天文星表、数据库

何勃亮

国家天文台 国家天文科学数据中心

2020-12-8

National Astronomical Data Center
国家天文科学数据中心

提 纲

- 天文星表
- 天文数据库
- 星表的管理操作
- VO 工具
- 其他

天文星表源流

- 什么是星表？

欽定四庫全書

靈臺秘苑卷十三　北周　庾季才　原撰

宋　王安禮等　重修

西方七宿 中外官附

奎宿

奎宿距西南大星去極七十二度半　星欲明則吉　若德政虧則星有角　動為兵　其中星明則大水月犯之其分亂邊兵水災貴人憂民不安

唐開元占經卷六十五

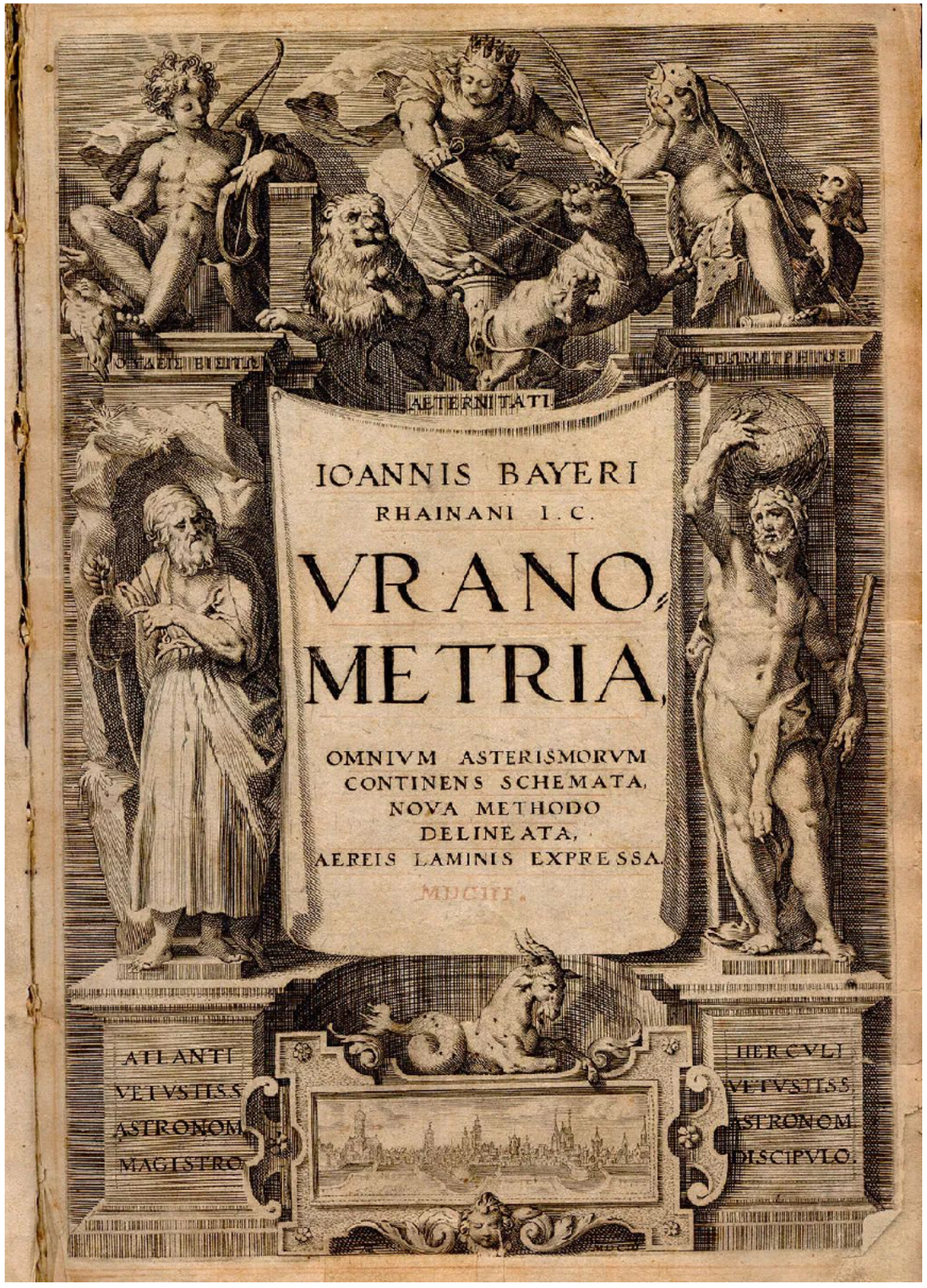
唐　瞿曇悉達　撰

石氏中官占上

攝提占一

石氏曰攝提六星夾大角入角八度少去北極五十九度半在黃道內三十二度太名天鉞一名天獄一名天楯一名天武一名天兵星東一名環樞一名天樞一名闕丘一名致法一名三老一


EFFIGIES TYCHONIS BRAHE O.F.
ÆDIFICII ET INSTRUMENTORUM
ASTRONOMICORUM STRUCTORIS.
Aº DOMINI 1587. ÆTATIS SUÆ 40.

