

SIMBAD : the bibliographic database

A meta-compilation of astronomical objects of interest that have been studied in the literature

EAS 2020



C. Loup,
on behalf of the
SIMBAD team



□ Home Page : <http://cds.unistra.fr>



Centre de Données astronomiques de Strasbourg *Strasbourg astronomical Data Center*



Entry point to all services



Object database



Catalogue database



Interactive sky atlas

Other services



X-match



Dictionary



Sesame



SimPlay

Latest news

- [Aladin Desktop v11 release](#)
- [HSC \(Hyper Suprime-Cam\) DR2 HiPS available](#)
- [Catalogs added between 20-Jun-2020 and 27-Jun-2020](#)
- [Catalogs added between 13-Jun-2020 and 20-Jun-2020](#)
- [Catalogs added between 06-Jun-2020 and 13-Jun-2020](#)





The Team

- Bibliography : S. Lesteven (software engineer)
- Scientific content : C. Loup (astronomer)
- Database & softwares : A. Oberto (software engineer)
- Nomenclature : B. Vollmer (astronomer)

- Documentalists : 3 teams
 - Nomenclature : M. Brouty, F. Marquis
 - Going through new articles via the software DJIN : A. Eisele, M. Magali, E. Son, P. Vonflie
 - Ingestion of tables of objects via the software COSIM : C. Brunet, M. Buga, E. Collas, F. Marquis, E. Perret, K. van der Woerd

- Software engineers : T. Boch, G. Mantelet
- Scientific expertise : C. Bot, L. Cambresy, S. Derrière, F. Genova, G. Monari, A. Nebot, P. Ocvirk, A. Siebert

