The CDS Intro tutorial

2nd ESCAPE - Virtual Observatory School

February 2022

Tutors: Stefania Amodeo, Sébastien Derriere

In this tutorial

CDS — Centre de Données astronomiques de Strasbourg
Strasbourg astronomical Data Center

Gather information and data on specific astronomical objects using the CDS tools:

SIMBAD Object database

VizieR Catalogue database

ALADIN Interactive sky atlas

X MATCH Cross-match service
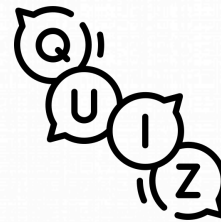
https://cds.unistra.fr

Plan

1. Intro to CDS services and guided exercises (~1h)

2. CDS services in a python Jupyter notebook (~1h)

It's your turn!

It's quiz time!

- Ask questions on the zoom chat

- Questions can be answered on-air or in a breakout room

The CDS portal
Entry point to all services

https://cdsportal.unistra.fr

The CDS portal
Entry point to all services

Open the CDS Portal and make a query for 12 01 53.002 -18 52 03.32 (NGC4038).

The result provides an overview of the information and data available for this object.

Click on More info in Simbad to see the full SIMBAD information on this object in a new tab.

https://cdsportal.unistra.fr

SIMBAD

The reference database for the identification of astronomical objects

Basic Info

Aladin Lite widget

Hierarchy: environment (parents, children, siblings)

Alternative identifiers

Literature on the object

http://simbad.cds.unistra.fr/simbad/

6

SIMBAD

The reference database for the identification of astronomical objects

The main Object Type of NGC4038 is Galaxy in Pairs of Galaxies (GiP).

Note the list of "Other object types". These types are drawn for the literature and are stored in SIMBAD using a hierarchical classification scheme. The full list of Object Types can be found here: https://simbad.cds.unistra.fr/simbad/sim-display?data=otypes .

In the Hierarchy section, use the "parents" button to identify the name of the galaxy pair. Sorting by the number of references can help bring out the most important ones.

Follow the link to the SIMBAD entry of the Antennae galaxy pair. There click on the children button to identify the name of the two galaxies making up the galaxy pair. Again the number of references might help to find them.
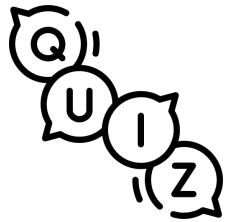
http://simbad.cds.unistra.fr/simbad/

SIMBAD

The reference database for the identification of astronomical objects

- How is NGC4038 "parent" classified?

- What is the name of the other galaxy of the pair?

- Which survey measured the angular size of NGC4038 and at which wavelength?

http://etc.ch/ijif

Aladin

The interactive sky atlas for access, visualisation and analysis of astronomical images, surveys, catalogues, databases and related data

https://aladin.cds.unistra.fr/aladin.gml

Aladin

The interactive sky atlas for access, visualisation and analysis of astronomical images, surveys, catalogues, databases and related data

Open Aladin

Type "NGC4038" in the "Command" box and press Enter. By default, Aladin will display a DSS colour image. Other images can be displayed by selecting them in the left column. For example, select the PanSTARRS DR1 and 2MASS colour images one after another to see a higher resolution image and an image at infrared wavelength of the galaxy pair. You can zoom in and out by scrolling your mouse.

We want to look for available data related to HII regions in these interacting galaxies. Use the SERVER SELECTOR window, which can be opened via File → Open server selector…

Select the SIMBAD tab in the SERVER SELECTOR and query for HII within 14 arcmin around NGC 4038.
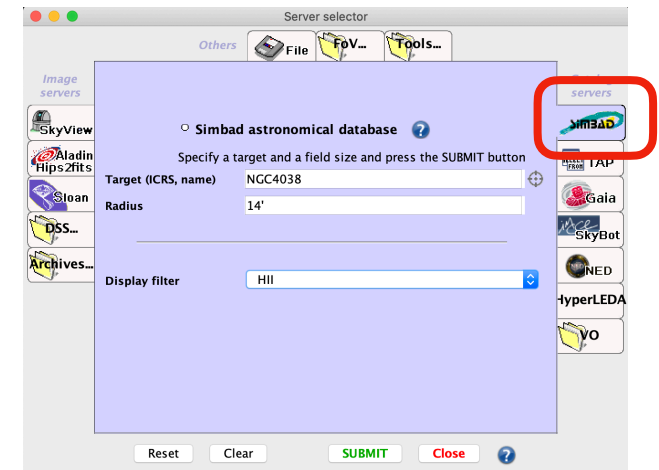
Aladin - SIMBAD - VizieR