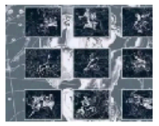


1603年德国的天文学家巴耶（Johann Bayer）根据第谷的观测资料出版了《测天图》*Uranometria*，使用希腊字母为恒星命名（称为巴耶命名法），还第一次加入了南天的星座。

1627年，开普勒将第谷和巴耶的观测资料，发表了《鲁道夫星表》*Rudolphine Tables*，包含一千多颗恒星的位置信息，为行星位置的测量提供了可靠的依据。

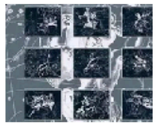
群星的族谱——天文学星表纵览（8）

2018年11月7日



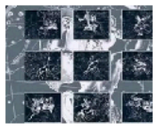
群星的族谱——天文学星表纵览（7）

2018年11月6日



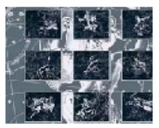
群星的族谱——天文学星表纵览（6）

2018年11月5日



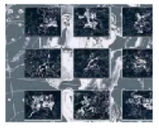
群星的族谱——天文学星表纵览（5）

2018年11月2日



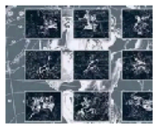
群星的族谱——天文学星表纵览（4）

2018年11月1日



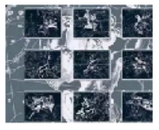
群星的族谱——天文学星表纵览（3）

2018年10月31日



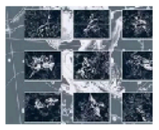
群星的族谱——天文学星表纵览（2）

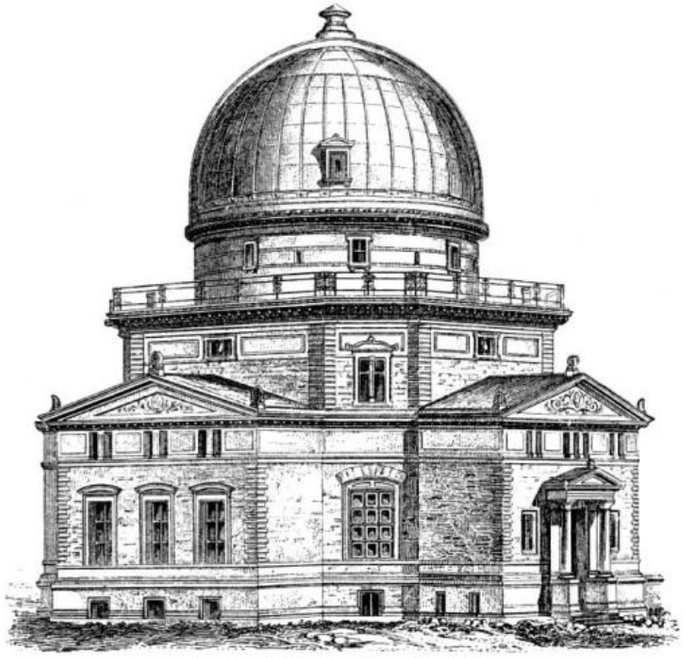
2018年10月30日



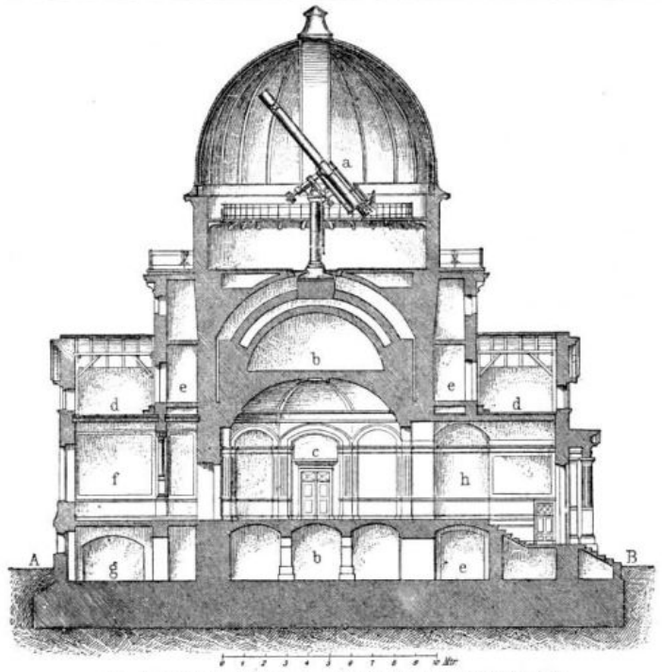
群星的族谱——天文学星表纵览（1）

2018年10月29日

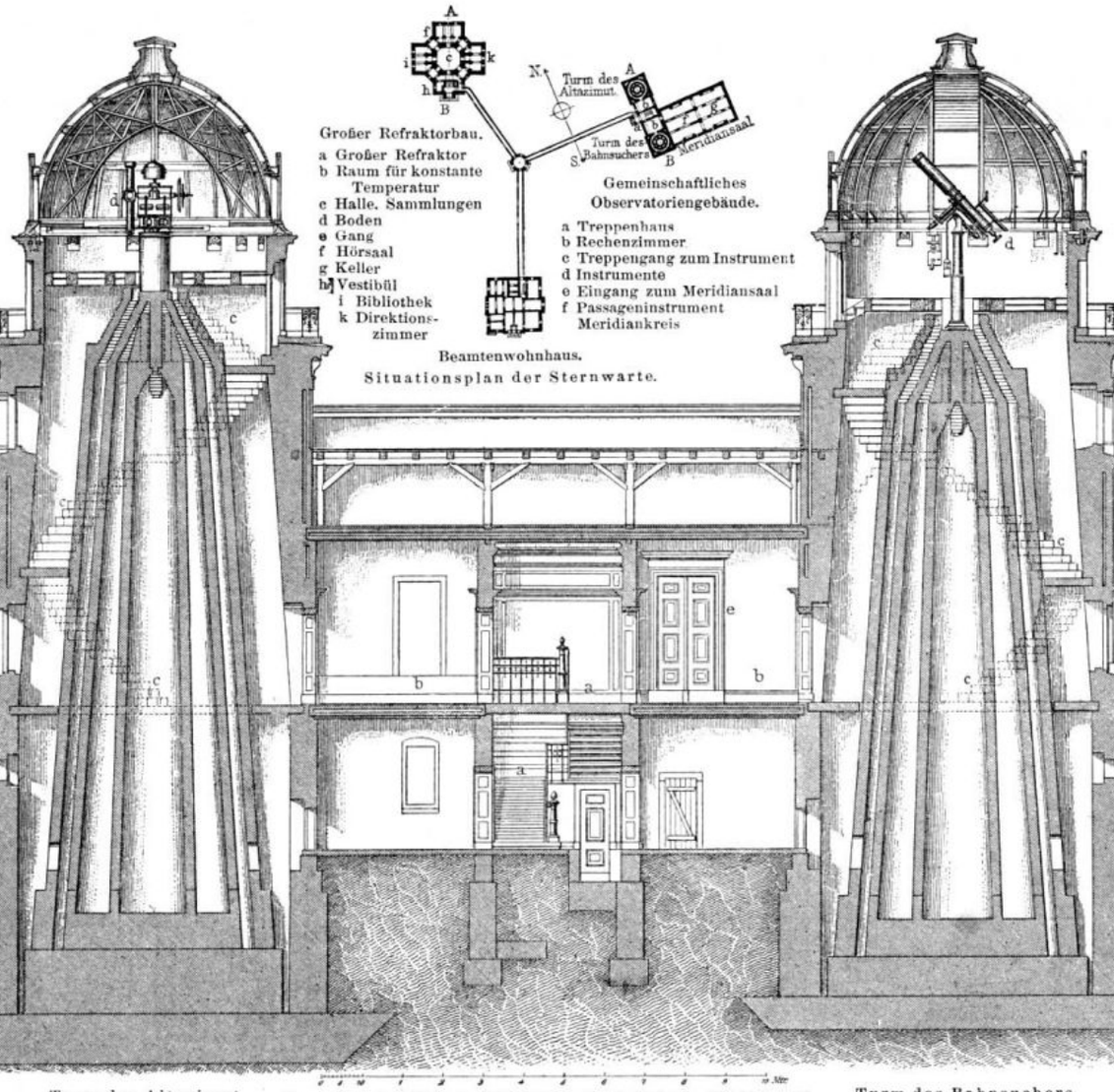




Großer Refraktorbau. (Ansicht.)



Großer Refraktorbau. (Durchschnitt von A nach B.)



Turm des Altazimut. Gemeinschaftliches Observatoriengebäude (Meridianbau). (Durchschnitt von A nach B.) Turm des Bahnsuchers.

Sternwarte der Kaiser Wilhelms-Universität zu Strassburg.

Centre de Données astronomiques

de Strasbourg

Astronomical Catalogues and Tables Adopted Standards

Version 2.0
February 2000

Prepared by François Ochsenbein
Centre de Données astronomiques de Strasbourg (CDS)

Document accessible at
http://vizier.u-strasbg.fr/doc/catstd.htx

http://cds.u-strasbg.fr/doc/catstd.pdf

天文数据库

- **CDS**
  - VizieR. http://vizier.china-vo.org/index.gml
  - SIMBAD http://simbad.u-strasbg.fr/simbad/
