbers as plotted will then be negative.)

15. Click on the triangle next to "Y label/unit", and enter [W1] for the label. Enter "mag" for the unit.

16. Leave the "grid" box checked.

17. Click "Apply."

18. Obtain this plot:
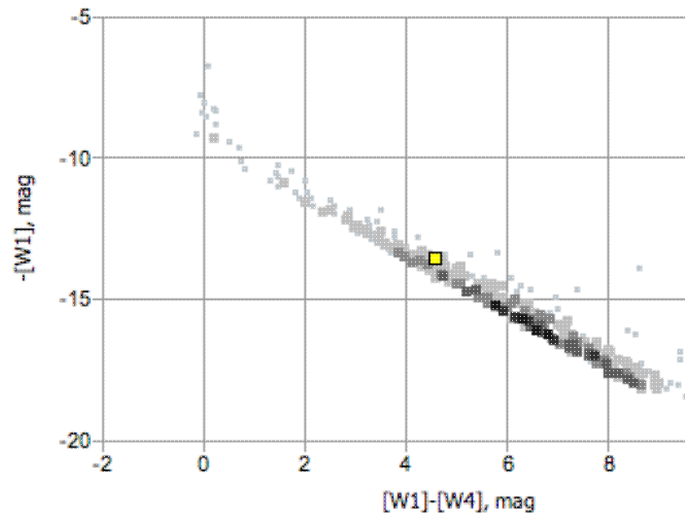
19. Note that all of the points are shades of grey, denoting that at least one of the points in the plot is representative of more than one row in the catalog.

20. Click and drag from corner given approximately by (-1,-6.3) to (10,-15).

21. The icons in the upper right change after you do this, and we want to zoom on this region. Click on the magnifying glass with a "+" inside.

22. After we zoom, the points are now shown as solid squares. This denotes that every point shown is truly a single row in the catalog.

23. We are still looking for bright sources likely to have an IRAS counterpart. Find the brightest source near [W1]-[W4]~0. Click on that point. No objects appear highlighted in our image, so this object is not in the field of view. Working down the next brightest sources, I don't see anything change in the image on the right... until I get to the 4th source or so. If you are having trouble selecting that individual point, click on the brightest star directly above the search position in the image. That source should be highlighted in the image and the plot at the same time, e.g.:
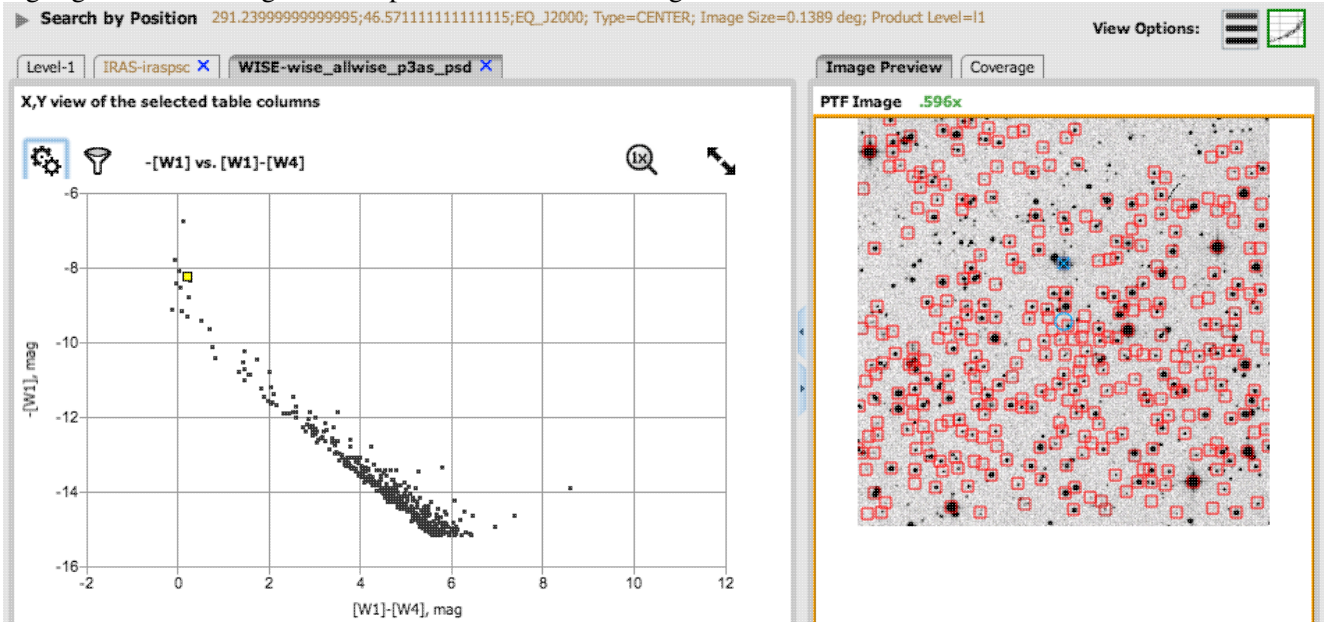
24. That source could be bright enough to contribute to the IRAS flux. But there is also a brightish red source down near [W1]~14, [W1]-[W4]~8, which should still appear in your zoomed-in plot. Click on that point and see where it falls in the image. It should be the closest WISE source to your search position (=the position of the IRAS source). This one is also a possibility for contributing to the IRAS point source measured flux density.

