Programmatic access to the CDS services and data

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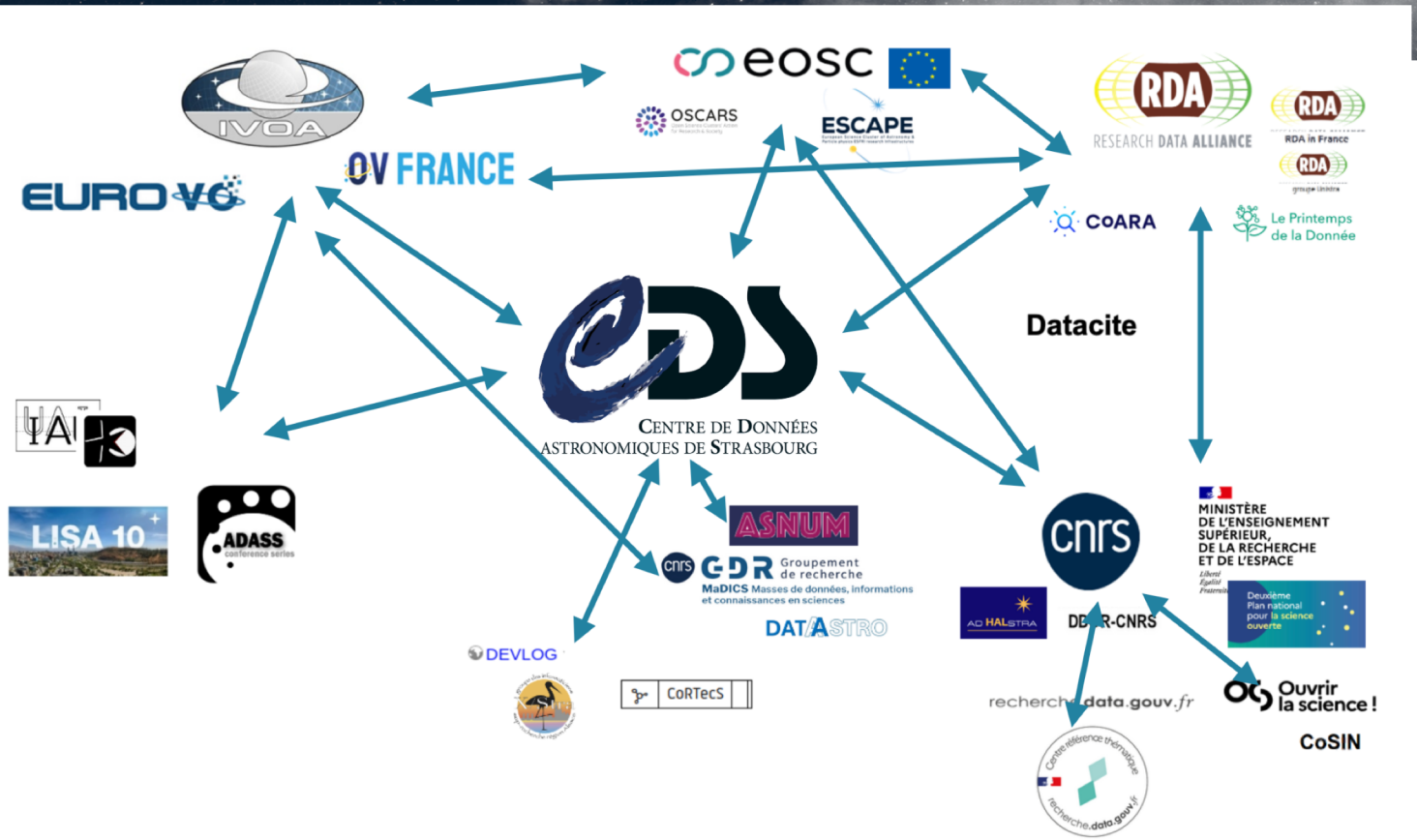
CDS (Centre de Données astronomiques de Strasbourg)

- **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/Submillimiter 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	

