天文星表、數據庫

何勃亮

國家天文臺 國家天文科學數據中心

2019-10-25

hebl@nao.cas.cn

提 綱

- 天文星表
- 天文數據庫
- 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

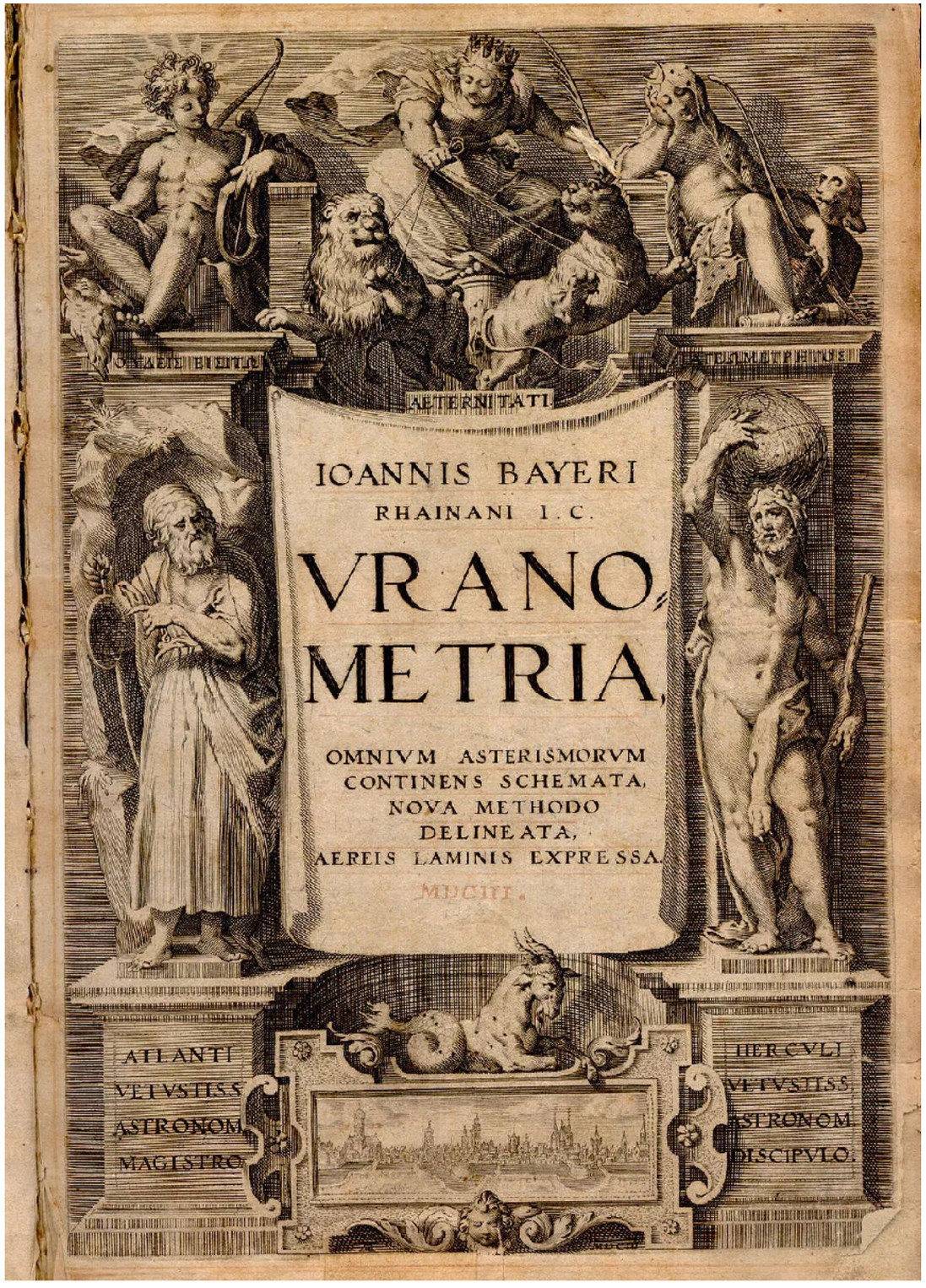
唐　瞿曇悉達　撰

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.

