

Programmatic access to the CDS services and data

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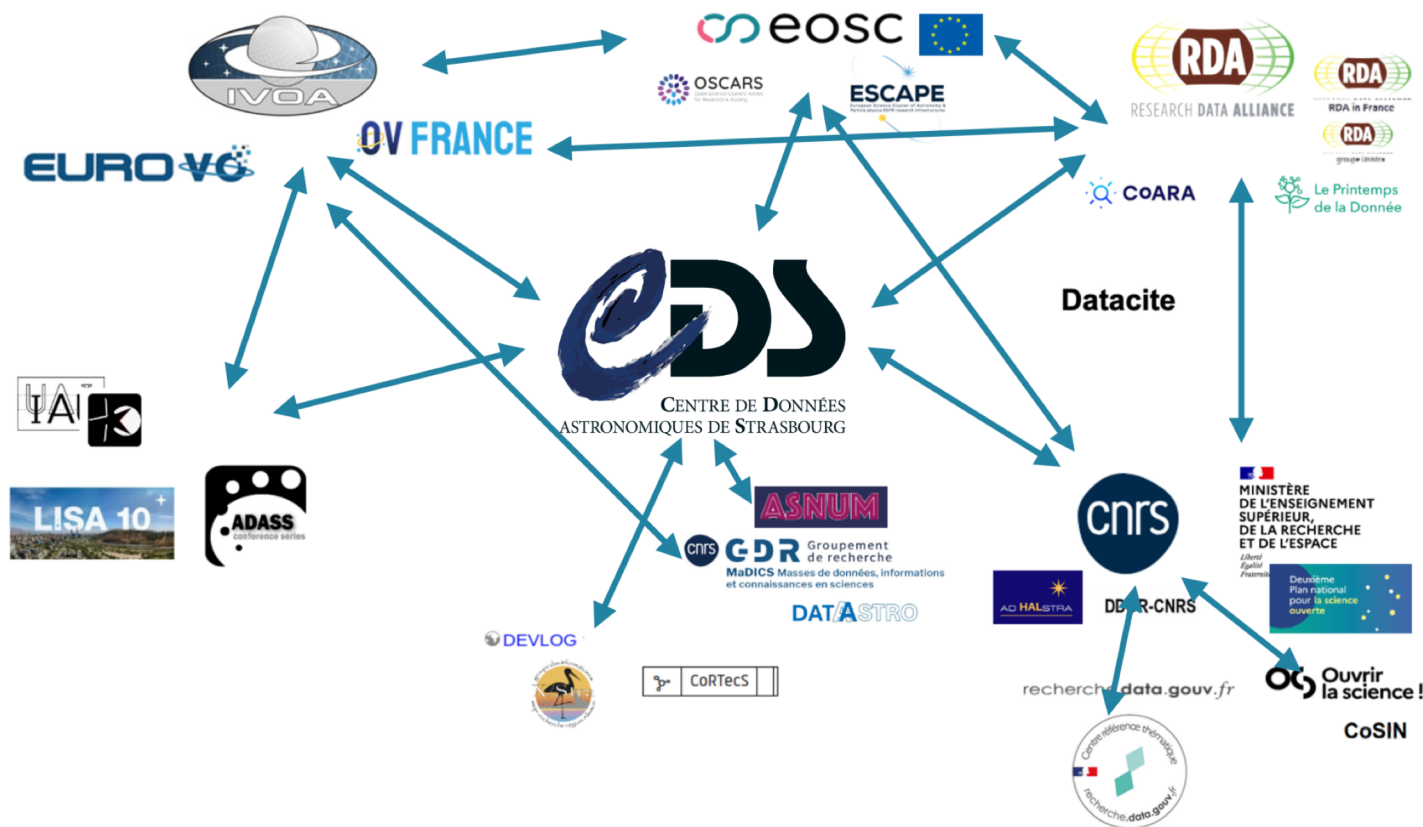


CDS (Centre de Données astronomiques de Strasbourg)