- **NED** https://ned.ipac.caltech.edu/
- **ADS** http://ads.harvard.edu/
- **SDSS** https://www.sdss.org/
- **IPAC**. https://irsa.ipac.caltech.edu/frontpage/
- **MAST** https://archive.stsci.edu/
- **ESA** https://www.cosmos.esa.int/web/esdc
- **ESO**. http://archive.eso.org/cms/eso-data.html
- **Gaia** http://gaia.ari.uni-heidelberg.de/index.html
- **GAVO** http://dc.zah.uni-heidelberg.de/
- **CADC** http://www.cadc-ccda.hia-iha.nrc-cnrc.gc.ca/en/

CDS

- I. 天体测量星表(Astrometric Data):
  - 主要记录恒星的位置，坐标，自行，视差数据，包括268个星表。德国天文学会星表(AGK3，I/61B)，波恩星表(I/122)，耶鲁分区星表(I/141)，依巴谷星表(I/239)，第谷2星表(I/259)，基本星表第六版(FK6，I/264)，哈勃导星星表(GSC，I/305)，美国海军星表(UCAC3，I/315)等著名星表都在此目录下。
- II. 测光星表(Photometric Data):
  - 记录天体各波段星等，测光数据，包括265个星表。有变星总表(II/139B)，斯隆巡天测光数据SDSS-DR7(II/294)，我国兴隆观测站施密特望远镜的大视场多色巡天(BATC)也在其中(II/262)。
- III. 光谱星表 (Spectroscopic Data):
  - 记录天体光谱观测数据，有226个星表，比如最早的光谱星表——亨利德雷珀星表及补编(III/1)，斯隆巡天光谱数据(SDSS-DR6，III/255)。
- IV. 交叉证认星表(Cross-Identifications)
  - 包含27 个星表，主要提供不同大型星表(比如SAO、HD、GC、DM)之间的编号对照。
- V.汇编星表(Combined data)(116 catalogues)
  - 基于文献和现有观测结果重新汇编导出的星表。比如根据耶鲁大学天文台巡天结果编制的耶鲁亮星星表（V/25），由斯特拉斯堡天文台编制的银河系行星状星云表（V/100），古希腊天文学家托勒密的《天文学大成》（Almagest）中的星表也收录在此（V/61）。
- VI. 其他星表(Miscellaneous)
  - 不适合其他任何目录的星表就放在这里。有106 个。有星座边界数据(VI/49) ，元素谱线列表(VI/69)，帕洛马天文台二期巡天底片位置(VI/114)等等。
- VII. 非恒星星表 (Non-stellar Objects)
  - 含有214个星表，星云，星团，星系，星系团都可以在这里找到，也包括类星体，小行星等天体。比如著名的NGC星表(VII/1B 1973年版本，2000年版本在VII/118)，阿贝尔和茨威基的星系团表(VII/4A 1973年版，1989年版VII/110A)。
- VIII. 射电和红外星表(Radio and Far-IR data)
  - 射电和红外波段的观测，85 个星表，包括剑桥大学的3C射电源表(VIII/1A)，北京天文台密云观测站232MHz巡天(VIII/44)。