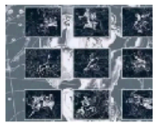


1603年德国的天文学家巴耶（Johann Bayer）根据第谷的观测资料出版了《测天图》*Uranometria*，使用希腊字母为恒星命名（称为巴耶命名法），还第一次加入了南天的星座。

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。

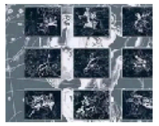
群星的族谱——天文学星表纵览（8）

2018年11月7日



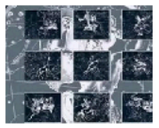
群星的族谱——天文学星表纵览（7）

2018年11月6日



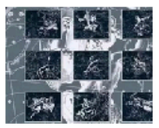
群星的族谱——天文学星表纵览（6）

2018年11月5日



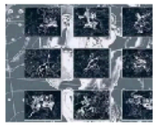
群星的族谱——天文学星表纵览（5）

2018年11月2日



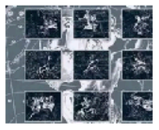
群星的族谱——天文学星表纵览（4）

2018年11月1日



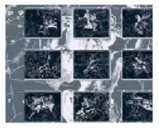
群星的族谱——天文学星表纵览（3）

2018年10月31日



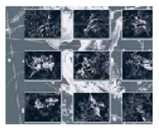
群星的族谱——天文学星表纵览（2）

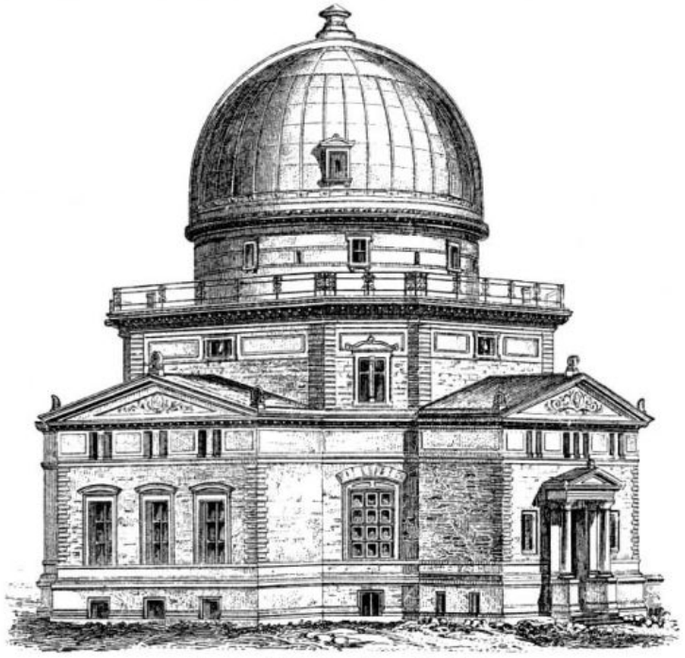
2018年10月30日



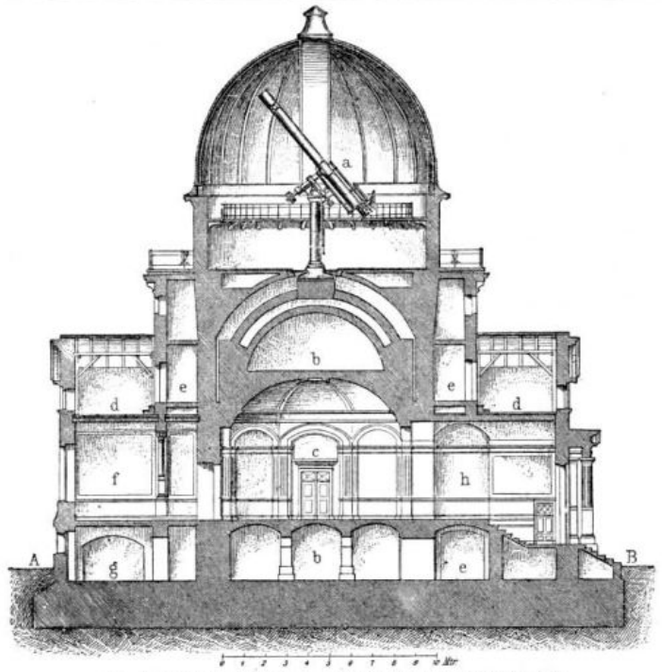
群星的族谱——天文学星表纵览（1）

2018年10月29日

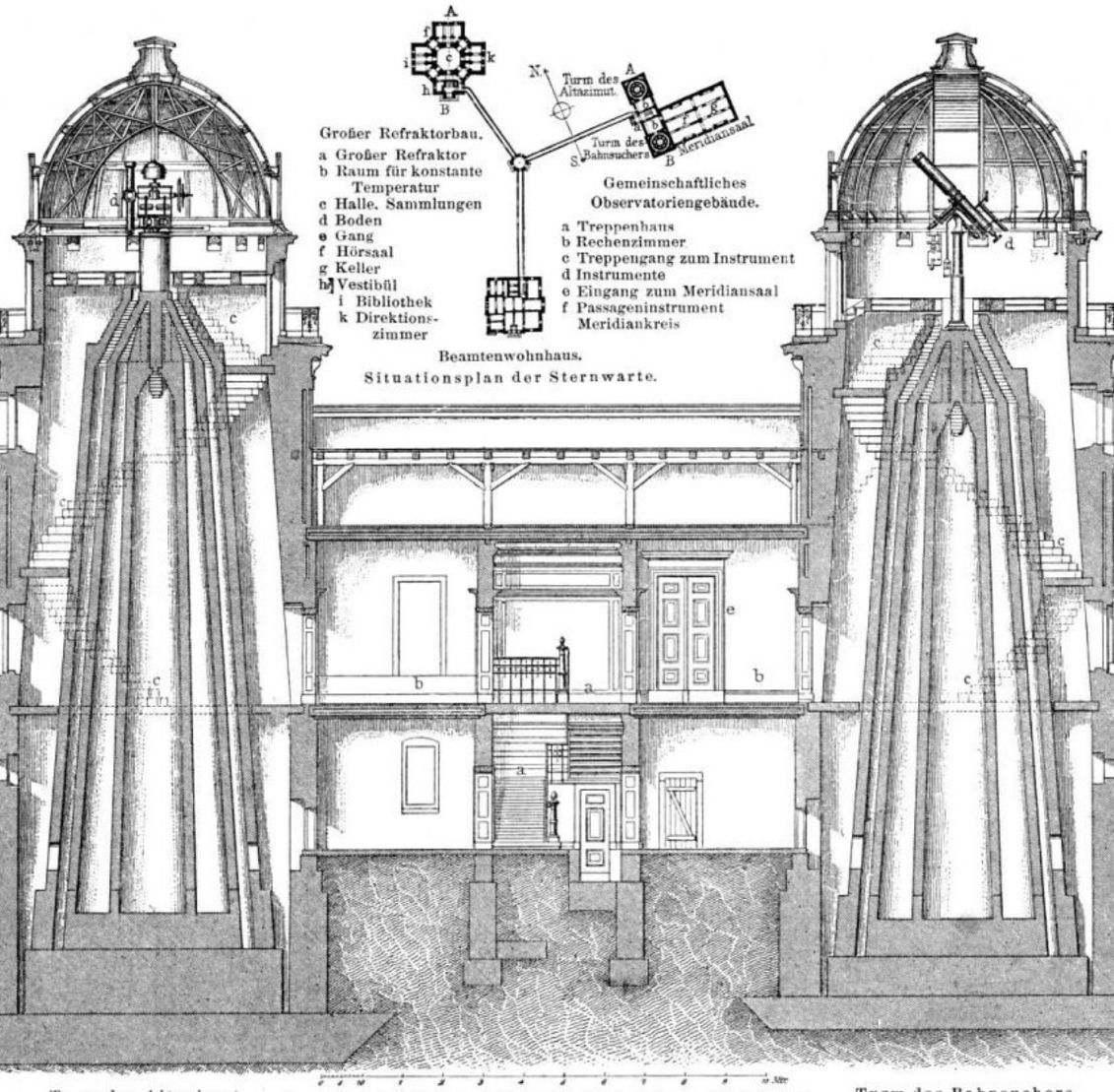




Großer Refraktorbau. (Ansicht.)