- The CDS is an international astronomical reference centre providing **curated, value-added** astronomical data to the research (not only astronomical as the access is public) community.
- For more than half a century, the CDS has **collected, standardized, and distributed** observational and bibliographic information through **services** such as **Simbad, VizieR, Aladin** and **Sesame**.
- By ensuring **data quality, interoperability, and long-term preservation**, the CDS enables researchers to **access, cross-match, visualize, and analyze** heterogeneous datasets in a consistent, FAIR-aligned environment.
- Core member of the International Virtual Observatory Alliance (IVOA) since its creation.
- And.. Infrastructure de Recherche

| DOMAINE SCIENTIFIQUE PRINCIPAL | DOMAINE(S) SCIENTIFIQUE(S) SECONDAIRE(S) | ACRONYME | TITRE COMPLET DE L'INFRASTRUCTURE | TYPE | STATUT ESFRI |
|--------------------------------|---|---------------|---|------|-----------------------|
| Astronomie et astrophysique | | ESO | European Southern Observatory | OSI | ELT : ESFRI landmark |
| | | ESO/ALMA | Atacama Large Millimeter/Submillimeter Array | | |
| | | SKAO | SKA Observatory | OSI | SKAO : ESFRI landmark |
| | | CFHT | Canada-France-Hawaii Telescope | IR* | |
| | Physique nucléaire et des hautes énergies | CTA | Cherenkov Telescope Array | IR* | CTA : ESFRI landmark |
| | | IRAM | Institut de RadioAstronomie Millimétrique | IR* | |
| | | CDS | Centre de Données astronomiques de Strasbourg | IR | |
| | Physique nucléaire et des hautes énergies | HESS | High Energy Stereoscopic System | IR | |
| | | Instrum-ESO | Instrumentation pour les grands télescopes de l'ESO | IR | |
| | | LOFAR/NenuFar | International Low Frequency Radio Array Telescope – LOFAR FR | IR | |
| | | PARADISE | Plateforme pour les Activités de Recherche Appliquée et de Développement en Instrumentation au Sol et Embarquée | IR | |

In the Research and Open Science landscape...



SIMBAD Astronomical Database

A comprehensive collection of **information** on **astronomical objects** *outside the Solar System*

including **basic data**, **object names** and **identifiers**, and also **bibliographic references** from the scientific literature.

SIMBAD Astronomical Database - CDS (Strasbourg)

What is SIMBAD ?

| Queries | Documentation | Information |
|---------------------------------|--|---------------------------------------|
| basic search | Object types | Presentation |
| by identifier | Nomenclature & Dictionary | Image thumbnails |
| by coordinates | Recommendations for Data Publication | Mobile version |
| by criteria | User's guide | SimWatch |
| reference query | Measurement description | Release: |
| scripts | List of journals | SIMBAD4 1.8 - 2025-11 |
| TAP queries | User annotations documentation | Releases history |
| Output options | Query by urls | |
| | Acknowledgment | |

| Content |
|---|
| The SIMBAD astronomical database provides basic data, cross-identifications, bibliography and measurements for astronomical objects outside the solar system. |
| SIMBAD can be queried by object name, coordinates and various criteria. Links to some other on-line services are also provided. |
| Use of SIMBAD service is free without any registration under ODbL licence. We request that users cite the original paper reference. |

| Basic search |
|---|
| <input type="text"/> |
| <i>identifier, coordinates (radius=10 arcmin), or bibcode</i> |
| <input type="button" value="SIMBAD search"/> <input type="button" value="clear"/> <input type="button" value="help"/> |
| Install the Simbad basic search in your tool bar |

| | |
|---|---|
| <input checked="" type="radio"/> Simbad first <input type="radio"/> Ned first <input checked="" type="checkbox"/> All Resolvers <input type="checkbox"/> Ignore cache <input type="checkbox"/> XML output | Enter the name of the astronomical object <input type="text"/> <input type="button" value="Submit"/> Alternatively enter the name of the file containing object names, one per line (lines starting by # are comments) <input type="button" value="Choisir un fichier"/> Aucun fichier choisi |
|---|---|

VizieR Catalogue Service & XMatch service

VizieR provides the most complete library of published astronomical catalogues, tables and associated data with verified and enriched data, accessible via multiple interfaces.

Tools related to VizieR

- [Catalogue collection](#) : Search VizieR catalogues
- [CDS Portal](#) : Access CDS data including VizieR in CDS Portal
- [Spectra, images in VizieR](#) : Search Spectra, images in VizieR
- [Photometry viewer](#) : Plot photometry (sed) in VizieR
- [TAP VizieR](#) : query VizieR using ADQL (a SQL dialect)
- [CDS cross-match service](#) : fast cross-identification