Using the Select tool (top of the toolbar), select some of the SIMBAD points either by clicking on one point or by holding the left mouse button and drawing a rectangle. The sources within the rectangle are then selected and displayed as a table below the image. Note that the data point belonging to a row in the table blinks in the main viewing window when hovering over the table row with the mouse.
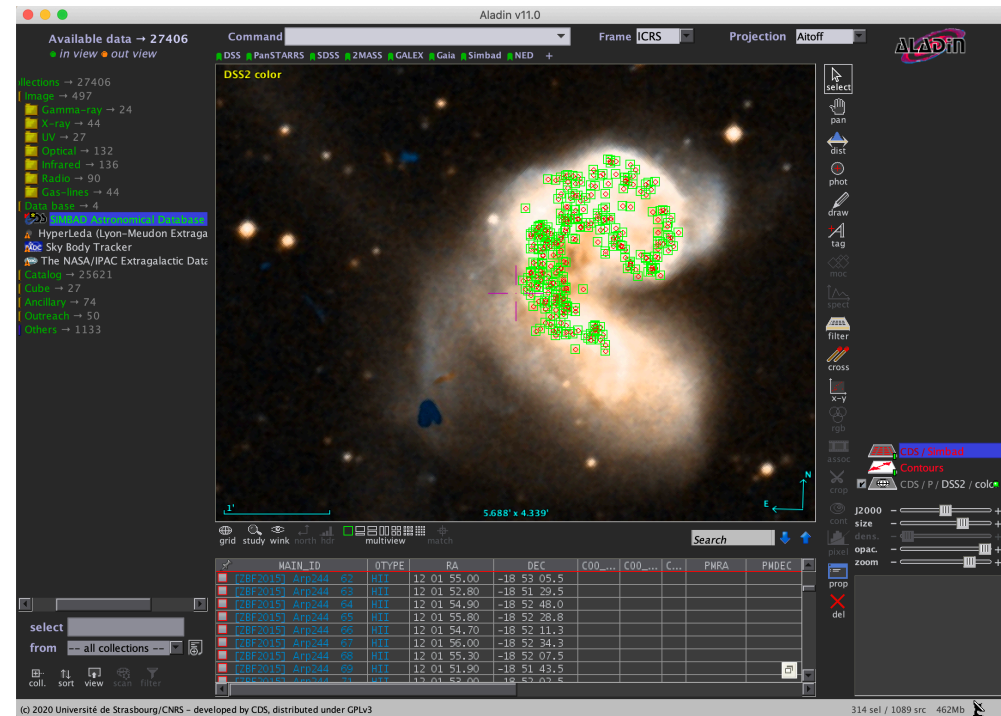
We notice that many sources belong to the reference [ZBF 2015]. Click on one of them to load related data in SIMBAD in your web browser. Scroll down to the "References" section in SIMBAD, display them and identify [ZBF 2015]. Open the catalogue in VizieR following the link to J/MNRAS/451/1307.

VizieR

*The catalogue service for the CDS reference collection
of astronomical catalogues and tables published in academic journals*

Target

Readme

Submit button

Options (additional columns, output format,…)

Restrictions on column values

https://vizier.cds.unistra.fr/index.gml

VizieR

*The catalogue service for the CDS reference collection
of astronomical catalogues and tables published in academic journals*

Query the VizieR table associated with the article J/MNRAS/451/1307 containing the physical properties of the HII regions in interacting and isolated galaxies (2299 rows).

Inspect the table columns and their description. As we are interested in the interacting galaxies only, apply the constraints "int" to n_Name.

You can download the catalogue for future use by changing the output format in "Preferences". Choose one between VOTable and FITS which are standard formats recognised by most tools.

Remember to set the max number of rows to "unlimited" (default is 50) and then click on the "Submit" Botton.

VizieR - Aladin

You can also continue your investigation using the CDS-VO tools. Set back the output format to "HTML Table" and submit the query.

We want to visualise the galaxies in this catalogue. We notice that there are many HII regions associated to each galaxy and the column "Seq" lists an id number for the HII regions in each catalog, starting from 1. Add a new constraint by clicking on "Modify query" on the left box. Apply Seq=1 and re-submit the query. Now we have one set of coordinates for each interactive galaxy in the study. For a quick view, start AladinLite and double-click on the check-boxes in the aladin column.