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

天文數據庫

- **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. 天體測量星表(Astrometric Data):
  - 主要記録恒星的位置，坐標，自行，視差數據，包括268個星表。德國天文學會星表(AGK3，I/61B)，波恩星表(I/122)，耶魯分區星表(I/141)，依巴穀星表(I/239)，第穀2星表(I/259)，基本星表第六版(FK6，I/264)，哈勃導星星表(GSC，I/305)，美國海軍星表(UCAC3，I/315)等著名星表都在此目録下。
- II. 測光星表(Photometric Data):
  - 記録天體各波段星等，測光數據，包括265個星表。有變星總表(II/139B)，斯隆巡天測光數據SDSS-DR7(II/294)，我國興隆觀測站施密特望遠鏡的大視場多色巡天(BATC)也在其中(II/262)。
- III. 光譜星表 (Spectroscopic Data):
  - 記録天體光譜觀測數據，有226個星表，比如最早的光譜星表——亨利德雷珀星表及補編(III/1)，斯隆巡天光譜數據(SDSS-DR6，III/255)。
- IV. 交叉證認星表(Cross-Identifications)
  - 包含27 個星表，主要提供不同大型星表(比如SAO、HD、GC、DM)之間的編號對照。
- V.匯編星表(Combined data)(116 catalogues)
  - 基于文獻和現有觀測結果重新匯編導出的星表。比如根據耶魯大學天文臺巡天結果編制的耶魯亮星星表（V/25），由斯特拉斯堡天文臺編制的銀河系行星狀星雲表（V/100），古希臘天文學家托勒密的《天文學大成》（Almagest）中的星表也收録在此（V/61）。
- VI. 其他星表(Miscellaneous)
  - 不適合其他任何目録的星表就放在這裏。有106 個。有星座邊界數據(VI/49)，元素譜綫列表(VI/69)，帕洛馬天文臺二期巡天底片位置(VI/114) 等等。
- VII. 非恒星星表 (Non-stellar Objects)
  - 含有214個星表，星雲，星團，星系，星系團都可以在這裏找到，也包括類星體，小行星等天體。比如著名的NGC星表(VII/1B 1973年版本，2000年版本在VII/118)，阿貝爾和茨威基的星系團表(VII/4A 1973年版，1989年版VII/110A)。
- VIII. 射電和紅外星表(Radio and Far-IR data)
  - 射電和紅外波段的觀測，85 個星表，包括劍橋大學的3C射電源表(VIII/1A)，北京天文臺密雲觀測站232MHz巡天(VIII/44)。
- IX. 高能星表 (High-Energy data)

