

How Do I...

Find data for objects in a given RA / Dec / Magnitude / Absolute Magnitude Range?

You can check use the SDSS search tools to find all objects that meet certain criteria, such as position, magnitude, color, or absolute magnitude. For position, magnitude, and color, you can use the Imaging Query Form. For absolute magnitude (and any of the others), you can write queries in SQL.

See the directions for using the Imaging Query form below, then see the **RA** and **Dec** and **Magnitude** sections of this guide to learn how to search by those parameters. See the **Absolute Magnitude** section to learn how to use SQL to search for objects by absolute magnitude.

To use the Imaging Query Form:

1. Go to the Imaging Query form. From the main page, click **Imaging Query**. You will see a screen like this:

The screenshot shows the 'Imaging Form Query' interface. At the top, there's a 'Submit Request' button and a text input for 'Limit number of output rows (0 for unlimited) to 50'. Below that, 'Output Format' is set to 'HTML'. A note says: 'Please see the [Query Limits help page](#) for timeouts and row limits. To get FITS files from the [Data Archive Server \(DAS\)](#), save results to CSV file and upload it to [DAS retrieval form](#).' The 'Parameters to return' section has three columns: 'Imaging' (dropdown: minimal, typical, reddec, model_mags, model_magerrs), 'Spectroscopy' (dropdown: none, minimal, typical, reddec), and 'Filter (for DAS use)' (checkboxes: u, g, r, i, z). Below this is another 'Submit Request' button. The 'Position Constraints' section has a 'Rectangle' radio button and two rows of input fields for 'min' and 'max' RA and Dec. A note says '(max 10 square degrees)'. The browser's status bar at the bottom shows 'Done'.

2. In the **Limit number of output rows** textbox, enter the number of objects you would like the search to return. If you want unlimited number of rows returned, enter 0.
3. In the **Output Format** textbox, enter the format you want for your output. **HTML** will output results as a table in your browser. **CSV** output can be read by many graphing programs.
4. In the *Parameters* section, select what types of **Imaging** data you would like returned. *Typical* returns the most common parameters. You can select any parameters from the menu. To select more than one, hold down CTRL while clicking on each one.
5. Select what types of **Spectroscopy** Data you would like returned. If you select *None* under Spectroscopy, the tool will not return any spectral data. If you select any of the other options, the tool will return spectral data for all objects, including those for which no spectrum has been observed – but objects without an observed spectrum have zeroes for all spectroscopic data.
6. You can use the **Filters** checkboxes to choose which filter names to return. The Imaging Query Form will return only the names of the filters, not the images. You can then use the filter names as part of a query to the Data Archive Server (DAS).
7. The rest of the page allows you to select the constraints for your search. See the directions below to learn how to choose positions and magnitudes as constraints for your query.

To find objects in a range of positions (RA and Dec):

One of the constraints you can use is to find objects only in a specific part of the sky. Use the *Position Constraints* box to choose constraints. You can choose not to use any position constraints (*None*), or you can choose one of three types (*Rectangle*, *Cone*, and *Proximity*).

1. *Rectangle* finds objects within a rectangle between a minimum and maximum RA and Dec. Enter minimums and maximums for RA and Dec, either in decimal degrees or in HMS/DMS. HMS input can be formatted as either HH:MM:SS.ss or HH MM SS.ss.
2. *Cone* finds objects within a radial patch of sky defined by a center RA/Dec and a radius. The default value is a cone search around RA = 180, Dec = 0.2.
3. *Proximity* finds objects near to a list of positions. You give the list, either by pasting into the textbox or by uploading a file. You can optionally specify a maximum separation in which to search.

4. When you have finished entering all your constraints, click **Submit Request**. The tool will return only the objects you asked for, in the output format you specified.
5. If you would rather use SQL to search by position, change your query so that you use one of the position functions, either `dbo.fGetNearbyObjEq(ra,dec,radius)` or `dbo.fGetObjFromRect(ra1,ra2,dec1,dec2)`. Specify the function in the **FROM** block, and be sure to check that the object IDs are the same in the **WHERE** block. So here is a query to search a radial patch of sky, returning IDs and positions:

```
SELECT p.objid, p.ra, p.dec
FROM PhotoObj p, dbo.fGetNearbyObjEq(180,0.2,5) n
WHERE n.objID = p.objID
```

Don't forget the line in the **WHERE** block, or else the query will return the whole database!