<http://cdsxmatch.u-strasbg.fr/xmatch/doc/cross-match-API.html>

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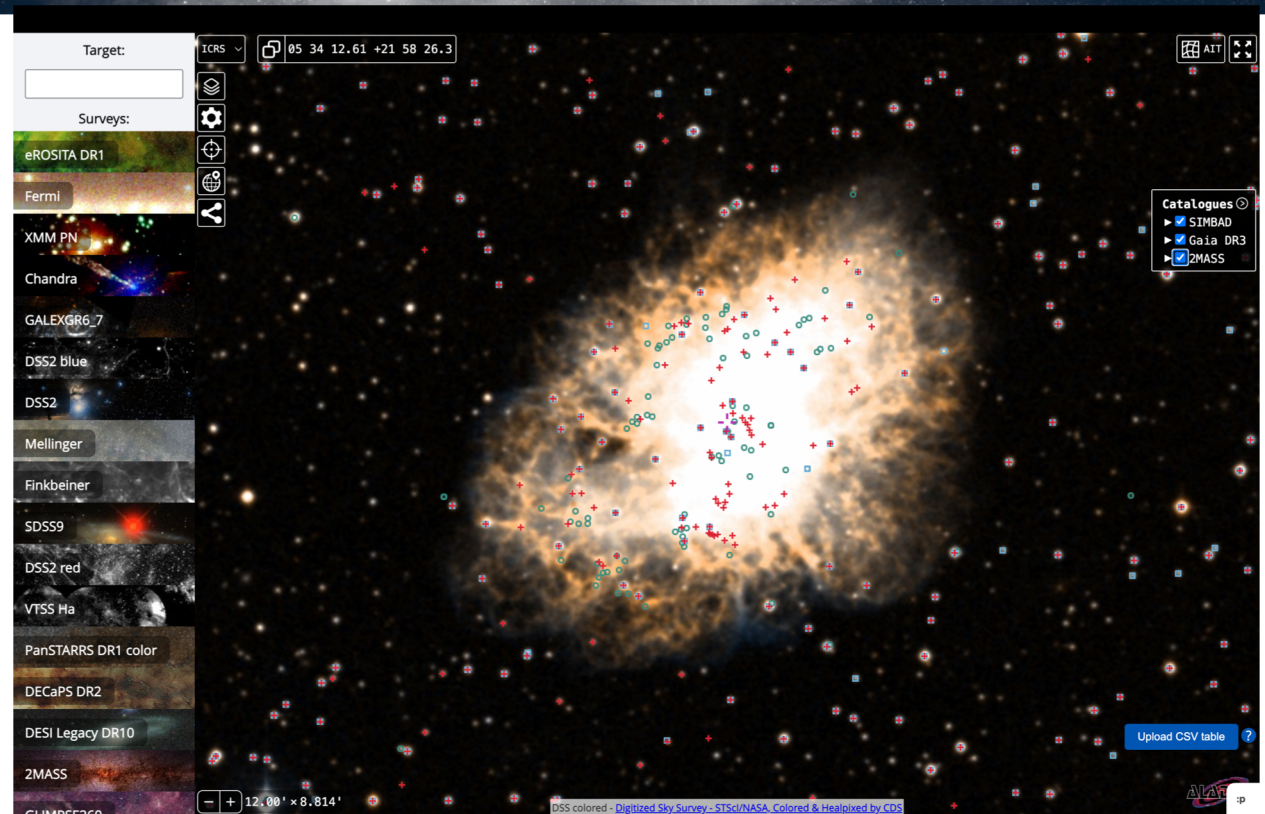
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□ Aladin Sky Atlas, Standalone and Lite

Aladin is an interactive sky atlas allowing the user to **visualize** digitized astronomical images or full surveys, **superimpose** entries from astronomical catalogues or databases, and **interactively** access **related data** and information from the *Simbad* database, the *VizieR* service and other archives for all known astronomical objects in the field.

Ipyaladin, Aladin Lite widget for Jupyter notebooks
<https://aladin.cds.unistra.fr/AladinLite/ipyaladin/>





IVOA, the Backbone of Programmatic access to VO astronomical Data and Services

- The Virtual Observatory (VO) is the vision that astronomical **datasets** and other **resources** should work as a seamless whole.
- Many projects and data centres worldwide are working towards this goal.
- Through specifications, <https://www.ivoa.net/documents/>, such as **VO standards**, **protocols and formats**, the IVOA provides a common framework that allows researchers to combine and explore data across archives, tools, and platforms, fostering open science and accelerating astronomical research.
- These protocols are widely implemented by many data providers in their Web services.
- **PyVO** is the convenient and basic way to access the VO compliant services
- **PyVO** is built on top of **Astropy**, the core Python library for astronomy, developed by the community to provide standardized data structures, algorithms, and utilities for astronomical research
- **Astroquery**, archive-oriented programmatic data access, is built on **Astropy**
- Less portable than **PyVO**



PyVO, remark

PyVO is a **Python** library providing **programmatic** access to VO compliant services. It implements core **IVOA** standards and integrates naturally with the Python scientific ecosystem (Astropy, NumPy, Pandas), making it a key component for building automated, reproducible, and scalable data-analysis pipelines in HPC and HPDA environments.