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

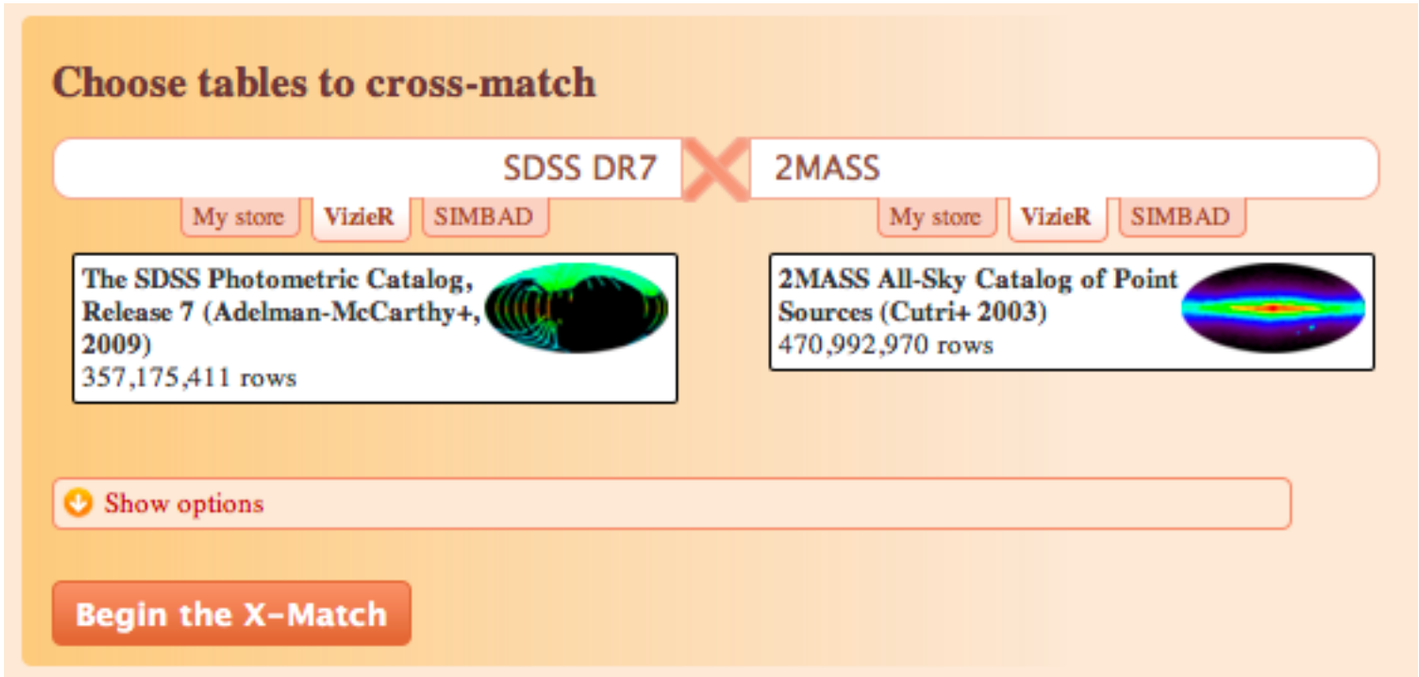
```
I/221               The Magellanic Catalogue of Stars - MACS (Tucholke+ 1996)
================================================================================
The Magellanic Catalogue of Stars - MACS
     Tucholke H.-J., de Boer K.S., Seitter W.C.
    <Astron. Astrophys. Suppl. Ser., 119, 91-98 (1996)>
    <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/

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。

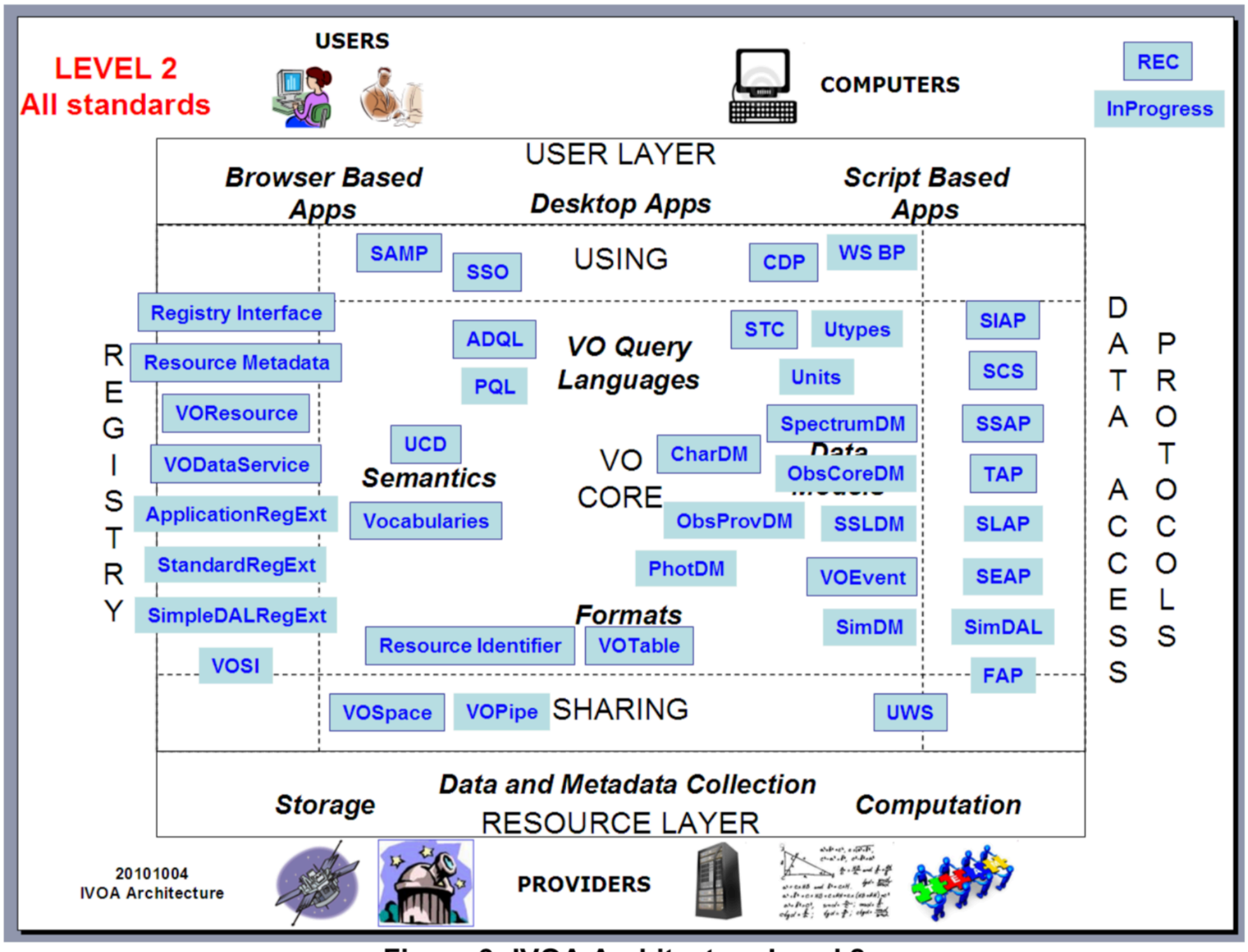


Figure 3: IVOA Architecture Level 2


The
Astropy
Project

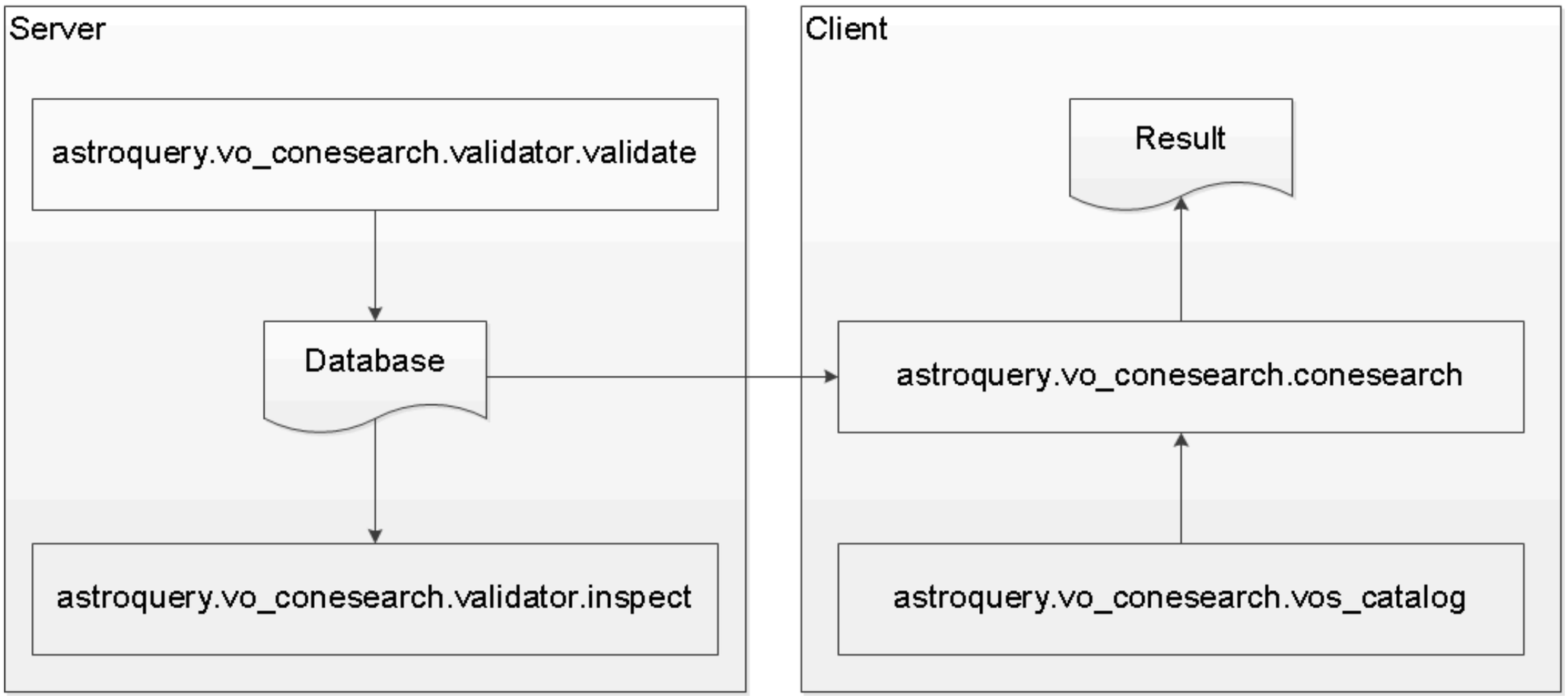
Astroquery Package

- 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

- 錐形檢索協議 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


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

2019 Oct 24

[ascl:1910.002] PreProFit: Pressure Profile Fitter for galaxy clusters in Python