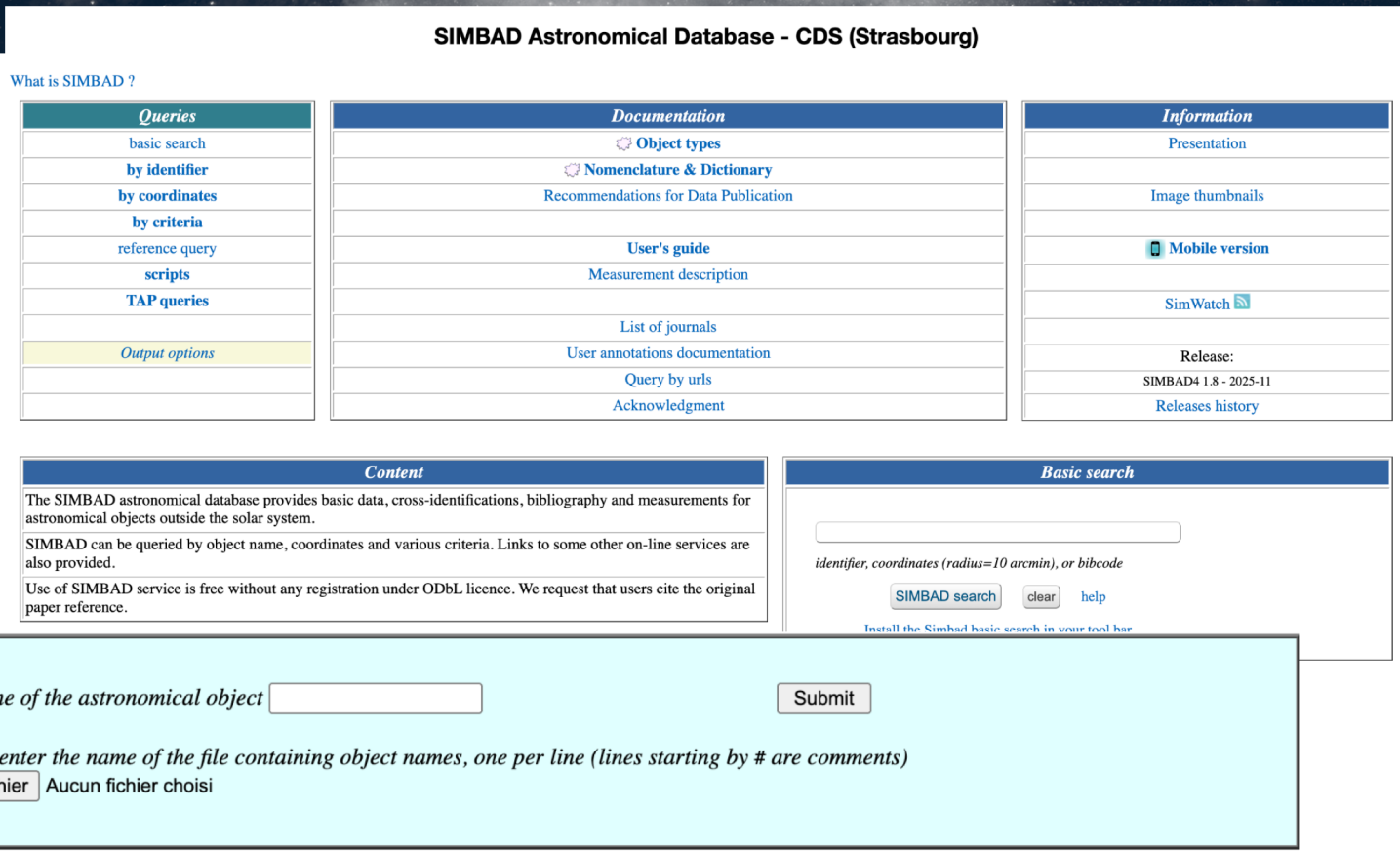
In the Research and Open Science landscape…



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.

