

Fig. 1

1. VO Data Discovery With pyVO

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- Virtual Observatory?
- Data Discovery?
- pyVO?
- Data Discovery in the Virtual Observatory with pyVO.



Funded by e-inf-astro, BMBF FKZ 05A20VH5

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2. What is the VO?

It's a

comprehensive set of data and services
relevant to **astronomy**
accessible from **clients of your choice**
regardless of where you are and
preserving products of digital astronomy.

3. Oh, Really?

If that's too much, try this:

(cf. Fig. 1)

In case you don't immediately recognise TOPCAT here (and you occasionally work with tables), you owe it to yourself to have a look at it: <https://www.star.bris.ac.uk/mbt/topcat/>

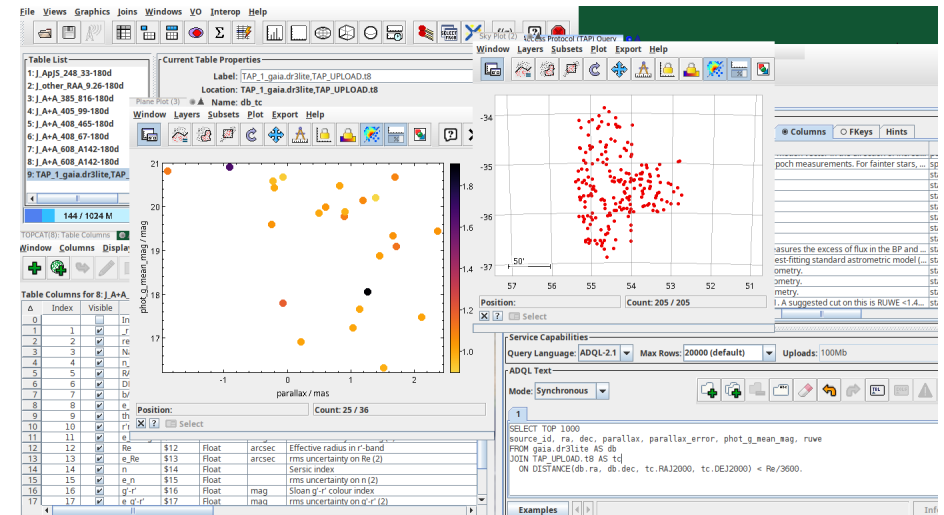


Fig. 2

4. Brief Demo

Assume you'd like to see if there is a point-like object in an LSB Galaxy from the Fornax Cluster in the Gaia catalogue (18 Mpc, distance modulus 31^m, so it probably won't be a star).

So: open VO/Cone Search, look for "LSB Galaxies"; conveniently, there's "Fornax Deep Survey with VST. III. LSB galaxies".

Let's pull the whole catalogue: RA, DEC 0,0, SR 180, double click on "J/A+A/608/A142".

Do a Sky Plot, briefly inspect the column metadata.

Now open VO/TAP, look for Gaia. Select the GAVO DC TAP service, look for the gaia.dr3lite table, select it, hit Examples → Upload → Upload Join.

Collect a few interesting columns by Control-Click and replace the * with them by clicking on "Cols" (but that's just a style thing, the * would have worked). Change the search radius to Re/3600; your query will then look somewhat like

```
SELECT TOP 1000
source_id, ra, dec, parallax, parallax_error, phot_g_mean_mag, ruwe
FROM gaia.dr3lite AS db
JOIN TAP_UPLOAD.t8 AS tc
ON DISTANCE(db.ra, db.dec, tc.RAJ2000, tc.DEJ2000) < Re/3600.
```

Send the query off, and in the result plot (say) the G mag vs. the parallax with ruwe on the aux axis.

If this were a reasonable science case, you'd now start your analysis.

(cf. Fig. 2)

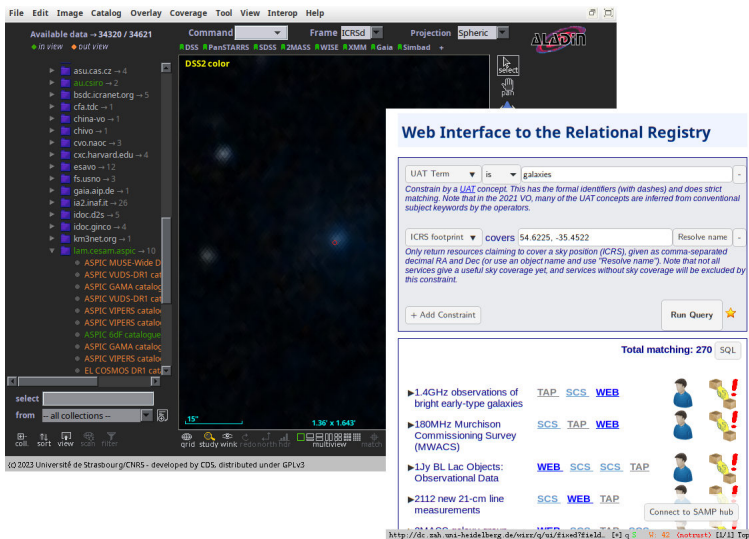


Fig. 3

5. Registry?

The VO Registry is what told TOPCAT where data on LSB galaxies can be queried and where you can run ADQL queries against Gaia tables.

Behind the scenes, Registry discovery just doing TAP queries (usually on a box here in Heidelberg), too.

But the queries to do that are not trivial to write, which is why you usually use the Registry through UIs.

6. Registry UIs

(cf. Fig. 3)

Two other ways to use the VO registry: On the left, Aladin's Discovery Tree (which uses coverage information from the registry to colour resources that definitely don't have data in the displayed part of the sky orange and ones that may have data green). The image, by the way, is one of the objects we found in our brief demo.

On the right, there's WIRR, a web interface with an, umm, itunes-like interface to query the Registry. Find it at <https://dc.g-vo.org/WIRR>.

7. In Python

The astropy-affiliated package pyVO has interfaces to most of the VO; in particular to the Registry. The rough plan is

- a function `registry.search`
- accepting any number of constraints on text, coverage, content...
- and returning objects from which you can construct services

```
from pyvo import registry

matches = registry.search(registry.Spatial((347.38, 8.6772)))
for m in matches: print(m.short_name)
svc = matches['ROSAT images'].get_service("sia")
images = svc.search((347.38, 8.6772))
```

pyVO is Debian-packaged (python3-pyvo) and pip-installable.

8. Demo Time

Try the notebook at

<https://blog.g-vo.org/media/2023/data-discovery-demo.ipynb>.

9. Parting Words

Do you want to learn more?

There will be a course on using the VO in the summer semester 2024 (Thursday morning).

Do you want to help out?

Please make your data available in the VO. VizieR tables count, and ESO by now does a good job, but still: too much stuff rots on too many disks.

Talk to me about getting your data into the VO!