Castagna, Fabio; Andreon, Stefano; Pranjal, R. S.

PreProFit fits the pressure profile of galaxy clusters using Markov chain Monte Carlo (MCMC). The software can analyze data from different sources and offers flexible parametrization for the pressure profile. PreProFit accounts for Abel integral, beam smearing, and transfer function filtering when fitting data and returns χ2, model parameters and uncertainties in addition to marginal and joint probability contours, diagnostic plots, and surface brightness radial profiles. The code can be used for analytic approximations for the beam and transfer functions for feasibility studies.

[ascl:1910.001] PINK: Parallelized rotation and flipping INvariant Kohonen maps

Polsterer, Kai Lars; Gieseke, Fabian; Doser, Bernd

Morphological classification is one of the most demanding challenges in astronomy. With the advent of all-sky surveys, an enormous amount of imaging data is publicly available, and are typically analyzed by experts or encouraged amateur volunteers. For upcoming surveys with billions of objects, however, such an approach is not feasible anymore. PINK (Parallelized rotation and flipping INvariant Kohonen maps) is a simple yet effective variant of a rotation-invariant self-organizing map that is suitable for many analysis tasks in astronomy. The code reduces the computational complexity via modern GPUs and applies the resulting framework to galaxy data for morphological analysis.

2019 Oct 08

[submitted] Magnetizer: computing magnetic fields of evolving galaxies

Rodrigues, Luiz F.S.; Chamandy, Luke

Computes time and radial dependent magnetic fields for a sample of galaxies in the output of a semi-analytic model of galaxy formation. The magnetic field is obtained by numerically solving the galactic dynamo equations throughout history of each galaxy. Stokes parameters and Faraday rotation measure can also be computed along a random line-of-sight for each galaxy.