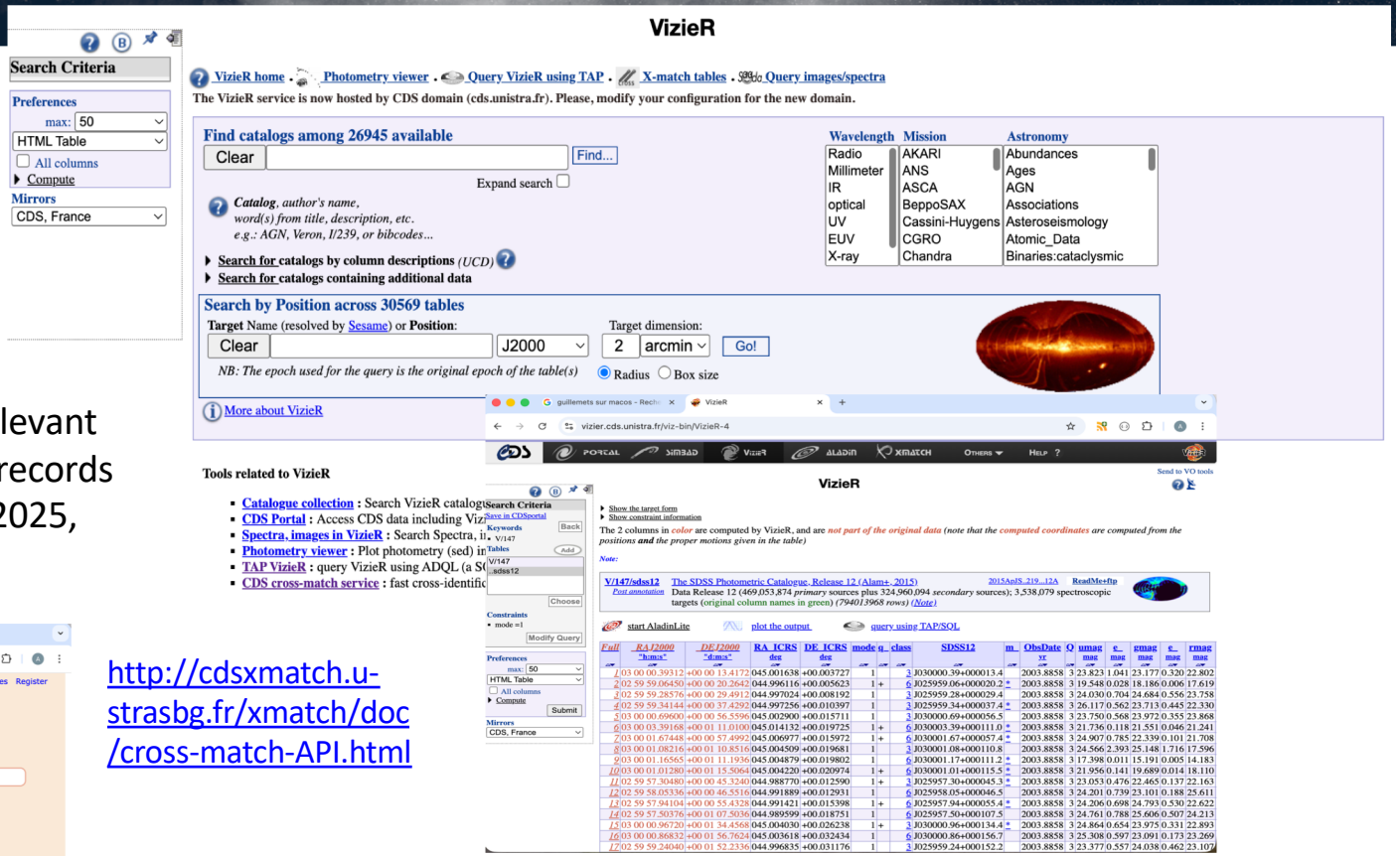


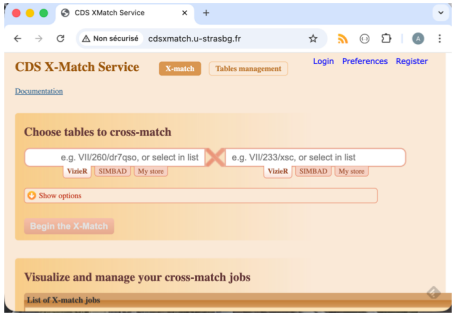
Also a name resolver

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.