start AladinLite

Send to VO tools

For further inspection, send this catalogue to your Aladin Desktop by clicking on the antenna on the top-right corner and allow the browser to connect to the SAMP hub. Then click on the newly appeared grey Broadcast button and go to your Aladin Desktop.
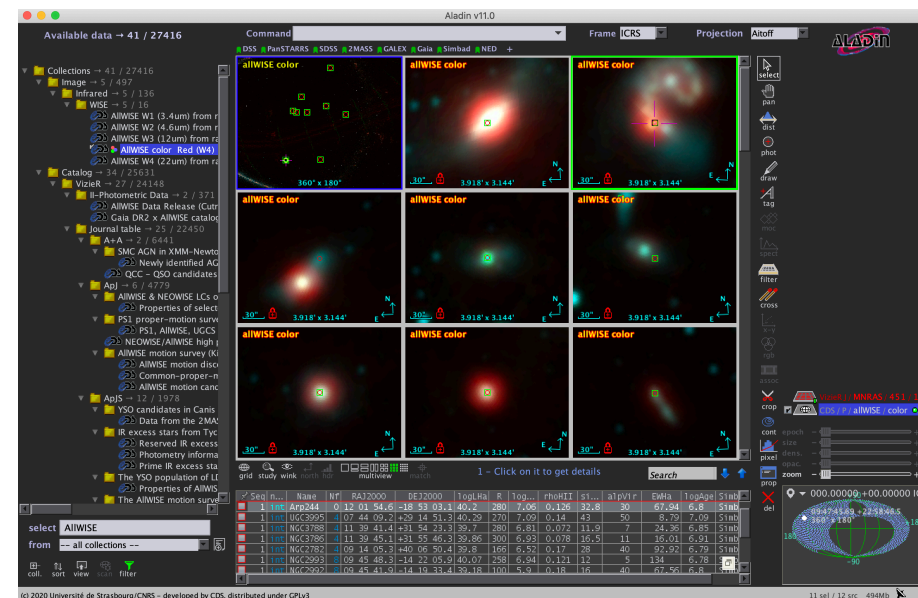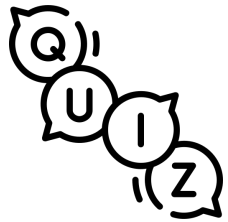
14

Aladin

A new plane view from Vizier should appear on the Aladin Desktop. Zoom out until you can see the regions. We are also interested in infrared data for this sample, we can check if there are available images from the AllWISE survey. Type "AllWISE" in the select box and all the relevant data sets will appear in the Data Tree. Note that Data sets in the Data Tree are colour coded in green or orange depending on whether or not they are available in the region currently visible in the main viewing window.

Load "AllWISE color" in Collections - Image → Infrared → WISE → AllWISE color. Now select all the sources from the VizieR catalog by double-clicking its name in the stack of planes on the right (or equivalently, by drawing a rectangle that contains them all). Finally, make thumbnails of the galaxies hosting the HII regions: Tool→ Thumbnail view generator… set the thumbnail size to 4 arcmin.

We will see more of the Aladin functionalities in Tutorial #4: Exploring large data sets with HiPS & MOCs   15

VizieR

Now that we have looked at the galaxies, we are interested in using the image fits files released by Zaragoza-Cardiel+, 2015 for our own studies.

- What are the typical sizes of the fits images?

- What is the approximate resolution of the images?

http://etc.ch/ijif

X-Match
Efficient cross-matching of sources in very large catalogues

http://cdsxmatch.u-strasbg.fr/

VizieR - X-Match

From the VizieR query page in your browser, you can forward the entire catalog directly to X-Match by clicking on "Fast Xmatch with large catalogs or Simbad" on the top-right. It will be automatically loaded into X-Match.

Alternatively, you can use the catalogue previously downloaded. Upload it in "Tables management" and select the RA, Dec columns with the correct units in "Add metadata". Then go back to the X-match main page and select your catalogue from "My store".

Select "AllWISE" as table to cross-match and review/modify the options (radius/area). When the cross-match is completed, you can download the result as a CSV, ASCII, or VOTable file.

Summary

We have gathered information on a specific object with **SIMBAD**

We have visualised it through survey images at different wavelengths with **ALADIN** and we have obtained the bibliographic reference of additional data of interest related to the same object, which we have inspected with **SIMBAD** as well.

We have obtained the entire catalog and the images published by the authors using **VizieR**, where we have selected a sample of objects (HII regions in interacting galaxies) which we have again visualised with **ALADIN**

In order to have complementary data, we have cross-matched the catalogue from **VizieR** with another large catalogue using **XMATCH**

The whole process was extremely fast. Now we have plenty of data and information to progress with our research!

Automate all this with Jupyter Notebooks

Excellent tool to share and reproduce research outputs

Interactive execution of Python code

Find the notebook on Binder (no installation required):
https://mybinder.org/v2/gh/cds-astro/tutorials/master?filepath=Notebooks
wait a moment for everything to load, then click on the link to CDS_Intro_tutorial.ipynb

Or download the notebook from Github and run it on your machine:
https://github.com/cds-astro/tutorials/blob/master/Notebooks/CDS_Intro_Tutorial.ipynb

More on Python and Notebooks:
Enrique Garcia, LAPP/CNRS
https://escape2020.github.io/school2021/posts/clase03/

Tips for Jupyter Notebooks

Type the name of a module followed by a dot in a code cell; then press 'tab' to see and select the available functions for that module.

Once selected a function, click inside the parenthesis and press 'shift' + 'tab' to see the related documentation, the required/optional input parameters, what the function returns etc.

More on Python and Notebooks:
Enrique Garcia, LAPP/CNRS
https://escape2020.github.io/school2021/posts/clase03/