PyVO

pyvo v1.9.dev4+gb00cb4e83 »

astropy Index Modules

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- Getting started
- Data Access
- Registry search
- Using **pyvo**

PyVO

Introduction

This is the documentation for PyVO, an affiliated package for the **astropy** package.

PyVO lets you find and retrieve astronomical data available from archives that support standard **IVOA** virtual observatory service protocols.

- **Table Access Protocol (TAP)** – accessing source catalogs using sql-ish queries.
- **Simple Image Access (SIA)** – finding images in an archive.
- **Simple Spectral Access (SSA)** – finding spectra in an archive.
- **Simple Cone Search (SCS)** – for positional searching a source catalog or an observation log.
- **Simple Line Access (SLAP)** – finding data about spectral lines, including their rest frequencies.

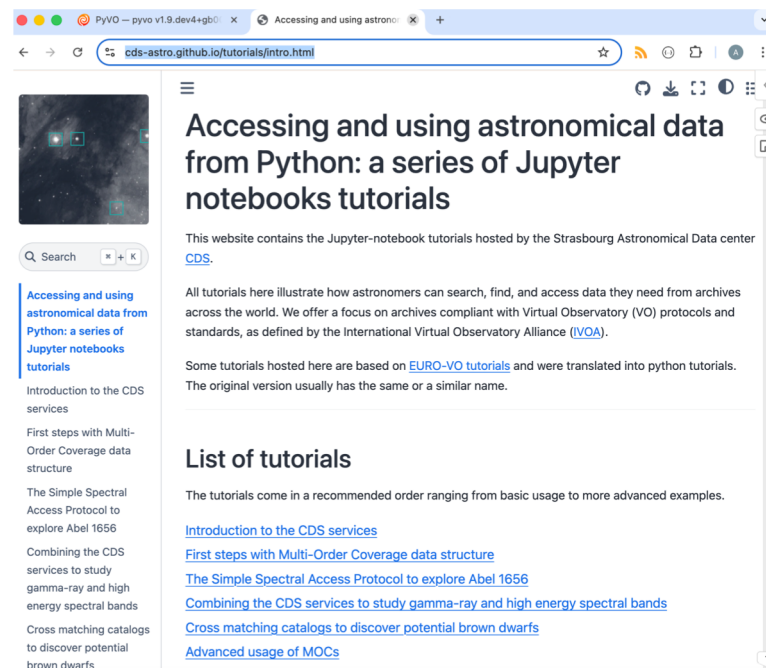
Note

If you need to access data which is not available via the Virtual Observatory standards, try the astropy affiliated package **astroquery** (and, of course, ask the data providers to do the right thing and use the proper standards for their publication).

□ Astropy, Astroquery : illustrations@CDS

A way to learn how to use the CDS services through Python is to have a look at the online tutorials using Jupyter notebooks

<https://cds-astro.github.io/tutorials/intro.html>



other resources in Java, Rust

- <https://cds.unistra.fr/fr/data-access/tools/>

The screenshot shows the CDS website with a dark blue header and a navigation bar. The 'Data access' tab is selected, leading to a page titled 'Query tools and API'. Below the title, it says 'CDS also provides libraries/packages, tools and APIs in order to access its data and to use its services.' A sidebar on the left lists various tools: Aladin, Coordinates, FITS, HEALPix, HIPS, MOC, Other VO protocols, SIMBAD, VizieR, and X-Match. The main content area displays the 'Aladin' section, which includes links to 'aladin', 'aladin-lite', and 'ipyaladin', each with a brief description of their functionality.

This screenshot shows the 'Tools' section of the CDS website. It features a sidebar with a list of tools: Aladin, Coordinates, FITS, HEALPix, HIPS, MOC, Other VO protocols, SIMBAD, VizieR, and X-Match. The main content area is divided into two columns. The left column lists tools like 'SIMBAD', 'VizieR', and 'X-Match' with brief descriptions. The right column lists tools like 'FITS', 'HEALPix', 'HIPS', and 'MOC' with more detailed descriptions, including links to external resources and code repositories.



□ Remark

- Unusual and massive usage of CDS services may lead to performance degradation and cause issues for other users.
- For experiments requiring large-scale access to CDS services, please contact us in advance.
- cds-question@unistra.fr



□ Conclusion

- CDS services are designed for both **web-based** and **programmatic** access.
- If you use the CDS services, even through a programmatic access, it would be nice to add an **acknowledgement**
- <https://cds.unistra.fr/help/acknowledgement/>