Table 2.1: Directory Tree of Catalogues at CDS

I/*number*	Astrometric Catalogues
II/*number*	Photometric Catalogues (except Radio)
III/*number*	Spectroscopic Catalogues
IV/*number*	Cross-Identifications
V/*number*	Combined Data
VI/*number*	Miscellaneous Catalogue
VII/*number*	Non-stellar Objects
VIII/*number*	Radio Catalogues
IX/*number*	High Energy Catalogues
J/*abbr*/*Volume*/*first_page*	Publications ordered by
	A+A = A&A
	A+AS = A&A *Supp*
	AJ = *Astron. J.*
	ApJ = *Astrophys.*
	ApJS = *Astrophys.*
	MNRAS = *Mon. Not.*
	PASP = *Publ. Astr*
	AZh = *Astron. Zh*
	PAZh = *Pis'ma As*
	other = Form **J**/**ot**
	= for other jo

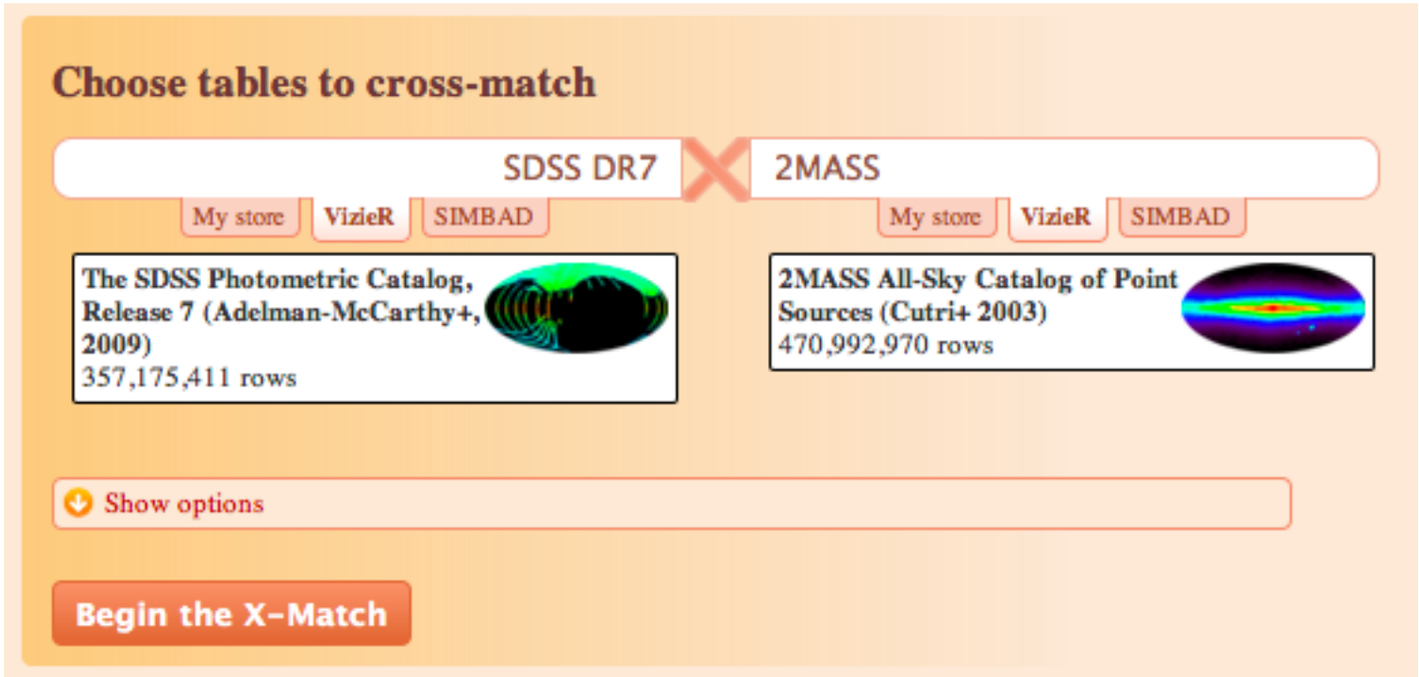
```
I/221               The Magellanic Catalogue of Stars - MACS (Tucholke+ 1996)
================================================================================
The Magellanic Catalogue of Stars - MACS
     Tucholke H.-J., de Boer K.S., Seitter W.C.
    <Astron. Astrophys. Suppl. Ser., 119, 91-98 (1996)>
    <The Messenger 81, 20 (1995)>
    =1996A&AS..119...91T
    =1995Msngr..81...20D
================================================================================
ADC_Keywords: Magellanic Clouds ; Positional data

Description:
    The Magellanic Catalogue of Stars (MACS) is based on scans of ESO
    Schmidt plates and contains about 244,000 stars covering large areas
    around the LMC and the SMC. The limiting magnitude is B<16.5m and the
    positional accuracy is better than 0.5" for 99% of the stars. The
    stars of this catalogue were screened interactively to ascertain that
    they are undisturbed by close neighbours.


File Summary:
--------------------------------------------------------------------------------
 FileName    Lrecl    Records    Explanations
--------------------------------------------------------------------------------
ReadMe          80          .    This file
lmc.dat         52     175779    The Large Magellanic Cloud
smc.dat         52      67782    The Small Magellanic Cloud
--------------------------------------------------------------------------------

Byte-by-byte Description of file: lmc.dat smc.dat
--------------------------------------------------------------------------------
   Bytes Format  Units   Label    Explanations
--------------------------------------------------------------------------------
   1- 12  A12    ---     MACS     Designation
  14- 15  I2     h       RAh      Right Ascension J2000 , Epoch 1989.0 (hours)
  17- 18  I2     min     RAm      Right Ascension J2000 (minutes)
  20- 25  F6.3   s       RAs      Right Ascension J2000 (seconds)
```