25. What are the WISE names of these objects? With either one selected in the image (or the plot), click on

the table view option (the first icon here): The object is highlighted in the table. I get that the fainter, red object should be J192458.19+463421.2, and the brighter object in this PTF image should be J192457.86+463303.9. By scrolling over in this catalog, you can see the measured magnitudes at the WISE bands for these objects.

26. Download the PTF data, and obtain the catalog from each exposure as part of the products that come with the data. Consult the PTF documentation in order to extract and then examine the light curves for both of these objects.

Downloading Data in PTF Image Service

Contents of page/chapter:

+Overview
+Options for Downloading Data
+Downloading Script
+Contents of your download - Quick Start

Overview

In the simplest case, on the search results page, just click the checkboxes on the far left of each row to pick specific data files to download, and then click "Prepare Download" to begin the packaging (and downloading) process. A pop-up window will appear in order to define exactly what kinds of data you would like to have packaged up. Clicking "prepare download" in the pop-up initializes this process.

To select *all* of the data you have displayed, click on the checkbox at the top of the column of checkboxes, and all of the rows are automatically clicked (even those on subsequent pages if you have more than one page). Then click "Prepare Download" to initiate the packaging process.

The packaging process spins off into the **background monitor**, which keeps track of its progress and notifies you when the downloads are complete. You can choose to have an email sent to you to let you know when things are ready, even after the packaging process has started.

Note that **you** control where the data are saved on your disk through your browser; your browser may be configured to store all downloads in a particular location on your disk. Look for a "Downloads" folder or search for recently modified files.

Options for Downloading Data

From the pop-up, you can choose whether or not to download the Level-1 Single Exposure processed images, or the Level-2 Coadded images.

The second option in the pop-up is "Download Ancillary Files." From here, you can select whether you would also like the mask files, the raw (Level 0) images, and/or the SExtractor or PSF catalogs that go with your selected data. The options that appear depend on whether you selected "prepare download" from the Level 1 or Level 2 tab. Some options may only work if you have **proprietary access**. Any error messages will be packaged with the downloaded data.

The next option asks if you would like to download full images or just cutouts.

Next, the choices here refer to how it packages up the data for you within a zip file. Your choices are to have it delivered in a "flattened" disk structure (without sub-folders), or "structured" (with sub-folders.

The last section of the pop-up gives you an option to provide an email address to which it will send an email when the packaging is done. (Within the same session, or if you are logged in, it remembers what you have entered before, but when initiating a new session, you will have to re-enter this information.)

Click "Prepare Download" in the pop-up window, and it will go do it!

When it packages up the data, it will spin off to the [background monitor](#) and create zip files. This process could be virtually instantaneous, or take some time. You can watch it in the background monitor. If your packaging is taking longer than expected, you can add an email address mid-stream, and it will email you when it is done.

Downloading Script

The Download Retrieval Script dialog gives you some options regarding which script you want to use. Generally speaking, the wget script is best for Linux and Unix users. The curl script is best for Mac users, because curl is part of the standard OS distribution; Mac users can also go retrieve and install [wget](#) ⬚ and then use the wget scripts. For any of the scripts, you can also choose to include an option that unzips the zip files automatically. The files stay on disk here for at least 72 hours, so you have a window of time to download them.

Save the script to a plain text file, and invoke the script. You can copy and paste the script lines individually into your terminal window, or by typing "csh [yourtextfile]" at the prompt. The files will be automatically and sequentially downloaded to your disk, and if you've selected that option, unzipped as well.

For Windows users, download and save the text file of URLs . Then follow the following steps to install the wget script and then download your data:

1. Go to the [Windows wget web page](#) ⬚
2. Scroll to the Download section and retrieve the wget installation.
3. Install wget and add the binary to your path.
4. Download the text file of URLs
5. At the command prompt: wget --content-disposition -i <file_of_urls_downloaded.txt>

If that is not working, try [7zip](#) ⬚.

Depending on how, exactly, you unzip your files, your computer may put the contents of each *zipfile* into one directory, rather than, say, the contents of each *observation* into one directory. If you are using a GUI-based method (e.g., click to uncompress), there should be a preferences option to allow you to uncompress subsequent zipfiles into the same root directory. If you use the download script above, the flags sent on the command line that unzip the files should put all files from the same observation in the same directory.