Query tools allow the user to select relevant data tables and to extract and format records matching given criteria. In December 2025, 25839 catalogues are available



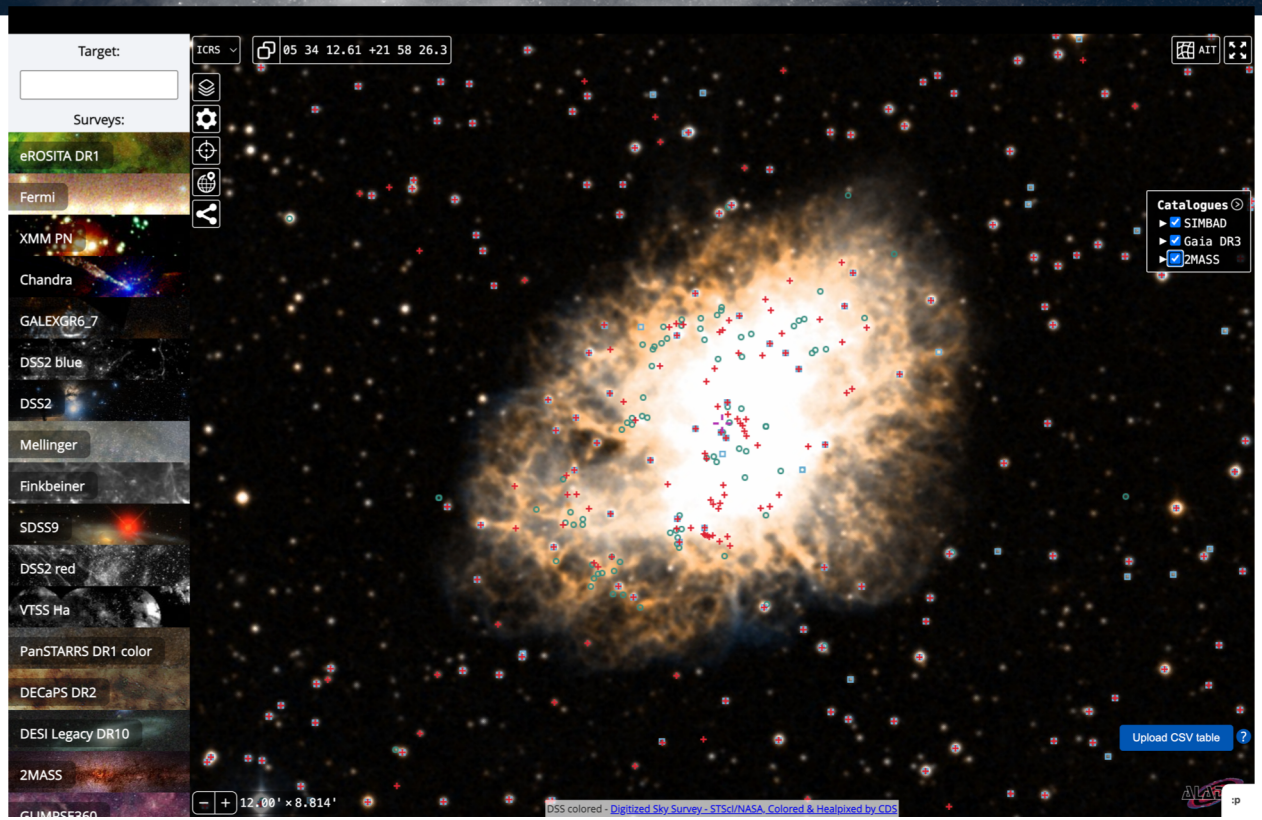


http://cdsxmatch.u-strasbg.fr/xmatch/doc/cross-match-API.html