CDS XMATCH



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

Available TAP tables

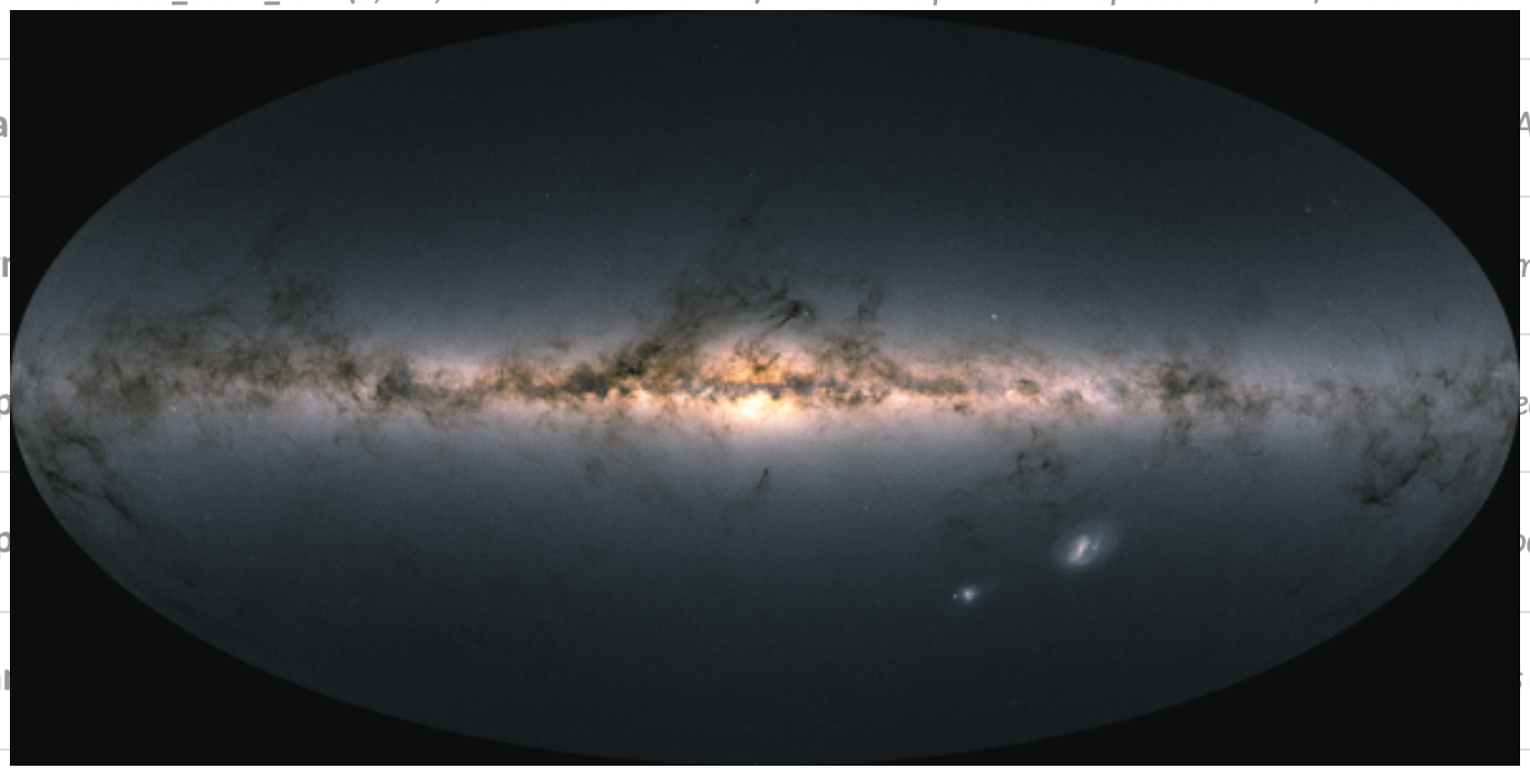
Search columns with human words...