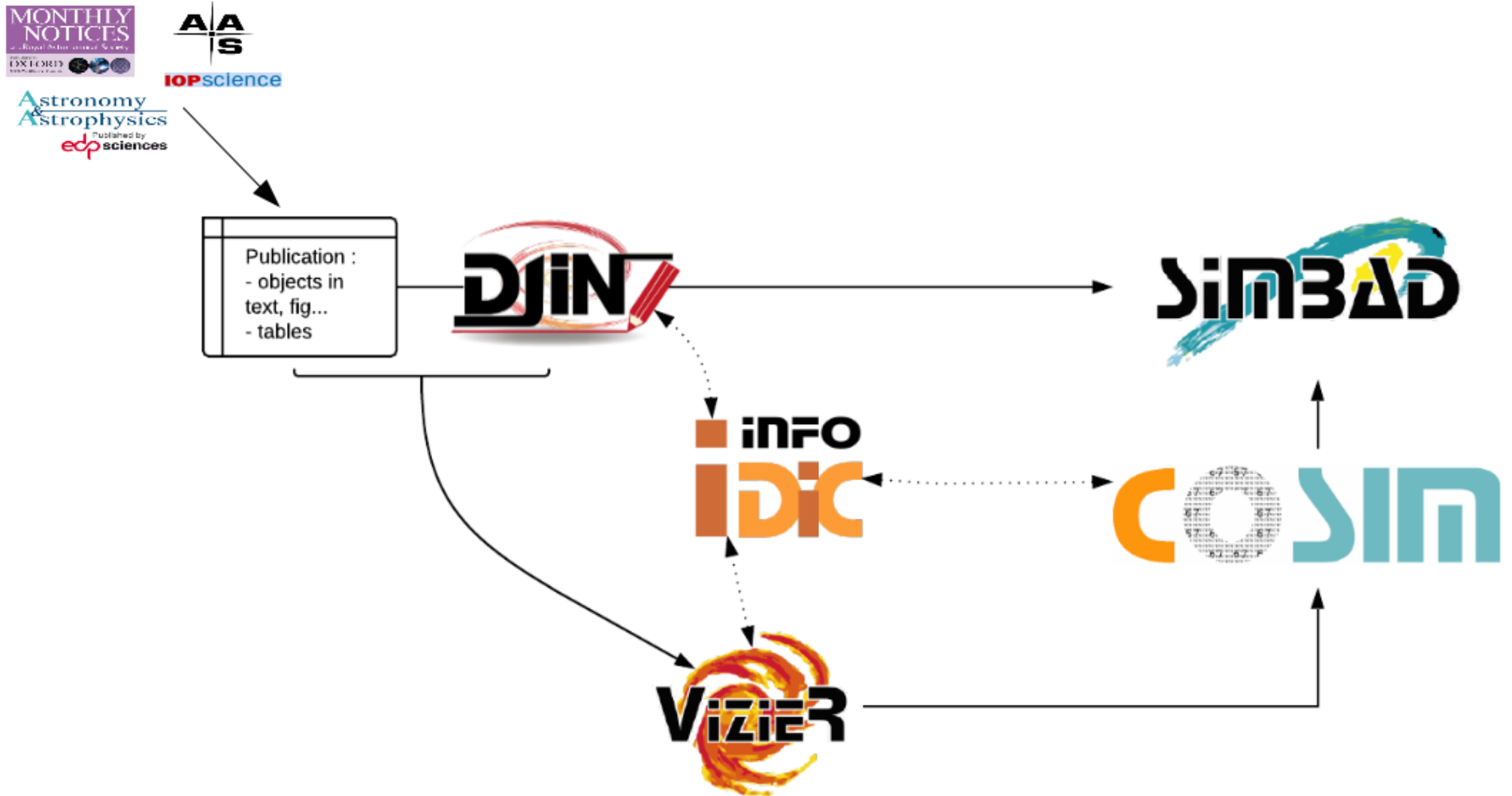


What is SIMBAD ?

A meta-compilation of objects of interest that have been studied in the literature

- Also includes all the Tycho2 stars / IRAS & 1RXS sources (historical)
- Does not contain entire very large catalogues like 2MASS, SDSS, Gaia; but special operations of Xid with SIMBAD are performed.
- Prioritization of tables of objects : spectroscopy, characterization, membership, ...
- → **VizieR & SIMBAD are complementary databases**
- Inhomogeneous by construction : all objects types (250) detected at any wavelength at any resolution or astrometric accuracy
- Overview of the content
 - 11.2 million objects
 - 36.2 million identifiers
 - 375,000 references
 - 21.9 million citations of objects in papers
 - 12 to 13,000 new references per year
 - A few to several 100,000 new objects per year

□ The processing pipeline





Nomenclature

The keystone of SIMBAD & a serious matter

- Fundamental principle : **unicity**, a name corresponds to a unique object
- Building an identifier : **acronym** + **format**, e.g.

HD 247377 or **2MASS** J05465186+3136536 or **Gaia** DR2 3445087280664517504

- Acronyms and formats are **encoded** in the database, and are **controlled**
- Nomenclature follows the acceptance of an acronym by the IAU commission B2
- Dictionary of nomenclature contains more entries than SIMBAD
<https://cds.u-strasbg.fr/cgi-bin/Dic-Simbad>
- Total number of acronyms in SIMBAD = 14,500

Challenge in the era of big data : minimize the number of new acronyms

- Encourage astronomers to follow IAU recommendations
- Avoid to rename sub-samples of objects that already have names.
- **The nature of an object lies in its object type(s) and measurements, not in its name.**



Which data are in SIMBAD ?