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

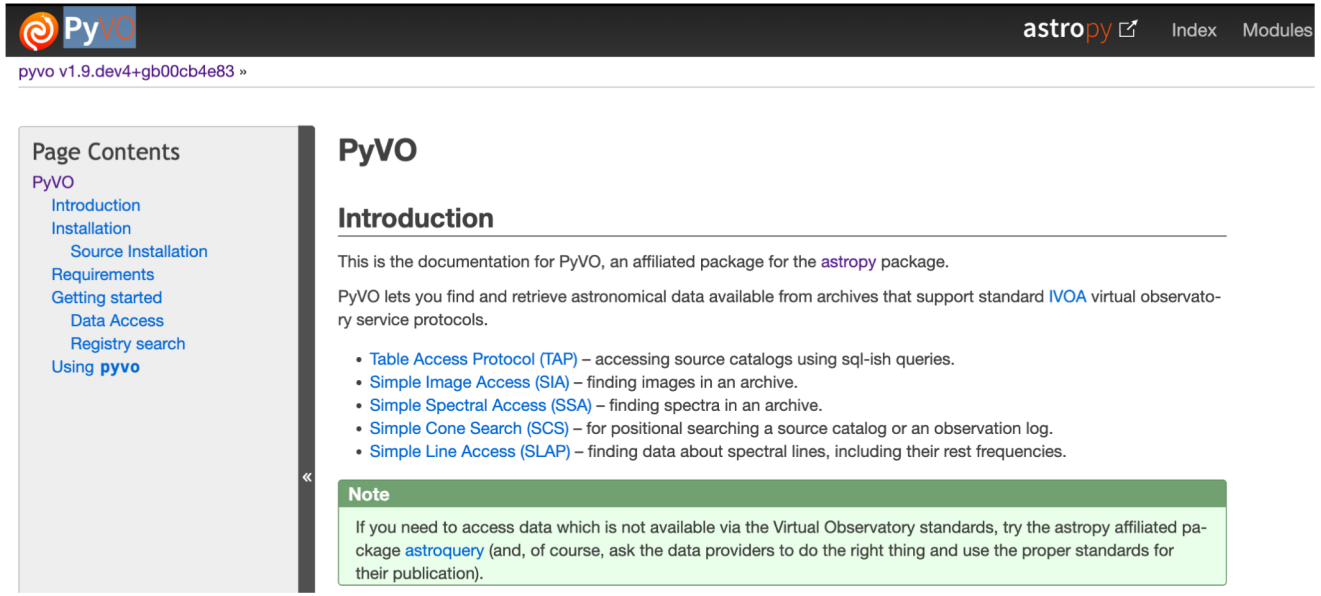
- PyVO is built on top of Astropy, the core Python library for astronomy, developed by the community to provide standardized data structures, algorithms, and utilities for astronomical research