Reset

Table Page

gaiaedr3 (22 tables)

- **gaia_source** (1,811,709,771 rows x 99 columns) - *This table has an entry for every Gaia observed source as listed in the Main Dat...*
- NO MAP **dr2_neighbourhood** (2,113,601,284 rows x 5 columns) - *Users wishing to look up the E/DR3 record for an astrophysical source i...*
- NO MAP **commanded_scan_law** (8,967,691 rows x 13 columns) - *This table provides a representation of the Gaia scanning law over the ...*
- NO MAP **fra** *AGIS frame rotator...*
- NO MAP **agr** *mber of external A...*
- NO MAP **hip** *d external catalog...*
- NO MAP **hip** *d neighbours for e...*
- NO MAP **par** *each matched Ga...*
- NO MAP **panstarrs1_neighbourhood** (951,850,826 rows x 6 columns) - *Pan-STARRS1 DR1 Neighbourhood table includes all good neig...*
- NO MAP **panstarrs1_join** (2,264,263,282 rows x 2 columns) - *Convenience table to be used to join Pan-STARRS1 DR1.1 catalogue with th...*
- NO MAP **sdssdr13_best_neighbour** (128,130,925 rows x 7 columns) - *SDSS DR13 BestNeighbour table lists each matched Gaia object ...*



- https://nadc.china-vo.org/data/data/gaiaedr3-source/f
- https://nadc.china-vo.org/data/mirror/Gaia/edr3/

虚拟天文台
Virtual Observatory

什么是虚拟天文台?

What is the Virtual Observatory?

The VO is a paradigm for Supporting interdisciplinary and collaborative research in astronomy and exploiting the full power of growing and emerging data sets

The latest stage of good data practices in astronomy

FITS provided a first standardization, the Virtual Observatory is the natural progression towards interoperability of data, services and tools

The VO is a framework

- For data centers to provide co-operating data services,
- For software providers to offer a variety of compatible analysis and visualization tools and user interfaces

The VO is an Evolving Ecosystem

- **IVOA defines VO "ecosystem" and interoperability standards**
- **VO registries, Archive interfaces and VO-enabled software offer Entry Points to VO resources, Visualization, Analysis**
- **Astronomy projects and data services build VO services and VO applications**
- Projects are welcome and encouraged to participate in the standards process