- Bibliography
- Objects types
- Identifiers = cross-identifications + links to data in VizieR
- Astrometry : coordinates (ICRS J2000), proper motions, parallax
- HRV, cz, or redshift; + recently added Vlsr
- Spectral type for stars
- Morphological type for galaxies
- Angular size
- Magnitudes : UBVRI G JHK ugriz
- Hierarchical links with % of membership
- Collections of measurements
 - Parallaxes (PLX), distances (distance), proper motions (PM)
 - Spectral types (SpT or formerly MK)
 - Teff, logg, [Fe/H] (fe_h) + rotational velocities (ROT)
 - Velocities (HRV, z , cz, Vlsr)

HD 21455

other query modes :

- Identifier query
- Coordinate query
- Criteria query
- Reference query
- Basic query
- Script submission
- TAP
- Output options
- Help

Query : HD 21455

C.D.S. - SIMBAD4 rel 1.7 - 2020.06.29CEST16:38:50

Available data : [Basic data](#) • [Identifiers](#) • [Plot & images](#) • [Bibliography](#) • [Measurements](#) • [External archives](#) • [Notes](#) • [Annotations](#)

Basic data :

HD 21455 -- Be Star

Other object types: * (HD,AG,...), ** (ADS,CCDM,...), Be* (Ref,2015AJ...149...7C,...), IR (AKARI,IRAS,...), *iC (Cl), Em* ([KW97]), UV (TD1)
ICRS coord. (ep=J2000) : 03 29 26.2865159828 +46 56 16.317222688 (Optical) [0.0407 0.0295 90] A 2018yCat.1345....0G
FK4 coord. (ep=B1950 eq=1950) : 03 25 56.3215232457 +46 45 59.641650399 [0.0407 0.0295 90]
Gal coord. (ep=J2000) : 148.9316450105402 -07.8019548163240 [0.0407 0.0295 90]
Proper motions mas/yr : 23.210 -25.706 [0.141 0.100 90] A 2018yCat.1345....0G
Radial velocity / Redshift / cz : V(km/s) 1.60 [1.1] / z(-) 0.000005 [0.000004] / cz 1.60 [1.10]
B 2006AstL...32..759G
Parallaxes (mas): 5.8881 [0.0585] A 2018yCat.1345....0G
B7Vne C 1994AJ...107.1556G
Spectral type: B 6.305 [0.014] D 2000AA...355L..27H
V 6.217 [0.010] D 2000AA...355L..27H
G 6.1632 [0.0005] C 2018yCat.1345....0G
Fluxes (6) : J 5.88 [0.03] C 2003yCat.2246....0C
H 5.902 [0.059] C 2003yCat.2246....0C
K 5.903 [0.021] C 2003yCat.2246....0C

SIMBAD with radius arcmin



Identifiers (33) :

An access of full data is available using the icon Vizier near the identifier of the catalogue

- | | | | |
|--|--|--|--|
| <p>HD 21455 </p> <p>ADS 2560 A</p> <p>AG+46 344 </p> <p>AKARI-IRC-V1 J0329263+465615 </p> <p>BD+46 760 </p> <p>CDM J03294+4656A </p> | <p>GCRV 1914</p> <p>GEN# +5.20200861</p> <p>GSC 03316-02311 </p> <p>HIC 16252 </p> <p>HIP 16252 </p> <p>HR 1047 </p> | <p>PPM 46236 </p> <p>ROT 498</p> <p>SAO 38874 </p> <p>SKY# 5257</p> <p>TD1 2211 </p> <p>TYC 3316-2311-1 </p> | <p>WDS J03294+4656A </p> <p>WEB 3098</p> <p>[JE82] 116</p> <p>[KW97] 15-39</p> <p>Gaia DR2 242889338420659968 </p> <p>Gaia DR1 242888956163684096 </p> |
|--|--|--|--|

References (93 between 1850 and 2020) (Total 93)

Simbad bibliographic survey began in 1850 for stars (at least bright stars) and in 1983 for all other objects (outside the solar system).