Here is a query to search a rectangular patch of sky, returning IDs and positions:

```
SELECT p.objid, p.ra, p.dec
FROM PhotoObj p, dbo.fGetObjFromRect(1.0,1.25,0,0.25) n
WHERE n.objID = p.objID
```

To find objects in a range of magnitudes:

Instead of, or in addition to, searching by position, you can also tell the Imaging Query Form to search by magnitude. To do this, use the *Imaging Constraints* section. The default is no constraints (that is, to return stars with any magnitudes).

1. First, select the **Type** of magnitude on which you would like to search: *Petrosian*, *Model* (the better fit of a DeVaucouleurs and exponential profile), or *PSF*.
2. Next, enter the magnitudes you would like to search for in the **Magnitudes** textbox. You can enter constraints on any of the SDSS's five filters (u, g, r, i, z), and you can enter minimums and/or maximums for each value.
3. You can also search for specific colors using the **Colors** textboxes, or for specific object types with the **Obj Type** checkboxes.
4. You can also search for the presence or absence of specific flags. See the document *How do I check quality of SDSS photometry for an object (photo flags)?* to see what flags mean and how to use them.
5. When you have finished entering all your constraints, click **Submit Request**. The tool will return only the objects you asked for, in the output format you specified.

6. If you would rather search by magnitudes with SQL, add the following line to the **WHERE** block of your query:

```
WHERE g < 17
```

Substitute any of the filters, the operator (=, <, >, <=, >=, !=), and the value. You can also use BETWEEN to specify a range of magnitudes.

For example, here is a query to find objects with r magnitudes between 15 and 19:

```
SELECT top 10 objid,ra,dec,r  
FROM PhotoObj  
WHERE g BETWEEN 15 and 19
```

Here are the results that it returns:

objid	ra	dec	r
587724197469028487	7.065522	13.789617	17.28
587724197469028498	7.077131	13.842591	17.658
587724197469028714	7.069536	13.823497	17.303
587724197469028527	7.111782	13.921283	17.454
587724197469028473	7.019663	13.79197	18.036
587724197469028541	7.133472	13.834375	16.888
587724197469028472	7.022366	13.789673	16.601
587724197469028503	7.080944	13.929755	17.354
587724197469028506	7.079892	13.856428	17.656
587724197469028546	7.138872	13.795383	17.55

To find objects in a range of absolute magnitudes:

Unfortunately, the Imaging Query Form allows you to search only by apparent magnitude, which is what is observed and stored in the database. Absolute magnitude relies on a distance calculation, which the SDSS can supply through redshift. Assuming Hubble Cosmology, the distance is equal to (4,280 MPc) x redshift. So the equation for absolute magnitude is

$$M = m - 5 \log(4,280 \text{ MPc} \times d) + 5.$$

SQL can perform simple mathematical calculations. So searching for absolute magnitude requires two things: searching the specPhoto view, which has both photometric and spectroscopic data, and adding this statement to your **WHERE** block:

```
WHERE modelmag_r-5*log10(4.28E+08*z)+5 < -21
```

For example, this query returns the object IDs, positions, and apparent and absolute r magnitudes for all objects with absolute magnitude less than -21:

```
SELECT top 10 objid,ra,dec,modelmag_r,modelmag_r-5*log10(4.28E+08*z)+5 as
abs_mag_r
FROM SpecPhoto
WHERE modelmag_r-5*log10(4.28E+08*z)+5 < -21
```

Here are the results that it returns:

objid	ra	dec	modelmag_g	abs_mag_r
587728949047722210	150.36554	0.155147	17.367	-21.510198
587722983344767535	166.40895	0.105307	18.557	-22.991739
587722983882162259	167.62318	0.616865	17.484	-21.388467
588848901525209245	184.37205	1.198946	17.562	-21.180317
588848899917611771	191.33626	-7.083175E-3	18.821	-22.842497
588848898844524765	192.80449	-0.850273	18.397	-24.27151
587722982821199898	196.80601	-0.407725	17.099	-23.525777
587722982285836573	200.25232	-0.747637	18.152	-22.465414
588848898850095315	205.57543	-0.89457	18.011	-23.9065
588848898850095241	205.57483	-0.859905	25.828	-23.370206