什么是虚拟天文台 ？一个多波段的数字星空，支持：检索、可视化、分析，数据来源于空间、地基甚至理论模拟。

虚拟天文台是互操作的，虚拟天文台是一个框架：数据中心提供互操作服务，VO软件提供兼容性的数据访问和可视化等多样化的功能服务。

虚拟天文台定义了VO生态系统和标准：VO注册、归档接口、软件。天文项目和数据中心构建VO服务和VO程序。

世界上主要的数据中心都加入到VO的大家庭中，并且以VO标准进行数据的管理发布。如 Gaia、ASKAP等。

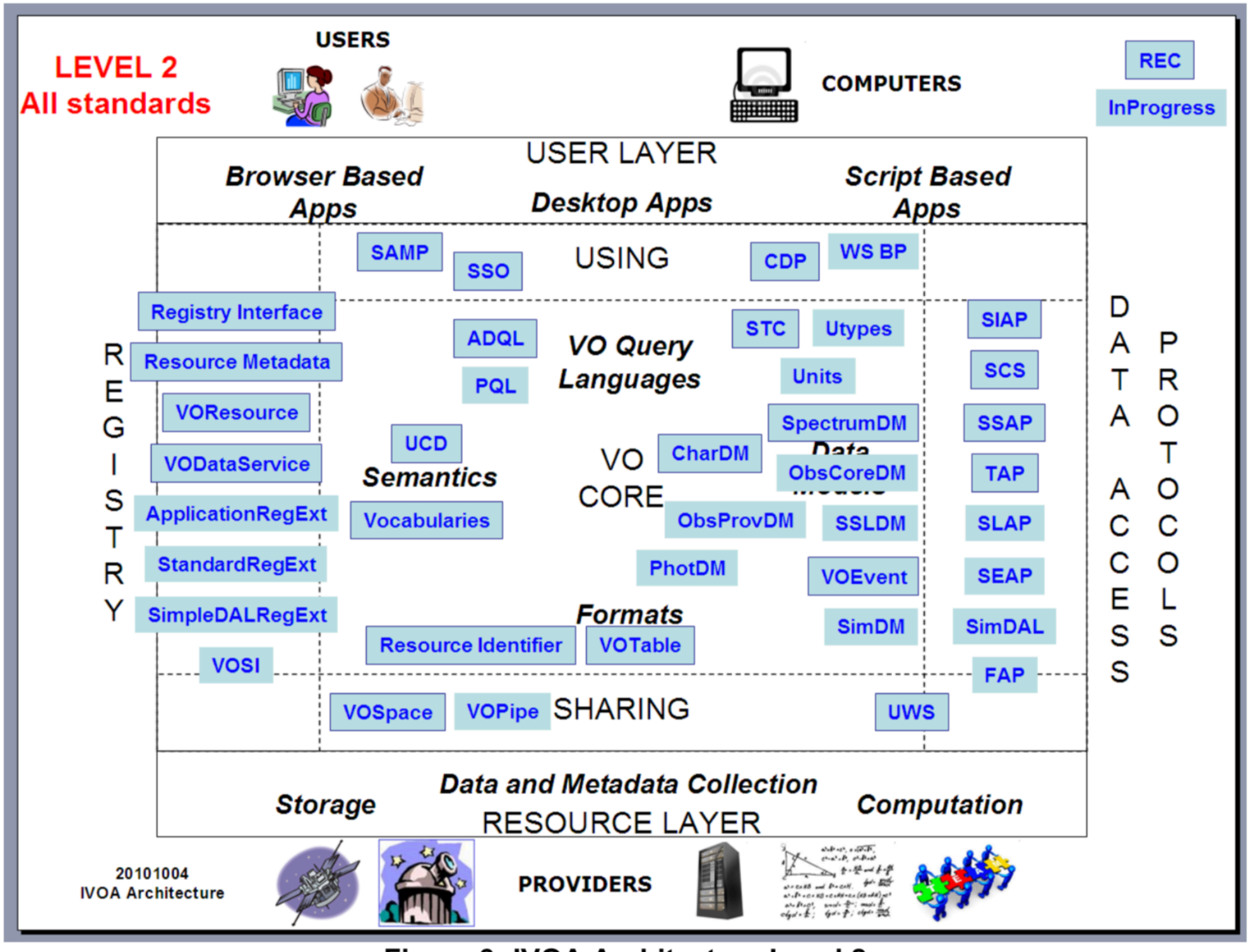


Figure 3: IVOA Architecture Level 2


The
Astropy
Project

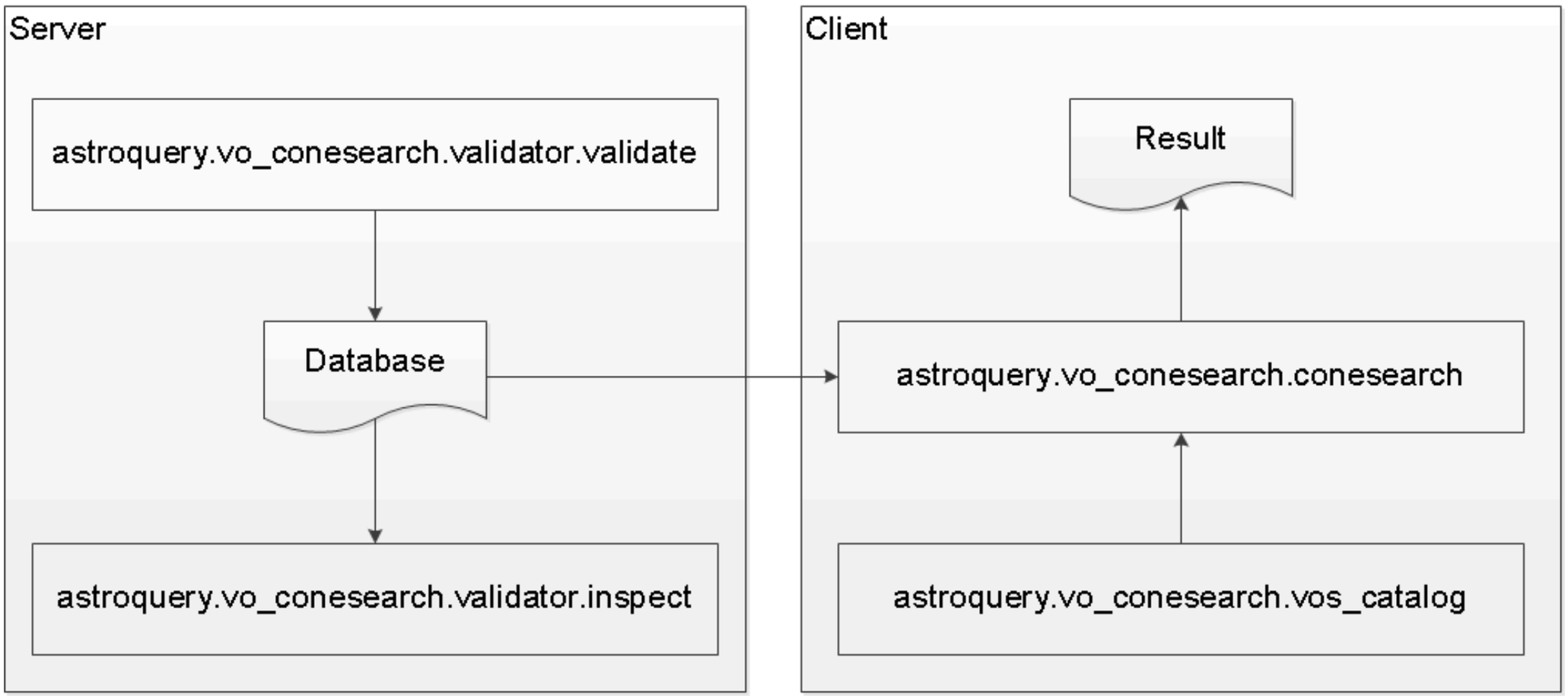
Astroquery Package

- ALMA Queries (**astroquery.alma**)
- Atomic Line List (**astroquery.atomic**)
- Besancon Queries (**astroquery.besancon**)
- CDS MOC Service (**astroquery.cds**)
- ESASky Queries (**astroquery.esasky**)
- ESO Queries (**astroquery.eso**)
- Gaia TAP+ (**astroquery.gaia**)
- GAMA Queries (**astroquery.gama**)
- HEASARC Queries (**astroquery.heasarc**)
- HITRAN Queries (**astroquery.hitran**)
- IRSA Image Server program interface (IBE) Queries (**astroquery.ibe**)
- IRSA Image Server program interface (IBE) Queries (**astroquery.ibe**)
- IRSA Queries (**astroquery.irsa**)
- IRSA Dust Extinction Service Queries (**astroquery.irsa_dust**)
- JPL Spectroscopy Queries (**astroquery.jplspec**)
- MAGPIS Queries (**astroquery.magpis**)
- MAST Queries (astroquery.mast)
- Minor Planet Center Queries (astroquery.mpc)
- NASA ADS Queries (astroquery.nasa_ads)
- NED Queries (astroquery.ned)
- NIST Queries (astroquery.nist)
- NRAO Queries (astroquery.nrao)
- NVAS Queries (astroquery.nvas)
- SIMBAD Queries (astroquery.simbad)
- Skyview Queries (astroquery.skyview)
- Splatalogue Queries (astroquery.splatalogue)
- UKIDSS Queries (astroquery.ukidss)
- Vamdc Queries (astroquery.vamdc)
- VizieR Queries (astroquery.vizier)
- VO Simple Cone Search (astroquery.vo_conesearch)
- VSA Queries (astroquery.vsa)
- xMatch Queries (astroquery.xmatch)