Follow new references on this object

Reference summaries :

from: to:

or select by : (not exhaustive, [explanation here](#))

Collections of Measurements

distance : 1
 velocities : 8
 ROT : 3
 PM : 3
 Fe_H : 2
 PLX : 5
 MK : 10





Cross-identifications

One of the highest Added-value of SIMBAD

Meetings involving astronomers and documentalists : guidelines adapted to each article taking into account both scientific and technical aspects for optimal ingestion

→ Adding new objects or data is not “automatic”, we call it semi-automatic

The multi-parameter cross-identification software COSIM

- Compares new data in the tables with the content of SIMBAD
- Searches on positions, but it is not just a blind X-match
- Check consistency between magnitudes, HRV/z, proper motions, object types
- Calculates a Xid score with an object already in SIMBAD; or proposes a new object

The expertise of the documentalists :

- Tuning the parameters of COSIM to avoid false Xid and decrease the number of unsolved cases (typically 10%)
- Checks on individual objects : other measurements in VizieR, various images in Aladin
- Ask for scientific expertise from the astronomers when required



Gaia DR2 in SIMBAD

5.3 million Gaia DR2 identifiers now with all their astrometric parameters and G mag

The massive Xid in June 2018 : 4.5 million

- Too heavy for COSIM → based on a Xmatch BUT with conditions
- Limited to objects with subarcsecond astrometry
- No neighbour within 3'' (2MASS resolution) in SIMBAD and in Gaia ($\Delta(G) < 3 \text{ mag}$)

Additional Xids performed later : + 800,000

- High proper motion stars (330,000) : from 85% to 97% now identified in Gaia DR2
- Crowded regions : especially Galactic Bulge
- Astrometric accuracy ~ a few arcseconds, especially RAVE, CRTS, and NSVS surveys
- Close double stars
- New stars added in SIMBAD after June 2018

Getting ready for Gaia EDR3 ...

□ The many ways to query SIMBAD

Identifier query

Coordinate query

Criteria query

Reference query

Basic query

Script submission

TAP

Output options

Help

- Individual request : identifier, coordinates, reference
- List of identifiers or coordinates : many output formats
- Selection & data mining
 - Criteria query (limited to 20,000)
 - Script submission
 - Python astroquery
 - **TAP** (ADQL language; limited to 3 million) : very powerful