  Astroquery, archive-oriented programmatic data access, is built on Astropy

- Less portable than PyVO

PyVO, remark

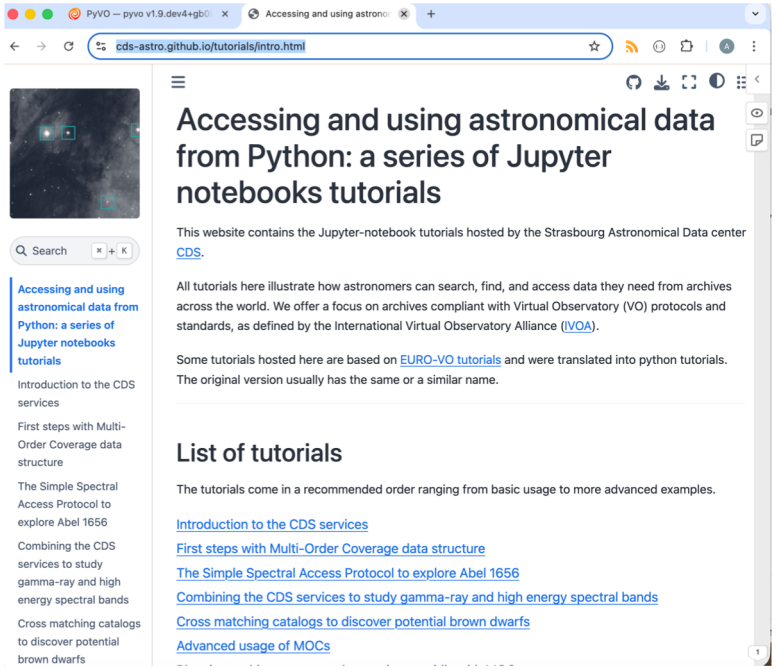
PyVO is a Python library providing programmatic access to VO compliant services.
It implements core IVOA standards and integrates naturally with the Python scientific ecosystem (Astropy, NumPy, Pandas), making it a key component for building automated, reproducible, and scalable data-analysis pipelines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



Astropy, Astroquery : illustrations@CDS

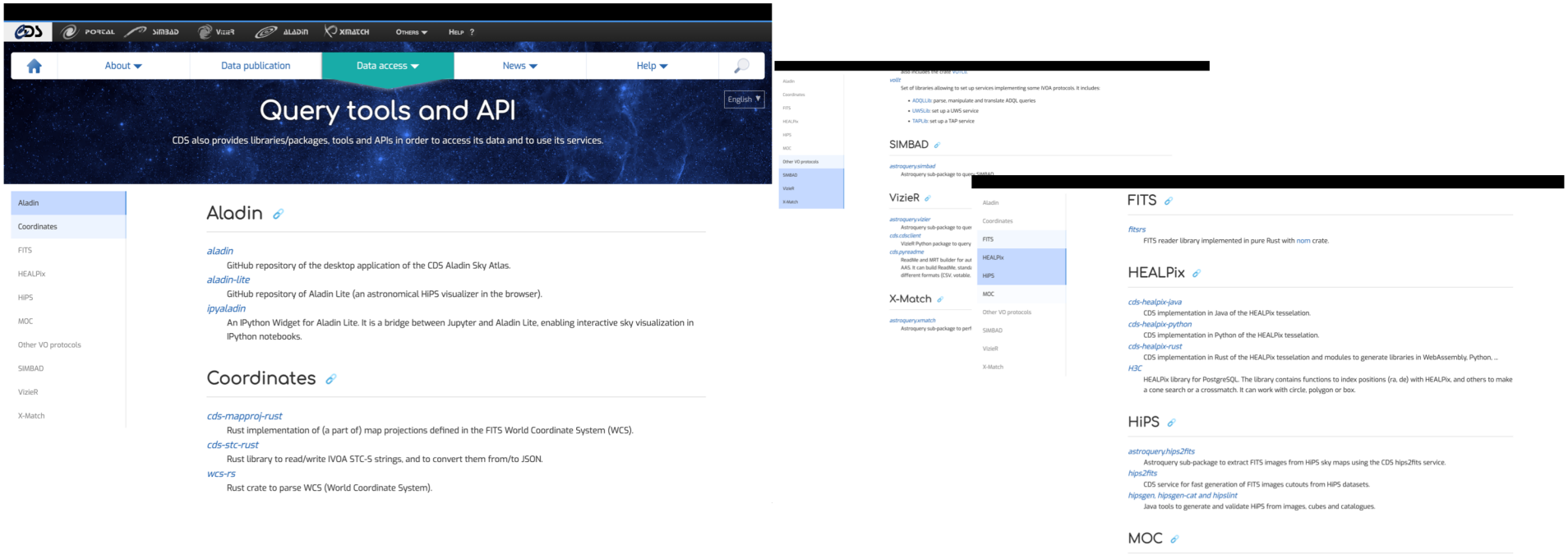
A way to learn how to use the CDS services through Python is to have a look at the online tutorials using Jupyter notebooks

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



other resources in Java, Rust

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



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/