- ALFALFA Queries (**astroquery.alfalfa**)
- CosmoSim Queries (**astroquery.cosmosim**)
- Exoplanet Orbit Database (**astroquery.exoplanet_orbit_database**)
- Fermi Queries (**astroquery.fermi**)
- JPL Horizons Queries (**astroquery.jplhorizons/astroquery.solarsystem.jpl.horizons**)
- JPL SBDB Queries (**astroquery.jplsbdb/astroquery.solarsystem.jpl.sbdb**)
- LAMDA Queries (**astroquery.lamda**)
- NASA Exoplanet Archive (**astroquery.nasa_exoplanet_archive**)
- OAC API Queries (**astroquery.oac**)
- OGLE Queries (**astroquery.ogle**)
- Open Exoplanet Catalogue(**astroquery.open_exoplanet_catalogue**)
- SDSS Queries (**astroquery.sdss**)
- Spitzer Heritage Archive (**astroquery.sha**)

ConeSearch

- 锥形检索协议 Simple Cone Search
  - **RA** -- a right-ascension in the ICRS coordinate system for the positon of the center of the cone to search, given in decimal degrees.
  - **DEC** -- a declination in the ICRS coordinate system for the positon of the center of the cone to search, given in decimal degrees.
  - **SR** -- the radius of the cone to search, given in decimal degrees.
- http://mycone.org/cgi-bin/search?RA=180.567&DEC=-30.45&SR=0.0125
- https://nadc.china-vo.org/data/data/gaiaedr3-source/cs.csvs?ra=1&dec=1&sr=0.01
- https://nadc.china-vo.org/data/data/gaiaedr3-source/cs.vots?ra=1&dec=1&sr=0.01


Server
astroquery.vo_conesearch.validator.validate
Database
astroquery.vo_conesearch.validator.inspect
Client
Result
astroquery.vo_conesearch.conesearch
astroquery.vo_conesearch.vos_catalog

TAP

resource type	resource name	required
TAP-sync	/sync	must
TAP-async	/async	must
TAP-sync	service specific	may (alternate authentication method)
TAP-async	service specific	may (alternate authentication method)
VOSI-availability	service specific	must (should be anonymous)
VOSI-availability	service specific	may (alternate authentication method)
VOSI-capabilities	/capabilities	must (must be anonymous)
VOSI-tables	/tables	should
VOSI-tables	service specific	may (alternate authentication method)
DALI-examples	/examples	should
DALI-examples	service specific	may (alternate authentication method)

TAP

http://tapvizier.u-strasbg.fr/adql/

http://www.cadc-ccda.hia-iha.nrc-cnrc.gc.ca/en/search/

ASCL

ASCL.net
Astrophysics Source Code Library

Making codes discoverable since 1999

Search Site | Search

Home | About | Resources | Browse | Submissions | News | Forum | Dashboard

Welcome to the ASCL

The Astrophysics Source Code Library (ASCL) is a free online registry for source codes of interest to astronomers and astrophysicists, including solar system astronomers, and lists codes that have been used in research that has appeared in, or been submitted to, peer-reviewed publications. The ASCL is indexed by the SAO/NASA Astrophysics Data System (ADS) and Web of Science and is citable by using the unique ascl ID assigned to each code. The ascl ID can be used to link to the code entry by prefacing the number with ascl.net (*i.e.*, ascl.net/1201.001).

Most Recently Added Codes

2020 Dec 06

[submitted] ExoPix: Exoplanet Imaging with JWST

Adams, J.; Wang, J.J

ExoPix is a collection of tutorials aimed at illustrating the imaging of exoplanets with the James Webb Space Telescope (JWST). ExoPix tutorials are meant to demonstrate the application of the PSF-subtraction algorithm pyKLIP to simulated JWST NIRCAM data. We provide simple walkthroughs of pyKLIP's ability to reveal exoplanets, compute contrast curves, and measure exoplanet astrometry and photometry in imaged extrasolar systems.

2020 Dec 05

[submitted] getsf: Multi-scale, multi-wavelength extraction of sources and filaments using separation of the structural components

Men'shchikov, Alexander

getsf is a new method for extracting sources and filaments in astronomical images using separation of their structural components, designed to handle multi-wavelength sets of images and very complex filamentary backgrounds. The method spatially decomposes the original images and separates the structural components of sources and filaments from each other and from their backgrounds, flattening their resulting images. It spatially decomposes the flattened components, combines them over wavelengths, and detects the positions of sources and skeletons of filaments. Finally, getsf measures the detected sources and filaments and creates the output catalogs and images. This universal and fully automated method has a single user-definable free parameter, which reduces to a minimum dependence of its results on the human factor.

2020 Nov 30

[ascl:2011.030] DDCalc: Dark matter direct detection phenomenology package

Bringmann, Torsten; Conrad, Jan; Cornell, Jonathan M.; Dal, Lars A.; Edsjö, Joakim; Farmer, Ben; Kahlhoefer, Felix; Kvellestad, Anders; Putze, Antje; Savage, Christopher; Scott, Pat; Weniger, Christoph; White, Martin; Wild, Sebastian

DDCalc performs various dark matter direct detection calculations, including signal rate predictions, constraints on light DM, and likelihoods for several experiments. It offers eighteen non-relativistic effective operators to describe velocity and momentum transfer, and elastic scattering of DM particles

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