Data Mining with TAP

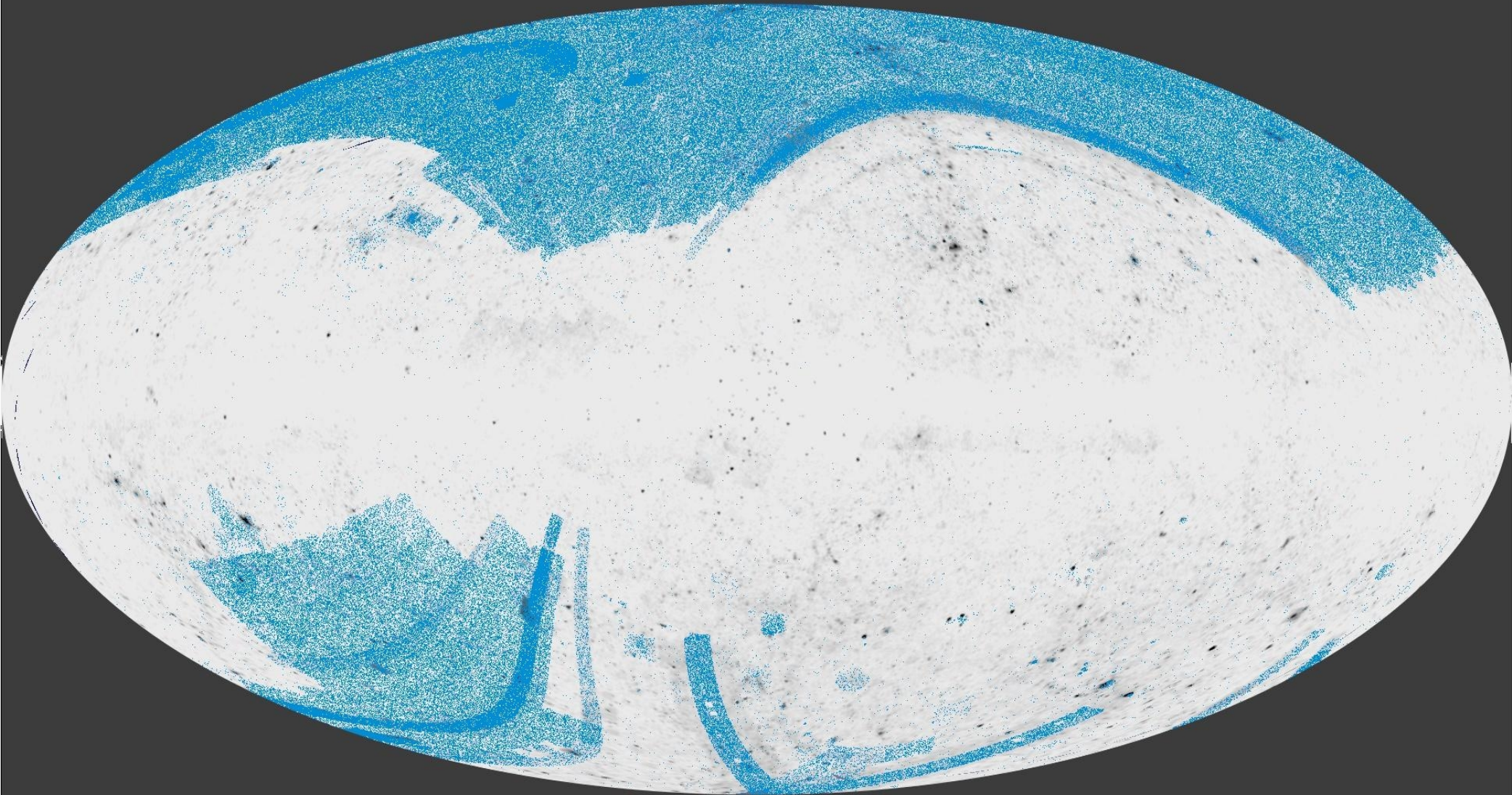
- <http://simbad.u-strasbg.fr/simbad/sim-tap>
- Gives help and examples, as well the structure of the SIMBAD tables
- Try also : search on position and click on View this query in SQL-Like (TAP)

```
SELECT TOP 50 main_id, ra, dec, distance(POINT('ICRS', ra, dec),point('ICRS',52.32982916666666,
46.94246944444444)) as dist
FROM basic
WHERE CONTAINS(POINT('ICRS', ra, dec), CIRCLE('ICRS', 52.32982916666666, 46.94246944444444,
0.03333333333333333)) = 1
ORDER BY dist
```
- Our closest neighbours : `SELECT count(*) FROM basic WHERE plx_value >= 40.0;` 5370
- All AGNs : `SELECT count(*) FROM basic WHERE otype = 'AGN..';` 668940
- All QSOs : `SELECT count(*) FROM basic WHERE otype = 'QSO..';` 566305
- Spectroscopically confirmed White Dwarfs also CSPN or in double stars :
`SELECT count(*) FROM basic WHERE sp_type LIKE '%D%';` 40388