Contents of your download - Quick Start

The [PTF page on file naming conventions](#) ⬚ breaks down the filename structure for Level 1 (individual frames) and Level 2 (combined frames) data. We strongly recommend reading the documentation at the PTF site to understand the contents of your download. However, very briefly, depending on what level you are downloading, and what files you select for packaging when you download your data, you can get:

- *.fits = fits files. Alphanumeric strings define such things as the time, filter, and pipeline version. (See [PTF page](#) ⬚)
- *daopsf.rpsf = PSF
- *depcov.fits = depth of coverage image, in units of input images
- *psfcat.ctlg = Binary fits table with DAOPhot-based PSF photometry catalog
- *psfgrd.fits = Image of coarse grid of PSFs showing variation across the image
- *refimg*.fits = reference image (Level 2 summed image). Note that the characters at the end of the filename (which may be all your computer shows you by default) may be different (e.g., "asec500")
- *sexcat.ctlg = Binary fits table with Sextractor-based aperature extraction photometry catalog
- *srcds9.regn = region file for extracted sources

- *uncert.fits = uncertainty image

PTF Image Service: User Registration for the IRSA Archives

There is one user registration for all IRSA applications, but data access, preferences, search history, data tagging, etc., are all unique to each archive.

While you certainly **do not have to register** to search the archive, download data, analyze data, and write a paper, you may wish to register.

On the other hand, *if you have access to the PTF proprietary data, you will need to log in* so that the system grants you access to your data. If you got email from the PTF project about account information, you may already have an account; otherwise you can set up an account (see below). Once you have set up an account, please contact the PTF project so that we can tie your new account to your proprietary data.

Login

The "Login" link is in the far top right of the page.

Select this option to log in if you know your password, or to create a new account.

Create Account

Find this option by selecting "Login" in the far top right of the browser window, and then "Create an account" appears as an option in the lower left of the pop-up window.

Select this option to create a new account.

Forgot your Username or Password

If you do not remember your username or password, select this option to retrieve this lost information.

Find this option by selecting "Login" in the far top right of the browser page, and then "forgot your password?" appears as an option below the Login button.

Edit Profile

Find this option by logging in, and then clicking on your account name in the top right of the browser window. Then, select "Edit Profile" to change your password on an existing account.

Change Password

Find this option by logging in, and then clicking on your account name in the top right of the browser window. Then, select "Change Password" to change your password on an existing account.

Update Email

Find this option by logging in, and then clicking on your account name in the top right of the browser window. Then, select "Update Email" to change your email on an existing account.

Frequently Asked Questions (FAQs) about the IRSA/PTF Image Service

I've retrieved a catalog from the catalog tab (e.g., not a PTF catalog). What are all these columns?

> The columns that are returned are exactly those that are stored in the corresponding archive for that catalog. Each catalog is different. Please check the project's documentation for each catalog separately -- catalogs retrieved from IRSA have documentation that is available at IRSA, but you can also retrieve catalogs via the VO, so the documentation for those catalogs would be at the catalog's place of origin. Some of the more commonly used IRSA ones are:
>
> > ◊ [2MASS](#) 🔲
> > ◊ [WISE](#) 🔲
> > ◊ [IRAS](#) 🔲

I've created a nice image within the FITS viewer, and I have the stretch and overlays exactly the way that I want them. How do I save this?

> The diskette icon in the toolbox enables you to save the image as a FITS file (no overlays), a ds9 region file (just the overlays), or a PNG file (a copy of what you are viewing, image with that stretch plus overlays).

What do I do with the zip files I get when I download data?

> To uncompress the files you have downloaded, type "unzip foo.zip". To uncompress multiple files at once, type "unzip '*.zip'" (the single quotes are important), or "unzip *.zip" -- you just have to escape out the wildcard. If you have a Windows machine, try [7zip](#) 🔲.

How do I get more help?

> The "Help" blue tab leads you into this online help, as does "PTF Help" from under the "Help" in the IRSA menu on the top of the PTF page. You can also download a PDF version of this manual; look at the top of the help window.
>
> You can submit questions to the [IRSA Help Desk](#) 🔲.

How do I report a bug?

> The known bugs and issues in this version of the PTF Image Service are listed [here](#) 🔲. If you think you have found a bug, before reporting it, please check this list, and read this online PTF Image Service help. It may be a "feature" we already know about. If you have found a new, real bug then please do contact us via the [IRSA Help Desk](#) 🔲. Please include your operating system version and your browser software and version. If you can, please also include any specific error message you may have gotten. (NB: In our testing, copying shortcuts worked on Windows and Linux; the command-C did not work on Macs, but selecting and clicking the right mouse button did.)

PTF Image Service: Notice to Users -- Privacy Notice

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- The date and time you access our site
- The pages you access (recorded by the text and graphics files that compose that page)
- The Internet address of the website from which you linked directly to our site.

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The website also collects and stores information about your search options, such as

- Name resolver choice (NED/Simbad)
- Page size (number of rows)
- Which search results (tabs) should be displayed
- Email address, if provided, for email notifications
- Search parameters so that you can resubmit your search via your search history
- Data tags, if you create one
- Plus, additional preferences that may be developed in the future, such as those tied to the visualization options.

If you register as a user, these options will be kept in our database (along with your login ID and password via MD5 hash) and used for your session the next time you log in. If you do not register as a user, these options are set via cookies kept on your computer; if you clear your cookies and start a new session, these preferences are lost.

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