QSOs on the Sky

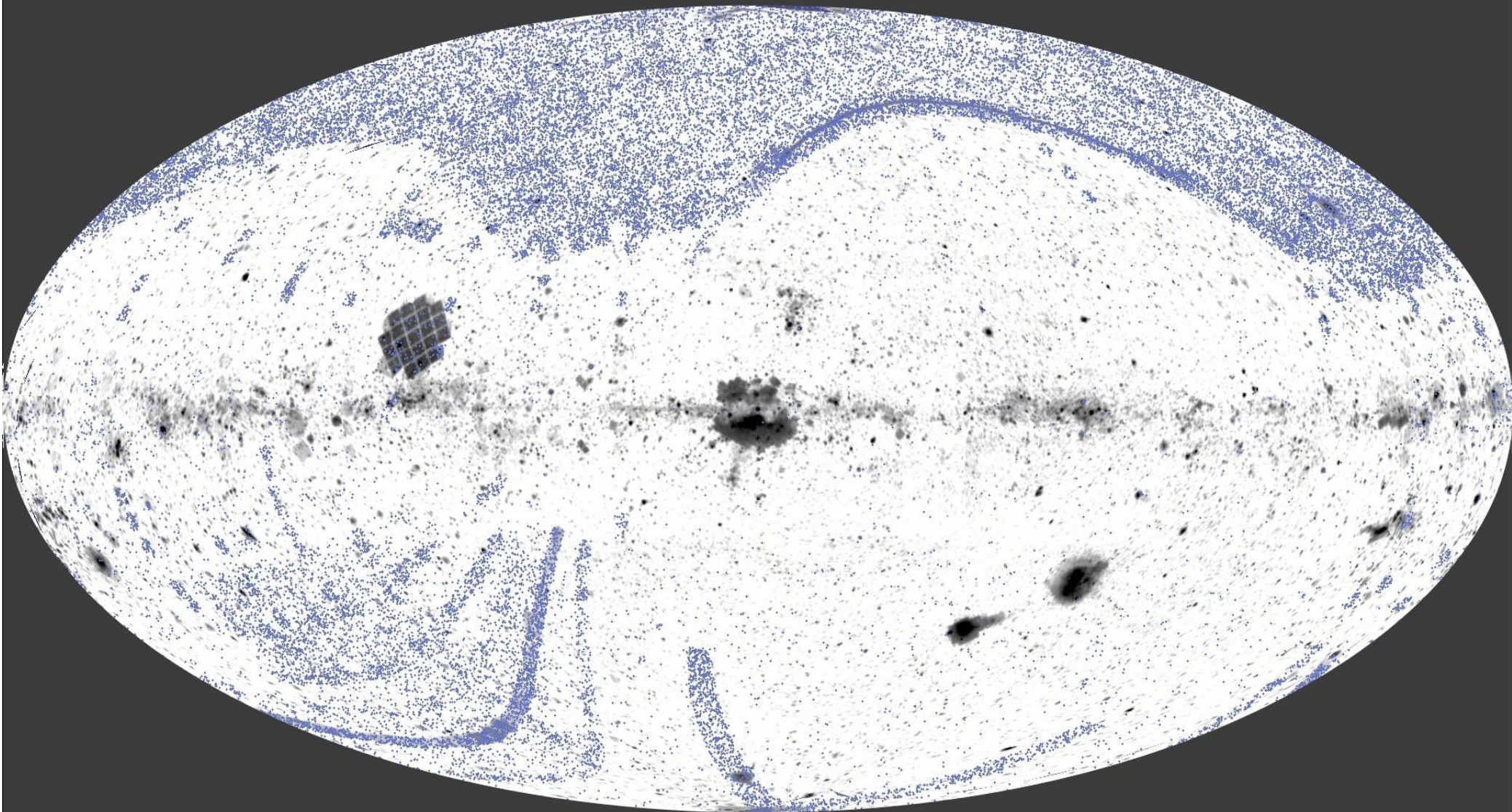
DM simbad-biblio otypes Galaxy





White Dwarfs on the Sky

DM simbad-biblio otypes Star





Help us to help you !

Challenge in the era of big data : maintain the quality of the content

The efficiency of the processing has been improved, but we also need your input to save time

- Check your names (in SIMBAD or NED or in the Dictionary of Nomenclature)
- No truncated names (not unique); no nick names
- Submit new acronyms to IAU commission B2 prior publication
- Tables of objects : give both a correct name and accurate coordinates
- Xid : specify whether it is a blind Xmatch or a validated Xid
- Xid : do not only list coordinates and mags, but also the identifiers (otherwise we have to remake your work ...)
- New objects : check them in SIMBAD or NED, often they are not all new
- Classification : please check for possible contradictory classifications in the literature, in SIMBAD, or/and in NED (e.g. QSO versus White Dwarf or RR Lyrae)